Overview of the EU-27 building policies and programs. Factsheets on the nine Entranze target countries

D5.1 and D5.2 of WP5 from Entranze Project

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EEG	Energy Economics Group Institute of Power Systems and Energy Economics Vienna University of Technology
NCRC	National Consumer Research Centre
Fraunhofer	Fraunhofer Society for the advancement of applied research
CENER	National Renewable Energy Centre
eERG	end use Efficiency Research Group, Politecnico di Milano
Oeko	Öko-Institut
SOFENA	Sofia Energy Agency
BPIE	Buildings Performance Institute Europe
Enerdata	Enerdata
SEVEn	SEVEn, The Energy Efficiency Center

The ENTRANZE project

The objective of the ENTRANZE project is to actively support policy making by providing the required data, analysis and guidelines to achieve a fast and strong penetration of nZEB and RES-H/C within the existing national building stocks. The project intends to connect building experts from European research and academia to national decision makers and key stakeholders with a view to build ambitious, but reality proof, policies and roadmaps.

The core part of the project is the dialogue with policy makers and experts and will focus on nine countries, covering >60% of the EU-27 building stock. Data, scenarios and recommendations will also be provided for EU-27 (+ Croatia and Serbia).

This report provides a brief overview of buildings policy frameworks in the EU-27 countries. It has been compiled based on the knowledge basis created by an EU-wide review undertaken by BPIE in 2011 and on the evaluation of the existing countries' definitions and initiatives for moving towards nZEBs. A particular focus has been given to the 9 target countries of the Entranze project. On the whole, the report comprises dedicated factsheets for each target country, presenting national and regional policies, energy standards in the building sector (e.g. building codes requirements), updates on implementation status of EPCs, nearly zero energy buildings, cost-optimality, as well as financial support programmes for new low energy buildings/passive houses and building retrofits.

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1. Introduction

This report provides a brief overview of buildings policy frameworks in the EU-27 countries, including building codes requirements, enforcement and compliance, renewable energy use in buildings, nearly zero energy buildings policies and main economic instruments in place in the EU-27 countries. The main sources of information for this part of the report are the followings:

- Detailed policy review in ENTRANZE target countries, carried out by all project partners within this project
- BPIE Europe wide survey from 2011 on buildings policies, regulations and building stock data
- The European buildings data hub from www.buildingsdata.eu
- BPIE study from 2011 'Europe's buildings under the microscope' [1]
- BPIE study from 2011 'Principles for nearly zero energy buildings' [2]
- BPIE report from 2012 on 'Energy Efficiency Policies in Buildings – The Use of Financial Instruments at Member State Level [3]
- Second National Energy Efficiency Action Plans (NEEAPs) under Directive 32/2006/EC [4]
- First National Renewable Energy Plans (NREAPs) under the Directive 28/2009/EC [5]

A particular focus has been given to the 9 target countries of the ENTRANZE project. On the whole, the report comprises dedicated factsheets for each ENTRANZE target country, presenting national and regional policies, energy standards in the building sector (e.g. building codes requirements), updates on implementation status of EPCs, nearly zero energy buildings, cost-optimality, as well as financial support programs for new low energy buildings/passive houses and building retrofits. The country factsheets are built based on information provided by ENTRANZE consortium partners and on the CA-EPBD report from 2010 on implementing the Energy performance of Buildings Directive.

2. Building codes and energy performance certification in the European countries

Incorporating energy-related requirements during the design or retrofit phase of a building is a key driver for implementing energy efficiency measures which in turn highlights the role of building energy codes in reducing CO2 emissions and reaching the energy saving potential of buildings. Several Member States introduced building code requirements (prescriptive-based[1]) associated with the thermal performance of buildings fol-

[1] Prescriptive-based requirements= energy requirements are set for each building component (windows, walls, roofs) as well as heating, ventilation and air conditioning and lighting equipment

lowing the oil price increases in the 1970s while requirements in some Scandinavian countries have been in place since the mid-1940s.

The Energy Performance of Buildings Directive (EPBD, 2002/91/EC) was the first major attempt requiring all Member States to introduce a general framework for setting building energy code requirements based on a "whole building" approach (so called performance-based[2]). Although subsidiarity applies to implementation of the EPBD, Member States were required to introduce a methodology at the national or regional level to calculate the energy performance of buildings based upon this framework and apply minimum requirements on the energy performance of new buildings and large existing buildings subject to major renovation.

Following the EPBD in 2002, requirements have gradually started shifting from prescriptive to a performance-based approach which is regarded as a major change in the building code trends.

Major changes are also expected through the application of the cost optimality concept in the energy performance requirements as introduced by the recast of the EPBD in 2010 (2010/31/EU). Member States are required to set their national requirements in accordance with cost optimal levels by applying a harmonised calculation methodology (Article 5 and annex III of EPBD recast). The introduction of cost optimality in building regulations is likely to have a significant impact in many countries, with requirements being improved and further strengthened. Moreover, Cost optimal levels should also gradually converge or harmonised to future nearly zero energy standards which would comprise a requirement for new buildings from 2020 onwards. Due to these foreseen changes, building codes are anticipated to be in a dynamic phase in the next decade.

Understanding building codes however requires specific technical expertise which makes monitoring and evaluating the progress of what is happening from the political level difficult. Given the environmental and climate mitigation impacts of building codes, it is crucial to keep track of all the key transformations happening in the field of building energy codes in a simple, understandable way.

Through its 2011 survey [1], BPIE has collected country-by-country information, making the first attempt to provide an overall picture of what is happening in Europe in the area of building codes. A summary of the key performance-based requirements and prescriptive criteria adopted by different countries is presented in Table 1. With the exception of a few countries, all countries have now embedded building regulations for both new and renovated buildings.

[2] Performance-based requirements= energy requirements are set on a building's overall (primary or final) energy consumption.

Table 1: Summary of building energy code requirement and prescriptive criteria (source: BPIE 2011 survey)

	Building code require-ments		Perfor-mance Based Require-ments		Prescriptive/element-based criteria in building codes					
	New build	Renovations	New build	Renovations	Thermal Insulation	Air permeability	Ventilation requirements	Boiler/AC system efficiency	Lighting Efficiency	Other requirements
AT	Y	Y	Y	Y	Y	Y	Y	Y	N	Summer comfort require-ments
BE - WI	Y	Y	Y	N	Y	N	Y	N	N	Overheating indicator should not exceed 17500kh. T_{in} must be under 26°C for 90% of year in RE. K-values on global thermal insulation of entire building. Thermal bridges
BE -Br	Y	Y	Y	N	Y	N	Y	N	N	
BE -Fl	Y	Y	Y	N	Y	N	Y	N	N	
BG	Y	Y	Y	Y	Y	Y	N	Y	N	
CH	Y	Y	Y	Y	Y	N	N	Y	N R E	Thermal bridges, solar shad-ing, max 80% of demand for heating & DHW covered by non-RES
CY	Y	Y	Y	Y	Y	N	N	N	N	Solar collectors in new RE
CZ	Y	Y	Y	Y	Y	Y	N	BO	N	T_{in} of 20°C in winter and 27°C summer
DE	Y	Y	Y	N	Y	Y	Y	Y	N R E	T_{in} (20-26°C), humidity, air change rate & air velocity requirements
DK	Y	Y	Y	N	Y	Y	Y	Y	N R E	Max T_{in} 26°C. Thermal bridges requirements
EE	Y	Y	Y	Y	Y	Y	Y	Y	N R E	RE & office temperature requirements

	Building code require-ments		Perfor-mance Based Require-ments		Prescriptive/element-based criteria in building codes					
	New build	Renovations	New build	Renovations	Thermal Insulation	Air permeability	Ventilation requirements	Boiler/AC system efficiency	Lighting Efficiency	Other requirements
ES	Y	Y	Y	Y	Y	Y	Y	Y	NRE	Thermal comfort, T_{in} 21°C (winter), 26°C (summer), mandatory RES use (solar collectors/PVs)
FI	Y	P	Y	P[2]	Y	Y	Y	BO	Y	Max T_{in} applies (typically 25°C). Max CO^2 concentration in indoor air.
FR	Y	Y	Y	Y	Y	Y	Y	Y	NRE	Max T_{in} applies based on a number of factors
GR	Y	Y	Y	Y	Y	Y	Y	Y	N	
HU	Y	Y	Y	Y	Y	N	N	N	N	
IE	Y	Y	Y	N	Y	Y		Y		Thermal bridges
IT	Y	Y	Y	Y	Y	Y	Y	Y	N	
LT	Y	Y	Y	Y	Y	Y	Y	Y	N	
LV	Y	Y	N	N	Y	Y	Y	N	N	Orientation, window size, air temperature, air humidity & air velocity, specific heat losses of whole building & per m^2
MT	Y	N	N	N	Y	N	N	Y	NRE	Window size, glazing
NL	Y	Y	Y	N	Y	Y	Y		NRE	Daylight
NO	Y	Y	Y	Y	Y	Y	Y	Y	N	Window size, thermal bridges, ventilation fan power, heat recovery, summer/winter t_{in}
PL	Y	Y	Y	Y	Y	N	Y	Y	Y	Solar shading, window area
PT	Y	Y	Y	Y	Y	Y	NRE	Y	N	Max g-value, thermal bridge, solar collectors, cooling, DHW reqs apply
RO	Y	N	N	N	Y	N	N	N	N	Overall thermal coefficient g-value

	Building code require-ments		Perfor-mance Based Require-ments		Prescriptive/element-based criteria in building codes					
	New build	Renovations	New build	Renovations	Thermal Insulation	Air permeability	Ventilation requirements	Boiler/AC system efficiency	Lighting Efficiency	Other requirements
SE	Y	Y	Y	Y	Y	Y	Y	Y	N	
SI	Y	Y	Y	Y[3]	Y	Y	Y	Y	N	Solar shading, max T_{in}
SK	Y	Y	Y	Y	Y	Y	Y	Y	N	Max T_{in}, humidity & air velocity apply.
UK	Y	Y	Y	Y	Y	Y	Y	Y	Y	

2.1 Performance based requirements for new buildings

For many countries the EPBD was the means of introducing new elements in their building codes prior to which there were no energy performance requirements concerning the building as a whole or specific elements. Nearly all countries have now adopted a national methodology which sets performance-based requirements for new buildings. For countries in which prescriptive requirements existed before 2002 (e.g. Czech Republic, Belgium, Estonia, Bulgaria, Hungary, Ireland, Poland), there was a shift towards a holistic-based (i.e. whole building) approach whereby existing single element requirements in many cases were tightened. In some cases, the single element requirements are just supplementary demands to the energy performance requirements ensuring the efficiency of individual parts of a building is sufficient (e.g. Denmark). In others, they act as alternative methods where the two approaches exist in parallel (e.g. Spain, Poland); the first based on the performance of single elements and the second on the overall performance of a building. In Switzerland, for example, the holistic approach is used mainly for new buildings and the single element approach for shallow or deep renovations while in deep renovation cases, the holistic approach is sometimes chosen. In countries where the performance-based approach is the main form of requirement, most of the elements listed in the prescriptive criteria of Table 1 are already integral parts of the methodology, while additional elements such as RES (solar collectors, PV, heat pumps), summer comfort, indoor climate are embedded in the methodology.

The EPBD mentions specifically that the energy performance of buildings should be calculated on the basis of a methodology, which may be differentiated at national and regional level. However, that methodology should take into account existing European standards[3]. While no country has directly and fully applied them in their methodology procedures, many countries have adopted an approach which is broadly compatible with the European standards [5] [6].

A variety of reasons were cited for not using the European standards, including difficulty of converting into practical procedures, timing and copyright issues. Most national procedures are applied as software programmes and many countries (but by no means all) have adopted a methodology based on a methodology recommended by the European standards (EN 15 603: Energy Performance of Buildings) and/or are using the EN 13 790 monthly calculation procedure, as the basis for the calculation "engine" for simple buildings. Others allow proprietary dynamic simulation (for more complex buildings), whilst others have developed their own national methods. The assessment of existing buildings (for building code or certification purposes) is often based on a reduced data-set model.

A detailed assessment of the energy performance requirements is provided in Table 1. It can be seen that many different approaches have been applied and no two countries have adopted the same approach. It is important not to attempt to compare the performance requirements set by Member States, given the variety of calculation methods used to measure compliance and major differences in definitions (e.g. definitions of primary and final energy, heated floor area, carbon conversion factors, regulated energy and total energy requirement etc.). The setting of building code requirements with legally binding performance targets, is normally based on either an absolute (i.e. not to exceed) value, generally expressed in kWh/m^2a, or on a percentage improvement requirement based on a reference building of the same type, size, shape and orientation. Some countries (e.g. Belgium) express the performance requirement as having to meet a defined "E value" on a 0 to 100 scale, or on an A+ to G scale (e.g. Italy and Cyprus).

Most methodology procedures are applied as software programmes. Software quality assurance accreditation is undertaken in only about half of the countries, a finding which has been drawn by the Concerted Action 2010 Report. About 50% of Member States have already introduced changes to their methodology procedures to either to tighten requirements, achieve greater conformity with CEN standards, and include additional technologies and/or to correct weaknesses/gaps in earlier EPBD methodology procedures.

There is a growing interest in the harmonisation of methodology procedures. This is likely to become an increasingly important issue in the context of the EPBD recast Article 2.2 and Article 9 requirements associated with nearly Zero Energy Buildings (nZEB)

[3] According to EPBD, 'European standard' means a standard adopted by the European Committee for Standardisation, the European Committee for Electrotechnical Standardisation or the European Telecommunications Standards Institute and made available for public use.

and cost optimality (EPBD recast Article 5) since the European Commission will need to demonstrate that all Member States are delivering equivalent outcomes. A harmonised approach to setting and measuring nZEB targets and cost-optimality implies that a broadly equivalent methodology will be required.

2.2 Prescriptive-based requirements for new buildings

Member States have different prescriptive, element-based requirements associated with building energy codes such as maximum U values, minimum/maximum indoor temperatures, requirements for minimum ventilation rates and boiler and/or air conditioning plant efficiency.

2.2.1 Insulation

Limiting the thermal conductivity of major construction elements is the most common thermal performance requirement for buildings. These are based upon U value requirements (expressed in W/m2K) for the main building envelope construction elements. These U values are worst acceptable standards which as a stand-alone measure would not necessarily mean that a building meets the overall performance-based requirements in the respective country. Given the diversity in climatic conditions, maximum U value requirements vary widely across different countries where Spain, France, Greece, Italy and Portugal have multiple maximum U values due to the considerable variation in climatic conditions within each country.

In some countries, variations also apply for different types of buildings (e.g. Latvia) and type of heating (e.g. Sweden). A comparison between the collected data and the cost optimal U values published by EURIMA/Ecofys [7] in 2007 confirm that Member State maximum U values are still higher than the cost-optimal requirements, suggesting that U value requirements in most Member States should be made more demanding. This was also one of the key findings of the IEA information paper on building codes [8] where it was shown that existing U value requirements for building components did not reflect the economic optimum.

2.2.2 Air tightness/permeability and ventilation requirements

Most countries have introduced requirements to ensure minimum levels of ventilation within buildings.

These are generally based upon metabolic rates and activity within the building. The requirements associated with ventilation relate principally to health, comfort and productivity; however they do have direct impact on energy requirements. The thermal performance of buildings is directly related to airtightness and the requirements for ventilation. Excessive ventilation as a consequence of poor construction detailing, can lead to considerable energy wastage and for this reason a number of countries have introduced requirements to limit the air permeability of buildings. Air permeability is normally measured using a pressure test, typically at 50Pa (4Pa in France and 10Pa in The Netherlands) to determine the air leakage rate. The requirement is typically expressed in m3/h.m^2 (where m^2 is the external envelope area) or in the case of Denmark in l/s.m^2 (where m^2 is the floor area).

2.2.3 Other requirements

A number of countries (e.g. Austria, Denmark, France, Estonia and Poland) have introduced minimum requirements for specific fan power (generally expressed in W/l.s or kW/m3.s.). Given the increasing use of mechanical ventilation system, the fan power requirement in low energy buildings is becoming an important issue.

Additionally most countries have requirements associated with the minimum performance of boilers and air-conditioning systems.

Most building codes require minimum levels of daylight to be achieved within buildings, whilst ensuring that solar gains do not result in significant overheating and/or the requirement for air conditioning. Building requirements associated with limiting solar gains vary from simple approaches (e.g. limiting window areas on building aspects exposed to solar gains) through to requirements for complex modeling and simulation to demonstrate that effective measures have been adopted to provide solar protection. The Concerted Action report 1 recommended that much greater attention should be given to the issue of estimating the impact of summertime overheating in the methodology in order to reduce the rapid increase in demand for air conditioning.

In addition to specifying maximum U values, several countries have also set limits for maximum permissible thermal bridging. This is generally expressed in W/mK. Thermal bridges can significantly increase the building energy demand for heating and cooling and in nearly Zero Energy Buildings thermal bridging can account for a significant proportion of the total heat loss or gain. Thermal bridging is specific to the design and specification and can be complex and time consuming to calculate. For this reason, some countries allow a default thermal bridging value to be used, based upon a percentage (typically 15%) of the overall heat loss calculation. However, if a detailed thermal bridging calculation has been undertaken, which demonstrates that thermal bridges have been reduced or eliminated, this value can be used instead of the default. ASIEPI estimate that “a third of EU Member States have no real ‘good practice’ guidance on thermal bridges, in the framework of their building energy regulations. The quality of guidance in the remaining States is very varied” [9].

2.2.4 Building codes requirements for existing buildings

Despite being an EPBD requirement, not all countries have reported specific mandatory building codes associated with improving the energy performance of existing buildings. It is important to recognise that EPBD (Article 5) only applies to buildings over 1000 m^2 and most Member States have introduced requirements for consequential improvements associated with buildings over 1000 m^2. It should be noted that these requirements may not be applied when they are not deemed to be “technically, functionally and economically feasible”.

Table 2 provides a summary of different approaches adopted by a number of Member States when a building undergoes major renovation. Switzerland has adopted a very progressive approach to improving the performance of existing buildings, where the thermal performance of renovated buildings must not exceed 125% of the new building

limit. A number of Member States have introduced minimum component performance standards when building elements (e.g. windows, doors etc.) or building's energy plants (boilers, a/c equipment etc.) are being replaced. Good examples include countries which have a performance-based requirement as well as requirements for any component that is replaced or refurbished.

Table 2: Building code requirements for existing buildings (source: BPIE survey 2011)

AT	Specific maximum heating energy demand targets for major renovation of residential and non-residential buildings. Values for renovated buildings are around 25-38% higher than new build requirements. Heat recovery must be added to ventilation systems when renewed. Maximum permitted U values for different elements in case of single measure or major renovations. Prescriptive requirements to limit summer over-heating.
BE	Maximum U values and ventilation requirements apply depending on the region.
BG	Regulations requiring performance-based standards of existing housing and other buildings after renovation. Requirements for new and renovated buildings are the same.
CH	Renovated buildings are required to use no more than 125% of the space heating demand of an equivalent new building. A single element approach may also be applicable for renovations.
CY	Minimum energy performance requirements (class A or B) for buildings over 1 000 m 2 undergoing major renovation.
CZ	Performance-based requirements when a building over 1 000 m2 is renovated. Requirements for new and renovated buildings are the same.
DE	Conditional requirements apply in the case of renovation of components whereby requirements apply exclusively to those parts of the building surface and parts of the installation that are the subject of the measures. Alternatively, a holistic assessment can also be made where values for renovated buildings should not exceed new build requirements by more than 40%.
DK	Component level requirements when existing buildings are refurbished for all improvements or extensions regardless of building size.
EE	Performance-based requirements for all building types when buildings are major renovated. Values for renovated buildings are around 25-38% higher than new build requirements.
ES	Existing buildings over 1 000 m 2 must comply with the same minimum performance requirements as new buildings if more than 25% of the envelope is renovated.
FI	Register under development by ARA, the Housing Finance and Development Centre of Finland.
FR	Performance-based requirements for buildings undergoing renovation apply for residential buildings and values depend on the climate and type of heating (fossil fuel/electricity). Requirements for components also apply during building renovation. New renovation requirements for all buildings from 2013.

HU	Performance-based requirements (in terms of primary energy) apply for residential buildings, offices and educational buildings. Requirements for new and renovated buildings are the same.
LT	Buildings over 1 000 m2 undergoing major renovation must achieve the energy performance standard of a Class D building where D corresponds to 110 kWh/m 2 a for buildings > 3 000 m 2 ; 130 kWh/m 2 a for buildings from 501 to 3 000 m 2 ; 145 kWh/m 2 a for buildings up to 500 m 2 .
LV	Requirements on different elements are applicable.
MT	U value requirements for existing renovated buildings.
NL	The Energy Performance Standard (EPN) sets requirements for the energy performance of major renovations of existing buildings (expressed as an energy performance coefficient).
NO	Building regulation requirements only apply when the purpose or use of the building is changed at renovation or if considered so extensive as to be equivalent to a new building.
PT	Special requirements for buildings over 1 000 m2 and over a specified threshold energy cost. A mandatory energy efficiency plan must be prepared and all energy efficiency improvement measures with a payback of less than 8 years must (by law) be implemented. The threshold is based upon 40% of the worst performing buildings by typology.
SI	Minimum requirements apply to major renovations (i.e. if at least 25 % of the envelope is renovated). The requirements apply to buildings of all size (NB the 1 000 m2 limit is not used). Min. requirements apply for the renovation of heating systems.
SK	Requirements for improving the thermal performance of apartment by at least 20% when being renovated.
UK	Specific requirements when replacing “controlled elements” such as windows, boilers and thermal elements in residential buildings. Consequential improvement requirements for buildings over 1 000 m2 undergoing major renovation in so far as they are “technically, functionally and economically feasible”.

2.3 Enforcement and Compliance

Building control requirements prior to, during and upon completion of the construction phase typically involve announcement to authority, application for permits, approval of plans, inspections by authority and completion of certificates. These requirements can be a critical step for ensuring regulation enforcement. Based on a comprehensive review of Building Control published in June 2006 [10] by the Consortium of European Building Control (CEBC), building control systems in Europe have undergone significant change over the past two decades. In many countries greater market liberalisation has resulted in a move away from government-run building control functions. There are growing calls for minimum quality assurance standards to be introduced in all countries to license, audit and regulate the activities of individuals (both public and private) involved in undertaking the building control function. This is particularly important in the context of the structural, fire protection and energy performance regulation requirements, where the issues are technically complex and specialist skills and expertise is required.

In the context of renovations, the BPIE survey has gathered information on the requirements, typical time period and main obstacles associated with obtaining a permit for carrying out renovation work. From the reported answers, it was clear that not all countries have permit requirements for renovations while, for the ones that do so, permits are typically necessary if major changes are undertaken in the facade of buildings (e.g. from modifying the roof to adding external insulation in case of France). Moreover, the time required to obtain a permit could vary substantially from one month (e.g. in Czech Republic) to several months (e.g. in Belgium) where the timeframe can be shorter if the project is supported by a renovation programme (e.g. in Germany this is the case with the KfW Programme).

In addition, many observers suggest that the compliance and enforcement of building energy codes is currently undertaken with less rigor and attention to detail, than other building regulation requirements such as structural integrity and/or fire safety. While there are few studies on compliance with building energy codes, there is a growing body of academic research suggesting that as building thermal requirements become more demanding (e.g. in the pursuit of nearly Zero Energy Buildings) there is increasing evidence of a performance gap between design intent (i.e. theoretical performance as modeled using national calculation methods) and the actual energy performance in-use. This suggests one or more of the following issues: the calculation methods are flawed, the enforcement regime is not being undertaken sufficiently rigorously or designers and builders are failing to satisfactorily deliver the outcome intended.

Closing the performance gap between design intent and regulatory requirement is likely to become an important issue over the next decade if countries are to deliver the climate and environmental targets related to buildings. The key findings of the PRC/Delft University of Technology review of National Building Regulations [10] found that there was “little attention yet to enforcing sustainable building regulations in most of the various countries analysed”. The report also suggested that, given the highly technical nature of the requirements associated with sustainability and energy, there was a serious shortage of individuals with appropriate expertise to undertake the building control function. This is resulting in poor enforcement of compliance associated with these important issues.

2.4 Energy Performance Certificates (EPCs)

The implementation of the EPC schemes has been gradual in almost all Member States due to the nature of application of the certificates. While most countries set up the first certification relating to new buildings, the scheme for renovated, new and existing public buildings were usually left for later implementation.

Before the EPBD was created, both The Netherlands and Denmark had already set up energy certification schemes for buildings at national level (in 1995 and 1997 respectively). Germany started in 2002 (having recasted it in 2009) and from then on, most of the countries started the implementation and enforcement of the EPC schemes from 2007 to 2009. Generally, Member States found it easier to introduce requirements for new buildings, as there are already processes in place to approve new buildings. How-

ever, greater benefit can be derived from identifying and stimulating uptake of energy savings measures within the existing stock.

At the moment all countries have started the certification process but nine of them haven't, by the end of 2010, operating schemes for all buildings required by the EPBD back in 2002. Greece, Romania, Spain, Luxembourg, Lithuania and the Brussels Region of Belgium implemented the remaining requirements still in 2011.

Also, some countries already have an up and running database for the registered EPCs as can be seen on the table 3 below.

Table 3: Existence of EPC register/database at national level (Source: BPIE survey 2011)

AT	No	Data held individually by each region. Centralized system to be introduced in 2011
BE	No	Database existing only for the Flemish and the Walloon regions
BG	Yes	
CH	No	
CY	No	
CZ	No	
DE	No	There are data protection concerns
DK	Yes	Offentlige Informationsserver
EE	Yes	Building Register
ES	No	Only the Autonomous Communities of Andalucía, Galicia, Canarias, Extremadura, Navarra, Valencia and Cataluña have set registries.
FI	No	
FR	No	Register under final development by ADEME
GR	Yes	Database competency of the Ministry of Environment, Energy and Climate Change (YPEKA)
HU	No	Existing database not fully operational
IE	Yes	National Administration System maintained by SEAI
IT	No	No national database, some at local/regional levels
LT	Yes	Available at the Certification Center of Building Products (SPSC - Statybosprodukcijossertifikavimocentras)
LV	No	A Construction Information System is to be introduced in 2012 to include an EPC register
MT	No	
NL	Yes	Maintained by NL Agency (www.ep-online.nl or www.energiecijfers.nl)
NO	No	There are plans to build a database which collects data on EPCs.
PL	No	Only hard copies are collected at the Poviat Building Inspectorates
PT	Yes	Administered by ADENE
RO	No	

SE	Yes	The National Register of Energy Certificates (Griffon) administered by the National Board of Housing, Building and Planning
SK	Yes	Administered by the Building Testing and Research Institute - TSUS
SI	No	
UK	Yes	England & Wales: collected by Landmark Scotland: the Home Energy Efficiency Database, maintained by the Energy Saving Trust (www.epbniregister.com) Northern Ireland: www.epbnindregister.com

3. Nearly Zero-Energy Buildings in the European Union

The EU legislative framework for buildings has been significantly strengthened in recent years by the recast of the Energy Performance of Buildings (EPBD, 2010/31/EU), the Energy Efficiency Directive (EED, 2012/27/EU) and to a lesser degree, the Renewable Energy Directive (RED, 2009/28/EC). Together, the three Directives set out a package of measures that create the conditions for significant, long term improvements in the energy performance of Europe's building stock.

Member States are required to draw up national plans for increasing the number of nearly Zero-Energy Buildings, with targets that may be differentiated according to different building categories. According to paragraph 3 of Article 9, these plans shall include:

- A definition of nearly Zero-Energy Buildings, reflecting national, regional or local conditions and include a numerical indicator of primary energy use, expressed in kWh/m2 per year.
- Intermediate targets for improving the energy performance of new buildings by 2015.
- Information on policies, financial or other measures adopted for the promotion of nearly Zero-Energy Buildings, including details on the use of renewable sources in new buildings and existing buildings undergoing major renovation (Article 13(4) of Directive 2009/28/EC and Articles 6 and 7 of Directive 2010/31/EU).

Furthermore, paragraph 2 of Article 9 asks Member States to show a leading example by developing particular policies and measures for refurbishing public buildings towards nearly zero-energy levels and to inform the Commission of national plans.

The European Commission shall evaluate the national plans, notably the adequacy of the measures envisaged by Member States in relation to the objectives of this Directive. The Commission, taking due account of the principle of subsidiarity, may request further specific information regarding the requirements. In that case, the Member State concerned shall submit the requested information or propose amendments within nine months following the request from the Commission. Following its evaluation, the Commission may issue a recommendation.

In addition to the requirements in EPBD, the Renewable Energy Directive (2009/28/EC) on the promotion of the use of energy from renewable sources requires Member States to introduce appropriate measures in their building regulations and codes in order to increase the share of all kinds of energy from renewable sources in the building sector (Article 13(4)).

According to an earlier survey [11] there are EU MSs such as Denmark, the UK, France, Germany and Belgium (Brussels Region) had been already established general strategies or aims on nZEB definitions.

The Concerted Action EPBD project has a regular survey on the implementation of the EPBD requirements in the EU MSs. According to their preliminary survey, at the beginning of 2012 only Denmark had an officially commitment for an nZEB definition and plan. The rest of the EU MSs reported ongoing preparatory studies or the intentions to start working on the nZEB over 2012 or later (figure 1) [12] [4]. In addition to these, Belgium/Brussels Region published in September 2011 an amendment of the Energy Performance of Buildings Ordinance [13] which stipulates that from January 2015 onwards, all new public and residential buildings have to fulfill a primary energy need at level of Passive House standard.

Overall, at the Concerted Action EPBD, several national approaches to the nZEB application have been presented and it is clear that the approaches will be quite different from country to country. They vary from zero carbon to explicit maximum primary energy values. Besides the primary energy indicator required by the new EPBD, many countries also intend to include a list of additional indicators, dealing with the building envelope and also with the building service system efficiency as well as the generated renewable energy. A gradual approach in form of a roadmap towards the 2020 goals (nZEB) is planned in most countries.

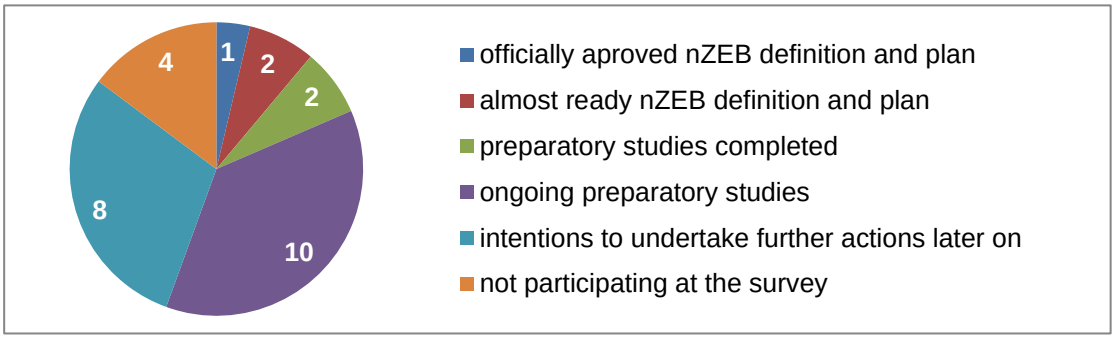

Figure 1: Overview of the status of nZEB implementation in the EU MSs as resulted from the CA-EPBD survey for 23 countries

This chapter will be further updated and extended in April 2013, after the work on "cross-analysis on Member States' plans to develop their building regulations towards the nZEB standard" within the project ENTRANZE will be completed.

In order to prepare the first progress report as requested by the EPBD, the EU Commission asked the EU MSs in autumn 2012 to show the status of the nZEB implementation. While the EU Commission report is still pending for publication, apparently only 9 MSs sent a feedback and out of these only up to 5 MSs declared a nZEB definition and plan.

[4] Hans Erhorn, Heike Erhorn-Kluttig: The Path towards 2020: Nearly Zero-Energy Buildings. Figures adjusted following a private communication with authors.

A more detailed analysis of the status of nZEB definitions in the EU MSs covered by the ENTRANZE project is provided in the country factsheets from following chapters. However, below are presented few examples of countries already adopted nZEB definitions and plans or having a general strategy and a indicative target by 2020.

- **Denmark** is one of the first EU countries that had already set-up their national nZEB definition and roadmap to 2020. The minimum energy performance requirements from set buildings regulations will gradually become stricter, starting from the actual standard, BR10 [14], with an interim milestone in 2015 and a final target in 2020 (table 1).

The minimum requirements are different for residential buildings (and other non-residential buildings with similar type of use such as hotels) and non-residential buildings. The energy scope is aligned to EPBD requirements and includes the energy need for heating, ventilation, cooling, domestic hot water and for the auxiliary equipment. For non-residential buildings, the energy for lighting is also included within the regulated energy.

The improvement of the energy performance is basically done by increasing the requirements for buildings insulation. In addition, the primary energy factors for electricity and district heating have to be improved by 2020 and the renewable energy supply from nearby and onsite will have to grow.

Table 4: Evolution of the energy performance requirements towards nZEB levels in Denmark (source: REHVA) [12] [5]

		BR10	2015	2020
Minimum requirement	Residential buildings (housing sector and hotels)	52.5 + 1650/A* kWh/m^2/yr	30 + 1000/A kWh/m^2/yr	20 kWh/m^2/yr
	Non-residential buildings (offices, schools, hospitals, others)	71.3 + 1650/A kWh/m^2/yr	41 + 1000/A kWh/m^2/yr	25 kWh/m^2/yr
Conversion factors	Electricity	2.5	2.5	1.8
	District heating	1.0	0.8	0.6

Note: A=the heated gross floor area

[5] paper *explaining the Building Class 2020 and also mentioning that Denmark has this Building Class 2020 as their NZEB (only in Danish):* http://www.ens.dk/da-DK/ForbrugOgBesparelser/IndsatsIBygninger/lavenergiklasser/Documents/baggrundsnotat_for_tyvetyve.pdf

- **Belgium/Brussels Region** amended in 2011 the Energy Performance of Buildings Ordinance [13] stipulating that from January 2015 onwards, all new public and residential buildings have to fulfill a primary energy need at level of Passive House standard.

The requirement is different for residential and non-residential buildings, such as in the followings:

- all residential buildings will have a primary energy consumption for heating, DHW and auxiliary energy below 45kWh/m2/yr and heating need below 15kWh/m^2/yr , the latter being equivalent to one of the passive house requirements.

- all office and education buildings will have a primary energy consumption below (90-2.5*C) kWh/m^2/yr (C=Volume/area) and heating need below 15kWh/m^2/yr and cooling need below 15kWh/m^2/yr.

- **In France**, few years ago, 'Grenelle Environnement' (the Environmental Round Table) recommended the adoption of more ambitious requirements for all new constructions, i.e. at the same levels as BBC-effinergie (BBC= Bâtiment Basse Consommation), the voluntary low-energy standard in France. Consequently, low energy requirements were adopted in the recast of the French thermal regulation, RT 2012, which is already applied for new non-residential buildings and since January 2013 also for new residential buildings. The requirement addresses the building's energy need for space heating, domestic hot water, cooling, lighting and auxiliary energy (e.g. for fans and pumps). RT 2012 set the minimum performance requirements at 50 kWh/m²/yr in primary energy. The minimum energy requirement is adjusted by climatic zone and altitude and hence varies between 40 and 65 kWh/m²/yr. By 2020, the Grenelle -1 Law requires that all new building have to be energy positive, i.e. to produce more renewable energy than the building's need.

- **The United Kingdom** developed a roadmap for implementing zero carbon buildings by 2016/2019. Overall the ambition in England, Wales, Northern Ireland and Scotland has a strong focus on going for carbon neutral rather than nearly zero energy buildings. As there are some differences them, in the following we focus on England. The government has announced that from 2016 all new homes and from 2019 all new non-domestic buildings in England will be built to zero carbon standards. The process of nZEB definition has been finished and built on the voluntary certification system "Code

for Sustainable Homes (CSH)", where the 2016/2019 standard is equivalent to step 5 of CSH. Step 5 means carbon neutrality for heating, ventilation, DHW, cooling and lighting. For 2013 changes in the regulation ("close to Passive House") have been foreseen to act as an interim step on the trajectory towards achieving zero carbon standards from 2016/19. From 2016 the carbon compliance limits for the building performance should be 10 kg CO2(eq) /m²/year for detached houses or ~46 kWh/m^2/year

- 11 kg CO2(eq) /m²/year for attached houses or ~46 kWh/m^2/year
- 14 kg CO2 (eq) /m²/year for low rise apartment blocks (four storeys and below) or ~39 kWh/m^2/year.

However, there is not yet committed an official plan and the necessary provisions for gradually tightening of buildings requirements. In contrast to most other countries apart from taking into consideration onsite renewable generation it is also discussed how investments in off-site renewable energy ("allowable solutions") can be taken into account in the nZEB balance.

- **In Germany**, the government had been initiated a project [15] [16] to research the possible nZEB definition and determine the best solution. The project "Analysis of the revised EPBD" came up with the following concept that is similar to the approach in the energy savings ordinance EnEV. The project report mention that the EnEV method is generally suited to assess also nearly zero-energy buildings, with some amendments for including not only the electricity generated by renewables but also other renewable energy generated on-site. Moreover, the analysis identified that the new buildings in 2020 will have an energy performance by 50% better than the buildings performance nowadays, i.e. according to the EnEV2009 standard. For the residential sector, this correspond to a KfW Efficiency House 40 level and the project consortium recommends to communicate this level as being the future nZEB definition for Germany.

In addition, the actual legislation has to be changed for including the requirement for new buildings to comply with an nZEB standard. The changes of the energy efficiency act are likely to be enacted by the German government in February 2013 [16] [15] [17] and the new EnEV Regulation will probably come into force in the 2nd half of 2013. [18]

4. Measures for implementing Article 13(4) of the Renewable Energy Directive

The table below summarises MS plans to increase the deployment of RES in buildings. This information has been derived from the National Renewable Energy Action Plans[6]. However, should be noted that only few countries have renewable energy requirements in building regulations, many other having still to implement the Article 13(4) of the Renewable Energy Directive [19].

Table 5: MSs plans to increase the use of renewable energy in buildings

Country	Description
BE	There is currently no RES-H building obligation in the Brussels-Capital region. The Brussels legislation implementing the requirements of the European directive 2002/91/CE regarding the promotion of buildings´ energy performance stipulates that the heating plants shall comply with several requirements aiming at improving their energy performance. To that purpose, heating installations shall be controlled by professionals accredited by the Brussels region (Art. 20, Ordonnance du 7 juin 2007; art. 24 Arrêté du 3 juin 2010). However no obligation concerning the installation of heating plants using renewable energy sources in buildings is mentioned.
BE	The Walloon legislation "EPB-Energetic Performance of Buildings" (PEB- Performance énergétique des bâtiments), which entered in force on 1 May 2010, implements the requirements of the European directive 2002/91/CE regarding the promotion of buildings´ energy performance. Art. 237/32 of the CWATUPE introduces the obligation for certain new buildings as well as existing buildings with a floor area greater than 1000 m² to install thermal solar collectors or any other installation allowing an energy saving at least equivalent to thermal solar collectors.
CY	Decree No. 446/2009 contains the following regulations for buildings: • Mandatory solar installations on every new residential building to satisfy domestic hot water requirements • RES installations on every new building for power generation
DK	The 2010 Building Regulations oblige owners of new or renovated buildings with a hot water consumption of more than 2000 litre per day to install solar heating panels. These panels shall cover an energy demand equivalent to the hot water consumption under normal operating conditions. This obligation does not apply to buildings using direct heating (Building Regulations art. 8.6.2. par. 2)
EE	At present the statutory law provides no minimum norms or building obligations concerning RES-H. Nevertheless, minimum requirements and obligations apply concerning energy efficiency in construction.
HU	For new building projects with a surface of more than 1000 m² Decree No. 7/2006 recommends the consideration of using renewable energy sources for decentralised energy supply in the planning process (§ 5 Decree No. 7/2006). Nevertheless, this is a recommendation rather than obligation. Further, the NREAP

[6] The EU Member States had notified their first national renewable energy action plans (NREAPs) to the European Commission by 30 June 2010 (some of them with a delay). In the NREAPs, Member States set out the sectoral targets, the technology mix they expect to use, the trajectory they will follow and the measures and reforms they will undertake to overcome the barriers to developing renewable energy [32].

Country	Description
	envisages obligations for minimum levels of renewable energy in new and newly refurbished buildings. However, according to the Energy Office such obligations have not been in place so far.
IE	New buildings are required to comply with renewable energy requirements of Part L of the Building Regulations, contributing to the renewable heat target. According to S.I. 259 of 2011, for new dwellings, a reasonable proportion of the energy consumption to meet its energy performance shall be provided by renewable energy sources (regulation 5 L3 (b) S.I. 259 of 2011). Additionally, requirements in Part L shall be met by "providing energy efficient space and water heating systems with efficient heat sources and effective controls" (regulation 5 L3 (d) S.I. 259 of 2011). New buildings are also required to have a Building Energy Rating (BER) certificate, which assess the energy performance of the building. The Building Regulation Technical Guidance Document 2011 refers to the minimum level of renewable technologies to be used in order to comply with regulation L3 (b) as follows: • 10 kWh/m2/annum contributing to energy use for domestic hot water heating, space heating or cooling; or • 4 kWh/m2/annum of electrical energy; or • a combination of these which would have an equivalent effect. According to the Technical Guidance Document, renewable technologies means "products or equipment that supply energy derived from renewable energy sources, e.g. solar thermal installations, solar photovoltaic installations, biomass installations, installations using biofuels, heat pumps, aero generators and other small scale renewable installations".
LV	When constructing a building with a total area of more than 1000 square metres it is recommended to evaluate the possibility to use renewable energy installations, for example decentralised energy supply installations, CHP installations, local heating and cooling installations or heat pumps (§ 7 Law on the Energy Performance of Buildings). According to the Ministry of Economy, local authorities' planning documents shall be such as to create conditions promoting the use of renewable energy in buildings. The government is planning a new law introducing a duty on local authorities to include a renewables obligation in their building regulations. The new law will be adopted on 9 July 2012.
LU	Regarding building obligation in the field of renewable energy the government introduced in 2012 a schedule of due dates in order to reach the objectives defined in the European directive 2010/31/UE regarding energetic performance of buildings. The Grand Ducal decree of 5 May 2012 stipulates that from 1 July 2012, new buildings shall comply with the requirements of the energetic class B concerning energetic performance, which involves the need of an increased use of renewable energies (Art. 1, RGD du 5 mai 2005). The regulation takes into consideration renewable energies used for heat and cooling purposes as well as for the production of sanitary hot water. This includes the use of biomass as well as solar, geothermal and aerothermal energy (Annex, RGD du 5 mai 2005).
MT	The building regulations in Malta do not impose minimum requirements for renewable energy. However, the support schemes introduced so far have strongly promoted renewable energy use in buildings, e.g. domestic water heating using solar technologies or electricity generation with roof-top PV systems or micro wind generators.
PT	DL 80/2006 on the Regulation for the Characteristics of the Thermal Behaviour of Buildings (RCCTE) introduces the obligation to use solar thermal collectors for heating water in buildings addressed under the RCCTE rules (art. 2 DL 80/2006). The obligation is applicable whenever there is "suitable solar exposure" (defined by art. 7(3) RCCTE) and relates to a minimum area of solar panels (1m² of panel per occupant according to art. 7(2) RCCTE). Annex II of DL 80/2006 defines sanitary hot

Country	Description
	water as „potable water with a temperature above 35 ° C used for baths, cleaning, cooking and other purposes". According to art. 7(4) RCCTE, other forms of renewable energy can be used as an alternative to the solar thermal collectors if they capture the equivalent amount of energy (measured in annual terms). In addition, these other forms of RE can be used for other purposes if they are more efficient or convenient.
SK	The only requirement for renewable energy in buildings is Act No. 555/2005 on the energy performance of buildings, which imposes an obligation to consider the possibility of using renewable energy in new large buildings (over 1,000 square metres). The measures to be taken into account include: • Decentralised installations for the supply of energy from RES • CHP-plants • Block heating or district heating and cooling using energy from RES • Heat pumps The output of the energy assessment must be stated in the technical description of the project documentation (§ 4 par. 2 and 3 Act No. 555/2005). However, this requirement has rather recommending character and does not actually constitute an obligation for investors. This situation could change with an amendment to the current zoning law or the passage of a new renewable heating act which are being discussed in Parliament.
SI	The terms set in RS52/2010 are used when constructing new buildings or when reconstructing buildings or one of its elements if this reconstruction affects at least 25 percent of the thermal envelope, and the change is technically possible. (§ 2 of RS 52/2010). Exceptions are listed in § 3 of RS 52/2010. These rules govern, when it comes to RES-H, that hot water is normally provided using solar panels or alternative installations using RES (§ 13 RS 52/2010). Furthermore it sets out (§ 16 RS 52/2010) that the energy efficiency of buildings is achieved if, in addition to the requirements of § 7 RS 52/2010 (which sets the energy efficiency technical parameters that buildings need to meet): • Either at least 25 percent of total energy consumption for the operation of facilities in a building is provided with the use of renewable energy in the building itself • or that the proportion of final energy consumption for heating and cooling and hot water production in the building is produced in one of the following ways: o At least 25 % of solar radiation, o At least 30 % of gaseous biomass, o At least 50 % of solid biomass, o At least 70 % from geothermal energy, o At least 50 % of the heat of the environment, o At least 50 % of CHP plants with high efficiency o The heating and cooling of the building is supplied to at least 50 % from energy-efficient installations. Irrespective of the requirements stated above, single-family houses meet the criteria when using at least 6 m2 (bright areas) of solar collectors with an annual yield of 500 kWh.
SE	In Sweden there is no national, regional or local legislation that requires the use of renewable heating sources in the building sector. The use of renewable energy in the building sector is incentivised through direct subsidies for the use of such sources and energy-saving measures in buildings.
UK	Feed-In Tariff for RES-E introduced in 2010 to encourage households, communities and small businesses investing in renewables

Country	Description
	The Renewable Heat Incentive (RHI), a bonus-type of support system for RES-H, opened for applications at the end of November 2011, to encourage installation of equipment like solar collectors, heat pumps and biomass boilers. Being restricted to non-domestic buildings in the beginning the scheme will be extended to residential buildings in summer 2013. The Renewable Heat Premium Payment provides financial support to households to encourage the deployment of renewables on residential properties. New homes (from 2016) and new non-domestic buildings (from 2019) to be Zero Carbon and not add extra carbon emissions to the atmosphere. This will stimulate greater uptake of on-site renewables

4.1 Economic instruments for improving the energy performance of buildings

There is a major challenge to improve the energy performance of Europe's buildings stock. Policies and roadmaps are moving fast to a longer time horizon, focusing on the years 2020, 2030 and 2050. With Europe's overall policy aiming to significantly decarbonise its economy by 80 to 95 % by 2050, the building's sector, with 40% of the region's energy consumption and almost the same level of GHG emissions, must play a key role.

However, any strategy to tackle the challenge in the buildings sector will require significant economic support and mainly in terms of funding – funding that continues throughout the entire time period. In 2012, BPIE had undertaken a review of the financing instruments in Europe evaluating financial instruments in place [3] and their effectiveness and impact. This BPIE review leads to the following findings:

- In general, all 27 MS have on-going programmes to support the energy performance of buildings, in the form of conventional or innovative or through the help of external funding.
- Most of financial instruments have targeted existing buildings, mainly in the residential sector.
- Grants and subsidies are used more than other financial instruments. They are followed by preferential loans. Fiscal instruments (e.g. tax credits) are widely used but not to the extent of financial instruments such as grants.
- Many of the new Member States are more highly reliant on external funding (e.g. EU structural funds or support through international financial institutions such as the European Investment Bank) than most of the EU-15.
- While there are many programmes in place, the understanding of their overall effectiveness is unclear. Relevant information on different programmes evaluation is often hard to collect and even harder to compare because there is no standardised way to monitor and evaluate the individual programmes and Member States using different key performance indicators. Very few programmes have set ex-ante goals and objectives, and few have an evaluation of their effectiveness. Few of the programmes have identified an on-going monitoring (feedback) process along the programme implementation.

- Few financial instruments target deep renovations or low energy buildings in general.
- Many financial instruments target specific technologies or building aspects although about one-third of the financial instruments support a holistic approach.
- Non-government instruments such as Energy Performance Contracting and Energy Efficiency Obligations (white certificates) have important roles to play because they can mobilise private funding.
- European-wide and international funding streams (EU Structural Funds, European Investment Bank and the like) are increasingly important and can play an even greater role in the future. There is some concern that some Member States are almost entirely dependent on such funding for their "national" programmes.
- There is no single solution. Funding a major retrofit strategy will require the use and possible bundling of all of the financial instruments available because of the overall cost of a deep retrofit.
- There is much more to know and learn from existing programmes. New ways are needed to better understand the existing programmes in order to learn how to achieve better implementation and impact.

A great variety of economic instruments are available throughout Europe to support the improved energy performance of buildings. The way Member States use them vary from country to country, mostly depending on the political context.

These economic instruments can be divided into two broad categories: **"conventional"** and **"innovative"**. The conventional financial instruments that have been used since the oil crises of the 1970s include: grants and subsidies, loans, and tax incentives. Levies have been to a much lesser extent. There have also been funds (such as from international financial institutions) that often provide the financing for such as loans or grants. There are also funds coming from the selling of Assigned Amount Units (AAUs), also known as carbon credits, under the Kyoto Protocol that have been used for the funding of subsidy schemes[7].

Each support instrument contributes in a different way to overcome the significant market barrier which is financing. As it was mentioned in several previous studies, while over the lifetime of the building it is cost-effective, the investments in low-energy buildings are high and this is very often a major barrier for undertaking major improvements of buildings' energy performance. Overall, the most common economic instruments used in Europe are such as in the following:

- **Direct grants or subsidies**: can be offered from public funds and are directly allocated by the authorities or, more typical, accessed through banks or foundations.

[7] Much of this comes from Energy Charter Secretariat [31]

- **Preferential Loans schemes** encourage energy efficient practices by subsidised interest rates or credit risk support. Typically, national and local authorities support these schemes by regulatory measures, by sharing the risks with the banks and/or by covering a share of the loan interest.
- **Value Added Tax (VAT)** normally affects the final consumer but not the producer – who passes the cost onto the consumer. Differential VAT rates can be used to influence the choice of energy efficient technology or energy performance upgrade measures by householders.
- **Taxes, tax incentives or tax rebates** which can take three forms: a tax on energy, sales tax incentives to promote market penetration, or tax rebates given in recognition of energy savings investments. These are accessed either through the tax office or at point of sale. The energy and/or climate taxes may be used for creating a fund for financing measures that contributes to the reduction of the energy consumption and associated GHG emissions (e.g. a levy on electricity sales to fund renewable energy schemes)

Less common economic instruments include energy supply obligations (white certificates) or energy performance contracting (and energy services companies-ESCOs). They are considered innovative but, for example, energy performance contracting has been around since the 1980s and energy supply obligations since the 1990s, at least in Europe. There is another distinction, which is important for policymakers. These innovative instruments normally rely on private financing and not government budgets, although there are exceptions.

The following chapters provide a general evaluation of varied support measures as resulted from BPIE survey from 2011 as well as from recent studies.

The analysis provide within this report is based on data collected in 2010-2011. However, another Entranze report[8] will investigate and describe more detailed new and innovative policy instruments. The impact of some of these policy instruments will be model in more detail for the target countries within this project.

4.2 Overview of financial instruments in place in 2011

The BPIE review has identified 132 major programmes on-going during 2011 in the European Union; 100[9] running as conventional programmes, 18 as innovative programmes, 8[10] supported through the EC Structural Funds, and 6 carried out by international institutions such as EBRD, United Nations Development Programme, etc[11].

[8] A new ENTRANZE report provided an "Overview and assessment of new and innovative integrated policy sets that aim at the nZEB standard" will be available in April 2013 [33]

[9] 10 programmes using Structural Funds were included in conventional.

[10] Structural Funds reported by MS, excluded the 10 programmes in conventional.

[11] There can be some double counting but as much as possible, programmes funded under, for example, the Structural Funds, were categorised as conventional programmes of the Member States or programmes really led by Structural Fund support.

Considering the broad category of conventional programmes, 26 Member States out of 27 had on-going incentives in 2011 for a total of 100 running programmes using different type of instruments. The following figure depicts the number of identified programmes by type of instrument and country.

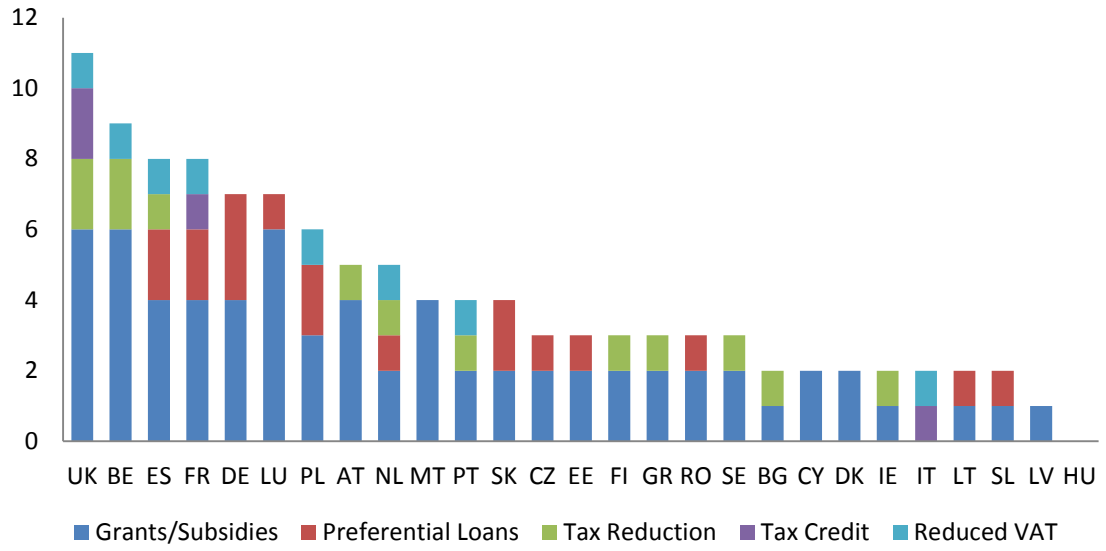

Figure 2: Number of financial instruments in place in 2011 by country

Source: BPIE 2012 [3]

In total, there are: 68 grant and subsidies schemes, 18 preferential loans, and 25 tax related instruments (13 Tax reduction, 4 Tax credit, 8 Reduced VAT). Ten programmes (CZ, 2 DE, ES, 1 LT, 2 PT, 2 SK, SL, UK) were implemented together with more than one type of instrument in place. Most commonly "grants and subsidies" were combined with "preferential loans", and "tax reduction" with the "tax credit" measure. Grants and subsidies are apparently the most widespread type of schemes, followed by preferential loans and tax reduction. Reduced VAT is of growing importance while only a few Member States use a tax credit.

Belgium and the UK have (n.b. in 2010-2011) the greatest number of identified instruments in large part because the majority of the programmes in these countries are developed and implemented at the regional level. Italy had only fiscal programmes ongoing nation-wide during 2011. The Italian regions developed a series of programmes through the support of EU Structural Funds.

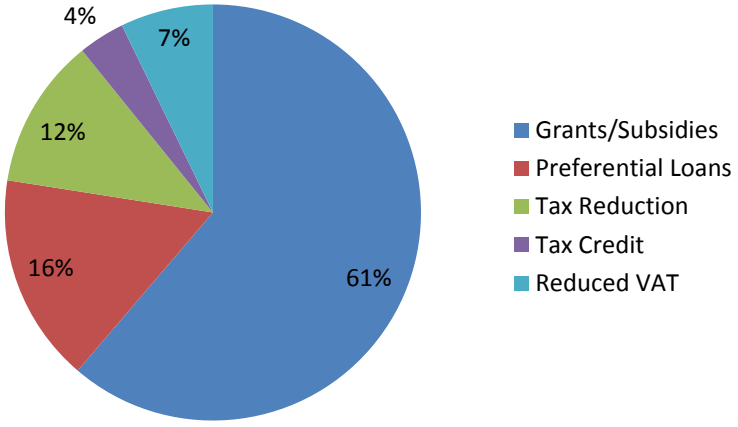

Figure 3: Share of different types of instruments

Source: BPIE 2012 [3]

However, it should be taken into account that this weighting has been carried out in terms of "number of programs", not in terms of program budgets.

4.3 Financial incentives

Financial incentives for the energy efficiency in buildings are divided in two major categories that include *Grants/Subsidies* and *Preferential Loans*.

During 2011, 25 MS had on-going financial incentives specifically designed for works and investments for the energy efficiency in buildings for a total of 73 measures. The following figure shows the aggregated number of on-going financial incentives used in 2011 by MS.

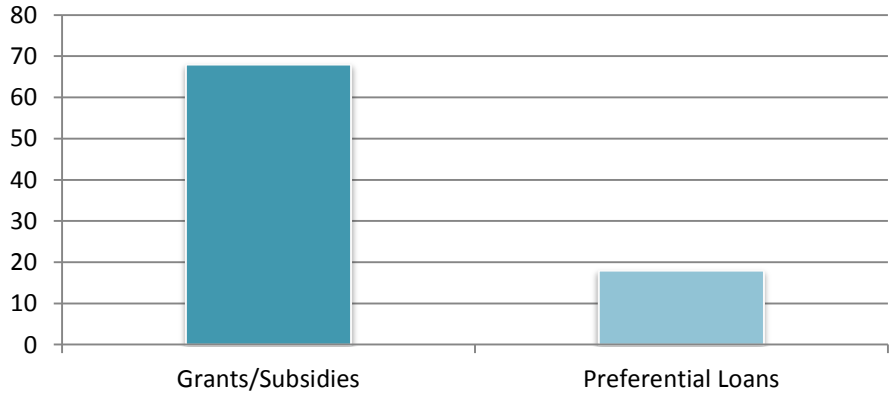

Figure 4: Number of financial incentives by type

Source: BPIE 2012 [3]

The upmost type of financial incentives used is in the form of grants and subsidies which count a total of 68, whereas there are only 18 preferential loans schemes.

The below figure shows the EU aggregate share according to the type of building the incentives cover (only new buildings, only existing buildings, both).

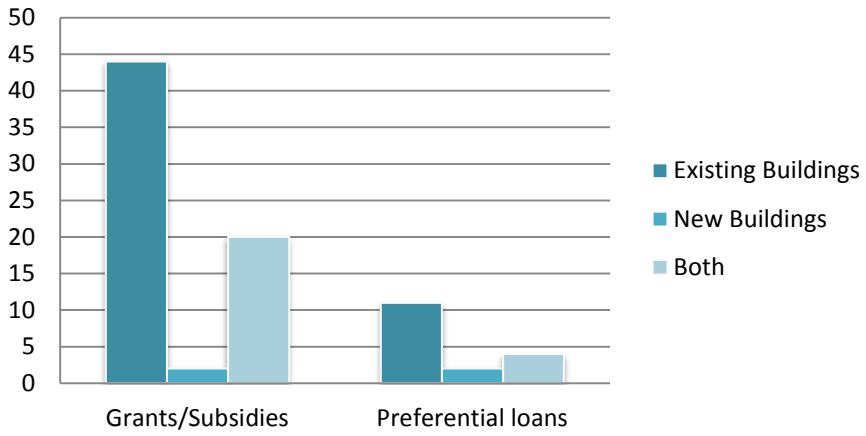

Figure 5: Number of financial incentives by type of building (New buildings/Existing buildings)

Source: BPIE 2012 [3]

Most of the financial programmes, grants/subsidies and preferential loans, are directed at existing buildings and few to exclusively new buildings. Many programmes cover both existing and new buildings.

Residential buildings are the target for most financial incentives while the non-residential sector has received much less support (figure 7). This, in large part, is because in the EU-27, the non-residential buildings count for 25% of the floor space whereas the residential stock represents 75% of the floor space [1] and because it is felt that individual homeowners need more financial support to undertake the necessary measures.

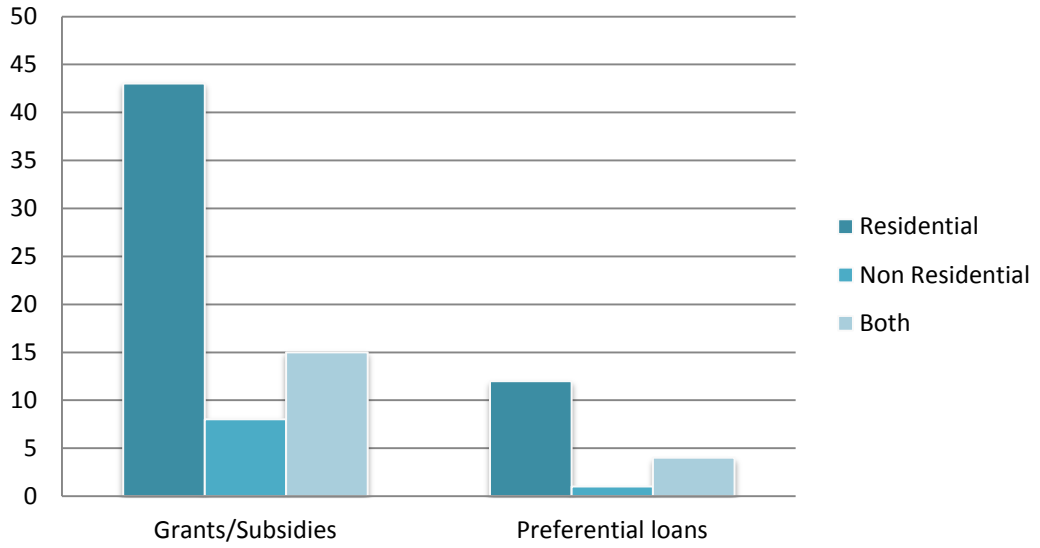

Figure 6: Number of financial incentives by type of building (Residential/Non-residential)

Source: BPIE 2012 [3]

Figure 8 illustrates that a good part of the financial incentives support all three categories (envelope, equipment, others) in a holistic approach (32%). Envelope and equipment together receive good support (23%). Single categories are well supported too (envelope 13%, equipment 15% and other 11%).[12]

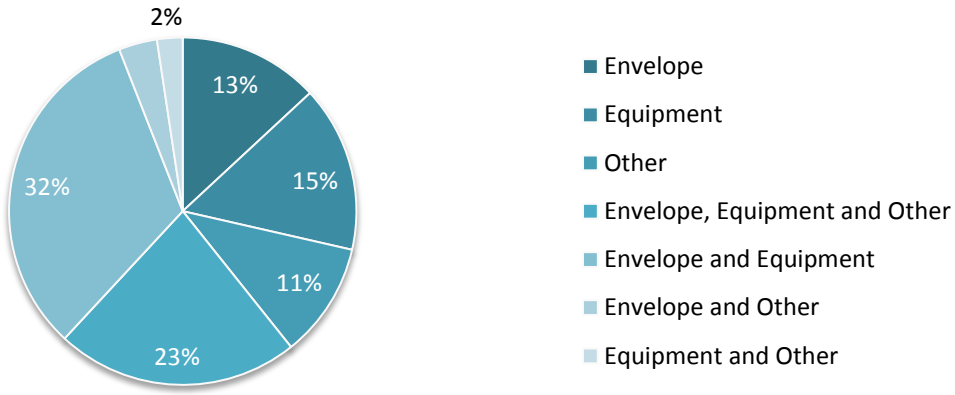

Figure 7: Share of financial incentives by type of measures covered

Source: BPIE 2012 [3]

[12] The "Other" category includes measures such as audits, education and training.

The above graph illustrates that grants, subsidies and preferential loans mainly target the "envelope" and "equipment". However, the "other" category, which includes non-technological measures as energy audit and education and training activities, also receives strong support in terms of the number of instruments that provide support for such activities.

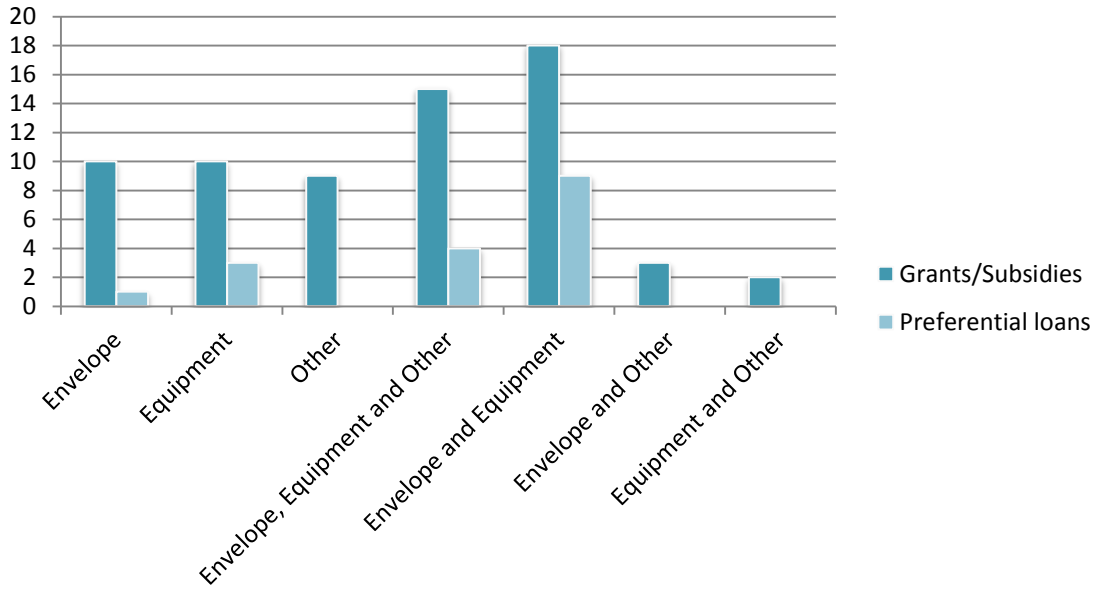

Figure 8: Number of financial incentives by type of measures covered

Source: BPIE 2012 [3]

It is important to know what level of support financial instruments give for specific investments. The level of support can be used to motivate consumers to take up actions. The following table (table 6) provides information on the level of support available from the different financial instruments. The information is divided by level of support in terms of percentage of the entire investment, the support per square metre and the total support available for an individual measure. Nevertheless, the table covers only countries that provided details on specific support programs.

Table 6: Level of support given by financial instruments in Europe in 2010/2011

	Grants	Preferential Loans
Level of support	**[%]**	**[value]**
BE (Brussels Capital)	50% (envelope, energy audit) 30% to 50% (equipment)	
BE (Walloon Region)	50% (biomass heating system) up to 60% (energy audit) up to 75% (equipment)	
BE (Flemish Region)	max 75% (equipment) 30% (envelope, equipment)	
BG	20% (envelope, other)	
CY	30% of eligible costs (envelope) 45/55% of eligible costs (equipment)	
CZ	up to 85% of a project's total eligible expenditures (envelope, equipment)	
DE	up to 20% of a project's investment costs (envelope, equipment); max. 15.000 EUR	2,55/3% (envelope, equipment) up to 50.000 euros with fixed interest rate (new) up to 100.000 euro with a fixed interest rate for 5/10 y (2/3,35%) (envelope, equipment)
DK	25% (or DKK 10 000 DKK/y per residence) (equipment) 20% (up to DKK 10 000 DKK) (envelope)	
EE	10% (no more than 4000 EUR for the reconstruction project) (envelope)	fixed interest for 10 years (not more than 4.4%) (envelope, equipment)
ES		Up to 90% of costs is financed with fixed rate of 1,5% (envelope, equipment)
FI	15/25% (equipment, Energy audits) 40/50% (Energy audit)	
FR	20/35% (envelope, equipment) 50% (Energy audit)	up to 30.000 euros (per 10 or 15 years) (envelope, equipment, other) tax-free interest of 2.5% a year (complementary to the 2005 tax credit scheme) (equipment)
LV	up to 50% (envelope)	
LT	50% (preparation technical project and construction supervision) 15% (envelope, equipment) 100% (of renovation costs for low income families and lonely (single) persons)	long-term loans with fixed interest rate of 3% (envelope, equipment, other)
LU		reduction of 0.125% on the interest rate granted for the full duration of the loan (new)

MT	20% (up to 233 euros) (envelope, equipment)	
NL		green loans with lower interest (300/600 euros/m2) (envelope, equipment)
PL	45% of the loan (equipment)	25% of the loan is subsidized by the State (envelope, equipment, other)
RO	80% (envelope)	90% is financed through bank loans (envelope, equipment)
SK	up to the 50 % of eligible costs (or max 500 SKK/m2 of flat floor area) (envelope)	
SL	25% of eligible costs (envelope, equipment)	
SE	25% (equipment)	
UK (Scotland)	100 % (envelope, other)	
UK (Wales)	100% (other)	

Policymakers are increasingly trying to encourage “deep” renovations. Deep renovations are defined differently. Often it is a percentage reduction in energy use. It can also be in terms of reaching an “A” category under the Energy Performance Certificate schemes. It can also be in terms of achieving a certain level of energy consumption per square metre per year.

The following table provides information on the level of ambition from the schemes that provided such information. The level of ambition varies significantly but there are several programmes that have a high level of ambition showing that it is possible to achieve “deep” improvements. In some countries, there can be different programmes or different support levels targeting different levels of ambition. Such is the case in Germany with the range of KfW offerings. However, the following table only illustrates the most ambitious levels, in order to show that the integration of such levels is feasible.

Table 7: Level of ambition of financial instruments in Europe

	Level of ambition
AT	• high quality standards for thermal renovation, including the whole building shell (exterior walls, windows and doors, ceilings and roof); • maximum energy performance codes for newly constructed buildings that go well beyond standards that are foreseen in general construction codes;
BE (Brussels Capital)	Low energy buildings (<30kW/m2a) (new/retrofit)
BG	25-35 kWh/m2 area / yr (retrofit)
CZ	Class B (retrofit)
DE	passive house (new), 45% below reference standard of a comparable new building (existing buildings)
EE	improve energy efficiency by at least 20%. Must take an energy audit (retrofit)
ES	Class A/B/C (new/retrofit) Class A/B (new) min annual reduction of 25% of electricity consumption for lighting interior (retrofit)
FR	low consumption buildings (BBC) (new/retrofit)
GR	overall reduction by 30% of existing municipal buildings or 11,14 GWh (958 toe) per year (retrofit)
LU	low energy buildings and passive housing (new/retrofit)
NL	Class B (retrofit) the new building is 30% better than the required energy performance (new)
RO	decrease energy consumption to 100kWh/m2 (retrofit)
SL	very low energy consumption buildings (new)

4.4 Fiscal Measures

Fiscal incentives for the energy efficiency in buildings include several measures to lower the taxes paid by consumers investing in buildings' energy efficiency. Measures include t*ax reduction* (individual and corporate and on properties), *tax credit* and *reduced VAT*.

During 2011, 14 MS out of 27 had on-going fiscal incentives supporting works and investments for the energy efficiency in buildings for a total of 25 measures. The following figure (figure 9) shows the *total number of fiscal incentives by the type.* The figure illustrates that most fiscal incentives used are in the form of tax reductions (13), followed by reduced VAT (8) and tax credits (4).

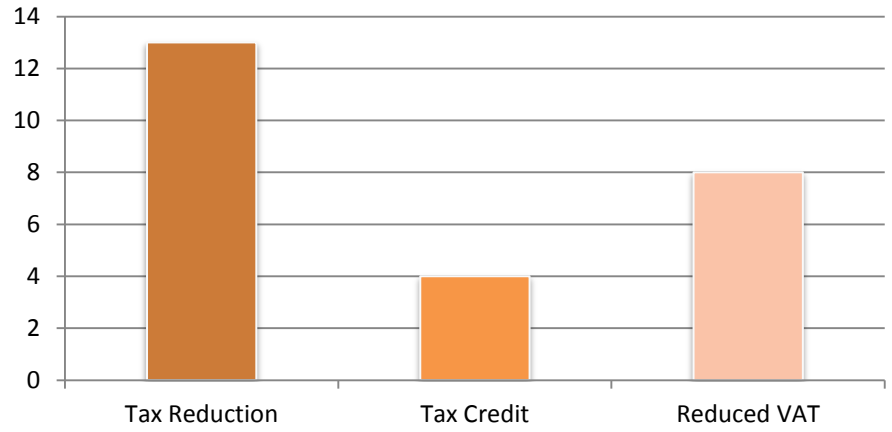

Figure 9: Number of fiscal incentives by type

Source: BPIE 2012 [3]

Figure 10 shows the EU aggregate share according to the type of building the incentives cover (only new buildings, only existing buildings, both). Most of the fiscal incentives are for existing buildings, especially tax reduction and reduced VAT. Moreover, most of the fiscal instruments address the residential sector (figure 11).

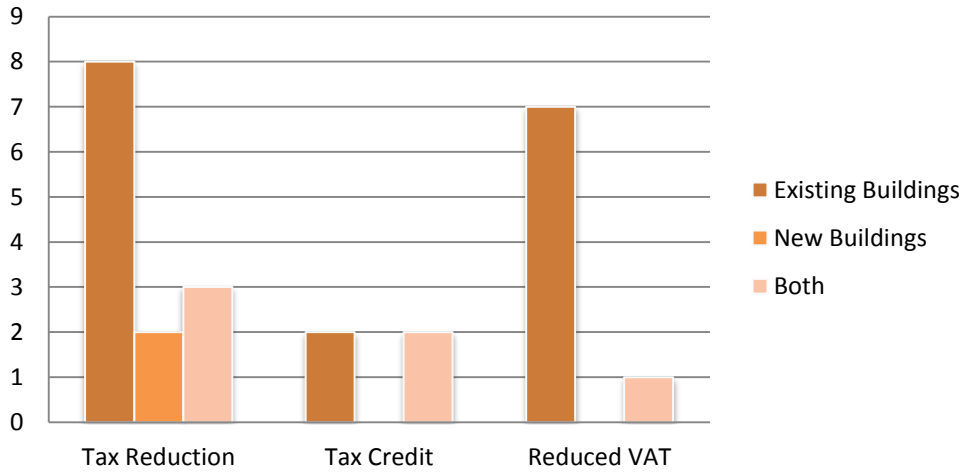

Figure 10: Number of fiscal incentives by type of building (New buildings/Existing buildings)

Source: BPIE 2012 [3]

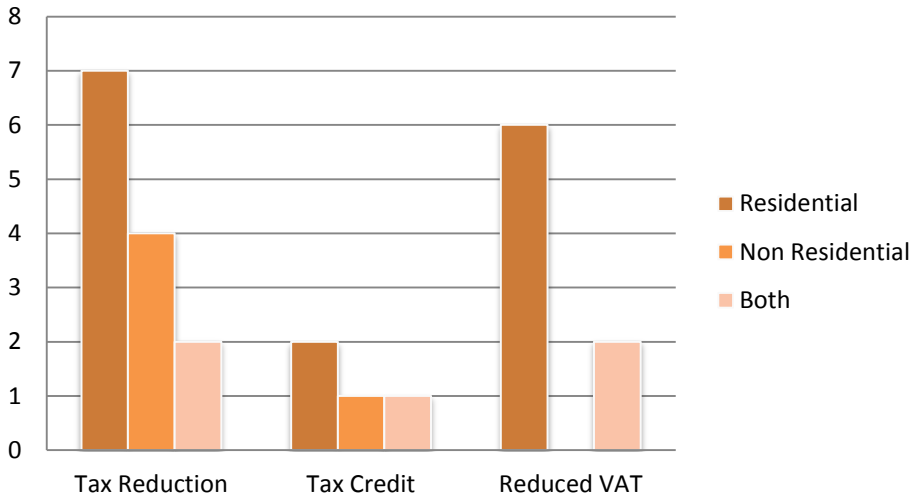

Figure 11: Number of fiscal incentives by type of building (Residential/Non-residential)

Source: BPIE 2012 [3]

Both envelope and equipment are supported for the majority by fiscal incentives, representing more than half (52%) of the total support share (figure 12). Equipment itself also receives significant attention (24%). Envelope and other measures themselves are discretely supported (8%).

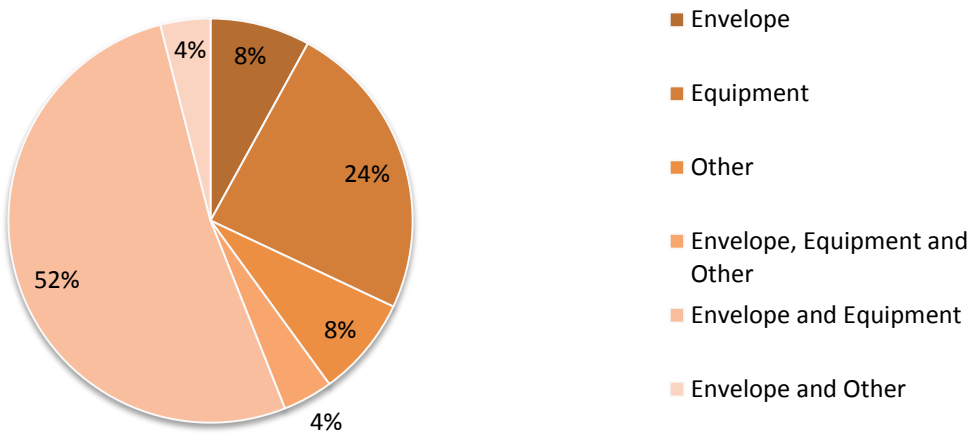

Figure 12: Share of fiscal incentives by type of measures covered

Source: BPIE 2012 [3]

Most fiscal measures cover a combination of investments in both the envelope and equipment. Tax reductions are also heavily used just for equipment (figure 13).

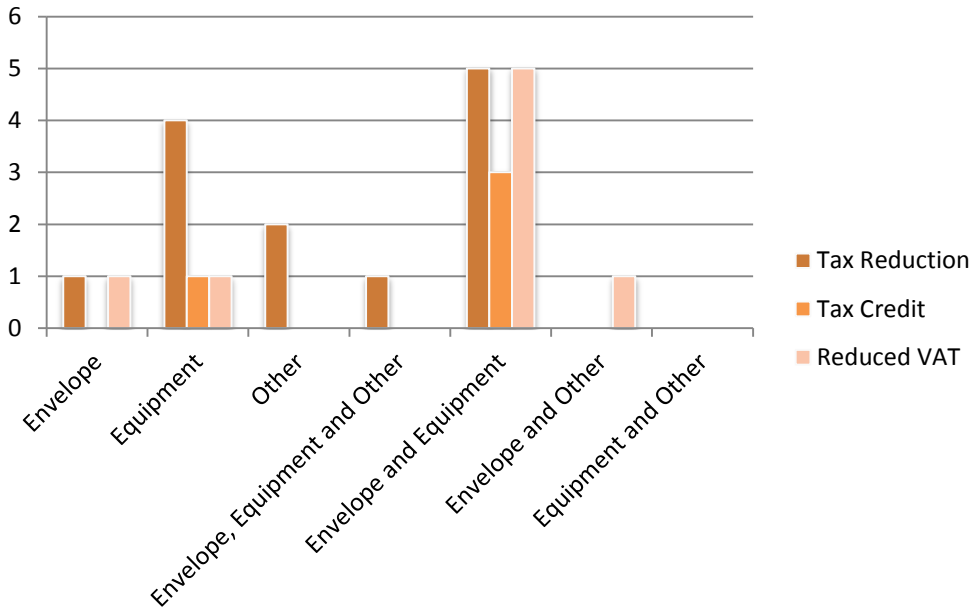

Figure 13: Number of fiscal incentives by type of measure covered

Source: BPIE 2012 [3]

Table 8 provides information made available through the BPIE survey on the level of support available from the different fiscal measures for the member states reporting such measures. Only those Member States providing any information are included.

Table 8: Level of support given by fiscal instruments in Europe

	Tax reduction				Tax credit	Reduced VAT
	Level of support	**on individual/ households**	**on property tax**	**on taxable profit**	**Level of support**	**Level of support**
AT	25% (envelope, equipment)	x				
BE (Federal)	40% (envelope, equipment, other)	x				6% (envelope, equipment) instead of normal rate of 21%
BE (Brx)	20% (new) E-level of E60 40% (new) E-level of E40 or less		x			
BG	100% (for 7/10 year Class A)		x			

	Tax reduction				Tax credit	Reduced VAT
	3/5 y Class B) (building commissioned after January 1st 2005)					
ES	up to 10% (envelope, equipment)	x				8% (envelope, equipment) instead of normal rate of 18%
FI	40% of labour costs (envelope, equipment)	x				
FR					40% on the interest of the home for 7 yrs (complements the zero interest rate loan) (envelope, equipment)	5,5% (7% from 1°of January 2012) (envelope, equipment) instead of normal rate of 19,60%
GR	up to 700 euros (equipment)	x				
IE	write off 100% of the purchase value in the year of purchase (equipment)			x		
IT					36/55% (envelope, equipment)	10% (envelope, equipment) instead of normal rate of 21%
NL	41,5% (of annual investment costs) (equipment)			x		6% (envelope) instead of normal rate of 19%
PL						8% (envelope, other) instead of normal rate of 23%
PT	25/50% property tax (Class A/A+)(equipment) 10% increase in the deduction related to house loans in the individual tax (Class A/A+) 30% (investment in RES)	x	x			13% (equipment) instead of normal rate of 23%
SE	5.000 euros/y/building (labour costs)	x				
UK	n/a (equipment) n/a (envelope)		x	x	100% tax relief on the cost (equipment)	5% (envelope, equipment) instead of

	Tax reduction				Tax credit	Reduced VAT
					1.860 euros/yr (£1500/yr) (envelope, equipment)	normal rate of 20%

Table 9 provides information on the level of ambition from the fiscal schemes that provided such information.

Table 9: Level of ambition of fiscal instruments in Europe

	Level of ambition
BE	The discount is 20% of the annual property tax for residential buildings with an E-level of E60 or less and 40% for residential buildings with an E-level of E40 or less. (new)
BG	Class A or B (building commissioned after January 1st 2005)
FR	Low consumption buildings (BBC < 50kWh EP/m2/y) (new/retrofit)
PT	Class A/A+ (new/retrofit)

4.5 Innovative Economic Instruments

The two main types of innovative financial instruments include **"energy performance contracting"** and **"energy efficiency obligations"**. Both were designed and encouraged because they do not rely on government budgets and, thus, if used properly can provide long-term financial support that cannot be guaranteed by government budgetary priorities. While they have both been used for many years, their deployment has been limited for reasons that government policies are trying to overcome.

4.5.1 Energy Performance Contracting/Third Party Financing

Energy performance contracting (EPC) has been widely promoted by the Commission, the European Investment Bank and the European Bank for Reconstruction and Development (see below). Organisations such as the International Energy Agency support the instrument because it provides a framework to encourage private funding to support energy efficiency investments with a minimum role for governments. In the BPIE survey several Member States referred to some EPC activities in their countries, although there was limited data because many of the activities are solely within the private sector domain with only limited monitoring by governmental agencies.

The 2006 Energy Services Directive (Directive 2006/32/EC) defines energy performance contracting as "a contractual arrangement between the beneficiary and the provider (normally an ESCO) of an energy efficiency improvement measure, where in-

vestments in that measure are paid for in relation to a contractually agreed level of energy efficiency improvement".

The association for energy performance contracting in Europe, the European Federation of Intelligent Energy Efficiency Services, defines EPCs as: The EPC involves the realisation of measures which lead to verifiable and measurable or (if the metering is not suitable) estimable energy savings. In addition, the contract includes a guarantee of results to be accomplished by the operator during the term of the contract.

The recently approved Energy Efficiency Directive encourages public bodies to promote the use of energy performance contracting. The first major promotion was as far back as 1993 in the Council Directive 93/76 but there is a view that EPC can play an even greater role.

While many Member States acknowledge there is significant activity by ESCOs within their borders, there are not much hard data. The European Commission Joint Research Centre reports regularly on the ESCO market in Europe. The most recent JRC's ESCO report from 2010 [20] mentions that despite the last years' progress, the energy service market in the European Union (EU) and neighbouring countries is far from utilizing its full potential even in countries with a particularly developed ESCO sector.

The European Commission states that the current EPC market in Europe is about €6 billion annually. This compares to a market of €30 billion in the United States. [21]

4.5.2 Energy Efficiency Obligations/White Certificates

Energy efficiency obligations (or often called white certificates scheme) have been used in the European Union for many years. The 2006 Energy Services Directive was thought to lead to the big breakthrough to get energy companies to play a major role in all Member States but such did not happen. However, over the past decade there has been important awareness creation and information gathering. Europe has benefited from the experience within several countries as well as in the United States. It was the US that has traditionally shown leadership in having energy companies play a significant role in promoting energy efficiency. This has been evolving since the 1970s.

There are five Member States that have ongoing energy efficiency obligations schemes: Belgium (Flanders Region), Denmark, France, Italy and the United Kingdom. Poland introduced very recently a similar scheme, but it is too early to have an evaluation of it. All five countries provided information to the BPIE 2011 survey on the use of white certificates. For the most part, the information has already been updated by other sources. This was important because energy efficiency obligations were included in the now approved Energy Efficiency Directive.

The most recent source of information on energy efficiency obligations comes from an eceee report from March 2012. [22] Table 11 shows the targets together with the annual expenditure by the energy companies for the countries with EEOs in the EU.

Table 10: Comparison of the Target and the Size of the Energy Efficiency Obligation in the EU as of 2008

Country	Nature of saving target	Current size of target	Estimated annual spend by companies, €M (€/person)
Belgium-Flanders	1st year primary energy	0.6 TWh annual	26 (4)
France	Lifetime delivered energy	54 TWh over 3 years	180 (3)
Italy	Cumulative 5 year primary energy	2.2 Mtoe in 2008	190 (3)
GB	Lifetime CO2	154 MtCO2 in 3 years to 2011	900 (15)
Denmark	1st year delivered energy	0.82 TWh annual	25 (5)

Source: Eoin Lees, *Energy efficiency obligations – the EU experience*, eceee, March 2, 2012 [22]

While the EEOs can be used in all sectors, the residential sector has received much of the attention. Within the residential sector, the following figure shows what the energy companies in the four countries have supported in previous compliance periods in order to meet their targets.

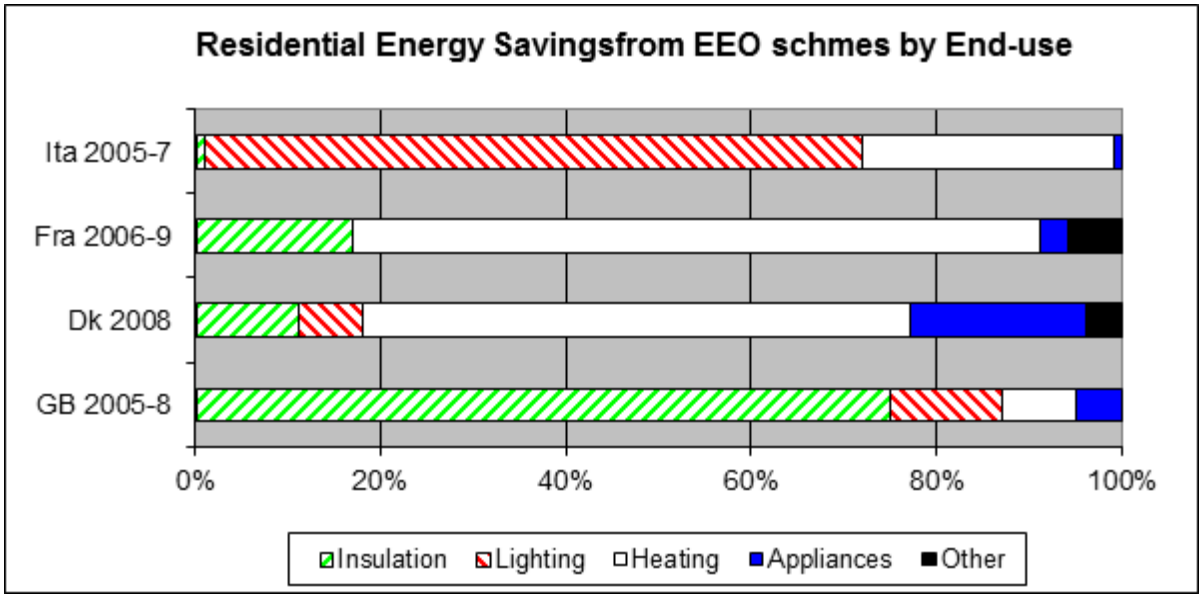

Figure 14: Residential Energy Savings from EEO Schemes by End-Use

Source: Eoin Lees, *Energy efficiency obligations – the EU experience*, eceee, March 2, 2012 [22]

The BPIE survey shows that other Member States also had energy companies playing a role to promote energy efficiency although they are not technically energy efficiency obligations. For example, in Slovakia, the Eko-Fund was funded by the Slovak Gas Industry in 2007 with measures including support for the efficient use of energy, and for dissemination and awareness building activities.

4.6 European Union and International Financial Instruments

The multilateral financial organisations play a key role in financing improvements in energy performance in buildings in Europe. There are three key institutions to describe: the European Investment Bank and the European Union itself and the European Bank for Reconstruction and Development.[13]

The following is a brief summary of their activities related to supporting projects that improve the energy performance of buildings.

4.6.1 The European Investment Bank

The European Investment Bank (EIB) provides the public and private sectors with a wide range of financial instruments for energy efficiency investments within and outside the EU [23] :

- Intermediated lending, including framework loans, available through financial intermediaries in the banking sector or through public authorities, energy service companies or public-private partnerships. It also provides indirect financing to energy effi-

[13] There are also programmes of the Global Environment Facility, the World Bank and the UN.

ciency projects via investment funds that have different geographical coverage and are established with the private sector and a range of international financial institutions.

- Risk-sharing instruments combining loans with grants and providing technical support, partnering with the European Commission or national authorities. For example, the EEEF (European Energy Efficiency Fund) launched jointly with the European Commission and other investors in 2011 to provide finance for sustainable energy projects. The Fund has a capital of €265 million and also includes technical assistance to projects financed by the Facility. The first project funded by the fund is the renovation of the Jewish Museum in Berlin, which also involved the use of energy performance contracting.

To support project preparation and operation, the EIB manages and participates in several initiatives and programmes:

- ELENA (European Local Energy Assistance) forms part of the EIB's broader effort to support the EU's climate and energy policy objectives. This initiative, managed by the Bank and funded by the Commission, helps local and regional authorities to prepare large-scale energy efficiency and renewable energy projects.
- JESSICA – Joint European Support for Sustainable Investment in City Areas – is also an innovative initiative that uses existing structural fund grant allocations to support urban development including energy efficiency projects. 11 Member States (BG, CZ, DE, EE, EL, SE, IT, LT, PL, PT and UK) have moved part of their ERDF14 allocation into specific JESSICA projects (both for energy efficiency and renewable energy projects) for a global amount of €1558.7 million (of which 75% ERDF resources), resulting in the creation of 16 holding funds (of which 15 managed by the EIB), while 4 financial instruments are set up without a holding fund [24].

4.6.2 The EU Structural and Cohesion Funds

Structural and Cohesion Funds (2007-2013) may be used for energy-efficiency and renewable-energy investments not only in public and commercial buildings but also in existing housing. The new proposal for an EU Cohesion Policy for 2014-2020 places even greater emphasis on supporting investments related to EU energy targets and suggests nearly doubling the amount allocated to sustainable energy in the current period, including for building renovation.

Cohesion Policy Funds have helped to trigger more investments especially in the buildings sector, even though they have a wider remit than energy efficiency. In the 2007-2013 phase, around 4.6 billion euro is available for energy efficiency. Since 2009 up to

[14] ERDF= The European Regional Development Fund

4% of the national ERDF allocations can be used for energy efficiency improvements and renewable energy investments in existing housing that supports social cohesion.

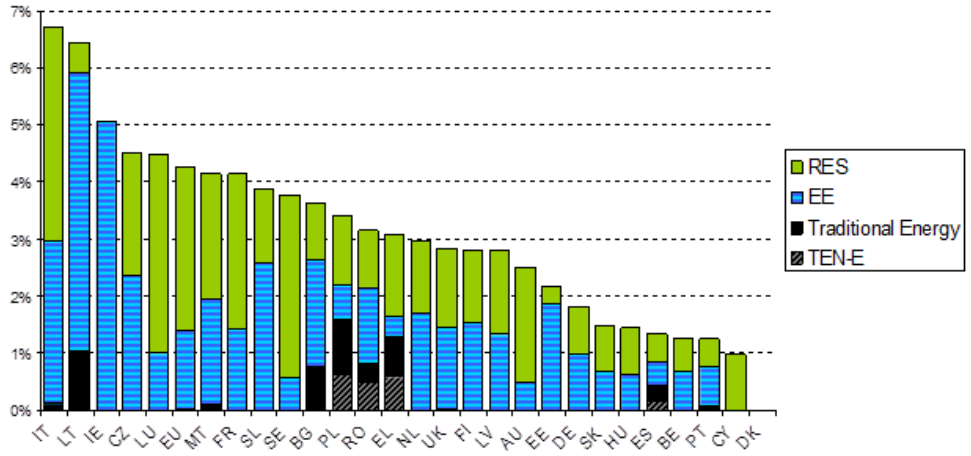

Figure 15: Funding for 2007-2013 Period

Source: Doubrava presentation at CECODHAS workshop, May 15, 2012 [25]

From the BPIE survey, 18 programmes[15] were identified from 13 Member States. This is undoubtedly understating the use of structural funds because all 27 Member States have access to the Structural Funds for such purposes. By the end of 2009, Member States allocated less than 1% of the ERDF funding for building renovation, while they can use up to 6% [25].

The proposals for the next phase (2014-2020) foresees about a doubling of funds available for energy efficiency and renewable energy to €17 billion.

The European Union also provides support funding for buildings through the 7th Framework Programme for R&D [26] as well through the Intelligent Energy Europe (IEE) programme [27]. Under the Horizon 2020 programme [28], the Commission proposes that €6.5 billion be allocated to energy research and innovation, including the continuation and reinforcement of current IEE Programme activities including continued and strengthened support through ELENA.

To assist Member States and other stakeholders with better targeting and use of the EU Funding towards energy efficiency, the Commission has been stepping up its capacity building and awareness rising efforts, focusing on National Authorities (i.e. the

[15] 10 programmes were analysed under conventional instruments.

European Public-Private Partnership's information campaign on Structural Funds and PPPs), Regional and Local Authorities (i.e. capacity building activities in the context of the Covenant of Mayors), and other actors (especially through the IEE Programme). Particular attention has been paid to the provision of technical assistance for the development of bankable projects [29].

4.6.3 European Bank for Reconstruction and Development

The European Bank for Reconstruction and Development (EBRD) was created to support the development of market economies in the region following the widespread collapse of communist regimes. The principal forms of direct financing provided by the EBRD are loans, equity and guarantees:

- **loans** are tailored to meet the particular requirements of a project. The credit risk may be taken entirely by the Bank or partly syndicated to the market.
- an **equity** investment may be undertaken in a variety of forms. When the EBRD takes an equity stake, it expects an appropriate return on its investment and will only take a minority position.
- **guarantees** are also provided by the Bank to help borrowers gain access to financing.

It has, over the years, provided financing that has had an impact on buildings. It was very active in improving the performance of district heating systems. It helped fund third party financing companies in new MS, starting in the 1990s. Of the new MS, it has set up dedicated funds in Bulgaria, Romania and Slovak Republic that have helped fund renovation of buildings.

The EBRD has an initiative called the Sustainable Energy Initiative. From 2006 to 2011, the EBRD invested €8.8 billion in 464 sustainable energy projects in 29 countries. The total project value was 46.9 billion, showing a strong leveraging effect. This represented 30% of the EBRD's activities. The EBRD has been transitioning away from the new EU members, other than Bulgaria and Romania, where they remain quite active. The refurbishment of buildings has not been a distinct work area and many of the activities in buildings are integrated into the theme of industrial energy efficiency, which includes commercial buildings. Until recently, the EBRD saw a difficult business case for investing in energy efficiency in buildings because, in part, of the need for bundling and because of the difficulty to develop a bankable project that is interesting to investors.

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ANNEX

A1. Austria

A.1.1 Strategies and (action) plans for the building sector

Some Austrian regions (Bundesländer) have implemented visions for the building and energy sectors. In Upper Austria, for example, 100% of heating should come from renewables up to 2030, which is only achievable with a significant reduction of space heating energy demand. Currently (January 2013) a draft document of national plan for nZEB is available including targets for the heating energy needs, delivered energy, total efficiency factor, primary energy demand and CO2-emissions.

Regarding the EED requirement for the annual renovation rate of 3% in central Government buildings, no measures have yet been put in place. The responsible federal ministry of economy, family and youth is currently working on the issue.

A.1.2 Building Codes

In Austria, building related policies and legislation lies within the competence of the nine regions (Bundesländer). Within the last years the regions worked on a harmonisation of their policies, building codes, etc. The OIB standard 6 from 2007[16] (OIB-Richtlinie 6 Energieeinsparung und Wärmeschutz, April 2007) is the current building code in place in Austria. The new version of OIB standard 6 (2011) includes stronger requirements. Up to now (January 2013) it is in place in Carinthia, Styria, Vorarlberg and Vienna, but will be implemented in all other regions probably until 2014.

The draft action plan for NZEB includes interim targets for the construction of new buildings and major building renovation for 2014, 2016, 2018 and 2020 (see details below).

A.1.2.1. Energy performance requirements

Energy performance requirements are only available on the level of heating and cooling energy demand (calculated energy consumption). For both new and renovated stock, there are no agreed conversion factors for primary energy or energy performance requirements regarding final energy. These are under discussion and being elaborated in the course of the necessary revisions due to the EPBD Recast.

OIB standard 6 (2007) allowed values depending on the building geometry up to an absolute limit which must not be exceeded. These limits are the following, calculated for reference climate, in terms of useful energy.

[16] http://www.bauordnung.at/oesterreich/oib_richtlinie6.php

Table 11: Energy performance requirements

		Residential buildings		Non-residential buildings	
		min	**max**	**min**	**max**
New stock	**Heating**	Depending on geometry	66.5 (2011: 54.4) kWh/m²/yr	N/A	22,75 (2011: 18.7) kWh/m³/yr
	Cooling		N/A	N/A	1 kWh/m³/yr
Renovated stock	**Heating**	Depending on geometry	87.5 kWh/m²/yr	N/A	30 kWh/m³/yr
	Cooling		N/A	N/A	2 kWh/m³a/yr

A.1.2.2. Thermal insulation requirements[17]

In Austria, there is a strong instrument for supporting residential building construction and renovation (Wohnbauförderung). All regions (Bundesländer) have implemented some type of this instrument with additional, stronger requirements regarding U-values and energy performance of buildings. These standards differ between regions (Bundesländer).

The table below (table 12) provides the maximum permitted U-values valid for new buildings and replacement and maintenance of a building component. Regarding these requirements, OIB standard 6 (2011) does not distinguish between the construction of new buildings, renovation of buildings or building components.

Table 12: U-value requirements

Building component		U-value [W/m²K]	U-value [W/m²K]									
			Single family		Multi-family		Offices		Education		Health	
			New	Ren	New	Ren	New	Ren	New	Ren	New	Ren
Walls	**External walls**	0,35	0,35	0,35	0,35	0,35	0,35	0,35	0,35	0,35	0,35	0,35
	Internal walls between residential and non-	0,9	0,9	0,9	0,9	0,9	0,9	0,9	0,9	0,9	0,9	0,9

[17] More information at http://www.oib.or.at/ (in German language only)

	residential use											
	Internal walls to non-conditioned areas (except attic)	0,60	0,60	0,60	0,60	0,60	0,60	0,60	0,60	0,60	0,60	0,60
	Walls to non-conditioned attic	0,35	0,35	0,35	0,35	0,35	0,35	0,35	0,35	0,35	0,35	0,35
	Walls to other buildings	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5	0,5
	Wall, basement in contact with the ground	0,40	0,40	0,40	0,40	0,40	0,40	0,40	0,40	0,40	0,40	0,40
Windows	**Windows**	1,40	1,40	1,40	1,40	1,40	1,40	1,40	1,40	1,40	1,40	1,40
	Other windows and doors	1,70	1,70	1,70	1,70	1,70	1,70	1,70	1,70	1,70	1,70	1,70
	Roof windows	1,70	1,70	1,70	1,70	1,70	1,70	1,70	1,70	1,70	1,70	1,70
	Other external transparent components horizontal or slope	2,00	2,00	2,00	2,00	2,00	2,00	2,00	2,00	2,00	2,00	2,00
Roof/Ceilings	**Roof**	0,20	0,20	0,20	0,20	0,20	0,20	0,20	0,20	0,20	0,20	0,20
	Internal ceiling to uncondi-tioned areas	0,40	0,40	0,40	0,40	0,40	0,40	0,40	0,40	0,40	0,40	0,40
	Internal ceiling between resi-dential and non-residential use	0,90	0,90	0,90	0,90	0,90	0,90	0,90	0,90	0,90	0,90	0,90
Floors	**In contact to ground**	0,4	0,4	0,4	0,4	0,4	0,4	0,4	0,4	0,4	0,4	0,4

A.1.2.3. Compliance

There are no official compliance statistics or evaluations. For new buildings, compliance is considered good, in particular for beneficiaries of the construction and renovation support programme “Wohnbauförderung”, through which energy efficiency criteria are checked. For renovation, no monitoring is in place and compliance is probably moderate. Also, probably more than half of all renovation activities do not include thermal renovation activities.

A.1.3 Measures for implementing Article 13(4) of the RED

Up to now, no measures to fulfil the RED requirement to use minimum levels of energy from renewable sources in new and existing buildings have been taken.

However, in Austria, there is a strong instrument for supporting residential building construction and renovation (Wohnbauförderung) and all regions (Bundesländer) have implemented some type of requirement to make use of RES-H as a pre-condition to receive this support.

A.1.4 Energy Performance Certificates

The federal law that regulates the obligations to present the energy certificate according to the EPBD went into force on January 1st, 2008.

The EPC energy classes are provided in the following table (they are not distinguished between different building types):

Table 13: EPC Energy classes

	OIB standard 6, version 2007:	**OIB standard, version 2011 lists additional primary energy classes**		
Class	***Energy for space heating (reference climate)***	***Primary energy***	***CO2 emission***	***Final energy efficiency factor***
Klasse A++	HWBBGF,Ref ≤ 10 kWh/m²a	PEBBGF,SK ≤ 60 kWh/m²a	CO2 BGF,SK ≤ 8 kg/m²a	fGEE ≤ 0,55
Klasse A+	HWBBGF,Ref ≤ 15 kWh/m²a	PEBBGF,SK ≤ 70 kWh/m²a	CO2 BGF,SK ≤ 10 kg/m²a	fGEE ≤ 0,70
Klasse A	HWBBGF,Ref ≤ 25 kWh/m²a	PEBBGF,SK ≤ 80 kWh/m²a	CO2 BGF,SK ≤ 15 kg/m²a	fGEE ≤ 0,85
Klasse B	HWBBGF,Ref ≤ 50 kWh/m²a	PEBBGF,SK ≤ 160 kWh/m²a	CO2 BGF,SK ≤ 30 kg/m²a	fGEE ≤ 1,00
Klasse C	HWBBGF,Ref ≤ 100 kWh/m²a	PEBBGF,SK ≤ 220 kWh/m²a	CO2 BGF,SK ≤ 40 kg/m²a	fGEE ≤ 1,75
Klasse D	HWBBGF,Ref ≤ 150 kWh/m²a	PEBBGF,SK ≤ 280 kWh/m²a	CO2 BGF,SK ≤ 50 kg/m²a	fGEE ≤ 2,50
Klasse E	HWBBGF,Ref ≤ 200 kWh/m²a	PEBBGF,SK ≤ 340 kWh/m²a	CO2 BGF,SK ≤ 60 kg/m²a	fGEE ≤ 3,25
Klasse F	HWBBGF,Ref ≤ 250	PEBBGF,SK ≤ 400	CO2 BGF,SK ≤ 70	fGEE ≤ 4,00

	kWh/m²a	kWh/m²a	kg/m²a	
Klasse G	HWBBGF,Ref > 250 kWh/m²a	PEBBGF,SK > 400 kWh/m²a	CO2 BGF,SK > 70 kg/m²a	fGEE > 4,00

A.1.5 Inspections (for boilers and/or air conditioning systems): article 8 of first EPBD

HVAC inspections are regulated on regional level in different ways. In all regions there is some form of obligatory inspections of boilers and A/C systems. The details (e.g. periods) depend on the type and size of the boiler and AC system. The inspection of boilers are carried out by chimney sweepers and range from up to four times a year for large solid fuel boilers to every 4 years for small gaseous boilers. Both emissions and efficiency are monitored and minimum requirements for emissions (air pollutants) have to be achieved. Compared to heating systems, the inspection of air conditioning is still at an early stage. Only AC systems above a rated output of 12 kW have to be inspected. (Jilek 2011)

A.1.6 Cost optimality

Several studies are currently being carried out and commissioned by different institutions, which should be included in the communication of the Austrian government to the European Commission on Cost-Optimality in March 2013.

A.1.7 nZEB: requirements and roadmaps

Up to now the regions (Bundesländer) have agreed on a draft document for the definition of nZEB and interim targets in a national plan according to the EPBD (recast). This national plan foresees targets for the heating energy need, delivered energy, total efficiency factor of the building, primary energy demand and CO2-emissions for the years 2014 (start of implementation 1.1.2015), 2016 (1.1.2017), 2016 (1.1.2018) and 2020 (1.1.2021).

The following tables show the interim targets for new and existing residential buildings that undergo major renovation.

Table 14: Interim targets for new residential buildings

	HWB_{max} [kWh/m²a]	EEB_{max} [kWh/m²a]	$f_{GEE,max}$ [-]	PEB_{max} [kWh/m²a]	CO_{2max} [kg/m²a]
2014	$16 \cdot (1+3/l_c)$	Using $HTEB_{Ref}$	0,9	190	30
2016	$16 \cdot (1+3/l_c)$	Using $HTEB_{Ref}$	0,85	180	28
	or				
	$14 \cdot (1+3/l_c)$				
2018	$16 \cdot (1+3/l_c)$	Using $HTEB_{Ref}$	0,8	170	26
	or				
	$12 \cdot (1+3/l_c)$				

2020	$16 \cdot (1+3/l_c)$	Using $HTEB_{Ref}$	0,75	170	26
	or				
	$10 \cdot (1+3/l_c)$				

Table 15: Interim targets for major renovations for residential buildings

	HWB_{max} [kWh/m²a]	EEB_{max} [kWh/m²a]	$f_{GEE,max}$ [-]	PEB_{max} [kWh/m²a]	CO_{2max} [kg/m²a]
2014	$23 \cdot (1+2,5/l_c)$	Using $HTEB_{Ref}$	1,1	230	38
	or				
	$25 \cdot (1+2,5/l_c)$				
2016	$21 \cdot (1+2,5/l_c)$	Using $HTEB_{Ref}$	1,05	220	36
	or				
	$25 \cdot (1+2,5/l_c)$				
2018	$19 \cdot (1+2,5/l_c)$	Using $HTEB_{Ref}$	1,0	210	34
	or				
	$25 \cdot (1+2,5/l_c)$				
2020	$17 \cdot (1+2,5/l_c)$	Using $HTEB_{Ref}$	0,95	200	32
	or				
	$25 \cdot (1+2,5/l_c)$				

For non-residential buildings, corresponding requirements are under development.

A.1.8 Other relevant topics

A.1.8.1. Permit requirements for renovation

Permits are only required for enlargements and additional construction activities.

A.1.8.2. Organisation of owners in multi-family buildings and their decision process on renovation of buildings

To carry out thermal renovation activities in a multi-family building, it is in general needed a simple majority of votes from the owners. However, there are several exemptions. In particular, in some old rental contracts there are quite strong rights for the tenants. For that reason, in some cases all tenants have to agree on activities involving measures within the dwellings (e.g. installation of central heating). In general, construction works within tenant's dwellings must not take longer than 3 days.

Residential property (Residential Property Act)
In order to manage the whole property (not the single residential property units), the total of residential owners constitute the owners corporation, which is a legal person with legal capacity (§2 subpar. 5 Residential Property Act). Measures for thermal refurbishment are regarded either as maintenance or as improvement measures. A single majority in co-ownership share, not in number, is sufficient to decide upon these measures. Depending on the kind of work, there are different ways to contradict the decision. However, in case that the owners corporation takes up a loan in order to finance the measures, resulting in a lien-related record in the land register (which de-

pends on the credit provider), then each residential property owner must agree to the entry of lien on his competency.

Simple joint ownership (General Civil Code)
In the case of simple joint ownership, there is no entry of residential property foundation in the land register. In order to carry out refurbishment measures, one needs the bare majority (more than half of the share of the property). The minority owner is not entitled any particular minority rights.

A.1.8.3. National consultation processes

There is no regular formal consultation process, but the regional governments (Bundesländer) are responsible for building issues and there are several organisations providing a platform for building-related discussions and information exchange among stakeholders.

A.1.8.4. Buildings databases/registers

Up to now, there is no publicly available building register. Statistics Austria currently sets up a building register but it will not be available before mid of 2013.

Statistics Austria regularly publishes Microcensus results including data on the building stock and heating systems. Currently (January 2013), the latest published data on a complete survey of the Austrian building stock dates from 2001.

A.1.8.5. Landlord-tenant dilemma

There is no systematic approach to tackle the landlord-tenant dilemma.

A.1.8.6. Financial and fiscal support policies/programmes

In Austria several financial programmes have been put in place to support the energy efficiency of buildings. Further, certain programmes at the “Additional substantial support programmes for residential building construction and renovation (Wohnbauförderung)”, have been established at different time period in the different Regions (Bundesländer).

The following tables provide an extract on the on-going programmes and/or a selection of some of past programmes [18].

Programme *A*

Programme name	UFI 2014, Support of domestic environmental measures
Start – End Dates	2011 - 2014
Type of programme	Grant

[18] Please note that other programmes exist.

Budget	EUR 90,24 Mio. per year
Measures covered	Support of measures for energy efficiency and renewables (and other environmental measures) in the Austrian industry and service sector; energy efficiency measures in the building sector are included but are not specified in detail.
Programme impacts	N/A
Targeted buildings:	

New build-ings	Existing buildings	Residential		Non Residential	
		Private owned	Public owned	Private owned	Public owned
				x	x

Programme *B*

Programme name	**Klima aktiv: consulting and information campaign for renewable energy and energy efficiency**[19]
Start – End Dates	2004 - ongoing
Type of programme	Grant
Budget	Approx. EUR 7 million/year (annual budget of ab. 250.000 euros for non-residential and ab. 300.000 euros for residential)
Measures covered	Consulting and information campaign for renewable energy and energy efficiency
Programme impacts	N/A
Targeted buildings:	

New build-ings	Existing buildings	Residential		Non Residential	
		Private owned	Public owned	Private owned	Public owned
x	x	x		x	

[19] http://www.klimaaktiv.at/article/archive/29297/

Programme *C*

Programme name	**Additional substantial support programmes for renewable heating (solar thermal, biomass, heat pumps) and PV from the regional governments**
Start – End Dates	ongoing
Type of programme	Grant
Budget	Due to the split between the nine regions, this data is not available
Measures covered	solar thermal, biomass heating, heat pumps, PV
Programme impacts	N/A

Targeted buildings:

New build-ings	Existing buildings	Residential		Non Residential	
		Private owned	Public owned	Private owned	Public owned
x	x	x	x	x	x

Programme *D*

Programme name	**Additional substantial support programmes for residential build-ing construction and renovation (Wohnbauförderung)**
Start – End Dates	ongoing
Type of programme	Loan
Budget	2 billion euros, annually
Measures covered	support of residential building construction and renovation; partly budget for efficiency measures and renewables; stronger regulations than in the building codes and partly requirements to use renewable heating
Programme impacts	N/A

Targeted buildings:

New build-ings	Existing buildings	Residential		Non Residential	
		Private owned	Public owned	Private owned	Public owned
x	x	x			

Programme *E*

<table>
<tr><th>Programme name</th><th>Package thermal building renovation (measure from the federal government) 2009/2010</th></tr>
<tr><td>Start – End Dates</td><td>20/02/2012 - 31/12/2012 (The package started in 2009 and budget is allocated on a yearly basis)</td></tr>
<tr><td>Type of programme</td><td>Loan</td></tr>
<tr><td>Budget</td><td>100 M€, of which 70 M€ residential, EUR 30 M€ non-residential</td></tr>
<tr><td>Measures covered</td><td>thermal renovation of buildings</td></tr>
<tr><td>Programme impacts</td><td>N/A</td></tr>
<tr><td>Targeted buildings:</td><td>
<table>
<tr><th rowspan="2">New build-ings</th><th rowspan="2">Existing buildings</th><th colspan="2">Residential</th><th colspan="2">Non Residential</th></tr>
<tr><th>Private owned</th><th>Public owned</th><th>Private owned</th><th>Public owned</th></tr>
<tr><td></td><td>x</td><td>x</td><td></td><td></td><td></td></tr>
</table>
</td></tr>
</table>

Programme *F*

Programme name	Tax Incentives[20]
Start – End Dates	N/A
Type of programme	Tax reduction
Budget	€ 2,920 per year for ordinary tax payers. Additional deduction of € 2,920 for single income households, and € 1,460 granted if at least three children living in the household. Only 25% of the amount may be deducted from the income
Measures covered	- ENVELOPE (including insulation, windows & glazing, exterior wall, doors, ceiling, etc.) - EQUIPMENT (including efficient heating, efficient lighting systems, ventilation, cooling, control systems, etc.)
Programme impacts	N/A

[20] http://www.bmf.gv.at/Publikationen/Downloads/BroschrenundRatgeber/STB_09_D_WEB(2).pdf (In German version)

Targeted buildings:	New build-ings	Existing buildings	Residential		Non Residential	
			Private owned	Public owned	Private owned	Public owned
		x	x			

A2. Bulgaria

A.2.1 Strategies and (action) plans for the building sector

In Bulgaria medium strategies are connected with consultations and developing of the EPBD requirements and their implementation at local level. However, the process will start next year, after the validation of the final definition for the nZEB.

Concerning the Energy Efficiency Law, amendments and additions have been provided and already introduced in the National Legislative Assembly. In this respect, endorsements are foreseen. The amendments are connected with the energy efficiency buildings and not exactly with the nZEB as no official definition of the nZEB exists yet.

The Bulgarian Government has the intention to reach 1.5% renovation target instead of the 3% renovation rate planned in the EED. The 3% renovation rate is seen too ambitious for the moment. This 1.5% should be done in the time frame defined in Brussels. At present, no barriers exist for implementing this rate.

A.2.2 Building codes

In Bulgaria energy performance requirements are not defined in building norms. However, different Regulations are in place for the building sector. Regulation № 18 of 12.11.2004 on energy performance of objects regulates the improvement of the energy performance of existing housing through renovation, which will lead to reduction of heat losses through building envelope, increase of operational quality of dwellings and achievement of comfort of habitation. Regulation №7 of 15.12.2004 on heat saving and on energy efficiency of buildings regulates the implementation of high effective materials and technologies to housing and public construction and to refurbishing existing buildings. The latter, amended by the Bulgarian Ministry of Regional Development and Public Works in 2009, also specifies minimum U-values requirements for the building envelope

The requirements for the building elements are the same for new buildings and in case of energy renovation of existing buildings. Moreover, there is no difference between requirements for residential and non-residential buildings.

There are regulations for design of heating, ventilation and air conditioning systems (HVAC), domestic hot water supply and electrical installations and lighting. Some of ordinances refer to national and international standards in this field (mainly for calculation methods). There are different norms for the appliances which are harmonized with the EU legislation for the relevant product categories. Normally there are no requirements for purchasing and installation of systems and appliances with minimum technical requirements or rated with higher category of eco-labels (with the exception of some heating boilers). Using of highly efficient systems and appliances is optional and eco-labels and standards for efficient appliances are not obligatory in tenders for public buildings.

In case of new building with total floor area more than 1000 m^2 the possibilities for decentralized systems for production and consumption of energy from RES and heat pumps should be considered.

A.2.3.1 Energy performance requirements

In Bulgaria energy performance requirements are not defined in building norms.

The following table (table 16) provides with estimations for final energy consumptions. Maximum and minimum heating/cooling performance requirements of the buildings are also included.

Table 16: Energy performance requirements (kWh/m^2/year)

		Single family houses		Multi-family houses		Offices		Schools		Hospitals	
		min	max	min	max	min	max	min	max	min	max
New stock	Final energy	146	122	146	90	132	80	98	56	242	180
	Heating	102,5	82,5	102,5	50	82	40	82	40	102,5	50
	Cooling	102,5	82,5	102,5	50	82	40	82	40	102,5	50
Renovated stock	Final energy	146	122	146	90	132	80	82	40	102,5	50
	Heating	102,5	82,5	102,5	50	82	40	82	40	102,5	50
	Cooling	102,5	82,5	102,5	50	82	40	82	40	102,5	50

The evaluations of maximal and minimal performance values for all buildings are based on the following assumptions:

- Max performance assumptions – DD = 2100, A/V = 0,2 (for single-family houses A/V = 0,8), 32 % share of glazing,
- Min performance assumptions – DD = 3300, A/V = 1,2, 32 % share of glazing

DD – heating day-degree
A – area of building envelope in m^2
V – volume of building in m^3.

The method used for calculation of energy performances is BDS EN ISO 13790 (in English). In Bulgarian it can be found in Regulation № 7 /October 2009 “On energy efficiency, heat and energy saving in buildings”. The method is complex[21]. Values for specific energy consumption for heating of buildings, for minimal and maximal values of

[21] More information are available at the following link: http://www.econ.bg/content/Naredba%20naredba.pdf.

DD and A/V, derive from Regulation № RD-16-296 from 01.04.2008 r. for energy performances of sites.

A.2.3.2 Thermal insulation requirements

The specific requirements (Maximum U-value, W/m2K) for building components are presented in the table below (table 17).

Table 17: U-value requirements

Building component	U-value* [W/m²K]									
	Single family		Multi-family		Offices		Education		Health	
	New	Ren	New	Ren	New	Ren	New	Ren	New	Ren
Walls	0,35									
Windows	1,7									
Roof	0,28									
Floor	0,4									

*Remark: U-values depend also on the average indoor temperature (they defer for buildings with temperature less than 15°C and more than and equal to 15°C) and boundary conditions (border to the ground, air or heated space), there are also some exceptions for windows with aluminium frames.

A.2.3.3 Compliance

Any new building must have a technical passport which also include the energy passport. During the construction there are two types of control: one from the designer and the other one from the investor. There is no statistical information or studies for the compliance with the regulations valid in the year of construction.

In case an energy audit reveal non-conformity of more than 10% of the net energy in the energy passport and the calculated net energy based on the real building charac-

teristics and components, the auditor have to inform the national Agency for Sustainable Energy Development, which will start a procedure for paying penalties.

So far no information for such cases exists as energy audit of new building can be performed after the first 3 years of building exploitation and the legislation came in 2009.

A.2.3 Measures for implementing Article 13(4) of the RED

The current renewable energy law in Bulgaria (last amendment on 28.03.2012) foresees simplification of the procedures in implementation of small windturbines and small PVs in private properties. Further, in case of new buildings with total floor area more than 1000 m^2 the possibilities for decentralized systems for production and consumption of energy from RES and heat pumps should be considered.

A.2.4 Energy Performance Certificates

Up to now the requirements for EPC are for existing public buildings in exploitation (excluding closed and abandoned buildings and buildings for military, cultural, religious and other purposes) with total floor area more than 1000 m^2.

The Energy classes for buildings in Bulgaria are defined in Ordinance RD-16-1058, issued by the Ministry of Economy, Energy and Tourism and Bulgarian Ministy of Regional Development and Public Works (2009).

The following table (table 18) shows the EPC energy classes which are the same for each building categories.

Table 18: EPC energy classes

Energy class	Energy consumption band
A	EP ≤ 0.5*EPmax,r
B	0.5*EPmax,r< EP ≤ EPmax,r
C	EPmax,r< EP ≤ 0.5*(EPmax,r + EPmax,s)
D	0.5*(EPmax,r + EPmax,s) < EP ≤ EPmax,s
E	EPmax,s< EP ≤ 1.25*EPmax,s
F	1.25*EPmax,s< EP ≤ 1.5*EPmax,s
G	1.5*EPmax,s< EP

Where:
EP – Energy performance characteristic (kWh/m^2/yr) with the U-values of the building.
EPmax,r – Energy performance characteristic (kWh/m^2/yr) of the building calculated with the lastissued U-values norms (i.e. the existing norms in accordance with the current legislation at themoment of the estimations).
EPmax,s – Energy performance characteristic (kWh/m^2/yr) of the building calculated with the U-values norms active in the moment of building commissioning.

A proposal for a new energy performance of buildings Law transposing the EPBD is in the Bulgarian Parliament for final vote. The obligations for EPC will include also buildings for rent and sale.

Up to now there are more than 5000 issued EPCs, however there is no publicly available evaluation of the issued EPCs. EPCSEPCs are usually issued in case of applying for grant for energy renovation and/or to apply for tax deduction in case the building falls into class A or B.

A.2.5 Inspections (for boilers and/or air conditioning systems): article 8 of first EPBD

Inspections of boilers and AC systems are performed according to the provisions of the Law on Energy Efficiency and Regulation № RD-16-932 of 23 October 2009 on the conditions and the order of executing inspections for energy efficiency of heat-only-boilers and air conditioning systems.

Requirements concerning the efficiency and the exhaust gases of boilers are regulated by the Ordinance RD-16-932 of the Bulgarian Ministry of Economy Energy and Tourism (2009). So far only penalties for not regular inspections and declaration of boilers were applied. The Ordinance is relatively new and there are no reports on the efficiency of the scheme in Bulgaria.

In accordance with the Law on Energy Efficiency:
Art. 27.
(1) Subject of inspection are the existing newly introduced into use heat-only-boilers:
- liquid and hard fuelled boilers with a rated capacity from 20 to 100 kW;
- liquid and hard fuelled boilers with a rated capacity from over 100 kW;
- gas fuelled boilers with a rated capacity from over 100 kW

(2) Heat-only-boilers are subject of obligatory inspection for energy efficiency once per:
- three years – for boilers as per par. 1(1);
- two years – for boilers as per par. 1(2);
- four year – for boilers as per par. 1(3)

Art. 28.
(1) All AC systems with rated capacity above 12 kW are subject of inspection under this act.
(2) AC systems are subject to obligatory inspection for energy efficiency once in 4 years.

A.2.6 Cost optimality

The requirements are being developed at the moment. When ready they will be included in the national legislation. The first steps are expected to be done in the first half of 2013.

A.2.7 nZEB: requirements and roadmaps

After consultation by the two responsible ministries (Ministry of Regional Development and Public Works and Ministry of Economy Energy and Tourism), the National Energy Efficiency Agency and several NGOs, the Bulgarian project definition for nZEBs have been sent to Brussels in December 2012 (acc. to article 9 of the Directive) for official approval.

Up to now, no “renovation maps” exist. However, the government has recommendations and a proposal for a roadmap on nZEB in Bulgaria. Negotiations with all stakeholders for developing such roadmaps for medium and long-term period are planned to start in 2013. Thus, concrete plans and measures for the increase of these buildings will be worked out in 2013 after the acceptance of the final definition for these buildings.

Amendments and additions in the Energy Efficiency Law connected with the energy efficiency buildings have been already introduced in the National Legislative Assembly.

A.2.8 Other relevant topics

A.2.8.1 Permit requirements for renovation

A building permit is required in case of major renovation (when some of the essential requirements are affected as energy economy and heat retention). It is issued by the chief architect of the municipality where the building is constructed after proving the compliances with Ordinance 7[22] (2004, 2007) for heat retention of buildings. The requirement is the investment project to have part “Energy Efficiency” (apart from the others on construction, HVAC, electricity, water supply), where this compliance is declared and proved. It normally takes up to two months to get a building permit.

A.2.8.2 Organisation of owners in multi-family buildings and their decision process on renovation of buildings

In case of renovation of multi occupancy buildings, 75% of the owners must agree. However the issue for financing of the renovation of those owners that not agree is still open (they cannot be forced to pay) and still the decision process is blocked. Tenants can do energy renovations upon agreement with the owners.

A.2.8.3 National consultation processes

There are no consultations between the national and regional governments up to now. On national level there are only consultations and processes performed with NGOs and professors from Universities connected with the definition of the nZEB and the necessary changes in the national legislation.

[22] Ordinance 7 from 15.12.2004 for Energy Efficiency, Heat Retention and Energy Savings in Buildings

http://www.mrrb.government.bg/index.php?do=law&id=386&lang=bg&type=7

A.2.8.4 Buildings databases/registers

In Bulgaria there is national statistic only for the residential buildings. Information is provided by years and by construction.[23]Non-residential buildings are not included into the national statistic and estimates are published in BPIE study: Europe's Buildings under the Microscope[24]. TABULA project also provides analysis on the building stock, however only for residential buildings[25].

No statistic on the renovated buildings and their energy performance exist. An estimate could be received from the Census 2011 for residential buildings which includes information for dwellings with replaced windows and insulated dwellings.

A.2.8.5 Landlord-tenant dilemma

No particular actions are there for the landlord-tenant dilemma.

In reference to other market barrier, a National Fund for Energy Efficiency has been created with main goals to support the business by improving the cooperation among bank credits and by providing additional guaranty for these credits.

A.2.8.6 Financial and fiscal support policies/programmes

In Bulgaria financial programmes have been set up by the National Government to support the energy efficiency in buildings. In particular programmes are set to boost the renovation of the existing building stock.

The National Programme for housing renovation in Bulgaria 2006-2020 (including the National Strategy for financing the building insulation) is a document for policy makers that analyses the housing stock and provide financial needs for the period. BGN 5295,842 millions are foreseen from 2006 to 2020 for all measures of which BGN 3234,795 millions for buildings insulation improvement (BGN 2490 millions for residential buildings (BGN 498 millions grant - 20 %) and BGN 744,795 millions for public buildings).

The following tables provide an extract on the ongoing programmes and a selection of some of past programmes[26].

Programme *A*

Programme name	Energy Renovation of the Bulgarian Homes
Start – End Dates	02.07.2012-2015
Type of programme	Grants (50%).Operational Programme "Regional Development"

[23] http://www.nsi.bg/otrasalen.php?otr=45
[24] http://www.bpie.eu/eu_buildings_under_microscope.html
[25] http://www.building-typology.eu/
[26] Please note that other programmes exist.

Budget	50 million levs (around 25 million euro)
Measures covered	Renovation of the homes – change of the windows, roofs, etc., energy renovation of the walls, etc.
Programme impacts	The main aim is to decrease the energy consumption in these buildings and to decrease the level of CO2 emissions.

Targeted buildings types:

New buildings	Existing buildings	Residential		Non Residential	
		Private owned	Public owned	Private owned	Public owned
	x	x			

Programme *B*

Programme name	**Building Tax Exemption**
Start – End Dates	2005 -ongoing
Type of programme	Tax reduction
Budget	N/A
Measures covered	- ENVELOPE (including insulation, windows & glazing, exterior wall, doors, ceiling, etc.) - EQUIPMENT (including efficient heating, efficient lighting systems, ventilation, cooling, control systems, etc.) - Renewable energy sources
Programme impacts	N/A

Targeted buildings types:

New buildings	Existing buildings	Residential		Non Residential	
		Private owned	Public owned	Private owned	Public owned
	x			x	x

A3. Czech Republic

A.3.1 Strategies and (action) plans for the building sector

At the moment, the Second National Action Plan on Energy Efficiency (NEEAP-II) from 2011[27] is the main strategic document addressing energy performance in buildings. The document is set up to fulfil national indicative aim of 9% of energy savings in end-energy consumption by 2016 without synergy effects. The aims of the plan include high priority processes such as “maximizing of energy efficiency by GDP creation” and “maximizing of energy efficiency by energy transformation”. Maximizing of energy efficiency of heat savings is also an aim with the highest potential.

Programmes covered in the plan addressing the building sector are the following:

- State program for energy savings and RES;
- Operation program environment;
- Operation program enterprise and innovations;
- Green investment scheme;
- New panel program;
- Regional programs;

Renovations to highly efficient (nZEB) standard are still not included in the plan.

Once the nZEB detailed specification definition process in Czech Republic comes to an end, it is expected to strengthen and lower the primary energy requirements on the national building code. This is expected to result on the implementation of better energy efficiency measures and RES, lowering the overall consumption of the buildings in the long term.

No specific measures are planned yet to achieve the EED 3% renovation rate for central Governmental buildings. So far EPCs are mandatory for public buildings, as well as energy audits (based on national legislation and methodology) and both their recommendations are mandatory to be implemented in these buildings.

A.3.2 Building codes

In Czech Republic there is a complex framework of legal and technical regulations, requirements and recommendations. The Energy Management Act 406/2000[28] has been updated to transpose the recast EPBD through the law 318/2012, coming into force on January 1st 2013. The providing decree No. 148/2007 on Energy Performance of Buildings transposing the EPBD into Czech law in 2007 is expected to be recast in February 2013 and coming into force in April 2013. In the period between January and April 2013, the requirements on buildings and certification shall be done on a basis of

[27] http://www.mpo.cz/dokument92353.html
[28] http://www.tzb-info.cz/pravni-predpisy/zakon-c-406-2000-sb-a-souvisejici-predpisy

the existing decree. Also, the Standard ČSN 73 0540 on Thermal Protection of Buildings, defining especially U-values requirements was updated in November 2011.

A.3.2.1 Energy performance requirements

Up to the end of April 2013 energy consumption requirements are set only for final energy. Table 19 shows the fixed maximum values for different building types.

Table 19: Energy performance requirements (kWh/m^2/year)

		Single family houses		Multi-family houses		Offices		Schools		Hospitals	
		min	**max**	**min**	**max**	**min**	**max**	**min**	**max**	**min**	**max**
New stock	**Final energy**	N/A	142	N/A	120	N/A	179	N/A	130	N/A	310
	Heating	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Cooling	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Renovated stock	**Final energy**	N/A	142	N/A	120	N/A	179	N/A	130	N/A	310
	Heating	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Cooling	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Starting in 2013, concrete requirements for both final and primary energy values will be calculated for each case (i.e. every evaluated building will have its own reference = required values). Roughly estimated, final energy requirements calculated on a basis of these reference buildings will be about 10-20% lower in average compared to existing requirements. As the primary energy is not calculated at present, comparison is not possible.

A.3.2.2 Thermal insulation

U-values are defined by the Standard ČSN 73 0540 Thermal protection of buildings, which defines U-values requirements on a basis of prevailing indoor temperature and not on a basis of building type or new/renovated building. Further, the standard defines recommended U-values (better) and U-values recommended for passive houses. The following table (Table 20) shows the required and recommended U-values for prevailing indoor temperature 18-22°C.

Table 20: U-value requirements

Building component		U-value [W/m²K]									
		Single family		Multi-family		Offices		Education		Health	
		New	Ren	New	Ren	New	Ren	New	Ren	New	Ren
Walls	External wall heavy (over 100 kg/m^2 of wall)	0,30 (recommended 0,25; 0,18 – 0,12 passive house)									
	External wall light	0,30(recommended 0,20; 0,18 – 0,12 passive house)									
Windows/Doors	Windows	1,5 (recommended 1,2; 0,8 – 0,6 passive house)									
	Doors	1,7 (recommended 1,2; 0,9 passive house)									
Roof/ Ceilings	Roof	0,24 (recommended 0,16; 0,15 – 0,10 passive house)									
Floors	Floor	0,45 (recommended 0,30; 0,22 – 0,15 passive house)									

A.3.2.3 Compliance

Building Code compliance. The Building authority (state authority related to municipality) issues building permits for planned new buildings and renovations of existing ones. This authority verify that the documentation meet all the requirements. During the final inspection, which takes place after the building is completed, the real shape of the building is controlled and compared with the planned one. If any substantial differences are found, legal mechanisms such as penalties or building use restriction till the correction is done can be applied by this authority.

EPC compliance. The State Energy Inspection (SEI) has the responsibility of the system of quality control. Possible penalties are described by the Energy Management Act. However, up to now, only very big project are controlled by SEI. With the new law in 2013, SEI should get more capacity to control the Certificates. Further, starting in 2016, SEI will have an obligation to issue official approval to the Certificate during building permit administration.

No effective data collection from Certificates exists.

Building Authorities verify whether the EP Certificate is a part of the building permit documentation. However, they are not in charge of verifying the Certificate reliability.

A.3.3 Measures for implementing Article 13(4) of the RED

Starting from 2015, the Energy Management Act requires buildings to reach stronger primary energy requirements. These shall be fulfilled with the support of RES installation. The concrete values and requirements shall be a part of the expected regulation.

A.3.4 Energy Performance Certificates

The EPC certification scheme exists since 2007 and certification became mandatory in 2009 for new buildings and major renovations. The Energy Performance Certificate (EPC) has to be part of building permit documentation.

The existing Regulation 148/2007 on Energy Performance of Buildings[29] specifies the following energy classes for EPCs:

Table 21: EPC Energy classes

Building type	Energy classes (kWh/m2/year)						
	A	B	C	D	E	F	G
Single family house	< 51	51 - 97	98 - 142	143 - 191	192 - 240	241 - 286	> 286
Multi family house	< 43	43 - 82	83 - 120	121 - 162	163 - 205	206 - 245	> 245
Offices	< 62	62 - 123	124 - 179	180 - 236	237 - 293	294 - 345	> 345
Hospitals	< 109	109 - 210	211 - 310	311 - 415	416 - 520	521 - 625	> 625
Schools	< 47	47 - 89	90 - 130	131 - 174	175 - 220	221 - 265	> 265

The new system, starting in 2013, will be based on reference = required value calculation specifically for each evaluated building instead of fixed values set by the existing decree (see table 21). This calculated requirement will always create a borderline between C and D classes. The other bands for classes A-G will be calculated on a basis of EN 15217.

A.3.5 Inspections (for boilers and/or air conditioning systems): article 8 of first EPBD

The inspections and reporting for boilers and A/C plants are defined in the Energy Management Act 406/2000 Coll. on a basis of EPBD. This law introduced regular inspection of boilers (at regular intervals) and one-off inspection of boilers (over 15 years). However, due to wording of the law, an obligation exist to implement only regu-

[29] http://www.zakonyprolidi.cz/cs/2007-148

lar inspection of boilers that are located in buildings with power above 20 kW that are not used exclusively for heating and HW in family houses. The obligation to provide one-off inspection of boilers (over 15 years) is missing in the law.
Regular inspections are further divided to the inspection of boilers with a rated power (1) of less than 200 kW and more than 200 kW.

- **Boilers up to 200 kW:** 1 control per two years, gas boilers 1 control per 4 years. Inspection of boilers up to 200 kW has to be provided according to Regulation No. 276/2007 by persons approved by Ministry of Industry and Trade.
- **Boilers over 200 kW** should be controlled 1 time per year (due to amending Regulation 150/2001 cancellation). This inspection is being issued by energy auditors accredited by the Ministry of Industry and Trade.

For air conditioning systems, the owner or operator of a facility with a rated cooling output greater than 12 kW must ensure regular review every 4 years based on the Energy Management Act 406/2000 Coll. and its providing Regulation No. 277/2007 Coll. The law requires owners and operators of buildings to ensure the control since 1.1.2009.
Inspections include a visual inspection, system identification, system operation, energy intensity and efficiency of the facility, including verification of maintenance. The cost for a regular inspection of a boiler starts from 1850 CZK (74 EUR) per boiler. Experience shows that in many cases outputs without real added value and optimization opportunity can be provided for such costs. Due to the lack of quality control of these inspections (by authorities), and the pressure on price because of high competition, the price can be such low. Investors (e.g. building owners) do not stress on inspection quality as this is understood as bureaucracy more than a possibility to improve energy efficiency. Effective data collection from these inspections is missing.

A.3.6 Cost optimality

In Czech Republic the implementation of the cost-optimal methodology is in progress and the official calculations are likely to be finalized soon. Briefly, there are already defined reference buildings for four building types, single-family houses, multi-family buildings, office buildings and “other public” buildings, represented by a school. For each of these building types, two reference buildings for the existing stock (i.e. for renovation activities) and one new reference building have been defined. As required by the EU cost-optimality Regulation, the sensitivity analysis is performed by considering several combinations of improvement packages and variants, private financial and societal (macro-economic) discount rates, varied investment costs and pre-defined energy prices scenarios. In Czech Republic it is decided that for checking/improving the requirements for both building elements (e.g. U-values) and the whole building´s energy performance, the results of cost-optimal calculations at the private financial level will be used.

A.3.7 nZEB: requirements and roadmaps

The nZEB definition shall be settled in the recast regulation coming into force in April 2013 (see section 2). Presumably the requirements on nZEB buildings will be set by

tightening requirement on specific primary energy and average U-value of a building. Adjustment of the requirements shall be made within the arranged consultation platform (see paragraph/section 8c) and shall apply to new buildings only.

At the moment, the Ministry of Environment is planning a subsidy program which will include informational campaigns and could already start in 2013. The program is being called “New Greenlight to savings” (see section 9).

A.3.8 Other relevant topics

A.3.8.1 Permit requirements for renovation

All major renovations need a building permit issued by the Building authority (the same situation as in case on new building). Building authorities are related to municipalities (usually as a department of a municipality). Meeting the requirements shall be controlled by the authority with use of the Energy Performance Certificate as well.

The system of building permission is based on Building Law 183/2006 Coll. (i.e. Building Code). In general, the construction or systems that shall be renovated/ changed have to meet the same requirements as in newly built buildings.

After building’s permit application and all required documents (including the EPC) are exhibited to the building authority, the based-on-law period is 30 days to give the permission. Usually there are some delays due to additional documents required by the authority.

A.3.8.2 Organisation of owners in multi-family buildings and their decision process on renovation of buildings

In Czech Republic, multi-family buildings are owned by housing cooperatives or home owners associations. Both these institutions are regulated by law and the voting system for any common issue (including building renovation) is defined accordingly within it. For a whole building renovation, usually, at least 75% of the members (flat owners) have to agree on it to make it happen.

A.3.8.3 National consultation processes

There are two main working groups related to energy efficiency in buildings, one is headed by the Czech Chamber of Commerce, and the other one by the Faculty of Civil Engineering of the Czech Technical University in Prague. Many expert companies, NGOs, independent experts take part in both groups (SEVEn, Passive House Center, Czech Green Building Council etc.) in order to cooperate with the Ministry of Industry and Trade on legislation preparation, including nZEB Czech definition.

A.3.8.4 Buildings database/register

The main data sources on the Czech building stock come from the project Tabula[30], and the Czech Statistical Office[31] (especially from Public census – last in 2011 and

[30] http://www.building-typology.eu/country/typology-cz.html

from Energo 2004 survey[32]). Today, there is limited data on energy consumption from these sources. The Public census is very brief and general in terms of housing and energy related quality. The Energo 2004 survey was based on a survey of several thousands of interviewees only.

There is not, at the moment, data being collected from the EPCs to be used as statistical information.

A.3.8.5 Landlord-tenant dilemma

The landlord-tenant problem can be identified as in other countries. In general, as an offer of flats to rent is higher than demand, there is some push on landlords to create quite favourable conditions for tenants in Czech Republic. Due to completed deregulation of tenancy in the country and energy market, the costs for energy and flats renting motivate tenants to find appropriate living for adequate costs. It motivates the landlords to improve quality of occupying their buildings and helps to tenants negotiate reasonable payments to the landlord. Obviously, the landlord can be motivated to improve his building by higher payments by tenants that can equal to tenants´ savings on energy bills. Further, the landlords´ investment can be supported by adequate subsidy system.

In general, overcoming the market barriers to increase energy efficiency measures investments has to be supported by information campaign that shows to citizens that the requirements are cost optimal in long term period (based on EPBD 2 as well). At present, owners are mostly focusing on investment costs than long-term view. Further, subsidized loans and direct subsidy for better quality renovations and new buildings shall be introduced (see section 9).

A.3.8.6 Support policies/programmes (economic & financial instruments)

Several financial programmes were put in place in Czech Republic to support the energy efficiency in buildings, especially measures under the European Structural Funds. However, at the moment past programmes reached to an end or were stopped due to funding allocation exceed (i.e. the subsidy program “Greenlight to savings” based on AAU units selling) and currently there are no new financial or fiscal programmes in place to support energy efficiency measures in buildings.

At the moment, the Ministry of Environment is planning a subsidy program which will include informational campaigns and could start in 2013. The program is being called now “New Greenlight to savings”. It is not known yet, whether nZEB standard or passive house standard or some other “better than required” standard will be subsidized. Direct subsidies as well as interests for loans should be subsidized. Compared to previous “Greenlight to savings” subsidy program (based on AAU units selling as well), in the planned program not only residential buildings should be subsidized. Presumably,

[31] http://www.czso.cz/sldb2011/eng/redakce.nsf/i/final_census_results
[32] http://www.czso.cz/csu/tz.nsf/i/energo_2004

the direct subsidies for m^2 of energy efficient measure should be provided (and not per m^2 of floor area).

Up to now, the last call of Operational program Environment (EU Structural funding) for public buildings refurbishment was in 2012. It is expected that some new similar program should start in 2014 with new budgetary program period of EU.

The following tables provide an extract on the upcoming programmes and a selection of some of some of past programmes [33].

Programme *A*

Programme name	**New Greenlight to savings**					
Start – End Dates	foreseen to start in 2013					
Type of programme	direct subsidy (grant) and interest rate subsidy					
Budget	N/A					
Measures covered	- ENVELOPE (including insulation, windows & glazing, exterior wall, doors, ceiling, etc.) - EQUIPMENT (including efficient heating, efficient lighting systems, ventilation, cooling, control systems, etc.)					
Programme impacts	Presumably both ex-ante and ex-post					
Targeted buildings: **(presumably)**	New buildings	Existing buildings	Residential		Non Residential	
			Private owned	Public owned	Private owned	Public owned
	x	x	x	x	x	x

Programme *B*

Programme name	**National Environment Fund: Operational Programme Environment (OPZP in Czech)34**
Start – End Dates	2007-2013
Type of programme	Grants
Budget	Total EUR 673 million

[33] Please note that other programmes exist.
[34] http://en.opzp.cz/sekce/509/priority-axis-3/

Measures covered	ENVELOPE (including insulation, windows & glazing, exterior wall, doors, ceiling, etc.) EQUIPMENT (including efficient heating, efficient lighting systems, ventilation, cooling, control systems, etc.)
Programme impacts	N/A

Targeted buildings: **(presumably)**	New buildings	Existing buildings	Residential		Non Residential	
			Private owned	Public owned	Private owned	Public owned
	x	x				x

Programme *C*

Programme name	**Building Retrofit Subsidies: PANEL programme**
Start – End Dates	2004 (amended in 2009)
Type of programme	Grants, Preferential loans, Third Party financing
Budget	CZK 4.1 billion (2009)
Measures covered	Envelope, technical equipment (heating, ventilation systems, RES in buildings)
Programme impacts	N/A

Targeted buildings: **(presumably)**	New buildings	Existing buildings	Residential		Non Residential	
			Private owned	Public owned	Private owned	Public owned
		x	x	x		

A4. Finland

A.4.1 Strategies and (action) plans for the building sector

In Finland, the ERA 17 Action Plan[35] for an Energy-Smart Built Environment 2017 sets out a long-term vision for the energy performance of the building sector. The plan's ambitious goal is to reach the efficiency requirements set for 2020 three years early, in 2017. The main objectives of this plan are:

- the rapid reduction of energy use and emissions in communities and buildings;
- that Finland becomes a pioneer in sustainable building;
- increased use of renewable energy;
- that the built environment is viewed as whole: spatial planning, community planning, construction, living environments.

Renovation is one part of the ERA-17 roadmap, which also includes energy efficiency in new construction, land use planning and energy efficient operations. The main measure is to develop energy efficiency standards for renovation, as well as competency requirements for renovation contractors.

Also, the planning for the achievement of the EED 3% renovation rate for central government buildings has just started. A working group has been set up, including the Ministry of Finance (which is in charge of state administration), Senate Properties (which owns most of the building stock) and the National Board of Antiquities. They will be reviewing the options of renovating 3% of the building stock or achieving the same savings with other measures. [36]

A.4.2 Building codes

The energy standards in the Finnish Building Code (part D3)[37] were recently revised and the new requirements entered into force on July 1, 2012. The main feature is a shift from requirements concerning the heat loss of individual components to one figure (the E index) describing the total calculated energy use of the building. This index refers to the product of the energy purchased into the building and the primary energy factor for each energy source.

The aim of the newest revision is to move away from regulating individual components and to allow builders the flexibility to choose the ways in which the standards are met. The purpose is also to place emphasis on primary energy use; this influences especially the use of electricity.

The regulations only concern new buildings. Requirements for existing have been prepared and are planned to enter into force in early 2013. They are likely to require that

[35] More information on: http://era17.fi/en/files/2010/11/ERA17_presentation.pdf
[36] http://energia.fi/sites/default/files/dokumentit/energia-ja-ymparisto/esitys_vaisanen.pdf
[37] http://www.finlex.fi/data/normit/37188-D3-2012_Suomi.pdf (In Finnish version only)

the energy use of components or of the entire building is cut by 50% compared to the previous situation when renovations are undertaken.

A.4.2.1 Energy performance requirements

The E index, i.e., the total primary energy consumption, is to be calculated when applying for a building permit. The maximum calculated energy use for different building types is shown in table 22.

Table 22: Energy performance requirements (kWh/m^2/year)

		Single family houses		Multi-family houses		Offices		Schools		Hospitals	
		min	max	min	max	min	max	min	max	min	max
New stock	Primary energy	N/A	< 120m^2 = 204; >120m^2 = 130-204[38]	N/A	130	N/A	170	N/A	170	N/A	450
	Heating	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Cooling	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Renovated stock	Primary energy	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Heating	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Cooling	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

The above requirements are specified in terms of primary energy use. The following conversion factors are used for primary energy from different sources:

- fossil fuels: 1
- electricity: 1,7
- district heat: 0,7
- renewable energy: 0,5

A.4.2.2 Thermal insulation

There are no longer fixed requirements for individual components. Instead, the heat loss of the building envelope is calculated on the basis of the sum of the heat losses of individual building components multiplied by their area.

[38] depends on the size of the building

The next table shows the reference U-values for heated (≥ +17^{0}C) and semi-heated spaces (from +5^{0}C to +17^{0}C).

Table 23: U-value requirements

Building component		U-value for heated spaces [W/m²K]	U-values for the semi-heated spaces [W/m²K]
Walls	**Wall**	0,17	0,26
	Log wall	0,40	0,60
Windows	**Window, door, skylight**	1,0	1,4
Roof/Ceilings	**Roof**	0,09	0,14
Floors	**Base floor on ground**	0,16	0,24
	Floor when there are ventilated foundations	0,17	0,26

A.4.2.3 Compliance[39]

The main form of control is the submission of the energy analysis, which is a requirement for application for a building permit. This calculation establishes the calculated energy use for the building. The municipal building inspector monitors compliance with these requirements and ensures that the energy analysis if correctly performed before issuing a building permit. There are also requirements concerning the main building designer's competence.

A final inspection is required before the building is approved for use and sale. This must be completed within a period defined in the building permit. The building inspector inspects that the requirements of the building code have been fulfilled.

A.4.3 Measures for implementing Article 13(4) of the RED

The new energy regulations in the national Building Code offer an advantage to energy produced using renewable energy sources (primary energy conversion factor 0.5).

There have also been plans to mandate a share of renewable energy in new buildings; these have been postponed to the next revision of the energy requirements in the national Building Code.

[39] More information at http://www.finlex.fi/data/normit/28238-A1su2006.pdf (In Finnish version only)

A.4.4 Energy Performance Certificates

EPC energy classes for each building category in Finland are included in the following table.

Table 24: EPC Energy classes

	Energy consumption band (kWh/gross m²/year)				
Energy class	**Single-family houses**	**Apartment Blocks**	**Offices**	**Educational buildings**	**Hospitals**
A	< 150	< 100	< 90	< 120	< 160
B	151-170	101-120	91-110	121-150	161-200
C	171-190	121-140	111-130	151-190	201-260
D	191-230	141-180	131-170	191-230	261-340
E	231-270	181-230	171-230	231-300	341-450
F	271-320	231-280	231-320	301-400	451-600
G	> 321	> 281	> 321	> 401	> 601

Since 2008, the owner of newly constructed building needs to obtain an energy performance certificate when the building or a part of it is utilised, sold or rent. Since 2009, the legislation is also covering buildings constructed before 2008; however the certificate has been optional for single-family houses or buildings with less than six apartments that have been built prior 2008 and certificates will not be required for holiday homes or smaller buildings, industrial premises, protected buildings and churches.

A.4.5 Inspections (for boilers and/or air conditioning systems): article 8 of first EPBD[40]

Since 1997 there has been a voluntary inspections scheme approach for oil-heated properties instead of mandatory boiler inspections. From 2013, also bio boilers, including boilers with a nominal capacity of less than 20 kW, are inspected alternatively by giving further information about more energy efficient heating systems and renovation of older systems. It is estimated that at least the same savings in energy can be gained by alternative guidance than by obligatory regular inspections.

There has also been a grant provided for residential buildings for converting heating systems to renewable energy sources. This grant has covered 20% of the investment costs but it is no longer included in the state budget for 2013.

[40] More information at http://www.ideal-epbd.eu/index.php?option=com_content&view=article&id=20&Itemid=4&lang=en

Inspection of air-conditioning systems has been compulsory since the beginning of 2008. It concerns equipment of at least 12 kW of power and is only mandatory, where cooling systems are based on the use of compressors. However, in 2013 the legislation will be overruled and there will be a switch to alternative regime similar to the case of the heating boilers.

A.4.6 Cost optimality

The cost optimality method is being developed in a research project involving several major universities and research institutes. The first results will be available in March 2013.

A.4.7 nZEB requirements and roadmaps

The technical specifications on NZEB are being prepared. The overall roadmap involves several stages, such as the new energy performance certificate classification and other provisions, the provision of energy standards for existing buildings that are renovated, and the development of requirements for the use of renewable energy sources and specifications on how this is integrated into the calculation of the E index. Technical specifications of NZEB are expected in 2015 and will be integrated in these preceding developments.[41]

A.4.8 Other relevant topics

A.4.8.1 Permit requirements for renovation[42,43]

Building permits are required for renovation and alteration works that are comparable to new construction, including extensions and essential changes of usage purpose, as well as for works that have an impact on health and safety of building users. Examples include: changes to rooms with a floor gully, essential changes in heating, water or ventilation systems; façade changes especially in areas covered by the town plan; energy efficiency improvements by adding insulation; changes to load-bearing structures; changes to roof shape; installation of a new elevator; renewal or construction of a chimney or fireplace (except when approved products and installers are used, in which cases a notification is sufficient); changes in apartments, which can influence other residents.

Construction permits are issued and monitored by the municipalities (building inspectors). The definition of major renovations and the extent to which the current energy standards are applied to the renovations is done by the building inspectors on a case-by-case basis.

[41] More information at http://web.finnexpo.fi/Sites1/FinnBuild/MaterialBank/RoadMap%202012-2020.pdf (In Finnish version only)

[42] http://www.korjaustieto.fi/viranomaistieto/saadokset-ja-maaraykset/luvat-kuntoon/milloin-tarvitaan-lupaa.html (In Finnish language)

[43] http://www.korvo.fi/11lammaneristysenergia/114 (In Finnish language)

A.4.8.2 Organisation of owners in multi-family buildings and their decision process on renovation of buildings[44]

Owner-occupied apartment buildings and terraced houses are owned by housing companies, i.e., the owners own shares giving them right to a certain dwelling or dwellings in the building, in which they usually live themselves (but can - and often do - also rent). Owners make decisions about the building collectively, in the residents' general assembly. A simple majority of more than 50% of the shares is needed to decide on a renovation. The decisions are prepared and legal responsibility is borne by the residents' board elected by this assembly. The housing company is responsible for the maintenance of building structures and insulation, as well as for heating, electricity, data communications, water, sewage and ventilation systems (Housing Companies Act 2010). The Housing Companies Act also requires housing companies to make long-term renovation plans, which is expected to facilitate the financing of major renovations. Operative management is the responsibility of the house manager; these are today usually contracted professional companies.

Compared to some countries, the decision making is facilitated by the fact that the housing company is a legal entity and the owner of the property. It can hence take out a loan for the renovation once a decision has been reached.

A.4.8.3 National consultation processes

The already mentioned ERA 17[45] Action Plan for an Energy-Smart Built Environment 2017 resulted from the gathering of a broad-based group of experts to map out the best ways to take further energy-smartness back in January 2010.

The Government has regular consultations with representatives of industry and other stakeholder groups, through the relevant national associations. For example, the Ministry of Environment organized an electronic consultation survey in 2012 on the Road Map for building regulations for NZEB construction by 2020. A total of 346 experts and stakeholders participated and gave their views on the schedule for reaching various NZEB milestones as well as on the need for accompanying measures[46].

A.4.8.4 Buildings database/register[47]

The Building Registry (RH registry) is a database that stores data on all measures related to building permits, as well as several other kinds of data on all Finnish buildings. It is maintained by the Population Register Centre and the Local Register Offices. Some of these data are publicly available in aggregated form via the Statistics Finland.

As part of an updating of the energy performance certification legislation, work is underway to develop a register that can receive also the most important data from energy

[44] http://www.finlex.fi/fi/laki/ajantasa/2009/20091599 (In Finnish language)
[45] http://era17.fi/en/files/2010/11/ERA17_presentation.pdf
[46] Säteri, H. (2012). Rakennusten energiavaatimusten RoadMap – moottoritie kohti 2020. Energiasta kestävyyteen – seminaari, Finlandia-talo, 7.6.2012.
[47] http://era17.fi/rakentamisen-ohjaus/rakennusten-energiatodistus-ja-kiinteistotietojen-rekisteri/ (In Finnish language)

performance certificates issues. These data will be entered in connection with the building permit process or when energy performance certificates are drawn up for existing buildings. This work is being done under the leadership of the Ministry of Environment and the Ministry of Finance.

The preparation of a registry that conforms to the EPBD started in spring 2011 and the plan is to take the registry into use during 2013, at the latest. The registry will be hosted by ARA, the Housing Finance and Development Centre of Finland.

A.4.8.5 Landlord-tenant dilemma

The landlord-tenant issue has not until now been a problem in Finland, because heating energy costs are usually charged as part of the rent. Hence, it is as much in the landlords' as much as in the tenants' interests to reduce energy costs.

A.4.8.6 Support policies/programmes (economic & financial instruments)

Numerous supporting programmes exist in Finland to encourage the energy efficiency in buildings. Further, to support the long-term strategy to improve the energy efficiency by 20% by 2020, voluntary agreements with targets to reduce energy consumption have been put in place.

The following tables provide an extract on the on-going programmes and a selection of some past programmes [48].

Programme *A*

Programme name	Grant for renewable energy
Start – End Dates	2006-2008, 2011-2012
Type of programme	Grant
Budget	Varies: a total of 10 million € were allocated in 2012.
Measures covered	The grant is managed by the Housing Finance and Development Centre of Finland (ARA) on the basis of annual allocations from the government budget and handed out and monitored by the municipalities. The contents change somewhat every few years: In 2012, grants are awarded for ground-source heat, air-water source heat pumps, pellet and wood-chip burners, wood-based central heating, and hybrid systems including solar heat and power. Grants are only available for existing buildings and recipients can receive 20% of the investment costs. The grant can be combined with a general tax deduction from work conducted in the household, which can be used for e.g. installment and drilling of boreholes for ground source heat. In addition, grants are also available for

[48] Please note that other programmes exist.

	other energy efficiency investments by low-income households. In addition, grants are also available for other energy efficiency investments by low-income households.
Programme impacts	The programme was used by about 10 000 households between 2006-2008. The estimated CO2 reductions are about 25 000 t CO2e/year. The most recent term has not yet been evaluated.
Targeted buildings types:	**New buildings**:	**Existing buildings**:	**Residential**: **Private owned**:	**Residential**: **Public owned**:	**Non Residential**: **Private owned**:	**Non Residential**: **Public owned**: | |		x	x			

Programme *B*

Programme name	**Tax deduction for household work**[49]
Start – End Dates	Has been applicable to renovations since 2005
Type of programme	Tax deduction
Budget	N/A
Measures covered	The tax deduction is not specific to energy renovations, but covers several categories of work performed in the household (since 2001). Since 2005, this has included home improvements and renovations (including energy renovations) made in permanently occupied homes. In the case of energy renovations, this is mainly relevant for single-family homes, where renovations are made individually by the household. The maximum amount of the tax deduction in 2012 is 2000 € per person (this can change annually) of the labor costs. Since a court decision in 2009, the tax deduction can be used for also for e.g. installment and drilling of boreholes for ground source heat.
Programme impacts	Evaluations are not available. The tax authority does not register for which purpose the tax deduction is used, so the instrument is impossible to evaluate.
Targeted buildings types:	**New buildings**:	**Existing buildings**:	**Residential**: **Private owned**:	**Residential**: **Public owned**:	**Non Residential**: **Private owned**:	**Non Residential**: **Public owned**: | |		x	x			

[49] http://www.soininvaara.fi/2010/12/30/verotyoryhman-kommentointia-3-kotitalousvahennys/

Programme *C*

Programme name	Energy grant for multifamily buildings
Start – End Dates	2003 - ongoing (with somewhat different criteria and grant levels annually)
Type of programme	Grant
Budget	Varies annually: 57 million EUR in 2010, 8.8 million in 2012
Measures covered	The grant covers a maximum of 40% of the costs of an energy audit and a maximum of 15% of the costs of various approved energy efficiency measures (e.g. window replacement, insulation, heating and ventilation system adjustment and valve replacement, heat recovery, connection to district heat)
Programme impacts	According to an evaluation conducted in 2007, the energy saving impacts of this instrument as concerned the measures completed were about 180 GWh/a. No impacts were estimated for the energy audits.

Targeted buildings types:

New buildings	Existing buildings	Residential		Non Residential	
		Private owned	Public owned	Private owned	Public owned
	x	x			

Programme *D*

Programme name	Voluntary agreement for rental housing organizations
Start – End Dates	2010 – 2016 (as part of the voluntary agreement of the real estate sector)
Type of programme	Voluntary agreement
Budget	N/A
Measures covered	Targets to reduce average specific energy consumption in rental estates by 20% by 2020. All kinds of measures can be used (new construction, renovation, operational measures)
Programme impacts	Measures taken by signatories are reported and monitored annually, but no evaluation is available.

Targeted buildings types:

New buildings	Existing buildings	Residential		Non Residential	
		Private owned	Public owned	Private owned	Public owned
x	x	x	x		

Programme *E*

Programme name	**Voluntary agreement for service buildings**
Start – End Dates	2010 – 2016 (as part of the voluntary agreement of the real estate sector)
Type of programme	Voluntary agreement
Budget	N/A
Measures covered	Target to reduce energy use by members by 6% from 2010 levels by 2016. Long term target to improve energy efficiency by 20% by 2020. All kinds of measures can be used (new construction, renovation, operational measures)
Programme impacts	Measures taken by signatories are reported and monitored annually, but no evaluation is available.
Targeted buildings types:	**New buildings** / **Existing buildings** / **Residential** (**Private owned**, **Public owned**) / **Non Residential** (**Private owned**, **Public owned**)
				x	x

Programme *F*

Programme name	**Grants for low-income single-family homeowners**
Start – End Dates	2006 - ongoing
Type of programme	Grant
Budget	2 million EUR in 2012
Measures covered	The grant is managed by the Housing Finance and Development Centre of Finland (ARA) on the basis of annual allocations from the government budget and handed out and monitored by the municipalities. Grants of a maximum of 25% are awarded for several kinds of energy improvements that are deemed sensible and necessary. The income limits are 1 355 EUR/month for households of one person and 2 260 EUR/month for households with two persons.
Programme impacts	No evaluation exists.
Targeted buildings types:	**New buildings** / **Existing buildings** / **Residential** (**Private owned**, **Public owned**) / **Non Residential** (**Private owned**, **Public owned**)
	x	x			

A5. France

A.5.1 Strategies and (action) plans for the building sector

In France, there is a long term objective established by the French energy law in 2005, known as *Facteur 4*, to reduce greenhouse gas emissions by a factor of four by 2050, when compared with the emissions level of 1990.

As the construction sector accounts for 44% of France's final energy consumption, the Environment Round Table (Grenelle) has set very ambitious targets for new and existing building. New buildings should be energy positive by 2020 (BEPOS, primary energy average consumption lower or equal to 0 kWhep/m2/year[50]), whilst for existing building stock, a 38% reduction in primary energy consumption has been set with the objective to achieve an average specific energy consumption of 150 kWhep/m2/year in primary energy terms by 2020, compared with a current average of 240 kWhep/m2/year. To achieve this goal a massive programme of major renovation must be implemented and the target is to achieve 400 000 renovations per year over the period 2013-2020. Further, a range of diversified instruments is being mobilized such as regulations, financial incentives, training, information and awareness-raising.[51]

Regarding the EED requirement for the annual renovation rate of 3% in central Government buildings, the Grenelle 1 has already set, back in 2009, to subject all of the state buildings, as well as those of its public establishments, to an energy audit by the end of 2010. The aim was to begin renovation of these buildings by 2012, at a rate of 3% per year, using the diagnosis produced. This renovation should achieve a reduction of at least 40% in energy consumption and 50% in greenhouse gas emissions in the State building stock by 2020.

More information on plans and programs is available on the NEEAP 2[52].

A.5.2 Building codes

In France the building code reference document is the 2012 Thermal Regulation (RT)[53] which replaces the RT 2005. The new document strengthens requirements concerning the thermal performance of new buildings. In particular, all new buildings with a building permit lodged after 1 January 2013 must have a specific energy consumption in primary terms below a threshold of 50 kWhep/m2/year, including space heating, cooling, lighting, domestic hot water and auxiliary equipment (pumps and fans). This requirement applied earlier, from 28 October 2011, in the case of public and service buildings.

For major renovation[54] of buildings more than 1000 m², the global Thermal Regulation sets a global energy performance target for renovated buildings, built after 1948. The

[50] kWep= primary equivalent of 1 kWh of electricity; 1 kWhep=2,58 kWh
[51] Source : NEEAP II
[52] National energy efficiency action plan for France, pursuant to Articles 4 and 14 of Directive 2006/32/EC, available on http://ec.europa.eu/energy/efficiency/end-use_en.htm
[53] http://www.rt-batiment.fr/batiments-neufs/reglementation-thermique-2012/presentation.html
[54] Only apply to renovation that costs more than 25% of the value of the building, excluding land cost, ie 322 €/m² for dwellings and 275 €/m² for non residential buildings (cost without taxes).

target is for dwellings to reach a consumption between 80 and 195 kWh/m²/yr between 2005 and 2010 and a range of 80-165 kWh/m²/year since 2010 compared to an average of 240 kWh/m²/yr for the existing stock. The range depends on the climatic zone and heating fuel. For non-residential buildings the savings should be of 30%.

For major renovation of buildings less than 1000 m^2, or buildings more than 1000 m² undergoing minor renovation, the element-by-element Thermal Regulation sets a minimum performance level for elements replaced or installed: this concerns, in particular, insulation, heating, hot-water production, cooling and ventilation equipment.

In case of existing buildings, the Thermal Regulation aims to ensure significant improvement in the energy performance when a contracting authority undertakes work with potential for such an improvement. The applicable measures, the global Thermal Regulation and the element-by-element Thermal Regulation, differ according to the scale of the work undertaken.

A.5.2.1 Energy performance requirements

The thermal performance is expressed in primary energy kWhep: for all fossil fuels 1 kWh= 1 kWhep; for electricity 1 kWh= 2.58 kWhep.

Table 25 shows the maximum values for different building types.

Table 25: Energy performance requirements (kWhep/m^2/year)

		Single family houses		Multi-family houses		Offices		Schools		Hospitals	
		min	**max**	**min**	**max**	**min**	**max**	**min**	**max**	**min**	**max**
New stock	**Primary energy (kWhep/m^2/year)**	N/A	50	N/A	50	N/A	50	N/A	50	N/A	50
Renovated stock (>1000 m², built after 1948)	**Final energy (kWh/m²/year)**	N/A	N/A	80	165[55]	80	165	80	165	80	165

The threshold varies according to geographical location, altitude, nature of use of the building, average surface area of the dwellings and greenhouse gas emissions.

[55] The range 80-165 kWh/m²/ye depends on the climatic zone and heating fuel/

A.5.2.2 Thermal insulation requirements

The reference value coefficient for heat losses through the building envelope is noted « Ubât-réf », and is expressed according to the following formula:

$$\frac{a1 * A1 + a2 * A2 + a3 * A3 + a4 * A4 + a5 * A5 + a6 * A6 + a7 * A7 + a8 * L8 + a9 * L9 + a10 * L10}{A1 + A2 + A3 + A4 + A5 + A6 + A7}$$

With:
A1: Area of opaque vertical walls including vertical walls from attic but exclusive of opaque areas accounted for as A5, A6 and A7;
A2: area of upper floors and roofs exclusive of areas accounted for as A3;
A3: Area of terraces and metallic roofs in non-residential buildings;
A4: Area of ground floors;
A5: Door area except for totally glazed doors;
A6: Area of windows, totally glazed doors, French windows and transparent or translucid walls in residential buildings;
A7: Area of windows, totally glazed doors, French windows and transparent or translucid walls in non-residential buildings;
L8: length of peripheral link between ground floor and walls;
L9: length of peripheral link between intermediate floors and walls;
L10: length of peripheral link between roofs, or terraces and walls

Areas are measured on the inside; and L8 to L10 are evaluated from the interior dimensions of the rooms. For these lengths and areas, are only considered the surfaces of a heated volume in contact with outside or a non-heated volume.

Coefficients a1 to a10 are indicated in table 26:

Table 26: Reference value coefficients for thermal regulation of buildings

Coefficient a1	Zones H1, H2 and H2>800m	Zone H2≤800m
a1 (W/m²K)	0.36	0.40
a2 (W/m²K)	0.20	0.25
a3 (W/m²K)	0.27	0.27
a4 (W/m²K)	0.27	0.36
a5 (W/m²K)	1.50	1.50
a6 (W/m²K)	2.10	2.30

a7 (W/m²K)	1.80	2.10
a8 (W/m²K)	0.40	0.40
a9 (W/m²K)	0.55 for single family dwellings and 0.60 for other type of dwellings	0.55 for single family dwellings and 0.60 for other type of dwellings
a10 (W/m²K)	0.50 for single family dwellings and 0.60 for other type of dwellings	0.50 for single family dwellings and 0.60 for other type of dwellings

A.5.2.3 Compliance

The global compliance monitoring is not defined in the building code requirements. Further, no official statistics exist. However, some penalties occur in case construction rules are not applied (i.e. penalties up to 45 000€, and to 75 000€ in case of recurrence (+6 months jail)). In the frame of RT 2012 new buildings are now required to have two certificates: one at the time of deposit of the construction permit attesting RT 2012 has been considered, and the other at the building completion. The latter is established only by a qualified professional and has a measurement of the air tightness of the building.[56]

No official control exists so far on NZEB (or BEPOS in French with primary energy average consumption lower or equal to 0 kWhep/m^2/year).

A.5.3 Measures for implementing Article 13(4) of the RED

No measures for implementing Article 13(4) of the RED currently are in place.

A.5.4 Energy Performance Certificates[57]

The Energy Performance Diagnosis in buildings (DPE) has been mandatory when selling any dwelling or building in metropolitan France, for both private individuals and professionals, since 1 November 2006. From 1 July 2007, DPE was extended to rental agreements as well. Public buildings must display the Diagnosis in the reception area. Since 1 January 2011, it has been mandatory to display the energy class of a dwelling in any property advertisement concerning the sale or rental of a property. In addition, auditors are required to forward all Energy Performance Diagnoses undertaken to the French Environment and Energy Management Agency (ADEME).

The certificate should display the specific energy consumption in primary energy terms (kWhep) and CO_2 emissions. The energy class are the same for all types of dwellings.

[56] More information available at http://www.architectes.org/actualites/le-respect-de-la-rt-2012-les-modalites-de-controle-avant-et-apres-les-travaux/

[57] http://www.rt-batiment.fr/batiments-existants/dpe/presentation.html

Table 27 shows the different EPC energy classes and the relevant energy consumption.

Table 27: EPC Energy classes

	Specific energy consumption for dwellings	
Energy class	**kWh_{ep}/m^2year**	**kg_{eqCO2}/m^2year**
A	≤ 50	≤ 5
B	51 – 90	6 – 10
C	91 – 150	11 – 20
D	151 – 230	21 – 35
E	231 – 330	36 – 55
F	331 – 450	56 – 80
G	> 450	> 80

A.5.5 Inspections (for boilers and/or air conditioning systems): article 8 of first EPBD

In France, the requirement of the Directive 2002/91/EEC to establish at MS level a periodic inspection of air-conditioning systems of an effective rated output of more than 12 kW was transposed within the framework of a decree on 31 March 2010. The decree specifies the main inspection stages: inspection of documentation, evaluation of system performance, evaluation of system dimensions in relation to building cooling requirements, provision of necessary recommendations on proper use of the system in place, possible improvements to the installation, possible benefit from its replacement and other potential solutions. Inspections take place every five years and cover 300 000 installations in France (10% of installed stock).

Boilers between 4 and 400 kW are required for annual maintenance to be carried out by a qualified professional. A maintenance certificate informing the client about the state of his or her boiler and central heating system must be given to the client no later than 15 days after the visit and kept for two years by the client to produce in the event of a check.

A.5.6 Cost optimality

In respect of Article 5 of the EPBD 2010 version France is currently developing a study on RT 2012 and on thermal regulation on existing buildings to determine the energy performance requirements-optimal levels in terms of overall costs. The report will be provided to the European Commission by the end of April 2013.

A.5.7 nZEB: requirements and roadmaps

In France there is not an official definition of NZEB yet. However, the definition of NZEB currently used corresponds to the BEPOS with primary energy average consumption lower or equal to 0 kWhep/m^2/year.

Plans to increasing nZEB in the existing building stock (Art 9(1) of EPBD) include:

- **Exemption from property tax** on existing buildings for BBC Dwellings: local authorities and public establishments grant 50% or 100% exemption from property tax on existing buildings and construction of new dwellings completed from 1 January 2009 and having a BBC label.
- **Targeting of Scellier aid** for rental investment towards BBC Dwellings: The Finance Law for 2010 provided for 'greening' of the so-called 'Scellier' tax relief for rental investment, that is to say, tax reduction rate applicable to dwellings without a 'BBC - low energy consumption building' label. The applicable tax reduction rate decreased from 25% in 2010 to 10% in 2012; the rate applicable to dwellings with a BBC label, was maintained at 20% in 2012.
- **Targeting of aid for housing purchase towards BBC Dwellings**: zero rate eco-loans and CITEPA ('greening' of tax credit on interest on loans contracted for purchase or construction of a permanently occupied dwellings ('TEPA tax credit', dwellings with a 'low consumption building, BBC 2005' label).

A.5.8 Other relevant topics

A.5.8.1 Permit requirements for renovation

No permit is required for renovation as long as the building envelope external outlook is not modified.

A simplified declaration scheme is obligatory for some building envelope modifications when the concerned area is limited (sunspaces or sun houses of less than 20 m^2), for use of renewable energy (solar collectors (<4 m^2 per dwelling), PV panels (<20 m^2)).

Building permit is necessary when the building features are modified: new windows (different size or material than previously), modification of roof, of building height, external insulation, etc. The minimum delay for building permit delivery is 3 months and the average amount of time it takes is around 5-6 months.

A.5.8.2 Organisation of owners in multi-family buildings and their decision process on renovation of buildings[58]

Decisions about renovations in owner-occupied multi-family are made by the owners collectively (the condominium association). According to ARC17 (2006), the condominium association is a legal entity represented by a collective decision (syndic in French), which can be one of the owners or a professional mandated representative. The collective decision is supported and controlled by a board of trustees. Decisions about reno-

[58] http://ecocitoyens.ademe.fr/mon-habitation/en-copropriete/renover-en-copropriete

vations are taken by an absolute majority (i.e, more than half of all shareowners need to agree and be represented in the meeting). However, there is no requirement for a renovation fund, although these are strongly advocated by ARC (2012).[59]

Grenelle 2 (Article 7) provides for amendment of the condominium decision-making rules to introduce:

1. A majority vote of condominium for major retrofitting;
2. A majority vote of condominium on installation of thermal energy meters or heating cost distributors;
3. Mandatory inclusion of the energy performance contract on the agenda of the condominium's general meeting that follows the drawing-up.

A.5.8.3 National consultation processes

In the building sector, each review of the energy regulations (which occurs every 5 years) is associated with a regular consultation of national stakeholders. A progress review is presented every 6 months and a large number of technical and non-technical working groups are set up and animated by the Department of Housing.

For other subjects, the Grenelle de l'Environnement national debate launched in mid 2007 and lasted until end of 2008, was the first national consultation ever with such a large array of stakeholders.

A.5.8.4 Buildings databases/registers

The main data source on the French building stock is the OPEN Observatory (Observatoire Permanent de l'amélioration ENergétique du logement[60]) which is financed and created by the French Environment and Energy Management Agency (ADEME) and provides quantitative data on residential financial efforts to improve the energy performance of their dwelling. CEREN, a private company, surveys the building stock and thus data are collected on a continuous basis.

Also, the population general census collects a number of information related to buildings which allow for the general knowledge on the residential sector. The database contains the information on all the main residences of the French population with some technical information (area, heating system, construction period, energy carrier, etc.).

A.5.8.5 Landlord-tenant dilemma

Rallying Law No 2009-323 on Housing and Combating Exclusion, adopted on 25 March 2009, established a new system of distribution of energy savings between owner/landlord and tenants. Due to inequalities between landlords and tenants (because tenants benefit from energy savings outcomes while retrofit burden costs are paid by landlords) and in order to encourage a 'win-win' relationship, landlords are now able to require tenants to contribute half of the retrofit burden cost. This contribution will be

[59] D2.4. of WP2 of the Entranze Project
[60] http://ademe.typepad.fr/files/2012-syntheseopen2011-2.pdf

available only if landlords carry out a mix of efficiency retrofit involving at least two actions.[61]

A.5.9 Financial and fiscal support policies/programmes

Several programmes are in place in France to support the energy efficiency in the building sector. In fact, in order to achieve its targets, France is mobilising a range of diversified instruments which include, within others, financial incentives. The Sustainable Development Tax Credit and the Zero-Rated Eco-loan are two major measures supporting refurbishment of the existing dwelling stock.

The following tables provide an extract on the on-going programmes and/or a selection of some of past programmes [62].

Programme *A*

Programme name	**Zero-rated eco-loan (eco-PTZ)[63]**					
Start – End Dates	2009 - ongoing					
Type of programme	Soft loan					
Budget	€75 million for 2009-2011					
Measures covered	Major renovation work: - ENVELOPE (including insulation, windows & glazing, exterior wall, doors, ceiling, etc.) - EQUIPMENT (including efficient heating, efficient lighting systems, ventilation, control systems, etc.) - OTHER (including energy audits, consultancy costs, education and training activities, etc.)					
Programme impacts	Implementation of zero-rated eco-loans enables annual final energy consumption to be reduced by 0.06 Mtoe in 2010 and 0.81 Mtoe in 2016 and 2020[64]					
Targeted buildings types:	**New buildings**	**Existing buildings**	**Residential**		**Non Residential**	
			Private owned	**Public owned**	**Private owned**	**Public owned**
		x	**x**		**x**	

[61] French NEEAP 2, English version, At page 192, Distribution of energy savings between owner/landlord and tenant (Measure B.20)
[62] Please note that other programmes exist.
[63] http://www.developpement-durable.gouv.fr/L-eco-pret-a-taux-zero-en-13.html
[64] Source: SceGES evaluation (see paragraph I.3.1.3 and Annex 2, Chapter III).

Programme *B*

<table>
<tr><th>Programme name</th><th>Lower VAT rate for renovation work</th></tr>
<tr><td>Start – End Dates</td><td>2009 - ongoing</td></tr>
<tr><td>Type of programme</td><td>Tax exemption</td></tr>
<tr><td>Budget</td><td>N/A</td></tr>
<tr><td>Measures covered</td><td>Works for dwellings completed more than two years ago related to improvement, conversion, upgrading and maintenance of dwellings are eligible for a lower VAT rate (5.5% instead of 19.6% until January 2012 and 7% now). Although this measure is not specific to energy-saving work, it allows, in particular, support for energy renovation of dwellings.

Measures covered are related to the:
- Building envelope (including insulation, windows & glazing, exterior wall, doors, ceiling, etc.)
- Installation of equipment (including efficient heating, efficient lighting systems, ventilation, control systems, etc.)</td></tr>
<tr><td>Programme impacts</td><td></td></tr>
<tr><td>Targeted buildings types:</td><td>
<table>
<tr><th rowspan="2">New buildings</th><th rowspan="2">Existing buildings</th><th colspan="2">Residential</th><th colspan="2">Non Residential</th></tr>
<tr><th>Private owned</th><th>Public owned</th><th>Private owned</th><th>Public owned</th></tr>
<tr><td></td><td>x</td><td>x</td><td></td><td></td><td></td></tr>
</table>
</td></tr>
</table>

Programme *C*

<table>
<tr><th>Programme name</th><th>Social housing eco-loans</th></tr>
<tr><td>Start – End Dates</td><td>2009 - ongoing</td></tr>
<tr><td>Type of programme</td><td>Soft loans</td></tr>
<tr><td>Budget</td><td>Estimation 110 M€/year.</td></tr>
<tr><td>Measures covered</td><td>They are available to HLM agencies, SEMs or communes owning or managing social housing in the context of thermal

renovation of poorly insulated housing</td></tr>
<tr><td>Programme impacts</td><td>At the end of February 2011 more than 75 000 social housing eco-loans (éco-PLS) had been issued, enabling annual final energy sav-</td></tr>
</table>

	ings of 0.07 Mtoe
Targeted buildings types:	**New buildings**:	**Existing buildings**: x	**Residential**: **Private owned**:	**Residential**: **Public owned**: x	**Non Residential**: **Private owned**:	**Non Residential**: **Public owned**:

Programme *D*

Programme name	**eco-subsidies for low-income owner-occupiers and eco premium**
Start – End Dates	2009 - ongoing
Type of programme	subsidies
Budget	(500 M€ for 2010-2017
Measures covered	The National Housing Improvement Agency (ANAH) helps owner-occupiers, subject to an income ceiling, and social landlords to carry out housing improvement work. Measures covered are: - ENVELOPE (including insulation, windows & glazing, exterior wall, doors, ceiling, etc.) - EQUIPMENT (including efficient heating, efficient lighting systems, ventilation, control systems, etc.)
Programme impacts	N/A
Targeted buildings types:	**New buildings**:	**Existing buildings**: x	**Residential**: **Private owned**: x	**Residential**: **Public owned**:	**Non Residential**: **Private owned**:	**Non Residential**: **Public owned**:

Programme *E*

Programme name	**The sustainable development account: Livret de Developpement Durable: Preferential loans for energy saving measures**
Start – End Dates	2007 - ongoing
Type of programme	Preferential loans, Reduced interest rates (soft loans)
Budget	Total 60 billion euros
Measures covered	EQUIPMENT (including efficient heating, efficient lighting systems, ventilation, cooling, control systems, etc.)
Programme impacts	N/A

Targeted buildings:	<table><tr><th rowspan="2">New build-ings</th><th rowspan="2">Existing buildings</th><th colspan="2">Residential</th><th colspan="2">Non Residential</th></tr><tr><th>Private owned</th><th>Public owned</th><th>Private owned</th><th>Public owned</th></tr><tr><td>x</td><td>x</td><td>x</td><td></td><td>x</td><td></td></tr></table>

Programme *F*

Programme name	**Realisation of low consumption buildings (AAP PREBAT)**
Start – End Dates	2006 - ongoing
Type of programme	Grants
Budget	from 2006 to 2009, a total support of 47M€, 53% from Ademe's budget, the complement from Regional budgets
Measures covered	N/A
Programme impacts	promote NZEB building diffusion
Targeted buildings:	<table><tr><th rowspan="2">New build-ings</th><th rowspan="2">Existing buildings</th><th colspan="2">Residential</th><th colspan="2">Non Residential</th></tr><tr><th>Private owned</th><th>Public owned</th><th>Private owned</th><th>Public owned</th></tr><tr><td>x</td><td></td><td>x</td><td>x</td><td>x</td><td>x</td></tr></table>

Programme *G*

Programme name	**Energy efficiency tax credit (including exoneration of land tax for BBC buildings)**
Start – End Dates	2005 - ongoing
Type of programme	Subsidies, co-financing
Budget	Total cost of 2.7 billion Euros from 2005 to 2009 (instead of predicted 1 billion Euros)
Measures covered	- ENVELOPE (including insulation, windows & glazing, exterior wall, doors, ceiling, etc.) - EQUIPMENT (including efficient heating, efficient lighting systems, ventilation, control systems, etc.)
Programme impacts	N/A

Targeted buildings:	**New build-ings**	**Existing buildings**	**Residential**		**Non Residential**	
			Private owned	**Public owned**	**Private owned**	**Public owned**
	x	**x**	**x**			

Programme *H*

Programme name	**Energy efficiency of residential and tertiary buildings - Program OPATB**[65]					
Start – End Dates	2002 - 2010					
Type of programme	Subsidies, co-financing					
Budget	16 Communities, 20 M€ retrofit works with various supports from ANAH, Ademe, local authorities,…					
Measures covered	- ENVELOPE (including insulation, windows & glazing, exterior wall, doors, ceiling, etc.) - EQUIPMENT (including efficient heating, efficient lighting systems, ventilation, control systems, etc.)					
Programme impacts	MWh/y saved; Tons of CO2 saved; increase of financial investment					
Targeted buildings:	**New build-ings**	**Existing buildings**	**Residential**		**Non Residential**	
			Private owned	**Public owned**	**Private owned**	**Public owned**
		x	**x**	**x**	**x**	**x**

Programme I

Programme name	**Grants for energy audits in buildings**
Start – End Dates	2000 - ongoing
Type of programme	Grants
Budget	in 2010, 24500 buildings have been audited with a financial support (50% of energy audit cost) from Ademe of 9.5 M€.
Measures covered	Energy audits

[65] http://www2.ademe.fr/servlet/KBaseShow?sort=-1&cid=96&m=3&catid=16908

Programme impacts	N/A					
Targeted buildings:	**New build-ings**	**Existing buildings**	**Residential**		**Non Residential**	
			Private owned	**Public owned**	**Private owned**	**Public owned**
		x	**x**	**x**	**x**	**x**

A6. Germany

A.6.1 Strategies and (action) plans for the building sector

The energy concept of the German government, decided and published in 2010, sets various targets in the field of rational energy use, energy savings and increasing the use of renewable energy. One of the main targets concerning the building stock is to have an almost climate neutral building stock by 2050, mainly by reducing heat demand and providing the remaining energy through renewable sources. To achieve such a reduction in energy demand the rate of building renovation shall be doubled and the heating demand shall be reduced by 20 % by 2020. In addition by 2050 Germany aims to reduce overall primary energy demand by around 80 %.[66]

Also, the energy concept of the German Government has established that "*In this context, the German government will [...] develop a renovation roadmap for existing buildings which starts in 2020, builds on the current renovation cycles for existing buildings and maps out a step-by-step approach for the building stock to reach the target of an 80% reduction of primary energy demand by 2050."* Furthermore, the roadmaps shall build on existing investment cycles where renovation would be necessary. It is also acknowledged that measures shall pay off within a reasonable period of time. There is no information available on when the renovation roadmap shall be established[67].

In order to achieve a public buildings' renovation rate of 3 % as defined by the Energy Efficiency Directive (EED), the federal authority for real property administration (Bundesanstalt für Immobilienaufgaben, BImA) holding more than 4.700 civil and military properties has decided to work with the German Energy Agency (dena) to establish a renovation roadmap for the federal properties. The roadmap shall be available in 2013 and comprise the order and the technical level of the renovations until 2050. Furthermore for the timeframe up to 2015 the planning will be detailed.[68]

In terms of proposed or scheduled legislation affecting requirements for energy performance of buildings, the draft of the Energy Savings Ordinances (EnEV) recast comprises an average reduction of maximum primary energy demand by 12.5 % for new buildings compared to the previous standard[69]. The revised EnEV is scheduled to be affective from 2014 onwards. Requirement on existing buildings as well as on maximum heat transfer are not tightened. Distribution and control mechanisms around the energy certificate shall also be enhanced in the revised ordinance.

[66] More information available on:
http://www.bmu.de/english/energy_efficiency/doc/46733.php
http://www.bmwi.de/English/Navigation/Service/publications,did=241986.html
[67] http://www.bmu.de/english/energy_efficiency/doc/46733.php
[68] http://www.dena.de/index.php?id=5831&L=1&no_cache=1
[69] http://www.zukunft-haus.info/de/planer-handwerker/fachwissen-bauen-und-sanieren/gesetze-und-verordnungen/enev-2013-und-energiekonzept.html?up=1&cHash=9c4269a35f

A.6.2 Building codes

The minimum energy requirements for residential and non-residential buildings, both in terms of new buildings and the rehabilitation of existing ones, are regulated by the German Energy Saving Ordinance[70] (Energieeinsparverordnung, hereafter EnEV).

For **new buildings**, the EnEV lays down maximum building-specific levels of primary energy demand and the required energy performance of the building envelope (expressed in maximum values of the specific transmission heat loss related to the heat transmitting surface area). The requirements (maximum levels) are defined by means of a reference building which corresponds to the real building in terms of geometry, net floor area, orientation and utilisation, but whose technical structure is defined according to Appendix 2 of the EnEV.

For the **renovation of buildings** the EnEV sets component-specific minimum efficiency requirements which have to be complied with when it is necessary to change or modernize a building component (e.g. the roof, the windows or the exterior wall). However, there is no obligation to conduct upgrade measures. This means where no renovation takes place there is no requirement to fulfil any performance standard at all (with the exemption of some obligatory refurbishment measures such as the insulation of the heat distribution and hot water pipes as well as fittings or the insulation of top floor ceilings)..

Major renovations meet the EnEV standard if the refurbished building (residential and non-residential) does not exceed the annual primary energy demand of the corresponding (new) reference building (see above) and the maximum value of the specific transmission heat loss related to the heat-transmitting surface area of the reference building by more than 40%. In case of single measures modifications are to be designed in such a way that specific heat transfer coefficients of the exterior components are not exceeded (see Appendix 3 of the EnEV).

A.6.2.1 Energy performance requirements

Requirements set by the German building code refer to primary energy.

No direct energy consumption requirements are defined in the EnEV.

A.6.2.2 Thermal insulation requirements

The following table (table 28) shows the component based maximum U-values of the different reference buildings according to type of building and construction work (new construction or renovation).

[70] http://www.zukunft-haus.info/index.php?id=11883 (incl. an English version of the EnEV)

Table 28: U-value requirements

Building component		U-value [W/m²K]									
		Single family		Multi-family		Offices		Education		Health	
		New	Ren	New	Ren	New	Ren	New	Ren	New	Ren
Walls	External wall	0,28 – 0,35	0,24	0,28 – 0,35	0,24	0,28 – 0,35	0,24 – 0,35	0,28 – 0,35	0,24 – 0,35	0,28 – 0,35	0,24 – 0,35
Windows/Doors	Windows and French doors	1,30	1,30	1,30	1,30	1,30 – 1,90	1,30 – 1,90	1,30 – 1,90	1,30 – 1,90	1,30 – 1,90	1,30 – 1,90
	Skylights	1,40	1,40	1,40	1,40	1,40 – 1,90	1,40 – 1,90	1,40 – 1,90	1,40 – 1,90	1,40 – 1,90	1,40 – 1,90
	Dome lights	2,70		2,70		2,7		2,7		2,7	
	Outside doors	1,80		1,80		1,8 – 2,9		1,8 – 2,9		1,8 – 2,9	
	Light bands					2,4		2,4		2,4	
Roof/Ceilings	Roof and/or top floor ceiling	0,2	0,20 – 0,24	0,2	0,20 – 0,24	0,20 – 0,35	0,20 – 0,35	0,20 – 0,35	0,20 – 0,35	0,20 – 0,35	0,20 – 0,35
	Glass roofs		2		2	2,70	2,00-2,70	2,70	2,00-2,70	2,70	2,00-2,70
Floors	Basement	0,30		0,30							

Please note that in the case of **new residential buildings**, in addition to the specific component based characteristics above, the overall maximum heat loss related to the heat transmitting surface area of the building to be constructed may not exceed the maximum values given in the following table:

Table 29: Maximum values of transmission heat loss for residential buildings

Building type	Maximum value of the specific transmission heat loss (W/m²K)
Single family house	0,40 – 0,50
Multi-family house	0,65

A.6.2.3 Compliance and control

Compliance with building codes is under the responsibility of the regions (Bundesländer) which generally transfer the responsibility to the local building authorities. Due to a lack of human resources, but also due to the fact that most modernisation measures are not subject of any form of licensing procedure, there are hardly any controls whether building owners comply with the requirements set by the EnEV. However there are no statistics about the magnitude of the compliance deficit in the building stock. A detailed evaluation of the EnEV is also missing whereas the preparation of an evaluation of the EEWärmeG (Act on the Promotion of Renewable Energies in the Heat Sector) is currently in process.

A.6.3 Measures for implementing Article 13(4) of the RED

New buildings are subject to a minimum RES-H share obligation. On the basis of the Act on the Promotion of Renewable Energies in the Heat Sector[71] (Erneuerbare-Energien-Wärmegesetz EEWärmeG) new building projects are subject to an obligation to use renewable energies for heat supply. Since 2011, the revised act also includes existing public buildings. This regulation covers both residential buildings and non-residential buildings. New buildings have to draw a minimum percentage of the building's heat and cooling supply from renewable energies. The minimum shares are fixed according to technology. In the case of solar thermal the minimum share is 15%, 30% in the case of biogas, and 50% if bio-oils, solid biomass (e.g. wood pellets) or geothermal energy are used or a heat pump is installed.

However this obligation does not apply to major renovations. Currently there is a debate on how to support the use of RES-H in existing buildings, but it is not foreseeable yet which instrument will be opted for.

A.6.4 Energy Performance Certificates

The EPC requirements are regulated in the EnEV (section 16-21). EPCs can optional be issued on the basis of the calculated energy demand or the recorded energy consumption. Instead of working with discrete efficiency classes in Germany the EPC is

[71] http://www.erneuerbare-energien.de/doc/42351.php (incl. an English version of the EEWärmeG)

based on a continuous scale[72]. EPC samples are provided by Appendix 7 (residential buildings) and Appendix 8 (non-residential buildings) of the EnEV.

A.6.5 Inspections (for boilers and/or air conditioning systems): article 8 of first EPBD

The inspection of boilers[73] is regulated in the First Ordinance on the Implementation of the Federal Immission Control Act (1. BImSchV). Boilers based on oil or natural gas needs to be inspected every two or three year (depending on their age).

The inspection of AC is regulated in the EnEV (on section 12). Operators of air-conditioning systems installed in the building with a cooling capacity of more than 12 kilowatts must have energy inspections of these systems performed by authorised persons. After the initial inspection the system must undergo a repeat inspection at least every ten years. The inspection includes measures to check components affecting the level of efficiency of the system and the size of the system in relation to the cooling needs of the building. The operator must present upon request the certification on performance of the inspection to the authority responsible according to state law.

A.6.6 Cost optimality

The Federal Institute for Research on Building, Urban Affairs and Spatial Development has initiated a project to assess the impact of the European calculation method of the "cost-optimal level" of energy efficiency. The goal of the project is to assess whether the development of the requirements of energy efficiency ordinance fulfil EPBD conditions. In that context the German requirement for profitability according to the energy efficiency act needs to be considered. The Institut für Wohnen und Umwelt GmbH (IWU) treating the project reviews different calculation methods and identifies the differences of possible calculation methods to comply with the directive and the current national profitability calculations. Subsequently the cost optimal levels for existing and new buildings are being calculated. The project is planned to be finished by the end of 2012.[74]

A.6.7 nZEB: requirements and roadmaps

The German government has initiated a project to research the possible NZEB definition and determine the best solution. The project "Analysis of the revised EPBD" came up with the following concept that is similar to the approach in the energy savings ordinance EnEV:

"The analysis shows that the EnEV method is generally suited to assess also nearly zero-energy buildings. However it is recommended to enlarge the very restrictively defined balancing room of Paragraph 5 of the EnEV in order to include not only the electricity generated by renewables but also other renewable energies generated on-site."

[72] German EPC samples at http://www.zukunft-haus.info/index.php?id=11883
[73] http://www.bmu.de/english/air_pollution_control/general_information/doc/4352.php, http://www.bmu.de/luftreinhaltung/downloads/doc/39616.php (download of 1. BImschV)
[74] http://www.iwu.de/forschung/energie/laufend/kostenoptimales-niveau-eu/

Also, *"making the legitimate assumption that [the trend of the past 30 years][will continue for the next years, it can be derived that new buildings in 2020 will have an energy performance of 50% better than the performance of current buildings. This corresponds in the residential sector to a KfW Efficiency House 40 level. The study consortium therefore advises to communicate this level as target for the nearly zero-energy buildings so that the market development can refer to it."*

This project has only recently been finished and the report was published in October 2012. Policy processes integrating the projects results are currently in progress.[75]

In addition, current legislation shall be changed to include the requirement of new buildings to comply with an nZEB standard. These changes of the energy efficiency act shall be enacted by the German government in February 2013.[76] The new EnEV will probably come into force in the 2nd half of 2013.

A.6.8 Other relevant topics

A.6.8.1 Permit requirements for renovation

Most renovation projects do not underlie any form of permit requirements which means that generally local building authorities lack any form of overview about how many buildings are currently subject of a modernisation measure. However new fossil and biomass boilers need to be approved by the chimney sweeper. Article 7 of the EPBD (on achieving minimum energy performance requirements for buildings undergoing major renovation) is enforced by the EnEV.

A.6.8.2 Organisation of owners in multi-family buildings and their decision process on renovation of buildings

For renovation measures that aim at decreasing the energy consumption of the building in multi-occupancy buildings a minimum of 75% of the apartment owners need to be in favour of such measure. The detailed requirements are regulated in the German residential property law (Gesetz über das Wohnungseigentum und das Dauerwohnrecht (Wohnungseigentumsgesetz)).[77]

A.6.8.3 National consultation processes

Stakeholders are organised within the building council **DGNB** (Deutsche Gesellschaft für nachhaltiges Bauen, German Sustainable Building Council). The members of the German Sustainable Building Council represent the entire value chain of the construction and real estate sectors: architects, planners, industry, investors and science.

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[75] http://www.bbsr.bund.de/cln_032/nn_340720/BBSR/EN/Publications/BMVBS/Online/2012/ON162012.html; http://www.irb.fraunhofer.de/bauforschung/projekte.jsp?local=en&p=20128035721

[76] More information on:
http://www.bbsr.bund.de/cln_032/nn_340720/BBSR/EN/Publications/BMVBS/Online/2012/ON162012.htm
http://www.irb.fraunhofer.de/bauforschung/projekte.jsp?local=en&p=20128035721
http://www.bmvbs.de/SharedDocs/DE/Artikel/SW/energieeinsparverordnung-aktuelles-novellierungsverfahren.html (german only)

[77] Wohnungseigentumsgesetz under http://www.gesetze-im-internet.de/woeigg/BJNR001750951.html

Also, all responsible ministries, both at national and regional levels, maintain regular working groups on energy policies in buildings. As energy is a cross-sectional field several ministries are involved in stakeholder consultation processes. On the national level the Federal Ministry for the Environment, the Ministry of Economics and the Federal Ministry of Transport, Buildings and Urban Affairs maintain overlapping working groups. On the regional level ministries and their competences are not uniformly structures among the different States(“Länder”). However, they also maintain regular working groups including the relevant stakeholders.

A.6.8.4 Buildings databases/registers

Currently, no registers covering all renovated buildings or holding all issued EPCs exist.

The most relevant sources of data and information on the energy performance of buildings and on buildings data in general are:

- Statistisches Bundesamt;
- Datenbasis Gebäudebestand[78], Datenerhebung zur energetischen Qualität und zu den Modernisierungstrends im deutschen Wohngebäudebestand: empirical data collection based on a sample of around 7500 residential buildings (this is the most in depth database providing an overview of the current energetic characteristics of the residential building stock);

A.6.8.5 Landlord-tenant dilemma

Since Germany has one of the lowest home ownership rates within the EU, the landlord-tenant dilemma is a major barrier for modernisation measures in the building stock.

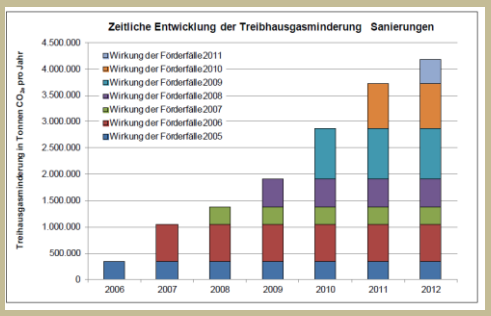
A.6.9 Financial and fiscal support policies/programmes

Germany has been implementing several financial and fiscal programmes supporting the energy efficiency in the building sector, in particular through the promotional bank (KfW Bankengruppe) and the Federal Office of Economics and Export Control (Bafa).

The following tables provide an extract on the on-going programmes and/or a selection of some of past programmes [79].

[78] http://datenbasis.iwu.de/dl/Endbericht_Datenbasis.pdf
[79] Please note that other programmes exist.

Programme *A*

Programme name	KfW Energy-Efficient Refurbishment[80]
Start – End Dates	2001- ongoing
Type of programme	grants, low-interest loans including redemption grants
Budget	2012-2014: 1,5 billion per year (incl. the budget of Programme C)
Measures covered	- ENVELOPE (including insulation, windows & glazing, exterior wall, doors, ceiling, etc.) - EQUIPMENT (including efficient heating, efficient lighting systems, ventilation, cooling, control systems, etc.)
Programme impacts	Evaluation 2011: Coverage: 181.000 apartments Induced reduction final energy: 1.250 GWh/a Induced reduction of primary energy: 1.680 GWh/a Induced reduction of CO_2: 0,46 mio. t/a Accumulated CO_2-savings since 2006:  Evaluation report 2011: http://www.kfw.de/kfw/de/I/II/Download_Center/Fachthemen/Research/PDF-Dokumente_Evaluationen/Monitoring_EBS_2011.pdf
Targeted buildings types:	**New buildings**: ; **Existing buildings**: x ; **Residential**: Private owned: x, Public owned: x ; **Non Residential**: Private owned: , Public owned:

[80] http://www.kfw.de/kfw/en/Domestic_Promotion/Our_offers/Housing.jsp

Programme *B*

Programme name	**Market Incentive Programme (MAP) for renewable energies in the heat market**
Start – End Dates	2000 – ongoing
Type of programme	Grants, soft loans
Budget	Approx. 500 mio EUR/a
Measures covered	Renewable heating and cooling installations
Programme impacts	Evaluation 2010: Induced generation of RES-H final energy: 1,5 GWh Induced reduction of CO_2: 0,4 mio. t CO_2/a Evaluation report 2010: http://www.erneuerbare-enegien.de/files/pdfs/allgemein/application/pdf/evaluation_map_2010.pdf

Targeted buildings types:	**New buildings**	**Existing buildings**	**Residential**		**Non Residential**	
			Private owned	**Public owned**	**Private owned**	**Public owned**
		x	**x**	**x**	**x**	**x**

Programme *C*

Programme name	**KfW Energy-Efficient Construction**
Start – End Dates	2009 – ongoing
Type of programme	Soft loans
Budget	2012-2014: 1,5 billion per year (incl. the budget of Programme A)
Measures covered	New buildings reaching a primary energy standard which is 30% below the reference standard or better.
Programme impacts	N/A

Targeted buildings types:	**New buildings**	**Existing buildings**	**Residential**		**Non Residential**	
			Private owned	**Public owned**	**Private owned**	**Public owned**
	x		**x**			

Programme *D*

Programme name	On-site energy advice (Vor-Ort-Beratung) / Energiesparberatung vor Ort (BAFA)
Start – End Dates	1991 – ongoing
Type of programme	Grants
Budget	around 3.5 million Euro in 2005
Measures covered	Funding is provided for an on-site consultation by accredited energy advisors dealing comprehensively with structural thermal insulation as well as heat generation and distribution including water heating and use of renewable energies.
Programme impacts	An ex-ante evaluation of the advice programme was carried out by a group of research institute on behalf of the Umweltbundesamt (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 CO2 reductions which are calculated with the heating model are extrapolated to the number of buildings which are energetically improved due to the advice given by this programme. According to a survey by BAFA (2000) it is assumed that around 64% of the advice services were followed by energy saving investments which were strongly influenced by the programme. When the programme is extrapolated to 2030, cumulative gross savings of 0.57 Mt CO2 could be achieved. But these savings cannot be only assigned to the advice programme, since many owners use financial incentive programmes for the implementation of the suggested saving measures. The share of the financial incentive programmes in the gross savings is estimated at about 60 % in this impact evaluation.

Table 2: Cumulative CO_2 and energy savings due to the On-site Energy Advice Programme in the household sector

Ex-post evaluation	2005[2)]							
CO_2 (kt)								
Incl. interaction with financial measures	22							
Savings concerned by interaction (62 %)	14							
Energy (TJ)[1)]								
Incl. interaction with financial measures	350							
Savings concerned by interaction (62 %)	217							
Ex-ante evaluation	2006[2)]	2007[2)]	2008[2)]	2009[2)]	2010[2)]	2020[3)]	2030[3)]	2016[4)]
CO_2 (kt)								
Incl. interaction with financial measures	44	66	88	110	132	350	570	

Savings excl. interaction (62%)	130[5] 28 50[5]	210[5] 42 80[5]	300[5] 56 110[5]	70	470[5] 84 180[5]	1310[5] 133 500[5]	2150[5] 217 820[5]	
Energy (TJ) [1] Incl. interaction with financial measures	700	1050	1400	1750	2100	5570	9063	25000 -
Savings concerned by interaction (62 %)	434	650	868	1085	1300	2115	3444	50000

1) Assuming a CO_2 factor of 63 kt/PJ
2) Kleemann/Hansen 2005
3) Umweltbundesamt 2008
4) BMWi 2007
5) Umweltbundesamt 2009, S.101,

Sources Kleemann/Hansen 2005; Umweltbundesamt 2008; BMWi (2007)

Targeted buildings types:	New buildings	Existing buildings	Residential		Non Residential	
			Private owned	Public owned	Private owned	Public owned
		x	x			

A7. Italy

A.7.1 Strategies and (action) plans for the building sector

With regard to energy efficiency Italy aims to overcome the 20% European target with an expected savings of up to 24% (approximately 20 Mtoe of primary energy compared to today).

In order to implement the recast EPBD (Directive 2010/31/EU), it is expected the adaptation of the energy requirements in force. The adoption process was rejected in late June 2012 and the revisions of Parliament are still in progress. However, as in the New National Energy Strategy document the latest measures implemented (new energy requirements, EPC scheme, incentives for building refurbishment and RES systems, White Certificate mechanism) are emphasized as almost sufficient to achieve the general objectives, no paradigmatic revolutions are foreseen.

In accordance with the current version of the New National Energy Strategy, the Italian Government aims to:

- reinforce the actions that can affect the high energy saving potential unexploited (building included) and to strengthen the control and sanction mechanisms, making them consistent across all regions;
- introduce instruments for the direct stimulation of energy efficiency measures in public administration (which, by the well-known budget constraints and lack of access to tax deductions, it is not able to exploit the full potential of energy savings);
- stimulate actions on energy planning and sustainable urban development, with the aim to enable innovative models of urban planning and energy flows, grid efficiency , mobility and upgrading of the building stock;
- adopt plans for sustainable development of renewable energy sources.

Regarding the development and implementation of renovation roadmaps (or long-term strategies), there has been, in recent years (Finance Act 2007 and following Finance Acts) a national incentive mechanism for the renovation of residential building (covering large part of the energy consumption of the Italian building stock). It allows building owners to recover 55% of the investment costs (with maximum limits) in 10 years within the income declaration procedure. This mechanism, positively judged by ENEA , the Italian National Agency for New Technologies, Energy and Sustainable Economic Development (in charge for the management), has been renewed for 2013 but there are no guarantees about further renewals[81].

Concerning the EED target to renovate 3% of public central building, no specific and well defined measures are there. Given the historical value of many of these buildings it will be complicate to implement effective renovation actions.

[81] http://efficienzaenergetica.acs.enea.it/doc/rapporto%20mercato%20v3p.pdf (Italian Version only)

A.7.2 Building codes

The Decree law 192/2005 was updated by the Decree Law 311/2006 which proposes (for five Italian climatic zones):

- revised values for maximum U-values for the various opaque and transparent components of the building envelope;
- minimum average seasonal thermal efficiency of the heat generation system;
- maximum annual total primary energy consumption for space heating expressed as a function of S/V ratio and HDD and referred to heated net floor area for residential building (while to heated net volume for other building uses). These requirements are applied to new buildings and major renovation of buildings with a floor area greater than 1000 m^2.

With the D.P.R. of 24 February 2009, maximum annual total primary energy consumptions for space cooling have been introduced.[82]

Additional requirements for new buildings and major refurbishment:

- for new buildings and refurbishment is obligatory to install a solar thermal plant designed to cover at least 50% of the thermal energy consumed annually to produce DHW;
- Since June 2012 (Dlgs n. 28/2011) it is mandatory to cover 20% of thermal energy uses with thermal RES systems and to install 1 kW of electric renewable systems for every 80 m^2 of floor area. These requirements will be increased in the coming years.

A.7.2.1 Energy performance requirements

The building code requirements are specified in terms of primary energy. The following table (table 30) shows the minimum and maximum values for different building types.

Table 30: Energy performance requirements

		Single family houses (kWh/m^2/year)		Multi-family houses (kWh/m^2/year)		Offices (kWh/m^3/year)		Schools (kWh/m^3/year)		Hospitals (kWh/m^3/year)	
		min	**max**	**min**	**max**	**min**	**max**	**min**	**max**	**min**	**max**
New stock	**Final energy**	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Heating	8,5	116,0	8,5	116,0	2,0	31,0	2,0	31,0	2,0	31,0
	Cooling	30	40	30	40	10	14	10	14	10	14

[82] http://www.aivc.org/medias/pdf/Workshop032009/Wednesday_Session4_11.15/P5_Italy_Pagliano.pdf

Renovated stock	**Final energy**	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Heating	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Cooling	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

A.7.2.2 Thermal insulation requirements

The Decree Law 311/2006 sets the following U-values applying to the various components of the building envelope and according to the climatic zone.

Table 31: U-value requirements

Building component	U-value [W/m²K]									
	Single family		Multi-family		Offices		Education		Health	
	New	Ren	New	Ren	New	Ren	New	Ren	New	Ren
Walls	0,33 – 0,62		0,33 – 0,62		0,33 – 0,62		0,33 – 0,62		0,33 – 0,62	
Windows	2,00 – 4,60		2,00 – 4,60		2,00 – 4,60		2,00 – 4,60		2,00 – 4,60	
Roof	0,29 – 0,38		0,29 – 0,38		0,29 – 0,38		0,29 – 0,38		0,29 – 0,38	
Basement	0,32 – 0,65		0,32 – 0,65		0,32 – 0,65		0,32 – 0,65		0,32 – 0,65	

A.7.2.3 Compliance

Nominally the control task is delegated to the municipal technical, but the self-declaration of compliance with the building code requirements by designers and builders is a very common practice. In general the municipalities do not have sufficient resources to establish and manage effective monitoring and control mechanisms in order to apply the existing sanctions for infringement.

A.7.3 Measures for implementing Article 13(4) of the RED

According to the Dlgs. 28/2011, from 2017 the consumption of thermal energy (heating, DHW and cooling) should be covered by renewable sources to 50%. Today this requirement is 20% and it will be increased to 35% from the beginning of 2014. These obligations cannot be fulfilled by renewable energy plants that produce only electricity for the operation of devices or equipment for the production of domestic hot water, heating and cooling. Regarding electricity, it is necessary to install a renewable power that varies based on the area of the building multiplied by a factor that increases in 3 steps between now and 2017: 1 kW per 80 m^2 of building up to the end of 2013, 1 kW for every 65 m^2 up to the end of 2016, 1 kW for every 50 square meters by 2017. In addition to new buildings, existing buildings with a surface area greater than 1000m^2 undergoing complete renovation (as well as existing buildings subject to demolition and

reconstruction) are subject to these obligations. For public buildings the obligations of integration of RES have increased by 10%.

A.7.4 Energy Performance Certificates

At national level, Italian law allows building owners themselves to make a self-declaration for the energy performance of the building if they state that the energy level of the building is of the lowest class (G) and that the energy costs for the prospective tenant or buyer are going to be very high. However, in the last years, more effective EPC schemes have been set up in more than half of the regions. In general this allows a better management of the mechanism, but it implies an important heterogeneity of definition (e.g. about general rules, energy classes, calculation procedures/tools) and application.[83]

On the tables below (tables 32, 33) the energy performance classes set through the national scheme level are presented.

Table 32: EPC Energy classes

National Level - D.M. 26/06/09: Primary energy classes for space heating as a function of energy requirements for new buildings

Class	ALL BUILDINGS
A+	$EP_H < 0.25\ EP_L$
A	$0.25\ EP_L < EP_H < 0.50\ EP_L$
B	$0.50\ EP_L < EP_H < 0.75\ EP_L$
C	$0.75\ EP_L < EP_H < 1.00\ EP_L$
D	$1.00\ EP_L < EP_H < 1.25\ EP_L$
E	$1.25\ EP_L < EP_H < 1.75\ EP_L$
F	$1.75\ EP_L < EP_H < 2.50\ EP_L$
G	$EP_H < 2.50\ EP_L$

Table 33: EPC Energy classes

National Level - D.M. 26/06/09: Primary energy classes for DHW

[kWh/m2/year] Class	ALL BUILDINGS
A	$EP_{DHW} < 9$
B	$9 < EP_{DHW} < 12$
C	$12 < EP_{DHW} < 18$
D	$18 < EP_{DHW} < 21$

[83] http://efficienzaenergetica.acs.enea.it/doc/attuazione_certificazione_energetica-rapporto_CTI.pdf (Italian only)

E	$21 < EP_{DHW} < 24$
F	$24 < EP_{DHW} < 30$
G	$EP_{DHW} < 30$

A.7.5 Inspections (for boilers and/or air conditioning systems): article 8 of first EPBD

Transposing the EPBD Directive, the Legislative Decree 192/2005 introduced obligations for regular inspections of boilers. The periodicity of the controls depends by the type and power of the boiler.

Italy has not adopted any measures regarding the requirement to carry out regular inspections of air-conditioning systems in order to evaluate their performance.

A.7.6 Cost optimality

Official Cost-optimal calculation procedure is not still available. The Energy Department of the Economic Development Ministry commissioned the Italian energy agency (ENEA), supported by some CTI Commissions, to prepare a first proposal.

A.7.7 nZEB: requirements and roadmaps

Italy does not have an official nZEB definition yet. Currently, the Energy Department of the Economic Development Ministry commissioned the Italian energy agency (ENEA) to prepare a first nZEB proposal, with the support of some CTI Commissions and through the Regional Authorities consultation. However, the adoption of the Italian nZEB definition is expected to be a long process. While nothing is officially assumed at the moment, the plan for implementing the nZEB in Italy is likely to come with a gradual strengthening of the energy performance requirements for both new buildings and major renovation of the existing ones.

At regional level, Regione Lombardia is currently analysing how to bring forward the nZEB target to 2015 (this analysis is foreseen in the recent Development Plan of the Region).

As support measures for enhancing the energy performance of buildings, the intention of Italian authorities is to extend/reinforce the existing incentive schemes of 55% tax deduction for residential sector (“Conto Energia”) and the White Certificates scheme. In addition, it is planned to introduce a new mechanism (“Conto Energia Termico”) for stimulating the adoption of RES-heating systems.

A.7.8 Other relevant topics

A.7.8.1 Permit requirements for renovation

The permit requirements for renovations change according to the type of interventions.

- The “Certificate communication for the start of the works (so called SCIA)”, is presented by a professional (engineer, architect, quantity surveyor) on behalf of his client, by which he assumed the responsibility that the renovation will be in line with all the urban regulations (urban plan, urban buildings regulation…).

Without it is not allowed to start any kind of work. The Municipality could deny the regularity and stop the works by 60 days from the communication. After the 60 days, the Municipality could intervene only in presence of for the serious damage for the public interest. This procedure could be used only for the renovations that not comply with change of the surface, volume or outline of the building.

- The "Permit to build", is submitted by a professional (engineer, architect…) to the urban office of the municipality. Without it is not allowed to start any kind of work.

These rules can change at regional level.

All requirements in force for new buildings are extended to complete refurbishment of the existing building envelope elements with useful area > 1000 m² and in the case of demolition and reconstruction of existing buildings with maintenance usable area > 1000 m².

A.7.8.2 Organisation of owners in multi-family buildings and their decision process on renovation of buildings

To renovate the building envelope or replace components of the thermal plants it is necessary to achieving an agreement of owners who representing the 51% of the building value. The building administrator is the guarantor of the decisional process.

A.7.8.3 National consultation processes

A public consultation at national level has opened on the 16th October 2012 (ending 30 November) for the New National Energy Strategy with the following general objectives:

- reducing energy costs;
- full satisfaction of all European environment objectives (in particular with reference to "20-20-20" plan);
- greater security of supply ;
- industrial development of the energy sector.

At the end of the consultation phase a public meeting will be held in order to share the results and define the implementation process[84].

A.7.8.4 Buildings databases/registers

The EPC databases at national and regional level are managed by public companies. However, data are not publically available.

[84] More information on: http://www.sviluppoeconomico.gov.it/?option=com_content&view=article&idmenu=806&idarea2=0&sectionid=4&andor=AND&idarea3=0&andorcat=AND&partebassaType=4&MvediT=1&showMenu=1&showCat=1&idarea1=0&idarea4=0&idareaCalendario1=0&showArchiveNewsBotton=1&id=2024875&viewType=0

A.7.8.5 Landlord-tenant dilemma

In order to overcome the tenant-landlord barrier, the following general measures should be considered:

- establish a link between rentals and building energy consumption;
- in case of efficiency actions in condominiums, provide to the building administrator remuneration proportional to the savings achieved.

Presidential Decree no. 59 of 2 April 2009 provides that in case of renovation or installation of new heating systems in existing buildings with a number of housing units greater than 4, (where technically possible) actions necessary to allow the heat accounting and thermoregulation for single housing unit must be made.

Other general measures should be also taken into account to tackle other market barriers for investing in improving the energy performance of buildings.

A.7.9 Financial and fiscal support policies/programmes

Within the financial and fiscal programmes developed in Italy to support the energy efficiency of the building sector, the existing incentive schemes of 55% tax deduction for residential sector has been positively evaluated by ENEA, the Italian National Agency for New Technologies, Energy and Sustainable Economic Development. In addition, a new mechanism ("Conto Energia Termico") for stimulating the adoption of RES-heating systems is planned to be introduced.

The following tables provide an extract on the new, on-going programmes and/or a selection of some of past programmes [85].

Programme *A*

Programme name	**55% of tax deduction86**
Start – End Dates	01/01/2012 – 30/06/2013
Type of programme	Tax related
Budget	Around 2,5 billion of euro (of lower tax revenue)
Measures covered	Insulation, new window system, condensing boiler, thermal solar panels, overall renovations.
Programme impacts	Energy savings in the period 2008-2012: 9 500 GWh Emissions reduction in the period 2008-2012: 2 000 ktCO2

[85] Please note that other programmes exist.

[86] http://efficienzaenergetica.acs.enea.it/doc/rapporto_2010_pubblicato.pdf

Targeted buildings types:	New buildings	Existing buildings	Residential		Non Residential	
			Private owned	Public owned	Private owned	Public owned
		x	x			

Programme *B*

Programme name	"V ContoEnergia"
Start – End Dates	27/08/2012 – 26/02/2015
Type of programme	incentive
Budget	700 million of euro(+ 6 billion of euro of previous programmes)
Measures covered	Photovoltaic systems In case of installation on a building roof, to obtain the maximum incentive rate it is necessary to install completely integrated PV systems and to renovate (insulate) the building roof.
Programme impacts	Expectation of total power installed at the end of 2013: 6600 MWp

Targeted buildings types:	New buildings	Existing buildings	Residential		Non Residential	
			Private owned	Public owned	Private owned	Public owned
	x	x	x	x	x	x

Programme *C*

Programme name	WhiteCert Scheme87
Start – End Dates	01/06/2005 – 31/05/2013 (extensions expected until 2020)
Type of programme	white certificates
Budget	531 million of euro in the period 2005-2009
Measures covered	Envelope, technical equipment
Programme im-	Energy consumption reduction in the period 2005-2010: 2 Mtep

[87] http://www.autorita.energia.it/allegati/docs/12/070-12.pdf (Italian Version only)

pacts[88]	Expectation of energy consumption reduction in the period 2011-2020: 5 Mtep
Targeted buildings types:	

New buildings	Existing buildings	Residential		Non Residential	
		Private owned	Public owned	Private owned	Public owned
	x	x	x	x	x

Programme *D*

Programme name	**"ContoTermico" (NEW)**
Start – End Dates	2013 - 2020
Type of programme	incentive
Budget	900 million of euro
Measures covered	Thermal RES system
Programme impacts	Expectation of energy consumption reduction in the period 2013-2020: 2,5 Mtep
Targeted buildings types:	

New buildings	Existing buildings	Residential		Non Residential	
		Private owned	Public owned	Private owned	Public owned
x	x	x	x	x	x

Programme E

Programme name	**VAT Reduction**
Start – End Dates	2010 - 2015
Type of programme	Tax reduction
Budget	N/A
Measures covered	- ENVELOPE (including insulation, windows & glazing, exterior wall, doors, ceiling, etc.)

[88] http://www.sviluppoeconomico.gov.it/images/stories/documenti/20121016SEN-Documento-di-consultazione-vOnlinexxx.pdf (Italian Version only)

<table>
<tr><td></td><td>- EQUIPMENT (including efficient heating, efficient lighting systems, ventilation, cooling, control systems, etc.)</td></tr>
<tr><td>Programme impacts</td><td>N/A</td></tr>
<tr><td>Targeted buildings types:</td><td>
<table>
<tr><td rowspan="2">New buildings</td><td rowspan="2">Existing buildings</td><td colspan="2">Residential</td><td colspan="2">Non Residential</td></tr>
<tr><td>Private owned</td><td>Public owned</td><td>Private owned</td><td>Public owned</td></tr>
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A8. Romania

A.8.1 Strategies and (action) plans for the building sector

Romania has several energy and specific energy efficiency and renewable energy strategies[89] such as in the followings:

- The energy roadmap for Romania (GD 890/2003) aiming at a final electricity consumption of 57,59TWh in 2015;
- The strategy on renewable energy sources (GD 1535/2003) reinforced by the Renewable energy Action Plan under the RE Directive;
- The national strategy on energy efficiency (GD 163/2004) integrating the National Energy Efficiency Action Plan under the ESD;
- The national strategy on the heating supply of localities through district generation and distribution systems (GD 882/2004);
- The national program "Heating 2006 - 2015 heat and comfort" (GD 462/2006) aiming at important energy savings by the rehabilitation of the DH systems and thermal rehabilitation of buildings;
- The National Development Plan 2007-2013, in conjunction with ERDF sectorial programmes and with three major sub-programmes on efficient and sustainable energy, renewable energy sources and interconnection networks;
- Romania's national energy strategy 2007-2020 (GD 1069/2007) aiming to reach a primary energy intensity of 0,32 in 2015 and 0,26 in 2020;
- The national strategy on the sustainable development of Romania - Horizons 2013-2020-2030 (GD 1460/2008).

Romania's energy strategy for 2007-2020 (GD 1069/20071) includes forecast of the energy consumption made in 2007. However, such forecasts do not consider the influence of the economic crisis. The main measures of the strategy related to buildings are such as in the followings:

- intensifying the information campaigns of the population and of the business environment;
- continuing the "Heating 2006-2015 heat and comfort" program;
- continuing the Program for the thermal retrofitting of blocks of flats;
- expanding the National program for energy efficiency (retrofitting the heating system, retrofitting public buildings and increasing the efficiency of public lighting) for 2011 – 2015;
- the compulsory acquirement of the energy efficiency certificate, starting with 2010, for residential buildings (i.e. single family homes and apartments) that are sold or leased out;
- the enforcement by the central and local public authorities of GO no. 22/2008 on energy efficiency and the promotion of the final consumer use of energy from renewable sources.

[89] The Second Romanian Energy Efficiency Action Plan under Directive 2006/32/EC

In the second National Energy Efficiency Action Plan under the Energy Services Directive (32/2006/EC) is estimated an annual reduction of 823 ktoe in primary energy consumption in the residential sector.

A.8.2 Building codes

As a general statement it is important to notice that there are no explicit minimum requirements for energy performance of buildings neither for new build nor renovations, i.e. maximum values for final energy consumption. Instead, there are minimum requirements for thermal quality of building envelope.

A.8.2.1 Energy performance requirements

In Romania there are no energy performance requirements at the moment, expressed in final or primary energy indicator. However, for thermal rehabilitation of block-of-flats in the national rehabilitation program (OUG 18/2008) a requirement is set on the energy demand for space heating after the thermal insulation of the building envelope, which has to be less than 100 kWh/m²year.

A.8.2.2 Thermal insulation requirements

For new buildings, the amended regulation C107/2010[90,91] of the Order 2055/2005 indicates the minimum requirements for thermal resistance values. The requirements for new buildings depend on building type and on the envelope of the building. Therefore, the regulation indicates the minimum thermal requirements for:

- Minimum thermal resistance corrected with thermal bridges R' – value;
- Maximum thermal transmittance corrected with thermal bridges U'-value;
- Maximum overall thermal coefficients G-values.

For upgrading / major renovations of existing buildings, no minimum requirements are imposed, but the values for new buildings are recommended and a combined technical and economical assessment is conducted (energy audit). There are no specified requirements for renovations for any type of building (residential and non-residential). However, if public money is somehow involved (e.g. National program for rehabilitation), then a maximum value of 100kWh/m²year is specified for space heating final consumption.
Otherwise, the use of U-values required for new buildings are generally recommended.
Moreover, for the existing buildings, the actual building characteristics are compared with a reference building having the same shape and the U'_{max}-values provided in table 34.

[90] Ordinul 2055 din 29 noiembrie 2005 (Ordinul 2055/2005) pentru aprobarea Reglementarii tehnice "Normativ privind calculul termotehnic al elementelor de constructie ale cladirilor", indicativ C 107-2005. Published in the Official Monitor 1124 from 13 December 2005 (M. Of. 1124/2005)

[91] Ordinul 2513 din 22 noiembrie 2010 (Ordinul 2513/2010) pentru modificarea Reglementarii tehnice "Normativ privind calculul termotehnic al elementelor de constructie ale cladirilor", indicativ C 107-2005, aprobata prin Ordinul ministrului transporturilor, constructiilor si turismului nr. 2.055/2005. Published in the Official Monitor 820 from 8 December 2010 (M. Of. 820/2010).

Table 34: Reference U-values required for residential buildings

ENVELOPE ELEMENTS	Residential buildings	
	Maximum Thermal transmittances (corrected with the influence of thermal bridges) C107/2010 U'_{max} [m²K/W]	
	New built*	Existing to be renovated**
External walls	0.56	0.71
External windows	1.30	2.50
Terraces	0.20	0.33
Floors above unheated basement	0.35	0.60
Ground floors (no basements)	0.22	0.33
Floors of heated basements	0.21	0.24
External walls of heated basements	0.35	0.50

(C107-2005 – amended in 2010)
**mandatory for new buildings and recommended for thermal rehabilitations*
*** values for reference buildings*

For non-residential buildings there are no explicit minimum thermal resistance values, instead a global maximum reference G-value (overall thermal transmittance coefficient) is defined, based on the following "a" to "e" coefficients, where:

a - Thermal resistance value of external walls [m²K/W],
b - Thermal resistance value of terraces [m²K/W],
c - Thermal resistance value of floors above unheated basement [m²K/W],
d - Thermal linear resistance value of building perimeter to the ground [m²K/W]
e - Thermal resistance value of external windows [m²K/W]

Table 35: Reference G values for non-residential buildings

Non-residential buildings with full-time occupation or part-time occupation and high thermal inertia						
Building Type	**Climatic Zone**	**a [m²K/W]**	**b [m²K/W]**	**c [m²K/W]**	**d [m²K/W]**	**e [m²K/W]**
Hospitals, kindergarten and Clinics	I	1.70	4.00	2.10	1.40	0.69
	II	1.75	4.50	2.50	1.40	0.69
	III, IV	1.80	5.00	2.90	1.40	0.69
Educational and sports	I	1.70	4.00	2.10	1.40	0.50
	II	1.75	4.50	2.50	1.40	0.50
	III, IV	1.80	5.00	2.90	1.40	0.50
Offices, commercial and hotels	I	1.60	3.50	2.10	1.40	0.50
	II	1.70	4.00	2.50	1.40	0.50
	III, IV	1.80	4.50	2.90	1.40	0.50
Other types (normal conditions)	I	1.10	3.00	1.10	1.40	0.40
	II	1.10	3.00	1.20	1.40	0.40
	III, IV	1.10	3.00	1.30	1.40	0.40

(C107-2005 – amended in 2010)

Table 36: G-value reference

Non-residential buildings with part-time occupation but no high thermal inertia						
Building Type	**Climatic Zone**	**a [m²K/W]**	**b [m²K/W]**	**c [m²K/W]**	**d [m²K/W]**	**e [m²K/W]**
Hospitals, kinder-garten and Clinics	I	1.50	4.00	2.00	1.40	0.69
	II	1.60	4.50	2.30	1.40	0.69
	III, IV	1.70	5.00	2.60	1.40	0.69
Educational and sports	I	1.50	4.00	2.00	1.40	0.50
	II	1.60	4.50	2.30	1.40	0.50
	III, IV	1.70	5.00	2.60	1.40	0.50
Offices, commer-cial and hotels	I	1.50	3.50	2.00	1.40	0.50
	II	1.60	4.00	2.30	1.40	0.50
	III, IV	1.70	4.50	2.60	1.40	0.50
Other types (nor-mal conditions)	I	1.00	2.90	1.00	1.40	0.40
	II	1.00	2.90	1.10	1.40	0.40
	III, IV	1.00	2.90	1.20	1.40	0.40

(C107-2005 – amended in 2010)

A.8.2.3 Compliance

The proof of compliance must be made in two stages: (1) when requesting the building permit and (2) after completion of the building. The main responsible body for compliance control in construction is the State Inspectorate in Constructions (SIC), a public institution with a legal personality, subordinated to the Ministry of Regional Development and Tourism (MDRT).

If a construction is built without a permit or infringes its permit, the control authorities may order the demolition of those elements which are not compliant with the permit or were built without a permit. In such cases, the construction works can be suspended. The administrative fine to be paid by the investor is up to approximately 2 300 Euro in addition to indemnities for the damage caused by the construction.

A.8.3 Measures for implementing Article 13(4) of the RED

Concerning the implementation of Article 13(4) of the RED, no requirements for using renewable energy and DHW in buildings are introduced yet in the Romanian building regulations. [92]

Even if the market can offer adequate technology, there are neither clear mandatory actions, nor provisions stimulating the increase of renewable energy use in buildings yet in place.

The Government proposal for a legal act to transpose the EPBD recast (2010/31/EU) is pending for approval in the Parliament. This proposal foresees that a feasibility study concerning the potential use of renewable energy in the designed building has to be

[92] BPIE (2012). Implementing nearly Zero-Energy Buildings (nZEB) in Romania. Towards a definition and roadmap. http://www.bpie.eu/low_energy_buildings_east_eu.html

provided for each new building at the authorising stage. However, without any incentives for the owner, there is no guarantee that the proposed technologies will be actually applied.

The use of renewable energy technologies in buildings is not a usual practice yet but started to grow significantly over the last years. The main driver for the installation of renewable energy technology in buildings is the "Casa Verde" (Green House) Programme, coordinated by the Environment Fund Administration, which applies to residential and public buildings (for details, see the sub-chapter below on support schemes).

Overall, the most popular technologies are solar thermal systems. According to EurObserv'ER[93] renewable energy barometer, the total installed solar-thermal collectors area in 2010 in Romania was approx. 144.000 m² with a thermal capacity of around 101MWhth. The Romanian solar thermal industry reported for 2010 a turnover 20 million Euro and 250 direct and indirect jobs. Solar photovoltaic and heat pumps are also used, but their market share is still very small (below 1%).

A.8.4 Energy Performance Certificates

In January 2007 the energy certification of building came into force for all new buildings, existing public buildings and major renovation works. The Romanian EPC shows the final energy consumption of the building and of the reference building (except for flats). The energy classes in EPC are from A (the most efficient) to G (the most energy consuming). The EPC also includes 'sub-energy classes' for the specific annual energy consumption for heating, cooling, ventilation, DHW and lighting (these are the "utilities", i.e. energy uses). The energy consumption for a building which has no cooling system and no mechanical ventilation system, the energy use class A is below 125 kWh/m²/yr .

The table 37 shows the EPC energy classes in Romania.

Table 37: EPC Energy classes

Energy class	Total: (heating, DWH, lighting)	Heating	DWH	Lighting	Air-conditioning	Mechanical Ventilation
	[kWh/m^2/yr]	[kWh/m^2/yr]	[kWh/m^2/yr]	[kWh/m^2/yr]	[kWh/m^2/yr]	[kWh/m^2/yr]
A	<125	<70	<15	<40	<20	<5
B	125<E<201	70<E<117	15<E<35	40<E<49	20<E<50	5<E<8
C	201<E<291	117<E<173	35<E<59	49<E<59	50<E<87	8<E<11

[93] EurObserv'ER (2011): The state of renewable energy in Europe. 11th EurObserv'ER Report, available at: http://www.energies-renouvelables.org/observ-er/stat_baro/barobilan/barobilan11.pdf

D		291<E<408	173<E<245	59<E<90	59<E<73	87<E<134	11<E<15
E		408<E<566	245<E<343	90<E<132	73<E<91	134<E<198	15<E<21
F		566<E<820	343<E<500	132<E<200	91<E<120	198<E<300	21<E<30
G		820<E	500<E	200<E	120<E	300<E	30<E
Reference building	**Class**	B	B	D	A	-	-
	[kWh/m2/yr]	194.94	96.43	87.25	11.26	-	-

A.8.5 Inspections (for boilers and/or air conditioning systems): article 8 of first EPBD

Romania opted to implement alternative measures having similar effect as the regular inspections for heating and air conditioning systems. These measures are such as in the followings:

- **For new buildings** – the requirement to elaborate a study concerning the feasibility of using highly efficient alternative systems, as a pre-condition to obtain the construction permit issued by the competent local/county public administration authorities;
- **For existent buildings** – in case of a major renovation of the buildings, their owners/administrators may implement alternative systems for generating energy, as far as the project establishes that this is technically, functionally and economically possible.

For all new and existing buildings, their owners/administrators may request, under legal conditions, the installation of smart meters, active control systems, as well as automation and control and/or monitoring systems.

The inspection of heating systems in buildings is performed by authorised experts that are obliged to fill detailed reports, including recommendations for improving the energy efficiency of the system. [94]

A.8.6 Cost optimality

The cost-optimality methodology is not yet developed in Romania. The Ministry for Regional Development and Tourism (responsible with buildings policies in Romania) launched a call for tender on December 20th for the elaboration of a preparatory study on applying cost-optimality in Romania. The contract is likely to be allocated in February 2013 and to be finalised in 9 months after the kick-off.

[94] The Second Romanian Energy Efficiency Action Plan under Directive 2006/32/EC

A.8.7 nZEB: requirements and roadmaps

Romania did not define yet the nZEB levels nor the implementation plan by 2020. The Ministry for Regional Development and Tourism (responsible with buildings policies in Romania) launched a call for tender on December 20th for the elaboration of a preparatory study for the implementation of nZEB in Romania. The contract is likely to be allocated in February 2013 and to be finalised in 918 months after the kick-off.

A.8.8 Other relevant topics

A.8.8.1 Permit requirements for renovation

For undertaking major renovation measures that may have an impact of the building structure, it is necessary to have a permit attesting that the renovation project fulfil all the requirements. If the building is listed or is located in a historical area, an additional permit confirming that the renovation of the façade does not change the main characteristics of the building and/or area is required.

A.8.8.2 Organisation of owners in multi-family buildings and their decision process on renovation of buildings

Owners living in multifamily buildings are organised in Owners Associations which are legally created according to Romanian Law no. 230/2007 regarding the creation, the organisation and the operation of Residential Multifamily Buildings Owners Associations. The owners association will be represented by a committee formed of several representatives.

According to the Government Emergency Ordinance no. 69/June 2010 the decision for the building renovation can be taken based on the agreement of two thirds of the owners.

A.8.8.3 National consultation processes[95,96]

The consultation process of government with national stakeholders is not quite regular. There are meetings with the occasion of conferences and seminars organised by the professional associations or building councils. More than ten events are scheduled all year long.

In many counties/localities associations (NGOs) have been created associations for energy efficiency with county/local councils as founder members. Many commercial companies (especially SMEs) are members of these associations. Many of these associations were founded with an initial financial support from the European Union. These organisations generally undertake the following activities:

- Offer technical advice and consultancy to public local authorities and subordinated institutions as well as to companies for initiating and implementing measures for energy management.

[95] The Second Romanian Energy Efficiency Action Plan under Directive 2006/32/EC
[96] BPIE private communication with local experts

- Carry out activities for disseminating information at a local level (including in schools).
- Organize fairs and expositions with a specific thematic, etc.

A representative association is “Energy Cities Romania” (ECR). The association gathers 31 municipalities interested in improving energy efficiency in public urban services (heating, public illumination, water and gas supply, collection, storage and transport of domestic waste, etc.), in promoting renewable energy sources and environment protection. The main activities carried out by the association are:

- Support to local authorities in preparing and implementing energy efficiency and environmental policies at local level;
- Information on best practices, new and energy efficient technologies;
- ***Facilitate the exchange of experience between members of the network and with associations and other similar organisations;***
- Policy consultancy;
- Training for representatives of local authorities;
- Defend the members’ interest to the national administration and energy operators;
- Organize conferences, seminars at regional, national and international level;
- Participate in regional, national and European projects;
- Newsletters and other publications;
- Elaboration of databases at local and national level.

There are also some other relevant national organisations of local authorities such as:

- Association of Romanian Municipalities (all the 103 municipalities in the country, as well as the 6 Districts from Bucharest);
- Association of Romanian Cities (185 members and aims to also represent the interests of small towns);
- Association of Romanian Communes (more than 2000 members);
- Federation of Romanian Local Authorities (comprising the three above mentioned associations);

All these associations carry out significant activities regarding the management and administration of energy.

Currently, 30 communities from Romania adhered to the Covenant of Mayors and implement SEAPs and Sustainable Mobility Action Plans.

There are also several associations of main building industries or offering services for buildings such as:

- The Romanian Association of Construction Entrepreneurs (A.R.A.C.O.) - www.araco.org
- Employers organization for window panes, windows and facades
- Employers organization for cold and air conditioning
- The Romanian Industry Employers’ Confederation (C.O.N.P.I.R.O.M.) - www.conpirom.ro
- The Concrete Manufacturers Association in Romania

- The Employers Organization from the Cement Industry and of other Mineral Products for Constructions – C.I.R.O.M.
- The Employers Organization for Prefab and BCA Materials Manufacturers B.C.A.-P.R.E.F.A.R.O.M.
- The Employers Association of Constructors
- The Association of the Construction Materials Manufacturers in Romania (A.P.M.C.R.) www.apmcr.org
- The Construction Companies Employers Organization www.ugir.ro
- Renewable Energies Employers Organization (RENERG)- www.ugir1903.org
- The Federation of Environment Employers Organizations
- Employers Association for New Energy Sources (SUNE)
- Employers Association for the Thermal Insulation Carpentry Manufacturers (PPTT)
- The Association of Buildings Energy Auditors- www.aaec.ro

The Romanian Association of Installation Engineers –www.aiiro.ro

A.8.8.4 Buildings databases/registers

According to law 372/2005, the auditors have the obligation to send the EPCs to the "URBAN-INCERC" National Institute for Research and Development in Construction, Urban Planning and Sustainable Spatial Development institution established following the Decision of the Romanian Government No. 1398 of 18 November 2009, published in "Monitorul Oficial" No. 816 of 27 November 2009[97]. URBAN-INCERC has the role of collecting the certificates and creating a national data base after the statistical analysis of data. The process of energy performance certification is not yet controlled. However, every energy auditor has to keep a register with all EPCs issued, mentioning the date, the beneficiary, the certified objective address etc. The Romanian law stipulates that the energy auditor is the only responsible for the compliance with requirements of the certification and for the correctness of the energy audit.

Some data about multi-family residential buildings characteristics in main Romanian cities still exists in the archives of former Design Institutes like Proiect Bucuresti and IPCT Bucharest, or the County's Design Institutes (Institutele de Proiectare Judetene).

A.8.8.5 Landlord-tenant dilemma

No specific actions are taken for the landlord-tenant dilemma issue, also because the ownership rate of residential buildings in Romania is very high (at around 96%).

A.8.9 Financial and fiscal support policies/programmes

For residential buildings two thermal rehabilitation programs are active: one established by Government Emergency Ordinance (GEO) no. 18/2009 applied block of flats built in the period 1950-1990 and the other one established by GEO no. 69/2010 for all residential buildings.

[97] http://www.incd.ro/

In 2002, in Romania had been launched a National thermal rehabilitation programme for block of flats. After years of hesitation the programme was re-launched in 2007 as part of the first National Energy Efficiency Action Plan (under the 2006/32/EC Directive). The programme was extended in 2009 by the Government Ordinance GEO 18/2009.

Further, GEO no. 18/2009 sets a Multiannual National Programme for increasing of the energy performance of condominium type buildings built between 1950 and 1990 (with high energy consumption for space heating) by renovation. In November 2012, GEO no 18/2009 was modified by GEO 63/2012 and the scheme had been modified for using EU Structural Funds (under the Regional OP, Priority 1: Sustainable development of cities). Therefore, the new financing scheme has an overall budget of 304 Mln Euro where 150 Mln Euro are coming from the EU and the other from national sources. The projects have to be committed in 2013, while the execution of the works may continue afterwards.

For non-residential buildings, only the pilot thermal rehabilitation program for public buildings exists in the framework of the financial assistance offered by the Swiss Government for energy efficiency projects in buildings was applicable (33 buildings).

The following tables provide an extract on the on-going programmes and/or a selection of some of past programmes [98,99].

Programme *A*

Programme name	**Multiannual National Programme for increasing the energy performance of the block of flat/houses**
Start – End Dates	Since 2002, continuously operational
Type of programme	Grants
Budget	In 2011 alone: RON 150 million (≈EUR 35,4 million). Around 204 Mln Euro cumulative budget between 2008-2011. The programme was extended by using structural funds with an overall budget of 304 Mln EURO
Measures covered	- Envelope: exterior walls, roof, double glaze of windows and exterior doors, construction works and painting of the external walls and other structural and non-structural parts of the building shell. - Other energy-efficiency related measures: works for reducing the thermal losses of the pipes and furniture from the basement of the build-

[98] BPIE survey on buildings data 2011.

[99] BPIE (2012). Implementing nearly Zero-Energy Buildings (nZEB) in Romania. Towards a definition and roadmap. http://www.bpie.eu/low_energy_buildings_east_eu.html

	ing.
Programme impacts	2008-2011: Cumulative energy savings (BPIE est): approx 0,6 TWh/yr Aprox 80.000 apartments thermo-renovated (up to 3% of the existing dwellings in block of flats) Potential energy savings of the extension: aprox 1 TWh/yr
Targeted buildings types:	**New buildings** / **Existing buildings** / **Residential** (**Private owned**, **Public owned**) / **Non Residential** (**Private owned**, **Public owned**) x / x

Programme *B*

Programme name	**Direct reduction of energy consumption through community based retrofits and market development - Component 3 of the LGGE Improving Energy Efficiency in Low-Income Households and Regions of Romania**
Start – End Dates	2011 - 2015
Type of programme	Grants
Budget	(values in USD) GEF financing: 2,027,100 2%; Co-financing (Ministry of Regional Development and Tourism + Ministry of Environment and Forest): 118,701,500 98% ; Total: 120,728,600 Volume of investments in EE buildings leveraged (cumulative USD by EOP): baseline = 0, targets end of project = USD 10 741 000
Measures covered	Envelope: Energy efficient buildings reconstructed (and potentially new buildings constructed) with reduced fuel costs or using improved sustainable energy technologies in low income communities; INSULATION sustainable heating systems in buildings
Programme impacts	Ex-ante: Tonnes CO2eq per year reduced (direct reductions) by end-of-project (EOP): baseline=849, targets end of project=22227; Tonnes CO2eq reduced over the lifetime of the EE measures introduced (direct reductions): baseline = 25456, targets end of project = 666800. MWh in heat energy per year saved as a direct result of this project by end of project: baseline = 2197, Targets End of Project = 43374. No. of people

	living in EE buildings by the end of project: baseline = 4500, targets end of project = 110616.
Targeted buildings types:	

New buildings	Existing buildings	Residential		Non Residential	
		Private owned	Public owned	Private owned	Public owned
	x	x	x		x

Programme *C*

Programme name	**Thermal rehabilitation of housing stock financed by bank loans with Government guarantee**
Start – End Dates	Since 2010
Type of programme	Loans
Budget	Available budget, for 2011 alone: RON 143,1 million (≈EUR 33,7 million)
Measures covered	- Envelope: exterior walls, roof - Technical equipment (HVAC, RES, etc.): installation, if appropriate, of alternative systems for partially/totally providing energy for heating water, lighting and/or heating.
Programme impacts	N/A
Targeted buildings types:	

New buildings	Existing buildings	Residential		Non Residential	
		Private owned	Public owned	Private owned	Public owned
	x	x			

Programme *D*

Programme name	**Program Casa Verde for individuals**
Start – End Dates	Since 2010
Type of programme	Grants
Budget	For 2011 alone: RON 100 million (≈EUR 23,6 million)
Measures covered	Technical equipment (heating, ventilation systems, RES in buildings, etc.): installing of heating systems that use renewable energy. The scope is that of replacing the traditional methods (such as burning wood and fossil fuels) used to produce thermal energy for domestic use.

Programme impacts	N/A					
Targeted buildings types:	**New buildings**	**Existing buildings**	**Residential**		**Non Residential**	
			Private owned	**Public owned**	**Private owned**	**Public owned**
	x	**x**	**x**			

Programme *E*

Programme name	**Program Casa Verde for public bodies**					
Start – End Dates	Since 2010					
Type of programme	Grants					
Budget	For 2011 alone: RON 100 million (≈EUR 23,6 million)					
Measures covered	Technical equipment (heating, ventilation systems, RES in buildings, etc.): installing of heating systems that use renewable energy. The scope is that of replacing the traditional methods (such as burning wood and fossil fuels) used to produce thermal energy for domestic use.					
Programme impacts	N/A					
Targeted buildings types:	**New buildings**	**Existing buildings**	**Residential**		**Non Residential**	
			Private owned	**Public owned**	**Private owned**	**Public owned**
	x	**x**				**x**

A9. Spain

A.9.1 Strategies and (action) plans for the building sector

The main strategy developed for the improvement of the energy efficiency of the building stock in Spain was drafted by the Ministry of Industry, Tourism and Commerce, along with the IDAE (Institute for Energy Diversification and Savings). The resulting **Energy Saving and Efficiency Action Plan 2011-2020**[100] includes, among others, measures to boost the ESCOs market (**Plan to Promote Energy Service Contracts, known as Plan 2000 ESCO**) and the proposal of actions to guarantee the necessary exemplary role of the public sector (**Energy Saving & Efficiency Activation Plan in the buildings of the State's General Administration)** which will also support to meet EED requirement on achieving 3% renovation rate for central Government buildings. This plan directed to public buildings was approved in Cabinet Meeting as of 1st December 2009 with the objective of achieve energy savings of 20% in 2016 in 330 of energy consumers centres of the State's General Administration, by carrying out saving and energy efficiency measures implemented by ESCOs. The Plan to Promote Energy Service Contracts (approved in Cabinet Meeting as of 16th July 2010), involves the extension to the rest of the Regional Public Administrations of the former plan, affecting 1000 energy-consuming centres belonging to the Regional and Local Administration and other 1000 ones belonging to the state's general administration.

The specific measures to intensify energy savings in buildings sector which have been taken place in last Action Plans are:

- As regards the energy saving measures affecting buildings, one key measure is the restriction on indoor temperatures in climate-controlled non-residential buildings and other public spaces, with the exception of hospitals and other centres requiring special indoor environments.
- In the framework of the renewal plan for tourism infrastructure, which has been given a budget of 500 million euros for 2009, part of this line will be set aside to finance investments promoting energy savings in tourism facilities.
- Amendment of the Royal Decree on Energy Efficiency in New Buildings to make it obligatory for new national administration buildings to achieve a high energy rating.

The specific measures to intensify energy savings in buildings sector which are detailed in **Energy Saving and Efficiency Action Plan 2011-2020** are:

- Energy refurbishment of thermal envelope of existing buildings
- Energy efficiency improvement of thermal installations for existing buildings
- Energy efficiency improvement of lighting indoor systems for existing buildings
- Promoting of high EPC for new and existing buildings (at refurbishment context)

[100] http://www.idae.es/index.php/id.663/relmenu.332/lang.uk/mod.pags/mem.detalle

- Promoting of nZEB buildings (new buildings or refurbishment of existing buildings)
- Energy efficiency improvement of cooling systems for tertiary sector
- Energy efficiency improvement of appliances stock

Regarding meeting the EED article 4 requirement for developing a long term strategy for mobilising investment in the renovation of the national building stocks, there is, so far in place, the *National Housing and Refurbishment Plan 2009-2012* which is promoting the refurbishment of residential building sector. This plan grants subsidies in order to improve the energy performance of dwellings. Within the Energy Savings and Efficiency Action Plan 2011-2020, there are other plans like this planned to be developed until 2020.

A.9.2 Building codes

The main legislation referred to energy performance of buildings for Spain are: the Technical Building Code 2006[101] (TBC), the Regulation for Buildings' Thermal Installations 2007[102] and Regulation for Energy Efficiency Certification 2007.

A.9.2.1 Energy performance requirements

The Technical Building Code is organised in 6 sections. DB HE is the section referred to energy performance. DB HE is divided in 5 sections: HE1 (energy need limitation), HE2 (efficiency in HVAC), HE3 (efficiency in lighting), HE4 (minimum contribution of RES: solar thermal energy for DHW) and HE5 (minimum contribution of RES: solar photovoltaic in tertiary buildings).

HE1 Section of TBC 2006 which is related to minimum energy requirements has been reviewed in order to follow the EPBD recast from 2010. The draft is already available and it is looking forward its approval.

The Technical Building Code 2006 defines 12 climatic zones in Spain, according to winter and summer severity indexes. The minimum energy requirements are coherent with each climatic zone (A4, A3, B4, B3, C4, C3, C2, C1, D3, D2, D1 and E1).

Existing buildings have to comply with the same minimum requirements as new ones, when building rehabilitation, enlargement or renovation are carried out, if the floor area exceeds 1000 m2, and more than 25% of the building envelope undergoes renovation.

Current Spanish regulations (TBC 2006) do not oblige to reach a certain energy performance for any kind of building. Those regulations only establish some minimum values for thermal transmittance to be reached within each climate area.

Energy performance requirements depend on each case (reference building) and climatic zone. The minimum energy performance requirement used to match with energy certification D.

[101] http://www.codigotecnico.org/ingles/introduction/
[102] http://www.idae.es/index.php/mod.pags/mem.detalle/relcategoria.1030/id.27/relmenu.53

A.9.2.2 Thermal insulation

Although the regulation is much more complex, the main minimum requirements (U-values) according to Winter Severity Index are:

Table 38: U-value requirements

Building component		U-value [W/m²K]									
		Single family		Multi-family		Offices		Education		Health	
		New	Ren	New	Ren	New	Ren	New	Ren	New	Ren
Walls	Façade, inner walls in contact with no inhabitable spaces, first meter of floor in ground contact and first meter on wall in ground contact	0,74 – 1,22									
	Wall in contact with another building	1,00 – 1,22									
	Frames and windows	3,10 – 5,70									
	Roof	0,46 – 0,65									
	Floors	0,62 – 0,69									

N.B. Spanish Standard does not have different criteria according to building's typology.

A.9.2.3 Compliance

The TBC is dependent on the Architecture and Housing Policy Directorate of Ministry for Housing, with the cooperation of Eduardo Torroja Construction Sciences Institute (IET cc) which belongs to the Higher Council for Scientific Research (CSIC). The mechanisms to ensure the compliance with the Building Code requirements are competence of each Spanish Region. The Professional Associations (Architects and Engineers) are responsible to check that design projects contain all documents according to the TBC. Besides, each Administration should check these documents before they grant works licences.

Ultimately the professional, who sign the design project, is responsible for TBC enforcement because otherwise the end user could complaint and this professional must respond from the legal point of view. Therefore and overall, the control mechanisms are considered adequate and effective.

A.9.3 Measures for implementing Article 13(4) of the RED

In order to meet the Renewable Energy Directive requirement of using minimum levels of energy from renewable sources in new buildings and in existing buildings that are subject to major renovation, the Technical Building Code 2006 includes an obligation to consider a minimum RES share. In particular, the HE4 Section of the Code requires that a share (that can range from 30 to 70%) of domestic hot water shall be covered by thermal solar energy according to consumption, climatic zone and technology system.

Also, the HE5 Section of the Code imposes minimum shares of photovoltaic power that non-residential buildings must incorporate when above a certain size/area.

A.9.4 Energy Performance Certificates

At the moment, EPC legislation is fully into force for new buildings and these must be certified. The draft of energy certification regulation for all buildings already exists and shall be approved in 2013.

For residential buildings, the EPC grading is based on heating, cooling and domestic hot water consumptions while for non-residential buildings, lighting and auxiliary systems consumptions are also taken into account.

Table 39: EPC Energy classes

	Energy efficiency classification indexes ($kgCO_2/m^2year$)	
Class	**Residential buildings**	**Non-residential buildings**
A	C1 < 0,15	C < 0,40
B	0,15 ≤ C1 < 0,50	0,40 ≤ C < 0,65
C	0,50 ≤ C1 < 1,00	0,65 ≤ C < 1,00
D	1,00 ≤ C1 < 1,75	1,00 ≤ C < 1,3
E	C1 > 1,75 and C2 < 1,00	1,3 ≤ C < 1,6
F	C1 > 1,75 and 1,00 ≤ C2 < 1,5	1,6 ≤ C < 2
G	C1 > 1,75 and C2 ≥ 1,50	C ≥ 2

Parameter C in the table 39 represents CO_2 global emission and it is calculated as follow[103]:

$$C1 = \frac{\left(\frac{I_O}{I_r} R\right) - 1}{2(R-1)} + 0.6$$

$$C2 = \frac{\left(\frac{I_O}{I_s} R'\right) - 1}{2(R'-1)} + 0.5$$

I_O, CO_2 emissions of the building in question.

I_r, CO_2 emissions of a building that strictly meets the enforced regulation.

I_S, CO_2 average value of the building of the existing housing stock in 2006.

R, ratio between I_r and CO_2 emissions of the 10% percentile of the buildings strictly meeting the regulation.

R', ratio between I_S and CO_2 emissions of the 10% percentile of the existing housing stock in 2006

And

$$C = \frac{I_{objeto}}{I_{reference}}$$

I_{objeto}, CO_2 emissions of the building in question.

$I_{referencia}$, CO_2 emissions of the reference building.

The following table includes the sum of associated emissions ($kgCO_2/m^2year$) to heating, cooling and DHW for residential buildings, according to the 12 climatic zones. No data for tertiary sector are developed as the scale of each building is referred itself.[104]

[103] CA-EPBD Spain November 2010

[104] The definition of tertiary buildings scale is based on referenced itself methodology. This means the scale is developed at the moment of evaluation of the project, based on a reference building according to each project (i.e. a building modelled from geometry of target building but meeting minimum energy requirements). Hence, an infinite scales' number exists.

Table 40: Associated emissions to heating, cooling and DHW for residential buildings, according to the 12 climatic zones in Spain

Climatic Zone		Total emissions (kg CO_2/m^2)					
		A-B	B-C	C-D	D-E	E-F	F-G
E1	Single dwelling	16,9	26,0	38,7	57,7	101,0	118,2
	Block of dwelling	11,6	17,9	26,7	39,7	74,1	86,7
D1	Single dwelling	14,7	22,6	33,8	50,3	77,2	95,0
	Block of dwelling	10,0	15,4	23,0	34,3	62,0	74,4
D2	Single dwelling	11,9	19,2	29,8	45,8	97,2	127,3
	Block of dwelling	8,1	13,1	20,3	31,2	78,4	91,7
D3	Single dwelling	10,1	16,3	25,3	38,9	66,0	79,2
	Block of dwelling	6,8	11,1	17,2	26,4	59,1	70,9
C1	Single dwelling	9,1	14,7	22,8	35,1	62,0	78,1
	Block of dwelling	6,0	9,8	15,1	23,2	48,0	57,6
C2	Single dwelling	8,0	12,9	20,0	30,8	54,0	64,8
	Block of dwelling	5,4	8,7	13,5	20,7	40,8	47,7
C3	Single dwelling	8,2	14,2	23,2	36,5	71,0	91,6
	Block of dwelling	5,6	9,7	15,9	24,9	53,2	60,1
C4	Single dwelling	9,3	16,0	26,2	41,1	72,3	88,9
	Block of dwelling	6,3	10,9	17,8	28,0	61,6	69,6
B3	Single dwelling	5,4	10,3	17,4	27,9	52,2	61,1

Climatic Zone		Total emissions (kg CO_2/m^2)					
	Block of dwelling	3,5	6,5	11,1	17,7	38,2	43,2
B4	Single dwelling	6,3	10,9	17,9	28,0	54,5	67,0
	Block of dwelling	4,2	7,2	11,7	18,4	41,0	44,7
A3	Single dwelling	3,9	7,4	12,5	20,0	37,3	44,8
	Block of dwelling	1,3	1,5	1,8	2,3	4,7	5,5
A4	Single dwelling	4,4	8,3	14,0	22,5	39,4	42,9
	Block of dwelling	2,8	5,3	9,0	14,4	28,8	31,4

Residential scale is based on comparative scenarios (i.e. based on reference energy need values). As a consequence these limits or bands are different in each climatic zone and according to building typology (single family house or apartment block). Therefore, a total of 24 different scales were defined for residential buildings.[105]

A.9.5 Inspections (for boilers and/or air conditioning systems): article 8 of first EPBD

To meet the EPBD requirement on inspections of heating and AC system, the Regulation for Buildings' Thermal Installations 2007 establishes inspections' frequencies that range from once a month (for heating and cooling systems with power above 1000kW) to a quarterly frequency (for heating and AC systems between 70 and 1000kW of power) and once every two years (for heating systems between 20 and 70 kW of power).

A.9.6 Cost optimality

Architecture and Housing Policy Directorate of Ministry for Housing, with the cooperation of Eduardo Torroja Construction Sciences Institute (IET cc) is working on the cost-effective analysis report which should be submitted to the Commission before April 2013. This report will be based on the energy certification methodology. Therefore, same energy consumes according to each building typology will be take into account.

[105] More information available at http://www.minetur.gob.es/ENERGIA/DESARROLLO/EFICIENCIAENERGETICA/CERTIFICACIONENERGETICA/Paginas/certificacion.aspx

A.9.7 nZEB: requirements and roadmaps

Spain does not have an nZEB definition yet. However, in the Energy Savings and Efficiency Action Plan 2011-2020 and in the Second National Energy Efficiency Action Plan under the EU Energy services Directive106, Spanish authorities has been defined and presented a preliminary roadmap for implementing nZEB. The nZEB definition is likely to be based on the energy performance certification methodology and the energy classes as they are defined in the Energy Performance Certificates (see the detailed description of the EPCs at the above related section). Therefore, the Spanish nZEB definition is likely to be at the level of A Class from the EPCs, which means that all buildings constructed in by 2021 onwards will have a primary energy consumption 70% less than current building codes requirements (Technical Building Code-TBC2006) and 85% less than reference buildings for 2006 building stock.

The measure 5 from the Energy Saving and Efficiency Action Plan 2011-2020 and from the 2nd NEEAP is specifically tailored on the promotion of nZEB buildings (both for new buildings or refurbishment of existing buildings)107. This measure mentions that the Spanish nZEB plan will foresee several provisions, including the followings:

- nZEB will be defined for primary energy need (kWh/m2/yr), climate adjusted for each of the 12s climate zones of Spain;–
- intermediate goals in order to improve the energy performance of new buildings will be defined by 2015;–
- a package of policies and financial tools for the nZEB implementation will be established.

IDAE (Institute for Energy Diversification and Savings) will support the implementation of nZEB in Spain by coordinating several support mechanisms such as:

- Subsidies for nZEB projects allocated on annual call basis;
- Communication campaign for promoting selected nZEB

A.9.8 Other relevant topics

A.9.8.1 Permit requirements for renovation

Major renovations must meet the same requirements as new buildings have to comply with in the Technical Building Code 2006 (TBC). In particular, a renovation must meet the requirements of BTC 2006 if more than 25% of the building envelope undergoes renovation and the floor area exceeds 1000 m^2.

[106] For more information: http://www.idae.es/index.php/id.663/mod.pags/mem.detalle
[107] For more information: http://www.idae.es/index.php/id.663/relmenu.332/lang.uk/mod.pags/mem.detalle

A.9.8.2 Organization of owners in multi-family buildings and their decision process on renovation of buildings

In multi-apartment blocks, decisions that concern the whole building are made collectively by the residents. Any investment or renovation must be put to the vote of owners and a majority is necessary in order to achieve approval.

A.9.8.3 National consultation processes

In Spain several consultation platforms exist for the energy efficiency in buildings.

IDAE (Institute for Energy Diversification and Savings) is the most important communication platform for energy performance of buildings. It has a Public Information Service on Energy Efficiency and Renewable Energy Sources (SICER).[108]

The Spanish Technology Platform of Energy Efficiency (PTE-EE) aims innovation in energy efficiency technology, generating new solutions through the promotion of research and development of new technologies, products and services that contribute to reducing energy demand through energy efficiency.[109]

Finally, the Association of Energy Efficiency Companies (A3E) is a non-profit organisation that currently brings together 60 companies which work wholly or partially in the field of energy efficiency, in local, national or international context.[110]

The Ministry of Environment has also its own platform to inform about climatic change.

The Government launched the Council for Sustainability, Innovation and Quality of Construction (Royal Decree 315/2006 of 17 March), which among other things, reports of regulatory proposals, promotes adaptation to EU regulatory provisions in terms of building and promotes the development and ongoing updating of the Technical Building Code. Several stakeholders, such as associations of developers and builders, the Superior Council of Colleges of Architects and the Institute of Engineering among other professional associations, testing laboratories, insurers, suppliers of construction products and others institutions.

A.9.8.4 Buildings database/register

The National Institute of Statistics (INE) collects information through the Census mainly on the existing residential building stock every ten years (last time in 2011). No other database or register covering information on characteristics of the building stock exist.

The registration of EPCs is competence of each Spanish Region and therefore the registration system has been developed in different ways. At the moment, IDAE (Institute

[108] http://www.idae.es/index.php/lang.uk/mod.global/mem.formEnvioInfo
http://www.idae.es/index.php/id.67/relmenu.333/mod.pags/mem.detalle
[109] http://www.pte-ee.org/
[110] http://www.asociacion3e.org/

for Energy Diversification and Savings from the Ministry of Industry, Energy and Tourism) is working on developing a national database of EPCs.[111]

A.9.8.5 Landlord tenant-dilemma

No specific information is available on the landlord tenant-dilemma issue.

A.9.9 Support policies/programmes (economic & financial instruments)

Spain has developed several financial and fiscal programmes to support the energy efficiency of buildings, especially for the renovation of existing ones.

The following tables provide a snapshot on the ongoing programmes and a selection of some of past programmes[112].

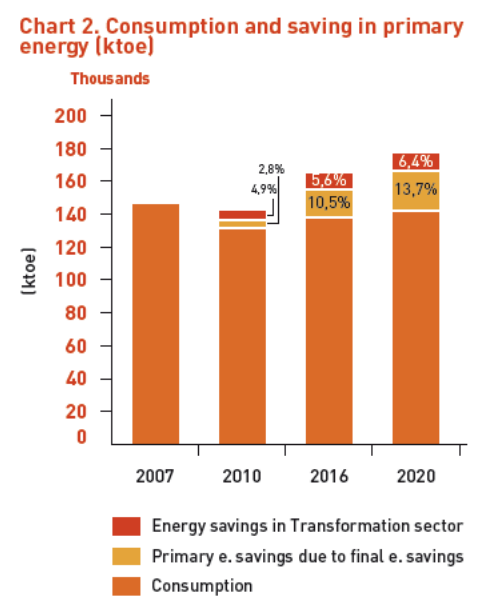
Programme *A*

Programme name	**National Housing and Refurbishment Plan 2009-2012**
Start – End Dates	2009 – 2012
Type of programme	Subsidies
Budget	N/A
Measures covered	Improving energy efficiency performance, hygiene, health and environmental protection in housing buildings: ▪ Solar panels installation ▪ Efficiency improvement of heating and/or cooling systems ▪ Efficiency improvement of heating and/or cooling systems ▪ Supply facilities improvement of water network Actions to ensure the safety and sealing of buildings: ▪ Structural elements: walls, columns, beams, etc. ▪ Electrical installations ▪ Interventions on roofs and walls affected by humidity Accessibility improvement: ▪ Lifts, ramps or access devices ▪ Information elements allow orientation ▪ Adjustment needs of people with disabilities and people over 65 years
Programme impacts	Important reduction of primary energy consumption for residential sector

Targeted buildings types:	**New buildings**	**Existing buildings**	**Residential**		**Non Residential**	
			Private owned	**Public owned**	**Private owned**	**Public owned**
	x	**x**		**x**		

[111] https://administracionelectronica.navarra.es/webCertificacionesEnergeticas/Default.aspx
[112] Please note that other programmes exist.

Programme *B*

Programme name	**Energy Savings and Efficiency Action Plan 2011-2020**
Start – End Dates	2011 - 2020
Type of programme	Subsidies
Budget	27.322 M€ goes to building sector (2.883 M€ from Public Sector + 24.439 M€ from Private Sector)
Measures covered	INDUSTRY TRANSPORT BUILDINGS ▪ Thermal envelope ▪ Thermal systems ▪ Lighting EQUIPMENTS PUBLIC SERVICES AGRICULTURE CHP GENERATION
Programme impacts	The final & primary energy savings of Action Plan 2011-2020 have been established for years 2016 & 2020, in accordance with the same methodological criteria and the indicators for year 2010. The measures included in this Action Plan 2011-2020 will involve savings of final energy for 2020 worth 17,842 ktoe and of primary energy worth 35,585 ktoe, calculated with reference to year 2007 and in accordance with the methodology proposed by the European Commission. 
Targeted buildings types:	**New buildings** / **Existing buildings** / **Residential** (**Private owned**, **Public owned**) / **Non Residential** (**Private owned**, **Public owned**)

	x	x	x	x	x	x

Programme *C*

Programme name	Grants for Energy Efficiency in Buildings					
Start – End Dates	2008 - 2012					
Type of programme	Grants					
Budget	From the Government: EUR 1 billion subsidies for the refurbishment of existing residential buildings					
Measures covered	- ENVELOPE (including insulation, windows & glazing, exterior wall, doors, ceiling, etc.) - EQUIPMENT (including efficient heating, efficient lighting systems, ventilation, cooling, control systems, etc.) - OTHER (including energy audits, consultancy costs, education and training activities, etc.)					
Programme impacts						
Targeted buildings types:	**New buildings**	**Existing buildings**	**Residential**		**Non Residential**	
			Private owned	**Public owned**	**Private owned**	**Public owned**
		x		x		

Programme *D*

Programme name	Support for Energy Efficiency in Buildings (incuded in the EE Action Plan)					
Start – End Dates	2009 - 2012					
Type of programme	Grants, preferential loans					
Budget	€804bn from 2008 to 2012					
Measures covered	- ENVELOPE (including insulation, windows & glazing, exterior wall, doors, ceiling, etc.) - EQUIPMENT (including efficient heating, efficient lighting systems, ventilation, cooling, control systems, etc.)					
Programme impacts	N/A					
Targeted buildings types:	**New buildings**	**Existing buildings**	**Residential**		**Non Residential**	
			Private owned	**Public owned**	**Private owned**	**Public owned**
	x	x	x		x	

Programme *E*

Programme name	**Renove Tourism Plan 2009**					
Start – End Dates	2009 - 2021					
Type of programme	Preferential loans					
Budget	EUR 1 billion					
Measures covered	- ENVELOPE (including insulation, windows & glazing, exterior wall, doors, ceiling, etc.) - EQUIPMENT (including efficient heating, efficient lighting systems, ventilation, cooling, control systems, etc.)					
Programme impacts	N/A					
Targeted buildings types:	**New buildings**	**Existing buildings**	**Residential**		**Non Residential**	
			Private owned	**Public owned**	**Private owned**	**Public owned**
		x			**x**	

Programme *F*

Programme name	**Action Plan 2008-2012: Studies, feasibility analyses and audits to improve the energy efficiency in installations**					
Start – End Dates	2008 - 2012					
Type of programme	Subsidies					
Budget	0.6 Million euros from 2008-2012					
Measures covered	OTHER (including energy audits, consultancy costs, education and training activities, etc.)					
Programme impacts	N/A					
Targeted buildings types:	**New buildings**	**Existing buildings**	**Residential**		**Non Residential**	
			Private owned	**Public owned**	**Private owned**	**Public owned**
		x	**x**	**x**	**x**	**x**

Programme *G*

Programme name	**RD 5/2011, April 29th**					
Start – End Dates	2010 - ongoing					
Type of programme	Personal income taxes reduction (Tax reduction)					
Budget	N/A					
Measures covered	- ENVELOPE (including insulation, windows & glazing, exterior wall, doors, ceiling, etc.) - EQUIPMENT (including efficient heating, efficient lighting systems, ventilation, cooling, control systems, etc.) - Refurbishment in general					
Programme impacts	N/A					
Targeted buildings types:	**New buildings**	**Existing buildings**	**Residential**		**Non Residential**	
			Private owned	**Public owned**	**Private owned**	**Public owned**
		x	x			

Programme *H*

Programme name	**VAT reduction**					
Start – End Dates	2010 - ongoing					
Type of programme	Fiscal incentive (VAT reduction)					
Budget	N/A					
Measures covered	- ENVELOPE (including insulation, windows & glazing, exterior wall, doors, ceiling, etc.) - EQUIPMENT (including efficient heating, efficient lighting systems, ventilation, cooling, control systems, etc.)					
Programme impacts	N/A					
Targeted buildings types:	**New buildings**	**Existing buildings**	**Residential**		**Non Residential**	
			Private owned	**Public owned**	**Private owned**	**Public owned**
		x	x			