"Assessment of national building codes, EPBD implementation and standards identified"

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Summary

D1.2 titled "Assessment of national building codes, EPBD implementation and standards identified." is a public document delivered in the context of WP1, Task 1.2: Analysis of building codes, EPBD implementation and technology standardization.

This document analyses how the building codes of the different European countries take into account energy efficiency, RES and in particular, energy storage for new construction and retrofitting of existing buildings.

Contents

Abbreviations

MESSIB	Multy-Source Energy Storage Systems integrated in Buildings.
EPBD	Energy Performance Building Directive
ESD	Energy Service Directive
CEN	European Committee for Standardization

1. Introduction

In order to support the research and demonstration work planned in the frame of the MESSIB project (*Development, evaluation and demonstration of an affordable multi-source energy storage system integrated in building, based on new materials, technologies and control systems, for significant reduction of its energy consumption and active management of the building energy demand*), it is necessary to analyse the building codes as they are implemented in the various EU countries and to assess the degree of implementation of the EPBD.

The current deliverable titled *D1.2: "*Assessment of national building codes, EPBD implementation and standards identified*"* is structured in five main chapters addressing the above goals as follows:

- Building and energy related codes active at national level
- Implementation of the ENERGY PERFORMANCE BUILDING DIRECTIVE (EPBD) at national level
- Implementation of the ENERGY SERVICE DIRECTIVE (ESD) at national level
- Details on energy efficiency, RES and energy storage for new construction and for retrofitting of existing buildings, inside the national codes
- Standards developed by the CEN in the frame of the EPBD

The countries covered in D1.2 are: Finland, France, Germany, Greece, Italy, the Netherlands, Poland, Slovenia and Spain.

D1.2 will serve as background material for the R&D targets to be achieved in the various Work Packages of the MESSIB project and can be used as a reference and check-point towards the planned innovative technical developments.
The target group for the use of the D1.2 is primarily the Consortium of the Project, since - as already stated - it serves as background material for the R&D work of the Project. However, the work presented in D1.2 is original and can be used in the frame of the Dissemination activities of the project to inform all stakeholders of the Construction Sector.

D1.2 has been prepared with contributions from all the MESSIB partners involved in WP1. Particular mention should be made to the major contributions received from ACCIONA, LABEIN, VTT, UPONOR, FhG, MOSTOSTAL, CCS, CSTB, CNR, GESTA, D'APPOLONIA and ECN. The input has been completed, harmonized and edited by NTUA.HMCS.

2. Building and Energy related Codes active in national area

Since 1992 there is a growing body of legal obligations on European Member States that directly relate to buildings energy efficiency. The main ones are the following:

- **Council Directive 93/76/EEC** of 13 September 1993 on "to limit carbon dioxide emissions by improving energy efficiency (SAVE)."
- **Directive 2001/77/EC** on the promotion of electricity produced from renewable energy sources in the internal electricity market ("Renewables Directive")
- **Directive 2002/91/EC** of the European Parliament and of the Council of 16 December 2002 on the energy performance of buildings.
- **Directive 2004/8/EC** of the European Parliament and of the Council of 11 February 2004 on the promotion of cogeneration based on a useful heat demand in the internal energy market and amending Directive 92/42/EEC
- **Directive 2006/32/EC** of the European Parliament and of the Council of 5 April 2006 on energy end-use efficiency and energy services and repealing Council Directive 93/76/EEC

Additional legislative measures related to energy efficiency in buildings that have been adopted by the European Union since 1989 are reported in appendix.

These European directives have been transposed in the Member States, leading to various National policies. Some national initiatives that allow achieving significant progress are presented below - based on the best results in energy-efficiency in the household sector between 1990 and 2002[1].

[1] "Energy-efficiency monitoring in the EU-15", ISBN: 978-2-86817-819-7

2.1 Finland

2.1.1 The National Building Codes of Finland

Finland's Environmental Administration develops and controls land use planning and construction throughout Finland.

In Finland land use, spatial planning and construction are controlled by the Land Use and Building Act, which came into force in 2000. More detailed regulations and controls on construction are included in the Land Use and Building Decree. The National Building contains regulations and guidelines that complement the legislation in the Land Use and Building Act.

The regulations are binding, and concern the construction of new buildings. The regulations are applicable to renovation and alteration works only insofar as the type and extent of the measure and a possible change in use of the building require. The instructions are not binding but present acceptable solutions. Local regulations subordinate to these national laws are additionally defined in municipal building codes.[2]
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A General section	A1 Supervision of construction work. Regulations and guidelines 2006 A2 Building designers and plans (unofficial translation). Regulations and guidelines 2002 A4 Maintenance manual for the care and use of buildings. Regulations and guidelines 2000 A5 Plan notations. Regulations 2000
B The strength of structures	B1 Structural safety and loads. Regulations 1998 B2 Loadbearing structures. Regulations 1990 and revised 2007 B3 Foundations (unofficial translation). Regulations and guidelines 2004 B4 Concrete structures. Guidelines 2005 B5 Structures of lightweight concrete blocks. Guidelines 2007 B6 Light gauge steel structures. Guidelines 1989 B7 Steel structures. Guidelines 1996 B8 Brick structures. Guidelines 2007 B9 Structures of concrete blocks. Guidelines 1993 B10 Timber structures. Guidelines 2001* National Application Documents to the Eurocode Prestandards

[2] Ministry of the Environment - Land use and building legislation

C Insulation	C1 Sound insulation and noise abatement in building. Regulations and guidelines 1998 C2 Moisture. Regulations and guidelines 1998 C3Thermal insulation in a building (unofficial translation). Regulations 2003. Revised version came into operation on January 2008. *New version 2010.* C4 Thermal insulation (unofficial translation). Guidelines 2003
D Hepac and energy management	D1 Water supply and drainage installations for buildings. Regulations and guidelines 2007 D2 Indoor climate and ventilation of buildings (unofficial translation). Regulations and guidelines. *New version 2010.* D3 Energy management in buildings. Regulations and guidelines. Revised version came into operation on January 2008. *New version 2010.* D4 HEPAC drawings. Regulations 1978 D5 Calculation of power and energy needs for heating of buildings. Guidelines. Revised version came into operation on January 2008. D7 Efficiency requirements for boilers. Regulations 1997
E Structural fire safety	E1 Fire safety of buildings (unofficial translation). Regulations and guidelines 2002 E2 Fire safety of production and warehouse buildings (unofficial translation). Guidelines 2005, New version 2008. E3 Small chimneys. Guidelines 2007 E4 Fire safety of garages (unofficial translation). Guidelines 2005 E7 Fire safety of ventilation installations (unofficial translation). Guidelines 2004 E8 Masonry fireplaces. Guidelines 1985 E9 Fire safety of boiler rooms and fuel stores (unofficial translation). Guidelines 2005
F General building planning	F1 Barrier-free building (unofficial translation). Regulations and guidelines 2005 F2 Safety in use buildings. Regulations and guidelines 2001.
G Housing planning and building	G1 Housing design (unofficial translation). Regulations and guidelines 2005 G2 Subsidized housing. Regulations and guidelines 1998.

Table 1: The National Building Code of Finland3

2.1.2 Eurocode standards in Finland

[3] Ministry of the Environment - The National Building Code of Finland

In accordance with the decision by the Ministry of the Environment by virtue of Section 13 of the Land Use and Building Act (132/1999), enacted on 5th of February 1999 the following Annexes are enforced in building constructions:
When applying Eurocode –design standards (Eurocodes) in the designing of supporting structures, the National Annexes decreed by the Ministry of Environment of Finland have to be followed. This decree (Ministry of the Environment Decree on applying Eurocode standards in building construction, 2007) enforces the National Annexes of the following Eurocodes (
Table 2). The decree was supplemented in July 2008. These national annexes set out the national parameters and guidelines.[4]

SFS-EN 1990 *), annex 1	Basis of structural design
SFS-EN 1991-1-1, annex 2	Eurocode 1: Actions on structures. Part 1-1: General actions. Densities, self-weight, imposed loads for buildings. 11-1-2007
SFS-EN 1991-1-2, annex 3	Eurocode 1: Actions on structures. Part 1-2: General actions. Actions on structures exposed to fire
SFS-EN 1991-1-3, annex 4	Eurocode 1: Actions on structures. Part 1-3: General actions. Snow loads. 11-1-2007
SFS-EN 1991-1-4, annex 5	Eurocode 1: Actions on structures. Part 1-4: General actions. Wind actions. 11-1-2007
SFS-EN 1991-1-5, annex 6	Eurocode 1: Actions on structures. Part 1-5: General actions. Thermal actions. 11-1-2007
SFS-EN 1992-1-1, annex 7	Eurocode 2: Design of concrete structures. Part 1-1: General rules and rules for buildingsSFS-EN 1992-1-2, annex 8. 11-1-2007
SFS-EN 1993-1-1, annex 9	Eurocode 3: Design of steel structures. Part 1-1: General rules and rules for buildings. 11-1-2007
SFS-EN 1993-1-2, annex 10	Eurocode 3: Design of steel structures. Part 1-2: General rules. Structural fire design. 11-1-2007
SFS-EN 1993-1-8, annex 11	Eurocode 3: Design of steel structures. Part 1-8: Design of joints. 11-1-2007
SFS-EN 1993-1-9, annex 12	Eurocode 3: Design of steel structures. Part 1-9: Fatigue. 11-1-2007
SFS-EN 1993-1-10, annex 13	Eurocode 3: Design of steel structures. Part 1-10: Material toughness and through-thickness properties. 11-1-2007
SFS-EN 1994-1-1, annex 14	Eurocode 4: Design of composite steel and concrete structures. Part 1-1: General rules and rules for buildings. 11-1-2007
SFS-EN 1994-1-2, annex 15	Eurocode 4. Design of composite steel and concrete structures. Part 1-2: General rules. Structural fire design. 11-1-2007
SFS-EN 1995-1-1, annex 16	Eurocode 5: Design of timber structures. Part 1-1: General. Common rules and rules for buildings. 11-1-2007
SFS-EN 1995-1-2, annex 17	Eurocode 5: Design of timber structures. Part 1-2: General. Structural fire design. 11-1-2007
SFS-EN 1997-1, annex 18	Eurocode 7: Geotechnical design. Part 1: General rules. 11-1-2007

SFS-EN 1993-1-3, annex 19	Eurocode 3. Design of steel structures. Part 1-3: General rules. Supplementary rules for cold-formed members and sheeting. July 2008
SFS-EN 1993-1-4, annex 20	Eurocode 3. Design of steel structures. Part 1-4: General rules. Supplementary rules for stainless steels. July 2008
SFS-EN 1993-1-5, annex 21	Eurocode 3. Design of steel structures. Part 1-5: Plated structural elements. July 2008
SFS-EN 1993-1-6, annex 22	Eurocode 1. Actions on structures. Part 1-6: General actions. Actions during execution. July 2008
SFS-EN 1993-1-7, annex 23	Eurocode 1. Actions on structures. Part 1-7: General actions. Accidental actions. July 2008
SFS-EN 1993-3-1, annex 24	Design of steel structures. Part 3-1: Towers, masts and chimneys. Towers and masts. July 2008
SFS-EN 1993-3-2, annex 25	Eurocode 3. Design of steel structures. Part 3-2: Towers, masts and chimneys. Chimneys. July 2008
SFS-EN 1997-2, annex 26	Eurocode 7. Geotechnical design. Part 2: Ground investigation and testing. July 2008

Table 2: Eurocode standards in Finland[4]

*) The Finnish Standards Association (SFS) is the leading certification body in Finland and issues the SFS–standards for building products in Finland. The tasks of the SFS comprise the valuation and certification of control systems, the certification of products and the quality control of building products.[5]

[4] Ministry of the Environment
[5] Finnish Standards Association SFS

2.2 France

2.2.1 The National Building Codes of France

One of the main documents in France for new buildings constructions is the thermal regulation. This document is made by : Directions Départementales et Régionales de l'Équipement (DDE et DRE), Direction Générale de l'Urbanisme, de l'Habitat et de la Construction, Bureau de la qualité technique et de la prévention and Centre Scientifique et Technique du Bâtiment.

It concerns new building (industrials building and residential) and construction renovation. Every 5 years an improvement is realized to take into account regulation evolution and new normative aspects like low level consumption building (label BBC in France) or positive energy building (label BePos in France).Now it is RT2005 which is used for building construction and renovation. Main objectives are energy consumption control, greenhouse gas emissions decreasing to protect energy reserves and decrease global warming impact.

The RT2005 put a limit on the energy consumption of building; a comparison is done with references for materials, thermal looses etc. For more precision, each reference depends on period (summer and winter) and depends on geographic zone (3 main zones are considered in France).

Links below give some details about building thermal regulation:
http://www.industrie.gouv.fr/energie/developp/econo/batiments.htm
http://www.rt2005.com/sw11076.asp (official text)
http://www.logement.gouv.fr/recherche.php3?recherche=RT2005&valid_rech.x=0&valid_rech.y=0&valid_rech=Valide+la+recherche (official text)
http://rw-france1.inforce.dk/graphics/Design/RT2005/Pdf/RT2005%20Arr%EAt%E9%20du%2024%20mai%202006.pdf

2.3 Germany

2.3.1 The National Building Codes of Germany

Energy Conservation Act (EnEG 2005, amended 2009)
The EnEG is the basis of the all requirements of energy efficient buildings (building and components) and building equipments and appliances (heating, domestic hot water, ventilation, air condition and refrigeration, lighting). The German Federal Parlament use this ordinance to determine requirements for:
- Heat protection, tightness and thermal bright of buildings
- Efficient energy performance and maintenance and services of heating appliances
- The billing of heating cost according to individual consumption of the tenants.

- Ordinances to enforce the state-of-the-art
- Disbursement of energy certification
- Control the ordinances on the part of the Federal States
- Summary proceedings, if the ordinances are not broken

In 2009 the Energy Conservation Act is amended because the requirements of the insulation level and the energy performance are tightened.

Energy Saving Ordinance (EnEV 2009)

Based on the on the ENEG the Energy Saving Ordinance the EnEV sets up requirements for new buildings and the refurbishment of building stock, for all heated and cooled/Chilled buildings and parts of buildings.
There are special regulations for other buildings, such as buildings with temporary heating, cooling or use (summer cottage, air-inflated structure) and for special use (greenhouse).
The Energy Saving Ordinance regulated:
- Minimal energy requirements for new buildings,
- Minimal energy requirements for refurbishment, modification and extension of existing buildings
- Energy Certificate (Energiepass) for new buildings and refurbishment of building stock
- Minimal requirements for HVAC and hot water supply
- Energy Service for air conditioning plants
- Administrative offence

For normally heated new buildings the overall requirement is based on primary energy. An Energy Certificate (Energiepass) has to be issued for new buildings as well as for buildings in the course of major refurbishments.

Requirements for new buildings

The level of requirements for new buildings is governed by the function and the type of building (residential/ non-residential with detailed conditions of use) and also a calculated reference building (geometry, useful area of building and orientation), which is confirm to the requirements of the regulation. The DIN V 18599 is the base for calculation, for residential buildings the DIN V 4608-6 and DIN-V-4701-10 can be used for the energy balance too. The requirements are followed

- A maximum allowable primary energy demand
- A maximum allowable average u-value – maximum allowable value of transmission heat losses H'_T,
- Maximal allowable u-value of each element of the building 's fabric
- building air-tightness,
- The prevention of thermal bridge,
- Several requirements on quality of boilers, controls and pipe insulation

- Minimum requirement heating systems – product of primary energy factor and facilities efficient factor (primary energy divided by total useful energy) must be <1.3
- Conditions for using renewable energies, such as integration the power from renewable energy into the calculation of end energy demand,
- The primary energy factor for power is 2.6
- make demands on qualification of suppliers of Energy Certificates
- Kind of documentation of using regulation of EnEV 2009
- Definition of regulatory offense
- Private burden of proof of the building measures to agree with the EnEV 2009

Requirements for existing buildings

Most of conditions are used for dwelling buildings. There are requirements for necessary retrofit equipment, such as:
- insulation upper ceiling or cellar ceiling, exchange the old heating system,
- exchange old heating systems, special electric heating systems (night storage unit)
- insulation of heating pipes

If more than 10% of the elements (walls, windows, roof/upper ceiling, cellar ceiling/walls/) in an existing building are changed, the EnEV defines the energetic conditions for the reconstructed building.
- maximum primary energy demand is 140% of the new building (reference building calculation)
- maximum allowable u-value of each element of buildings fabric only to the new parts of building area
- maximum allowable value of transmission heat losses H'_T not more than 40 % over a new building
- requirements for HVAC and hot water systems are the same as for new buildings
- Energy Certificate is necessary, if the Reference Building Calculation is used or large-scale changes was done in the construction of building

Energy Certificate
Certificates based on energy consumption include yearly data of energy supply for the last three years. There are no regulations about how the data are to obtain. All consumption data have to be revised by considering regional climate.
The Certificate content:
- Information to ventilation
- Year of construction
- Energy calculation method
- Compliances heat protection in summer
- Information to use renewable energies
- Measures in combination with the Renewable energy Heat Law (EEWärmeG)

Calculation operators for the energy balance of buildings

The calculation procedures for existing and new residential buildings are based on two German pre-standards, which are mainly transpositions on EN 832 2003-06 (annual primary energy demand for residential buildings). The current version:
- DIN 4108-6 2003-06 calculation of the annual heat demand and heat energy demand of residential buildings by using monthly energy balance
- Din 4701-10 2006-12 calculation of the end energy and primary energy demand of HVAC - systems for heating, generation of hot water and ventilation.

In accord to the Energy Saving Ordinance 2009 the calculation method for residential building after the reference-building-method used the DIN V 18599 2007-02, Part 1-10.
The DIN V 18599 is the result of an interdisciplinary work as the calculation method for overall energy performance of buildings including all aspects of EPBD. The standardisation works where initiated by the federal government in order to have a universal method covering all aspects including lighting and cooling for residential and non- residential buildings.

2.3.2 Other ordinances in Combination with the EnEV

Heating Cost Ordinance (HeizkostenVO 2009)

Target of this regulation shout be an appeal for tenants to reduce the energy and the water consumption. The calculation of the energy billing of multi-storage buildings is described – 70 % of the consumption is calculated for the direct consumption in the flats, the rest is calculated for the general consumption (pipe heat losses, conversion losses of heater). In energy efficient houses with a heat demand <15kWh/m²a billing of energy consumption is not necessary.

Firning Equipment Ordinance (FeuVO 200)

The ordinance regulates the installation conditions for the several different heating systems. It is connected with the Construction Ordinance and different in the several Federal Land.

Renewable Energy Sources Act EEG 2008)

This act includes the generation of power from hydropower, wind power, mine gas, landfill gas, biogas, radiation energy, and geothermal energy. The target of this ordinance is
- the sustainable development of energy supply,
- reduce the energy costs,
- preserve fossil energy resource,
- further development of technology to produce power from renewable energies with the target, the part of renewable power in the power generation extent at 30 % in 2020.

The content of the ordinance is
- integration of power from renewable energy sources into the grid connection,
- prior system cut –over, transmission, allocation and adequate consideration of this power by the operators,
- compensation rules for special consumer with a high degree of utilization of power.

Renewable Energy Sources Heating Act (EE WärmeG 2009)

The EEWärmeG must used for all new heated buildings, residential and non-residential buildings with more than 50 m² useful area. For the existing buildings the every Federal Lands can define own requirements.
The target of this ordinance is
- preserve fossil energy resource,
- reduce the dependency from import of energy
- sustainable development of energy supply,
- further development of technology to produce heat from renewable energies with the target, the part of renewable energies on the end energy demand for heating, hot water and cooling extent at 14 % in 2020.

This act included the generation for heating, hot water generation and cooling from
- geothermal energy (50 % cover of heat demand),
- energy from the air (without waste heat) or water (50 % cover of heat demand),
- solar radiation (15% cover of heat demand),
- biomass energy (mine gas, landfill gas, biogas) (30 % cover of heat demand
- waste air (50 % cover of energy demand)
- CHP (combined heat and power plant) 50 % cover of heat demand)

In the EEWärmeG describe the conditions of the use of renewable energy sources for heating and cooling, the burden of proof of compliances of the requirements and the financial support of operators.

2.4 Greece

Greece has adopted the Directive 2002/91/CE (EPBD Energy Performance Building Directive) and the correspondent law is:
- Law *3661/2008 - Measures for decreasing the energy consumption of buildings*

The Law is fully harmonized with the requirements set by EU regarding the energy performance of buildings.

The energy performance regulation in Hellas (Greece) is still under development. A new regulation is being prepared (KENAK) and there is limited information about the structure and the proposed calculation procedures. In the near future more details about KENAK will be public available.

2.5 Italy

Italy has adopted the Directive 2002/91/CE (EPBD Energy Performance Building Directive) with two legislative decrees, which modify the old but still valid law 10/1991. The two decrees are:

* Legislative Decree 192/2005
* Legislative Decree 311/2006

The two decrees set the minimum requirements in terms of energy performance indexes but, unfortunately, so far, the relevant application decrees, which would provide guidelines, have not been issued; they should cover important issues like for example, clearly set the energy classification of buildings.

This permanent lack, together with the legislative competence of the regions, has produced a very fragmented normative framework. Many regions (Lombardia, Piemonte, Emilia Romagna, etc.), have already issued the relevant provisions and some municipalities are adopting an autonomous behavior (Reggio Emilia is one of them). The final result is that the same building on this side and on the opposite side of the regional/municipal boundary, with the same characteristics is classified in two different ways.

For what concerns the technical rules (UNI), the following rule have been issued: UNI TS 11300:2008 parts 1 and 2 on performances; parts 3 and 4 are still missing: they should implement the energy performances for summer air conditioning (not yet requested!) and the use of renewable energy sources in the energy performances calculation; for what concerns energy storage and retrofitting, Italy is unfortunately still quite far away from the integration of these systems into the current rules framework. At present the certification classes often do not even consider the renewable energy source contribution on the energy performances.

Furthermore, the most recent country report with the status on 26th June 2008 can be found on www.buildingsplatform.eu

2.5.1 The National Building Codes of Italy

Regarding the building codes, we refer to the site www.uni.com. One can select the English language and go to the chapter UNISTORE – Catalogue of standards.
With the keyword "building" one will find a list 636 current standards related to the active building codes. The list gives a short description of the content in the title of each code.
The codes cover every detail of the Italian standards for every imaginable topic related to buildings.
Downloading this list adds very little value to this reply. The CNR has a subscription and has the possibility to download them. In case the content of specific codes is desired, let us know and we will organise to obtain them.

Regarding the codes related to energy in buildings, the same exercise as above was done and 30 active codes were found listed hereunder with a short description.

UNI/TS 11300-1:2008
Energy performance of buildings – part 1: Evaluation of energy need for space heating and cooling

UNI/TS 11300-1:2008
Energy performance of buildings – part 2: Evaluation of primary energy need and of system efficiencies for space heating and domestic hot water production

UNI EN 15193:2008
Energy performance of buildings – Energy requirements for lighting

UNI EN 15217:2007
Energy performance of buildings – Methods for expressing energy performance and for energy certification of buildings

UNI EN 15232:2007
Energy performance of buildings – Impact of Building Automation, Controls and Building Management

UNI EN 15239:2008
Ventilation for buildings – Energy performance of buildings – Guidelines for inspection of ventilation systems

UNI EN 15240:2008
Ventilation for buildings – Energy performance of buildings – Guidelines for inspection of air-conditioning systems

UNI EN 15241:2008
Ventilation for buildings – Calculation methods for energy losses due to ventilation and infiltration in commercial buildings

UNI EN 15243:2008
Ventilation for buildings – Calculation of room temperatures and of load and energy for buildings with room conditioning systems

UNI EN 15251:2008
Indoor environmental input parameters for design and assessment of energy performance of buildings addressing indoor air quality, thermal environment, lighting and acoustics

UNI EN 15255:2008
Energy performance of buildings – Sensible room cooling load calculation – General criteria and validation procedures

UNI EN 15265:2008
Energy performance of buildings – Calculation of energy need for space heating and cooling using dynamic methods – General criteria and validation procedures

UNI EN 15316-2-1:2008
Heating systems in buildings – Method for calculation of system energy requirements and system efficiencies – Part 2-1: Space heating emission systems

UNI EN 15316-2-3:2008
Heating systems in buildings – Method for calculation of system energy requirements and system efficiencies – Part 2-3: Space heating distribution systems

UNI EN 15316-3-1:2008

Heating systems in buildings – Method for calculation of system energy requirements and system efficiencies – Part 3-1: Domestic hot water systems, characterisation of needs (tapping requirements)
UNI EN 15316-3-2:2008
Heating systems in buildings – Method for calculation of system energy requirements and system efficiencies – Part 3-2: Domestic hot water systems, distribution
UNI EN 15316-3-3:2008
Heating systems in buildings – Method for calculation of system energy requirements and system efficiencies – Part 3-3: Domestic hot water systems, generation
UNI EN 15316-4-1:2008
Heating systems in buildings – Method for calculation of system energy requirements and system efficiencies – Part 4-1: Space heating generation systems, combustion systems (boilers)
UNI EN 15316-4-2:2008
Heating systems in buildings – Method for calculation of system energy requirements and system efficiencies – Part 4-2: Space heating generation systems, heat pump systems
UNI EN 15316-4-3:2008
Heating systems in buildings – Method for calculation of system energy requirements and system efficiencies – Part 4-3: Space heating generation systems, thermal solar systems
UNI EN 15316-4-4:2008
Heating systems in buildings – Method for calculation of system energy requirements and system efficiencies – Part 4-4: Heat generation systems, building-integrated cogeneration systems
UNI EN 15316-4-5:2008
Heating systems in buildings – Method for calculation of system energy requirements and system efficiencies – Part 4-5: Space heating generation systems, the performance and quality of district heating and large volume systems
UNI EN 15316-4-6:2008
Heating systems in buildings – Method for calculation of system energy requirements and system efficiencies – Part 4-6: Heat generation systems, photovoltaic systems
UNI EN 15316-1:2008
Heating systems in buildings – Method for calculation of system energy requirements and system efficiencies – Part 1: General
UNI EN 15377-3:2008
Heating systems in buildings – Design of embedded water based surface heating and cooling systems – part 3: Optimising for use of renewable energy sources
UNI EN 15459:2008
Energy performance of buildings – Economic evaluation procedure for energy systems in buildings
UNI EN 15603:2008
Energy performance of buildings – Overall energy use and definition of energy ratings
UNI CEN/TR 15615:2008

Explanation of the general relationship between various European standards and the Energy Performance of Buildings Directive (EPBD) – Umbrella Document
UNI EN ISO 13790:2008
Energy performance of buildings – Calculation of energy use for space heating and cooling
UNI EN ISO 15927-4:2005
Hygrothermal performance of buildings – Calculation and presentation of climatic data – Part 4: Hourly data for assessing the annual energy use for heating and cooling

2.6 Netherlands

2.6.1 The National Building Codes of the Netherlands

Energy Performance Standard (EPN)
Since 1995, EPN is part of the Dutch building code and sets requirements for the energy efficiency of new buildings and major renovations of existing buildings. Builders can choose their own package of measures to meet the requirements. The required so-called Energy Performance Coefficient (EPC) gradually decreased over the years. Nowadays, EPC required for (new or largely renovated) residential buildings is 0.8 for residential buildings. For non-residential buildings the value differs per category.
Within the Dutch EPC of the EPN standard CH is excluded because of the impact of energy (saving) measures on the monumental values of the buildings [Amsterdam Rosenberg].
Regarding the standards within the EPN the following codes are effective which enables the energy efficiency of the construction and installation technical parts of a building to be fully assessed.
NEN 5128 - gives terms, definitions and methodology for determining the energy performance coefficient (EPC) of a residential building.
NEN 2916 - is a method for determining the energy performance coefficient (EPC) of a utility building.
However, these codes are being replaced in the nearby future by NEN 7120.

Developments in energy performance standard NEN 7120
In the wake of the European Energy Performance of Buildings Directive (EPBD) is a system with more than 30 European standards in determining the energy of a building. These standards are also required for the Netherlands and the conflicting methods of determining the current energy standards are repealed.

Broadly, the differences between the European standards and our national determination are not substantially, because within the European standard development much energy is put into the contribution from the Netherlands regarding the energy standards. One important difference with the current Dutch situation is that the whole standards system must be suitable to the existing building

to go, because the EPBD requires an energy performance certificate for existing buildings. This means that the current EPA instruments' ISSO 75 and SSO 82 'must give way to this system.

The Dutch standard subcommittee has recently worked intensively with this adjustment operation. There is chosen for a cross-Dutch energy performance standard: NEN 7120. In this standard, the European methodology and assessment methods are tailored to the Dutch market. In terms of ease of use the standard texts are marked with:

- [A] for general application parts
- [WN] for new build homes or residential buildings
- [WB] for existing houses and residential buildings
- [UN] for new build utility buildings
- [UB] for existing utility buildings

The big advantage of this integrated methodology for the energy performance of buildings (EPG) is that new and existing building will have a common basis.

A draft comparison with current energy standards results in the following proposed changes:

- Improved content and structure of formulas: more generic and modular design,
- A consistent separation of calculation rules and accounting values, because the latter also determined by the application (WN, WB, UN and UB)
- Conversion to primary energy moved to the end of the calculation
- Calculating heat loss by ventilation is improved and extended with measures that nowadays are still treated as equivalent solutions
- For utility buildings without cooling system a fixed energy consumption for cooling in the case of overheating (added mobile refrigerators)
- New reference climate according to NEN5060:2008 (coming)
- Valuation of new techniques such as shower heat recovery (WTW)
- The energy savings rate measures (EMC): an indicator of the extent to which the potential of saving measures have already been exploited.

At the end of Chapter 5 of draft NEN7120 is much scope for a detailed explanation of the benefits and opportunities of the above mentioned energy savings rate measures in relation to the current used energy index (EI) within the EPA-methodology.

The timetable for the further development and introduction of NEN7120 is as follows:
- February 2009: publication Draft NEN 7120 (critical period 3 months),
- December 2009: final publication NEN 7120
- 1 January, 2011: legally required by the Building directive (together with an tightening EPC value of 0.6, at least according to current standards).

Energy Performance on Location (EPL)
This code is used for larger scale projects such as city areas, and can not be applied for buildings.

2.7 Poland

2.7.1 The National Building Codes of Poland

Building Law (*Prawo budowlane*) – describes all general requirements related to buildings, like: construction safety, fire safety, HVAC standards, correspondent environmental protection and more.

Among many executive regulations there are few most important decrees:

- Decree on technical requirements that ought to be met by buildings and theirs location (*Rozporządzenie w sprawie warunków technicznych, jakim powinny odpowiadać budynki i ich usytuowanie*) – explains in a more detailed way requirements of Building Law and describes means of fulfilling the requirements.
- Decree on calculation methodology of energy performance certificates of a building and dwelling or a part of a building which states independent technical-usable as a whole and on certificate example and manner of its preparation (*Rozporządzenie w sprawie metodologii obliczania charakterystyki energetycznej budynku i lokalu mieszkalnego lub części budynku stanowiącej samodzielną całość techniczno-użytkową oraz sposobu sporządzania i wzorów świadectw ich charakterystyki energetycznej*).
- Decree on detailed scope and form of civil design document. (*Rozporządzenie w sprawie szczegółowego zakresu i formy projektu budowlanego*) – explains all necessary data that should contain a civil design document including energy calculations of designed building.

Act on support for thermo-modernization and renovation (*Ustawa o wspieraniu termomodernizacji i remontów*) – describes financial mechanism and technical requirements that need to be fulfilled in order to receive a grant for modernization that improves energy characteristic of a building.

Decree on requirements of energy efficiency (*Rozporządzenie w sprawie wymagań w zakresie efektywności energetycznej*) – describes minimal efficiency requirements for: heating boilers fired with solid fuels 10 - 300 kW, certain domestic air-conditioning units, electric and gas water heaters, gas space heaters.

Decree on fundamental requirements for energy efficiency of new water heating boilers fired with liquid or gas fuels (*Rozporządzenie w sprawie zasadniczych wymagań dotyczących efektywności energetycznej nowych wodnych kotłów grzewczych opalanych paliwami ciekłymi lub gazowymi*) – sets minimal energy efficiency requirement for listed boilers.

2.8 Slovenia

2.8.1 The National Building Codes of Slovenia

Energetski zakon (Energy law), Ur. l. RS 26/2005

This law provides principles of energy polity, energy market rules, forms and ways of public services implementation, supply reliability principles, energy efficiency principles.

IX. Energy efficiency and renewable energy sources
Article 65.
EE and RES promotion are components of energy policy.
In the case of equal costs to use energy savings on the demand side or to new facilities provision for the equal range of energy, energy saving measures have priority.
Republic of Slovenia implements promotion of energy saving measures and renewable energy use with different programs:

- educational,
- informational,
- public awareness,
- energy counselling, http://www.gi-zrmk.si/ensvet.htm

Offices in Slovenia:energy auditing encouraging, (subsidies possible)
http://www.aure.si/

- local energy concepts (for municipalities, subsidies possible) encouraging, http://www.aure.si/
- standards and technical regulations preparing,
- fiscal measures,
- other incentives: subsidies for energy renovation of residential buildings, installation of heat pumps, etc...

All these measures are systematically checked. Minister responsible for energy determined the process of evaluation.

Article 66

Ministry, responsible for energy, implements the following tasks at the national level:
– implements programmes for efficiency use of energy and use of RES promotion of measures
– prepares proposals and implements efficiency use of energy and use of RES promotion at national level,
– prepares proposals appropriate regulations, which encourage the efficiency use of energy and use of RES,
– monitors energy efficiency and realisation of saving potentials and use of RES and the associated reduction of environmental stress,
– cooperate at the international level in the field of efficiency use of energy and use of RES,
– encourages operation of non-governmental organisations, which acting in the public interest in the field of efficiency use of energy and use of RES,
Local communities implement programs of efficiency use of energy and use of RES within the frameworks of its powers on the local energy concepts basis. Local community could receive state subsidies if they have local energy concept plan.

Article 66.a

Programs that reduce energy use from networks (gas, electricity ...) or increase the efficiency and RES use, carried out at the public mandate by the public services contractors, defined by the energy law.

Article 67

Suppliers of electricity, natural gas or district heating (potential stakeholders) must at least once a year to inform customers about the trends and characteristics of energy consumption.
They could establish programs, which at the appropriate manner encourage and guide the customers to the efficiency use of energy and use of savings potentials.
Suppliers could these programs conduct on the principle of economic principles, or these programs could be incentive oriented. In the last case the costs for these programs could be covered by the price of energy. In such cases at the program and related costs minister, responsible for energy must give consent.
Suppliers to implement incentive programmes in the field of efficiency use of energy must once at year report to minister, responsible for energy, about the results of incentive activities with precise calculation of the costs.

Article 66

Producers and importers of products, which for their operations using fuels, electricity or heat should in technical specifications, indicate the use of fuels, electricity or heat for the typical conditions of use. Products can be fitted with energy efficiency label and other, for energy efficiency important features (detailed definition

traces; for us are interesting Rules for energy efficiency labelling for buildings, which will be described in more detail specially).

Zakon o graditvi objektov (law on the construction of buildings) (110/02, 47/04, 126/07)

Article 2
3.1:
The last positions of technique are situations which at a given moment, when the project documentation are produced or construction is implemented, represents the achieved level of technical development (capacity of construction products, processes or services), which based on the recognized results of science, technique and experiences on the construction, having regard the reasonable costs.
4:
Participants in construction are:

- investor,
- Designers (civil engineer, mechanical engineer, architect, electrical engineer),
- contractor,
- supervisor,
- auditor

Article 9: (construction requires)
(1) buildings should allow energy savings and conservation of heat
(2) ...

Regulation on the types of buildings according to requirements (37/08)

Article 22: (investment maintenance)
Investment maintenance works are part works on the building or for the needs of the building and include implementation of repairs, construction, installation and craft works and improvements following the technical progress.
For example:

- installation of aggregate for electricity production,
- installation of heating appliances,
- installation of solar collectors or PV modules,
- installation of heat pump.
- installation of wind turbine for electricity production,
- installation of air conditioning equipment,
- implementation of geosond borehole,...

Regulations on the project documentation (55/08)
Article 4: (essential requirements)
6)"energy savings and conservation of heat"
Taking into account the climate conditions and ensuring the adequate thermal comfort for working and living into buildings, efficient use of energy must be

ensuring. By selecting the appropriate thermal isolation, HVAC, lighting system and hot water preparing system the limited energy use values must be ensured.

Regulations on energy efficiency in buildings (93/08)

I. General provisions
Article 1: (content of regulations)
Article 2: (the scope of the regulations)
Article 3: (relation to other provisions)
Article 4: (definitions)

II: Technical requirements for energy efficiency use in buildings
Article 5: (types of technical requirements)
(1) Technical requirements for energy efficiency use in buildings are divided into basic and additional technical requirements
(2) Basic technical requirements are expressed by:
-allowable heat losses and power of heating devices and air-ventilation devices,
-permissible thermal stresses and power of cooling devices,
-mandatory installation of RES devices,
-compulsory production of the statement of the heat characteristics of building
(3) Additional technical requirements are:
-requirements for building physics,
-requirements for heating and cooling devices,
-requirements for ventilation and air conditioning devices,
-requirements for lighting
(4) Buildings, which are minimum 50% financed by the public sources, may achieve maximum 90% of values from Arcticle 6 and Arcticle 7 of this regulations.

1. Basic technical requirements for energy efficiency and use of renewable energy sources in buildings

Article 6: (allowed brought annual energy)
...maximum annual primary energy for heating, ventilation, cooling, hot water preparing must be less or equal according to values in articles 7 to 21.

Article 7: (allowed thermal properties of building)
(1) buildings should be built so that maximum values of medium heat transfer, inclouding thermal bridges, for each elements of building envelope, are not exceeded values in Annex 1, table 1.

No	Building construction	Umax (W/m2K) theta(iph)>19°C (heating season) theta(iph)=26°C (cooling season)	Umax (W/m2K) 19°C <theta(iph)> 12°C (residental buildings and non-residental buildings; industrial)
1	Outside walls and walls against unheated spaces; floor over unheated cellar, floor over unheated space, floor over outside air,	0,28	0,35
2	Outside walls and walls against unheated spaces; smal surfaces (<10% of opaque surfaces)	0,6	0,6
3	Walls between heated spaces	0,9	1,0
4	Walls, bordered with neighboring buildings	0,5	0,6
5	Double facades	1,4, **g = 0,48** **τ□D65 = 0,72**	1,9, **g = 0,6** **τ□D65 = 0,78**
6	Outside walls and ceilings against terrain	0,3	0,35
7	Ceiling between heated spaces	1,35	1,35
8	Ceiling against unheated spaces	0,2	0,35
9	Floor over the terrain (not for industrial buildings!) *surface heating*	0,3 *0,3*	0,35 *0,3*
10	Light building constructions (<150 kg/m2)	0,2	0,3
	Additional U value (thermal bridges) ΔU	0,05	0,1

			Min TI thickness: **>** 14 cm (outside wall)

Table 3: Maximum allowable heat transfer, Annex 1

Shall apply decently also for internal constructions which bordering to spaces with maximum temperature 12°C.

(2) Transmission heat losses, FI(VH), per unit volume of heated, V(e), must be equal or lower of FI(VT) = 2 + 10.f(o) (W/m3)

(3) Ventilation heat losses, FI(VV), per unit volume of heated, V(e), must be equal or lower of FI(VV) = 0,1. n(e). delta*theta(h) (W/m3)

(4) Total heat losses, FI(VL): FI(VL)= FI(VT) + FI(VV) (W/m3)

(5) Average thermal transient of building shall not exceed:
U(m)= (2 + 10. f(o))/(f(o). delta*theta(h)) (W/m2K)

(6) Maximum cooling load for cooling the living rooms, per unit volume of cooled V(e), must be lower than FI(VC) = 24 W/m3

(7)If the maximum cooling load is exceeded, must be proven why. (for example: nor with technology changes nor construction of construction of the building, the required value can not be achieved)

(8) Maximum rated power of heat generators for heating, hot water preparing and ventilation in the heating season is:
P(VH) = 1,05 (FI(VT) + FI(VV) + FI(W)). V(e)/eta(gh) (W)

(9) Maximum rated electrical power of generators of cold is
P(VC,e) = 1,05.FI(VC).V(e)/ EER (W(e))

(10) Necessary electrical power connection P(KGH) for heating, ventilation, air-conditioning and hot water preparing shall be determined separately for heating and cooling season.

(11) Assumed electricity consumption: estimated time of operation and same-timing of operation must be taken into account.

(12) the power of devices should be coordinate with the offer on the market.

Article 8: (use of renewable energy sources)
Article 8: (use of renewable energy sources)
(1) At least 25% power for heating, ventilation, cooling and hot water preparing must be ensured by RES:

- environmental heat,
- solar irradiation
- geothermal energy,
- wind energy,
- connection to the devices for heat or cold generation from RES

These requirements are also complied in the following cases:

- for solar collectors: A(SC) = 4 + 0,02 Au (m2) of bright surface, with annual return minimum 500 kWh/m2a for each square meter of usable area of building Au, but minimum 6 m2 per dwelling unit, together with the heat reservoir (minimum 25 l/m2)

- for PV modules: minimum 5 W for each square meter of usable area of building Au, with nominal efficiency of the system 12,5%

- if it is built natural-ice reservoir or system for active natural cooling which provides minimum 25% of total needs for cooling.

2. Additional technical requirements for building physics

Article 9: (building envelope)
(1) Thermal transitions of individual constructions is determined according to standards SIST EN ISO 6946 and SIST EN ISO 10211-1.
(2) Annex 1, Table 1: Shall aply decently also for internal constructions which bordering to spaces with maximum temperature 12°C.

Article 10: (thermal bridges)
(1) The impact of thermal bridges on annual need for heat should be minimazed. Measures in respect the state of the technique must be accepted.
(2) Thermal bridges with external linear heat transfer value PSI(e)> 0,2 W/mK according to standard SIST EN ISO 14683 , table 2 Annex 1, are not allowed (

Article 11: (requirements for the windows)
U ≤1,3 W/m^{2}K (U ≤ 1,1 W/m^{2}K; glazing only)
U ≤1,6 W/m^{2}K (bussines buildings, metal window frame)
U ≤1,9W/m^{2}K (industry buildings, metal window frame)

g = 0,6
τ□D65 = 0,78

outside doors: U ≤ 1,8 W/m^{2}K
role box above windows: U ≤ 0,6 W/m^{2}K

air permeability: min class 2 (min class 3 for multi storage buildings)

Article 12: (installation of building furniture)
other requires for windows and doors: **SIST EN 12207**

Article 13: (air permeability of building envelope)

Article 14: (protection against solar irradiation and overheating)

3. Additional technical requirements for heating and cooling devices

Article 15: (heating devices)

- buildings with one or two apartments: heat generator must be inside the heat wrapper of building,
- thermal losses of the distribution network are maximum 5%,
- maximum project temperature of the heating system is 55°C, except for domestic hot water preparing (70°C), air-conditioning systems air preparing; there are no limits for distribution systems between the buildings,
- distribution system must be inside the the heat wrapper of building, except for connecting pypes,
- specific use of electricity for the hot water transport must be less than 0,015 Wel/Wheat,
- pumps in buildings with more than two apartments must have electrical regulation na constant work pressure,
- all heating or cooling bodies must have temperature regulation elements with proportional interval 1K, if the used area of the space is more of 6 m2, This is not necessary when equal or better air temperature regulation system is used,
- hydraulic balanced of distribution systems is required,
- final heat exchangers must be free placed, usually at the outside wall,
- surface heat or cool exchangers must take into account the best available practise,
- in the multi apartment buildings heat measurement devices must be installed,
- in all buildings the automatic regulation systems must be installed for heating, air-conditioning, cooling, according to the best available practise,

Minimum efficiency for new boilers:

- fuel oil minimum efficiency 0,82 – 0,88
- biomass minimum efficiency 0,76 – 0,83
- natural gas minimum efficiency 0,91 – 0,99 (condensing boilers only allowed; not for peak up boilers)

Article 16: (cooling devices)

- rated project cooled water temperature in the humidifying systems is 6/14 °C, in the case without humidifying 14/18 °C and 18/23 °C for surface cooling; primary and secondary cool water circle must be assumed;

- specific use of electricity for the cold water transport must be less than 0,02Wel/Wcool in primary circle and less than 30 Wel/Wcool in secondary circle
- cooling power regulation with hot gas circulation for cooled power up to 25 kW is not allowed,
- only cool generators with minimum efficiency is allowed
- Installations of heat pumps, according to Decision of Commission nb. 2007/742/ES, 9. 11. 2007 about environmental criteria determination for Union environmental award for electric, gas and absorbent heat pumps are allowed

Calculation minimum allowed efficiency of **CG**, according to SIST prEN 14511 (ARI 550/590, 560 for COP* and IPVL)

* COP valid for ARI measurements: it is equal to EER without taking into account additional electric power

Type of refrigeration system (cold generator; CG)	EER	COP	ESEER	COP*	IPVL
Test along:	prEN 14511	prEN 14511	Euro vent	ARI 550/560/590	ARI
Air cooled CG	2,90	3,00	3,00	2,80	3,05
Air cooled CG with connected channels	2,50	2,80	3,00	-	-
Air cooled CG (surface heating or cooling)	3,65	3,9	4,2	-	-
Water cooled CG (every type till 1500 kW)	4,65	4,15	4,25	-	-
Water cooled CG with piston compressor	-	-	-	4,45	5,05
Water cooled CG - spiral, screw compressor, till 500 kW	-	-	5,00	4,45	5,2
Water cooled CG - screw compressor, 500 kW – 1000 kW	-	-	5,00	4,9	5,6
Water cooled CG - centrifugal compressor, till 500 kW	-	-	5,15	5,00	5,25
Water cooled CG - centrifugal compressor, 500 kW - 1000 kW	-	-	5,8	5,55	5,9
Water cooled CG - centrifugal compressor, up to 1000 kW	-	-	6,3	6,1	6,4
Water cooled CG (surface heating or cooling)	4,9	4,2	5	-	-
CG with remote capatitor	3,4	-	3,6	3,1	3,45
Absorbent air/water cooled, (1 rate)	-	-	-	0,6/0,7	-
Absorbent air/water cooled, (2 rate)	-	-	-	1,00	1,00

Test conditions:
1. cooling: evaporator: 12/7 °C (23/18°C for surface cooling)
capacitor 30/35°C ** (35°C dry termometer temperature, air cooling)

**details in SIST prEN 14511

2. inverse process (heating): evaporator: 7/10°C, capacitor 45/40°C

EER and COP are valid for single unit for air cooled units till 600 kW and water cooled units till 1500 kW, except in same cases, where more than 1500 kW is needed.

Article 17: (thermal insulation of pipes)

Article 18: (devices for hot water preparing)

- domestic hot water preparation must be central with hot water reservoir in combination with heating system, solar system, heat pump (subsidies to install in the last ten years) or other similar way,
- hot water reservoir must be indirectly heated, in buildings until 500 m2 like bi or three-valente, in bigger buildings according BAT,
- distribution system of hot water must be into heat wrapper, inside the installation wall and isolated,
- distribution system must be with heat and/or flow meters equipped (in every apartment or supplied unit),
- hot water pump in distribution system (if exist) must be temperature controlled,
- if planed costs are disproportionate or if the planed use is only occasionally, local hot water heaters are allowed. In this case heat pumps with reservoir and auxiliary electrical heaters (when is occasionally needed to reach up to 70 °C and is only with heat pump impossible), according to SIST EN 806
- local hot water preparation with electrical boilers or streamed electrical heaters is not allowed, except in administrative and office buildings, one or two apartment buildings (electrical heaters max 2 kW) and in buildings with disproportionate costs (more than twice compare with electrical heater)

4. Additional requirements for ventilation and air conditioning ventilations

Article 19: (return air ventilation heat)

Article 20: (power of pumps, air-tightness and other requirements)

5. Additional technical requirements for lighting

Article 21: (quality of lamps and regulation of lighting)

	Max. allowed power density of lamps on the unit of usefull area of building	max W/Au
Label according to CC-SI	description	W/m2
1242	Garages, parking places	3
111, 112	Residental buildings	8
12301	Department stores, supermarkets, etc...	8
11300, 12630,12111, 12120, 1220, 12740, 1241, 12201	Student homes, hotels, motels, jails, fireman stations, etc...	11
12650, 12620, 12201, 1265, 12610	Gyms, museums, post offices, sporting halls, social events halls,...	12
12203, 12201, 1264, 12610, 1263	Convention centers, Courts, hospitals, cinemas, schools, laboratories	13
12111, 12620, 12510, 12721	Restaurants, libraries, production facilities, religious objects	14
12112, 1251	Restaurants, production facilities	15
12301	Independent shops	16
12601	theaters	17

- Values in the table are average. Local power of the lamps could be greater or smaller, depending on the real needs, for example taking into account daylighting.

6. Specificities concerning compliance technical requirements

Article 22: (smaller buildings)
Article 23: (requirements for the takeover of new buildings, renovation of buildings, and investment maintenance of buildings)
Article 24: (recommendations)

III: Meet the technical requirements of regulations

Article 25: (calculation of annual allowable energy for heating and cooling)
Article 26: (calculation of annual primary energy for the operation of building)
Article 27: (calculation of the release of CO2 and indicators)
Article 28: (energy indicators)

IV: Climatic data and information on materials

Article 29: (climatic data)
Article 30: (information on materials)

V. Project documentation

Article 31: (meet the requirements and indicators)

Rules on the methodology of energy labelling of buildings (draft version)

Article 7 (recommendations for improvements)
For the existing building (except in the case of renting) the cost efficient requirements for energy efficiency measures must be enclosed. Recommendations should be given in the generic form in accordance with the rules of profession and the last positions of technique.

Rules on the methodology and study feasibility of alternative systems for the supply of buildings with energy (35/08)
Mandatory for buildings with nett usefull plan area 1000 m2 or more.
Alternative systems for the supply of buildings with energy are:

- decentralized systems on the RES basis,
- cogeneration of heat, cold, electricity in different combinations,
- district or common heating or cooling
- heat pumps

2.9 Spain

The EU's Directive on the Energy Performance of Buildings (EPBD – 2002/91/EC) is the key legislative instrument to improve the energy use and efficiency of new and existing buildings across the EU. According to the European Climate Change Programme, this directive, when it was originally agreed in 2002, had the potential to deliver up to 45 million tonnes (Mt) of CO2 reduction by 2010 in the EU15.

2.9.1 The National Building Codes of Spain

All Spanish legislation becomes official when it is published in the BOE (Boletín Oficial del Estado – Estate Official Bulletin).
The following codes contain the information on building and energy in the Spanish regulation:

Orden de 5/9/1985: Administrative and technical rules for the operation and interconnection to the grid of hydroelectric power plants up to 5MVA and co-generation plants.
It provides general rules for the interconnection of RES and co-generation plants to the grid. Utilities are bound to buy the surplus of electricity generated by these installations at higher than market prices.

The following issues are covered:
- *DG resources*: Not specific
- *Generation technology*: Not specific
- *DG rated power*: Up to 5 MVA in hydro
- *Voltage Level*: Not specific
- *Topology*: Interconnected
- *General requirements*: Max DG power and short circuit capacity
- *Interconnection requirements*: Installation, protection and synchronisation
- *Power Quality requirements*: Power factor, harmonics and voltage variations
- *Disturbance requirements*: Loss of mains and reclosure conditions
- *Commissioning*:
- *Operation and Communication*: Metering

Released September 1985.

Ley de 54/1997: Electric sector law.
It governs the activities intended for electricity supply including generation, transmission, distribution, marketing and international power exchanges. This law also sets the basic requirements on power quality and security of installations being used as source for other specific regulation

The following issues are covered:
- *DG resources*: Not specific
- *Generation technology*: Not specific
- *DG rated power*: Not specific
- *Voltage Level*: Not specific
- *Topology*: Interconnected
- *General requirements*:
- *Interconnection requirements*:
- *Power Quality requirements*:
- *Disturbance requirements*:
- *Commissioning*:
- *Operation and Communication*:

Released November 1997, modified December 2001

Real Decreto 2818/1998: Production of electric energy by RES, waste and co-generation.
It defines the requirements and procedures to invoke the Régimen Especial (specific treatment for some sources of electric energy, basically RES and co-generation), procedures for registration, supply conditions and economic rules. Specific generation types receive different incentives to promote them.

The following issues are covered:
- *DG resources*: RES and co-generation
- *Generation technology*: Not specific
- *DG rated power*: Up to 50 MW
- *Voltage Level*: Not specific
- *Topology*: Interconnected
- *General requirements*: Max DG power
- *Interconnection requirements*: Protection
- *Power Quality requirements*: Power factor
- *Disturbance requirements*:
- *Commissioning*:
- *Operation and Communication*: Metering

Released December 1998, modified February 1999.

Real Decreto 1663/2000: Interconnection of photo-voltaic installations to the LV grids; **Resolución 31/501:** Contract and Invoice format models for LV PV installations.
It regulates the interconnection of photo-voltaic installations to LV grids.

The following issues are covered:
- *DG resources*: PV
- *Generation technology*: Static inverter
- *DG rated power*: Up to 100 kVA

- *Voltage Level*: LV
- *Topology*: Interconnected
- *General requirements*: Max DG power
- *Interconnection requirements*: Installation, protection and accessible disconnection switch
- *Power Quality requirements*: Power factor, harmonics and voltage variations
- *Disturbance requirements*: Loss of mains, reclosure conditions and DC injection
- *Commissioning*:
- *Operation and Communication*: Metering and information exchange.

Released September 2002.

Real Decreto 1995/2000: Rules for transmission, distribution, commercialisation, supply and permission procedures for electric power plants.
It establishes the legal system applicable to the transmission, distribution, marketing and generation activities.

The following issues are covered:
- *DG resources*: Not specific
- *Generation technology*: Not specific
- *DG rated power*: Not specific
- *Voltage Level*: Not specific
- *Topology*: Interconnected
- *General requirements*: Max DG power
- *Interconnection requirements*: Installation and measurement
- *Power Quality requirements*: Power factor
- *Disturbance requirements*:
- *Commissioning*:
- *Operation and Communication*: Metering and maintenance

Released December 2000.

Real Decreto 842/2002: Low voltage generation technical regulation.
It defines complementary instructions applicable to generation installations from any type of energy into electricity.

The following issues are covered:
- *DG resources*: Not specific
- *Generation technology*: Not specific
- *DG rated power*: Not specific
- *Voltage Level*: LV
- *Topology*: Interconnected and isolated
- *General requirements*: Max DG power and short circuit capacity
- *Interconnection requirements*: Installation, protection, synchronisation and accessible disconnection switch

- *Power Quality requirements*: Power factor and harmonics
- *Disturbance requirements*:
- *Commissioning*: Basic requirements
- *Operation and Communication*: Metering

Released September 2002.

Real Decreto 2018/1997: Electricity consumption and metering code; **Orden de 12/04/119:** Complementary technical instructions to RD 2018/1997; **Real Decreto 385/2002:** Updates to RD 2018/1997.
It regulates the metering system operation. In spite of not being specific to DG all it is also applied to DG

The following issues are covered:
- *DG resources*: Not specific
- *Generation technology*: Not specific
- *DG rated power*: Not specific
- *Voltage Level*: Not specific
- *Topology*: Interconnected
- *General requirements*:
- *Interconnection requirements*:
- *Power Quality requirements*:
- *Disturbance requirements*:
- *Commissioning*:
- *Operation and Communication*: Metering and information exchange

Released May 2002.

Real Decreto 436/2004 (modified by Real Decreto 661/2007): Methodology for updating and systematisation of legal and economic rules for RES, waste and co-generation.
It details administrative issues and incentives applied to Régimen Especial (specific treatment for some sources of electric energy, basically RES and co-generation) although it does not provide additional interconnection requirements to Orden 05/09/1985. Substitutes to RD 2818/1998 and modifies RD 2018/1997 contributing to a longer term stability on the incentives system.

The following issues are covered:
- *DG resources*: RES and co-generation
- *Generation technology*: Not specific
- *DG rated power*: Up to 50 MW
- *Voltage Level*: Not specific
- *Topology*: Interconnected
- *General requirements*: Max DG power
- *Interconnection requirements*: Protection
- *Power Quality requirements*: Power factor

- *Disturbance requirements*:
- *Commissioning*:
- *Operation and Communication*: Metering

Released March 2004.

Resolución 26-June-2007: Modification of operation rules of the market for electricity productiona.

Real Decreto 1634/2006: Establishment of electricity tariffs from 1 January 2007.
Orden ITC/2794/2007: Revision of electricity tariffs from 1 October 2007.

Real Decreto 1110/2007: Approval of Unified Regulation concerning the points of measurement of electrical system. The purpose of this regulation is the regulation of the operating conditions of the system of measures in the national electricity system, the measure equipments and its features, in order to ensure proper technical management of the electrical system and the acquisition of the data required for the liquidation of the energy and associated services, as well as for the calculation of the billing rates.

Real Decreto 616/2007: Promotion of cogeneration.
Orden ITC/1673/2007: Approval of program on conditions for the implementation of power contribution to the electrical system of certain producers and consumers associated in order to contribute in assuring the security of supply of electricity. It is aimed at cogeneration facilities.

Real Decreto 1578/2008: Remuneration of production of electricity through technology solar photovoltaic technology after the deadline for maintenance of the remuneration of RD 661/2007, for such technology (29-September-2008).

Real Decreto 1371/2007: Technical Building Code CTE
The Technical Building Code, from now on CTE, is the regulatory framework for regulating the basic quality requirements to be fulfilled by buildings, including its facilities, in order to guarantee the basic requirements of safety and habitability established in the Law 38/1999 of November 5 of Building Management, from now on LOE.

The CTE provides the basic requirements for structural safety; fire safety; safety of use; hygiene, health and environment protection; protection against noise; and energy saving and thermal insulation established in Article 3 of the LOE. It provides procedures to demonstrate its compliance with sufficient technical guarantees. The basic requirements must be fulfilled in the design, construction, maintenance and conservation phases of buildings and facilities.

Considering energy saving the following issues are covered:
- Basic Requirement HE1: Limiting energy demand

- Basic Requirement HE2: Performance of the thermal installations
- Basic Requirement HE3: Energy efficiency of lighting installations
- Basic requirement HE4: Minimum solar contribution to domestic hot water
- Basic requirement HE5: Minimum PV contribution to electric energy.

Released March 2006

Real Decreto 47/2007: Energy certification of new buildings
The basic procedure for certification of energy efficiency of new buildings is defined.

The following issues are covered:
- Technical specifications of the methodology for calculating the energy efficiency rating
- Energy Efficiency Label

Released January 2007.

Real Decreto 1027/2007: Regulation of Thermal Installations in Buildings (RITE)
Establishes the energy efficiency and safety requirements of thermal installations in buildings. It is designed to meet the demand for welfare and health of people.
Released July 2007.

The need to transpose the Directive 2002/91/CE, of 16th of December, energy efficiency in buildings and the approval of the Technical Code of Construction by Royal Decree 314/2006, of 17th of March, advised to write up a new text that derogated and replaced the old Regulation of Thermal Systems in Buildings (RITE), approved by Royal Decree 1751/1998, of 31st of July and that incorporated the experience of its practical application during past years.

For that reason the Council of Ministers of the 20th of July of 2007 approved the Royal Decree 1027/2007 by which Regulation of Thermal Systems in Buildings was accepted. The Royal Decree has been elaborated by Ministry of Industry, Tourism and Commerce and Ministry of the House jointly.

The new Regulation of Thermal Systems in Buildings (RITE) establishes the conditions that systems for covering the demand of thermal comfort and hygiene must fulfil, by means of heating, air conditioning and domestic hot water systems in order to obtain a rational use of energy.

Biggest exigencies in energy efficiency established by Royal Decree are:
- Greater energy efficiency in heat and cold generating equipments, as well as those for movement and transport of fluids.
- Better insulation of equipments and conductions for thermal fluids.
- Better regulation and control to maintain design conditions in conditioned rooms.
- Use of available renewable energies, especially solar energy and biomass.
- Incorporation of subsystems of energy recovery and use of residual energies.

- Obligatory consumptions meters systems in case of collective installations. Gradual disappearance of most polluting solid fuels.
- Gradual disappearance of least efficient energy producing equipments.

RITE imposes the obligation to review and update periodically, at least every 5 years, energy efficiency exigencies. It is a task to be done by Advisory Commission of RITE, in charge of making the proposals, according to the evolution of the technique and national power policy.

This Royal Decree has the character of basic regulation of the State. For its application, corresponding complementary regulation will be developed by Autonomous Communities. This means that Autonomous Communities will be allowed to introduce additional requirements on the same matters whatever systems to be used in their territory.

Royal Decree 1027/2007, of 20th of July, by which the Regulation of Thermal Facilities in the Buildings is approved.

3. Energy Performance Building Directive (EPBD) implementation in national area

3.1 Finland

Finland has adopted appropriate measures to implement the directive into national law: on 13 April 2007 Parliament approved new legislation that, together with supplementary decrees issued in June 2007, constitutes the transposition of the EPBD into national law. The new legislation and decrees came into force on 1 January 2008.[6]

The European Union's Directive on the Energy Performance of Buildings was implemented in Finland through the Act on Energy Certification of Buildings and Ministry of the Environment Decree on Energy Certification of Buildings. The Act and Decree came into force on 1 January 2008. National building regulations on energy efficiency were also made more precise with the implementation. 000

The legislation includes also the Act on Inspection of Air-Conditioning Systems (488/2007), and a revision of the Land Use and Building Act.
The Decree on Energy Certification of Buildings (765/2007), covering the details of energy certification, was issued by the Ministry of the Environment in June 2007 and came into force on 1 January 2008. The certification of new buildings started at the beginning of 2008. For existing buildings, the certification started at the beginning of 2009. Certificates will not be required for holiday homes or smaller buildings, industrial premises, protected buildings and churches. Certificates will be optional for existing detached houses and residential properties consisting of no more than six homes. The Qualified experts for certification have the authority to issue so-called Separate Certificates. By June 2008, there were 150 qualified experts for energy certification. 000

Finland chose the option B (advice, voluntary inspections) instead of the mandatory boiler inspections for the implementation of Article 8. Even if the boiler inspections are voluntary, national inspection methodology has been developed for this purpose.

According to the new Act on Inspection of Air-Conditioning Systems, inspections will be compulsory for cooling equipment with a nominal cooling efficiency of at least 12 kilowatts, and will only be needed where cooling systems are based on the use of compressors. Such equipment shall be duly inspected at least every ten years.

[6] Ministry of Justice - Finlex, Copyright Edita Publishing Ltd
Ministry of the Environment - Land use and building legislation
Haakana, M. Implementation of the EPBD in Finland: Status and planning – August 2008. Country Review P120, 29-08-2008.

In Finland, the implementation of the EPBD is the overall responsibility of the Ministry of the Environment together with the Ministry of Employment and the Economy (formerly Trade and Industry). [000]

3.2 France

Legal context [7]

The implementation of the EPBD in France is the responsibility of the Ministry of Labor, Social Cohesion and Housing (all Articles except Articles 8 and 9) and the Ministry of Economy, Finances and Industry (Articles 8 and 9).
After the vote of the parliament, the French Government has promulgated, on 13 July 2005, the program Law defining the scope of the energy policy, regarding the main points for the transposition of the EPBD into French legislation. The execution orders are the responsibility of the Government.

Calculation procedures

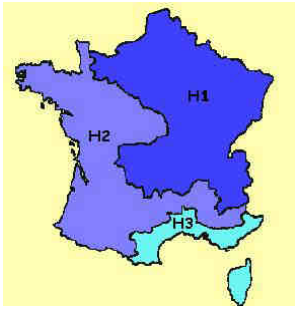
Calculation procedures pre-existed: they had been introduced by the preceding regulation on new buildings (RT2000). They had been based on the same principles as prEN 13790.
They have been developed between 2000 and 2005, to be ready at the end of 2005. The new calculation procedures were adopted by the Government on 24 July 2006 (decree of the 19th of July 2006 relating to the calculation procedures Th-C-E 2005). There are specific procedures for dwellings and for other buildings.

Requirements for new buildings

On 24 May 2006, the French Government adopted the minimum requirements for new buildings. The requirements came into force for building permits requested after 1 September 2006.
The type and level of requirements are governed by the function of the type of building (dwellings, office buildings schools…) and may cover:

- Maximum U-values for windows, walls, roofs and ceilings ;
- Requirement on average insulation level ;
- Maximum primary energy consumption per m² of floor area ;
- Maximum interior temperature in summer.

[7] http://www.buildingsplatform.org/cms/index.php?id=118&publication_id=2709



Type of heating	Climatic zone	Maximum consumption
Fossil fuels	H1	130 kWh primary/m^2/year
	H2	110 kWh primary/m^2/year
	H3	80 kWh primary/m^2/year
Electric heating (including heat pumps)	H1	250 kWh primary/m^2/year
	H2	190 kWh primary/m^2/year
	H3	130 kWh primary/m^2/year

Table 4: Maximum consumption expressed in primary energy for heating, cooling and production of sanitary hot water

The energy performance certificate labels both following aspects:

- The energy consumption of the dwelling or building;
- The impact of this consumption on greenhouse effect.

Energy consumption is either calculated according to one of the declared assessment methods or with an operational rating based on invoices (consumption noted over the last 3 years). The certificate also includes technical recommendations for the cost-effective improvement of the energy performance so that the owner is able to locate the most effective works to save energy.

Certification is compulsory since the 1st of November 2006, when dwellings or buildings are sold in France, except overseas areas. From this date, the certificate has to be available to the owner and by the owner to each prospective buyer, since the building or parts of the building are placed for sale.
For other buildings, certification will be needed from the 1st of July 2007, when buildings are rented and it will be obligatory for new buildings with a building permit required after the 1st of July 2007.

Moreover, the certificates will have to be displayed in public buildings over 1000 m² from January 2008.

Inspection of boilers and air conditioning
The Government will lay down different measures to establish a regular inspection of boilers and air conditioning systems. However, these procedures are still under discussion.

Relevant information
Detailed brochures as well as official texts and tools are available on the national websites: *http://www.logement.gouv.fr*
http://www.legifrance.gouv.fr

3.3 Germany

In Germany the EPBD is implemented in the legal context of the Energy Conservation Act (EnEG), which originally came into force in 1976 and has amended in 2005. In 2009 a new version of this act will be evaluated.

On this basis the current Energy Saving Ordinance (ENEV 2007, will be evaluated in 2009) sets up requirements for new buildings and refurbishment of building stock. For normally heated buildings the overall required is based on primary energy, an energy certificate (Energiepass) has to be issued for new buildings for 2007. The new version of the EnEV 2009 required an energy certificate to, if more than 10 % of the building surface area is modernised.

In 2005 the aspects of "lighting "and "cooling" was amended in the Energy Saving ACT. This was necessary for implementation of energy certificates for existing buildings, which are not subject to renovation.

The Energy Conservation Act and the Energy Saving Ordinance EnEV 2009 are combined with a lot of other regulation to reduce of the energy demand in buildings. Certification is obligatory for new buildings since February 2002. Existing buildings was certificated in three steps depending on the year of construction. Thus, certificates for residential buildings older than 1965 are mandatory from 2009.Time limit for non-residential building is determined to autumn 2009.

Certificates are based either on energy demand or consumption depending on the type of building, the amount of accommodation units and the year of construction. General, certificates for new buildings have to be based on energy demand.

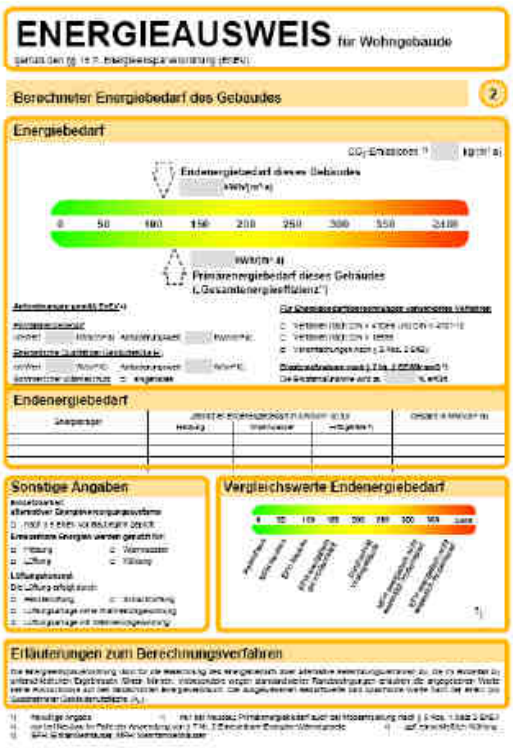
Existing non-residential buildings are free in choice between both alternatives. This does also apply to existing residential buildings with only one exception: buildings with less than 4 accommodation units, older than 1977 and without major renovation have to be base ion energy demand calculation.

Detailed information is available only when certification is done by calculating the energy demand. Therefore, for most existing buildings no adequate data for continuous commissioning will be available. It is obvious that additional investments for asset rating will be done only in case major renovation when stocking is done anyway.

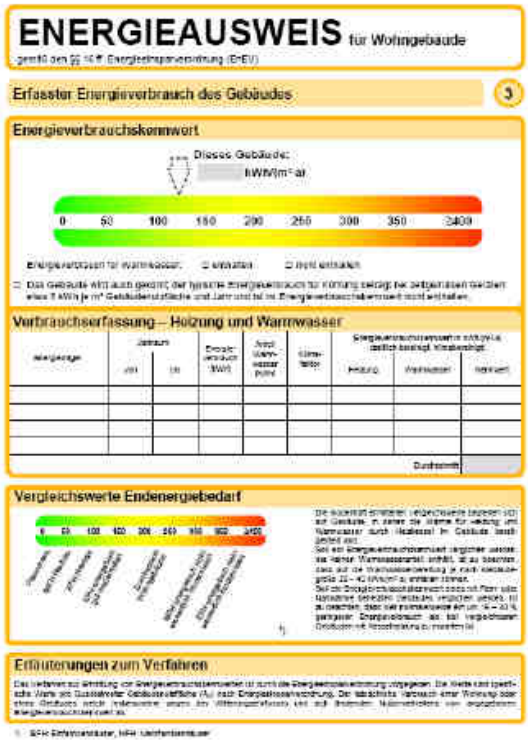
In principle, data from certification based on a demand are applicable for continuous commissioning – However, regulations on monitoring are necessary in order to enable further usage of all collected data. Up to new the ENEV does not foresee requirements on liking calculation and monitoring.

Today a high quantity of experts exists already for residential buildings. The qualification ranges from engineers, architects to craftsmen or chimneysweeper with or without a training for energy saving purposes. However calculation for non-residential buildings has to be undertaken only by experts with academic education and a specialisation in energy saving constructions.

A revision of the Energy Saving Ordinance is envisaged in 2012 with further tightening requirements to save energy.



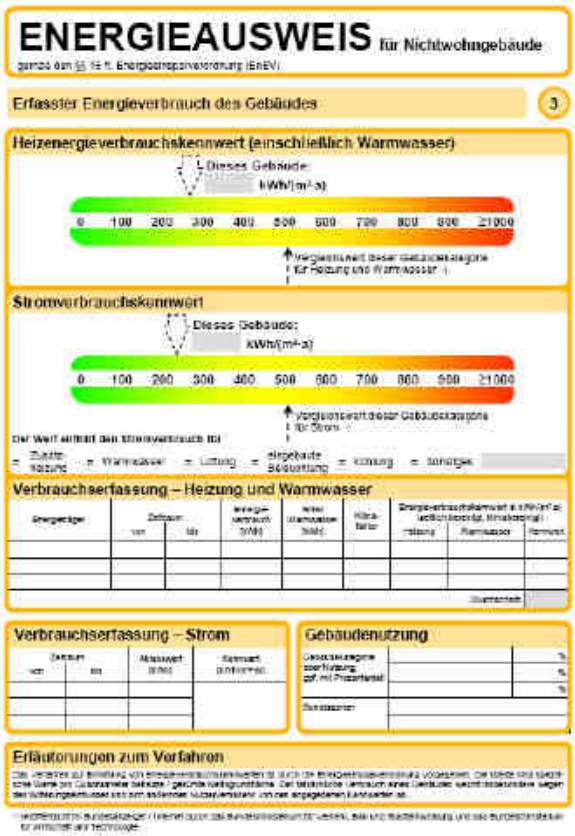
Energy Certificate for residential building base: calculated energy demand



Energy Certificate for residential building, base: energy consumption

Figure 1: Energy Certificates in Germany

Energy Certificate for non-residential building
base: calculated energy demand



Energy Certificate for non-residential buildings
base: energy consumption

Figure 2: Energy Certificates in Germany

3.4 Greece

Legal context

The implementation of the EPBD in Greece is the responsibility of the Ministry of Development and the Ministry of Environment. The country is delayed in transposing the EPBD. At this stage the draft law has been prepared. The draft has been analysed during a 3-day discussion of the appropriate Energy Committee of the Greek Parliament, where major consumer and technical advisory groups were consulted and the final text was agreed.
(*http://www.parliament.gr/ergasies/nomodetails.asp?-lawid=585*).
The Law passed through the Parliament and has officially been incorporated in the Greek legal system since May 2008.
The execution orders are the responsibility of the Ministries of Development and Environment, their formation has been assigned to CRES and they are expected to be published by Nov. of 2008.

Status of the implementation

- Calculation procedures

Greece is in the process of setting the regulations for the EPBD (general design/inspection principles and minimum requirements for the building envelope, lighting, boiler/heating system, air conditioning etc). The country is planning to develop the calculation procedures (art. 3) in parallel with the regulations. It is foreseen that the Government will adopt them during 2008. There will be specific procedures for dwellings and for non-domestic buildings.
Software tools are expected to be developed by the market and verified by appropriate government bodies thereafter.

-Requirements for new buildings

The Government of Greece is completing a study on minimum requirements for all new buildings. The task is being undertaken by the Ministry of Development with the help of the Regulatory Authority for Energy. The requirements will come into force for building permits requested after 1 January 2009.

The type and level of requirements are governed by the function and the type of building (dwellings, office buildings, schools …) and may cover:
› Maximum U-value;
› Requirement on average insulation level;
› Maximum primary energy consumption per m² of floor area;
› Boiler and air conditioner efficiencies.

New buildings should produce an energy study before the building permit is issued. The proof of compliance must be made after completion of the building. It is foreseen that control of the regulation is the responsibility of the Regional Authorities (the existing Building Permit Offices) where the building is located.

-Requirements for existing buildings

The procedure followed for new buildings covers also existing buildings. The ongoing studies examine minimum requirements for new building components for building renovation and for extensions to existing buildings.

The requirements will be formally adopted on 1 January 2009.

-Certification of buildings

The requirements regarding the certification of buildings will be adopted by the Government 6 months after the Law has been passed by the parliament (ie. end 2008). The general certificate model to be used will be the A-G label. There are considerations, however to allow for more categories above the B level (eg. A+, A, A- etc.), so as to stimulate competition towards more efficient building design in the future. Certification, accompanied by a building permit, will be obligatory for new buildings after 1 January 2009. There is an ongoing debate as to whether the certificate will be obligatory for buildings to be rented or sold. The main argument against this requirement is the large number of inspectors needed in the early stages of implementation.

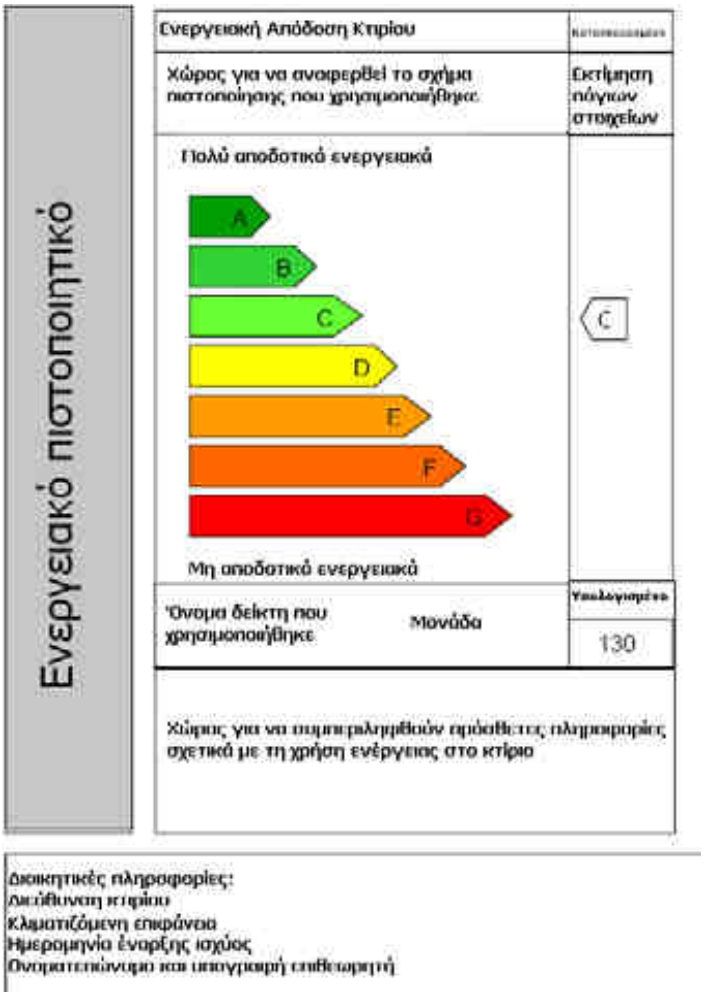


Figure 3: Energy Certificate in Greece

-Evaluation of building shell

A study was undertaken to define the steps required for the evaluation and inspection of the building envelope. The study examined every stage starting from an inspection contract agreement to collection of data (suggesting a standardised questionnaire) and issuing and registering the certificate. The procedure was defined, in accordance with the EPBD and the existing Greeek law of building insulation.

-Inspection of boilers and air conditioning

The plan for Inspection of boilers has been prepared and is under review by the Ministries of Development and Environment.
(*http://www.minenv.gr/4/41/g4100.html*).
It will replace existing boiler inspection procedures undertaken by the Ministry of Environment. A study was undertaken, utilising the databases of Eurovent-Certification, to examine state of the art air-conditioning equipment in the European market. The study concluded that only A class small air-conditioners could be used, while for larger machinery A & B class would be acceptable.
Indicative graphs depicting the energy category of small and large air-conditioning equipment for thousands of machines currently available across the EU, used to define acceptable systems, are given below.

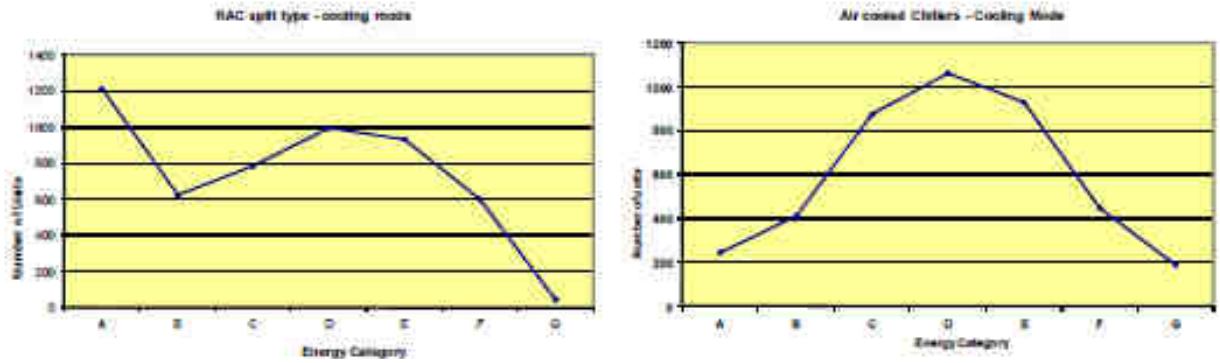


Figure 4: Graphs depicting energy category on air-conditioning equipment

A general framework of evaluation of air conditioners has been produced. Significant attention has been paid on defining a standard methodology on the regular servicing of air-conditioning equipment. The methodology will soon be implemented through a Ministerial Decision on energy requirements for public buildings. This decision will set minimum requirements on lighting fixtures available in the country, air-conditioning used in public buildings and it is in general more stringent than the EPBD and is expected to be signed and applied by summer 2008 (prior to the full implementation of the EPBD). The details are still under discussion for the next month.

-Energy design and inspection rates

The Technical Chamber of Greece has also financed a study which attempts to give a definition of the elements/steps necessary for the energy design of a building and the suggested (economic) rates for evaluators and inspectors. Such rates are in general within the range of 100-150 € for average buildings, boilers and air-

conditioners and are increasing by m2 or 100's kW for larger installations. For new buildings, the rates are expressed as a percentage (within 10-20%) of the architectural and mechanical engineering studies of energy consuming equipment.

Future planning

All aforementioned studies are being incorporated in the Regulation for the EPBD, which describes in detail the methodology for application and the technical specifications of the evaluation inspection procedures. The work started in April 2008, under the coordination of CRES and is expected to be completed in November 2008.

Relevant information

Detailed brochures as well as official texts and tools are available on the national websites
(eg. *http://www.cres.gr/kape/publications/-download.htm*,
www.cres/gr/greenbuilding , *www.ypan.gr*).

3.5 Italy

Actually in Italy there are different laws related with Energy saving:

- **D.Lgs. 192/2005**
- **D.Lgs. 311/2006** (which adds some modification to the former law about energy certification and methodology for efficiency calculation)
- **D.M. 19 Feb 2007** (about deduction costs for energy efficient retrofitting of buildings)

The Lgs. 192/2005 has acknowledged in Italy the **European Regulation 2002/91/CE.**
It establishes a series of steps over 3 years to regulate building energetic consumption in Italy and it introduces the idea of the "Energetic Certification for Buildings".
The D.Lgs. 311/2006 introduces some modifications to the former limit established by law: it modifies the issue of energetic certification and the methods for calculating energy efficiency.
In order to improve building requalification, the D.M. 19 Feb 2007 allows for the deduction of costs for energy efficient building retrofitting.
The major innovation, in comparison to the former laws, consists in the fact that D.Lgs. 311/2006 extends the application of the "Energetic Certification for Building" to all buildings, both new and pre-exiting (art. 6 e art. 11 comma 2) and for all uses (housing, commercial and industrial).
It sets the deadline, different for the different building typology, dimension and age, to obtain the Energetic Certification:

- From 2 of February 2007, the certification is mandatory for all the new buildings and all fully-refurbished buildings with a surface bigger than 1000 m^2;
- From 1 of July 2007 the certification is mandatory for all buildings with a surface larger than 1000 m^2 (new and pre-existing);
- From 1 of July 2008 the certification is mandatory for all building with a surface smaller than 1000m^2;
- From 1 of July 2009 the certification is mandatory for all single family houses.

Waiting for the Decreti Attuativi (law which gives indication about how to follow the general indication in laws), the Energetic Certification is substituted by Energetic Qualification (valid for 1 year) which is disciplined by Law 9 January 1991 n. 10 modified by D.Lgs. 192/05.

D.Lgs. 311/2006 fixes the insulation efficiency (in terms of conductivity) and the specific power consumption for heating for each climate zone and each typology of building. Moreover it gives some suggestions about how calculate different efficiency parameters related with energy consumption.
Buildings are considered by different point of view as:

- climate;

- building thermal characteristics;
- heating systems
- cooling systems
- lighting systems
- building location and orientation
- solar systems
- natural convection
- use of renewable energy, presence of cogeneration systems or district heating

To calculate the **maximum specific energy consumption** allowed by each building, two indexes are required:

- the building shape ratio, defined as the ratio between the external surface and the heated volume;
- the GG index (degree per day), which defines the different climate zone in Italy.

The GG index ("Gradi Giorno" GG) or HGT (HeizGradTage, from German) in [Kd/y] (Kelvin * day / year) is the unit used to indicate the thermal demands of a geographical zone according to law about building heating (D.P.R. n. 412 del 26 August 1993).

Zone	GG
A	< 600
B	601 – 900
C	901 -1400
D	1401 – 2100
E	2101 – 3000
F	> 3000

Table 5: GG for each Climate Zone

City	GG [Kelvin * day / year]
Aosta	2850
Torino	2617
MIlano	2404
Bolzano	2791
Perugia	2289
Terni	1650
Roma	1140
Napoli	877
Palermo	751

Table 6: Some example of GG for Italian Cities

For each Zone Class the maximum number of hours of heating allowed by law during winter is indicated, together with the periods in which is allowed to start the heating systems.

Zone	Maximum Number of Heating Hours
A	6 hours – from 1 Dec to 15 Mar
B	8 hours – from 1 Dec to 31 Mar
C	10 hours – from 15 Nov to 31 Mar
D	12 hours – from 1 Nov to 15 Apr
E	14 hours – from 15 Oct to 15 Apr
F	no restrictions

Starting from these two indexes, it is possible to calculate the maximum energy that can be used during winter for heating buildings belonging to each category.

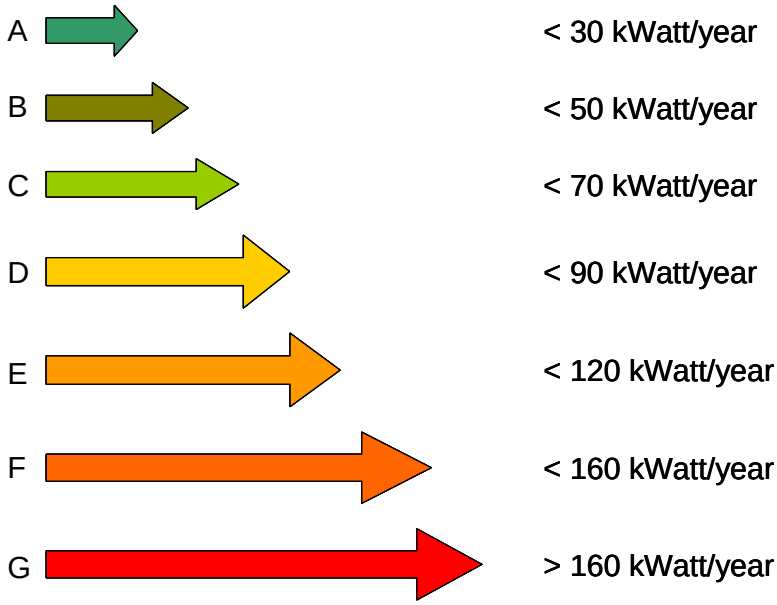
At the same time, for each building category, the range of values for wall/roof conductivity is established: different limits are set for vertical and horizontal walls. This parameter is also influenced by the climate category (defined by the GG).

The maximum values of specific power and conductivity are set in different tables, with limits that became narrow from nowadays to 2010 (the same building must waste less power for heating in 2010 that in 2009).

Summarizing: Italian Law sets the maximum specific power consumption which can be used during winter time for heating and maximum conductivity for external walls, but at now, limits for each Energy Certificated Building Class are set on a local base by each region.
Building energy classification is based on energy consumption for year per square meter of heated surface [kWh/(m^2year)], or cube meter of heated volume for non-residential buildings [kWh/(m^3year)], and on specific power consumption as shown below.
Each region has the possibility to deliberate its own regulation due to deregulation act. Some regions introduced in the last years their own criteria.

TRENTINO ALTO-ADIGE
The classification is based on two indexes: Energy primary consumption

- Efficiency of building (only structure)
- Global efficiency of building included heating-plants



- **Class A:** < 30 kWh/m^2 per year and < 3 litres of fuel/m^2 per year
- **Class B:** between 31 and 50 kWh/m^2 per year and between 3.1 and 5 litres of fuel/m^2 per year
- **Class C:** between 51 and 70 kWh/m^2 per year and between 5.1 and 7 litres of fuel/m^2 per year
- **Class D:** between 71 and 90 kWh/m^2 per year and between 7.1 and 9 litres of fuel/m^2 per year
- **Class E**: between 91 and 120 kWh/m^2 per year and between 9.1 and 12 litres of fuel/m^2 per year
- **Class F:** between 121 and 160 kWh/m^2 per year and between 12.1 and 16 litres of fuel/m^2 per year
- **Class G:** more than 161 kWh/m^2 per year and more than 16.1 litres of fuel/m^2 per year

LOMBARDIA

Resolution of Lombardia Regional Council n. 5773 of 31/10/2007: "Provisions concerning energy certification for buildings".
Building energy classification is based on energy consumption (heating) for year per square meter of heated surface [kWh/(m^2year)] or cube meter of heated volume for non-residential buildings [kWh/(m^3year)].

Class for residential buildings (E.1) [kWh/(m^2year)]

Classe	Edifici di classe E.1 esclusi collegi, conventi, case di pena e caserme		
	Zona E	Zona F1	Zona F2
A+	$EP_H < 14$	$EP_H < 20$	$EP_H < 25$
A	$14 \leq EP_H < 29$	$20 \leq EP_H < 39$	$25 \leq EP_H < 49$
B	$29 \leq EP_H < 58$	$39 \leq EP_H < 78$	$49 \leq EP_H < 98$
C	$58 \leq EP_H < 87$	$78 \leq EP_H < 118$	$98 \leq EP_H < 148$
D	$87 \leq EP_H < 116$	$118 \leq EP_H < 157$	$148 \leq EP_H < 198$
E	$116 \leq EP_H < 145$	$157 \leq EP_H < 197$	$198 \leq EP_H < 248$
F	$145 \leq EP_H < 175$	$197 \leq EP_H < 236$	$248 \leq EP_H < 298$
G	$EP_H \geq 175$	$EP_H \geq 236$	$EP_H \geq 298$

Class for non-residential buildings [kWh/(m^3year)]

Classe	Altri edifici		
	Zona E	Zona F1	Zona F2
A+	$EP_H < 3$	$EP_H < 4$	$EP_H < 5$
A	$3 \leq EP_H < 6$	$4 \leq EP_H < 7$	$5 \leq EP_H < 9$
B	$6 \leq EP_H < 11$	$7 \leq EP_H < 15$	$9 \leq EP_H < 19$
C	$11 \leq EP_H < 27$	$15 \leq EP_H < 37$	$19 \leq EP_H < 46$
D	$27 \leq EP_H < 43$	$37 \leq EP_H < 58$	$46 \leq EP_H < 74$
E	$43 \leq EP_H < 54$	$58 \leq EP_H < 73$	$74 \leq EP_H < 92$
F	$54 \leq EP_H < 65$	$73 \leq EP_H < 87$	$92 \leq EP_H < 110$
G	$EP_H \geq 65$	$EP_H \geq 87$	$EP_H \geq 110$

LIGURIA

Liguria region introduced in 2007 its own regulation (regional regulation N. 6 dated 8 November 2007 – Regulation for the implementation of art. 29 of regional law n. 22dated 29th May 2007) for EPBD. The classification is based on three indexes calculated as percentage on minimum value estimated on Legislative Decree 192/2005:

- Energy primary consumption
- Energy waste
- Global efficiency of heating-plants

Class for energy primary consumption

	A ≤	60%EP_{Li}(2010)
60%EP_{Li}(2010)	< B ≤	100%EP_{Li}(2010)
100%EP_{Li}(2010)	< C ≤	100%EP_{Li}(2008)
100%EP_{Li}(2008)	< D ≤	100%EP_{Li}(2005)
100%EP_{Li}(2005)	< E ≤	120%EP_{Li}(2005)
120%EP_{Li}(2005)	< F ≤	140%EP_{Li}(2005)
140%EP_{Li}(2005)	< G ≤	170%EP_{Li}(2005)
	NQE >	170%EP_{Li}(2005)

Class for energy waste

	A ≤	48%EP_{Li}(2010)
48%EP_{Li}(2010)	< B ≤	80%EP_{Li}(2010)
80%EP_{Li}(2010)	< C ≤	80%EP_{Li}(2008)
80%EP_{Li}(2008)	< D ≤	80%EP_{Li}(2005)
80%EP_{Li}(2005)	< E ≤	96%EP_{Li}(2005)
96%EP_{Li}(2005)	< F ≤	112%EP_{Li}(2005)
112%EP_{Li}(2005)	< G ≤	136%EP_{Li}(2005)
	NQE >	136%EP_{Li}(2005)

Class for global efficiency of heating-plants

	A ≤	1,2
1,2	< B ≤	1,37
1,37	< C ≤	1,65
1,65	< D ≤	1,73
1,73	< E ≤	1,91
1,91	< F ≤	2,1
	< G ≤	2,1

PIEMONTE

Piemonte Region has introduced the regional law n. 13 dated 28 May 2007: "Provisions concerning energy efficiency for buildings".

EMILIA ROMAGNA

Emilia Romagna region has produced a Guiding and Coordination Act on the Energy yields requirements and on the Energy certification procedures of buildings (04 March 2008).

Building energy classification is based on energy consumption for heating and DHW production (EPi + EP_{DHW} = EP_{tot}) for year per square meter of heated surface [kWh/

(m^2year)] or cube meter of heated volume for non-residential buildings [kWh/(m^3year)].

Class for residential buildings (E.1) [kWh/ (m^2year)]

A+	EPtot inf 25
A	EPtot inf 40
B	40 < EPtot <60
C	60 < EPtot <90
D	90 < EPtot <130
E	130 < EPtot <170
F	170 < EPtot <210
G	EPtot > 210

Class for non-residential buildings [kWh/(m^3year)]

A	EPtot inf 8
B	8 < EPtot < 16
C	16 < EPtot < 30
D	30 < EPtot < 44
E	44 < EPtot < 60
F	60 < EPtot < 80
G	EPtot > 80

3.6 Netherlands

Different EPBD implementations are well described at the European EPBD Buildings Platform project at http://www.buildingsplatform.org/. The editors of the Dutch Ministry of Environment (VROM) will send their latest P131 version shortly; for the time being, see http://www.buildingsplatform.eu/epbd_publication/doc/P131_EN_Netherlands_June08_p3255.pdf.

Energy Performance of Buildings (EPG)
The Energy Performance of Buildings (in Dutch Energie Prestatie Gebouwen, EPG) will be the national code for new and existing buildings from 1 January 2011 onwards, and will be based on carbon dioxide emission. The draft standard will be published February 2009 and the final version 1 January 2010. Finally the Optimal Energy Infrastructure (OEI) could replace the EI, EPN and EPL, as a univocal building code with respect to districts.

Energy Performance Certificate (Energielabel)
The date of implementation of the directive as to the energy performance certificate was 1 January 2008. For social housing companies, this was one year later on the provision of certification of their complete building stock. The permanent certification for public buildings is mandatory January 1st 2009.

Energy Performance Advice (EPA)
For this calculation method for existing buildings, no requirements are set. The quality assurance system and the calculation procedures have been ready since December 2006. In the Regulation on Energy Performance of Buildings (REG) issued on December 29th 2006, the Energy Performance Certificate requirements are outlined. Classes run from A (very energy efficient) to G (very energy in-efficient). The Energy Index (EI) indicates the standardized energy use per m^2 net floor surface in MJ/m^2.

The FP6 Securing the Take-off of Building Energy Certification (STABLE) project analyses how to design the energy certification of buildings so that they deliver an extra value for the user. The STABLE website is http://stable.motiva.fi. Another information source is the Improving Energy Performance Assessment and Certification Schemes by Tests (IMPACT) project. The website is http://www.e-impact.org.

3.7 Poland

Legal status for February 2009

Article 3, Adoption of a methodology

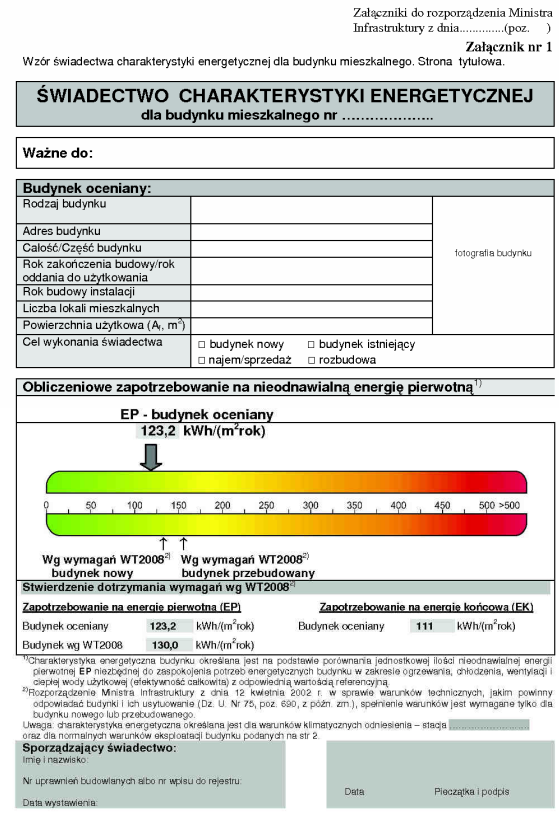
Methodology of calculation of the energy performance of buildings has been fully applied. It has been done at national level, by issuing executive regulation "Decree on calculation methodology of energy performance certificates of a building and dwelling or a part of a building which states independent technical-usable as a whole and on certificate example and manner of its preparation". The Decree came into force on January 1st, 2009. Standards and norms present in Polish legislation have been taken into account. Poland differentiated methodologies between buildings with and without cooling installations.

Article 4, Setting of energy performance requirements

There is no energy performance requirements scale set, based on A, B, C... classes. Energy certificate shows values graphically (see picture below).

Energy performance is described based on calculated annual not renewable primary energy demand index (EP) and compared with reference building for which technical requirements are set. There are two arrows below vertical scale that show EP values for new and renovated buildings. As there are no classes, Poland has not differentiated requirements between new and existing buildings – one can compare the calculated value with two references. Reference buildings may belong to different categories correspondingly to the evaluated building.

It has been decided not to set or apply energy performance requirements for categories of buildings listed in Article 4, point 3 of EPBD.



Załączniki do rozporządzenia Ministra Infrastruktury z dnia.....(poz.)

Załącznik nr 1

Wzór świadectwa charakterystyki energetycznej dla budynku mieszkalnego. Strona tytułowa.

ŚWIADECTWO CHARAKTERYSTYKI ENERGETYCZNEJ
dla budynku mieszkalnego nr .....

Ważne do:

Budynek oceniany:		
Rodzaj budynku		fotografia budynku
Adres budynku		
Całość/Część budynku		
Rok zakończenia budowy/rok oddania do użytkowania		
Rok budowy instalacji		
Liczba lokali mieszkalnych		
Powierzchnia użytkowa (A_f, m^2)		
Cel wykonania świadectwa	□ budynek nowy □ budynek istniejący □ najem/sprzedaż □ rozbudowa	

Obliczeniowe zapotrzebowanie na nieodnawialną energię pierwotną [1)]

EP - budynek oceniany
123,2 kWh/(m^2rok)

0 50 100 150 200 250 300 350 400 450 500 >500

Wg wymagań WT2008[2)] budynek nowy
Wg wymagań WT2008[2)] budynek przebudowany

Stwierdzenie dotrzymania wymagań wg WT2008[2)]

Zapotrzebowanie na energię pierwotną (EP)			Zapotrzebowanie na energię końcową (EK)		
Budynek oceniany	123,2	kWh/(m^2rok)	Budynek oceniany	111	kWh/(m^2rok)
Budynek wg WT2008	130,0	kWh/(m^2rok)			

[1)] Charakterystyka energetyczna budynku określana jest na podstawie porównania jednostkowej ilości nieodnawialnej energii pierwotnej **EP** niezbędnej do zaspokojenia potrzeb energetycznych budynku w zakresie ogrzewania, chłodzenia, wentylacji i ciepłej wody użytkowej (efektywność całkowita) z odpowiednią wartością referencyjną.

[2)] Rozporządzenie Ministra Infrastruktury z dnia 12 kwietnia 2002 r. w sprawie warunków technicznych, jakim powinny odpowiadać budynki i ich usytuowanie (Dz. U. Nr 75, poz. 690, z późn. zm.), spełnienie warunków jest wymagane tylko dla budynku nowego lub przebudowanego.

Uwaga: charakterystyka energetyczna określana jest dla warunków klimatycznych odniesienia – stacja ..... oraz dla normalnych warunków eksploatacji budynku podanych na str 2.

Sporządzający świadectwo:
Imię i nazwisko:

Nr uprawnień budowlanych albo nr wpisu do rejestru:

Data wystawienia:

Data Pieczątka i podpis

Figure 5: Energy Certificate in Poland

Article 7, Energy performance certificate

For new buildings, energy performance certificate needs to be provided before the permit for use is issued. For used buildings and dwellings, that are going to be sold or rented out, energy performance certificate needs to be provided before the contract is signed by prospective buyer or tenant. There is no legal penalty for not fulfilling this obligation. So, it is to be decided by market mechanisms not administrative rules if the certificate is in deed provided or not. Official statement made by Chamber of Civil Law Notaries says that notaries shall not check if a real estate property has appropriate certificate. It is disputable if the legislation in scope of obligation of the certificates of used buildings assures full implementation of EPBD.
The validity of all energy performance certificates is limited to 10 years.
Dwellings or units designed for separate use in buildings with a common heating system do not need individual certificates – one building certificate is valid for all dwellings.

Article 8, Inspection of boilers
Article 9, Inspection of air-conditioning systems
All regulations described in articles 8 and 9 of EBPD have been fully implemented by the last amendment to Building Law that came into force on January 1st, 2009.

Article 10, Independent experts
Boiler and air-conditioning system inspections need to be carried out by specialist engineers who have followed a course at a technical university and have passed special exams.
For the certification, candidates need to have a relevant higher education and pass an additional national exam. Certain specialised professions who have building license are exempt from following these courses and may access the market directly.

3.8 Slovenia

EPBD - requirements

- Calculate the overall energy efficiency of buildings with the determination of minimum requirements for new buildings and larger existing buildings in the case of renovation,
- Energy certification of buildings at construction, sales and placing on the rental and for large public buildings,
- Regular inspections of boilers on the non-renewable fuels with power more than 20 kW and advise on boilers and heating system (older than 15 years) efficiency
- Regular inspections of air-conditioning devices with power more than 12 kW.

Ref:

- http://www.cardiff.ac.uk/archi/research/auditac/index.html

(University of Ljubljana, Faculty of Mechanical Engineering is the Slovenian partner in this project). "The core aims of the AUDITAC project are to provide tools and information that will enable air-conditioning system Inspectors, Auditors, Owners and Operators across Europe to confidently identify actions that will save them money, and reduce the emissions of green house gases."

Adopted rule:

- Regulations on energy efficiency in buildings (93/08)
- Regulations concerning ventilation and air conditioning (42/02)
- Regulation on for periodic reviews of air conditioning systems (26/08)

Draft rules:

- Regulations on the energy performance certificate for buildings
- Rules governing the licensing and the licensing register
- The promotion of energy efficient heating systems
- Regulation on the establishment of the feasibility of alternative systems for the supply of buildings with energy
- Rules on training, licensing and registry of licenses of independent experts for regular inspections of air-conditioning systems
- Regulations on lighting housing with daylight
- Law on the architectural and engineering activities

3.9 Spain

The EPBD was transposed in Spain by means of three royal decrees:

- Royal Decree approving the 'Technical Code of Buildings (CTE)', approved by the Council of Ministers on the 17th of March 2006 and published in the Official Gazette on the 28th of March 2006.
- Royal Decree on the Basic Procedure for Energy Performance Certification of new buildings, approved by the Council of Ministers on the 17th of January 2007, and published in the Official Gazette on the 31st of January 2007.
- Royal Decree approving the review of the current 'Regulations for thermal installations in Buildings (RITE)', which was approved by the Council of Ministers on the 20th of July 2007 and published in the Official Gazette on the 29th of August 2007.

All decrees refer to the responsibilities of the Ministry of Housing, while the revised RITE and Energy Certification also refer to the responsibilities of the Ministry of Industry, Tourisms and Trade.

The Building Code (CTE for 'Código Técnico de la Edificación') includes a 'Basic Document' on energy saving, titled CTE-HE. This document is in line with the new requirements for energy performance in buildings described in the framework given by the EPBD, including energy saving and RES. This information can be downloaded from:

http://www.codigotecnico.org/fileadmin/Ficheros_CTE/Documentos/CTEFeb08/CTE%20Parte%202%20DB%20HE.pdf

The appropriate use of HE guarantees compliance with the basic requirements. These documents contain procedures, technical rules and examples of solutions for determining whether a building complies with the stipulated performance levels.

The Basic Document HE that concerns Energy Saving and consists of the following topics:

- HE1: Energy demand limitation
- HE2: Efficiency of thermal installations
- HE3: Energy efficiency of lighting installations
- HE4: Minimum solar contribution to domestic hot water
- HE5: Minimum photovoltaic contribution to electric power

1. HE1: Energy demand Limitation

Buildings shall feature a set of characteristics capable of adequately limiting the energy demand necessary to ensure human thermal comfort in accordance with the local climate, the use of the building, and the summer and winter regime as well as their characteristics of insulation and inertia, air permeability and exposure to solar radiation, reducing the risk of superficial and interstitial humidity that may affect

their characteristics, with appropriate treatment of the thermal points to limit heat losses or gains and to avoid any hydrothermal problems therein.

2. HE2: Efficiency of thermal installations

Buildings shall feature appropriate thermal installations to ensure human thermal comfort by regulating the efficiency of said installations and their equipment. This requirement is currently being developed in the prevailing Regulation of Thermal Installations and Buildings (RTIB, known by the Spanish acronym 'RITE') and its application shall be defined in the plan of the building.

3. HE3: Energy efficiency of lighting installations

Buildings shall feature adequate lighting installations for the needs of their users; installations shall also be energy efficient, with a control system to adjust the light to the actual occupancy of the area, as well as a regulation system to optimize the supply of natural light in areas that meet certain conditions.

4. HE4: Minimum solar contribution to domestic hot water

In buildings with foreseen demand for hot water or the conditioning of a covered swimming pool, in which, as established in this TBC, part of the thermal energy needs derived from said demand shall be covered by incorporating systems for the collection, storage and use of low temperature solar energy suitable for the global solar radiation of their location and the hot water demand of the building. The values derived from this basic requirement shall be considered minimum values, without prejudice to stricter values that may be established by the competent authorities which contribute to sustainability, in compliance with the specific characteristics of their location and territorial limits.

5. HE5: Minimum photovoltaic contribution to electric power

In buildings thus defined in this TBC shall be incorporated systems for the collection and transformation of solar energy into electric power by photovoltaic processes for proprietary use or supply to the network. The values derived from this basic requirement shall be considered minimum values without prejudice to stricter values that may be established by the competent authorities which contribute to sustainability, in compliance with the specific characteristics of their location and territorial limits.

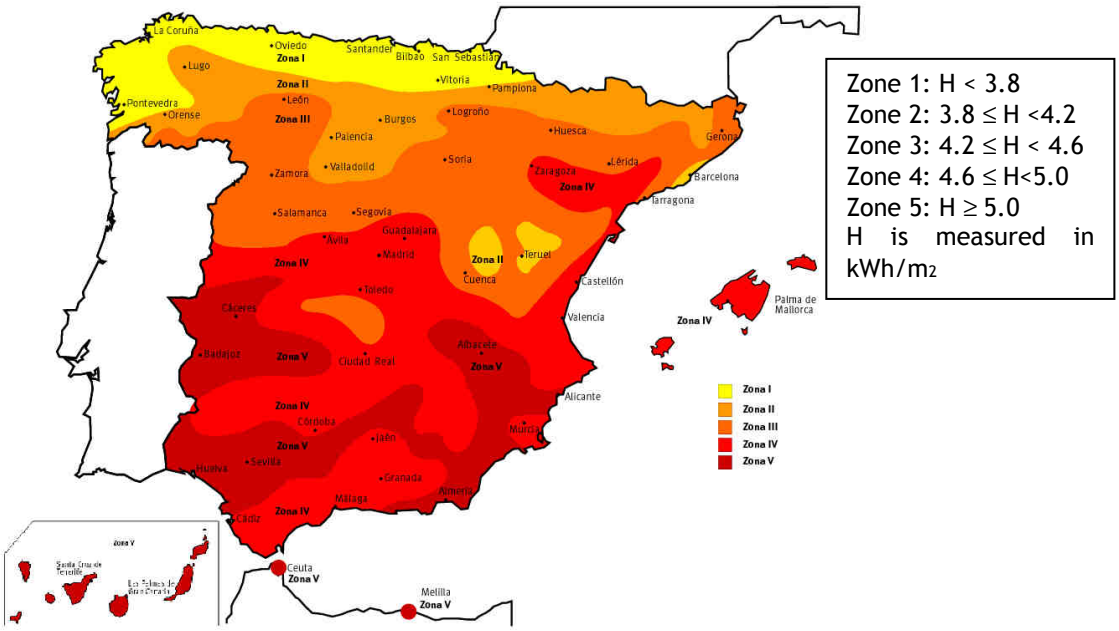
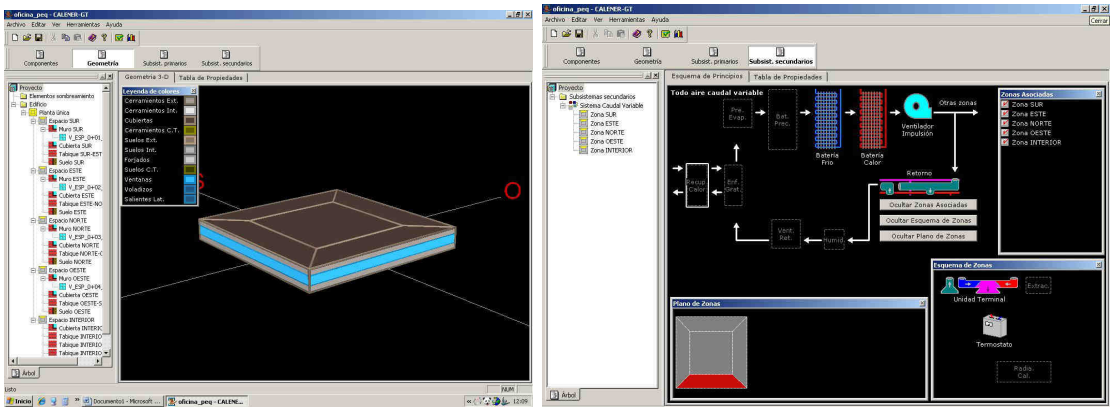


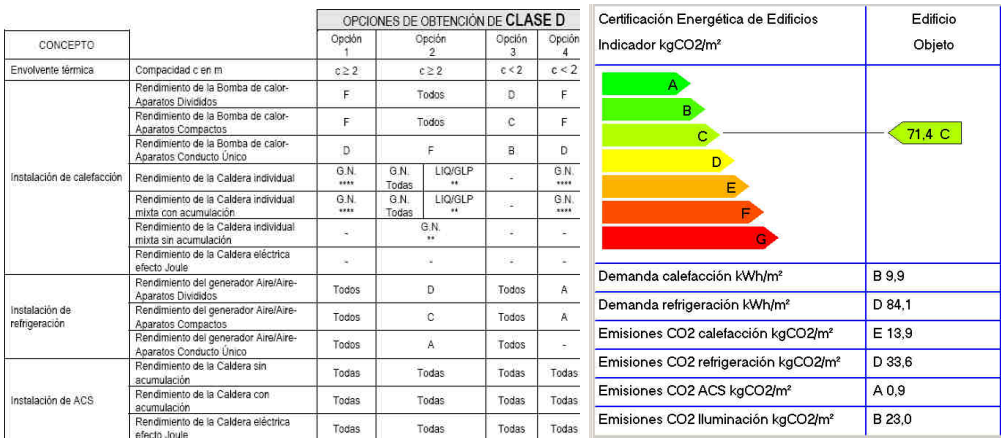
Figure 6: Zones in Spain[8]

Calculation Procedure:

The Spanish calculation procedure is presented in the document 'HE-1 Energy Saving' of the CTE (in Spanish1). This Basic Document also includes a software tool, LIDER2, designed to fulfil the energy demand limitation requirements as a general option. As an alternative to the general case, there is a simplified option following a prescriptive approach, to be used in the case of dwellings and within certain limitations, as described below.



[8] INM. Generated from global annual solar radiation isolines on a horizontal surface.



CONCEPTO		OPCIONES DE OBTENCIÓN DE CLASE D				
		Opción 1	Opción 2		Opción 3	Opción 4
Envolvente térmica	Compacidad c en m	c ≥ 2	c ≥ 2		c < 2	c < 2
Instalación de calefacción	Rendimiento de la Bomba de calor-Aparatos Divididos	F	Todos		D	F
	Rendimiento de la Bomba de calor-Aparatos Compactos	F	Todos		C	F
	Rendimiento de la Bomba de calor-Aparatos Conducto Único	D	F		B	D
	Rendimiento de la Caldera individual	G.N. ****	G.N. Todas	LIQ/GLP **	-	G.N. ****
	Rendimiento de la Caldera individual mixta con acumulación	G.N. ****	G.N. Todas	LIQ/GLP **	-	G.N. ****
	Rendimiento de la Caldera individual mixta sin acumulación	-	G.N. **		-	-
	Rendimiento de la Caldera eléctrica efecto Joule	-	-		-	-
Instalación de refrigeración	Rendimiento del generador Aire/Aire-Aparatos Divididos	Todos	D		Todos	A
	Rendimiento del generador Aire/Aire-Aparatos Compactos	Todos	C		Todos	A
	Rendimiento del generador Aire/Aire-Aparatos Conducto Único	Todos	A		Todos	-
Instalación de ACS	Rendimiento de la Caldera sin acumulación	Todas	Todas		Todas	Todas
	Rendimiento de la Caldera con acumulación	Todas	Todas		Todas	Todas
	Rendimiento de la Caldera eléctrica efecto Joule	Todas	Todas		Todas	Todas

Figure 7: Calculation and Energy Certificate

Energy Requirements for new buildings

The Building Code (CTE) prescribes minimum energy requirements for new buildings. The requirements apply to building permits requested after the 17th of September 2006.

The type and level of the performance requirements depend on the climatic zone where the building is located (in total, there are 12 climatic zones in the whole of Spain) and cover:

- Maximum U-values for different building elements;
- Solar factors for windows, roof lights, etc;
- Minimum Efficiency performance for thermal installations, depending on 'solar zones' (see map below);
- Minimum Efficiency performance for lighting installations;
- Minimum natural lighting contribution;
- Minimum solar contribution to Domestic Hot Water (DHW);
- Minimum photovoltaic contribution to electric power.

Compliance with the requirements of 'Energy demand limitation' (HE1) can be checked using either a simplified procedure (comparing the real values with the limit values for roof, facades, floor and walls in contact with the ground, as a function of the orientation) or by a complex procedure. The complex procedure requires the use of software tools. LIDER3, developed by the Government and available for free, is the official such software.

Indoor air quality

The Building Code (CTE) is a comprehensive legislation on building regulations and, as such, also covers indoor air quality requirements. The 'HS3 – Indoor air quality' section of the Basic Document 'DB-HS Wholesomeness' specifies indoor air quality minimum requirements for new and existing buildings. The following table lists the minimum ventilation requirements for different building spaces (in Spanish).

Requirements for existing buildings

Existing buildings have to comply with the same minimum requirements as new ones, when building rehabilitation, enlargement or renovation are carried out, the floor area exceeds 1.000 m2, or more than 25 % of the building envelope undergoes renovation. As for new buildings, these requirements are mandatory as of September 17th 2006.

Certification of buildings

Provisions regarding the energy performance certification of new buildings have been adopted by the Government at a national level as the 'National Basic Procedure for energy certification' through the Royal Decree 47/2007 of the 17th of January 2007, published on the 31st of January 20074. By the term 'Basic procedure' it is meant that other authorities with jurisdiction, such as the Autonomous Communities, can regulate and complete the National system, by giving more detailed provisions on what the control and inspections refer to. All parties and administrations involved are coordinated on a day to day basis by a National Advisory Commission created by the Decree, which studies the updates of target values and provides interpretations and solutions to problems or doubts raised by the new legislation.

Certification is obligatory for new buildings when the application for a building permit was made to the Local Authorities after the 31st of October 2007. This applies to all types of buildings (residential, public, commercial etc.).

Regional Governments have the authority to decide whether it is mandatory or not to display this certificate at the main entrance of the building. In any case, it is mandatory to display it for public buildings over 1.000 m2.

Certification of existing buildings is still in the process of administrative approval, with another relevant Royal Decree under way. As yet, it is not mandatory when selling or renting, buta 'Basic procedure' for the certification of existing buildings is expected to be ready and mandatory in 2009. As for the calculation of energy demands, the 'National Basic Procedure' for energy certification allows for two possible methods: a simplified method (that includes all validated procedures approved by the Certification Commission, in addition to the already existing simplified methodology for dwellings based on the 12 tables for the different climatic areas) and a complex method. The latter requires the use of a software tool, the official one being 'CALENER'.

So far, there are two different versions of CALENER: CALENER_VYP (for dwellings and small tertiary sector buildings)5 and CALENER_GT (for big tertiary sector buildings)6.

All matters pertaining to the control, inspection and registration of the energy performance certificates of buildings are under the authority of Regional Governments. Each region has its own internal structure. So, for example, certification will fall under the authority of the Industrial, Dwelling or Environmental Department, depending on the region. Thus, there are 19 different regional schemes in Spain.

Inspection of boilers and air conditioning

The inspection of boilers is already covered by the Regulation on thermal installations in Buildings (RITE), since its first version that was approved in 1982, revised in 1986,

and applicable since 1998. This last RITE version was revised and approved by the Council of Ministers on the 20th of July 2007, taking into account the new EPBD minimum requirements for thermal installations, including AC/HVAC energy efficiency inspections. At the same time, technical procedures for HVAC systems are included in this revised version of RITE. Details can be obtained from the Ministry's website:
http://www.mityc.es/Desarrollo/Seccion/EficienciaEnergetica/RITE/
In this way, basic requirements for thermal installations and HVAC systems are defined at a national level by RITE. In it, inspection procedures and inspection deadlines are standardized. In addition, the Ministry of Industry, through IDAE (Instituto para la Diversificación y Ahorro de la Energía – Institute for Diversification and Saving of Energy) has already published 13 guidelines on inspection methodologies, developed a software insulation tool and created a 'Subsidy Line' for regular energy efficiency inspections. As in the case of the Energy Performance Certificates for buildings, RITE is put into practice by the Regional Government administrations. They have the authority to strengthen the national basic requirements for inspections of boilers and HVAC systems (the full installation must be inspected) and are in charge of its practical implementation and data collection.
Thus, the regional governments are in charge of the 'practical implementation', which includes training courses (mostly by private entities), inspections, exams, etc.

Future planning
It is expected that the Royal Decree approving the Energy Performance Certification of Existing Buildings will be approved by the Government by the end of 2008.

Relevant information
Official texts and software tools are available on the national websites:

- *http://www.codigotecnico.org*
- *http://www.mityc.es/Desarrollo/Seccion/EficienciaEnergetica/CertificacionEnergetica/*
- *http://www.mityc.es/Desarrollo/Seccion/EficienciaEnergetica/RITE/*

4. Energy Service Directive (ESD) implementation in national area

4.1 Finland

The national implementation of the Energy Services Directive was already started in Finland in 2005. Officially the transposition of the Energy Services Directive was started on 17th February 2006. The Implementation Group became operative on 14th April 2006 with the first task to develop an implementation plan and schedule for the directive as well as to draw up the first National Energy Efficiency Action Plan. Finland's NEEAP was submitted to the European Commission on June 26th after being approved by the five ministries involved.

The scope of application of the EDS is the entire end-use of energy in Finland, excluding maritime traffic, air traffic and industrial sites within the scope of the emissions trading scheme (ETS sites).

NEEAP presents descriptions on the various energy end-use sectors and some background information relevant in relation to their energy use. For each sector, this is followed by descriptions of those energy efficiency improvement measures (Table 7) in place. Measures for which the energy savings have been calculated and included in the overall savings are underlined. For non-underlined tasks calculations on energy savings cannot yet be carried out.[9]

Households	Law (1241/1997) on the energy efficiency of household appliances
	Energy Labeling
	Household tax deduction
Buildings and construction	Building code 2003
	Subsidy scheme on apartment buildings
	Subsidy scheme on detached and semi-detached houses
	Voluntary agreements on energy efficiency (AESS)
	Höylä I, II and III programmes for oil-heated houses
	Procurement competition "Renovation window"
	Voluntary energy labeling for windows
	Energy Expert training scheme
	Heat-pumps in detached houses
	Low energy buildings
	Energy audits in the residential sector
	Energy certification (2002/91/EU)

[9] Finland's National energy efficiency plan (NEEAP 2008_2010)

	Promotion of radiator network balancing
Public sector/municipalities	Subsidy scheme on energy efficiency
	Energy audits in municipal public buildings
	Voluntary agreements on energy efficiency (KUESS/KEIS)
	Training campaign for maintenance personnel
	Training campaign for civil servants and elected officials
	EPC projects in municipal buildings
Public sector/government entities	Energy audits in government buildings
Private services	Subsidy scheme on energy efficiency
	Energy audits in private sector buildings
	Voluntary agreements on energy efficiency (KRESS)
	Environmental labeling scheme for buildings (PROMISE)
	Improving energy efficiency in cooling systems (KYTE)
Industry	Energy efficiency requirement in the environmental permit
	Subsidy scheme on energy efficiency
	Energy audits in industry
	Voluntary agreements on energy efficiency (TESS)
	EPC projects in industry
	Improving energy efficiency in compressed air systems (PATE)
Transportation	Government Degree on the obligation to present the fuel consumption and CO2-emissions of new cars (1247/2002)
	Wintertime speed limits
	Agreement on improving the fuel efficiency and reducing the CO2-emissions of new cars (EU agreement)
	Voluntary agreement on energy efficiency/Truck and van transport sector
	Voluntary agreement on energy efficiency/Public transport
	Ecodriving training for passenger car drivers
	Optimal tire pressure in passenger car and van traffic
	Guidelines on environmental and energy efficiency aspects in procurement of transportation services
	Traffic system planning
Agriculture	Subsidy scheme on energy efficiency

Energy sector	Voluntary agreement on energy efficiency/Power plants
	Voluntary agreement on energy efficiency/Elect. Transmission and distribution
	Voluntary agreement on energy efficiency/District heating
	Informative billing
	Promoting fuels switch from oil to district heating
	Customer advise
Horizontal measures	Energy taxation
	National Energy Agency Motiva
	Regional Energy Agencies
	Energy performance contracting
	Energy efficiency as a purchase criteria
	Information campaigns
	Regular monitoring of energy consumption

Table 7: Energy efficiency improvement measures in Finland[10]

Finland's overall 9 % indicative target for energy savings is 17 800 GWh. Through the actions currently known and adhering to the general framework of measuring and verifying energy savings set out in Annex IV of the ESD, the energy savings of 2016 will be 12,707 GWh, corresponding to approximately 71% of the total target. Table 8 shows the savings effects by sector achieved by the 14 most significant energy efficiency actions for which it has been possible to make an effectiveness assessment on the basis of the initial data available. [00]

Sector	2007 GWh	2010 GWh	2013 GWh	2016 GWh
Households				
Buildings	3,960	5,934	7,863	9,573
Public sector/municipal sector	84	69	66	66
Public sector/state administration				
Private services sector	144	90	102	102
Industrial sector	1,286	1,307	743	640
Transportation	869	1,142	1,299	1,387
Agriculture	480	659	809	938
Energy sector				
Horizontal				
Total savings	**6,824**	**9,201**	**10,882**	**12,707**

[10] The executive summary of Finland's national energy efficiency action plan (NEEAP 2008–2010) 26.6.2007

Table 8: Summary of savings effects by sector (GWh/a). [0]

The new extensive energy conservation agreement scheme is a major new action for the period 2008–2016. According to Annex II of the ESD, the Member States may apply a default co-efficient of 2.5 for savings in electricity. The division between heating and electricity has not been made yet for all actions presented in this action plan or their effects. On average, savings in electricity have accounted for 20% of the total savings in Finland. Applying on this basis the default co-efficient 2.5 set out in the ESD to the energy savings of other sectors excluding the transportation sector, the savings effect presented in Table 8 increases to 16,100 GWh, and, when the effect of the new energy efficiency agreements referred to above is taken into account, to 19,400–22,200 GWh. [0]

4.2 France

Some organizations are working for the implementation of building code in France. A more complete list is available with the document, and on these fallowing links:
http://www.buildingsplatform.org/cms/index.php?id=152
http://www.buildingsplatform.org/cms/index.php?id=37

Only a short list is presented here:
Ademe : http://www2.ademe.fr/servlet/getDoc?id=38480&m=3&cid=96
ADUHME - Agence Locale des Energies Clermont-Ferrand/Puy-de-Dôme : Clermont-Ferrand : www.aduhme.org
Réseau des Agences Locales de Maîtrise de l'Energie Grand Lyon et quelques communes limitrophes : Lyon : www.aduhme.org/ale/
FLAME - Fédération des agences locales de maitrise de l'énergie : Lyon : www.aduhme.org/flame
AILE - Association d'Initiatives Locales pour l'Energie et l'Environnement : Rennes : www.aile.asso.fr
ALE - Agence Locale de l'Energie de l'Agglomération Lyonnaise : Lyon : www.ale-lyon.org
ALE 08 - Agence Locale de l'Energie des Ardennes : Charleville-Mézières : www.ale08.org
ALECOB - Agence Locale de l'Energie du Centre-Ouest Bretagne : Carhaix-Plouguer
ALME - Agence Locale de l'énergie Mulhouse Sud Alsace : Mulhouse : www.alme-mulhouse.fr
ALME-SQY Agence Locale de Maîtrise de l'Energie Saint-Quentin-en-Yvelines : Magny Les Hameaux : www.energie-sqy.com
Agence Locale de l'Énergie de l'agglomération Grenobloise : Grenoble : www.ale-grenoble.org
ARD - Agence Régionale de Développement du Limousin : Limoges : www.ard-limousin.fr
ARER - Agence Régionale de l'Energie de la Réunion : Saint Pierre : www.arer.org
Clé - Conseil Local à l'Energie de Rennes : Rennes : www.conseil-local-energie.com
EE74 - Energies Environnement 74 : Meythet : www.ee74.info
ENER'GENCE - Agence de Maîtrise de l'Energie de Brest et sa région : Brest : www.energence.infini.fr
Heol - Agence Locale de l'Energie du Pays de Morlaix : Morlaix
LATERE - Loirénergie, Agence Technique pour une Energie Respectueuse de l'Environnement : Saint-Etienne : www.latere.org
MVE - Agence Locale de l'Energie de l'Est Parisien : Montreuil : www.agence-mve.org

This list was complete in 2006, for more information it can be useful to look on this website : http://www.managenergy.net/

4.3 Germany

According to Article 14(2) of the Directive, Member States shall submit their first National Energy Efficiency Action Plan (NEEAP) to the Commission by June 30, 2007. In their NEEAPs, Member States show how they intend to reach the 9% indicative energy savings target by 2016. For Germany, this is means a target value of 833 PJ or 1080PJ if greater, i.e. primary energy-related, saving is assumed in the electrical sector. The target value for the year 2010 is approximately 61% of the target value for 2016.These target will be primarily achieved through the provision of 3energy services and energy efficiency measures by private industry, but also through measures initiated by State.

The measures include the contribution to savings made by providers of energy efficiency measures, energy distributors, distribution systems operators and energy retailers, final customers/plants that have not hitherto been affected by the emission trading system. The parts of the action plan are included end energy use to improve and develop and promote energy service market.
The parts are:
- Measure must be focused on sectors and end energy uses with a high, absolute, final energy savings potential, which can be realised economically,
- The structure and expansion of the range of services concerned with the efficient use of heat, energy and lighting for final customers,
- The expansion and creation of markets and increasing he sale of energy-efficient products, techniques and processes,
- Strengthening the marketing proposal, including financing of energy-efficient products, techniques and processes,
- The provision of qualified information, target group-oriented consultations and audits, as well as the development and stipulation of standards and norms which support the abovementioned activities, simplify their broad application and motivate the actors,
- The utilisation of synergy effects by networking the market actors with regard to the drawing up and implementation of measures.

The German Federal Government has evaluated some measures of the target.

- A district tightening up of the energy requirements of buildings about 3 % in 2009 to previous 2007,
- The consolidation and launch of different funding programmes in order to mobilise cost-effective potential efficiencies in industrial, household, agriculture and forestry, trade, service and transport sectors,
- CO2 building Redevelopment Programme and extension of the circumstances in which funding,
- Increase investment in energy efficient of public buildings (presentation of the Energy Certificate),
- The procurement of energy-efficient products and services which form the basis of the Federal Government's procurement decisions,

- The liberalisation of electricity metering is to be the precondition for the rapid circulation of smart metering,
- Incentives to replace night-time electric storage heaters (EnEV 2009),
- Energy saving contracting in the residential building sector,
- Improving the energy consumption labelling of private cars
- Calling for the immediate stipulation of standards relating to equipment and products in the context of the transposition of the Eco-design Directive and the improvement in energy consumption labelling,
- Embarking on a technology programme entitled ”climate protection and energy efficiency”,
- Extending energy research in the sphere of improving energy efficiency in the building sector, in industry and in the trade, industrial and service sectors.

For the statistical evaluation of the energy saving a calculation model was created. In this regard, two different calculation methods of calculation are combined, namely the Bottom-up method (the success of individual energy efficiency measures is calculated and assessed retrospectively) assessed retro and the Top-down method for the saving. 2 national workshops was arranged in 2006 and 2007and a final report of the Fraunhofer Institute for Innovation System- Fraunhofer ISI was created to statistical-methodical questions of end energy efficiency und energy services.

Finally, the Directive calls to ensure that "final customers for electricity, natural gas, district heating and/or cooling and domestic hot water are provide with competitively-priced individual meters which accurately reflect the final customer's actual energy consumption and provide information on actual time of use. Even if these individual meters are available in Germany, taking into account technical opportunities currently available and the liberalisation of metering, the question nevertheless arises as to whether additional energy savings are possible through the targeted use information and communication technologies in metering. The Federal Ministry of Economic Affairs and Technology, which is in overall charge in this respect has started numerous initiatives in this regard.

4.4 Greece

Member States shall adopt and aim to achieve an overall national indicative energy savings target of **9 %** for the ninth year of application of the Directive to be reached by way of energy services and other energy efficiency improvement measures. MS shall take cost-effective, practicable and reasonable measures designed to contribute towards achieving this target.

CRES formulates the NAP for Energy Performance and Energy Services, according to directive 2006/32/EC **of the European Parliament and of the Council on energy end-use efficiency and energy services**, on behalf of the Ministry of Development.

The bottom-up approach to be followed shall have a time-scale of **9** years, it shall be broken down by sector and by use and shall be compliant with the general framework of energy saving measures set out in Annex IV to Directive 2006/32/EC.

Compiling the EEAP as stipulated in Articles 4, 5 and 14 of the Directive, entails carrying out studies and calculations.

Technical Content

1. Collection and analysis of energy data and determining a national target for energy savings in GWh
2. Analysis and forecast of growth in end-use demand for energy by sector and use
3. Available energy technologies and forecast of technological development
4. Determination of economic potential for energy savings and planning of measures to improve energy end-use efficiency
5. Determination of intermediate national target

4.5 Italy

The Dlgs. that implements Directive 2006/32/EEC on the end-use efficiency of energy and energy services, and that repeals Directive 93/76/EEC has been approved on 27 February 2008 by the Council of Ministers.
However, with the fall of the government and the cycle of elections and entry into force of the new government, this proposal of law has been placed on hold and is currently under review.

4.6 Netherlands

In 2006 the Energy Services Directive of the EU came into effect. In the context of this directive the energy monitoring of the Member States is further developed and harmonized. To make the Dutch monitoring system suitable Economic affairs ordered SenterNovem and ECN to set up a system for monitoring, evaluating and reporting of energy efficiency and savings in the Netherrlands in accordance with European requirements. This project consists of the following 4 components:

- Exploration of the available data and possible bottlenecks
- Establish a data collection plan
- Develop a data processing and reporting structure
- Adjusting the sectoral calculation models of ECN

The ESD will be implemented within the Dutch legislation soon

More information can be found at:

• Website: http://www.senternovem.nl/monitoring_energie_efficiency
• Contact: Dick Both, SenterNovem, Utrecht, telefoon: 030-2393429

4.7 Poland

In June 2007, Poland has prepared the first Energy Efficiency Action Plan (EEAP) thus fulfilled obligation stated in Article 14 point 2 of ESD.
As for February 2009, Polish Ministry of Economy has prepared a project of Energy Efficiency Act, which will fully implement Energy Saving Directive (2006/32/WE) on energy end-use efficiency and energy services in Poland. Afterwards the act project needs to be consulted socially and among government departments and then has to be voted by Polish parliament. The legislation is planned to come into force on January 1st, 2010.

4.8 Slovenia

Republic of Slovenija, together with 19 other countries, has received a warning letter from the EU Commission, whereas has not transferred Energy service directive in the national legislation. (29. 01. 2009)

4.9 Spain

The ESD requires to Member States to adopt and aim achieving an overall national indicative energy savings target of 9 % for the ninth year (2006 yr) of application of the Directive.

In order to achieve such a goal it establishes that action must be developed. The first action plan should have been released for 30th June 2007 and should have contained an intermediate national realistic indicative energy saving target for the third year of application of the Directive, and provide an overview of its strategy for the achievement of the intermediate and overall targets.

In order to comply with the requirements The Spanish Ministry of Industry, Tourism and Trade has released in 17th July 2007 the first action plan for 2008-2012. The energy saving objectives established in this action plan exceed the objective established in the Directive (9% for the year 2016), achieving a saving of 11% in the very year 2012.

The action plan contains a description of the measures to take and the economical cost of each measure. The measures are divided in the following topics:
- Agriculture and fishing

- Industry
- Public services
- Equipments
- Buildings
- Energy transformation
- Transport

5. Details on Energy Efficiency, RES and Energy Storage for new construction and for retrofitting of existing buildings, within the national codes

5.1 Finland

The existing building regulations given in the National Building Code of Finland under the Land Use and Building Act were amended by the Ministry of the Environment in order to comply with the directive. These building regulations deal with the calculation methodology and the minimum energy performance requirements, thus implementing Articles 3–5 of the EPBD. The amended building regulations were issued as decrees by the Ministry of the Environment in June 2007.

- Thermal insulation in a building (C3), Regulations 2007
- Energy performance of buildings (D3), Regulations and guidelines 2007
- Calculation of energy consumption and heating power demand of buildings (D5), Guidelines 2007
- Indoor climate and ventilation of buildings (D2), Regulations and guidelines 2003 (no EPBD-required amendments)
-

The new requirements are mandatory for building permits requested after 1 January 2008. The energy requirements are the same for all new buildings and include

- The requirement on maximum heat losses of the whole building (building envelope, ventilation and infiltration)
- The reference U-values and maximum U-values
- The reference value for the efficiency of the heat recovery from the exhaust air (yearly efficiency 30%)
- The reference value for the air-tightness of the building (n50= 4 1/h)
- The requirement on calculation of the energy demand of the building per m² of floor area (calculation has to be done, but there is no requirement for the level of energy demand)
- The control of summertime room temperature (the temperature has to be estimated when relevant)

The energy requirements will be amended again, in order to tighten the requirements by 30–40%. In June 2008 new proposals for the building regulations have been sent for public opinion. After the process is completed, the new requirements will be published in the National Building Code and will come into force at the beginning of 2010.
In renovations, the National Building Code is applied in accordance with the Land Use and Building Act, Section 13: "The regulations in the Building Code concern the construction of new buildings. Unless otherwise specifically prescribed by the regulations, they are applicable to renovation and alteration work only in so far as the type and extent of the measure and a possible change in use of the building or

part thereof require". The legislation allows the local building supervision authorities to decide whether the building regulations will be applied to the renovation or not. [11]

Voluntary energy saving agreements improve energy efficiency in the household and service sectors. An agreement with the Finnish Association of Building Owners RAKLI was signed in 1999, and extended in the autumn of 2002 to cover also public sector real estate. The extended agreement for public property units signed in 1997 and expired at the end of 2002. A new Energy Efficiency Agreement and an Energy Efficiency Programme for the municipal sector have been launched for the 2008-2016 period. The Ministry of Employment and the Economy provides support for energy audits, analyses and energy conservation investments eligible for subsidies and conducted by companies and communities adhering to the agreement.

The integration of renewable energy sources into energy audit activity and investigation of suitable pilots began in 2001. In October 2002 the first training course on integrating RES in energy audits for auditors was organized. 00
New Höylä III Energy efficiency agreement was started in 2008. The aim of this agreement is to combine the use of bio-fuel oil and other renewable energy sources in both existing and new oil-heating systems in a manner that is economical and has positive environmental impacts. The aim is for bio-fuel oil to account for 2 per cent of all liquid heating fuel deliveries in 2009, and 10 per cent in 2016. The aim is to increase the proportion of solar-heating systems connected to oilheating systems so that in 2016, a total of 20 per cent of all boiler replacements and installations of new heating systems would also involve the connection of a solarheating system to an oil-heating system. The amount of heat pumps is fast increasing and over 150000 heat pumps were installed in Finland in 2008.[12]

5.2 France

The French building code give the details values that need to be respect for new construction and for retrofit existing building.
Information can be found on the links

- http://www.industrie.gouv.fr/energie/developp/econo/batiments.htm
- http://www.rt2005.com/sw11076.asp (official text)
- http://www.logement.gouv.fr/recherche.php3?recherche=RT2005&valid_rech.x=0&valid_rech.y=0&valid_rech=Valide+la+recherche (official text)
- http://rw-france1.inforce.dk/graphics/Design/RT2005/Pdf/RT2005%20Arr%EAt%E9%20du%2024%20mai%202006.pdf

[11] Ministry of Justice - Finlex, Copyright Edita Publishing Ltd
Ministry of the Environment - Land use and building legislation
[12] Motiva

5.3 Germany

From thermal solar collectors, PV to biomass boilers, from cogeneration to heat pumps, a broad range of renewable energy systems can only be used efficiently, when storage is an essential part of the delivery system. Also the technologies available for storage are very diverse. The storage systems can be used in new or refurbished buildings in connection with the RES.

Thermal Storages
Heat storage is an enabled technology. Without it, renewable heating would not be possible, although heat storage is an impact on the amount of renewable energy generated in the house, the city or the country. With effectiveness of heat storage the efficient energy recovery of RES can be increase. Advanced heat storage technologies allow storing summer solar heat for winter, raising the solar fraction to 100 %. Thermal energy storages are the keys to increase the energy efficiency and to reduce the primary energy demand.
Diverse technologies, such as hot water tanks with a volume to 3000m³, earth storage filled with gravel and water, tanks with phase change materials and sorption storages were developed in the last years.
Various storage technologies were researched successfully in a lot of demonstration projects but the research and development of profitable and long-term stable systems and materials is not closed today. The Status Seminar in 2006 had given a review about the state of technology of thermal energy storages, systems, materials and energy concepts with thermal storages. In a book of abstracts most of the research projects, which are supported by the Federal Ministry of Economic Affairs and Technology, demonstrate the results of the developments.
As described in chapter 1 various ordinances and acts exist in Germany for using energy saving and renewable energies. In the calculation ordinances of energy demand for Buildings DIN 4108, DIN 4701-10 and DIN 15899, the heat storages are integrated in the calculation of the energy demand, if it is possible.

Storage for Power
Electrical storage in buildings is not as common as thermal storages. Usually electrical storages are used in buildings which are not connected with the grid-network. Other fields of application are in systems with small power rations, e.g. telecommunication systems, back-up systems or in vehicles. Various systems of batteries can be used. Other systems to store electricity are the use of hydrogen as a chemical storage in combination with a full cell and a flywheel. Research and technology works are necessary to improve the efficiency of these technologies.

Lead acid battery

In energy management lead acid batteries are often used as electrochemical storage because of their high reliability, their low invest costs, low self discharge and the long-time experience with lead acid batteries[13].
For lead acid batteries following guidelines have to be considered: the connection, the arrangement in a building, the danger of explosion, handling and servicing. These are listed in the standard EN 50272-2 „Safety requirements for secondary batteries and battery installations.

Stationary batteries
Applications for lead acid batteries are:
- Telecommunication systems - Back-up systems - Starter batteries - Photovoltaic hybrid systems - Uninterruptable power supply - Safety lighting
Several research activities are going on in lead acid batteries materials. For the application in hybrid vehicles carbon was added to the negative electrode, which is showing promising results[14].

Batteries based on nickel
There are two significant types of nickel-based batteries: the traditional NiCd-battery and the newer NiMH-battery. However there are other nickel systems, but they play a secondary role[13].
For the handling of nickel based batteries the standard EN 50272-2 is valid.
NiCd-batteries have good mechanical stability, long life-cycle and good low temperature proprieties. Compared to lead acid batteries NiCd-batteries are not damageable against deep discharge. The disadvantage is the low energy efficiency, which is between 61 and 73 percent.
NiMH-batteries have a higher performance, a higher capacity and are more environmentally compatible than NiCd-batteries. Disadvantages are high costs, a low potential for decreasing costs and they are more temperature-sensitive as NiCd-batteries[13].
Nickel-based batteries where used in:
- Telecommunication systems - Safety lighting and alarm systems - Uninterruptable power supply

Lithium battery
Because of the high gravimetric energy density Lithium accumulators are used in mobile applications[13]. Lithium can also be used as a short-time storage.
Lithium batteries must have a safety circuit to avoid the so-called thermal runaway.
The standard DIN EN 91960 describes the design, marking, electrical testing und testing protocols for lithium batteries.

[13] Vetter M., Schwunk S., Schossig P., Bobb G., Einergiespeicher für Verteilernetze Teil2, Fraunhofer Institut für Solare Energiesystem ISE, Heidenhofstr 2, 79110 Freiburg
[14] Jossen A, Dörring H., Batteriesysteme – Stand der Technik, Elektrische Energiespeicher Schlüsseltechnologie für energieeffiziente Anwendungen VDI Berichte 2058 25.03.2009 Fulda

The main application of lithium batteries are mobile devices like cameras or cell phones. Nowadays there are researches for mobile vehicles. Also there are researches on off-grid and on-grid photovoltaic hybrid systems.

Redox flow batteries

Redox flow batteries consist of a stack, pumps and tanks. The stack limits the power of the system. The electrical energy turns into chemical energy as solved redox pairs in the stack. This process is reversible. The two tanks store the chemical energy[15]. Instead of other electrochemical batteries the power is not depending on the capacity of the system. With variation of the tank volume the redox flow system can be used as long-time or as short-time storage. Redox flow batteries have nearly no self discharge over a long period.
The Austrian manufacture Cellstrom offers a 10 kW/100 kWh system.
Redox-flow batteries are use for:
- Telecommunication systems - Uninterruptable power supply - Photovoltaic hybrid systems - Better grid quality - Avoiding grid expansion
There are no standards existing for redox-flow storage systems. In principle redox-flow systems are protected against polarity reversal and they can be deep discharged without getting damaged. Redox-flow batteries need a collection tray, a leakage sensor and a hydrogen sensor.
Nowadays the vanadium redox-flow system is the most researched redox-flow system. The advantage of the vanadium system is that a crossover of the electrolyte only causes self discharge but not aging the electrolyte. However other redox pairs have a higher specific energy[16].

Hydrogen storage systems

Electrical power is stored as chemical power in hydrogen storage systems. Hydrogen must be stored in tanks. If required the hydrogen can be turned into electrical energy through fuel cells or gas engines. By connecting in serial the electrolysis, the tank and the fuel cells / gas engine the storage system has low energy efficiency. By separating the tank and power unit the dimensioning of the power to capacity is variable.
Hydrogen storage systems are used as
- Uninterruptable power supply - Photovoltaic hybrid systems - Avoiding grid expansion
Fuel cells are used as stochastic energy sources in PV-hybrid systems as battery charger in battery banks.

Flywheel

A Flywheel stores kinetic energy via a fast rotating mass. The amount of energy in the systems depends on the velocity of the flywheel. In case of discharge the kinetic

[15] Vetter M., Schwunk S., Schossig P., Bobb G., Einergiespeicher für Verteilernetze Teil2, Fraunhofer Institut für Solare Energiesystem ISE, Heidenhofstr 2, 79110 Freiburg
[16] Jossen A, Dörring H., Batteriesysteme – Stand der Technik, Elektrische Energiespeicher Schlüsseltechnologie für energieeffiziente Anwendungen VDI Berichte 2058 25.03.2009 Fulda

energy is transformed into electric energy by a generator. The self discharge of a flywheel is about 20 % per h[17]. That is the reason why flywheels are not used as long-term storage.
Nowadays the process is optimized for higher specific energy density, energy efficiency and long life-cycle[18].An important factor in a flywheel is the bearing. The bearing influences the long life-cycle and the energy efficiency. Today, emphasis on research is on magnetic bearings.
Applications of flywheels are uninterruptable power supply or a better grid quality. Due to the fast supply of power flywheels are predestined for power blackouts in sensitive industrial sectors[18].

5.4 Greece

Energy storage is not taken into account in the Greek national code. However, the energy aspects which are mentioned in the code are:

- Transmission related flows
- Ventilation related flows
- Internal gains
- Solar gains
- Lighting related energy flows
- Heating and cooling systems
- Losses of heating/cooling distribution
- Domestic hot water
- Renewable energies: thermal/electrical

The minimum requirements set by the EPBD and the Greek national code are:

- Insulation levels for walls, roofs, floors
- Window U-values
- Air flow rate
- Access to natural light
- Efficiency to heating/cooling units
- Insulation of domestic hot water tank
- Installed lighting power

Regarding innovative systems

[17] Hadjipaschalis I., Poullikkas A., Efthimiou V., Overview of current and future energy storage technologies for electric power applications, Electricity Authority of Cyprus, P.O Box 24506, 1299 Nicosia, Cyprus
[18] Werfel F. N., Batteriesysteme – Stand der Technik Elektrische Energiespeicher Schlüsseltechnologie für energieeffiziente Anwendungen VDI Berichte 2058 25.03.2009 Fulda

- Innovative systems are considered only if recognized laboratories certify their performance
- A reference framework that allows comparing the standard solutions with innovative ones is not yet determined.

Compliance

- An energy inspection is a part of the procedure. This inspection confirms the results of the performed Energy Study by analyzing the real behaviour of the building
- The proposed procedure includes the verification of the energy study one year after the operation of the building and after that systematically. For the existing buildings the regulation will be mandatory six years after the activation of the regulation.

5.5 Italy

In addition to the specific Decrees mentioned above, there are a whole series of technical standards (list of UNI codes) regarding the use of materials, procedures and rules to follow in carrying out installations that provide an adequate containment of energy consumption. Among these, it is the Decree 37/2008 regarding the installation of systems in buildings.

The use of renewable sources in the new construction is one of the forms for the rationalization and containment of the energy needs in buildings. The rules for promotion of renewable energy are contained in the Decree 387/2003 implementing Directive 2001/77/EEC. In order to encourage the installation of such facilities, the Authorization is subject to a simplified procedure of regional competence (or delegated authority) and even the 2008 and 2009 Financial Acts introduced the possibility for the responsible Municipality to present a simple DIA (activity opening statement) in order to implement certain categories of plants below certain thresholds for example photovoltaic plants up to 20 kW.

In addition the Finance Act 2008 and 2009 increases the amount of renewable energy that new buildings must use: starting from January 1st 2009, to have a building permit, the installation of systems for the production of electricity from renewable sources must be provided.
This adds up to the 55 % tax reduction for upgrading energy efficiency in existing buildings, the reduction of ICI (cadastral tax) for dwellings that will install plants using renewable sources, incentive fares of the Statement of Energy, encouraging the use of district heating for individual homes or the entire neighbourhood, incentives for the purchase of high efficiency lamps and engines to reduce power consumption.

5.6 Netherlands

The national building codes EPN and EPG take into account energy savings measures (e.g. insulation, energy efficient windows, heat recovery from ventilation air and waste shower water) as well as RES (e.g. PV, solar thermal and heat pumps). Application of these measures reduces the EPC. Energy storages are not a direct part of the EPN/EPG and their EPC, but they do play a role in making a building zero-energy and zero-emission. New energy saving measures and RES, not (yet) described in the EPN/EPG can still be considered through a declaration of conformity (in Dutch gelijkwaardigheidsverklaring) creating justice for new developments.

For further information, alternative related codes, projects, and regulations:
- ATHENA (Canada) LCA assessment tool
- BEQUEST (EC) assessment of buildings project
- BREEAM (United Kingdom) building rating system
- CASBEE (Japan) building rating system CENTC350 sustainability of construction work
- CENTC351 release of dangerous substances of construction products
- CRISP (EC) assessment of buildings project
- ECO-BAU building rating system
- Eco-Housing (EC) assessment of buildings project
- ECO-PRO (Germany) LCA assessment tool
- Eco-Profile (Norway) building rating system
- Eco-Quantum (Netherlands) LCA assessment tool
- EcoEffect (Sweden) building rating system
- EN13790 energy performance calculation
- ENVEST LCA assessment tool
- EQUER (France) LCA assessment tool
- ESCALE building rating system
- GPR (Netherlands) building rating system
- GreenCalc (Netherlands) LCA assessment tool
- HQE (France) building rating system
- LEED (USA) building rating system
- LEGEP LCA assessment tool
- LEnSE Buildings (EC) assessment of buildings project
- PRESCO (EC) assessment of buildings project
- SUSCON (Greece) LCA assessment tool
- VALIDEO (Belgium) LCA assessment tool

5.7 Poland

"Decree on technical requirements that ought to be met by buildings and theirs location" forms few obligations:

- §118.3 In order to increase energy efficiency of domestic hot water preparation, all circulation pipes of water installation have to be thermally insulated in a proper way.
- §151.1 Every supply-exhaust ventilation installation or comfort air-conditioning system with total air flow 2000 m³/h and more, shall be equipped in heat recovery proving efficiency not less than 50% or shall realize recirculation strategy with at least 10% of total volume flow.
- All appliances installed in buildings, as fallows: domestic hot water appliances (§118.2), heating appliances (§134.3) and ventilation and air-conditioning appliances (§147.4) shall fulfil requirements described in separate regulations – "Decree on requirements of energy efficiency".

"Act on support for thermo-modernization and renovation" explains technical conditions that need to be met in order to receive a financial support for a building renovation. General rule is that planned modernization has to result in described percentage of building energy demand reduction (10, 15 or 25%). Grant may also be received if energy source of local district heating system is changed to RES or highly efficient cogeneration.

There are no legal regulations directly concerning energy storage in buildings, implemented in Poland.

5.8 Slovenia

Regulations on energy efficiency in buildings (93/08)
II: Technical requirements for energy efficiency use in buildings
Article 5: (types of technical requirements)
(1) Technical requirements for energy efficiency use in buildings are divided into basic and additional technical requirements
(2) Basic technical requirements are expressed by:
-allowable heat losses and power of heating devices and air-ventilation devices,
-permissible thermal stresses and power of cooling devices,
-mandatory installation of RES devices,
-compulsory production of the statement of the heat characteristics of building

Article 8: (use of renewable energy sources)
(2) At least 25% power for heating, ventilation, cooling and hot water preparing must be ensured by RES:
- environmental heat,
- solar irradiation
- geothermal energy,
- wind energy,
- connection to the devices for heat or cold generation from RES

These requirements are also complied in the following cases:

- for solar collectors: A(SC) = 4 + 0,02 Au (m2) of bright surface, with annual return minimum 500 kWh/m2a for each square meter of usable area of building Au, but minimum 6 m2 per dwelling unit, together with the heat reservoir (minimum 25 l/m2)
- for PV modules: minimum 5 W for each square meter of usable area of building Au, with nominal efficiency of the system 12,5%
- if it is built natural-ice reservoir or system for active natural cooling which provides minimum 25% of total needs for cooling.

Rules on the methodology and study feasibility of alternative systems for the supply of buildings with energy (35/08)

Mandatory for buildings with nett usefull plan area 1000 m^2 or more.
Alternative systems for the supply of buildings with energy are:

- decentralized systems on the RES basis,
- cogeneration of heat, cold, electricity in different combinations,
- district or common heating or cooling
- heat pumps

Rules on the promotion the use of renewable energy sources

State aids for projects which allows:

- efficient use of energy,
- use of RES,
- efficient use of energy and use of RES
- production, distribution and use of hydrogen

National action plan for energy efficiency for the period from 2008 to 2016

- review of instruments for household
  - financial incentives for energy efficient renovation and sustainable buildings (low energy houses, passive houses, energy efficient renovation)
  - financial incentives for energy efficient heating systems (more efficient boilers, boilers to biomass, optimization of heating systems, use of solar systems or/and hat pumps for heating)
  - financial incentives for energy efficient use of electricity (energy efficient household appliances, energy efficient lighting, intelligent meters for households)
  - households with low income efficient use of energy scheme (achieve the minimum standard for the renovation, energy efficient lighting and other measures)
  - energy labelling of household appliances
  - mandatory cost sharing by actual consumption in multiple apartments
  - energy support web for citizens (energy consulting)

Estimated savings in 2016: 1165 GWh, 120 M Euro

- review of instruments for tertiary sector (public sector, services, craft, agriculture)
  - financial incentives for energy efficient renovation and sustainable buildings (low energy houses, passive houses, energy efficient renovation)
  - financial incentives for energy efficient heating systems (more efficient boilers, boilers to biomass, optimization of heating systems, use of solar systems or/and hat pumps for heating)
  - financial incentives for energy efficient use of electricity (energy efficient household appliances, energy efficient lighting, intelligent meters for households)
  - green public contracting

Estimated savings in 2016: 804 GWh, 109 M Euro

5.9 Spain

Energy Saving and Efficiency Plan 2008-11 – 2008 to 2011
€245m per year from 2008 to 2011; proportion on measures for buildings unknown

The Spanish government on 1 August 2008 approved the Spanish Industry Minister's 2008-2011 energy saving and efficiency plan announced two days earlier. The plan contains 31 recommendations aimed at reducing carbon dioxide emissions and saving EUR 4.14 billion in oil imports, or 47 million barrels per year over four years. The new plan will cover the transport, industrial, residential, tertiary and agricultural sectors. Measures follow four lines of action: transversal measures, mobility, buildings and energy savings.

Transversal measures:

- Encouraging the development of Energy Service Companies (ESCOs), through ensuring legal protection of these companies, providing financing and offering public contracts;

- Giving an advantage to certified energy companies (those with a certificate issued by Spain's standardisation and certification organisation AENOR) in public contracts;

- Doubling the budget for the government's Institute for Energy Saving and Diversification (IDEA) to EUR 120 million in order to support strategic projects by large companies and industrial groups;

- Agreements signed in the course of 2008 with Consumer and User Boards for these associations to carry out training and information campaigns on energy-saving measures and benefits.

Mobility:

- In collaboration with the autonomous regions and local authorities, a pilot project will be carried out to demonstrate the technical, energetic and economic viability of electric vehicles. The goal of this project, with the agreement of the automobile sector, will be to have one million electric or hybrid vehicles by 2014;

- The Spanish general administration will establish preferential criteria within the public contracting procedures for energy efficiency Class A passenger vehicles. In addition, by 2009 the public vehicle pool will be required to use a minimum of 20% biofuels.

- The necessary regulations will be developed to ensure the objective of 5.83% biofuels in automobile fuel consumption is met by 2010;

- Establishment of the VIVE (Vehículo Innovador - Vehículo Ecológico, Innovative Vehicle - Ecological Vehicle) Plan, to be in effect until 2010. VIVE will replace nearly 240 000 vehicles over 15 years old;

- Vehicle manufacturers will be required to inform consumers on the emissions and energy consumption of new vehicles for sale by means of a comparative energy label;

- A proposal will be presented to reduce by an average of 20% the speed limits entering large cities and on city ring-roads and high-capacity roads;

- Campaigns are to be conducted, notifying and informing citizens about efficient driving techniques, such as the importance of tyre pressure for fuel consumption;

- A special line of credit will be negotiated with the European Investment Bank to support sustainable urban mobility plans, enabling cities and towns to improve public transport systems, seek alternative routes, buy efficient vehicles, etc. Energy efficiency criteria will also be included in determining the Spanish administration's contribution towards financing public transport with City Councils;

- Mobile telephone network operators will be required to guarantee coverage on underground public transportation networks in all Spanish cities;

- Agreements are to be reached with autonomous regions and local authorities to extend the underground public transportation operating hours on the weekend;

- Promotion of bicycle use through agreements with local authorities, supporting the implementation of public-use bicycle systems and urban cycling lanes;

- In cities with populations of over 500,000, lanes reserved for collective passenger transport, known has HOV lanes, will be established by 2012;

- The Spanish general administration will put in place worker mobility plans for centres with over 100 employees, including establishing bus routes based on the workers' places of residence ;

- Air routes will be optimised using the Ministry of Defence's air corridors, reducing the length of the commercial air routes by up to a maximum of 10%;

Buildings:

- Establishing temperature limitations for air-conditioned non-residential and public buildings, excluding hospitals and centres that require special environmental conditions. Minimum temperature for the summer will be 26 degrees Celsius, and maximum temperature for the winter will be 21 degrees Celsius;

- A portion of the existing line of credit for renovating tourism infrastructures, totalling EUR 500 million in 2009, will be set aside to finance investments that promote energy savings in these facilities;

- The Royal Decree on Energy Efficiency in New Buildings will be modified so as to require new Spanish general administration buildings to achieve a high energy rating.

Energy saving measures:

- Work will be carried out with the European Commission to move forward the date for completely eliminating low-efficiency light bulbs from the market, to 2012;

- As part of this phase-out, all homes will receive a free low-consumption light bulb voucher in their next electricity bill, to be exchanged in stores. The measure cost will be EUR 105 million and will be repeated in 2010. Almost 49 million free energy saving bulbs will be distributed. The programme will be undertaken in cooperation with manufacturers. As a complement, 6 million

energy saving light bulbs will be distributed through a 2x1 programme for the voluntary replacement of incandescent bulbs.

- The Spanish general administration will be required to reduce energy consumption by 10% in the first half of 2009 compared to energy consumed the same period in 2008. This level of savings will be maintained permanently throughout the three-year period.

- Improved efficiency of public exterior lighting installations, and a 50% reduction in the energy consumption of highway and motorway lighting;

- Establishing a regulation to enable the urban and interurban railways to compensate the electricity recovered through braking on their electric bill.

Most of the 31 measures are recommendations and rely on the cooperation of local and regional authorities, as well as the citizens themselves.

Grants for Energy Efficiency in Buildings – 2008 to 2012
€1bn from 2008 to 2012

In December 2007, the Spanish government announced that it would provide 1 billion euros worth of subsidies for the refurbishment of existing residential buildings between 2008 and 2012, together with 2 billion euros in credit for energy efficiency improvements to homes. Additionally, the government said it would provide 200 million euros for energy efficiency improvements to schools and public buildings in large towns and cities.

Building Technical Code / Solar Panel Requirements – 2006, ongoing
Exact budget for sustainable energy in buildings unknown

To complement the incorporation of these standards [EPBD requirements] into its national law, Spain further required all new or renovated buildings to install solar power systems capable, at a minimum, of heating water.

A package of minimum construction standards, Spain's Building Technical Code (CTE - Código Técnico de la Edificación) will, specifically promotes solar energy by recommending public subsidies, tax benefits and interest-free loans for construction companies to install solar panels. Though nationally-applicable, theses subsidies are likely to differ in amount from region to region. The CTE supports Spain's goal to install 5 million square meters of thermal panels with 143MW capacity by 2010.

6. CEN standards for the EPBD

The European Commission has mandated the following CEN to produce a set of standards to support Member States for the national implementation of the EPBD:

- **CEN TC 350 Sustainability in Construction,**
- **ISO TC 59 Building Construction**
- **CEN TC 89 Thermal performance of buildings,**
- **CEN TC 156 Ventilation for Buildings,**
- **CEN TC 169 Light and Lighting,**
- **CEN TC 228 Heating Systems in Building,**
- **CEN TC 247 Building automation, controls and building management**

The standards under the mandate deal with energy uses and losses for heating and cooling, ventilation, domestic hot water, lighting, automation and controls. The methodology integrates, where relevant, the positive influences of active solar systems and heat and electricity from renewable energy sources, as well as Cogeneration (CHP including micro-CHP) and district heating and cooling systems

The use of CEN standards for calculating energy performance, including energy performance certification and the inspection of boilers and air-conditioning systems will reduce costs compared to developing and maintaining separate standards or guidelines at national level. The standards are flexible enough to allow for necessary national and regional differentiation.

The following is a list of the up-to-date completed standards, that can be found in:

http://www.buildingsplatform.org/cms/index.php?id=201#short_documents)

EN standards:

CR 1752 Design criteria and the indoor environment

EN 12599 Ventilation for buildings – Test procedures and measuring methods for handing over installed ventilation and air conditioning systems

EN 12792 Ventilation for buildings – Symbols, terminology and graphical symbols

EN 13187 Thermal performance of buildings – Qualitative detection of thermal irregularities in building envelopes – Infrared method

EN 13363-1 Solar protection devices combined with glazing – Calculation of solar and light transmittance - Part 1: Simplified method

EN 13363-2 Solar protection devices combined with glazing – Calculation of solar and light transmittance - Part 2: Detailed calculation method

EN 13465 Ventilation for buildings – Calculation methods for the determination of air flow rates in dwellings

EN 13779 Ventilation for non residential buildings - Performance requirements for ventilation and room-conditioning systems

EN 13829 Thermal performance of buildings – Determination of air permeability of buildings –Fan pressurization method (ISO 9972:1996, modified)

EN 13947 Thermal performance of curtain walling – Calculation of thermal transmittance

EN 15193 Energy performance of buildings - Energy requirements for lighting

EN 15217 Energy performance of buildings - Methods for expressing energy performance and for energy certification of buildings

EN 15232 Calculation methods for energy efficiency improvements by the application of integrated building automation systems

EN 15239 Ventilation for buildings - Energy performance of buildings - Guidelines for inspection of ventilation systems

EN 15240 Ventilation for buildings - Energy performance of buildings - Guidelines for inspection of air-conditioning systems

EN 15241 Ventilation for buildings - Calculation methods for energy losses due to ventilation and infiltration in commercial buildings

EN 15242 Ventilation for buildings - Calculation methods for the determination of air flowrates in buildings including infiltration

EN 15243 Ventilation for buildings - Calculation of room temperatures and of load and energy for buildings with room conditioning systems

EN 15251 Criteria for the indoor environment including thermal, indoor air quality, light and noise

EN 15255 Thermal performance of buildings - Sensible room cooling load calculation - General criteria and validation procedures

EN 15265 Thermal performance of buildings – Calculation of energy use for space heating and cooling – General criteria and validation procedures

EN 15316-1 Heating systems in buildings - Method for calculation of system energy requirements and system efficiencies – Part 1: General

EN 15316-2-1 Heating systems in buildings - Method for calculation of system energy requirements and system efficiencies – Part 2-1: Space heating emission systems

EN 15316-2-3 Heating systems in buildings - Method for calculation of system energy requirements and system efficiencies – Part 2-3: Space heating distribution systems

EN 15316-3 Heating systems in buildings – Method for calculation of system energy requirements and system efficiencies – Part 3: Domestic hot water systems

EN 15316-4 Heating systems in buildings - Method for calculation of system energy requirements and system efficiencies – Part 4: Space heating generation systems

EN 15377 Design of embedded water based surface heating and cooling systems

EN 15378 Heating systems in buildings — Inspection of boilers and heating systems

EN 15429 Data requirements for standard economic evaluation procedures related to energy systems in buildings, including renewable energy sources

EN 15603 Energy performance of buildings - Overall energy use and definition of ratings

EN ISO standards

EN ISO 6946 Building components and building elements – Thermal resistance and thermal transmittance – Calculation method

EN ISO 7345 Thermal insulation – Physical quantities and definitions

EN ISO 9251 Thermal insulation – Heat transfer conditions and properties of materials – Vocabulary

EN ISO 9288 Thermal insulation – Heat transfer by radiation – Physical quantities and definitions

EN ISO 10077-1 Thermal performance of windows, doors and shutters – Calculation of thermal transmittance – Part 1: General

EN ISO 10077-2 Thermal performance of windows, doors and shutters – Calculation of thermal transmittance – Part 2: Numerical method for frames

EN ISO 10211 Thermal bridges in building construction - Heat flows and surface temperatures - Detailed calculations

EN ISO 10456 Building materials and products - Hygrothermal properties - Tabulated design values and procedures for determining declared and design thermal values

EN ISO 12569 Thermal performance of buildings – Determination of air change in buildings – Tracer gas dilution method (ISO 12569:2000)

EN ISO 13370 Thermal performance of buildings – Heat transfer via the ground – Calculation methods

EN ISO 13786 Thermal performance of building components – Dynamic thermal characteristics –Calculation methods

EN ISO 13789 Thermal performance of buildings - Transmission and ventilation heat transfer coefficients - Calculation method

EN ISO 13790 Thermal performance of buildings - Calculation of energy use for space heating and cooling

EN ISO 13791 Thermal performance of buildings – Calculation of internal temperatures of a room in summer without mechanical cooling – General criteria and validation procedures

EN ISO 13792 Thermal performance of buildings – Calculation of internal temperatures of a room in summer without mechanical cooling – Simplified methods

EN ISO 14683 Thermal bridges in building construction – Linear thermal transmittance – Simplified methods and default values

EN ISO 15927-1 Hygrothermal performance of buildings – Calculation and presentation of climatic data – Part 1: Monthly and annual means of single meteorological elements

EN ISO 15927-2 Hygrothermal performance of buildings – Calculation and presentation of climatic data – Part 2: Data for design cooling loads and risk of overheating

EN ISO 15927-3 Hygrothermal performance of buildings – Calculation and presentation of climatic data – Part 3: Calculation of a driving rain index for vertical surfaces from hourly wind and rain data

EN ISO 15927-4 Hygrothermal performance of buildings – Calculation and presentation of climatic data – Part 4: Data for assessing the annual energy for heating and cooling

EN ISO 15927-5 Hygrothermal performance of buildings – Calculation and presentation of climatic data – Part 5: Winter external design air temperatures and related wind data

EN ISO 15927-6 Hygrothermal performance of buildings – Calculation and presentation of climatic data – Part 6: Accumulated temperature differences (degree days)

7. Conclusions

The review presented in D1.2 highlighted the differences occurring in different EU counties regarding their phasing with the EPBD and ESD.

It is expected that it will become possible in the future for the EU counties to refer in their national legislation to EN's. Overall, the expected time frame differs considerably from country to country.

Sustainability issues are covered by the EN's, however the topic of energy storage is very poorly addressed.

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