Work Package 2 –Task 2.3

Deliverable 2.3 Recommendations on summer energy efficiency on national building codes

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INTRODUCTION

The building regulations have a major role in controlling and limiting the energy consumption of the building sector. The Thermal Building Regulations of the European countries although had followed the EPBD Directive in what concerns the methodologies, differs on the requirements and recommendations on summer comfort and energy consumption for cooling, due to the particular conditions of each country.

A review of the national building codes concerning envelope constructive solutions (opaque and transparent), thermal mass, ventilation rates, energy consumption methodology and correspondent values limits has been undertaken for the participating countries of the Keep-Cool II Project and, was extended to other countries, by consulting building codes, technical reports concerning energy use in buildings and by direct contacts with colleagues.

The goal of this analysis consists on put in evidence the different strategies adopted and try to share and to supply information and experiences in so far as, the energy demand for cooling in European buildings is the energy use in the building sector with high increase rate among the other energy uses. In fact, cooling can be avoided or significantly reduced, without risking summer thermal comfort, by means of mature passive cooling solutions, renewable energy sources and reducing internal heat gains.

This present report summarizes, in Chapter 1, the information that has been compiled from questionnaire answers of partners of the Keep Cool II Project: Austria, France, Italy, German, Portugal, Slovenia, Sweden and United Kingdom.

Chapter 2 summarizes de final remarks and conclusions of the building regulations related to summer comfort and energy for cooling in or order to contribute for the dissemination activities.

In the Annexes are the questionnaire (Annex A) and the systematized replies to the questionnaire in a comparative form (Annex B), In the Annex C is the name of the experts that have answered to the questionnaire by country and institution. A review of the national building codes for other European countries is presented In the Annex D: Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Greece, Hungary, Ireland, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Romania, Slovakia Republic, Spain.

1. REPLIES TO THE QUESTIONNAIRE OF THE KEEPCOOL PARTNERS: RECOMMENDATIONS ON SUMMER ENERGY EFFICIENCY IN NATIONAL BUILDING CODES

In the framework of Task 2.3 entitled “Recommendations on summer energy efficiency in national building codes” a questionnaire was prepared and distributed among the participant countries of the Keep-Cool Project. Even if, Keep Cool Project is targeted for non residential buildings, the questions are addressed for both types, residential and non-residential in order to have a complete overview regarding summer comfort and energy consumption for cooling.

The questionnaire was divided in three parts:

1. Part A with general questions of the building regulation: date for the beginning, if it follows the EPBD, types of buildings, in what phase it will be necessary to verify it, main

entities involved, if information is or will be collected and in the affirmative case by whom and the main aspects of the methodologies adopted.

2. Part B focusing climatic conditions and the types of actions, regarding summer: solar heat prevention, solar heat attenuation, heat dissipation strategies**,** calculation procedures, internal gains and air conditioning systems requirements.
3. Part C recommendations or measures suggestions to be included in the building regulation as measures towards a sustainable summer comfort and reducing the use of cooling systems in the future.

The aim of this survey consisted on update the information regarding national building regulations and identify, in a regional basis, the measures adopted in the different European countries concerning summer comfort, energy consumption and summer requirements. This section summarizes the information that has been compiled from the answers to the Keep-Cool II questionnaire.

1.1. AUSTRIA

1.1.1 General Considerations

The new building regulations have been published following the Directive and are already in force for all type of buildings, except in Lower Austria and Vienna. The dates of coming into force of the new building regulations are different from one federal state to the other. As a Federal state Austria is divided in 9 regions each of them with its own building code, however, everyone is following Austria's basis document for implementing the Directive (OIB Richtlinie) differing sometimes on the demanding values.

The type of non-residential buildings covered are: office buildings, kindergarten, compulsories school, secondary schools, universities, hospitals, nursing homes, guest houses, hotels, restaurants, event centres, sports centres, shops and other conditioned buildings.

The building regulation should be applied before and after construction and the architects or engineers will have the technical responsibility. The information from the building regulation process will be collected in a central database and the authors of the energy performance certificate are committed to send the results to the Austrian statistics centre. There is also a voluntary system called ZEUS.

1.1.2 Requirements on Solar Heat Prevention, Attenuation and Dissipation Strategies

Austria is divided in 7 climatic zones for both seasons (winter and summer) but the duration of heating season is of 7 months while the summer season is 5 months according to he table:

Climatic Conditions:	Heating season	Cooling season
Most relevant season in your country	☒	☐
Duration (months)	7	5
Air Temperatures (Max, Min, Mean)	Linz, December 2003 11.8/-14.2/-0.1	Linz, August 2003 36.9/11.3/23
Degree Days Refer base temp. heating and cooling	3400*	Not available
Number of Climatic zones with different requirements	7	7

* According to the Austrian basis document (OIB RL 6) for the implementation of the EPBD; actual average: 3.800

In what concerns the quality of the envelope thermal mass (storage mass) is taken in account and there are requirements concerning U-Values:

- Wall - 0.38 to 0.50 W/m^{2o}C;
- Roof - 0.20 to 0.35 W/m^{2o}C;
- Floor - 0.35 to 0.50 W/m^{2o}C;
- Windows - 1.7 to 1.9 W/m^{2o}C.

Concerning heat dissipation strategies natural ventilation is already implemented with the standard ÖNORM B 8110-3: To ensure the necessary day and night ventilation, appropriate requirements for natural ventilation must be fulfilled (to ensure night ventilation, necessary safety demands (against storm, burglary, etc.) have to be considered). If the air change rates are applied their compliance has to be preserved – especially during night. During day the hygienic air change has to be ensured.

Number of façade or roof levels with ventilation openings	**Air change rate (h^{-1}) at complete opening of the ventilation blade**
One façade level	1.50
Two façade levels	2.50
Three or more façade levels (terraced house, free standing single family house)	3.00

1.1.3 Methodology or Calculation Procedures

For residential buildings there are minimum requirements for the quality of the envelope (maximum U-values, maximum heat energy demand) and, summer comfort has to be considered regarding the standard ÖNORM B 8110-3. The calculation of cooling load is regulated by the ÖNORM H 6040 standard and ÖNORM B 8110-6 standard regulates the calculation of the cooling demand.

For non-residential buildings there are also minimum requirements for the quality of the envelope (maximum U-values, maximum heat energy demand), the calculation of the occurrence of over temperature is carried out by the standard (ISO 13791:2004) – "*Thermal performance of buildings - Calculation of internal temperatures of a room in summer without mechanical cooling - General criteria and validation procedures*", and the application of the 3 Austrian standard referred above.

For new non residential buildings the maximum cooling demand allowed is 1 kWh/m³a (gross volume) while for existing buildings this value is equal to 2 kWh/m³a.

Austrian standard ÖNORM B 8110-3 regulates summer comfort (calculation of the occurrence of over temperature based on the standard ISO 13791:2004, without cooling or heating system under transient basic conditions), furthermore appoints overheating when the temperature exceeds during day 27 °C and during night: 25 °C. The norm provides also threshold temperatures and the determinants factors to calculate the daily temperatures curves in new buildings appointing minimum requirements for the immission area referred to the storage mass depending on the immission are referred to hourly air flow and it fixes the airflow rate at different façades.

Immission area referred hourly air flow $V_{L,s}$ [m³/(hm²)]	Immission area referred storage mass $m_{W,I}$ (2) [kg/m²]
≥ 100	≥ 2000
75	≥ 4000
50 (1)	≥ 8000

(1) Immission area referred air flows on less than 50 m²/(hm²) lead to a high overheating risk and are therefore to be avoided.

(2) Have to be interpolated if required

Calculation of the cooling load is based on the ÖNORM H 6040 standard and the theoretical indoor air temperatures, which results with or with limited cooling load, can be calculated with this standard. Cooling load and indoor air temperature are calculated with the average highest outdoor air temperatures and intensity of solar radiation. The two methods can be combined in a way that during one day the cooling load at a defined indoor air temperature and without cooling, the course of the indoor air temperature can be ranked with the other. This is necessary if the expected indoor air temperature change shall be calculated at a temporarily switched off cooling.

Is the cooling load, which is necessary to reach the defined indoor air temperature, not installed completely, it is possible to calculate that specific course of the indoor air temperature by the hour.

If a time step method is chosen for the calculation of the transient heat transport through components, the transient effect of the cooling load or the indoor air temperature from a starting condition can be calculated. This is necessary if the time of reaching the defined indoor air temperature after a reconnection of the cooling system shall be calculated (e.g. starting on Monday).

The mentioned method is based on a transient heat balance for the room.

The calculation method according to ÖNORM 6040 does not substitute simulations of the thermal behaviour of a room at changing meteorological conditions over a longer period.

In the Austrian standard ÖNORM B 8110-6, the monthly cooling demand is calculated according to the standard ÖNORM EN ISO 13790 ($E_p<E_{pmax}$). The annual cooling demand is the sum of the monthly cooling demands.

The air conditioning systems are not considered in the building regulation but are dealt within the deployment protection regulation (AStV, BGBl II Nr. 368/1998).

1.1.4 Recommendations

In what concerns the glazing areas the Austrian position expressed in the questionnaire reveals that it will be recommendable implement shading factors for shading systems in connection with glazing area/orientation divided in systems on the outside and inside. On the calculation must be defined the relation between glazing façade and total area of the façade.

Summer comfort should be explicitly introduced in the building regulation for all type of buildings.

In residential buildings air conditioning systems should not be allowed to be installed and the limitations on the use of air conditioning systems must be extended to non residential buildings - only in certain cases should be, for instance, if all passive measures have been undertaken but the internal loads are too high or specific circumstances that requires low temperatures (e.g. hospitals) then, an air conditioning system should be allowed.

The adaptation of passive systems must be checked and if realisable to be installed air conditioning systems should not be allowed (like concrete core activation or direct cooling with pre-cooling through earth is possible).

1.2 FRANCE

1.2.1 General Considerations

The new building regulations have been published at 24th May 2006 following the Directive and started at 1/09/06 and is required for existent and non-existent and residential or non residential, except for swimming-pool, livestock, rink, T°>12°C, heated or cooled for process reasons.

The building regulation should be applied after construction and the architects or engineers are in charge of the energy calculations while the builders must respect materials and specifications of design engineer. The builder owner must confirm if the calculation is really done. The information may be collected by state controllers.

1.2.2 Requirements on Solar Heat Prevention, Attenuation and Dissipation Strategies

The most relevant season is the winter with 7 months and is divided in 8 climatic zones for both seasons (winter and summer) according to the next table:

	Heating season	Cooling season
Most relevant season in your country	■	□
Duration (months)	7	
Air Temperatures (Max, Min, Mean)	-10	31
Degree Days Refer base temp. heating and cooling18/25	2000	
Number of Climatic zones with different requirements	8	8

For the envelope quality there is any indication about thermal mass but were imposed requirements concerning maximum U-Values for new buildings:

- Wall - 0.45 W/m^{2o}C;
- Roof - 0.34 (Flat) W/m^{2o}C; 0.28 (other type) W/m^{2o}C.
- Floor – 0.40 W/m^{2o}C;
- Windows – 2.6 W/m^{2o}C and maximum solar factor in bedrooms (all type of buildings).

For all type of buildings, existent, new and residential or non-residential, concerning heat dissipation strategies is referred that natural ventilation is already implemented (during daytime and night-time) as well as using the earth as a cooling source.

1.2.3 Methodology or Calculation Procedures

The regulation explicitly refers:

Summer comfort for new buildings ($T_{ic} \leq T_{ic}$ ref, T_{ic} ref depend on climatic zone and use of official software, for residential buildings or non-cooled buildings, the internal maximum temperature T_{ic} for a reference warm day (calculated as the average operative temperature for the 3 consecutives warmest days) must be verify the previous relationship being T_{ic} ref calculated by applying reference solar protections.

- Summer comfort and energy calculation.

  New buildings (residential, non residential and public buildings)

  - Primary energy consumption + indoor summer temperature + components minima (requirements on the building thermal envelope);

  Existent residential buildings - single family house or single flat in multifamily building

  - Replacement by new components reaching new standards

  Existent residential, entire multifamily building

  - Replacement by new components reaching new standards and when the floor area is greater than 1000 m^2 - Primary energy consumption + indoor summer temperature + components minima (requirements on the building thermal envelope).

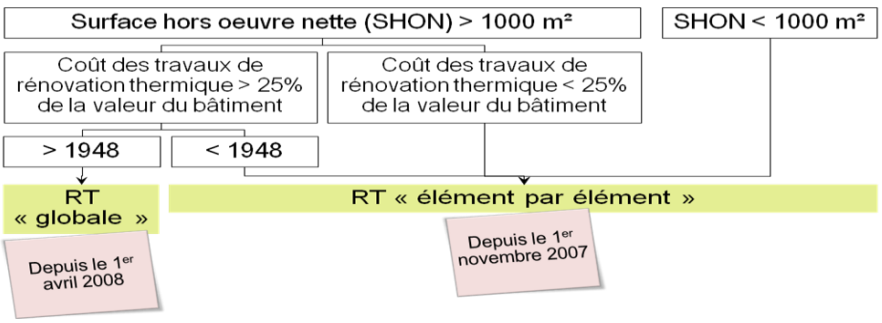
  Existent small non-residential (< 1000 m^2) and Public

  - Replacement by new components reaching new standards

  Existent large non residential buildings (> 1000 m^2)

  - Primary energy consumption + indoor summer temperature + components minima (requirements on the building thermal envelope);

  For the existing buildings there are two regulations according the following scheme:



The cooling loads are estimated for reference scenarios in an hourly base times simulation procedure using official software and is expressed in primary energy /m^2.

The internal gains (people, light and equipment) are considered as internal loads for all situations.

The calculation takes an average of one minute. Checking and introducing calculation entries takes from half an hour for an individual house, to some days for a big and complex building as a hospital.

The air conditioning systems are considered in the regulation for all type of buildings (Categories CE1 and CE2, (noise area and climatic zone) while mechanical ventilation only for new buildings.

1.2.4 Recommendations

Most of the recommendations are already implemented, for existing and new buildings: area of glazing per façade, use of shading, limitations on the use of air conditioning system for situations of T > 26°C, natural ventilation.

Summer comfort should be expressed for new and existing buildings, residential and non-residential, by checking the indoor temperatures and the standards should be explicitly introduced in the building regulation.

1.3 GERMANY

1.3.1 General Considerations

The new building regulation has been published following the Directive and is in force since 01/10/2007 and is applied to all types of buildings.

The building regulation should be applied before and after construction for sale or rent by energy certificates (for non residential buildings required from October 2009) and the main entities involved in the building application are the architects or engineers that will calculate and guarantee the compliance with the building directive, the builders that have to follow the instructions of the architects, planners and install the right equipment, and are responsible for the constructing activities. The build owners are responsible for regular inspection of air condition and for the change of the old boilers.

The information from the building regulation process is not expected that will be collected in a central database because building authorities don't control observance or deviations from the building directive.

1.3.2 Requirements on Solar Heat Prevention, Attenuation and Dissipation Strategies

Germany is divided in 12 climatic zones for both seasons (winter and summer). In what concerns the quality of the envelope there are any indication about requirements concerning maximum U-Values only on thermal mass for new residential buildings.

The only dissipation strategy referred is the night ventilation (bonus system). For the natural diurnal comfort ventilation and the earth as a cooling source is expressly manifested that is not taken in account.

There are only recommendations to glazing areas, solar shading given in the DIN 4108-2 for new residential buildings. These recommendations have been extended to specific requirements related to the maximum solar gains. In case of window to floor area ratios > 30% the standard defines a factor as maximum limit for solar input that depends on: climate conditions, thermal inertia, higher night ventilation rate > 1.5 h-1, solar factor (shading systems) and orientation of the windows. The building designer has to demonstrate that the solar gains does not exceed an limit value. This value depends on factors like climatic region, building mass, night ventilation, orientation, glazing system and shading systems. With the verifica-

tion of those requirements are avoided high cooling loads and limits the energy demands. For small windows <10% (ratio between window area and floor area) it is no necessary any verification. This proof is necessary in order to avoid high cooling loads and limits the energy demand which can be subsidiced by other building service systems (see DIN V 18599).

1.3.3 Methodology or Calculation Procedures

The regulation explicitly refers:

- Summer comfort for new residential and non residential buildings and, for both cases, the reference is the DIN 4108-2 standard.
- The calculation method is applied for residential and non residential buildings. In the new DIN V 18599, 2007, based on EN ISO 13790, an integrated monthly energy balance is proposed. The building, its usage and its technical equipment is evaluated by taking into account the mutual interaction of these. The balance covers energy expenditures for heating, ventilation, cooling, hot water supply and lighting.
- Existing non residential depends on the energy certificate delivered (oriented on the energy needs or energy consummation)

The internal gains of the residential buildings is expressed in W/m^2 in the Building Regulation with an abbreviate value.

Conditioning systems are considered in building regulation by standard DIN 18599 except for new residential building where the cooling, humidification is not taken into account. For these typologies, the requirements are based on benchmarks for buildings with comparable size that includes only energy demand for heating, ventilation and domestic hot water. If cooling, for instance, equipment will be installed has necessarily to be compensated by lower heat and DHW demand.

Only for new no residential buildings exists mandatory measures on the systems expressed on DIN 1946 standard and for existing one is not applied.

Additional there exists a building regulation (DIN 4108) since more than 50 years with recommendations for the design of buildings in order to avoid overheating problems. These recommendations have been extended to specific requirements for the maximum solar gains for new buildings since 1995 with the latest update in July 2003. The designer of a building has to document that the solar gains of a building or a zone does not exceed an limited value. This limited value depends on different influence factors like climatic region, building mass, night ventilation, orientation, glazing system and shading systems. This documentary proof is obligatory in order to avoid high cooling loads and limits the energy demand which can be subsidiced by other building service systems (see DIN V 18599). For small window to floor area ratios (< 10%) no proof is needed.

1.3.4 Recommendations

Summer comfort should be explicitly introduced in the building regulation for all type of buildings and standards should also be explicitly introduced in the building regulation. Actually for existing residential buildings is referred only on heat insulation and for the non residential to

40% below standard of new buildings is accepted (reference: annual primary energy need including air conditioning.

A suggestion towards a sustainable summer comfort, for the residential buildings news and existing, consists on "*eliminate enforcement deficits*".

1.4 ITALY

1.4.1 General Considerations

The new building regulation has been published following the Directive since August 2005 and is applied for the construction of new buildings and the renovation of the existing ones, at planning stage, before construction starts, in order to have a permit to build.

The only entities involved are the surveyors, the architects and engineers to design architectonical and plant systems and the builder to construct. There is not a central database to collect the building regulation processes

1.4.2 Requirements on Solar Heat Prevention, Attenuation and Dissipation Strategies

The most relevant season for energy calculation is winter, according to the next table:

	Heating season	**Cooling season**
Most relevant season in your country	☒	☐
Duration (months)	Depending by climatic zone	
Air Temperatures (Max, Min, Mean)	Minimum internal temperature has to be 20 ±1°C (except for industrial building which is set to 18±1°C	
Degree Days Refer base temp. heating (20°C) and cooling (none)	Changing zone by zone	
Number of Climatic zones with different requirements	7	

The Italian country land is zoned in six winter climatic zones[1] according to Degree Days for heating[2]. Every climatic zone is characterized by a variable duration of the space heating period and by the beginning day and the end day of the heating period.

In what concerns the energy quality of the building, according to the questionnaire answer, there is a minimum requirement for the delivered energy for heating (only for heating) for new buildings or for renovations (integral renovation of building envelope and "demolition and rebuilding" of existing building with a net surface bigger than 1000 m^2, building enlargement bigger than 20% of the original volume, partial renovation of building envelope). There are also requirements concerning maximum U-Values for technical elements of the building envelope:

- <u>Walls</u>

  0.44 – 0.85 $W/m^{2o}C$ at 1/1/2006

[1] A, B, C, D, E, F according to DPR 412/1993.
[2] Base temperature is 20°C.

0.35 – 0.72 W/m^2°C at 1/1/2009

0.33 – 0.62 W/m^2°C at 1/1/2010

- Roofs

  0.41 – 0.80 W/m^2°C at 1/1/2006

  0.31 – 0.42 W/m^2°C at 1/1/2008

  0.29 – 0.38 W/m^2°C at 1/1/2010

- Floors

  0.41 – 0.80 W/m^2°C at 1/1/2006

  0.36 - 0.74 W/m^2°C at 1/1/2008

  0.32 – 0.65 W/m^2°C at 1/1/2010

- Glazed panes + frames

  2.40 – 5.50 W/m^2°C at 1/1/2006

  2.20 - 5.00 W/m^2°C at 1/1/2009

  2.00 – 4.60 W/m^2°C at 1/1/2010

- Only glazed panes

  2.30 – 5.00 W/m^2°C at 1/1/2006

  1.70 - 4.50 W/m^2°C at 1/1/2009

  1.30 - 3.70 W/m^2°C at 1/1/2010

There are also requirements concerning minimum building superficial thermal mass which has to be higher than 230 kg/m^2 (or the designer has to demonstrate similar inertial characteristics, if he wants to use not massive solutions), if monthly mean irradiance on a horizontal plane during the most insolate month is higher than 290 W/m^2.

Effective shadings (not better specified) over transparent envelope and natural ventilation in buildings have to be promoted.

1.4.3 Methodology or Calculation Procedures

For the construction of new buildings or in case of renovation (integral renovation of building envelope and "demolition and rebuilding" of existing building with a net surface bigger than 1000 m^2, building enlargement bigger than 20% of the original volume, partial renovation of building envelope) for all type of building use except industrial buildings and leisure centres is necessary, to limit the cooling energy needs through:

1) The installation of effective solar protections for transparent elements of the building envelope;

2) The use of superficial thermal mass higher than 230 kg/m^2 in whose sites where monthly mean irradiance on an horizontal plane during the most insolate month is equal or higher than 290W/m^2;

3) The promotion of the use of cooling strategy based on natural ventilation.

The Calculation of the Delivered Energy for Space Heating by the Italian energy law in force (Dlgs 311/2006) requires activities for all destination of use and both for all new constructions and renovations, except very small isolated buildings which have a net surface minus than

50 m^2, buildings which have a cultural or landscape value and industrial or agricultural, non residential buildings if energy is not used for space heating).

The expression “new construction” infers to “construction of a new building and a related thermal plant”.

The term “renovation” infers to:

- Building enlargement bigger than 20% of the original volume;
- Integral renovation of building envelope and “demolition and rebuilding” of existing building with a net surface bigger than 1000 m^2;
- Partial renovation of building envelope;
- New installation of thermal plant in existing buildings;
- Just substitution of the heat generation system.

Dlgs 311/2006 assumes progressive requirements in function of the type of the intervention and the type of the building use. In particular, it infers to four categories in which to collect different building uses. They are:

- Residential building (with continuous occupation, with partial occupation and hotel, boarding house, ...);
- Tertiary building (office, hospital, commercial building, school building);
- Leisure centre;
- Industrial building.

The internal and solar gains are considered in the building calculation methodology (UNI EN ISO 13790/2008).

1.4.4 Recommendations

Summer comfort should be explicitly introduced in the building and be mandatory for new building and recommendations for the existing buildings. At least for the new buildings cooling energy and summer comfort calculations should be included as well as maximum legal values for primary energy for cooling. Standards should also be also explicitly introduced.

Effective shadings should be better specified and natural ventilation in buildings has to be promoted. Recommendations of glazing area per façade and orientation should be included in the thermal building regulation, as well as, use o passive systems, limitation of air conditioning and natural ventilation.

1.5 PORTUGAL

1.5.1 General Considerations

New building regulations have been published following the Directive and are already in force since July 2006.

There are two building regulations:

RCCTE addressed to residential and non residential with floor areas ≤ 1000m2 without HVAC systems or with installed power P ≤ 25 kW, major rehabilitations and enlargements but only on the expanded area.

RSECE: addressed to residential and small non-residential buildings (area≤1000m2) with installed P > 25 kW, all large non residential buildings (A>1000 m2) with or without systems and for all buildings type (news and existing) with new HCAV systems with P >25 kW.

The experts, architects and engineers, are responsible for the calculation of the new building regulation, visiting the building, making the EPB-declaration after construction and emission of Energy Certificate.

The builder is responsible for the existence of energy and air quality certificate, for the selection of an expert for the certification process, audits and periodical inspections and supply, whenever required, by the Portuguese Energy Agency all the necessary elements. The owner has the same responsibilities of the builder in case of sale or rent.

The information from the building regulation process collected in the Portuguese Energy Agency – ADENE, entity responsible for the Certification process.

1.5.2 Requirements on Solar Heat Prevention, Attenuation and Dissipation Strategies

Portugal has been divided in 3 winter and summer climatic zones.

	Heating season	**Cooling season**
Most relevant season in your country	both	both
Duration (months)	4,3-8 (depends on climatic zone)	4
Air Temperatures (Max, Min, Mean)		
Degree Days Refer base temp. heating and cooling	Base temperature- 20ºC 940-3000 ºC.days	----------
Number of Climatic zones	3	3

The duration of the winter period vary between 4, 3 to 8 months (heating degrees days 940-3000 ºC. days, T_b=20 ºC) while summer period has 4 months for the 3 climatic zones. The differentiation is, for summer, based upon the solar radiation intensity and the external temperature.

Combining the 3 climatic winter and the 3 summer zones, there are 9 climatic zones in the mainland plus one for Azores and another for Madeira.

There are requirements on solar heat prevention based on the limitation of solar factor (g⊥) for all the orientations between NE and NW (south quadrant), for all new buildings and for existing ones under great renovation/rehabilitation (residential and non residential):

- $0.15 \leq (g\perp) \leq 0.56$, depending on summer climatic zone and thermal inertia.

In what concerns solar gain attenuation, the thermal mass is included in the calculation procedure and there are also requirements concerning maximum U-Values for new buildings (existing buildings under major rehabilitation or extensions), depending on the winter climatic zone:

- External wall

  Main Land: 0.70 - 0.50 W/m^{2}ºC – Azores and Madeira: 1.40 W/m^{2}ºC

- External roofs and floors

  Main Land: 0.50 - 0.40 W/m^{2}ºC – Azores and Madeira: 0.80 W/m^{2}ºC.

In the building regulation as the mean external air temperature for the summer period (4 months – June - September) is always lower than 25 ºC, for all summer climatic zones, the ventilation in summer is always treated as a dissipation strategy.

Directly or indirectly the Portuguese Building Regulation takes in consideration the glazing areas per façade and orientation

1.5.3 Methodology or Calculation Procedures

There is no limitation of the internal temperatures and the calculation is based on PrEN ISO 13790. It is a monthly calculation procedure for RCCTE regulation and an hourly simulation for RSECE regulation.

RCCTE (based on EN 13790):

$Nvc = Qg \cdot (1 - \eta\ ) / Ap$ (kWh/m^2)

$1-\eta$ - summer utilisation factor

$Q_g = (Q_i + Q_W + Q_{opaque})$

Q_i – internal gains

Q_s – solar gains through transparent parts

Q_{opaque} – solar gains through external opaque envelope

RSECE:

Hourly heat balance between losses and gains through transparent and opaque envelope and internal gains (Q_{hc})

$Q_{hc} = Q_v + Q_w + Q_{em} + Q_g$ (W)

Q_v - ventilation gain and losses

Q_w - window conductive losses and gains

Q_{em} – opaque envelope conductive losses and gains

Q_g – total gains (internal, trough windows and opaque envelope- base on air-sun temperature)

The internal gains can be variable but, as default values can be assumed:

Residential – global value: 4 W/m^2

Small non residential buildings without or with systems with P≤ 25 kW a global value: 7 W/m^2 or hotels: 4 W/m^2; low occupancy density buildings: 2 W/m^2)

Large non residential buildings with systems with P > 25 kW occupant density and equipment density depending on building type (office, restaurant, etc.).

For the illumination density value will be considered the real one.

1.5.4 Recommendations

Summer comfort should be explicitly introduced in the building regulation for all type of buildings (news and existing).

The Portuguese regulation, in a future revision, should modify the limit values of the cooling energy demands towards a sustainable summer comfort. At the moment those limit are quite permissive, in opposition, with heating energy demands.

1.6 SLOVENIA

1.6.1 General Considerations

The new building regulations have been published following the Directive and are already in force from since last September (30.9.2008). The Regulation on efficient use of energy in buildings (Official Journal of RS nr. 93/08, from 30 September, 2008), based on Construction Act, covered the article 3, 4, 5.1 and 6 of EPBD, and thus defined the calculation methodology and minimum requirements for new and existing buildings in case of major renovation.

With the regulation a change was introduced – the central part of minimum requirements are expressed in maximum allowed power of systems for heating and cooling based on:

(a) Specific heating power demand (W/m^3) - SIST EN12831:2004

(b) Specific cooling power demand (W/m^3) - VDI 2078:1996 or ASHRAE.

While for checking the compliance with minimum requirements on the energy use of a building the calculation shall be done by a simplified method (before mentioned approach and seasonal calculation with heating and cooling degree days). Optionally EN ISO 13790 can be used for energy calculations.

Additionally, the technical requirements are imposed for envelope measures – insulation and shading and for cooling systems. Needed electrical power for HVAC is limited separately for winter and summer conditions. 25% of RES is requested in covering the needed power; this requirement is considered to be met also “by using ice storage for cooling”.

The Building Regulation is applied to all type of buildings new residential and non residential. The existing buildings only if the building permit is needed, i.e. if the renovation covers also structural changes and if after renovation the impact of the building to the environment and its appearance differ.

The Building Regulation is required to be verified before and after construction, when the building permit is requested and when the technical checking is done (before the building is

put in use) and the use permission is issued (i.e. the energy certificate is to be done /before the use permission).

The main entities involved in the building application are architects and engineers responsible for the elaboration of design documentation where 6 essential requirements for the building are proved by engineering methods, the builders are responsible for the quality of construction works, insulation, installations, the build owner for the reliable decision making during the design phase and the holistic long term view on maintenance and repair and the user/tenants are responsible for the rational use of energy in the operation phase, to achieve thermal comfort the most economically.

The Energy certificates (calculated for new buildings) will be collected and stored in and electronic database with a link to the cadastre of buildings. Energy indicators will be stored digitally, (not only pdf of certificate) and in this way to allow later energy demands calculation and a statistical analyses. This electronic data base is expected to be in use by January 2010.

1.6.2 Requirements on Solar Heat Prevention, Attenuation and Dissipation Strategies

The most relevant season for energy calculation is winter, according to the next table:

	Heating season	**Cooling season**
Most relevant season in your country	Most relevant	
Duration (months)	8	1 - 3
Air Temperatures (Max, Min, Mean)	-13, 3, 10	38, 10 , 19
Degree Days Refer base temp. heating and cooling - 20/12, 20/21	Central climate: 3300 Alpine Climate: 4700 Mediterranean: 2400	Central climate: 79 Alpine Climate: 2 Mediterranean: 144
Number of Climatic zones	n.a (minimum requirements are flexible depending on HDD)	n.a (minimum requirements are flexible depending on CDD)

The new regulation (2008) imposed more severe requirements on the maximum U-Values of the new building envelopes or existing building in case o renovation (above 25%in value):

- Wall - 0.28 W/m^{2o}C;
- Light structures – 0.20 W/m^{2o}C;
- Partitions between flats – 0.90 W/m^{2o}C;
- Roofs - 0.20 W/m^{2o}C;
- Floors – 0.30 W7m^{2o}C
- Doors – 1.8 W/m^{2o}C;
- Glass – 1,1 W/m^{2o}C;
- Windows with PVC or wooden frame 1.3 W/m^{2o}C;
- Windows with metal frame 1.6 W/m^{2o}C.

In the new buildings (residential and non residential) solar shading of glazed areas is requested (internal shading is not acceptable for all orientations except north), solar thermal and reflective glazing are allowed if incoming radiation is reduced to prescribed limit and the

glazing areas due to daylight are limited in ruled for design of residential buildings (<20%). Total glazing areas, for new residential buildings, has got the minimum value prescribe, due to sufficient day lighting the upper limit is not directly defined.

In what concerns heat dissipation strategies the air tightness of the envelope, where n50<3,5 for natural ventilation and n50<2 for mechanically ventilated buildings, respectively.

If air flow is greater than 1,25 m^3/s the exhaust air must be adiabatically cooled and used for pre-cooling of fresh air in the areas with external effective air temperature greater than 33 °C and relative humidity of exhaust air less than 50%.

1.6.3 Methodology or Calculation Procedures

The buildings should verify rule minimum requirements and calculations refer to a building as a whole, there is no differentiation per building type. However, requirements for existing buildings are valid in case of renovation (above 25% in value) and, in this case, additional insulation should be implemented.

The new regulation in 2008 imposed, in terms of the envelope solutions, as referred in the above paragraph, the use of internal shading devices is only acceptable for north orientation, solar thermal and reflective glazing are allowed if incoming radiation is reduced to prescribed limit and more severe requirements on maximum U-values.

The central part of minimum requirements are expressed in maximum allowed power of systems for heating and cooling based on (a) SIST EN12831:2004 calculation for specific heating power demand (W/m3) and (b) based on VDI 2078:1996 or ASHRAE calculation for specific cooling power demand (W/m3). In the regulation internal gains (people, equipment and light) are taken in account 5 W/m2 in 2002 and 4 W/m2 in December 2008 but just for certification, not for minimum requirements in building regulation.

The outputs of calculation related to cooling are: cooling load (W/m^3), cooling device power, energy (electricity) use for cooling QVC (kWh/a), electricity for operation of pumps for cooling (final) (kWhe/a), primary energy use for HVAC operation in building (kWh/a); (kWh/m3a), CO2, per energy source (kg/a), (kg/m2a); % of RES power in covering of heating and cooling loads.

For checking the compliance with minimum requirements on the (final) energy use for cooling the calculation shall be done by a simplified method (system power and seasonal calculation with cooling degree days). Optionally EN ISO 13790 can be used for energy calculations.

The minimum requirement for overall primary energy (heating, cooling, domestic hot water) is based on reference building according to:

- Maximum cooling load < Φ_{VC} = 24 W/m^3;
- Maximum cooling device power $P_{VC,e}$ = 1,05.Φ_{VC} .V_e/ EER (W_e); where EER and COP (by pr EN 14511) in ESEER (Eurovent) are listed;
- Maximum lighting power is defined based on the space purpose and in this way the heat load is thus also limited;
- Only cooling generators of class A, B and C are allowed.

Other design requirements for cooling:

- Design temperature. of water in dehumidification systems is 6/14 ^{o}C, without dehumidification 14/19 ^{o}C and 18/23 ^{o}C for surface cooling. Primary and secondary circle for cooled water is requested and hydraulic balance of the system is requested;

- Specific use of electricity for transport of cooling water should be less than 0,020 W_{el}/W_{cold} vin primary circle and less than 30 W_{el}/kW_{cold} in secondary circle. Variable regulation of flow depending on cooling load is requested in secondary circle.

- Regulation of cooling power with flow of hot gas is not allowed for cooling power above 25 kW.

- AC systems must have heat recovery efficiency better than 65%.

The calculation of final energy use for cooling shall be done by a simplified method (based on the cooling system power and seasonal calculation with cooling degree days).

Optionally EN ISO 13790 can be used for energy calculations the problem is that the national data in the standard are not prescribed so the EN ISO 13790 method is rather a tool for consultant and not a tool for demonstrating the compliance with minimum requirements in regulation but will on the other hand be the basis for energy certification.

1.6.4 Recommendations

Limitations on the use of air conditioning systems should be implemented and in colder areas the cooling devices should be substituted by the good design requirements based on good Slovenian architectural solutions, and standards should also be explicitly introduced in the building regulation for new buildings.

In what concerns the use of passive systems the earth as cooling source should be investigated if the building plot is adequate for this use, (optionally: feasibility study may be requested). For the new buildings should be prescribed a calculation to demonstrate the potential of night ventilation even if the cooling device is installed due to some other reason and for the existing ones should be given in the regulation as a recommendation for the way of building operation strategy.

In summer conditions the free floating temperature should be calculated and limited to justify the cooling devices adoption. Sumer comfort should be explicitly introduced in the new buildings and a summer comfort calculation should be required. In order to reach sustainable summer comfort for existent residential buildings it should be obligatory to shade when major renovation is ongoing.

Awareness-raising campaign on passive cooling for households would be useful. For the non residential existing buildings informative campaigns should be undertaken for building managers and users on passive cooling in order to prevent overheating. For the new residential buildings it is pointed out that emphasize should be put on passive measures in order to reduce cooling devices. Shading and night ventilation should be promoted instead of AC devices. No AC approach works well in Slovenian climate (except coastal area) under condition of reasonable design and proper user behaviour.

1.7 SWEDEN

1.7.1 General Considerations

The new building regulation has been published, since July 2006, following the Directive and is applied for all new buildings, before and after construction. For the existent complementary regulation is under preparation. The actual energy consumption for space heating, space cooling, hot water and ventilation and all electricity used for the operation of the building is to be verified through metering 24 months after the building has been constructed, which coincides with the mandatory building energy certification. For buildings with electricity heating/cooling this implies that two meters are installed or can also be estimated/calculated.

The actors of the building regulation are the architects and engineers in engineering ("consulting") firm's design, the building companies to build according to the design, builder owner often hires a consultant for following the construction process and to dialogue with the building company and the designer. Sweden has large, professional building owners (e.g. the public buildings are managed by an agency or by companies created for the purpose).

A central data base will collect the results of the energy certifications.

1.7.2 Requirements on Solar Heat Prevention, Attenuation and Dissipation Strategies

The most relevant season in the Winter and the climate conditions are summarized in the next table:

	Heating season	**Cooling season**
Most relevant season in your country	☒	☐
Duration (months)	8	
Air Temperatures (Max, Min, Mean)	Stockholm: -1,2 (0,2 in 2011-2040) Östersund: -5,0 (-3,2)	Stockholm: 15,1 (16,4 in 2011-2040) Östersund: 12,2 (13,2)
Degree Days Refer base temp. heating and cooling18/20	Winter: Stockholm: 574 (506 in 2011-2040) Östersund: 688 (634) Summer: Stockholm: 55 (25 in 2011-2040) Östersund: 146(114)	Stockholm: -0,4 (6,2 in 2011-2040) Östersund: 0 (0)
Number of Climatic zones with different requirements	2	2

In what concerns the quality of the envelope there are any indication about thermal mass but there are requirements concerning maximum U-Values for new buildings:

- Max U-value average = 0.5 W/m^2^{o}C;
- Windows – 1.3 W/m^2^{o}C for areas less than 100 m^2

The reduction of the demand for cooling is also recommended based on:

- good efficiency of the cooling system
- windows size and orientation (location)
- selective glazing and solar shading
- use of free-cooling and cooling storage (night cooling and accumulation of cold in the building structure)

further measures should be considered such as the selection of electric efficient lighting and equipment to reduce internal heat loads.

1.7.3 Methodology or Calculation Procedures

The most relevant season in Sweden is winter with 8 months and is divided in 2 climatic zones for both seasons (winter and summer). The minimum and maximum mean temperatures in winter and summer are, respectively, -5.0 ºC and 13.2 ºC.

The calculation procedures are not mandatory however are presented the methodologies adopted for new buildings, for the existents is not yet regulated.

Single family houses

- Two climate zones – North and South. For buildings with Area <100 m^2 a prescriptive simplified approach is allowed and energy produced with PV or solar heating is to be deducted from the actual energy use;
- maximum value for final energy use in kWh/m^2 (heated area) for heating, cooling, hot water, ventilation, independent from the energy carrier;
- North: 130 kWh/m^2 - South: 110 kWh/m^2 - maximum average U-value 0.5 W/m^2ºC
- For direct electricity heated buildings: North: 95 kWh/m^2 - South: 75 kWh/m^2

Residential entire multifamily building (no requirement for individual flats)

- Maximum value for final energy use in kWh/m^2 (heated area) for heating, cooling, hot water, ventilation, independent from the energy carrier. Two climate zones – North and South exist. Energy produced with PV or solar heating is to be deducted from the actual energy use.
- North: 130 kWh/m^2 - South: 110 kWh/m^2 - Max U-value average = 0,5 W/m^2ºC

Non residential buildings

- Maximum value for final energy use in kWh/m^2 (heated area) for heating, cooling, hot water, ventilation, independent from the energy carrier. Two climate zones – North and South- exist.
- North: 120 kWh/m^2 - South: 100 kWh/m^2 - Max U-value average = 0,7 W/m^2ºC
- A higher energy use is allowed dependent on the ventilation rate.

The internal gains are not taken in account in what concerns the tenant's electricity use, but otherwise yes.

The building regulation does not refer specific temperatures for the cooling season. But the agencies for social issues and for working environment recommend maximum temperatures.

1.7.4 Recommendations

Summer comfort should be explicitly introduced in the building regulation for all type of buildings and standards should also be explicitly introduced in the building regulation for new buildings.

1.8 UNITED KINGDOM

1.8.1 General Considerations

Since April 2006, the new building regulations have been published following the Directive and are already in force. The building Regulations 2000 approved document Part L "Conservation of fuel and Power" and now is under revision and is expected to be in action in October 2010. The Part L is applied to England and Wales. Scotland (Section 6) and Northern Ireland (Part F) have different documents and dates enforced. This paragraph provides mainly information of England and Wales with some references to Scotland and Northern Ireland.

For the new residential buildings is required to verify Part L1A, CSH, respectively, "Conservation of Fuel and Power in New Dwellings" and "Code of Sustainable Homes". For new non-residential buildings is required to verify Part L2A "Conservation of fuel and power in new dwellings" for the erection of a building of any kind, extensions or work carried out. Exemptions are applied to buildings listed in Schedule 2, in accordance with section 1 of the Planning (Listed Buildings and Conservation Areas) Act 1999, in a conservation area in accordance with section 69 of that act or included in the schedule of monuments maintained under section 1 of the Ancient Monuments and Archaeological Areas Act 1979. A new proposal plans to remove these exemptions are undertaken..

For the existing residential buildings Part L1B "Conservation of fuel and power in existing dwellings" is applicable to the thermal element under renovation, while for the existent non - residential Part L2B "Conservation of fuel and power in existing buildings other than dwellings" is applicable to the thermal element under renovation. Consequential improvements to energy performance apply to existing buildings with a useful floor area over 1000m^2 where the proposed works relate to extension, initial provision of fixed building services or an increase of the installed capacity of any fixed building services.

The Building Regulation Part L 2010 should verified before construction phase and the Code of Sustainable Homes before and after construction and the main entities involved in the process are the Department of Communities and Local Government (CLG) approved accreditation body, providing courses for all strands of commercial and residential energy assessment: CSH (Code for Sustainable Homes), SAP (Newly Constructed Dwellings), DEA (Existing Dwellings), SBEM/DSM (Commercial Buildings), DEC (Public Buildings), Chartered Institution of Building Services Engineers (CIBSE)- Certification, Training and Accreditation, Low Carbon Energy Assessor (Qualified energy assessors can lodge Energy Performance Certificates (EPC) and Display Energy Certificates (DEC) and the Royal Institution of British Architects (RIBA)- Energy Assessment Training and Accreditation in partnership with Stroma.

For the self-certification scheme a company or a person registered with a competent person is qualified. The work of organisations or individuals accepted as members of a scheme is not subject to Building Control inspection. Instead, the competent person self-certifies that the work is in compliance with the Building Regulations require to provide a certificate confirming that the work complies fully with all applicable building regulation requirements to the occupier of the building and to Building Control Body (BCB): a local authority or an approved inspector.

The information from the building regulation process in not expected to be collected in a central database but there are a couple of accreditation bodies approved by the Department for Communities and Local Government (CLG). They store the information about the Energy Performance Certificate (EPC) and Display Energy Certificate (DEC) (ie STROMA).

1.8.2 Requirements on Solar Heat Prevention, Attenuation and Dissipation Strategies

The climate conditions are summarized in the next table based, essentially, on the draft SAP2009 and the Winter is the most relevant season:

	Heating season	Cooling season
Most relevant season in your country	☒	☐
Duration (months)	October to May	June to August
Air Temperatures (Max, Min, Mean)	Mean external temperature variable with month (Jan 4.5 Feb 5.0 Mar 6.8 Apr 8.7 May 11.7 Jun 14.6 Jul 16.9 Aug 16.9 Sep 14.3 Oct 10.8 Nov 7.0 Dec 4.9°C)	Mean external temperature variable with region and month (10.6 – 17.8°C)
Degree Days Refer base temp. heating and cooling 15.5°C / 15.5°C (standard DD for the UK)	2463	213
Number of Climatic zones with different requirements	1 (SAP2005/draft SAP2009)	8 regions (SAP2005)/ 21 regions (draft SAP2009)

Concerning strategies for the solar gain attenuation the thermal mass parameter (TMP) is required for heating and cooling calculations and is also used to obtain the threshold internal temperature which is used to estimate the propensity of high internal temperature in summer (draftSAP2009) and imposes maximum U-Values for the building envelopes according Implementation of EPBD – Country reports 2008:

Dwellings:
Limiting U-values (W/m^2K)

Element	Area Weighted Average U-Value	Limiting U-Value
Wall	0.35	0.70
Floor	0.25	0.70
Roof	0.25	0.35
Windows, roof windows, roof lights and doors	2.20	3.30

Non-Dwellings:
Limiting U-values (W/m^2K)

Element	Area Weighted Average U-Value	Limiting U-Value
Wall	0.35	0.70
Floor	0.25	0.70
Roof	0.25	0.35
Windows, roof windows, roof lights and curtain walling	2.20	3.30
Pedestrian doors	2.2	3.0
Vehicle access and similar large doors	1.5	4.0
High usage entrance doors	6.0	6.0
Roof ventilators (including smoke vents)	6.0	6.0

A reasonable limit for design air permeability for both dwellings and non dwellings is set at $10m^3/h.m^2$) @ 50Pa

Concerning heat dissipation strategies, for all types of buildings, natural ventilation is implemented with operable windows and natural night ventilation is combined with high thermal capacity and also by limiting the solar gains with appropriate window size and orientation.

1.8.3 Methodology or Calculation Procedures

The most relevant season is winter with 8 months and one climatic zone while the cooling season has 3 months and is dived in 21 climatic zones according to draft SAP2009.

The calculation procedures for the new dwellings (single family house, single flat in a multi-family building or entire multifamily building), the Standard Assessment Procedure (SAP 2005), is the methodology adopted for the calculation of the energy performance of dwellings.

The compliance requires the calculation on CO2 emissions from the actual building: Dwelling Emission Rate (DER) with a notional “reference” building with the same size and shape: Target Emission Rate (TER).

The Dwelling CO2 emissions accountable in the calculation are from space and water heating, ventilation and lighting less the emissions savings from renewable energy generated.

Concerning the envelope quality in Part L1A are the required maximum U-values for walls roofs, floors and windows.

Criterion 3 applies for cooling: “the dwelling should have appropriate passive control measures to limit the effect of solar gains on indoor temperatures in summer, irrespective of whether or not the dwelling has mechanical cooling”. Unlike criterion 1 (CO2 emissions) which is mandatory, Criteria 2 to 5 are only for guidance. The Appendix P: Assessment of internal temperature in summer of SAP 2005 provides a method for assessing the tendency of a dwelling to have high internal temperature in hot weather.

In the current version this does not provide an estimate of cooling needs. The procedure does not affect the calculated SAP rating or CO2 emissions but the Draft SAP 2009, that is under consultation, includes a calculation of cooling loads when the dwelling has fixed air conditioning systems.

The Part L, also under consultation, provides guidance on the specification of fixed mechanical comfort cooling systems in dwellings to meet minimum energy efficiency standards. The dwellings should be designed to avoid or minimise the need for cooling through the appropriate use of solar control, secure ventilation and thermal mass.

The cooling systems in dwellings should meet the minimum standards for efficiency in Table 36 (Part LF2010 consultation vol2) and be controlled to prevent simultaneous heating and cooling of the same space within the dwelling.

For all the existent dwellings SAP 2005, as before but is not require that the emissions of DER have to be lower than those from TER.

For the small new non-residential building (< 1000 m^2) can be adopted a Simplified Building Energy Model (SBEM), calculation of cooling energy demand by carrying out an energy balance based on monthly average weather conditions, or an approved a Dynamic Simulation Model (DSM) software package.

The SBEM calculates the energy demands of each space in the building according to the activity within it. Different activities may have different temperatures, operating periods, lighting levels, etc. The SBEM calculates the heating and cooling energy demands by carrying

out an energy balance based on monthly average weather conditions. This is combined with information about system efficiencies in order to determine the energy consumption." The space heating and cooling demand are based on a methodology available in the EN ISO13790.

The relative performance of the proposed building is assessed on CO2 Emissions from a Building Energy Rating (BER) which are compared with those from a notional building Target Energy Rating (TER) .

The SBEM uses a Seasonal Energy Efficiency Ratio (SEER) to calculate the carbon dioxide emission rate for a new building expressed in CO2 emissions in kg/m²/year.

In order to comply with requirements from part L2 on summer comfort each cooling unit of the cooling plant shall achieve a minimum full load Energy Efficiency Ratio (EER) no worse than Table 34 (Part LF2010 consultation vol2) and the minimum control for comfort cooling specified in Table 35 shall be adopted.

For the residential buildings the limitation of internal temperature is not mandatory (draft-SAP2009).

For the small existent non-residential building (≤ 1000 m^2) the methodology is similar to L2A.

For all large non-residential buildings (> 1000 m^2): SBEM or DSM software for EPC level 3/4 assessors. DSM recognised software is required for EPC Level 5 assessors.

For new Public buildings with a useable floor area over 1000 m^2 that are occupied by public authorities and by institutions providing public services to a large number of persons and are therefore frequently visited by members of the public a Display Energy Certificate (DEC) and Advisory Report (AR) are required for public buildings. The certificate needs to be updated each year.

From 2008 (1st October) an Energy Performance Certificate (EPC) is required when a building (dwellings and commercial) is constructed, modified (fabric or services) is rented or sold.

The calculation based on EN ISO 13790 is not yet mandatory for cooling in all type of buildings (draftSAP2009).

The internal gains, people, light and efficient electrical equipment are considered in the regulation.

Concerning the air conditioning systems in the draft of SAP2009, for all type of buildings, the cooling loads will be estimated if dwellings will have a fixed AC systems and Mechanical ventilation (explain) Accountable in all calculations. Subject to specific regulation Part F (E&W). Concerning the humidification can be accountable if a DSM software is used for non residential buildings (news and existing ones).

1.8.4 Recommendations

The recommendations that could be, or should be implemented in order to increase the summer comfort and reduce the use of cooling systems are:

- The prevention of the solar gains are related to the total glazed area and maximum solar energy transmittance and are demonstrable if the solar gains through

the glazing aggregated over the period from April to September, inclusive,are lower than a reference glazing system (side lit facing East with maximum area of 40% glazing area viewed from the inside out, a framing factor of 10% and a g-value of 0.46 estimated according to BS EN 410.

- Concerning the glazing areas the use of shading for new buildings should be external and movable and taking in account the external obstructions and implement minimum requirements by the g-values combined with glazing area as suggested in Part L under consultation. For new buildings the glazing area per façade and orientation is recommendable in particular with combination with shading.

- Limitations on the use of air conditioning systems recommended for new and existing buildings and as much as possible to adopt natural ventilation or a mix-mode.

- The use of passive systems for the new buildings must be as much as possible and in first instance while for the existing ones should be recommended.

- Natural ventilation for the new buildings must be always adopted and, if not possible, hybrid solutions before deciding for mechanical or AC systems while for the existing building should be recommended.

Concerning summer comfort, for all type of buildings, is pointed out that should be explicitly introduced in the building regulation following the methodology in BS EN 37090.

2. RECOMMENDATIONS AND CONCLUSIONS

2.1 GENERAL ISSUES

This survey intends to update, in a regional basis, the information regarding national building regulations, identifying the measures adopted and delineating good practices concerning **energy consumption, summer comfort** and **summer requirements.**

The evaluation of the questionnaires reveals that the new building regulations were already adopted in all member states, following the Energy Performance Building Directive (EPBD), for new and existing residential and non-residential buildings, differing only on the starting date.

The verification of the regulation requirements in five countries will be undertaken in two phases – before and after construction, in France only after construction, prior to sale, rental and/or use, while in Italy only at the planning stage. The role and the entities involved in the application of the regulations are quite similar: architects and engineers the energy calculations and the technical responsibility, builders the quality of construction works, insulation, installations, respecting materials and specifications of design engineers. Concerning the builders-owners and users-tenants, in some countries, like Italy and Austria, no specific role is assigned to them.

In 5 countries a central database exists or will be created to collect the building regulation processes; however, in Italy no such database is expected to be implemented. In Germany,

a country where for more than 50 years there have been recommendations for the building design, building authorities don't control observance or deviations of building directive.

Among the good practices, one should stress the need for verification after construction, especially in countries that only recently adopted building thermal and energy regulations, and underline that an entity responsible for the archiving of the building regulation processes and the energy indicators should be helpful to allow future energy demand calculations and statistical analyses.

2.2 ENERGY CONSUMPTION

The prediction of the energy needs for cooling has already been calculated, in six of the eight countries of the Keep Cool II Project, based on the EN ISO 13790 standard (Ep<Epmax) and even, for Slovenia, when the energy use calculation for cooling can be done by a simplified method, the EN ISO 13790 can also be used as an option. Each country adopted one of the alternatives for the calculation of the cooling needs: monthly or seasonal method or a yearly hourly simulation procedure, with single zone or multizone options, based on simplified RC models for the building.

Only Italy manifests the calculation of the primary energy demand only for heating but manifests also that at least for the new buildings cooling energy calculations should be included as well as maximum legal values for primary energy for cooling.

However, it should not be obligatory to have only one calculation method in Europe but it should have common requirements: to be easy to use and well known to the building actors, to allow them to make the assessment of different strategies and to integrate innovations with a user-friendly software.

As referred this survey was extended to other countries (Annex D) in order to a have a clearer perception of the state of the art around Europe. There are some countries in which summer and cooling needs are not a priority like Romania and Bulgaria while others like Norway, although having cold climate conditions are quite concerned with cooling needs inside offices and services and the standard for the energy demand calculation in buildings includes energy for cooling. The results of the statistical studies for the office and commercial buildings reveal a continuous increase of the energy consumption.

2.3 RECOMMENDATIONS AND REQUIREMENTS FOR SUMMER COMFORT

2.3.1 Mandatory U-Values – walls and roofs

Among all countries of the Keep Cool II Project (Austria, France, Italy, German, Portugal, Slovenia, Sweden and United Kingdom), it was pointed out that the heating season is the most relevant season, only Portugal manifests that cooling and heating seasons are both relevant. However, the partners have already implemented requirements, differing and reflecting the building tradition and tecnhiques.

In all countries there exist requirements on the U-values and on the thermal mass of the building envelope. Six countries reported requirements concerning the U-values on both envelope elements: opaque and transparent; Portugal only reported on the opaque elements and in Germany the requirements are introduced indirectly in the calculation procedure, the requirement is based on the energy demand of a reference building. Figure 1 and Figure 2 present, respectively, the wall and roof U-values requirements for some European countries.

*- U-value average for Sweden

Figure 1 – Wall U-values requirements.

*- U-value average for Sweden

Figure 2 – Roof U-values requirements.

Concerning the envelope quality each country should analyze if it is necessary to impose more restrictive requirements in terms of U-values of the opaque envelope elements. For instance, in its following revision, Portugal intends to adopt more restrictive U-values.

2.3.2 Requirements on windows, shading and strategies for solar heat dissipation and prevention

Mandatory measures of shading devices in glazing façades are referred only by Portugal and Slovenia in an explicit manner (excluding only the north oriented windows). As example it can be referred that in Portugal this mandatory requirement is expressed in terms of the solar factor ($0.10 \leq g_{\perp} \leq 0.56$), depending on the climate summer zone and on the building thermal mass.

For the solar heat prevention, the countries that don't have any requirements until now in their Building Regulations pointed out that they should implement measures such as: shading devices, glazing area and total area of the façade, glazing area per orientation.

For new buildings the glazing area per façade and orientation is recommendable in particular in combination with shading and that relationship should be included in the calculation methodology.

In Slovenia internal shading is not acceptable, except for north oriented windows, and France pointed out the existence of minimum requirements on solar factor in bedrooms (without cooling).

Figure 3 – Glass requirements.

In Germany recommendations to glazing areas and solar shading for new residential buildings have existed for more than 50 years, to avoid overheating problems and, 15 years ago, those recommendations were extended to specific requirements. The building designer has to prove that the solar gains do not exceed a limit value related to the climatic conditions, building thermal mass, night ventilation, orientation, glazing system and shading systems, excluding only small window to floor area ratios of less than 10%.

For the next revision of the regulation, in the United Kingdom, the prevention of solar gains should be demonstrable if the aggregated solar gains, over the period from April to September, are lower than a reference glazing system (side lit facing East with maximum area of 40% glazing area viewed from the inside out, a framing factor of 10% and a g-value of 0.46).

Concerning the glazing areas the use of shading, for new buildings should be external and movable and take in account the external obstructions, and minimum requirements should also be implemented based on the g⊥-values combined with glazing area. So, at least for new buildings it should be recommendable to implement shading factors for shading systems in connection with glazing area/orientation.

The limitation of a totally glazed transparent envelope as a solar heat prevention strategy should be established, for the different countries, based on extensive simulation studies to avoid an increase of the heating energy demands and the penalization of day lighting strategies. In order to reach sustainable summer comfort for existent residential buildings it should be obligatory to shade them when major renovation will be ongoing.

For all types of buildings, existent, new and residential or non-residential, concerning heat dissipation strategies, natural ventilation is always mentioned as a measure to be adopted and, whenever natural ventilation is not sufficient, then the integration of a mechanical ventilation system is recommended.

Concerning dissipation strategies the only countries that do not refer to any strategy are Slovenia and Sweden. Other countries mention the natural ventilation (night ventilation) and France the earth as cooling source while Germany expressly manifested that is not taken in account.

Regarding the use of passive systems it is necessary to investigate what strategy or strategies should be included in the building regulation according the climate conditions, such as:

- diurnal thermal amplitudes to evaluate the night ventilation potential cooling;
- solar radiation intensity to adequate glazing areas and orientation as well as shading strategies without penalizing the natural light and the heating season;
- use of passive systems, namely the earth, as a cooling source should be investigated and the use of air conditioning systems should be avoided.

To ensure night ventilation safety demands against storms and burglary are also necessary.

Natural ventilation for the new buildings must be always adopted and, if not possible, hybrid solutions should be recommended before opting for mechanical or AC systems.

From the answers it is clear that those aspects should be introduced in the building regulations.

2.4 SUMMER COMFORT

The survey pointed out an enormous consensus for summer comfort to be explicitly introduced in the building regulations for all type of buildings (new and existing buildings, residential and non-residential) and also that summer comfort calculations should be required. Checking the indoor temperatures and standards should also be explicitly introduced. From the answers, the following comfort calculations can be followed by other countries;

- for new buildings and using the French official software (Tic ≤ Tic ref, Tic ref, residential buildings or non-cooled buildings, the internal maximum temperature Tic for a reference warm day (calculated as the average operative temperature for the 3 consecutives warmest days) the previous relationship must be verifed, with Tic ref calculated by applying reference solar protections depending on the climatic zone;

- calculation of the occurrence of over-temperature based on the standard ISO 13791:2004, without any cooling or heating system under transient basic conditions, furthermore appoints overheating when the temperature exceeds 27 °C during the day and 25 °C during the night .

- two standards were pointed out as to be adopted: BS EN 37090, EN 15251.

Most of the recommendations are already implemented, in France for existing and new buildings: area of glazing per façade and use of shading, included in the calculation of the reference building, limitations on the use of air conditioning system for situations of T > 26°C, natural ventilation. Presently, only Italy and Sweden didn´t include either requirements nor recommendations regarding summer comfort.

In summer conditions the free floating temperature should be calculated and limited to justify the cooling devices adoption. Summer comfort should be explicitly introduced in the new buildings and a summer comfort calculation should be required.

Summer comfort should be introduced in the building regulation for all types of buildings adopting or standards should be explicitly introduced in the building regulation.

The EN 15251 – “Indoor environmental input parameters for design and assessment of energy performance of buildings addressing indoor air quality, thermal environment, lighting and acoustics”, the adaptive thermal comfort model should be used for building design to prevent overheating, using solar shading or decreasing window size, increasing thermal capacity of the building or adopting operable windows to promote cross ventilation.

Summer comfort should be explicitly introduced in the building regulation for all types of buildings and standards should also be explicitly introduced in the building regulation. According to recent studies, more than half of the Member States are already using CEN standards or CEN methods.

2.5 FINAL REMARKS

The adaptation of passive systems must be checked and if realizable, the employment of mechanical cooling systems should always be avoided and only used if it is demonstrated that the passive solar measures (solar heat attenuation and heat dissipation) and the passive

cooling systems (ground tubes, natural ventilation devices, etc..) do not guarantee pleasant thermal internal comfort conditions.

Some countries, like Austria, have a more drastic point of view manifesting that in the residential buildings air conditioning systems should not be allowed to be installed and the limitations on the use of air conditioning systems must be extended to non residential buildings. Only in certain cases should they be allowed (for instance, if all passive measures have been undertaken but the internal loads are too high or specific circumstances exist that require low temperatures as in hospitals)

Each country should be encouraged to apply mandatory passive requirements for summer but not in an uniform way all over Europe.The requirements on the elements on the building design should be integrated in the building construction according to the climate conditions of each region.

In colder areas the mechanical cooling equipments should always be replaced by good design requirements based on architectural solutions. To reduce the cooling consumption further measures can also be adopted selecting efficient electric lighting and equipment and in this way reducing the internal gains.

At least for the new buildings cooling energy and summer comfort calculations should be included as well as maximum legal values for primary energy for cooling.

Informative campaigns on passive cooling, for households and for building managers and users, should be undertaken in order to prevent overheating and to reduce mechanical cooling devices.

So, for a sustainable summer comfort the adoption and use of passive systems must always be checked out and their contribution should be incorporated in the building regulation. On the other end the national building regulations should also have more exigent limit values of the cooling energy demands.

The increase of the use of air conditioning systems in Europe leads to considerable problems at peak load times, increasing the cost of electricity and disrupting the energy balance in the European countries. According to the recommendations of the European Parliament "*priority should be given to strategies which enhance the thermal performance of buildings during the summer period. To that end, there should be further development of passive cooling techniques, primarily those that improve indoor climatic conditions and the micro-climate around buildings*".

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ANNEX A

QUESTIONNAIRE OF TASK 2.3

CRITERIA FOR ENERGY EFFICIENCY IN NATIONAL BUILDING CODES CONCERNING SUMMER COMFORT

QUESTIONNAIRE

Country:				
Name:				
Contact:	E-mail		Telephone	

Part A - GENERAL QUESTIONS ABOUT BUILDING REGULATION IN YOUR COUNTRY

A1. What's the current status of building regulations in your country following the EPBD?

State the date when it started or when is predicted to start.

☐	New building regulations have been published following the Directive but are not yet in force Date:
☐	New building regulations have been published following the Directive and are already in force Date:
☐	No new building regulations have been published but the previous legislation is in force Date:
☐	No new building regulations have been published and no specific legislation is in force Date:
☐	Other (specify). Date:

Additional details or information:

_____

A2. In which buildings is (or will be) required to verify the Building Regulation?

☐	New Residential
☐	New Non – Residential (If yes explain in which case)
☐	Existent Residential (when major renovated) (If yes explain in which case)
☐	Existent Non - Residential (when major renovated) (If yes explain in which case)
☐	Other (specify).

A3.When is (or will be) required to verify the Building Regulation?

☐	Only at planning stage, before construction starts, in order to have a permit
☐	Only after construction, prior to sale, rental and/or use
☐	Both before (construction) and after construction (for sale, rental and/or use)
☐	Other (specify).

Additional details or information:

A4.What are the main entities involved in the building application and what's their role?

Entity	Role
Professional (Arch,Eng.)	
Builder	
Build Owner	
User/Tenant	

A5.Is or will be the information from the building regulation process collected in a central database? (If answer is "Yes", please describe the main information collected)

☐ No ☒ Yes. Please describe:

A6. Describe, very shortly, the main aspects of the methodologies used in your country for building regulation.

Refer the main steps and parameters. (*Ex. In the residential sector there are some minimum requirements related with solar factor, and a monthly calculation procedures in order to get the cooling energy needs, or in summer a calculation is needed in order to prove that the internal air temperature is below 25ºC, or….).*

Type of building	Short description of the methodology(ies) used in Building Regulation	
	New buildings	Existing buildings
Residential, single family house		
Residential, single flat in multifamily building		
Residential, entire multi-family building		
Small non-residential building (< 1000 m2)		
Large non-residential building (> 1000 m2)		
Public buildings		
Other		

Additional description or information:

Part B – QUESTIONS ON REQUIREMENTS/CALCULATION PROCEDURES

B1. Which types of actions are required in your Building Regulation, regarding summer? If necessary, provide additional information at the end of the table (e.g. explaining to which buildings it applies to, if it depends on the assessment method, etc.). ☒ yes ☐ no

Action to be followed in the Building Regulations concerning Summer	New buildings		Existing buildings	
	Residen-tial	Non-Resid.	Residen-tial	Non-Resid.
Recommendation or guidelines (envelope and systems) *Refers to suggestions, not mandatory*	☐	☐	☐	☐
If yes in previous explain				
Explicitly refer the summer comfort?	☐	☐	☐	☐
If yes in previous explain				
Minimum Requirements *Refers to glazing areas, solar shading ,*	☐	☐	☐	☐
If yes in previous explain				
Mandatory measures on the envelope **see B3** *Ex, mandatory shading in south glazing facades in summer…*	☐	☐	☐	☐
If yes in previous explain				
Mandatory measures on the systems *Ex, the air conditioning system is mandatory if…. summer*	☐	☐	☐	☐
If yes in previous explain				
Calculation procedures (**Describe in B8**)	☐	☐	☐	☐
Energy calculation	☐	☐	☐	☐
Summer comfort calculation	☐	☐	☐	☐
	☐	☐	☐	☐

Additional description or information:

B2. Describe the Climatic conditions

	Heating season	Cooling season
Most relevant season in your country	☐	☐
Duration (months)		
Air Temperatures (Max, Min, Mean)		
Degree Days Refer base temp. heating and cooling /		
Number of Climatic zones with different requirements		

Additional description or information:

B3. Requirements related with Solar Heat Prevention In this question the main goal is to identify if in your Building Regulation there are any requirement (this mean **mandatory** measures) related with any of the following items which need to be addressed in the procedures of application of the Building Regulation. ☒ yes ☐ no

Requirements on:	New		Existing	
	Residential	Non-Resid.	Residential	Non-Resid.
Total glazing area (*explain)*	☐	☐	☐	☐
Glazing area per orientation (*explain)*	☐	☐	☐	☐
Glazing type (*explain)*	☐	☐	☐	☐
Solar protection depend on orientation (*explain)*	☐	☐	☐	☐
Window U maximum ($W/m^2{}^oC$) (*explain)*	☐	☐	☐	☐
Maximum solar factor (*explain)*	☐	☐	☐	☐

Additional description or information:

B4. Internal Gains Are considered in Building Regulation? (Ex. In the calculation is needed to take in attention…..)

. ☒ yes ☐ no

	New		Existing	
	Residen-tial	Non-Resid.	Residen-tial	Non-Resid.
People (*explain)*	☐	☐	☐	☐
Lighting (*explain if requirements exist)*	☐	☐	☐	☐
Efficient electrical equipment (*explain if requirements exist)*	☐	☐	☐	☐

Additional description or information:

B5. Solar Gain Attenuation is considered in Building Regulation? (Ex. Minimum values?). ☒ yes ☐ no

	New		Existing	
Minimum requirements for:	Residen-tial	Non-Resid.	Residen-tial	Non-Resid.
Thermal mass (inertia) (*explain)*	☐	☐	☐	☐
Wall U-values ($W/m^2{}^oC$) (*explain)*	☐	☐	☐	☐
Roof U-values ($W/m^2{}^oC$) (*explain)*	☐	☐	☐	☐
Floor U-values ($W/m^2{}^oC$) (*explain)*	☐	☐	☐	☐

Additional description or information:

B6. Heat Dissipation Strategies is considered in Building Regulation? (Explain if yes, how is considered as suggestion? recommendation? calculation?). ☒ yes ☐ no

Passive strategies	New		Existing	
	Residen-tial	Non-Resid.	Residen-tial	Non-Resid.
Natural diurnal comfort ventilation (*explain)*	☐	☐	☐	☐
Natural night ventilation (*explain)*	☐	☐	☐	☐
Earth as cooling source (*explain)*	☐	☐	☐	☐
Other (*explain)*	☐	☐	☐	☐

Additional description or information:

B7. Air Conditioning Systems is considered in Building Regulation? (Explain if yes, how is considered as suggestion? recommendation, to avoid it? Mandatory if the internal temperature greater than….? Or a cooling load calculation).

☒ yes ☐ no

Requirements for:	New		Existing	
	Residen-tial	Non-Resid.	Residen-tial	Non-Resid.
Cooling (*explain)*	☐	☐	☐	☐
Humidification (*explain)*	☐	☐	☐	☐
Mechanical ventilation (*explain)*	☐	☐	☐	☐

Additional description or information:

B8. Calculation Procedures are considered in the procedures, as mandatory? ☒ yes ☐ no

Procedures	New		Existing	
	Resi-dential	Non-Resid.	Resi-dential	Non-Resid.
Limitation of internal temperature ($T_{ic} \leq T_{ic}$ ref) (*explain)*	☐	☐	☐	☐
Cooling loads (*explain)*	☐	☐	☐	☐
Energy performance method for cooling (Ep<Epmax) (*explain)*	☐	☐	☐	☐
Calculation based on PrEN ISO 13790 (*explain)*	☐	☐	☐	☐
Describe the output of the calculation (kWh/m^2, primary energy, other) (*explain)*	☐	☐	☐	☐
Monthly calculation procedure (*explain)*	☐	☐	☐	☐
Hourly simulation procedure (*explain)*	☐	☐	☐	☐
Other calculation procedures (*explain)*	☐	☐	☐	☐
	☐	☐	☐	☐

Additional description or information:

PART C – RECOMMENDATIONS TO INCREASE SUMMER COMFORT

C1. Please provide recommendations that could be, or should be implemented in your Building Regulation in order to increase the summer comfort and reduce the use of cooling systems:

Explain; should be/must be/recommendable/not interesting

Measures/Recommendation	New buildings	Existing buildings
Implement minimum requirements		
Area of Glazing per façade		
Area of Glazing per orientation		
Use of shading		
Limitations on the use of air conditioning systems		
Use of Passive Systems		
Natural ventilation		
Minimum requirements + Calculation requirements		
Others		

Additional description or information:

C2. Summer Comfort should be explicitly introduced in your building regulation? ☒ yes ☐ no

Type of building	New	Existing
Residential, (*explain how /give suggestions)*	☐	☐
Non-residential building (*explain how/give suggestions)*	☐	☐

C3. Standards should be explicitly introduced in your building regulation? ☒ yes ☐ no

Type of building	New	Existing
Residential, (*explain how /give suggestions)*	☐	☐
Non-residential building (*explain how/give suggestions)*	☐	☐

C4. Should any others suggestions to be included in the future as measures towards a sustainable summer comfort?

NEW building
Residential, (*suggestions)*
Non-residential building (*suggestions)*

EXISTENT building
Residential, (*suggestions)*
Non-residential building (*suggestions)*

Thank you

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ANNEX B

CRITERIA FOR ENERGY EFFICIENCY IN NATIONAL BUILDING CODES CONCERNING SUMMER COMFORT

COMPARATIVE ANALYSIS

QUESTION	A1	A2	A3	A4	A5	A6	
BUILDING REGULATION (BR) GENERAL QUESTIONS	current status of BR	BR applied to	stage of BR aplication	role and entities involved	BR process collected	BR methodologies	
						NEW	EXISTING
AU - Austria	New BR **after the Directive** and in force **except in Lower Austria and Vienna.** The dates are different from one federal state to the other and every one of the 9 federal states has its ownBR following Austria's basis document for implementing the Directive but some of them have more demanding values	**All new and existing residential and non-residential buildings**	**before and after construction**	**Arch,Eng.** Technical responsibility, liability **Build Owner** Ownership	**YES** The author of the energy performance certificate is listed and has an author number. They are committed to send the results to the Austrian statistics center. In addition there is a voluntary system called ZEUS www.energieausweise.net	**Residential** There are minimum requirements for the quality of the envelope (maximum U-values, maximum heat energy demand) summer comfort has to be considered regarding the Austrian standard ÖNORM B 8110-3* The Austrian standard ÖNORM H 6040 regulates the calculation of the cooling load. The Austrian standard ÖNORM B 8110-6 regulates the calculation of the cooling demand. **Non-residential** There are minimum requirements for the quality of the envelope (maximum U-values, maximum heat energy demand) For the calculation of the occurrence of over temperature the standard (ISO 13791:2004) has to be used: Thermal performance of buildings - Calculation of internal temperatures of a room in summer without mechanical cooling - General criteria and validation procedures The Austrian standard ÖNORM H 6040 regulates the calculation of the cooling load. The Austrian standard ÖNORM B 8110-6 regulates the calculation of the cooling demand. The Austrian standard ÖNORM B 8110-3 has to be fulfilled. The maximum cooling demand is **1 kWhm. 3-³a** (gross volume	**Residential** There are minimum requirements for the quality of the envelope (maximum U-values, maximum heat energy demand) summer comfort has to be considered regarding the Austrian standard ÖNORM B 8110-3* The Austrian standard ÖNORM H 6040 regulates the calculation of the cooling load. The Austrian standard ÖNORM B 8110-6 regulates the calculation of the cooling demand. **Non-residential** There are minimum requirements for the quality of the envelope (maximum U-values, maximum heat energy demand) For the calculation of the occurrence of over temperature the standard (ISO 13791:2004) has to be used: Thermal performance of buildings - Calculation of internal temperatures of a room in summer without mechanical cooling - General criteria and validation procedures The Austrian standard ÖNORM H 6040 regulates the calculation of the cooling load. The Austrian standard ÖNORM B 8110-6 regulates the calculation of the cooling demand. The Austrian standard ÖNORM B 8110-3 has to be fulfilled The maximum cooling demand is **2 kWh/m³a** (g
DE - Germany	New BR published **after the Directive** and in force **01/10/2007**	**All new and existing residential and non-residential buildings**	**before and after construction** for sale or rent energy certificates. Non residential certificates required from October 2009	**Arch.and Eng.** calculation builder **Builder** follow the instructions and responsible for constructing activities **Builder Owner** reponsible for inspection of arir condition and replacement of boilers **User Tenant** no role	**NO** building authorities don't control observance or deviations of building directive	**DIN V 18599, 2007 (residential and non-residential)** (integrate balance between:building, usage and technical equipment)	**DIN V 18599, 2007 (residential and non-residential)** (integrate balance between:building, usage and technical equipment)
FR - France	New BR published **after the Directive 24/5/2006** and in force **1/09/06**	**All new and existing residential and non-residential buildings** (new non residential except swimming-pool; rink; livestock ; T°>12°C ; heated or cooled for process reasons)	**Only after construction,** prior to sale, rental and/or use	**Arch.and Eng.** energy calculations in accordance with building regulation Builder Must respect materials and specifications of design engineer Builder Owner Is responsible that the calculation is done User Tenant no role	**YES** maybe by the state controlers	**ALL TYPE** Primary energy consumption + indoor summer temperature + components minima	**Residential** Replacement by new components reaching new standards >1000 m^2 Primary energy consumption + indoor summer temperature + components minima **Small non residential** Replacement by new components reaching new standards **Large non residential** Primary energy consumption + indoor summer temperature + components minima Detailed Scheme
IT- Italy	New BR published **after the Directive 24/5/2006** and in force **August 2005**	**All new and existing non-residential buildings**	**Only at planning stage**	**Arch.and Eng.** To design architectonical and plant systems **Builder** To construct building	**NO**	**ALL TYPE** National energy law says that, to limit the cooling energy needs: **1)** effective solar protections for trasparent elements of the building envelope have to be used; **2)** in whose zones where mouthly mean irradiance is equal or over to 290W/m2, the superficial thermal mass has to be higher than 230 kg/m3; **3)** natural ventilation has to be promoted **Remarks** Calculation of the Primary Energy Demand for Heating has to be done established for every use of building in function of the Surface/Volume ration and of the Climatic Zone	**ALL TYPE** National energy law says , about summer conditions,: **1)** effective solar protections for trasparent elements of the building envelope have to be used; **2)** in whose zones where mouthly mean irradiance is equal or over to 290W/m2, the superficial thermal mass has to be higher than 230 kg/m3; **3)** natural ventilation has to be promoted **Remarks** Calculation of the Primary Energy Demand for Heating has to be done established for every use of building in function of the Surface/Volume ration and of the Climatic Zone

QUESTION	A1	A2	A3	A4	A5	A6	
BUILDING REGULATION (BR) GENERAL QUESTIONS	current status of BR	BR applied to	stage of BR aplication	role and entities involved	BR process collected	BR methodologies	
						NEW	EXISTING
PT - Portugal	New BR published following the Directive and are already in force **03-07-2006** RCCTE addressed to residential and non residential with floor areas ≤ 1000m^2 without HVAC systems or with installed P ≤ 25 kW, major rehabilitations and enlargements but only to the expanded area. RSECE: addressed to residential and small non-residential buildings (area≤1000m2) with installed P > 25 kW, all large non residential buildings (A>1000 m^2) with or without systems and all buildings with new HCAV systems with P >25 kW	**New Residential** RCCTE or RSECE **New Non – Residential** RCCTE or RSECE **Existent Residential** (when major renovated - 25% of the building value RCCTE or RSECE **Existent Non - Residential** (≤1000 m^2 RCCTE other RSECE)	**before and after construction** necessary before construction with a declaration of conformity of the regulation national building and after construction before building use with an energy certificate	Arch and Eng. calculation of the new BR, visit of the building, making the EPB-declaration after construction, and emission of energy certificate **Builder** existence of energy and air quality certificate, selection of an expert for the certification process, audits and periodical inspections and supply all the necessary elements required by the Portuguese Energy Agency **Builder Owner** same responsibilities of the builder in case of sale or rent **User Tenant** ask for the certificate	**YES** Portuguese Energy Agency – ADENE, responsible for the Certification process.	**Type of building** **1** RCCTE **2** RCCTE **3** RCCTE/RSECE **4** RCCTE/RSECE **5** RSECE **6** RCCTE/RSECE **RCCTE** (EN 13790): **RSECE** (Hourly heat balance between losses and gains through transparent and opaque envelope and internal gains (Qhc)) The calculation methods are applied to residential and non-residential new and existing buildings according to question A.1,	**Type of building** **1** RCCTE **2** RCCTE **3** RCCTE/RSECE **4** RCCTE/RSECE **5** RSECE **6** RCCTE/RSECE RCCTE (EN 13790): RSECE (Hourly heat balance between losses and gains through transparent and opaque envelope and internal gains (Qhc)) The calculation methods are applied to residential and non-residential new and existing buildings according to question A.1,
SL- Slovenia	New BR publised after the Directive and in force **30.09.2008**	**All new and existing residential and non-residential buildings** (Existent buildings only if the building permit is needed, i.e. if the renovation covers also structural changes and if after renovation the impact of the building to the environment and its appearance differ)	**before and after construction** Building codes are verified when the building permit is requested, when the technical checking is done (before the building is put in use) and the permission to use is issued (i.e. the energy certificate is to be done /before the permission to use).	**Arch.and Eng.** Elaboration of design documentation where 6 essential requirements for the building are proved by engineering methods **Builder** Quality of construction works, insulation, installations **Builder Owner** Reliable decision making during the design phase (life cycle thinking, reasonable definition of required comfort level). Holistic long term view on maintenance and repair **User Tenant** Rational use of energy in operation phase, understanding of thermal comfort and how to reach it most economically	**yes** Energy certificates (calculated for new buildings will be stored in and electronic database with a link to the cadastre of buildings. Energy indicators will be stored digitally, (not only pdf of certificate) to allow later energy demand calculation and statistical analyses (electronic data base expected by Jan. 2010)	**No differentiation in minimum requirements or calculation approach per building type** Obligatory shading (internal shading is not acceptable) for all orientations except north, solar thermal and reflective glazing are allowed if incoming radiation is reduced to prescribed limit. The new regulation in 2008 imposed: More severe requirements on Umax (example: Umax wall < 0,28 W/m2K) Requirements: Max cooling load < □VC = 24 W/m3 Max cooling device power PVC,e = 1,05 □VC .Ve/ EER (We); where EER and COP (by pr EN 14511) in ESEER (Eurovent) are listed. Only cooling generators of class A, B and C are allowed	
Sweden	New BR published following the Directive and are already in force **01-07-2006**	**All new and existing residential and non-residential buildings**	**before and after construction** The actual energy consumption for space heating, space cooling, hot water and ventilation is to be verified through metering 24 month after the building has been constructed, which coincides with the mandatory building energy certification. For buildings with electricity heating/cooling this implies that two meters are installed	**Arch.and Eng.** Engineering ("consulting") firms design **Builder** Building companies build according to the design **Builder Owner** Building process. Procurer, often hires a consultant for following the construction process incl. the dialogue with the building company and the designer **User Tenant** Depends on the contract. Usually are very little involved in the building management	**YES** the information from the building energy certificates is stored in a centralised database	**Residential, single family house** Maximum value for final energy use in kWh/m2 (heated area) for heating, cooling, hot water, ventilation, independent from the energy carrier. A minimum average Uvalue is also required. Two climate zones – North and South-exist. For buildings with Area<100 a prescriptive simplified approach is allowed. Energy produced with PV or solar heating is to be deducted from the actual energy use. North: 130 kWh/m2 South: 110 kWh/m2 Max Uvalue average = 0,5 For direct electricity heated buildings: North: 95 kWh/m2 South: 75 kWh/m2 **Residential, entire multifamily building** Maximum value for final energy use in kWh/m2 (heated area) for heating, cooling, hot water, ventilation, independent from the energy carrier. A minimum average Uvalue is also required. Two climate zones – North and South-exist. Energy produced with PV or solar heating is to be deducted from the actual energy use. North: 130 kWh/m2 South: 110 kWh/m2 Max Uvalue average = 0,5 **Non Residential (large, small), Public**	**ALL TYPE** Not yet regulated

QUESTION	A1	A2	A3	A4	A5	A6	
BUILDING REGULATION (BR) GENERAL QUESTIONS	current status of BR	BR applied to	stage of BR aplication	role and entities involved	BR process collected	BR methodologies	
						NEW	EXISTING
UK- United Kingdom	New BR published **after the Directive** and in force **April 2006** Under further revision **2010**	**All new and existing residential and non-residential buildings**	**Part L- Conservation of fuel and Power after construtuion** prior to sale, rental and/or use **Part CHS -Code of Sustainable Homes before and after construction** f.	**Royal Institution of British Architects** (RIBA)- Energy Assessment Training and Accreditation in partnership with Stroma, a Department for Communities and Local Government (CLG) **Chartered Institution of Building Services Engineers** (CIBSE)- Certification, Training and Accreditation, Low Carbon Energy Assessor (Qualified energy assessors can lodge Energy Performance Certificates (EPC) and Display Energy Certificates (DEC). **A company or person registered with a competent person self-certification scheme**. The work of organisations or individuals accepted as members of a scheme is not subject to Building Control inspection. Instead, the competent person self-certifies that the work is in compliance with the Building Regulations. Require to provide a certificate confirming that the work complies fully with all applicable building regulation requirements to the occupier of the building and to Building Control Body (BCB): a local authority or an approved inspector	**NO** A couple of accreditation bodies approved by the Department for Communities and Local Government (CLG) store the information about the Energy Performance Certificate (EPC) and Display Energy Certificate (DEC) (ie STROMA).	**Residential** The Standard Assessment Procedure (SAP 2005) is the adopted methodology for calculating the energy performance of dwellings. **Small non-residential building (< 1000 m2)** Simplified Building Energy Model (SBEM) or approved Dynamic Simulation Model (DSM) software package.SBEM uses a Seasonal Energy Efficiency Ratio (SEER) to calculate the carbon dioxide emission rate for a new building. In order to comply with requirements from part L2 on summer comfort the cooling systems should met the following: Each cooling unit of the cooling plant shall achieve a minimum full load Energy Efficiency Ratio (EER) no worse than Table 34 (Part LF2010 consultation vol2) and the minimum control for comfort cooling specified in Table 35 shall be adopted. **Large non-residential building (> 1000 m2)** SBEM or DSM software for EPC level 3/4 assessors. DSM recognised software is required for EPC Level 5 assessors	**Residential** SAP 2005, as before but does not require the emissions of DER to be lower than those from TER **Small non-residential building (< 1000 m2)** SMethodology similar to L2A **Large non-residential building (> 1000 m2)** SBEM or DSM for EPC level 3/4 assessors. DSM recognised software is required for EPC Level 5 assessors.

PARTB	B1		B2	B3		B4		B5		B6		B7		B8	
REQUIREMENTS OR CALCULATION PROCEDURES	**actions regarding summer in BR**		**climatic conditions in BR**	**solar heat prevention**		**internal gains**		**solar gain attenuation**		**heat dissipation strategies**		**air conditioning sytems**	**air conditioning sytems**	**mandatory calculation procedures**	
	NEW	**EXISTING**		**NEW**	**EXISTING**	**NEW**	**EXISTING**	**NEW**	**EXISTING**	**NEW**	**EXISTING**	**NEW**	**EXISTING**	**NEW**	**EXISTING**
AU - Austria	**Residential and non Residential** Recommendation or guidelines - -Explicitly refers summer comfort - - energy calculation and - summer comfort calculation	**Residential and non Residential** recommendation or guidelines - -explicitly refers summer comfort - - energy calculation and - summer comfort calculation	**heating season** **heating season: 7 months** **Linz, December 2003** **11.8 /-14.2 / -0.1** **3800 °C.dias** **7 climatic zones** cooling season 36.9 / 11.3 /23 not available 7 climatic zones	Window U maximum (W/m²°C) (explain) u-values for windows vary between 1,7 and 1,9	Window U maximum (W/m²°C) (explain) u-values for windows vary between 1,7 and 1,9	**people and elecrtical equipment** equipment is considered in calculationseven if it is efficient or not.	**people and elecrtical equipment** equipment is considered in calculationseven if it is efficient or not.	**residential and non residential** **thermal mass** 1000 m³/h.m² – ≥ 2000 kg/m² 75 m³/h.m² – ≥ 4000 kg/m² 50 m³/h.m² – ≥ 8000 kg/m² **Wall U-values** 0.38- 0.5W/m²°C **Roof U-values** 0.2 - 0.35W/m²°C **Floor U-values** 0,35 - 0,50 W/m²°C	**residential and non residential** **thermal mass** 1000 m³/h.m² – ≥ 2000 kg/m² 75 m³/h.m² – ≥ 4000 kg/m² 50 m³/h.m² – ≥ 8000 kg/m² **Wall U-values** 0.38- 0.5W/m²°C **Roof U-values** 0.2 - 0.35W/m²°C Floor U-values 0,35 - 0,50 W/m²°C	**Natural diurnal comfort ventilation** **Natural night ventilation** Austrian standard ÖNORM B 8110-3: necessary day and night ventilation, appropriate requirements for a heightened natural ventilation, like a window that can be opened. To ensure the night ventilation, necessary safety demands (against storm, burglary, etc.) have to be considered. If the air change rates are applied their compliance has to be preserved – especially during night. During day the hygienic air change has to be ensured.	**Natural diurnal comfort ventilation** **Natural night ventilation** Austrian standard ÖNORM B 8110-3: necessary day and night ventilation, appropriate requirements for a heightened natural ventilation, like a window that can be opened. To ensure the night ventilation, necessary safety demands (against storm, burglary, etc.) have to be considered. If the air change rates are applied their compliance has to be preserved – especially during night. During day the hygienic air change has to be ensured.	**no** (Is dealt within the deployment protection regulation (AStV, BGBl II Nr. 368/1998)	**no** (Is dealt within the deployment protection regulation (AStV, BGBl II Nr. 368/1998)	(TicsTic ref) standard (ÖNORM EN ISO 13791) single room indoor temperatures without cooling or heating system under transient basic conditions. Does not contain sufficient information to define specific zones like sun places, atrium, indirect passive sun components (sun panels) internal conditions. Ep ≤ Epmax (kWh/m2) prEN 13790 The annual cooling demand is the sum of the monthly cooling demands. For non-residential buildings there is a limit: New buildings: 1 kWh/m²a (gross floor area) Detailed commented	(TicsTic ref) standard (ÖNORM EN ISO 13791) single room indoor temperatures without cooling or heating system under transient basic conditions. Does not contain sufficient information to define specific zones like sun places, atrium, indirect passive sun components (sun panels) internal conditions. Ep ≤ Epmax (kWh/m2) prEN 13790 The annual cooling demand is the sum of the monthly cooling demands. For non-residential buildings there is a limit: Existing buildings: 2 kWh/m²a (gross floor area Detailed commented
DE - Germany	**Residential** refers summer comfort - DIN 4108-2 Recommendations DIN 4108-2 **Non-residential** refers summer comfort - DIN 4108-2 mandatory measures on systems DIN 1946	**any indication** on all items **except for non-residential** explicity mark **no** for mandatory measures for systems	**Climatic Zones:** Winter -12 Summer-12	additional information in german **residential** **global balance method**	additional information in german **residential** **global balance method**	additional information in german **residential** **value on W/m²**	additional information in german **residential** **value on W/m²**	additional information in german **residential** only thermal mass U-values - no	additional information in german The same procedura but is not mandatory	**residential** natural night ventilation (bonus system) additional information in german	additional information in german not applied to the existent building	**residential** no for 3 items **DIN 18599**	**DIN 18599?**	**residential** any information **no residential** **Cooling loads** **DIN 18599**	**residential** any information **no residential** **on the energy certificate delivered (oriented on the energy needs or energy consummation**
FR - France	explicitly refers summer comfort minimum requirements on solar factor in bedroomsIf no cooling energy calculation summer comfort calculation	minimum requirements on solar factor in bedrooms If no cooling	**heating season** - heating season: 7month -10 °C 2000 °C.dias - cooling season: ----- 31 °C **Climatic Zones:** Winter -8 Summer-8	Window U maximum (W/m²°C) **2,6 W/m2°C** maximum solar factor **in bedrooms** (non residential hotels and hospitals)	Window U maximum (W/m²°C) **2,6 W/m2°C** maximum solar factor **in bedrooms** (non residential hotels and hospitals)	**yes** **residential** and **non residential**	**yes** **residential** and **non residential**	**Residential and non residential** **Wall U-values** **0,45 W/m²°C** **Roof U-values** **0.34** (flat) - **0.28** (other) **W/m²°C** **Floor U-values** **0,40 W/m²°C**	----------	**yes** Natural diurnal comfort ventilation Natural night ventilation Earth as cooling source	**yes** Natural diurnal comfort ventilation Natural night ventilation Earth as cooling source	**residential and non residential** Cooling - Categories CE1 and CE2 (noise area and climatic zone) mechanical ventilation	**residential and non residential** Cooling - Categories CE1 and CE2 (noise area and climatic zone)	**(TicsTic ref)** Tic ref depend of climatic zone use of official software **cooling loads** **energy /m2** **Hourly simulation procedure**	**(TicsTic ref)** Tic ref depend of climatic zone use of official software **cooling loads** **energy /m2** **Hourly simulation procedure**
It - Italy	**Residential and non Residential** Effective shadings (not better specified) and natural ventilation in buildings has to be promoted sufficient superficial mass (>230 kg/m2), if monthly mean irradiance is higher than 290W/m2	**Residential and non Residential** Effective shadings (not better specified) and natural ventilation in buildings has to be promoted sufficient superficial mass (>230 kg/m2), if monthly mean irradiance is higher than 290W/m2	**heating season** - depending by climatic zone - Minimum internal temperature has to be 20°C (±1) (except for industrial building which is set to 18°C) -degre-days changing zone by zone - 7 climatic zones **Remarks:** all these information are collected by the DPR 412/1993	**Glass+Frame** 2006 2,40-5,50 2009 2,20-5,00 **Glass** 2006 2,30-5,00 2009 1,60-5,00 **Remarks** Efficient shadings (not better specified) and sufficient superficial mass (>230 kg/m2)	**Glass+Frame** 2006 2,40-5,50 2009 2,20-5,00 Glass 2006 2,30-5,00 2009 1,60-5,00 **Remarks** Efficient shadings (not better specified) and sufficient superficial mass (>230 kg/m2)	**yes**	**yes**	**Residential** **Thermal mass** **230 kg/m2** **Wall U-values** **2006** **0,44 – 0,85 W/m2°C** **2009** **0,35-0,72 W/m2°C** **Non residential** **Wall U-values** **2006** **0,44 – 0,85 W/m2°C** **2009** **0,35-0,72 W/m2°C**	----------	**The UNI 10339-95 norm fixes the values of air changes, the air infiltration levels, the indoor air velocity for different building types**	**The UNI 10339-95 norm fixes the values of air changes, the air infiltration levels, the indoor air velocity for different building types**	Yes **Remarks:** **The comfort conditions and the efficiency of mechanical ventilation is not considered**	Yes **Remarks:** **The comfort conditions and the efficiency of mechanical ventilation is not considered**	**Calculation of the Primary Energy Demand for Heating (just for heating)**	**Calculation of the Primary Energy Demand for Heating (just for heating)**

PARTB	B1		B2	B3		B4		B5		B6		B7		B8	
REQUIREMENTS OR CALCULATION PROCEDURES	actions regarding summer in BR		climatic conditions in BR	solar heat prevention		internal gains		solar gain attenuation		heat dissipation strategies		air conditioning sytems	air conditioning sytems	mandatory calculation procedures	
	NEW	EXISTING		NEW	EXISTING	NEW	EXISTING	NEW	EXISTING	NEW	EXISTING	NEW	EXISTING	NEW	EXISTING
PT - Portugal	**Minimum requirements** referred to glazing areas and solar shading **mandatory measures** in south glazing façades Calculation procedures Tcool = 25 ºC	**Minimum requirements** referred to glazing areas and solar shading **mandatory measures** in south glazing façade (under major renovation) Calculation procedures Tcool = 25 ºC (residential under major renovation)	**both seasons** **heating season:** 4,3-8 month (depends on climatic zone) not available **Base temperature-** 20ºC 940-3000 ºC.dias **3 climatic zones** **cooling season:** 4 months 19ºC-23ºC (depends on climatic zone) not available **3 climatic zones** (combining the 3 climatic winter and the 3 summer zones, there are 9 climatic zones in the mainland plus one for Azores e another for Madeira)	Solar protection depend on orientation (Maximum solar factor (g⊥) for 7 orientations (NE-NW) Maximum solar factor 0,15 ≤ (g⊥) ≤ 0,56 Depending on summer climatic zone and thermal inertia	Solar protection depend on orientation (Maximum solar factor (g⊥) for 7 orientations (NE-NW) Maximum solar factor 0,15 ≤ (g⊥) ≤ 0,56 Depending on summer climatic zone and thermal inertia (residential under major renovation)	**residential** as default values a) global value: 4 W/m^2 **non residential buildings** b) small without or with systems with Ps 25 kW a global value: 7 W/m^2 or hotels: 4 W/m^2; low occupancy density buildings: 2W/m^2) c) large non residential buildings or small with systems with P >25 kW occupant density and equipment density depending on building type (office, restaurant, etc.), llumination density the real one	**residential** as default values a) global value: 4 W/m^2 **non residential buildings** b) small without or with systems with Ps 25 kW a global value: 7 W/m^2 or hotels: 4 W/m^2; low occupancy density buildings: 2W/m^2) c) large non residential buildings or small with systems with P >25 kW occupant density and equipment density depending on building type (office, restaurant, etc.), llumination density the real one	**yes to all** Limitation of the wall, roof, floor U-values of external elements or boundaries with areas without permanent occupation depending on the winter climatic zone severity	**yes to all** **Before a major renovation** Limitation of the wall, roof, floor U-values of external elements or boundaries with areas without permanent occupation depending on the winter climatic zone severity	Natural diurnal comfort ventilation Natural night ventilation In the calculation procedures the mean external air temperature for the summer period (4 months – June-September) is lower than 25 ºC the ventilation in summer is always a dissipation strategy.	Natural diurnal comfort ventilation Natural night ventilation In the calculation procedures the mean external air temperature for the summer period (4 months – June-September) is lower than 25 ºC the ventilation in summer is always a dissipation strategy.	**residential and non residential** Limitation of installed power and assure air renovation rates for air quality acceptable comfort conditions	**residential** Limitation of installed power and assure air renovation rates for air quality acceptable comfort conditions **Before a major renovation non residential** limitation of installed power and assure air renovation rates for air quality acceptable comfort conditions **when economically justifiable**	cooling loads Energy performance method for cooling (Ep<Epmax) Calculation based on PrEN ISO 13790 Primary energy Kgep/m^2. year) Residential and non residential A;<1000 m2 RCCTE - monthly non residential A>1000 m2 RSECE-hourly	cooling loads Energy performance method for cooling (Ep<Epmax) Calculation based on PrEN ISO 13790 Primary energy Kgep/m^2. year) Residential and non residential A;<1000 m2 RCCTE - monthly non residential A>1000 m2 RSECE-hourly
SL- Slovenia	**Residential and non Residential** Recommendation or guidelines air precooling; glazing areas; solar shading; Minimum requirements Glazing areas limited due to daylight (<20%) maximum U values of building envelope and windows Mandatory measures Obligatory shading (internal shading is not acceptable), energy calculation cooling load < □VC = 24 W/m3 Max cooling device power PVC,e = 1,05;	----------	**Heating season** **heating season:** 8 months **Air Temp.(Max, Min, Mean)** **Winter:** 11.8 /-14.2 / -0.1 **HDD (Tb 20/12):** **Central climate:** 3300 **Alpine Climate:** 4700 **Mediterranean:** 2400 **climatic zones** not available **Air Temp.(Max, Min, Mean)** **cooling season** **Summer:** 38, 10.19 **CDD (Tb 20/21)** **Central climate:** 79 **Alpine Climate:** 2 **Mediterranean:** 144 **climatic zones** not available	Total glazing areas e minimum value prescribe, due to sufficient daylighting in residential buildings. Upper limit is not directly defined. But due to the strict regulation for winter situation (limited average U), totally glazed - transparent envelopes are not feasible! Indirectly this gives positive impact to overheating prevention For all orientation except for north oriented windows , solar shading of glazed areas is required, (internal shading must not be considered as shading) PVC, wooden frame Uwin=1,3, 1,6 W/m2k for metal frames, Ug=1,1 W/m2K)	----------	**Residential** **People. Lighting and equipment** 5 W/m2 in 2002. (proposed 4 W/m2 in Dec. 08 but just for certification, not for minimum requirements in building regulation)	**Residential** **People. Lighting and equipment** 5 W/m2 in 2002. (proposed 4 W/m2 in Dec. 08 but just for certification, not for minimum requirements in building regulation)	**Wall U-values (W/m2ºC)** building envelope and windows (like 0,28 W/m2K for walls, (0,20 W/m2K for light structures), partitions between flats 0,90 W/m2K, windows 1,3 W/m2K, doors 1,8 W/m2K and to air tightness of the envelope, where n50<3,5 for natural ventilation and n50<2 for mechanically ventilated buildings, respectively **Roof U-values (W/m2ºC)** roof < 0,20 W/m2K **Floor U-values (W/m2ºC)** floor < 0,30 W/m2K	**Wall U-values (W/m2ºC)** building envelope and windows (like 0,28 W/m2K for walls, (0,20 W/m2K for light structures), partitions between flats 0,90 W/m2K, windows 1,3 W/m2K, doors 1,8 W/m2K and to air tightness of the envelope, where n50<3,5 for natural ventilation and n50<2 for mechanically ventilated buildings, respectively **Roof U-values (W/m2ºC)** roof < 0,20 W/m2K **Floor U-values (W/m2ºC)** floor < 0,30 W/m2K **Remarks:** Requirements for existing buildings are valid in case of renovation (above 25% in value)	**No**	**No**	**residential and non-residential** AC system is the decision of the investor and designer who has to fulfil comfort requirements in the buildings regulation - Regulation on ventilation from 2002.	'----------	**Cooling load** based on VDI 2078:1996 or ASHRAE calculation for specific cooling power demand (W/m3) and limited: Max cooling load < □VC = 24 W/m3 Max cooling device power PVC,e = 1,05.□VC .Ve/ EER (We); **Ep<Epmax** simplified method (based on the cooling system power and seasonal calculation with cooling degree days. The minimum energy requirement for cooling is determined on the same principle, i.e. based on the maximum allowed cooling power. **EN ISO 13790** optional method. The output of calculation related to cooling is: 1. Cooling load is calculated based on VDI 2078:1996 or ASHRAE calculation for specific cooling power demand (W/m3) 2. Cooling device power (We) 3. Energy (electricity) use for cooling QVC (kWh/a) 4. Electricity for operation of pumps for cooling (final) (kWhe/a), 5. Primary energy use for HVAC operation in building (kWh/a); (kWh/m3a) 6. CO2, per energy source (kg/a), (kg/m2a) 7. % of RES power in covering of heating anc cooling loads	'----------
Sweden	**Residential** Recommendation or guidelines Good efficiency of the cooling system. Orientation and size of windows. Selective glazing. Solar shading. Use of free-cooling. Cooling storage. Summer comfort as recommendation **Non residential** Recommendation or guidelines The method for calculating the energy use is free as the actual energy consumption will be metered. It is mentioned that a "safety margin" is to be left when designing the building and calculating its energy consumption in order to minimise the risk of exceeding the maximum allowed figure Summer comfort as recommendation	----------	**heating season** **heating season: 8 months** **Stockholm: -1,2 (0,2 in 2011-2040)** **Östersund: -5,0 (-3,2)** **ºC.dias** **2 climatic zones** **cooling season** **36.9 / 11.3 /23** **not available** **2 climatic zones**	**with A<100 m2:** **Uwindows<1,3 W/m^{2}ºC**	**with A<100 m2:** **Uwindows<1,3 W/m^{2}ºC**	----------	**People. Lighting and equipment** 5 W/m2 in 2002. (proposed 4 W/m2 in Dec. 08 but just for certification, not for minimum requirements in building regulation)	**Residential** Wall U-value Roof U-value Floor U-value **Non residential** Wall U-value Floor U-value	----------	----------	----------	Cooling power need is based in VDI 2078:1996 or ASHRAE calculation	The building regulation does not not refer specific temperatures for the cooling season. But the agencies for social issues and for working environment recommend maximum temperatures.	Final Energy	----------

PARTB	B1		B2	B3		B4		B5		B6		B7		B8	
REQUIREMENTS OR CALCULATION PROCEDURES	actions regarding summer in BR		climatic conditions in BR	solar heat prevention		internal gains		solar gain attenuation		heat dissipation strategies		air conditioning sytems	air conditioning sytems	mandatory calculation procedures	
	NEW	EXISTING		NEW	EXISTING	NEW	EXISTING	NEW	EXISTING	NEW	EXISTING	NEW	EXISTING	NEW	EXISTING
UK - United Kingdom	**Residential and non Residential** Recommendation or guidelines (envelope and systems) -Explicitly refers summer comfort - - energy calculation **a**	**Residential and non Residential** Recommendation or guidelines (envelope and systems) -Explicitly refers summer comfort - - energy calculation **a**	**heating season** October to May Mean external temperature variable with month (Jan 4.5 Feb 5.0 Mar 6.8 Apr 8.7 May 11.7 Jun 14.6 Jul 16.9 Aug 16.9 Sep 14.3 Oct 10.8 Nov 7.0 Dec 4.9°C) (draft SAP2009) 2463 degree days 1 Climate zone **cooling season** June to August Mean external temperature variable with region and month (10.6 – 17.8°C) (draft SAP2009) 213 degree days 8 climatic zones (SAP2005)/ 21 climatic zones (draft SAP2009)	**Remarks** For the next regulation Prevention of solar gains are demonstrable if the solar gains aggregated over the period from April to September are lower than a reference glazing system (side lit facing East with maximum area of 40% glazing area viewd from the inside out, a framing factor of 10% and a g-value of 0.46) (draft PartL2010)	**Remarks** For the next regulation Prevention of solar gains are demonstrable if the solar gains aggregated over the period from April to September are lower than a reference glazing system (side lit facing East with maximum area of 40% glazing area viewd from the inside out, a framing factor of 10% and a g-value of 0.46) (draft PartL2010)	**yes**	**yes**	**Residential and Non-residential** The Thermal mass parameter (TMP) is required for heating and cooling calculations. It is also used to obtain the threshold internal temperature which is used to estimate the propensity of high internal temperature in summer (draftSAP2009) Maximum U-valus for the envelope elements	**Residential and Non-residential** The Thermal mass parameter (TMP) is required for heating and cooling calculations. It is also used to obtain the threshold internal temperature which is used to estimate the propensity of high internal temperature in summer (draftSAP2009) Maximum U-valus for the envelope elements	**Natural diurnal** comfort ventilation openable windows, stack effect **Natural night ventilation** combined with high thermal capacity **limit solar gains** appropriate window size and orientation	**Natural diurnal** comfort ventilation openable windows, stack effect **Natural night ventilation** combined with high thermal capacity **limit solar gains** appropriate window size and orientation	**Residential and non-residential** **Cooling loads** calculated if the dwelling has a fixed air conditioned system (draftSAP2009) **Mechanical ventilation** Accountable in all calculations. Subject to specific regulation Part F (E&W). and **Non-residential Humidification** accountable with DSM software	**Residential and non-residential** **Cooling loads** calculated if the dwelling has a fixed air conditioned system (draftSAP2009) **Mechanical ventilation** Accountable in all calculations. Subject to specific regulation Part F (E&W). and **non-residential Humidification** accountable with DSM software	**Residential** Standard Assessment Procedure (SAP 2005) is the adopted methodology for calculating the energy performance of dwellings. output of the calculation CO2 emissions in kg/m²year **Non-residential** output of the calculation CO2 emissions in kg/m²year Monthly calculation procedure SBEM calculation of cooling energy demand by carrying out an energy balance based on monthly average weather conditions Hourly simulation procedure (explain) DSM recognised software	**Residential** SAP 2005, as before but does not require the emissions of DER to be lower than those from TER CO2 emissions in kg/m²year **Non-residential** output of the calculation CO2 emissions in kg/m²year Monthly calculation procedure SBEM calculation of cooling energy demand by carrying out an energy balance based on monthly average weather conditions Hourly simulation procedure (explain) DSM recognised software

PART C	C1		C2		C3		C4	
RECOMMENDATIONS TO INCREASE SUMMER COMFORT	recommendations that could be or should be implemented		summer comfort should be explicitly introduced		standards should be explicitly introduced in BR		suggestions towards a sustainable summer comfort	
	NEW	EXISTING	NEW	EXISTING	NEW	EXISTING	NEW	EXISTING
AU - Austria	**recommendable** minimum requirements and façade glazing area per orientation **Should be** use of shading outside **Must be** residential buildings air conditioning systems are not allowed to be installed non residential buildings there should be restrictions to the use of air conditioning systems. Use of Passive Systems Minimum requirements + Calculation requirements Calculation procedures e.g. for relation between glazing façade and total area of the façade have to be defined. Ventilation implemented	**recommendable** minimum requirements and façade glazing area per orientation **Should be** use of shading outside **Must be** residential buildings air conditioning systems are not allowed to be installed non residential buildings there should be restrictions to the use of air conditioning systems. Use of Passive Systems Minimum requirements + Calculation requirements Calculation procedures e.g. for relation between glazing façade and total area of the façade have to be defined. Ventilation implemented	**yes**	**yes**	**yes** (All suggestions mentioned in C1 and C2 should be introduced as standards)	**yes** (All suggestions mentioned in C1 and C2 should be introduced as standards)	**any indication**	**any indication**
DE - Germany	**additional information in german**	**additional information in german**	**yes**	**yes**	**residential and non residential** **yes**	**residential** Refers only on heat insulation **non residential** Up to 40% below standard of new buildings is accepted (reference: annual primary energy need including air condition	**residential** eliminates enforcement deficits **non-residential** any suggestion	**residential** eliminates enforcement deficits **non-residential** any suggestion
FR - France	**area of glazing per façade** already in the reference building **use shading** already **Limitations on the use of air conditioning systems** T> 26 ºC **Use of Passive Systems** already in the reference building	**use shading** already **Limitations on the use of air conditioning systems** T> 26 ºC **Use of Passive Systems** already in the reference building	**yes** all types	**yes** all types	**yes**	**yes**	**any indication**	**any indication**
It - Italy	----------	----------	**yes** all types	**yes** all types	----------	----------	----------	----------

PART C	C1		C2		C3		C4	
RECOMMENDATIONS TO INCREASE SUMMER COMFORT	recommendations that could be or should be implemented		summer comfort should be explicitly introduced		standards should be explicitly introduced in BR		suggestions towards a sustainable summer comfort	
	NEW	EXISTING	NEW	EXISTING	NEW	EXISTING	NEW	EXISTING
PT - Portugal	Directly or indirectly the Portuguese Building Regulation take in consideration most of these items	Directly or indirectly the Portuguese Building Regulation take in consideration most of these items	**yes** all types	**yes** all types	**residential** EN 15251 **non residential** EN 7730	**non residential** EN 7730	**residential** Change in the EPmax are necessary the actual values are too high **non residential** EPmax (IEE) need to be changed	**residential** Change in the EPmax are necessary the actual values are too high **non residential** EPmax (IEE) need to be changed
Slovenia	**Minimum requirements** in place **Area of Glazing per façade** implicitely in place **Use of shading** in place **Use of air conditioning systems limitation** In colder areas cooling devices should be substituted by the good design requirements. Residential buildings should be designed without cooling devices based on good architectural solutions in most of Slovenia. **Use of Passive Systems** Earth as cooling source should be investigated **Natural ventilation** Calculation should be prescribed for demonstration the potential of natural (night) ventilation even if the cooling device is installed due to some other reason. **Minimum requirements + Calculation requirements** Room free temperature in summer conditions should be calculated and limited, so that the need of cooling devices is justified. **Others** SIST EN ISO 13790 monthly methods should be used for energy calculations **Final Remarks** The promotion of passive cooling measures should be promoted event if it is not acceptable in all cases	**Use of shading** Shading should be implemented in case of major renovation. **Natural ventilation** Natural ventilation should be given in the regulation as a recommendation for the way of building operation strategy.	**Residential** For big apartment buildings summer comfort calculation is needed, to prevent installation of cooling devices **Non-residential** Summer comfort calculation should be required	----------	**yes**	**yes**	**Residential** More emphasize should be put on passive measures to reduce cooling devices. Shading and night ventilation should be promoted instead of AC devices. No AC approach works well in Slovenian climate under condition of reasonable design and proper user behaviour **Non residential** ----------	**Residential** Obligatory shading when major renovation is ongoing. Awareness raising on passive cooling for households. **Non-Residential** Information campaign for building managers and users on passive prevention of overheating.
Sweden	to be completed	to be completed	**yes** all types	**yes** all types	**yes**	----------	----------	----------

C1		C2		C3		C4	
recommendations that could be or should be implemented		summer comfort should be explicitly introduced		standards should be explicitly introduced in BR		suggestions towards a sustainable summer comfort	
NEW	EXISTING	NEW	EXISTING	NEW	EXISTING	NEW	EXISTING
recommendable Area of Glazing per façade Area of Glazing per orientation As much as possible adopt natural ventilation or a mix-mode **Should be** Preferably external and movable account for building and external obstructions Minimum requirements + Calculation requirements **Coul be** g-values combined with glazing area as suggested in Part L under consultation residential buildings air conditioning systems are not allowed to be installed non residential buildings there should be restrictions to the use of air conditioning systems. Use of Passive Systems Minimum requirements + Calculation requirements Calculation procedures e.g. for relation between glazing façade and total area of the façade have to be defined. Ventilation implemented **Must be** Use of Passive Systems as much as possible and in first instance Natural ventilation If not possible consider hybrid solutions before deciding for mechanical or AC systems.	**Recommendable** Implement minimum requirements Area of Glazing per façade Area of Glazing per orientation Use of shading Limitations on the use of air conditioning systems Use of Passive Systems Natural ventilation Minimum requirements + Calculation requirements	**yes** Follow suggested methodology in BS EN 37090	**yes** Follow suggested methodology in BS EN 37090	**residential and non residential** **yes**	**residential and non residential** **yes** Introduction of consequential improvements	**residential and non-residential** any suggestion Consideration of adaptive comfort theory through recommendations of BS-EN15251 for buildings without mechanical ventilation (category II). Site layout, green spaces and vegetation	**residential and non-residential** Consideration of adaptive comfort theory through recommendations of BS-EN15251 for buildings without mechanical ventilation (category III).

ANNEX C

EXPERTS THAT ANSWERED QUESTIONNAIRE IN THE FRAMEWORK OF TASK 2.3

RECOMMENDATIONS ON SUMMER ENERGY EFFICIENCY ON NATIONAL BUILDING CODES

In the next table are the experts identification by country and institution that answered to the Questionnaire prepared in the framework of Task 2.3 – Recommendations on summer energy efficiency on national building codes".

Table C.1 – Questionnaire of Task 2.3 and experts.

Country/Organization	Contac
Austria/AEA	Nicole Holanek
France/ARMINES ENSMP	Laurent Grignon Masse
Germany/IZES	Barbara Droeschel
Italy/eERG	Lorenzo Pagliano and Salvatore Carlucci
Portugal/LNEG (ex-INETI)	Helder Gonçalves
Slovenia/BCEI ZRMK	Marjana Sijanec Zavrl
Sweden/ STEM	Carlos Lopes
United Kingdom/LMU	Fergus Nicol and Luisa Brotas

ANNEX D

BUILDING REGULATIONS IN EUROPE – GENERAL REMARKS

D. BUILDING REGULATIONS IN EUROPE – GENERAL REMARKS

A review of the national building codes was extended, whenever possible, to other European countries by direct contacts with colleagues, consulting building codes and technical reports with respect to the requirements and summer calculations adopted in each country. The goal consists on identifying the positive and the negative aspects and selects the best practices. Cyprus was the only country that answers directly to the KeepCool questionnaire.

D.1 BELGIUM

In Belgium the implementation of the EPBD is the responsibility of each Region. In the Flemish Region the calculation procedure of the energy performance of new residential and non residential buildings started on March 2005. The Wallonia Region implemented the EPBD in April 2007. The Brussels capital region had a thermal regulation for new and renovated buildings since 2000. In what concerns the regulations according to the EPBD in 2009 should already be in force.

Flemish Region

There are requirements, with respect thermal insulation, concerning U-values for the envelope elements of the new buildings, while for the existing only on the renovated parts. New residential buildings, offices and schools have the most restringent requirements, indoor climate - ventilation and overheating – for the buildings that use energy to create specific indoor climate conditions for human activities.

The legislation intends to avoid the installation of active cooling with, for the residential buildings, with the calculation procedure – “Overheating Indicator”.

The Flemish EP legislation is a monthly overall energy method that considers: transmission and ventilation losses, passive solar gains, heating and hot water installations (installation efficiency, energy losses by distribution, energy use of fans and pumps, photovoltaic energy systems contribuition, and air conditioning installation (cooling). The internal gains are also considered and defined as a volume function. The Flemish Regulation does not allow to take into account ventilation strategies and passive cooling technologies. A new challenge consists on ameliorate the calculation procedure on in order to induce the use of those startegies. For the non residential buildings the cooling load is calculated for a set point of 23 ºC.

Wallonia

The regulation contains minimum requirements on maximum U-values, summer comfort and ventilation. In Wallonia Region the calculation procedures adopted the same calculation method of the flemmish Region with some adaptations, in collaboration with the other Regions.

Brussels

In this region, according to the available information, have also minimum requirements on maximum U-values, summer comfort and ventilation. For the Brussels Capital Region it is assumed that a similar method of the other regions will be adopted.

D.2 BULGARIA

The application of the new building regulation started in March 2005 following the EPBD for all type of buildings (news, existing, residential and non residential). The requirements depend on the building type, residential buildings and non residential (schools, hospitals, office and hotels) and may cover: maximum U-values for heated buildings, insulation level, and limitation of solar gains for new buildings (residential and non residential).

Cooling is not mentioned as a subject to be dealt with through a criteria or a calculation methodology in the Bulgarian building legislation. At the moment, it is assumed that the cooling has a negligible role compared to the heating consumption. So, as the major energy consumption is for heating, all regulations (for energy certification) examine energy demand for heating, only with maximum-values depending on form factor and heating degree days.

However, the general opinion in Bulgaria is that all the legislative documents related to energy performance of buildings, and requirements for building envelope (insulation of walls, ceilings, windows, etc.) are indirectly relevant for cooling, too, as they prevent heat from entering buildings during summer and thus reduce the cooling needs in buildings (in the same way they will prevent, in winter period, the cold from the outside).

D.3 CROATIA

The implementation of EPBD was expected in 2008 based on technical regulations on energy economy and heat retention in buildings and the requirements depending on the purpose and building size. The technical regulations prescribe the maximum required heat energy per year and In terms of the envelope quality are requirements on U-values including windows.

According to the available information was not found any specific measures to the summer period.

D.4 CYPRUS

D.4.1 General Considerations

New building regulations have been published following the Directive and are already in force since 21/12/2007. However, the building regulations concern only the thermal insulation of all new buildings and existing ones over 1000m^2 under major renovation. More requirements concerning the total energy consumption at the buildings was expected to be in force by the end of 2008. The Building Regulation will be required to be verified only at planning stage, before construction starts, in order to have a permit.

D.4.2 Requirements on Solar Heat Prevention, Attenuation and Dissipation Strategies

The number of climatic zones is 4 for each season and the duration of winter is 6 to 8 months and summer 2 to 4 months. The mean temperature in winter is 13 ºC with a with a heating degree number between 1049 and 2033 (base temperature of 20ºC). In summer the mean temperature is equal to 26ºC, according to the table:

	Heating season	Cooling season
Most relevant season in your country	☐	☒
Duration (months)	6 - 8	2 - 4
Air Temperatures (Max, Min, Mean)	Mean 11.6 - 14.2	Mean 25.2 - 27.2
Degree Days Refer base temp. heating and cooling20/24	1049 - 2033	-
Number of Climatic zones with different requirements	4	4

As the thermal regulation is not yet in force nevertheless are pointed out some aspects that will be taken in account in the future regulation:

- Requirement on the window U-value (a value that cannot be exceeded) and on the U-values of the elements of the building envelope, except for the elements in contact with the ground;

- Glazing type, solar protection depending on the orientation and solar factor will be taken in account but will not be mandatory measures;

The passive strategies are not yet considered in the future building regulation.

D.4.3 Methodology or Calculation Procedures

As mentioned above a new methodology was planned to be adopted at the end of 2008.

For the new Buildings a simplified calculation procedure using a simple software tool based on default and/or typical values (asset rating) while for the existing a similar calculation method but with an energy audit ((asset or operational rating).

The energy performance method for cooling (Ep < Epmax) will be calculated based on EN ISO 13790.

The national methodology is under discussion but will probably take into account the following:

The internal gains as an average value of Watts per m^2 of useful floor area for residential buildings, but, is expected a more detailed analysis for the non residential buildings, ventilation (natural and mechanical).

D.4.4 Recommendations

Should be implemented requirements on:

- U-values, solar factor and area of glazing per orientation;

- Use of shading for some orientations

Some of those requirements should be more exigent for non residential buildings and have recommendations on the use:

- air conditioning systems

- passive systems especially for some categories of non residential buildings;
- natural ventilation

Summer comfort should be explicitly introduced in the building regulation by setting the accepted internal temperature, humidity rate and ventilation as well as standards if are applicable to the country's specific climatic conditions.

Those aspects should be implemented for new and existing buildings. With the building regulation is expected that an investment of not more than 10% of the initial cost of the buildings used to be build prior to the regulation and concerning measures for the reduction of the heating and cooling needs of the buildings, could give savings up to 30%.

D.5 CZECH REPUBLIC

The EPDB was adopted in 1 July 2006 but will be only in force in the Czech Republic from the beginning of this year (.01.2009). It means that after this date, all new or renovated buildings (excluding buildings defined such as: experimental and temporary used buildings, churches, farm buildings, and detached houses with area below 50 m2), will require an energy performance certificate to obtain planning permission for construction and the requirements are the same for both. In terms of the envelope quality are requirements on U-values maximum.

For all buildings a calculation procedure for cooling energy has already been included in compliance with CEN Standards (EN ISO 13790) and contains requirement for maximum temperature and maximum daily increase of internal temperature. The calculation method also includes heat gains (internal and external) and ventilation. Passive cooling is not taken into account in the building regulation.

D.6 DENMARK

Denmark has implemented the EPBD since January 1st, 2006 for new building or renovation of an existing building to obtain planning permission for construction but has, for many years a long practice of strict energy requirements in the building regulations. An energy performance target is required buildings heated at least 15 ºC (except for commercial and energy production purposes). In terms of the envelope quality are requirements on maximum U-values but. The calculation procedure for new buildings (residential and non residential) is based on EN/ISO 13790 and and energy consumption for cooling is integrated on the global calculation with the other demands heating, DHW, power for pumps, fans, lighting).

The contribution of the passive systems for cooling are not inclued in the building regulation.

D.7 ESTONIA

The minimum energy requirements came into force in 1 january 2008 in terms of maximum U-values and energy consumption per m2 of floor area and will depending on the building use. Concerning summer conditions and requiremts.

D.8 FINLAND

The requirements of all new buildings and existing one under great renovation came into force after 1 January 2008 and the building regulation should be use to apply for a building permit. The energy requirements include attenuation strategies concerning the building envelope and solar heat prevention in order to avoid overheating: maximum U-values; requirements on average insulation level; structural shading. The restrictions concerning glazing areas due mainly to the thermal losses in winter can also be useful to reduce excessive solar gains in summer.

The building regulation is a monthly method adapted from EN 13790 and the indoor temperature of space can be estimated in summer whenever it will be relevant. The building regulation considers:transmission and ventilation losses, passive solar gains, heating and hot water installations (installation efficiency, energy losses by distribution, energy use of fans and pumps, photovoltaic energy systems contribuition, and air conditioning installation (cooling). The passive strategies are not yet incorporate in the building thermal regulation.

D.9 GREECE

In Greece the implementaion of the EPBD is delayed and the regulation and the certification process was still under study in May 2008, however, according to the building plataform the requirements for building permits came into force after 1 January 2009. Those requirements area related to maximum U-values, avererage insulation level, primary energy consumption limitation and equipment efficiency.

In what concerns comfort conditions is expected that he EP regulation will propose the design temperature in order to size the cooling/heating and reference values for the humidity levels.

The building regulation is expected that includes requirements on: solar protection, window U-values, insulation levels for walls, roofs, floors, air flow rate, access to natural light, efficiency to heating/cooling units, insulation of domestic hot water tank, lighting power installed.

For the whole building is determined the energy consumption for heating, cooling, lighting and domestic hot water and, according to this consumption the CO_2 emission will be calculated

D.10 HUNGARY

Regulation is in force from September 2006 for all new buildings and existing buildings in case of renovation and explicitly refers to summer conditions and contain mandatory summer requirements. Those requirements are related to the envelope quality, maximum U-values for each building element, and summer overheating that depends on the natural ventilation and thermal mass and is formulated in terms of the maximum mean daily indoor-outdoor temperature. This calculation is simple, but, for more complex buildings, it should be necessary to adopt a simulation tool.

D.11 IRELAND

The new building regulation was published in 2005 and had been reinforced by the Building Regulations (Amendment) Regulations in 2007. From July 2008 the Building Regulations includes a methodology for calculating energy performance of non-residential buildings.

In what concerns the quality of the there are also requirements concerning maximum U-Values for new buildings

- Wall: 0.27 W/m^{2o}C
- Pitched roof insulated at ceiling: 0.16 W/m^{2o}C
- Pitched roof insulated on slope: 0.20 W/m^{2o}C
- Flat roof: 0.22 W/m^{2o}C
- Ground floor: 0.25 W/m^{2o}C
- Other exposed floors: 0.25 W/m^{2o}C
- Doors, windows and roof lights 2.00 W/m^{2o}C (for dwellings depending on area of openings, in table total opening area is 25% of floor area) and 2.20 W/m^{2o}C (for non dwellings and the average U-value of external personnel doors, windows and roof lights may vary as described;
- Large doors for non dwellings 1.5 W/m^{2o}C

For new non-residential buildings the requirements covers limitation of solar overheating and measures to reduce the overheating risk and is pointed out a calculation procedure, this one can be replaced by alternative methods. For the residential buildings is not mandatory.

The national calculation methodology for new residential buildings, entitled Dwellings Energy Assessment Procedure (DEAP), is a simplified asset based monthly calculation which conforms to EN ISO 13790 with an accompanying data set of default assumptions based on age/type of construction, will be used.

For non-residential buildings, entitled “NEAP”, is an adapted version of the UK “National Calculation Method”.

Under this method, building designers and BER (building energy rating) assessors can, according to the complexity of the building, apply either an official simplified asset based calculation procedure entitled “Simplified Building Energy Model” (SBEM) or an approved dynamic simulation software package. Advisory reports have been prepared to help BER assessors namely on energy-efficient glazing.

D.12 LATVIA

The new building regulations, to achieve the requirements of EPBD, were implemented during 2008. The calculation procedures area based on CEN Standards covering: heating hot water, AC, ventilation and lighting systems. However, at this time, it seems that are not implemented specific requirements for summer period.

D.13 LITHUANIA

The new building regulation published in December 2005 is in force since January 2006. The certification started for all the new buildings in 2007 while for the existent buildings, the process will start in 2009. Even if a calculation procedure for cooling energy is not implemented in the building regulation, the regulation does not contain some requirements for glass and shading.

D.14 LUXEMBOURG

New building regulation and the certification are in force since January 2008 for the residential buildings (new and existent) and with the certification is expected the use of more insulation and better glazing in residential as also more efficient systems in the new buildings as also an increase in the use of renewable however, concerning the residential buildings and due to the climate conditions cooling requirements are not included on the calculation procedures. The regulation for non-residential buildings is, at the moment, still in preparation.

D.15 MALTA

Malta adopted measures to implement the Directive into national law in November 2006 when the Government issued the minimum requirements for the energy performance of buildings and is expected that will be implemented on the 2nd January 2009.

The regulation implements minimum requirements concerning:

- Thermal values of the building fabric, limitation on areas of glazing both in connections with loss of heat or coolness as well as with solar heat gains (exposed walls and floors -1.57 W/m^{2o}C; non-exposed floors - 1.97 W/m^{2o}C: roofs – 0,59 W/m^{2o}C. (area > 6.5 m^2 for exposed envelope elements)

- Limitations for windows and roof lights (U = 5.8 W/m^{2o}C, if the glass area is equal to 10% of roof area while for residential buildings the area of the exposed walls is 20%)

- Controls and insulation of heating and cooling systems

- Controls of artificial lighting systems

A separate assessment for the energy performance assessment of dwellings that takes into consideration both heating and cooling according to the relevant CEN standards is expected to have been developed by September 2008.

It expected that in Malta the enforcement of tighter regulations on better energy performing buildings especially dwellings will not decrease the use of energy because the owners will use more energy than what they use now and therefore the main aim of these measures is to control energy wastage whilst maintaining good comfort levels and air quality. It is also expected an increase on the price of the buildings

D.16 NEETHERLANDS

The calculation procedures integrate part of the EPBD and the minimum requirements for new buildings and major renovations should be verified before the completion of the building. For the existing buildings the regulation ensures that in case of a major renovation a minimum level of energy performance is met and for small renovations there are minimum requirements concerning ventilation and insulation.

For the new and existing buildings the regulation implements minimum requirements concerning:

- U-values (roofs, walls and ground) –2,5 W/m^{2o}C;

- U-values (windows, doors) – 4,2 W/m^{2o}C;

- Air change 0.9 dm^3/s per m^2 floor:
- Internal air quality – minimum requirements from the EPBD

In the new building the requirements for the day lighting imposes that window areas > 10 % of floor area while for the existing window areas > 2.5 – 7 % of floor area

The calculation concerning summer period includes area of transparent elements, overheating (time, Δ temperature), solar gains, windows shading and efficiency of the systems.

D.17 NORWAY

The requirements for new buildings are in force since February 2007 and will be presented for obtain the building permits. Some specific requirements concerning fenestration area and solar shading have been adopted

- Area fenestration to a maximum 20% of the conditioned floor area.
- Automatic outside shading or similar measures to avoid the use of local cooling.

In what concerns the inside temperature the *Health Safety Executive* (HSE) regulations points the temperature of 26 ºC as the recommended upper temperature for indoor air in areas for occupational activities and also that should not be exceeded more than 50 hours during a year.

The national building code is based on EN 13790 and the level of requirements is expressed as maximum net energy demand per m^2 of floor area, including the energy for cooling. The set point temperature in the cooling calculations is 22 ºC.

In the calculation of total energy demand the building thermal zoning will depend on the conditions of: sun exposition, internal gains and technical installations serving different parts of the building. For instance, for different building façades solar exposition should meet different thermal zones for the energy demand calculations. When the product of the windows, doors and glass (γsol) areas divided by the conditioned floor area and the total solar energy transmittance for window and shading, gt, supersedes 5 % (γsol/tg > 5 %), the building shall be divided in at least three calculation zones. However, an entirely building can be analysed as a single thermal zone if there the solar heat preventions strategies are adopted (adequate use of transparent areas with efficient outside shading).

The methodology does not include calculations requirements according to the *Health Safety Executive* (HSE) regulation for comfort temperatures, or the calculation of dimensioning heating or cooling load.

The calculation can be replaced by an alternative methodology that consists on show that measures such as: maximum U-values for wall, roof, floor and windows, maximum area of transparent elements, air tightness automatic outdoor shading equipment or other measures to avoid the need for local cooling, recovery of heat were adopted.

Cooling demand has been increasing over the last years, in spite of the rather cold climate, and for that reason has been adopted requirements to reduce the needs for cooling, the recommended upper temperature for indoor air is set 26 ºC. The previous standard for calculation of the energy demand in buildings did not include energy for cooling

All buildings must meet the following requirements:

- Total area of glass, windows and doors: a maximum of 20 percent of the heated floor area (m^2)
- U-value -exterior wall: 0.18 W/m^2 K;
- U-value –roof: 0.13 W/m^2 K
- U-value -exposed floors: 0.15 W/ W/m^2 K
- U-value – windows and doors: 1.2 W/ W/m^2 K;
- Standardized value for thermal bridges must not exceed 0.03 W/ W/m^2 K for dwellings and 0.06 W/ W/m^2 K for the other buildings;
- Air tightness: 1.5 air changes per hour by 50 Pa pressure difference. For dwellings the value of 2.5 air changes per hour by 50 Pa pressure difference applies
- Heat recovery of ventilation air in ventilation equipment (year mean heat recovery rate): 70 %
- Automatic equipment for shading or other precautions to avoid the use of local cooling systems Building performance in a cold climate can be a challenge.

Nowadays, the standard for calculation of the energy demand in buildings includes energy for cooling, because statistics on energy performance from the office and the commercial buildings showed that are heading in the wrong direction.

D.18 POLAND

Thermal protection calculations use two new regulations in Poland, the coefficients HT (heat loss through the envelope) and HV (heat loss through ventilation). The methodology for the calculation of HT is described in standard PN-EN ISO 13789.

Requirements for new and modernised buildings (maximum permissible U-values)

- external walls: 0.3 W/m^2K
- windows: 1.7-1.9 W/m^2K

In what concerns windows or transparent partitions:

- The maximum solar radiation coefficient for windows and glazed or transparent partitions, gc < 0.5 (total energy transmittance corrected by shading factor).

The requirements were imposed due to the heating season there any reference to summer comfort and or cooling energy requirements.

D.19 ROMANIA

There are no legislative requirements or criteria for summer cooling of the buildings. The window shading is not prescribed; it is up to investor or homebuilder to decide on its implementation and its type. There exists a national method for calculation of cooling systems, based on EN standards, but in practice expert work it has been observed that it is not functioning completely satisfactory. The indoor temperature in summer is assumed at 26 +/- 0,5 degrees, as part of the general conditions for indoor thermal comfort.

D.20 SLOVAKIA REPUBLIC

The calculation procedure is strictly based on the EN standards and the energy calculation as a sum of delivered energy for heating, cooling and ventilation, hot water, and lighting.

The regulation imposes requirements on thermal protection according to: maximum U-value required separately for existing and new building, minimum internal surface temperatures, thermal bridges, minimum air change rate (0.5 1/h) and energy criteria (maximum heat use for heating based on the form factor of building per m² of floor area).

New buildings - U- Values ($W/m^2{}^oC$)

- external walls and roofs with slope > 45° 0.32
- roofs with slope ≤ 45° 0.20
- ceiling above non-heated area 0.20
- ceiling below non-heated area 0.25
- Windows 1.7
- doors (entrance) 3.0

Existing buildings under major renovation U-Values ($W/m^2{}^oC$)

- external walls and roofs with slope > 45° 0.46
- roofs with slope ≤ 45° 0.30
- ceiling above non-heated area 0.30
- ceiling below non-heated area 0.35
- Windows 2.0
- doors (entrance) 4.3

D.21 SPAIN

Energy Requirements for new buildings requested after September 2006 to obtain building permits. 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
- Minimum Efficiency performance for lighting installations;
- Minimum natural lighting contribution;
- Minimum solar contribution to Domestic Hot Water (DHW)an
- Minimum photovoltaic contribution to electric power.