ENERGY CALCULATIONS AND CERTIFICATES

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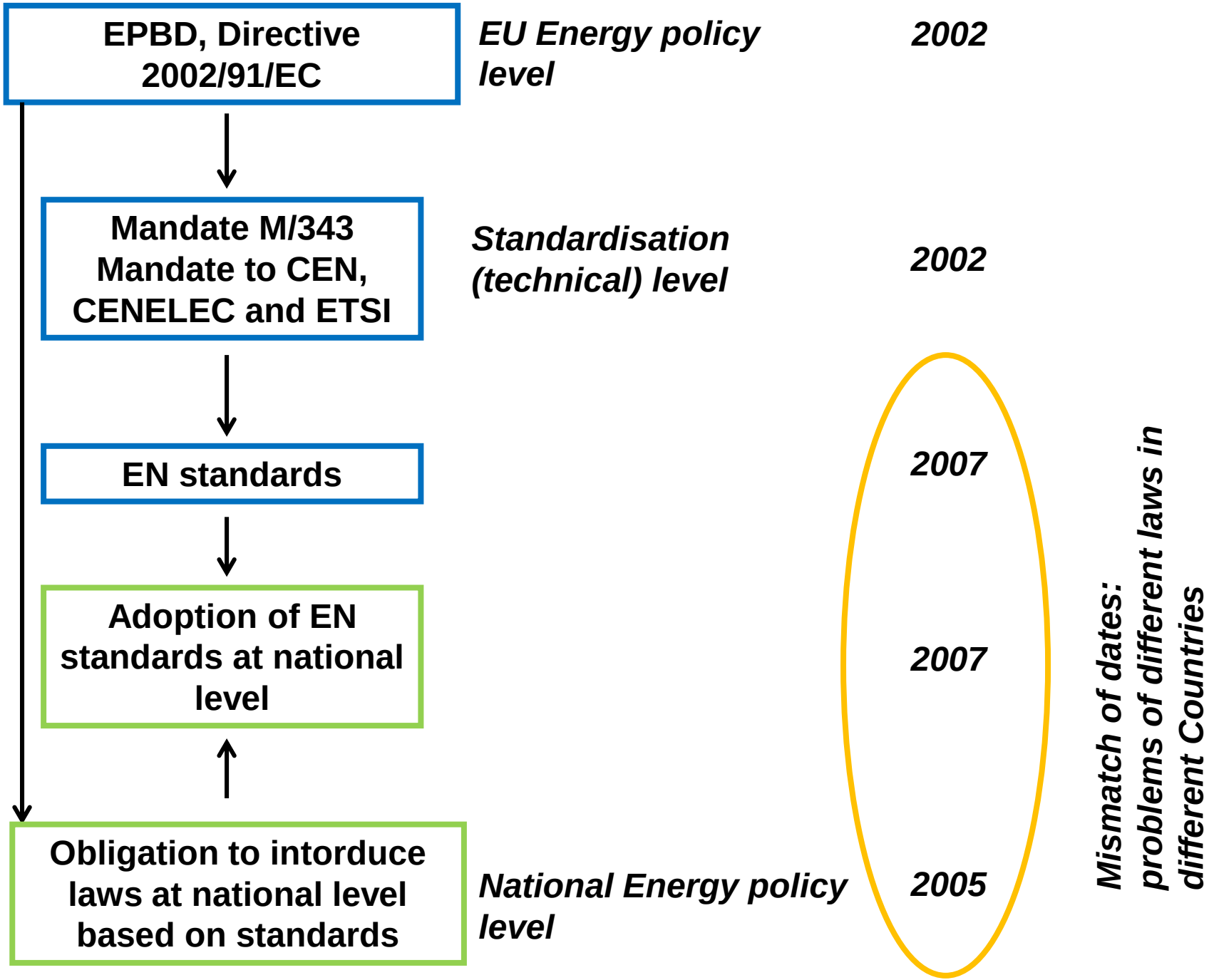
Development of energy calculation methods in Standards

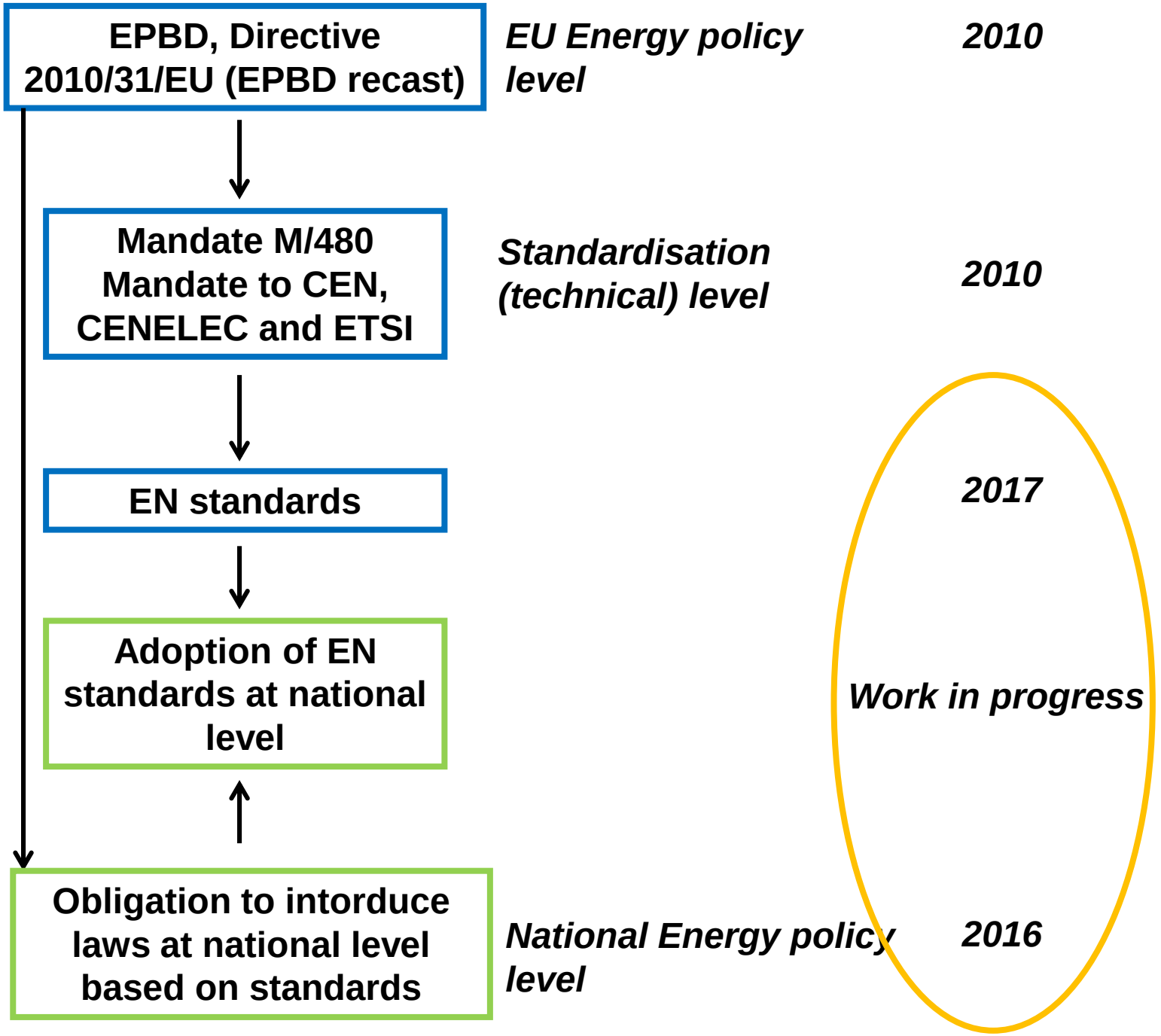
- **EN 832: Thermal Performance of Buildings - Calculation of Energy Use for Heating - Residential Buildings**

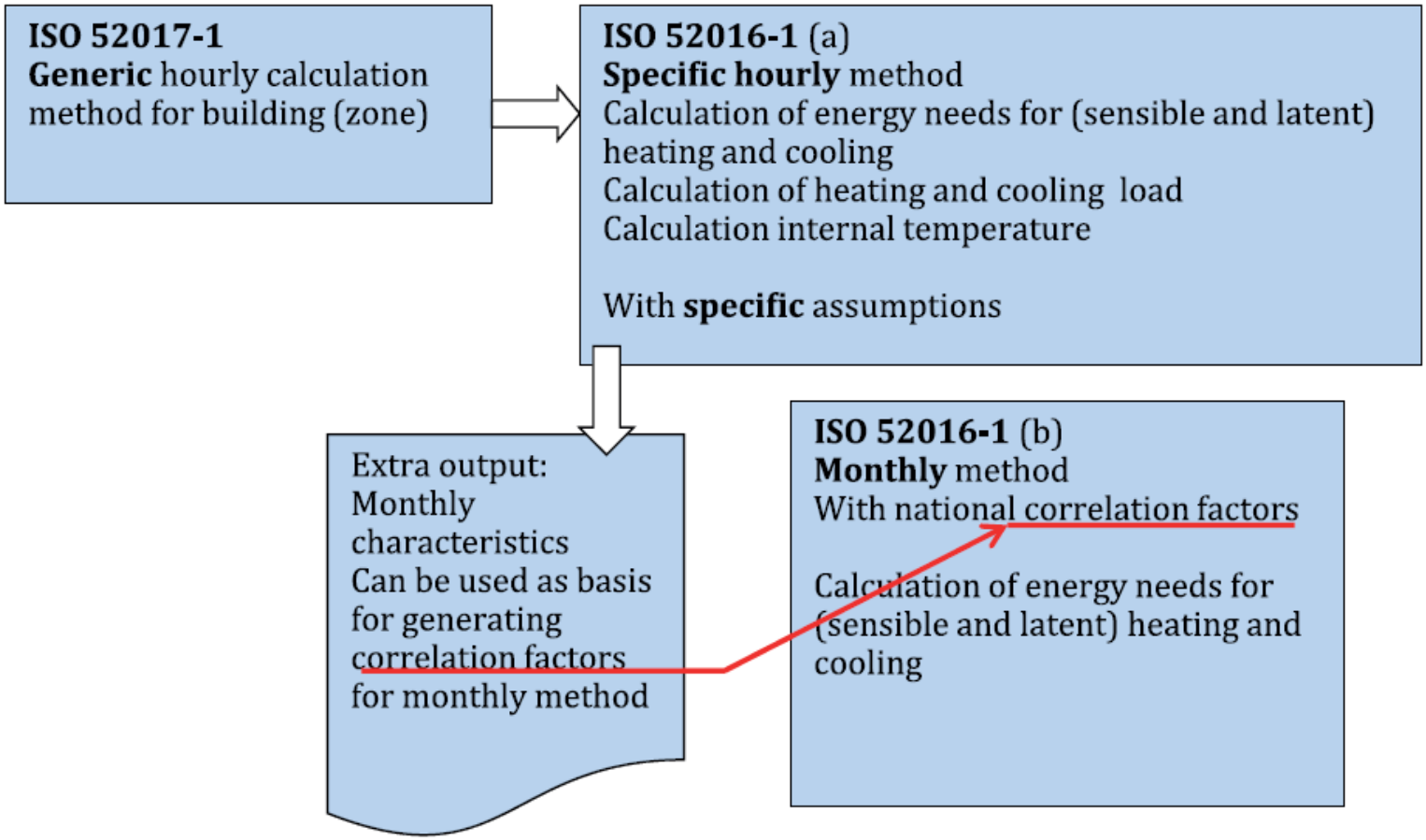
- **EN 13790:2005 Thermal performance of buildings - Calculation of energy use for space heating**

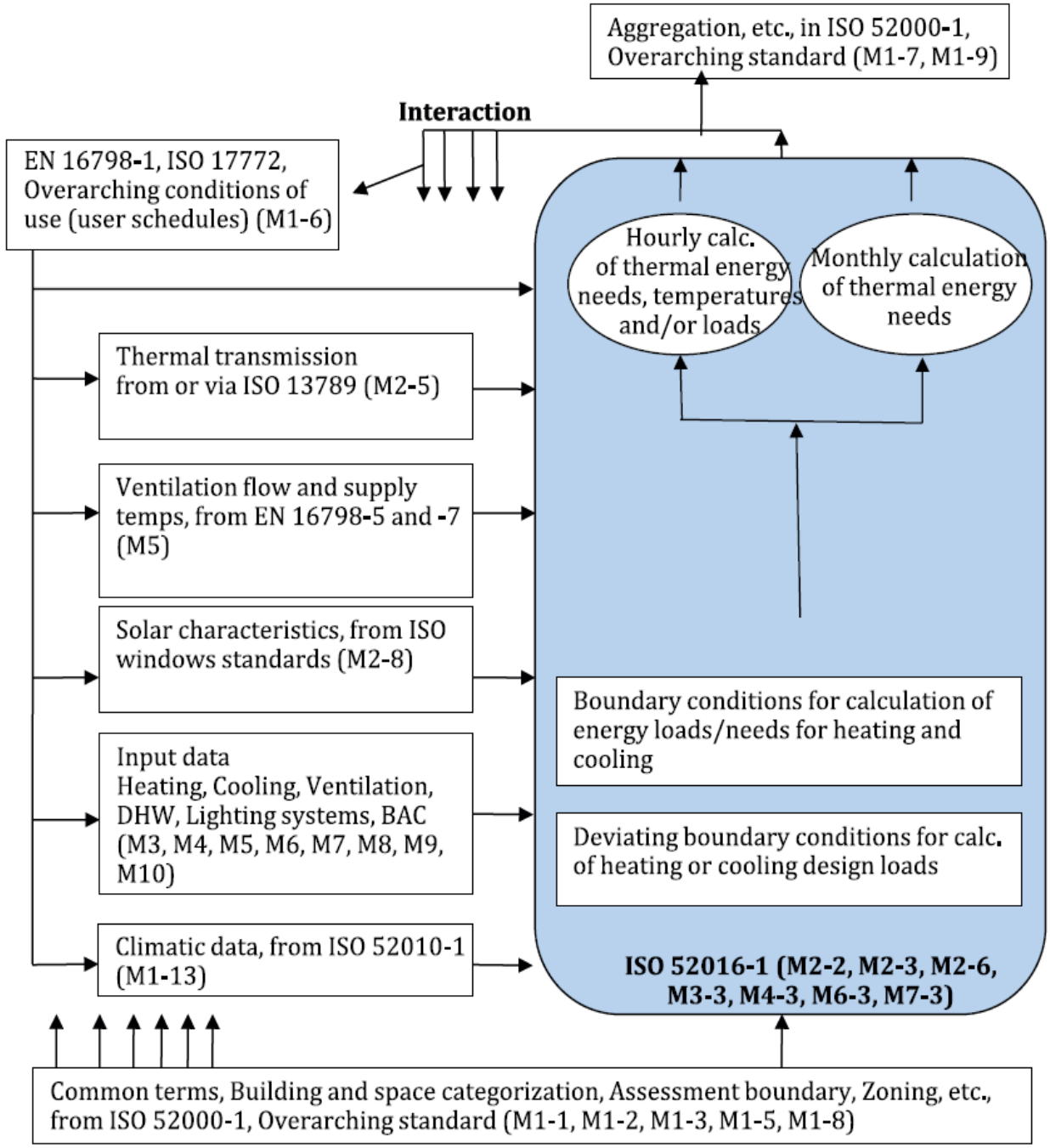
- **EN ISO 13790:2008 Thermal performance of buildings - Calculation of energy use for space heating and cooling**

- **EN ISO 52016-1:2017 Energy performance of buildings - Energy needs for heating and cooling, internal temperatures and sensible and latent heat loads - Part 1: Calculation procedures**


EPBD, Directive 2002/91/EC
EU Energy policy level
2002
Mandate M/343 Mandate to CEN, CENELEC and ETSI
Standardisation (technical) level
2002
EN standards
2007
Adoption of EN standards at national level
2007
Obligation to intorduce laws at national level based on standards
National Energy policy level
2005
Mismatch of dates: problems of different laws in different Countries


EPBD, Directive 2010/31/EU (EPBD recast)
EU Energy policy level
2010
Mandate M/480 Mandate to CEN, CENELEC and ETSI
Standardisation (technical) level
2010
EN standards
2017
Adoption of EN standards at national level
Work in progress
Obligation to intorduce laws at national level based on standards
National Energy policy level
2016
Mismatch of dates: problems of different laws in different Countries. But less differences then before

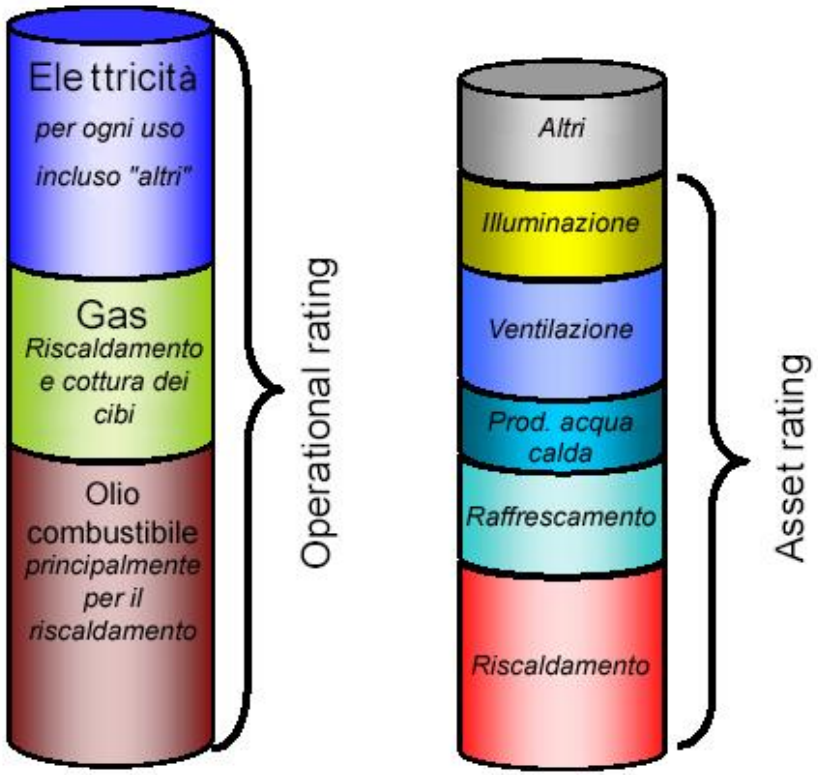

ISO 52017-1
Generic hourly calculation method for building (zone)
ISO 52016-1 (a)
Specific hourly method
Calculation of energy needs for (sensible and latent) heating and cooling
Calculation of heating and cooling load
Calculation internal temperature
With **specific** assumptions
Extra output:
Monthly characteristics
Can be used as basis for generating correlation factors for monthly method
ISO 52016-1 (b)
Monthly method
With national correlation factors
Calculation of energy needs for (sensible and latent) heating and cooling


Aggregation, etc., in ISO 52000-1, Overarching standard (M1-7, M1-9)
Interaction
EN 16798-1, ISO 17772, Overarching conditions of use (user schedules) (M1-6)
Hourly calc. of thermal energy needs, temperatures and/or loads
Monthly calculation of thermal energy needs
Thermal transmission from or via ISO 13789 (M2-5)
Ventilation flow and supply temps, from EN 16798-5 and -7 (M5)
Solar characteristics, from ISO windows standards (M2-8)
Input data Heating, Cooling, Ventilation, DHW, Lighting systems, BAC (M3, M4, M5, M6, M7, M8, M9, M10)
Climatic data, from ISO 52010-1 (M1-13)
Boundary conditions for calculation of energy loads/needs for heating and cooling
Deviating boundary conditions for calc. of heating or cooling design loads
ISO 52016-1 (M2-2, M2-3, M2-6, M3-3, M4-3, M6-3, M7-3)
Common terms, Building and space categorization, Assessment boundary, Zoning, etc., from ISO 52000-1, Overarching standard (M1-1, M1-2, M1-3, M1-5, M1-8)

Energy certificate and energy audit

There are 2 ways to determine energy consumptions:

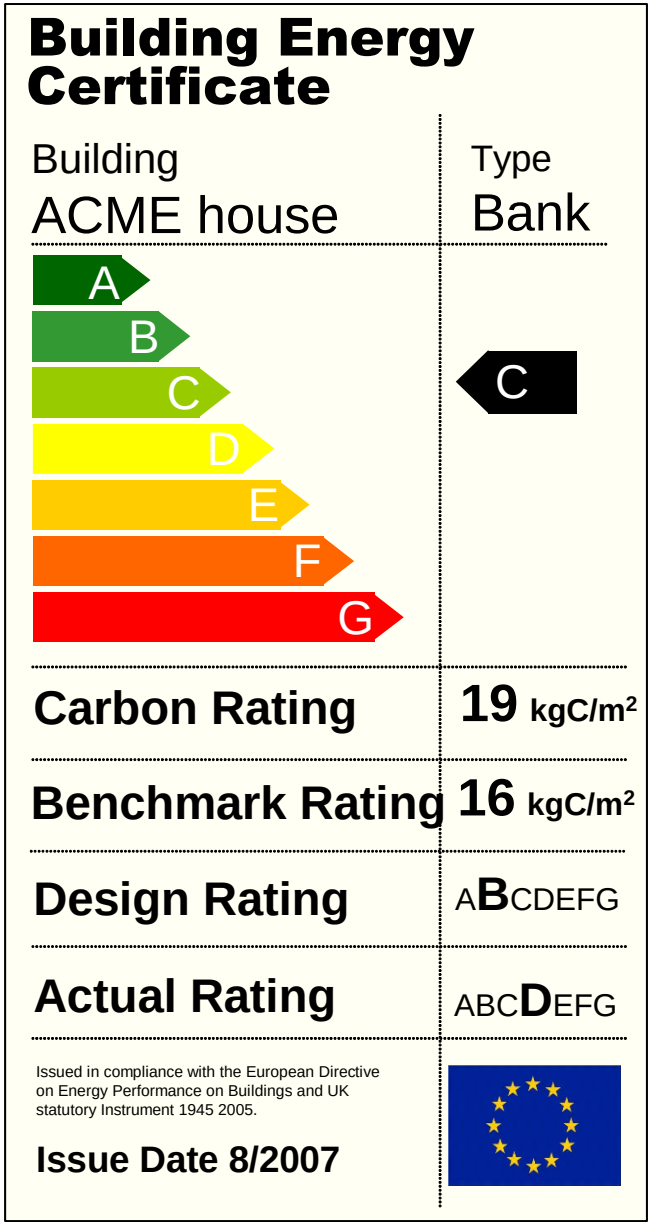
- Asset Rating: standardised estimation based on standard occupation;
- Operational Rating: estimation based on bills and measurements. It is the consumption of an in use building



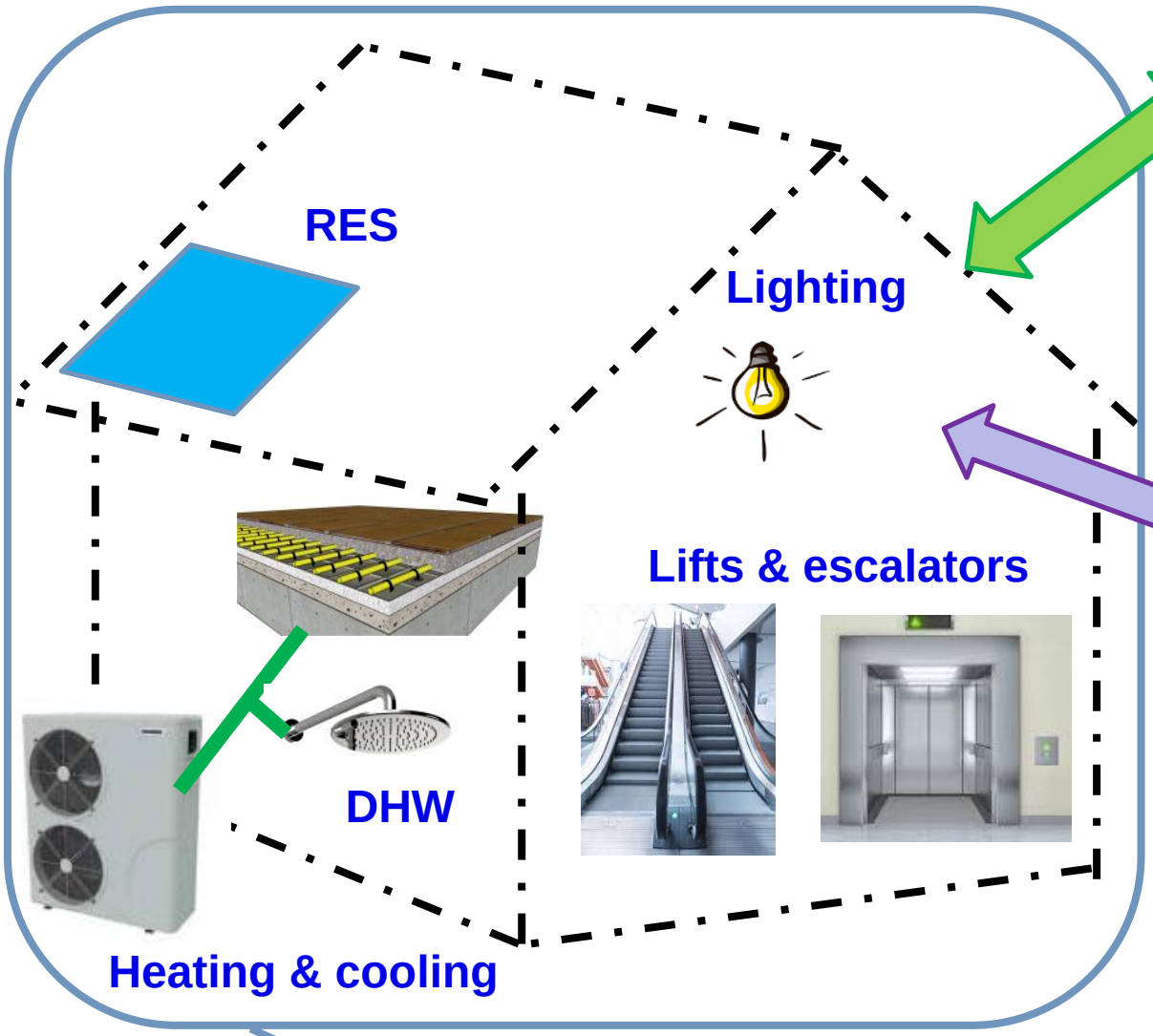
Energy Performance Certificates

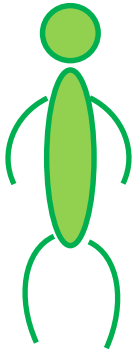
- Energy performance certificate no less than 10 years old available to purchaser/tenant
  (all domestic and commercial buildings)
- Label to show:
  - current legal standard
  - benchmarks
  - CO_2 emission indicator
- Recommendation for cost effective improvements
- Must be displayed in ***public buildings*** over 1000m^2 *(shops, banks, hotels?)*

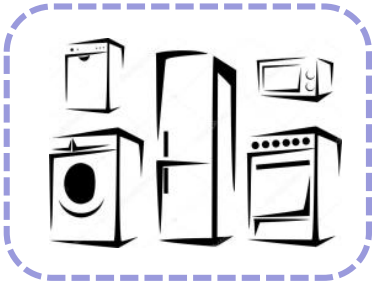
This could impact on property values

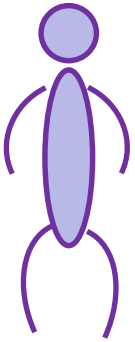


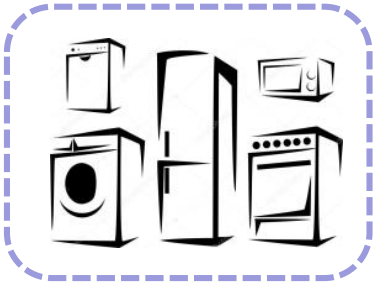
Energy Certificate











Unmodifiable or if modifications occur, a new certificate has to be done

Residential buildings

- **Heating**
- **Cooling**
- **DHW**

Non-residential buildings

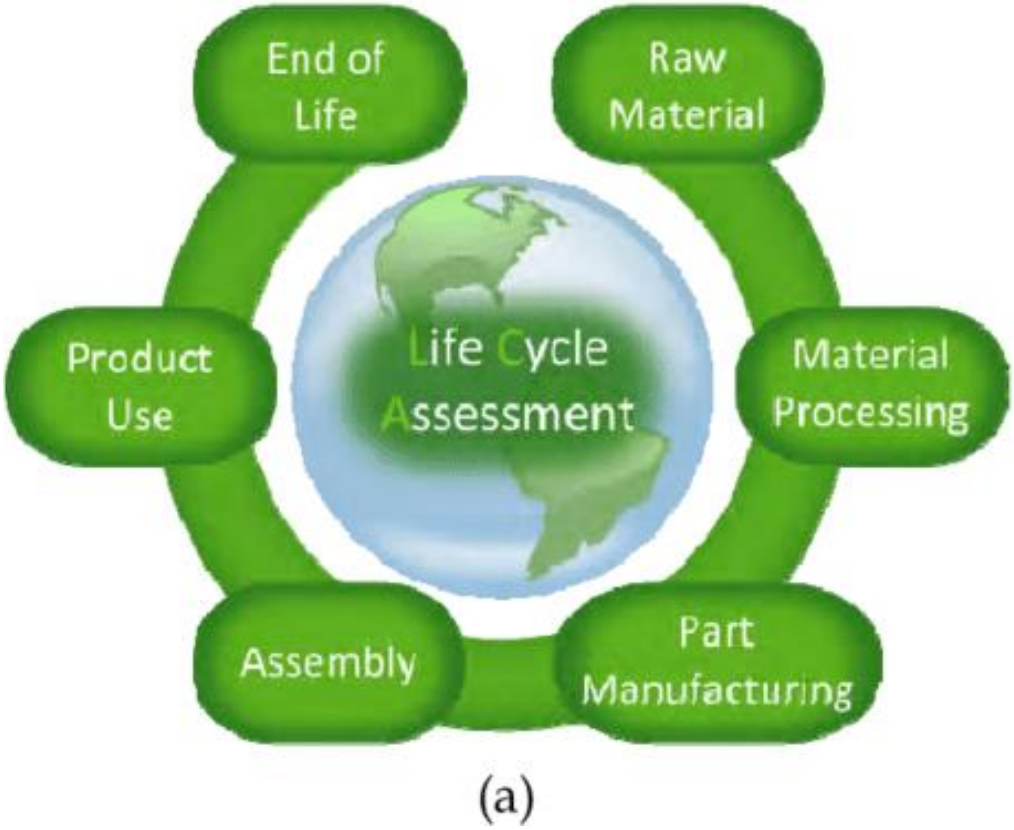
- **Heating**
- **Cooling**
- **DHW**
- **Lighting**
- **Lifts & escalators**

Due to the low amount of lighting in residential buildings it is only required the calculation of heating, cooling and DHW.

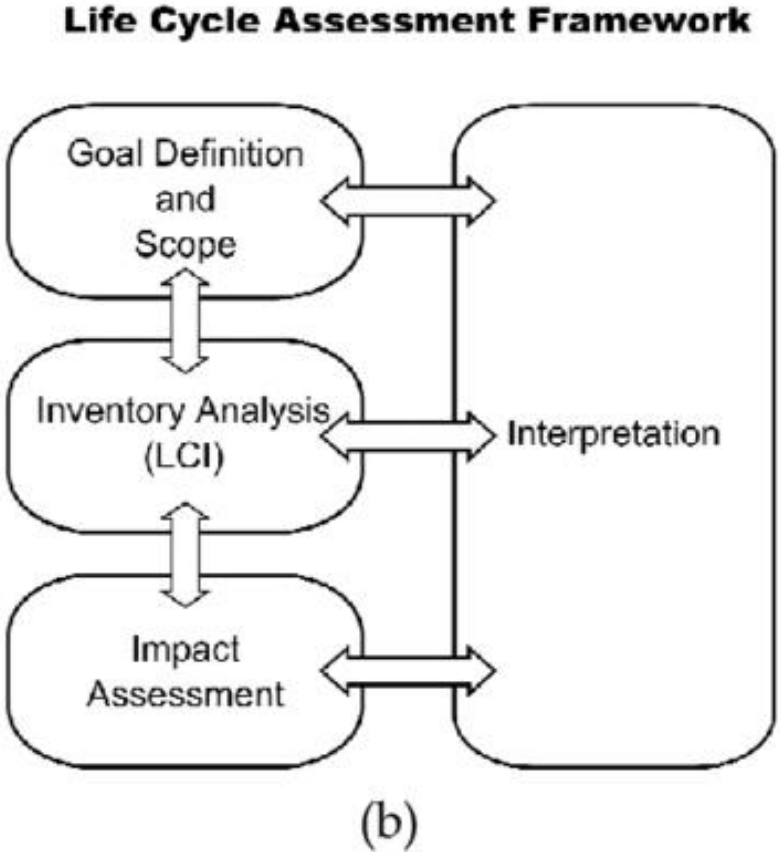
Energy certificate is mandatory and provides the operating rate of the building.

Life Cycle Analysis

In order to consider the whole emission of a building a Life Cycle Analysis (LCA) can be carried out.



(a)



(b)

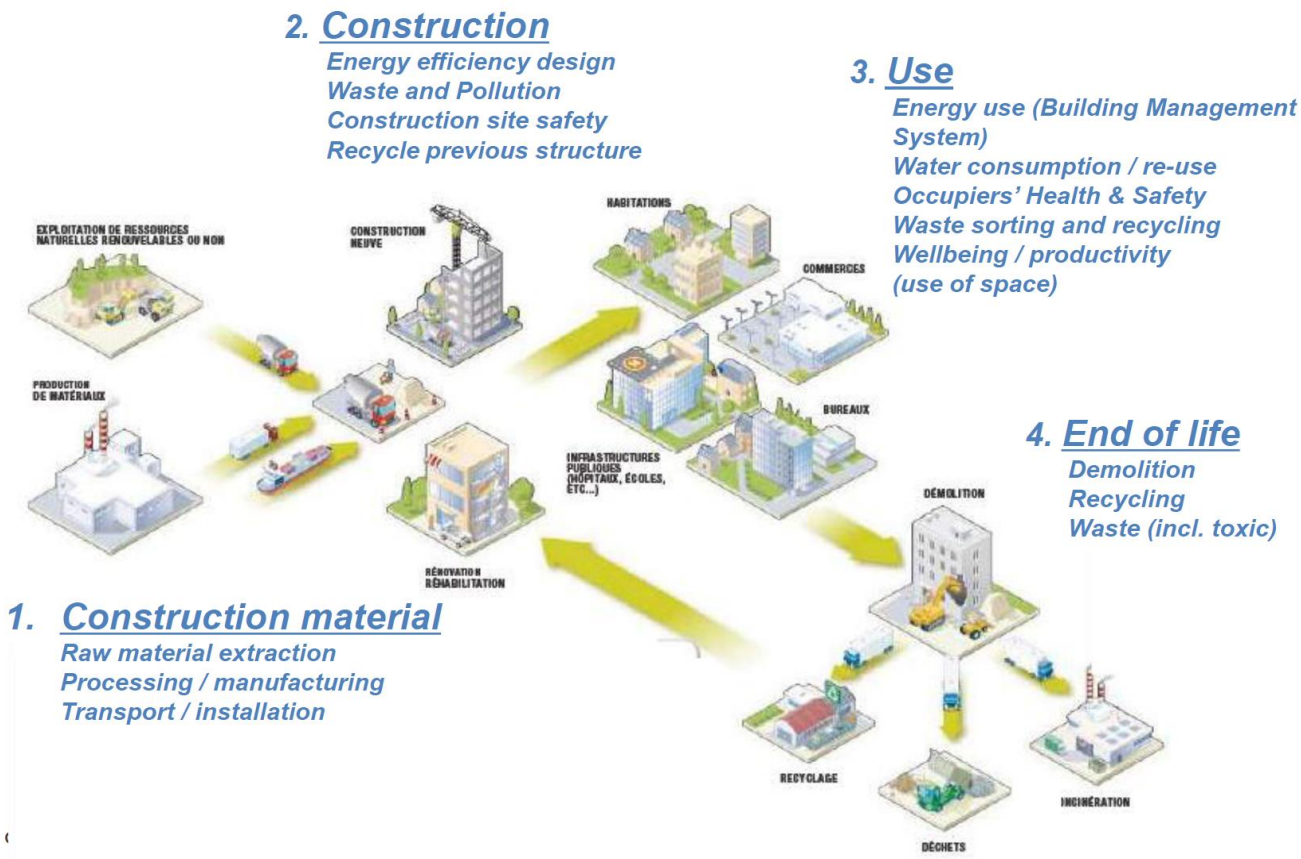
LCA, although interesting, is complicated and limited in buildings.

Environmental Certificates

LCA in buildings is an interesting solution, but many times the problems in a building are not the same as for a usual product, where the internal processes in a factory can be easily understood and hence measured:

- Materials impact has not always a clear value
- The choice of the duration of the building is quite complicated (30 years? 70 years? Centuries?)
- In buildings the different processes are complex and many times the build up of the building is complex.
- There are some architectural aspects which cannot be easily measured and evaluated
- The LCA is based on a detailed analysis of materials and this cannot be done while designing a building and come back to redesign for improving the overall performance of a building
- Usually in buildings the main consumption is in operation

Hence **environmental certificates** have been introduces which provide a rating of different criteria considering different aspects of the building, not only the energy in operation.



- BREEAM, BRE (Building Research Establishment) Environmental Assessment Method, proposed by BRE in the United Kingdom;
- LEED (Leader in Energy and Environmental Design), proposed by GBC, Green Building Council of the United States
- Green Star, proposed by the Green Building Council Australia
- CASBEE, Comprehensive Assessment System for Built Environment Efficiency, proposed by Japan GreenBuild Council and Japan Sustainable Building Consortium.

Areas for rating the environmental sustainability of a building

- Sustainable sites
- Water efficiency
- Energy and atmosphere
- Materials and resources
- Indoor environmental quality
- Innovation in design
- Sustainable transportation

Two possible certifications

Design, construction & operational phases

Check the building in the design phase. Constant collaboration between the different designers in an integrated approach. Recursive work to optimize the building.

Check the building during the construction and in the operation phase (commissioning)

Operational phase

Check how the building is managed and how the different sustainable recommendations are fulfilled.

It provides also the guidelines, establishing the path on how to further improve the sustainability of the building, providing rules to tenants.

Bo Palace is certified BREEAM in use