



European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung



Report to IEA/EBC Building Energy Codes WG on Energy Performance Building standards in Europe (CEN) and globally (ISO)

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Set of CEN standards on Energy Performance of Buildings (EPB)

- The SET of 53 standards is based on a holistic (systemic) approach:
- To assess the **integrated impact** on the energy performance of buildings (EPB)
 - Covering e.g. heating, cooling, ventilation, DHW, lighting and the impact of building automation and smart controls,
 - Also covering energy-using and renewable energy producing appliances
 - Respecting the IEQ requirements

- All published in 2017-2018
Full and coherent set of 53
European EPB standards (CEN)
 - and subset (key EPB standards) also published at global level (ISO):
The (EN) ISO 52000 family





Application of the EPB family of standards

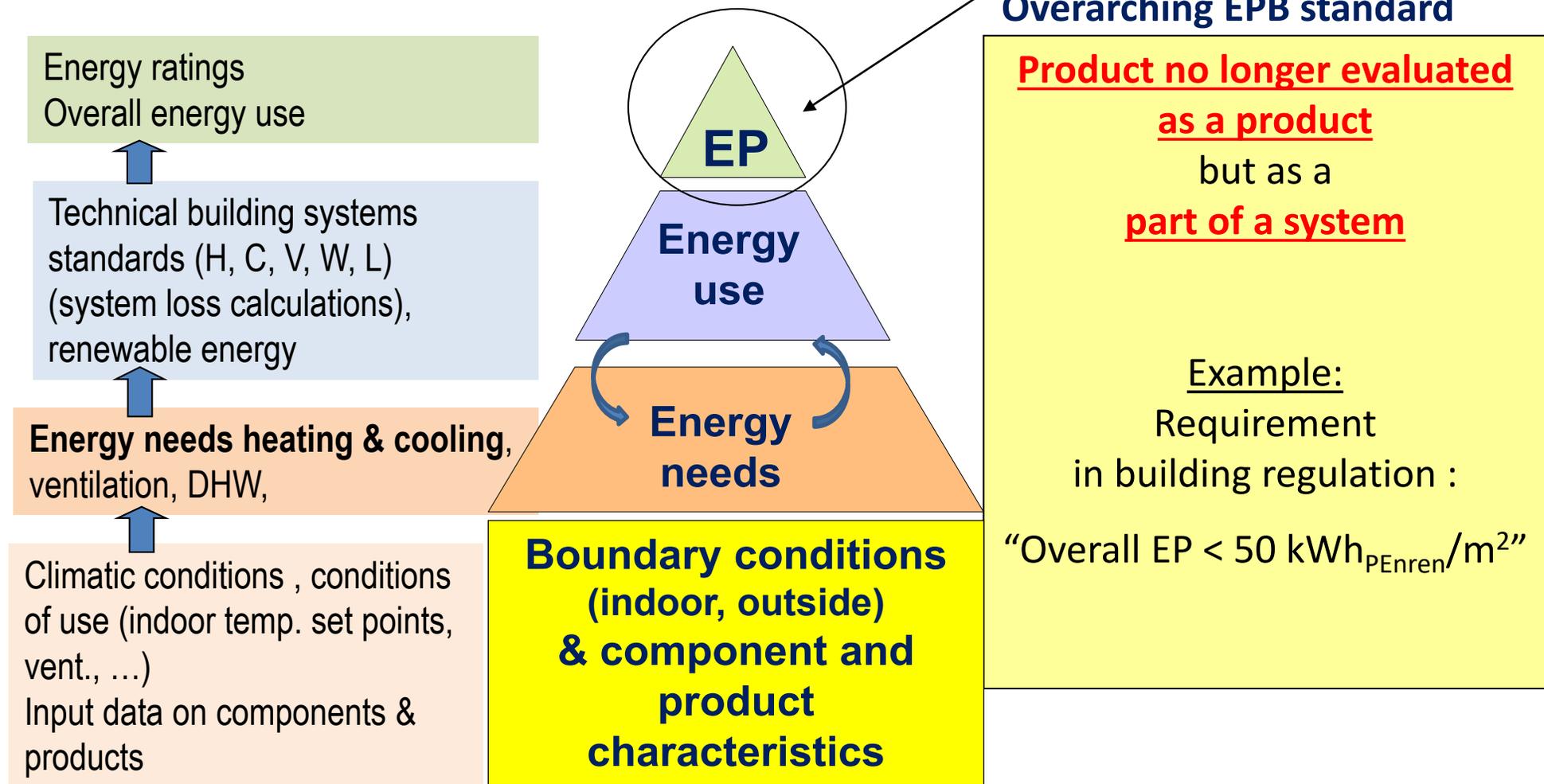
- Application:
 - To assess the energy performance of new and existing buildings in a **consistent** way
 - To bring **convergence and transparency** in the EPB assessment methods in Europe and also at global level
- In particular:
 - to check compliance with the minimum energy performance requirements (building codes)
 - as information for the energy performance certificate, and
 - **As basis for the customised advise to renovate the existing building stock**



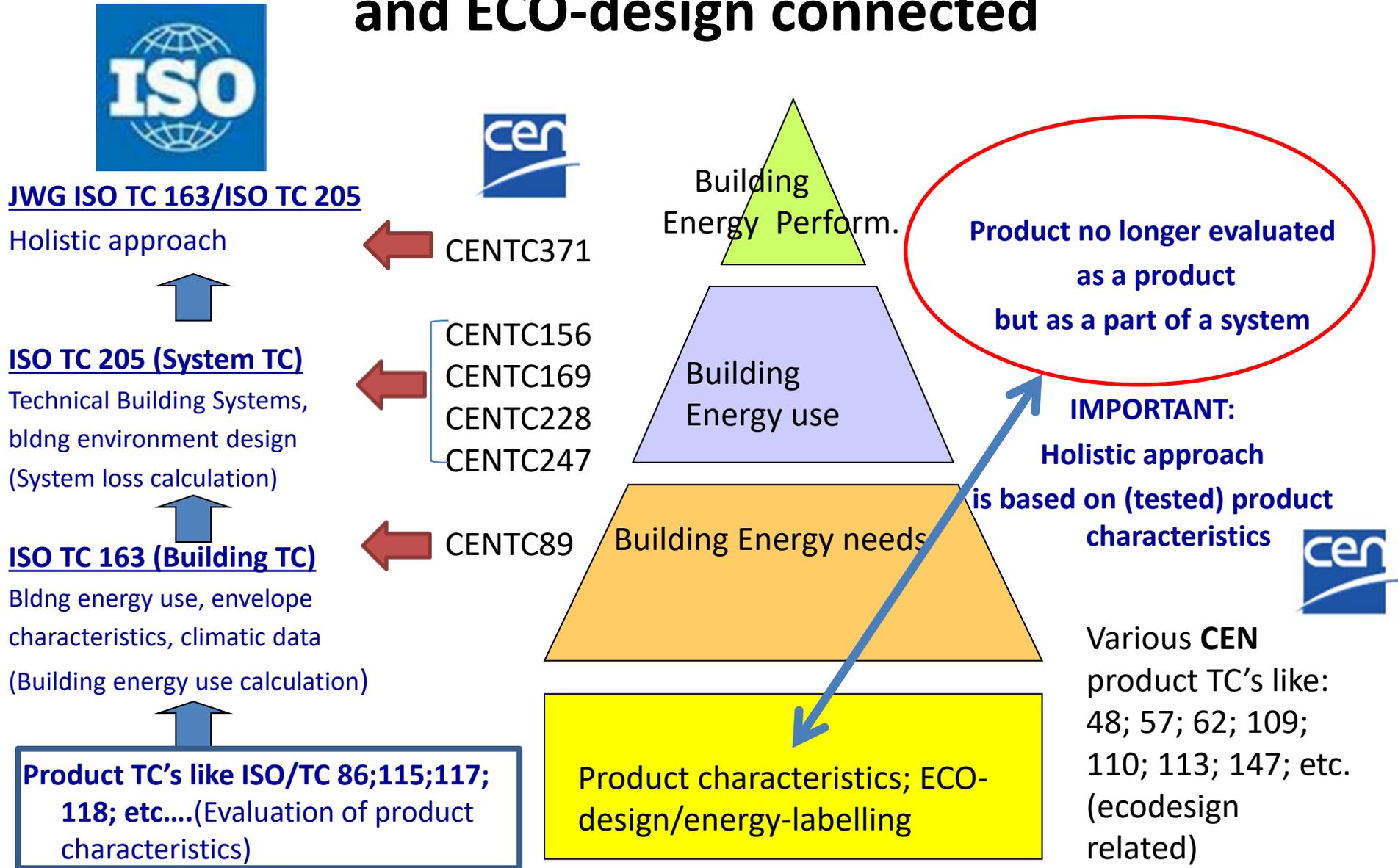
Set of EPB standards: the holistic approach

From *product* standards to *overall* energy use

EN ISO 52000-1
Overarching EPB standard



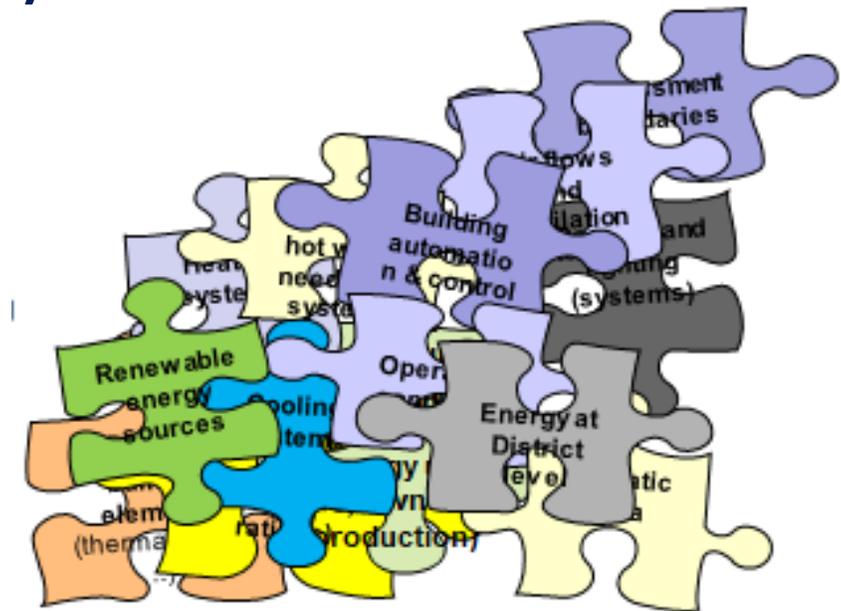
Continuity from the product to the system EP assessment EPBD and ECO-design connected





Set of EPB standards: **coherent** but flexible

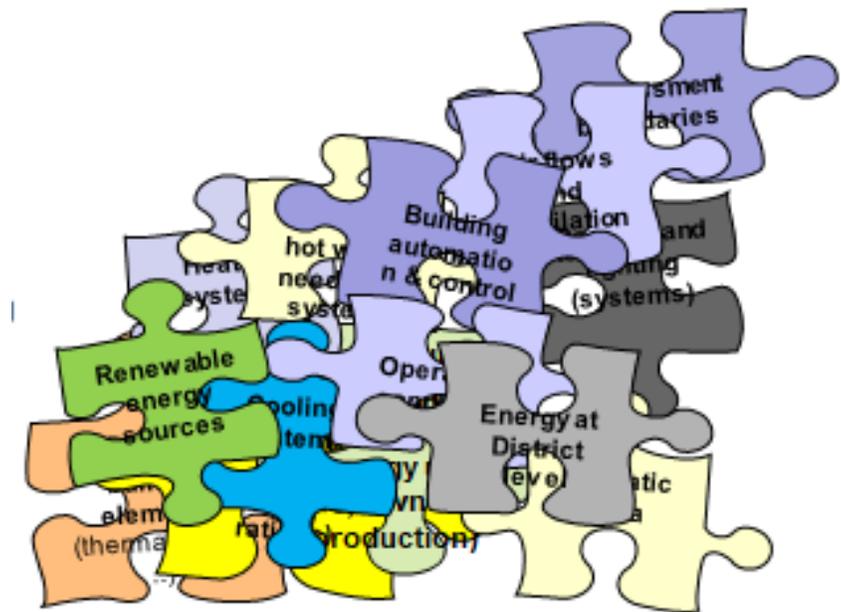
- Each EPB-standard respects specific requirements to ensure overall integrity, consistency and quality of the whole set (both in CEN and in ISO)
- *Because there are many interactions between the standards: heating, lighting, cooling, ...*





Set of EPB standards: coherent but **flexible**

- But at same time: specific choices are provided by the standards using the Annex A declaring the national choices
- *To take into account national legal context, building tradition, climate, building use*





Current Status EPB -standards implementation

- **All 53 EPB-standards and connected Technical Reports (EN and EN-ISO) have been published**
- Implementation of these standards via the national EPB regulation is ongoing in Europe, some EU MS's are quite advanced others lack behind
- Many EU countries will do this, step by step in the coming months/years, however there is a big variation in the national legislation framework, building regulation is up to the EU Member States (MS's).





Why implementation of the EPB standards is that important:

- If properly implemented, the benefits are:
 - **Harmonisation** (*some prefer **Alignment**, which may be a better term as it is about procedures and not the flexible choice of the boundary conditions*) of the EPB assessment procedures in Europe and possible globally via the use of these standards.
 - This will have an impact on the **product** and **system performance requirements** for **energy relevant products** used in buildings and their HVAC, DHW and lighting systems.
 - Expected to have a **positive impact on innovation** by creating a level playing field for energy saving solutions



Relation EPBD and ECODESIGN Directive in Europe

- EPBD requires EU MS's to have legislation on Energy Performance of buildings and encourage the use of the set of EPB standards
- The Ecodesign directive is a regulation on minimum product requirements, it regulates a.o. the minimum requirement on energy efficiency of a product to be allowed at the EU market.
- Energy using products need to have Label to declare this
- An EPREL database is set-up where all relevant product data have been included to allow the product access to the European market.



Revised EU Energy Performance Buildings Directive (EPBD) 2018

- More attention to renovation strategy, MS's shall set out a roadmap and progress indicators:
 - 40% GGE reduction by 2030 (compared with 1990) + increase of portion of renewables
 - Mid term goal 2040
 - Long term goal 80-95% GGE reduction by 2050
- Respecting the WHO IAQ guidelines and requirement for thermal comfort which data are included in the EN 16798-1 and ISO 17772-1
- More attention to Technical Building Systems and their control and automation (Building Automation and Control Systems required above 290 kW rated output)
- All buildings with an installed capacity above 70 kW require inspection of heating and HVAC systems, for stand-alone ventilation system this is foreseen as well.
- Introduction of the SRI (smart readiness indicator) which is to be defined but is a measure the capacity of buildings to interact with the connected energy grid and energy storage systems , including electric cars(obliged recharging points for new buildings by 2025 ...), optimising the overall EP of the building as part of the local energy grid



EPBD Annex 1: Common general framework for calculation of EP of buildings:

- The EP shall be expressed in kWh/(m².y) primary energy use and **MS's are encouraged to include the connected GHG emission produced in kgCO₂.eq/m².y**
- Methodology shall be transparent and open to innovation; this is guaranteed by using the set of EPB standards developed under the EU Mandate/480.
- To encourage this: MS's shall describe their national procedures following at least the overarching type of EPB standards: ISO 52000-1; 52003-1; 52010-1; 52016-1; 52018-1.



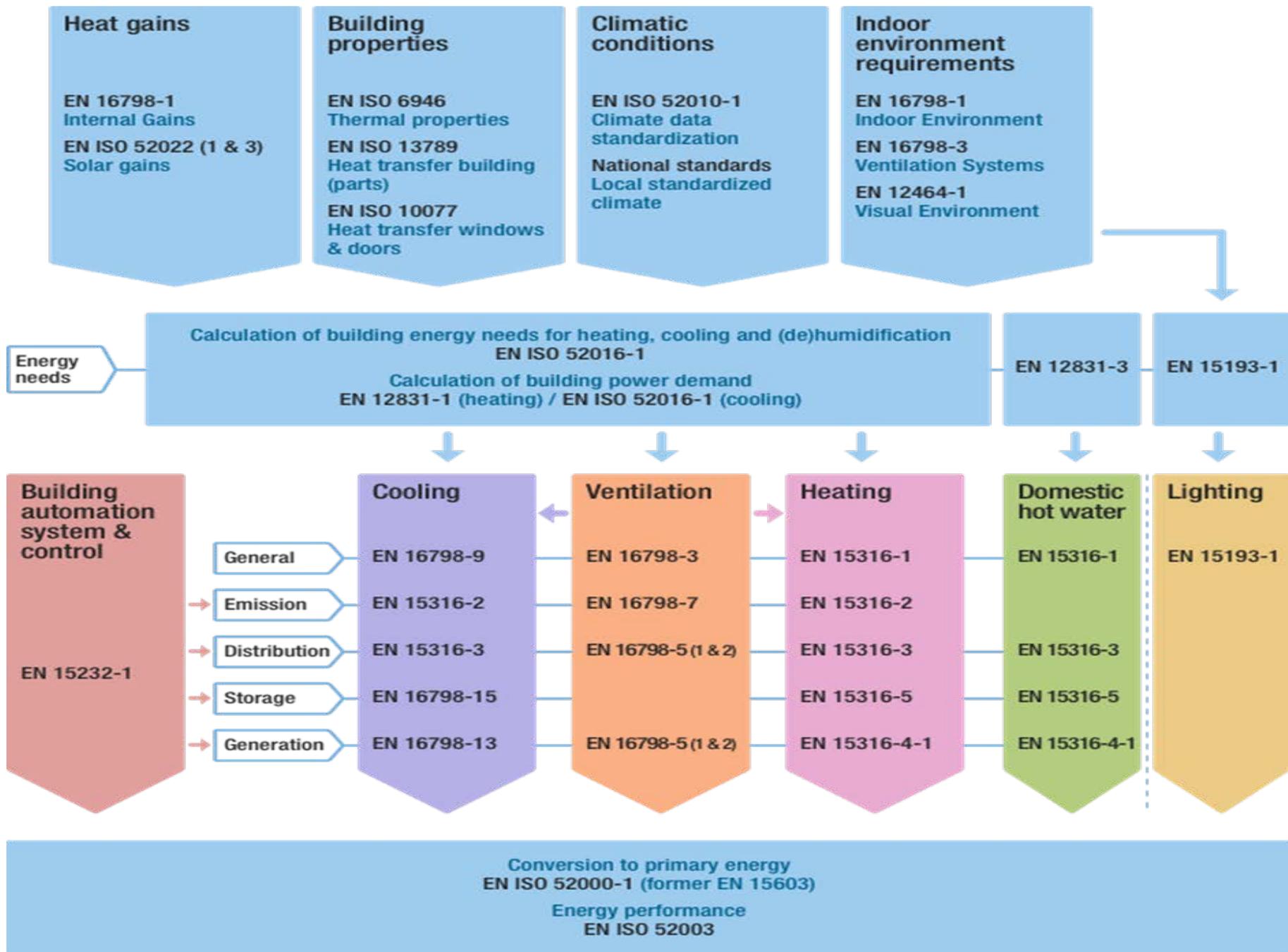
prEN 17423 Energy performance of buildings - Determination and reporting of Primary Energy Factors (PEF) and CO₂ emission coefficient - General Principles

- This current draft standard provides a transparent framework for reporting on choices related to the procedure to determine PEFs and CO₂ emission coefficients for energy delivered to and/or exported by the buildings as described in EN ISO 52000-1:2017.
- Exported PEFs and CO₂ emission coefficients can be different from those chosen for delivered energy. This standard can be considered as a supporting/complementing standard to EN ISO 52000-1, as the latter requires values for the PEFs and GHG Emissions factors to complete the EPB calculation. PEF: For each delivered or exported energy carrier, there are three PEF, related to different energy contents of the energy carrier, to be assessed: Non-renewable PEF ($fP;nren$); Renewable PEF ($fP;ren$); Total PEF ($fP;tot$);
- The CO₂ emission coefficient shall be expressed in kg of CO_{2eq} per kWh of the related energy carrier. The CO₂ emission coefficient can also include the equivalent emission of other greenhouse gases. The emission factors shall be coherent with the choice of referring to gross or net calorific value.

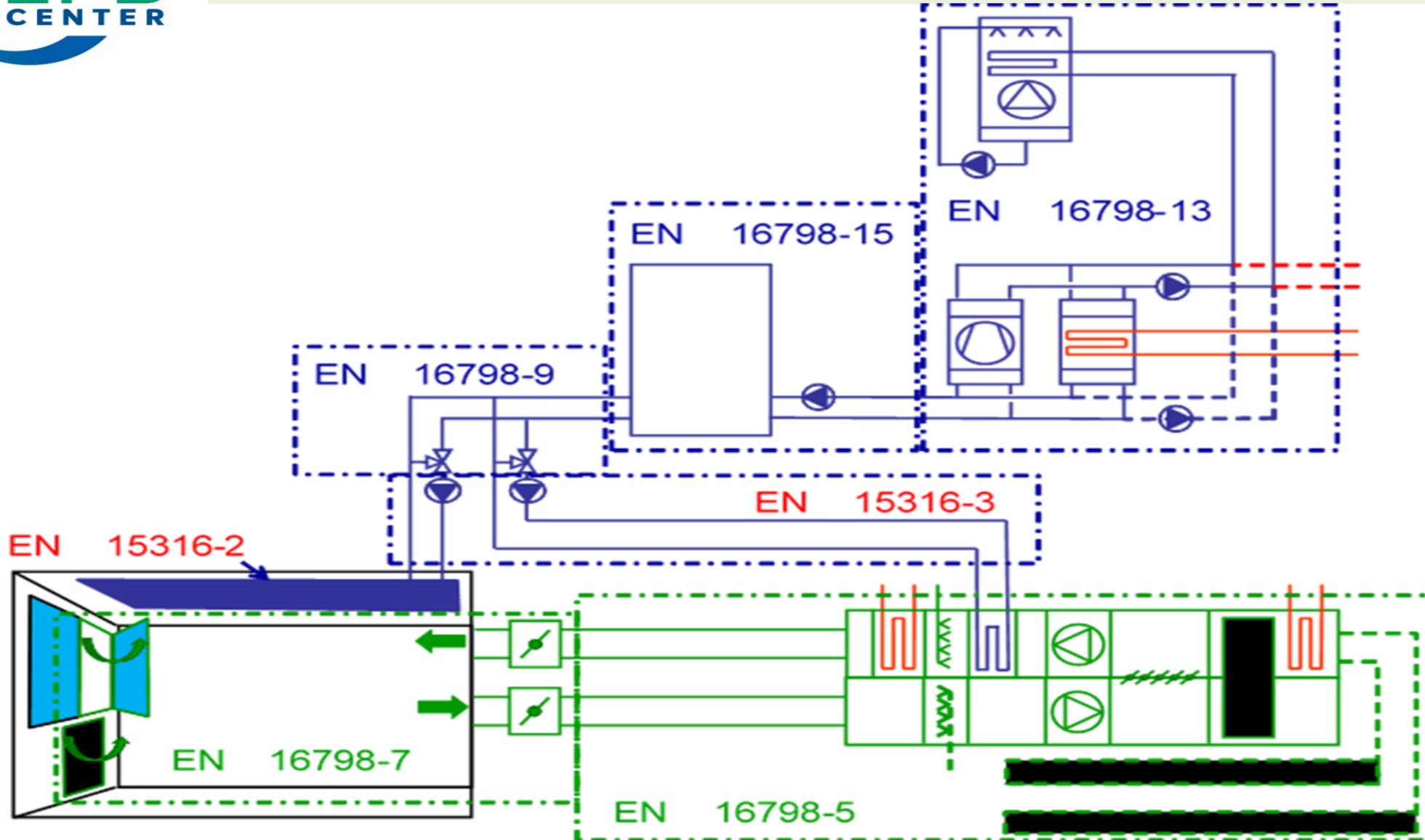


The overarching type ISO EPB standards required by the EPBD (This 52000 series of standards are also accepted in Europe and there addressed as EN ISO 52000 standards)

- **ISO 52000-1: Overarching EPB assessment —General framework and procedures**
- ISO 52003-1: Indicators, requirements, ratings and certificates —General aspects and application to the overall energy performance
- ISO 52010-1: External climatic conditions —Conversion of climatic data for energy calculations
- **ISO 52016-1: Energy needs for heating and cooling, internal temperatures and sensible and latent heat loads —Calculation procedures**
- ISO 52018-1: Indicators for partial EPB requirements related to thermal energy balance and fabric features —Overview of options



Overview of the use of the EN 16798 series of standards on ventilation and cooling (emission and distribution and generation)



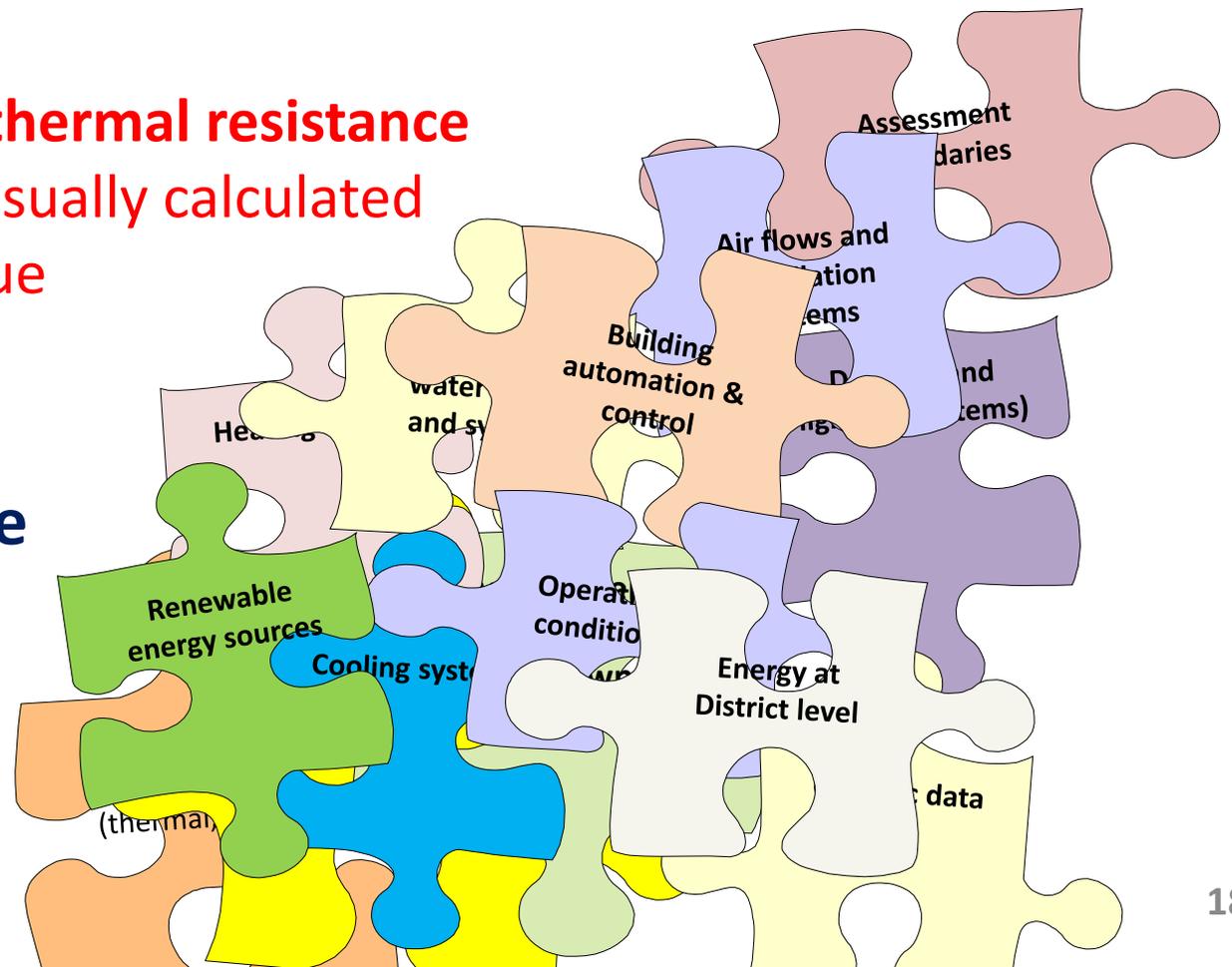


From yearly to hourly calculations

- EN ISO 52000-1, the overarching EPB standard, lists different options for the time interval for the calculation of the overall energy performance:
 - Hourly
 - Monthly
 - Seasonal
 - Yearly
 - Bin

From yearly to hourly calculations

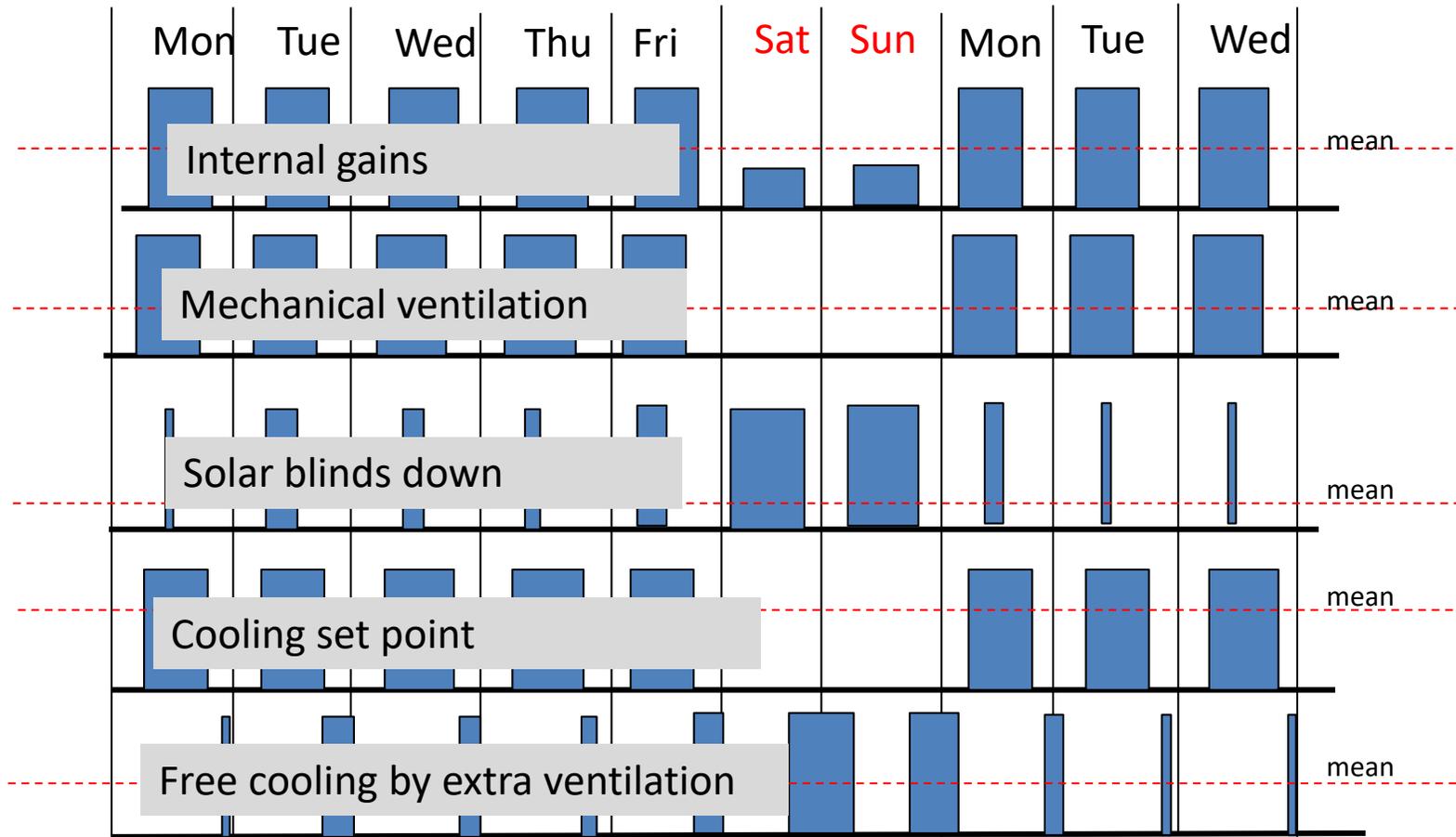
- The choices can be different per element in the calculation:
 - Trivial example: the **thermal resistance** of a construction is usually calculated as a fixed annual value
- On the other hand: in the holistic approach the **system performance** is evaluated as **part of the overall calculation**, taking into account **dynamic interactions**





Monthly or hourly calculations

- Many technologies, in particular for low energy buildings: varying in time, with strong and dynamic interactions with hourly and daily variations in weather and operation
 - Solar blinds
 - Occupation
 - Ventilative cooling
 - Temp.settings
 - Accumulation
 - weekend operation
 - Needs
 - Mechan.ventilation
 - etc.
- → strong effect on the heating and cooling calculation
- → Choice between **hourly or monthly** calculation procedures is most prominently visible in the calculation of the **energy needs for heating and cooling**





Spreadsheets developed for EPB standards

- As part of the Mandate M/480 from EC: for each calculation standard (*separately...*) a publicly available **spreadsheet** has been made (download on www.epb.center)
 - To demonstrate the correctness of the EPB calculation procedures
 - To enable a check of the list of input and output variables
- **Disclaimer:**
 - each spreadsheet was developed in parallel with the corresponding EPB standard: to detect omissions in the standard and mismatches in input-output relations
 - Not every detail of the calculation procedures is covered (e.g: no sunspace, only one type of ground-floor, ...)
 - → most recently available version of spreadsheet often reflects draft version of the standard (from 2014 or 2015)
 - not updated to published version of the standard (summer 2017)
 - **But some key spreadsheets will be updated during coming months (EC contract):** e.g. H&C needs, ventilation, heat pumps/chillers



ISO 52010-1

Energy performance of buildings – External climatic conditions – Part 1: Conversion of climatic data for energy calculations

Description:

- ISO 52010-1 specifies a calculation procedure for the conversion of climatic data for energy calculations
- The main element in ISO 52010-1 is the **calculation of solar irradiance on a surface with arbitrary orientation and tilt**, using measured data from weather station (such as solar irradiance on horizontal plane)



EN ISO 52016-1

Energy performance of buildings – Energy needs for heating and cooling, internal temperatures and sensible and latent heat loads– Part 1: Calculation procedures

Description:

- EN ISO 52016-1:2017 (replacing EN ISO 13790:2008)
 - Contains (improved) -fully described- **hourly** calculation method
 - Contains (improved) **monthly** calculation method
 - **NEW! Hourly method has been tailored to the goal:**
the input data asked from the user are the same for hourly and monthly method

No extra input data
needed for hourly
calculation!!

EN ISO 52016-1: parallel hourly and monthly calculation methods

Hourly calculation of

- energy needs for heating and cooling
- both sensible and latent heat
- indoor temperatures
- heating and cooling load

Same input data and boundary conditions

Extra output:

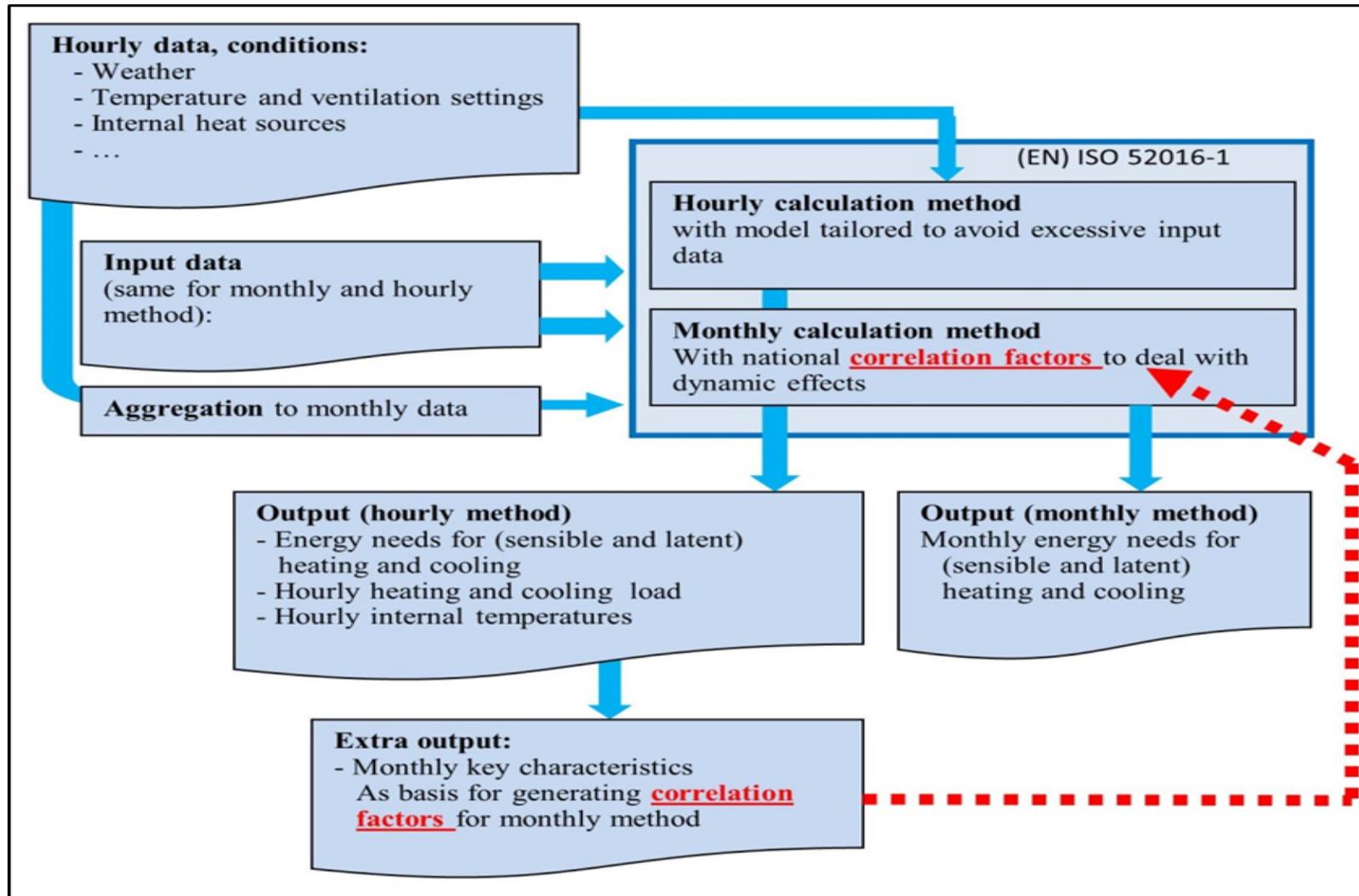
- Monthly characteristics
- Can be used as basis for generating or validating correlation factors for monthly method

Monthly calculation of energy needs for heating and cooling

- using national correlation factors to take into account dynamic effects
 - E.g. solar and internal gains, varying conditions of use (temperature and ventilation settings), ..

Demonstrated in Spreadsheet (update in preparation)

ISO 52016-1: links between the hourly and the monthly method provided in this standard





Demo spreadsheet ISO 52016-1

- Presentation of the input data file, showing the limited number of data needed, also for the hourly calculation
- Presentation of some of the graphical output:
 - Time series of outdoor and indoor temperatures, heating and cooling loads, etc.
 - Monthly heating and cooling loads from monthly and hourly method side by side
 - Energy signature
 - Monthly correlation factors generated by the hourly calculation method as basis for correlation factors that are needed to construct a simple monthly method
 - Heating and cooling load duration curves
 -

This updated spreadsheet will become publicly available at the EPB Center website within a few weeks from now



EPB Center Services

- Support Member States and National Standardization Bodies (NSB) to complete the national annexes of the overarching EPB standards
- Disseminate information and promote the use of the overarching and other EPB standards
- Information services for all involved stakeholders, such as industry, researchers, engineers and building professionals, financial institutions on the EPB standards
- Keeping track of corrections needed



Knowledge tools & building a community of practitioners

- FAQ on key issues (*How to fill in the annexes? How to use the standards?, ...*)
- Calculation tools for the individual standards
- Case study pool of practical examples tailored to the needs of different stakeholders
- Hands-on workshops/ webinars and offline training sessions
- Building an EPB Standards Community of practitioners to share knowledge and support the ambitious uptake of standards



National Annexes to the 'overarching' standards

Priority is given to the 'overarching' standards: mentioned in Annex 1 of the revised EPBD.

Each standard describes an important step in the assessment of the energy performance of buildings

EN ISO 52000-1: Weighted overall (primary) EP, share of renewables

- EN ISO 52003-1: Overall EP indicators
- EN ISO 52010-1: Climatic data for energy calculations
- EN ISO 52016-1: Energy needs (heating/cooling) and indoor temperatures
- EN ISO 52018-1: EP indicators at building fabric level



Public Information on several of these EPB standards
see: www.rehva.eu

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