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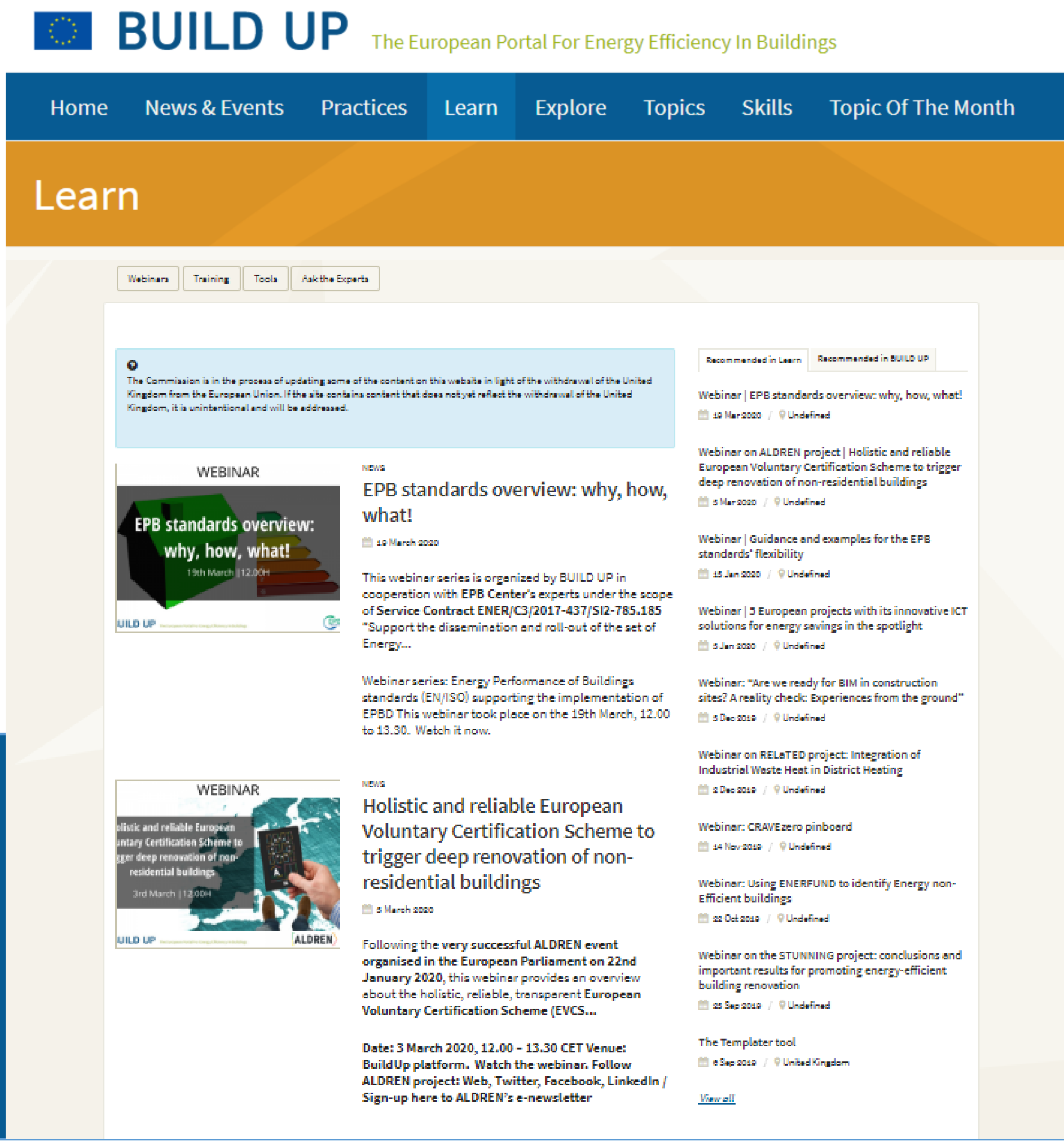


# Check our Learn section!

EPB CENTER

BUILD UP The European Portal For Energy Efficiency In Buildings

**Webinar 1** – **4th February 2020 –** Guidance and examples for the EPB standards' flexibility

**Webinar 2** – **19th March 2020) –** EPB standards overview: why, how, what!

**Webinar 3** – **16th April 2020** – How to make good use of the outputs of the EPB assessments

**Webinar 4** – **26th May 2020 (**12h00-13h30 CET**)** – EPB standards hourly vs monthly methods

**Webinar 5 – 16th June 2020 (**12h00-13h30 CET**)** – EPB standards linked to health and wellbeing

**Webinar 6** – **8th September 2020 (**12h00-13h30 CET**)** – Heating systems in the EPB standards

*Your service center for information and technical support on the new set of EPB standards*

# Thermal comfort and overheating


Gerhard Zweifel

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This project is facilitated by the EU-Commission Service Contract ENER/C3/2017-437/SI2.785185

Start: 21 September 2018 for 3 years


BUILD UP Webinar series
Webinar 5: *EPB standards linked to health and wellbeing*
*16* June 2020

# My background

- Professor emeritus, Lucerne University of Applied Sciences and Arts (HSLU) (≤ 2019)
- EPB Center expert (> 2017)
- Involved in initiation, preparation and coordination of set of EPB standards (2012-2017)
- Convenor of CEN Working Group responsible for system related EPB standards:

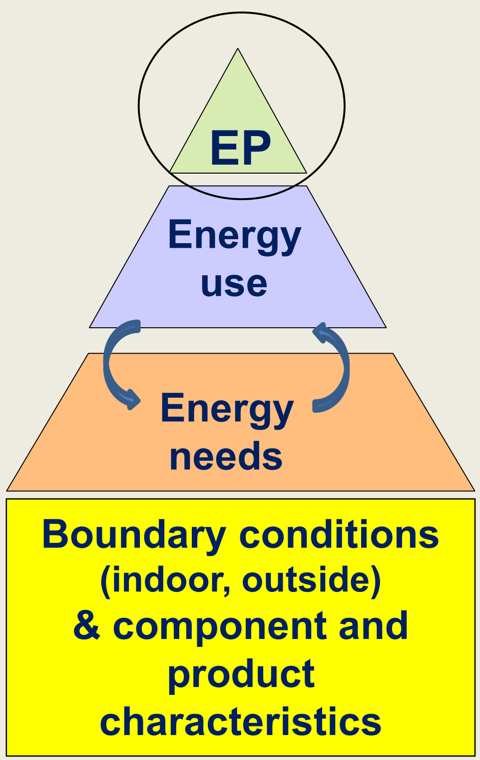
  Ventilation/cooling

  CEN/TC 156
- Member of ISO Joint Working Group on the overall set of EN ISO EPB standards, in collabora-tion with CEN, and some related working groups

  ISO/TC 163 & ISO/TC 205, CEN/TC 371, ISO/TC 163/SC 2/WG 15/16

# Set of (about 50) EPB standards. The core set

**EN ISO 52000-1, Overall EPB Framework (common terms, modular structure, ...)**




EN ISO 52000-1 Aggregation & conversion to primary energy

EN ISO 52003-1
Overall indicators, requirements, ratings

*<< Several system standards >>*

EN ISO 52016-1 Energy needs heating and cooling

EN ISO 52018-1
Partial indicators (building fabric, needs)

EN ISO 52010-1
Climatic conditions

EN 16798-1
Indoor environmental input parameters

# EPB Standard for thermal comfort and wellbeing

- EN 16798-1: Energy performance of buildings – Ventilation for buildings - Part 1: Indoor environmental input parameters for design and assessment of energy performance of buildings addressing indoor air quality, thermal environment, lighting and acoustics - Module M1-6 (former EN 15251)
- CEN/TR 16798-2: Energy performance of buildings - Ventilation for buildings - Part 2: Interpretation of the requirements in EN 16798-1 - Indoor environmental input parameters for design and assessment of energy performance of buildings addressing indoor air quality, thermal environment, lighting and acoustics (Module M1-6) (accompanying technical report)

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# EN 16798-1 Content

6 Design input parameters for design of buildings and sizing of heating, cooling, ventilation and lighting systems

6.1 Introduction

6.2 Thermal environment

6.3 Design for Indoor air quality (ventilation rates)

6.4 Humidity

6.5 Lighting

6.6 Noise

7 Indoor environment parameters for energy calculation

7.1 General

7.2 Thermal environment

7.3 Indoor air quality and ventilation

7.4 Humidity

7.5 Lighting

# EN 16798-1 Content

6 Design input parameters for design of buildings and sizing of heating, cooling, ventilation and lighting systems

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- 6.2 Thermal environment
- 6.3 Design for Indoor air quality (ventilation rates)
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7 Indoor environment parameters for energy calculation

- 7.1 General
- 7.2 Thermal environment
- 7.3 Indoor air quality and ventilation
- 7.4 Humidity
- 7.5 Lighting

Back reference

# EN 16798-1 Indoor environment

- Indoor environment classes (categories):

| Category | Level of expectation |
|---|---|
| $IEQ_{I}$ | High |
| $IEQ_{II}$ | Medium |
| $IEQ_{III}$ | Moderate |
| $IEQ_{IV}$ | Low |
| NOTE In the tables only the category numbers are used without the IEQx symbol. | |

- Used in Annex A/B for the choice of all indoor environment parameters
- National choices via National Annex NA on the assignment of data to the categories
- Additional source of information for energy calculations (not mentioned/referenced in IEQ chapters): occupancy schedules
  - Include temperature and humidity set points

# EN 16798-1 Thermal environment

- Shall be based on the thermal comfort indices PMV-PPD
  - PMV: Predicted mean vote
  - PPD: Predicted percentage of dissatisfied

-> EN ISO 7730

- with assumed typical levels of activity ("met") and typical values of thermal insulation for clothing ("clo", winter and summer)
- Based on the selected criteria a corresponding design operative temperature interval
- Selection of the category is building, zone or room specific
  - needs of special occupant groups such as elderly people (low metabolic rate and impaired control of body temperature) shall be considered
  - For this group of people: recommended to use category I
  - **> important information for health and wellbeing**
- PMV-PPD index can be used directly

# EN 16798-1 Thermal environment

- Seasonal and monthly calculations:
  - Same values as for design
- Hourly calculations:
  - Target value of the operative temperature shall be specified
  - Default values for the acceptable range of the indoor operative tempe-rature in B.2.4
  - Methods for evaluating the excess operative temperature are given in CEN/TR 16798–2

**Table B.5 — Temperature ranges for hourly calculation of cooling and heating energy in four categories of indoor environment**

| Type of building or space | Category | Temperature range for heating seasons, °C<br>Clothing approximately 1,0 clo | Temperature range for cooling seasons, °C<br>Clothing approximately 0,5 clo |
|---|---|---|---|
| Residential buildings, living spaces (bed room's, kitchens, living rooms etc.)<br>Sedentary activity ~1,2 met | I | 21,0 –25,0 | 23,5 - 25,5 |
| | **II** | **20,0–25,0** | **23,0 - 26,0** |
| | III | 18,0- 25,0 | 22,0 - 27,0 |
| | IV | 17,0–25,0 | 21,0 – 28,0 |
| Residential buildings, other spaces (utility rooms, storages etc.)<br>Standing-walking activity ~1,5 met | I | 18,0–25,0 | |
| | **II** | **16,0–25,0** | |
| | III | 14,0–25,0 | |
| Offices and spaces with similar activity (single offices, open plan offices, conference rooms, auditoria, cafeteria, restaurants, class rooms)<br>Sedentary activity ~1,2 met | I | 21,0 – 23,0 | 23,5 - 25,5 |
| | **II** | **20,0 – 24,0** | **23,0 - 26,0** |
| | III | 19,0 – 25,0 | 22,0 - 27,0 |
| | IV | 17,0–25,0 | 21,0 – 28,0 |
| During the between heating and cooling seasons (with $\Theta_{rm}$ between 10 and 15°C) temperature limits that lie in between the winter and summer values may be used. Air velocity is assumed < 0,1 m/s and RH~40% for heating season and 60% for cooling season. | | | |

# EN 16798-1 Thermal environment

- Seasonal and monthly calculations:
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**Table A.5 — Temperature ranges for hourly calculation of cooling and heating energy in 1–4 categories of indoor environment**

| Type of building or space | Category | Temperature range for heating, °C | Temperature range for cooling, °C |
|---|---|---|---|
| Residential buildings, living spaces (bed room's living rooms etc.) | I | | |
| | II | | |
| | III | | |
| | IV | | |
| Residential buildings, other spaces (kitchens, storages etc.) | I | | |
| | II | | |
| | III | | |
| Offices and spaces with similar activity (single offices, open plan offices, conference rooms, auditorium, cafeteria, restaurants, class rooms etc.) | I | | |
| | II | | |
| | III | | |
| | IV | | |
| OTHER | | | |
| | | | |
| | | | |
| | | | |

Annex A for national choices

Assumptions regarding clothing and activity shall be given.

# CEN/TR 16798-2 Thermal environment

**Calculated indicators of indoor environment:**

- Simple indicator
  - Representative rooms or spaces shall be simulated (-> hourly calculation, validated method)
  - Building meets criteria of a specific category if the rooms representing 95 % of building volume meet the criteria
- Hourly criteria
  - Number of actual hours or percentage of time when the criteria is met or not
  - Example in Annex D
- Degree hours criteria
  - Degree hours outside the upper or lower boundary (hours weighted by temperature difference)
  - Example in Annex D
- Overall thermal comfort criteria (weighted PMV criteria)
  - Example in Annex D

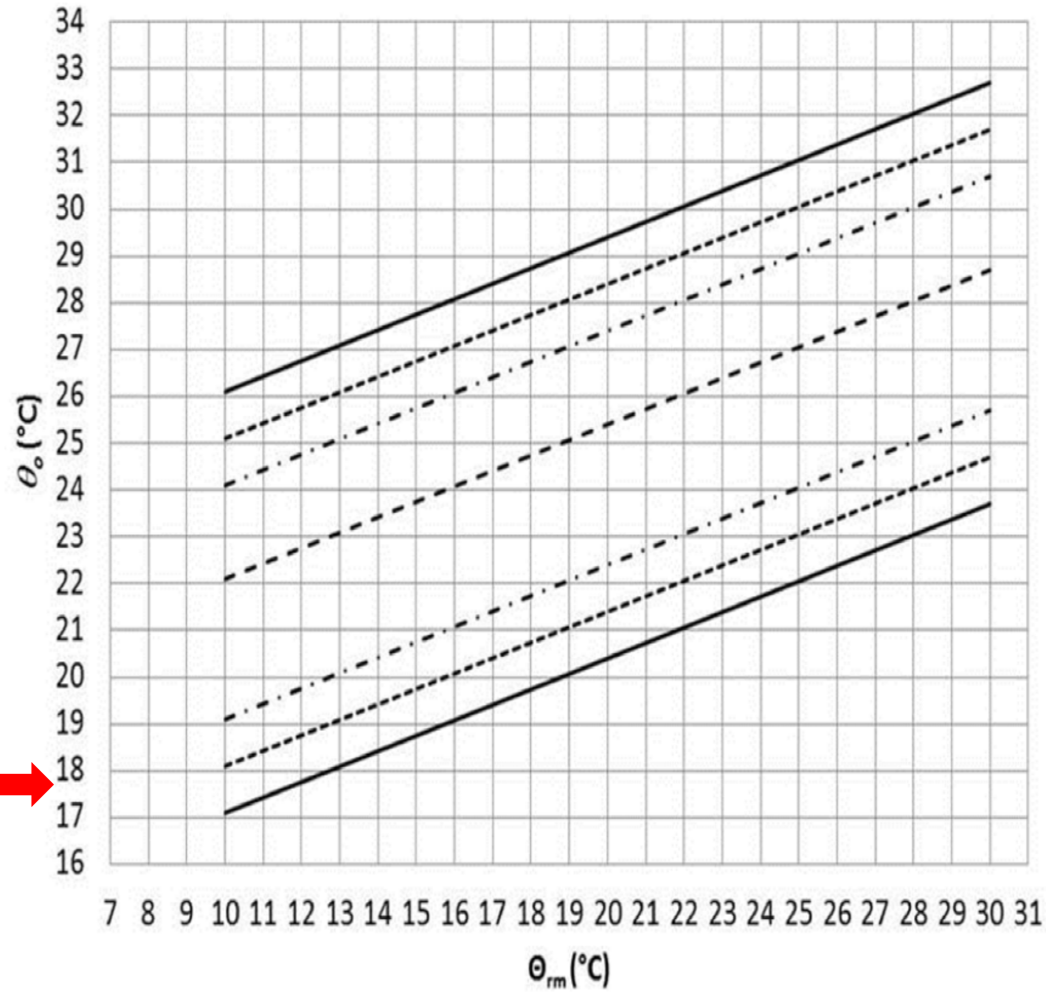
**Table D.1 — Examples of weighting factors based on temperature difference or PPD for mechanically heated or cooled buildings following the assumptions shown in the text**

| Temperature °C | | Weighting factors | |
|---|---|---|---|
| | | Wf (°C) | Wf (PPD) |
| Cool | 20 | 3 | 4,7 |
| | 21 | 2 | 3,1 |
| | 22 | 1 | 1,9 |
| Neutral | 23 | 0 | 0 |
| | 24 | 0 | 0 |
| | 25 | 0 | 0 |
| | 26 | 0 | 0 |
| Warm | 27 | 1 | 1,9 |
| | 28 | 2 | 3,1 |
| | 29 | 3 | 4,7 |

# EN 16798-1 Thermal environment

**Buildings without mechanical cooling:**

- Adaptive method (option!)
- only applies for occupants
  - with sedentary activities
  - without strict clothing policies
  - where thermal conditions are regulated primarily by the occupants through elements in the building envelope (e.g. windows, ventilation flaps, roof lights, etc.)
- Default criteria for indoor operative temperature in B.2.2
  - $\Theta_{rm}$ = Outdoor Running mean temperature for the considered day (°C)



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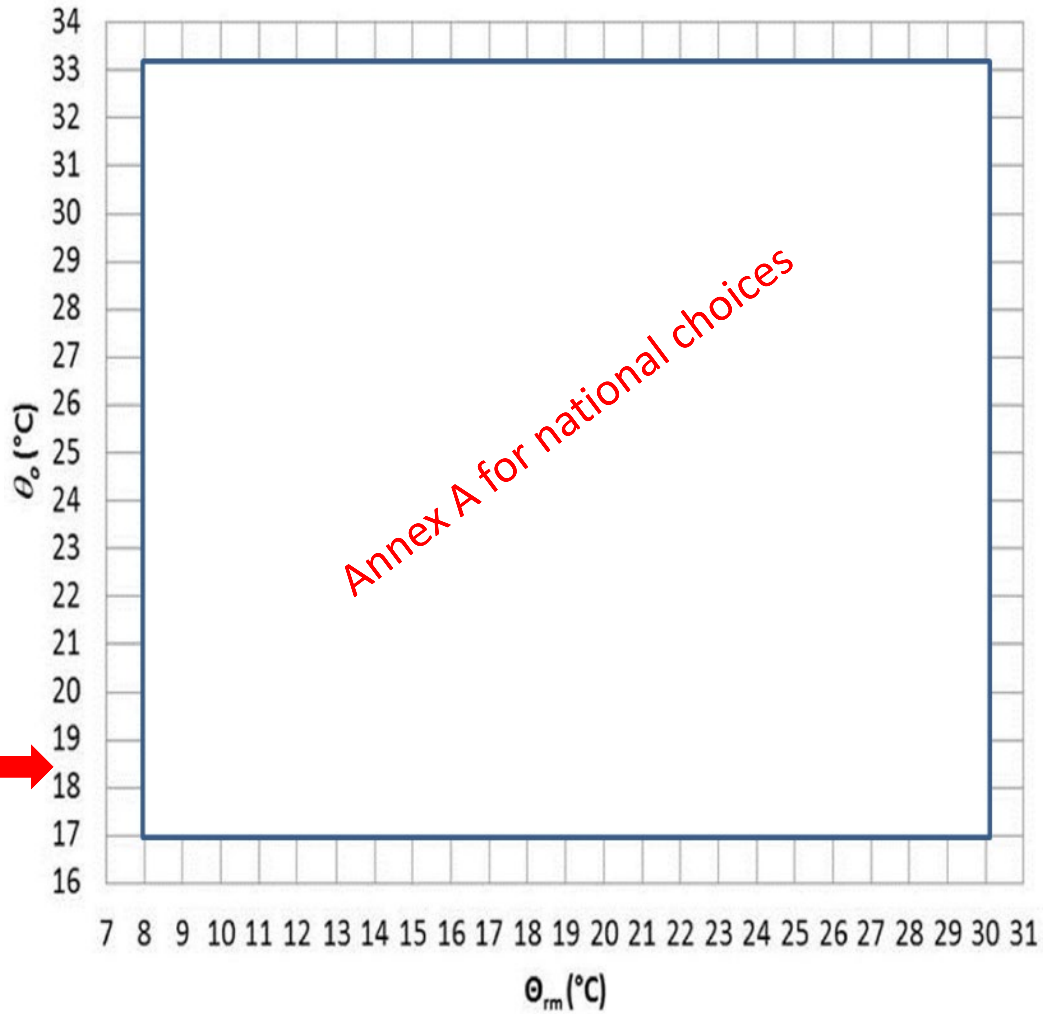

# EN 16798-1 Thermal environment

- Criteria for **local thermal discomfort**
  - Draught
  - radiant temperature asymmetry
  - vertical air temperature differences
  - and floor surface temperatures
- when designing buildings and HVAC systems
- No reference in “energy calculation” chapter
  - Not all possible to be evaluated by hourly method from EN ISO 52016-1
- Table B.3 for local thermal discomfort criteria

**Table B.3 — Local thermal discomfort design criteria**

| | **Draught** | | | **Vertical air temperature difference (head ankle)** | | **Range of floor temperature** | | **Radiant temperature asymmetry** | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | DR (Draught Rate) | Maximum air velocity [a] | | PD | Temp. Difference [b] | PD | Floor surface temperature range | PD | Warm ceiling | Cool wall | Cool ceiling | Warm wall |
| | [%] | Winter [m/s] | summer [m/s] | [%] | [K] | [%] | [°C] | [%] | [K] | [K] | [K] | [K] |
| Category I | 10 | 0,10 | 0,12 [c] | 3 | 2 | 10 | 19 to 29 | 5 | < 5 | < 10 | < 14 | < 23 |
| Category II | 20 | 0,16 | 0,19 [c] | 5 | 3 | 10 | 19 to 29 | 5 | < 5 | < 10 | < 14 | < 23 |
| Category III | 30 | 0,21 | 0,24 [c] | 10 | 4 | 15 | 17 to 31 | 10 | < 7 | < 13 | < 18 | < 35 |

[a] Assuming an activity level of 1,2 met, a turbulence intensity of 40% and an air temperature equal to the operative temperature of around 20 °C in winter and 23 °C in summer.

[b] Difference between 1,1 and 0,1 m above the floor.

[c] When the air temperature is above 25 °C higher maximum air speeds are allowed and often even preferred (draught becomes pleasurable breeze); but only under the condition that occupants have direct control over the air speed. See B.2.3 for examples of operative temperature corrections.

For more information, see EN ISO 7730 [10] and FprCEN/TR 16798–2 [7].

# EN 16798-1 Thermal environment

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**Table A.3 — Local thermal discomfort design criteria**

| | Draught | | | Vertical air temperature difference (head-ankle) | | Range of floor surface temperature | | Radiant temperature asymmetry | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Maximum air velocity<br>Winter [m/s] | summer [m/s] | | Temp. Difference [K] | | Floor surface temperature range [°C] | | Warm ceiling [K] | Cool wall [K] | Cool ceiling [K] | Warm wall [K] |
| Category I | | | | | | | | | | | | |
| Category II | | | | | | | | | | | | |
| Category III | | | | | | | | | | | | |

Annex A for national choices

*List any assumptions regarding the criteria.*

# EN 16798-1 Thermal environment

## Increased air velocity

- It shall be evaluated if increased air velocity (with or without personal control) can improve thermal comfort
- in summer conditions with indoor operative temperatures > 25 °C, increased air velocity can be used to reduce the adverse effects of increased air temperatures according to B.2.3

**Table B.4 — Indoor operative temperature correction ($\Delta\Theta_o$) applicable for buildings equipped with fans or personal systems providing building occupants with personal control over air speed at occupant level**

| Average Air Speed ($v_a$) 0,6 m/s | Average Air Speed ($v_a$) 0,9 m/s | Average Air Speed ($v_a$) 1,2 m/s |
|---|---|---|
| 1,2 °C | 1,8 °C | 2,2 °C |

# EN 16798-1 Thermal environment

## Increased air velocity

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**Table A.4 — Indoor operative temperature correction ($\Delta\Theta_o$) that can be applied when buildings are equipped with fans, personal systems that provide building occupants with personal control over air speed at workstation level**

| Average Air Speed (Va) 0,6 m/s | Average Air Speed (Va) 0,9 m/s | Average Air Speed (Va) 1,2 m/s |
|---|---|---|
| Annex A for national choices | | |

# EN 16798-1 Humidity

- Criteria used for design and sizing (6.4) shall also be used in energy calculations
- Indoor air shall
  - not be dehumidified to relative humidity < design values
  - not be humidified to relative humidity > design values
  - Besides: upper limit for the absolute humidity
  - Unoccupied buildings shall not be humidified (exceptions, e.g. museums)

**Table B.16 — Example of recommended design criteria for the humidity in occupied spaces if humidification or dehumidification systems are installed**

| Type of building/space | Category | Design relative humidity for dehumidification, % | Design relative humidity for humidification, % |
|---|---|---|---|
| Spaces where humidity criteria are set by human occupancy. Special spaces (museums, churches, etc.) may require other limits | I | 50 | 30 |
| | II | 60 | 25 |
| | III | 70 | 20 |
| | | | |

Besides it is recommended to limit the absolute humidity to 12g/kg.

# EN 16798-1 Humidity

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| Spaces where humidity criteria are set by human occupancy. Special spaces (museums, churches etc.) might require other limits | I | | |
| | II | | |
| | III | | |
| | | | |

Annex A for national choices

Besides it is recommended to limit the absolute humidity to 12 g/kg.

# EN 16798-1 & CEN/TR 16798-2

Related ISO documents:

- ISO 17772-1 & ISO/TR 17772-2
- No «Vienna Agreement» (= not an EN ISO standard), but same content

Future development:

- EN 16798-1 & CEN/TR 16798-2 subject to plans for (soon) revision
  - To be devided in different parts
  - Experts from different topical areas to be involved

Far end goal:

- EN ISO 52007-1 & CEN ISO/TR 52007-2
- Proposal in preparation

*Your service center for information and technical support on the new set of EPB standards*

# Energy need calculation (EN ISO 52016-1) and thermal comfort


Dick van Dijk

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Start: 21 September 2018 for 3 years


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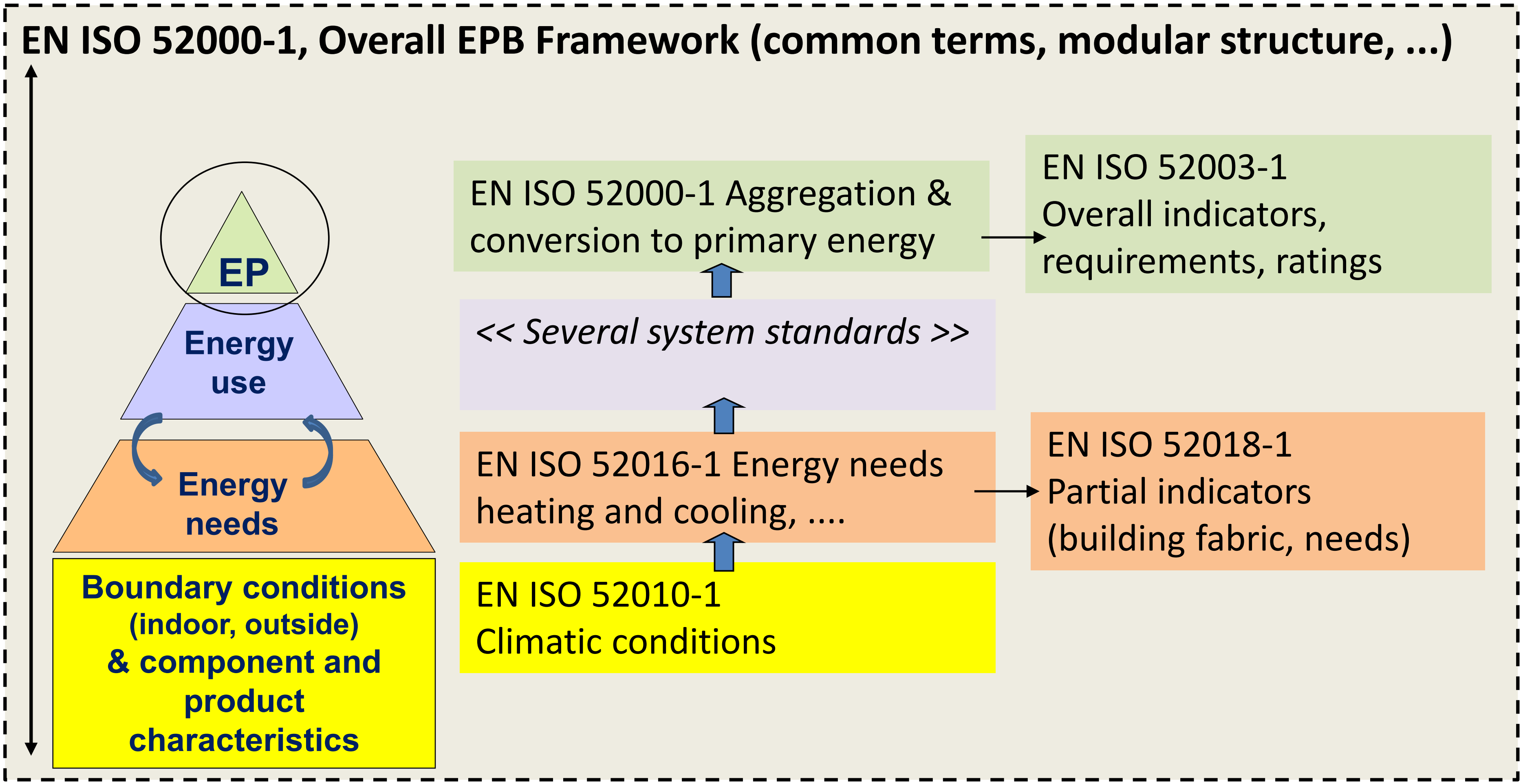
# My background

- EPB Center expert (> 2017)
- Involved in initiation, preparation and coordination of set of EPB standards (2012-2017)
- Co-convenor of ISO Joint Working Group on the overall set of EN ISO EPB standards, in collaboration with CEN

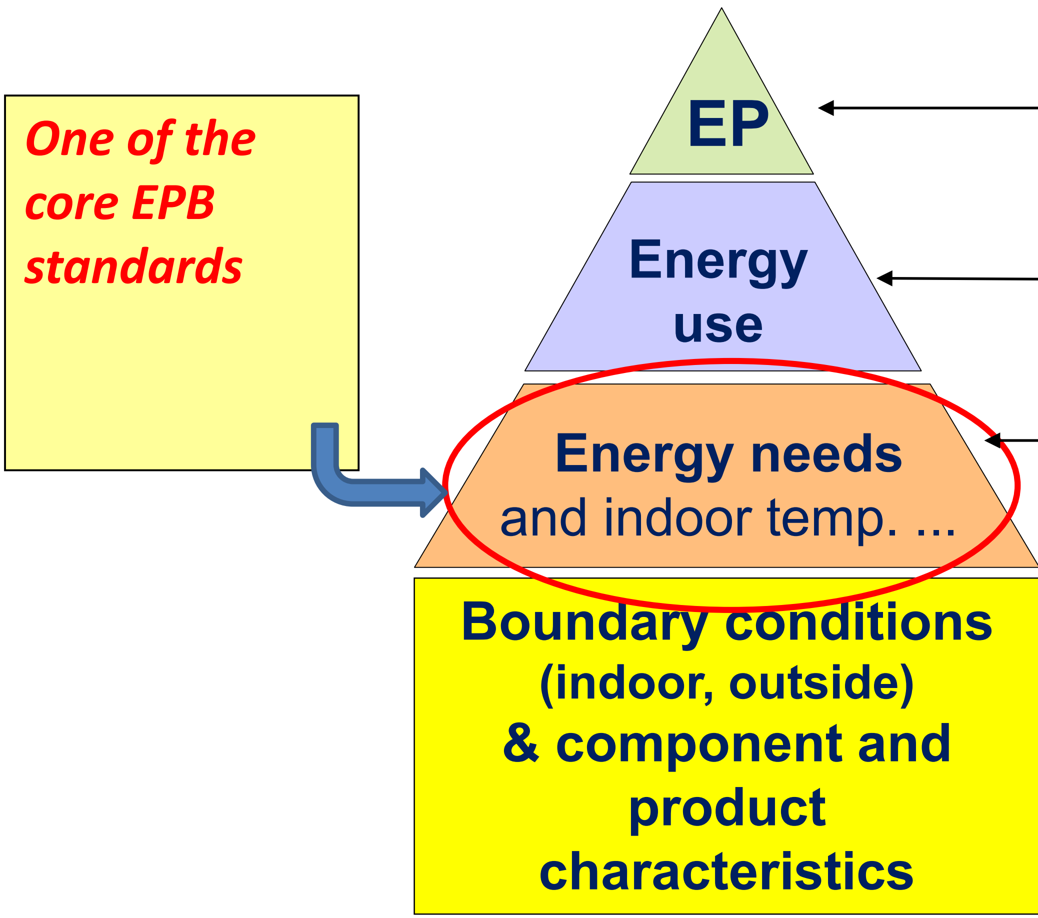
  ISO/TC 163 & ISO/TC 205, CEN/TC 371
- Convenor of ISO Working Group responsible for few key EPB standards:

  Energy needs heating/cooling, Climatic data, Partial EP indicators (ISO/TC 163/SC 2/WG 15)

# Set of (about 50) EPB standards. The core set



# Calculation procedures of energy needs and indoor temperatures




EN ISO 52000-1
Overarching EPB standard

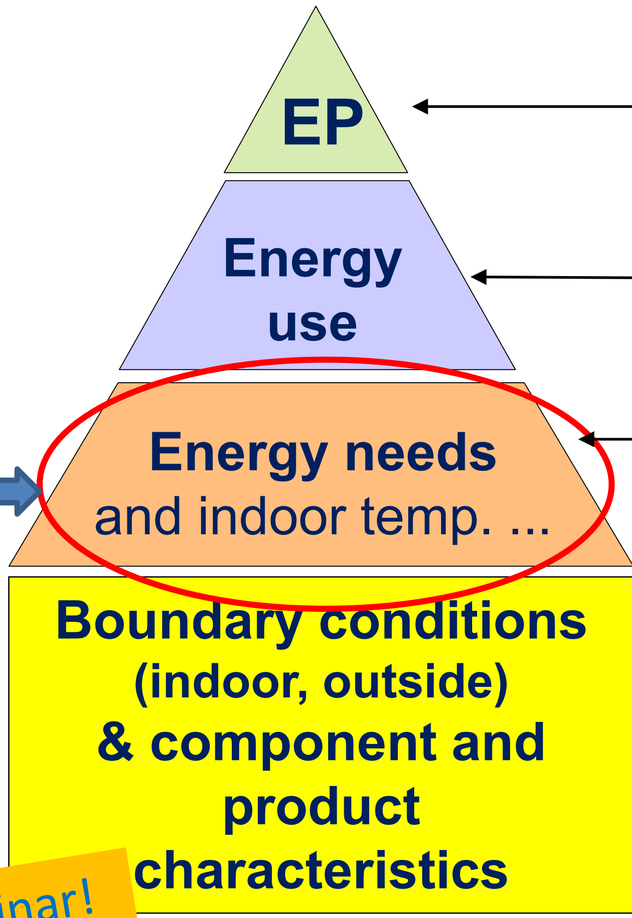
EN xxxx
*Suite of system standards*

**EN ISO 52016-1**
**Calculation of energy needs for heating and cooling, internal temperatures and sensible and latent heat loads**

# Calculation procedures of energy needs and indoor temperatures

***One of the core EPB standards***

***Provides the choice between monthly or hourly calculations***

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See previous webinar!

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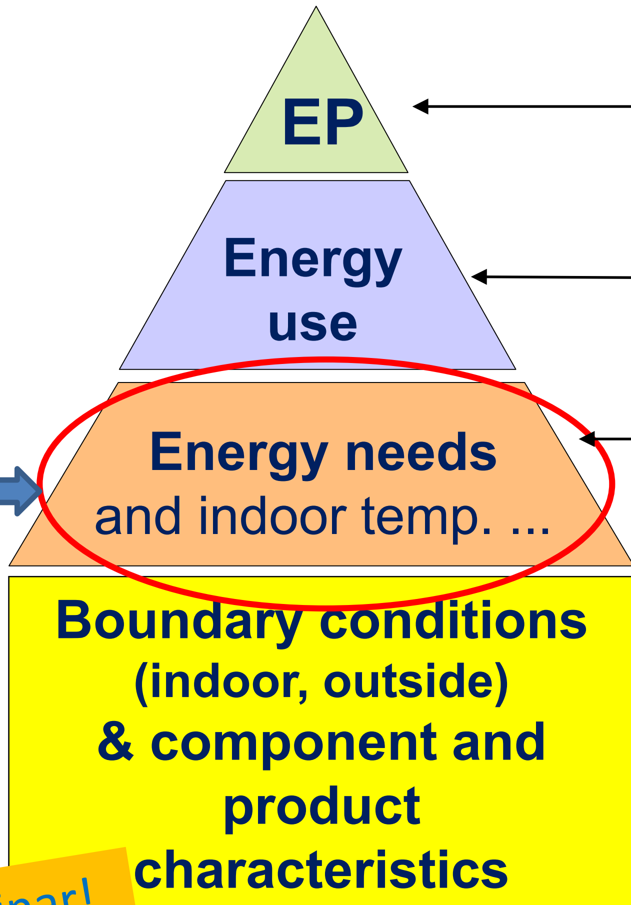


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**EN ISO 52016-1**
**Calculation of energy needs for heating and cooling, internal temperatures and sensible and latent heat loads**

See previous webinar!

Spreadsheet available at EPB Center for hourly and monthly calculation method running in parallel

# Conditions of use: national choice

- To be specified at national or regional level:
  - Occupant schedules
  - Temperature and humidity set points
  - Internal heat and moisture loads
- These can be set for each hour and each day
  - E.g. a standard office schedule
  - E.g. a standard residential building schedule
  - ...

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Default schedules are provided in EN 16798-1

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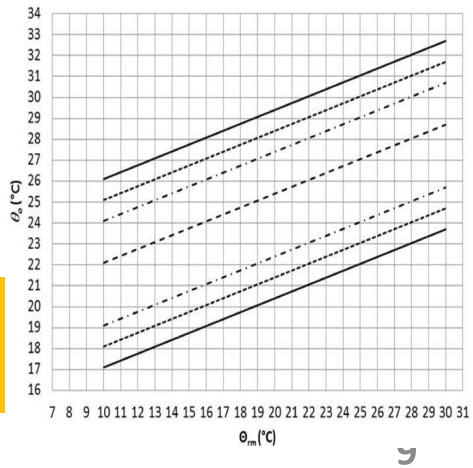
- These can be set for each hour and each day
  - E.g. a standard office schedule
  - E.g. a standard residential building schedule
  - ...

Default schedules are provided in EN 16798-1

- Instead of fixed temperature setpoints: adaptive comfort criteria are also possible

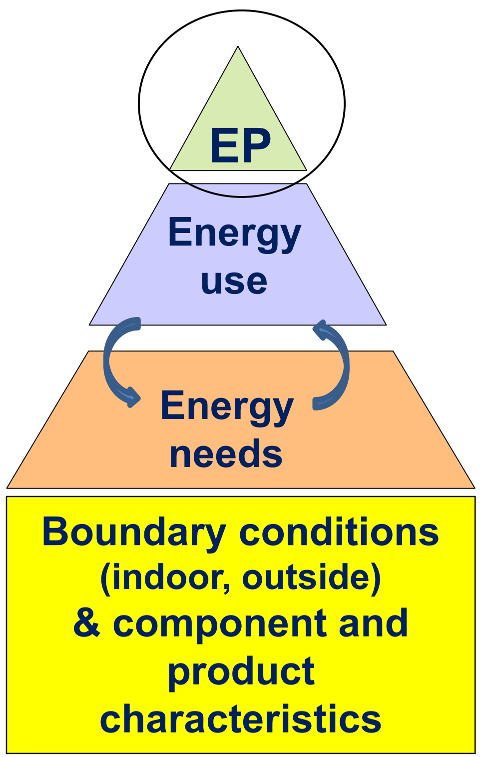
As presented by prof Zweifel, (EN 16798-1)



# Links to thermal comfort

- Hourly calculation method:
  - Produces separate indoor air and indoor mean radiant temperatures ➔ **operative temperature**
  - Produces hourly indoor temperatures ➔ **under- and overheating quantified** *(examples shown further on)*
  - Includes also **latent heat load calculation** (energy needed for [de]humidification)
  - Comprises mode for **design heating or cooling load** calculation (sizing)
  - Can be run in **“system specific” mode** *(-> next slides)*

# EN ISO 52016-1: bridge from energy needs to systems



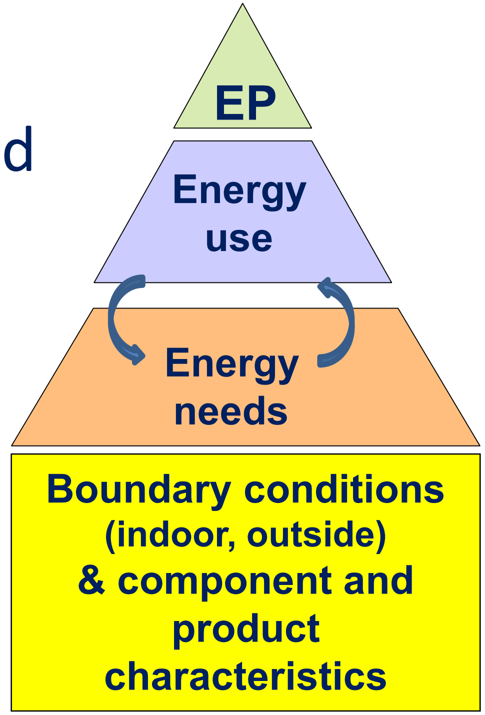

*<< Several system standards >>*

EN ISO 52016-1 Energy needs for heating and cooling, internal temperatures and sensible and latent heat loads

# EN ISO 52016-1: bridge from energy needs to systems

- EN ISO 52016-1 can be run in the so called "**basic energy need mode**"
  - With default system parameters, like infinite system size, ideal control and default recoverable system losses

- EN ISO 52016-1 can also be run in a so called "**system specific mode**"
- = taking into account the impact of e.g.:
  - **undersized** heating or cooling **power**
  - **recoverable** system heat **losses**
  - **Imperfect** system **control**



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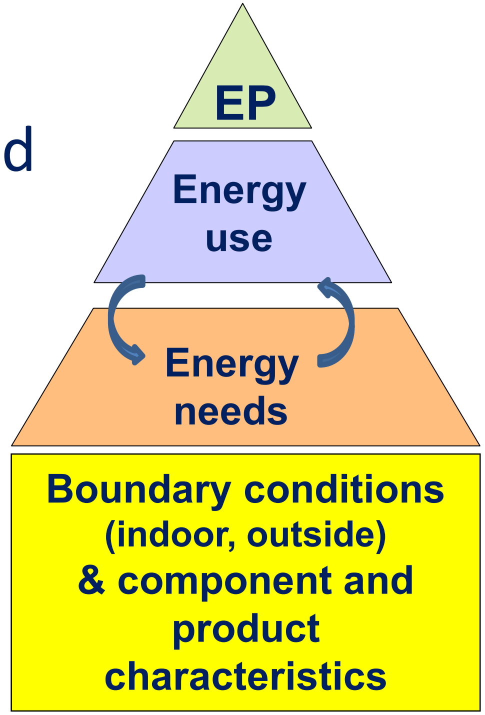
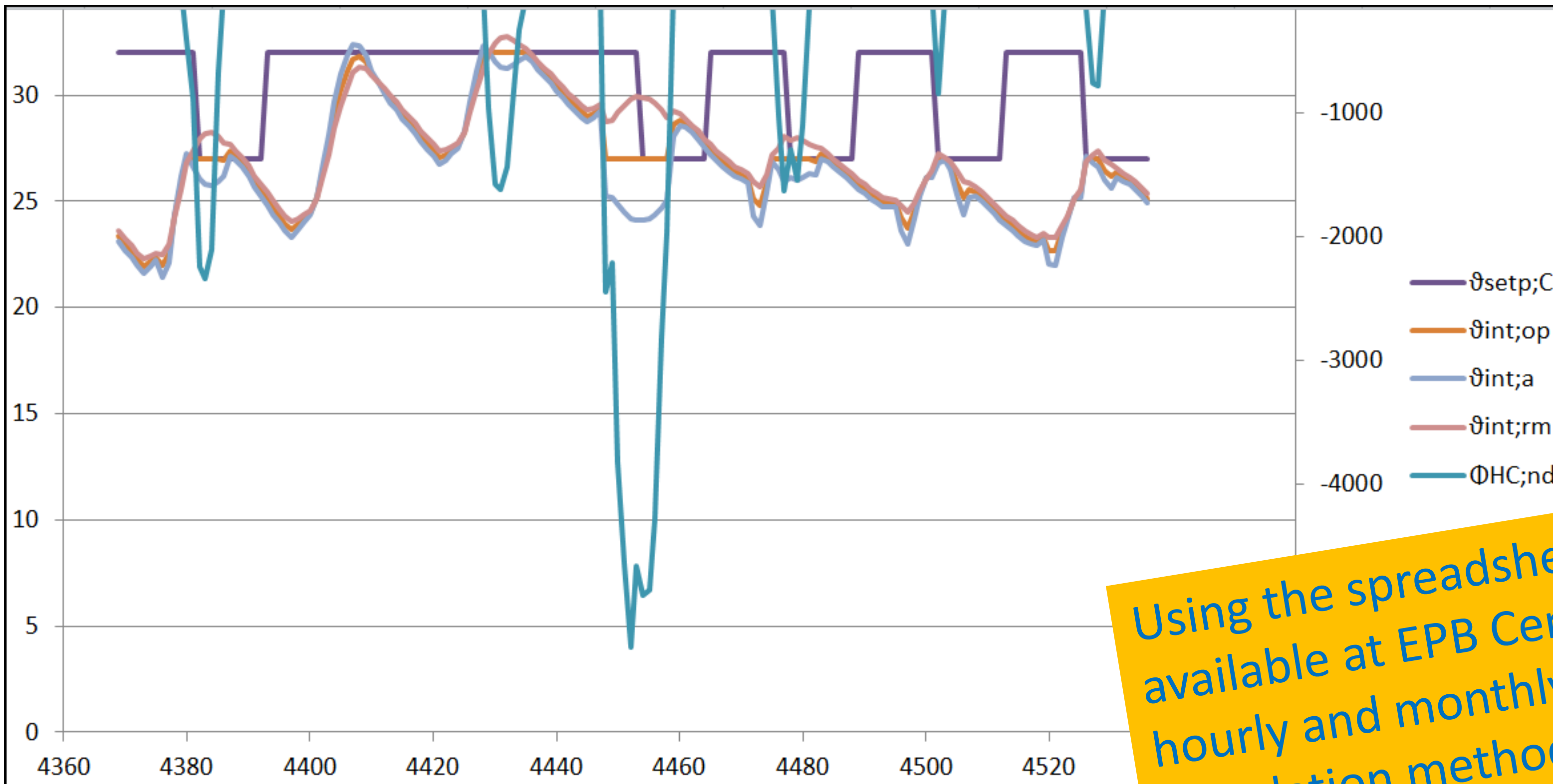


# Examples

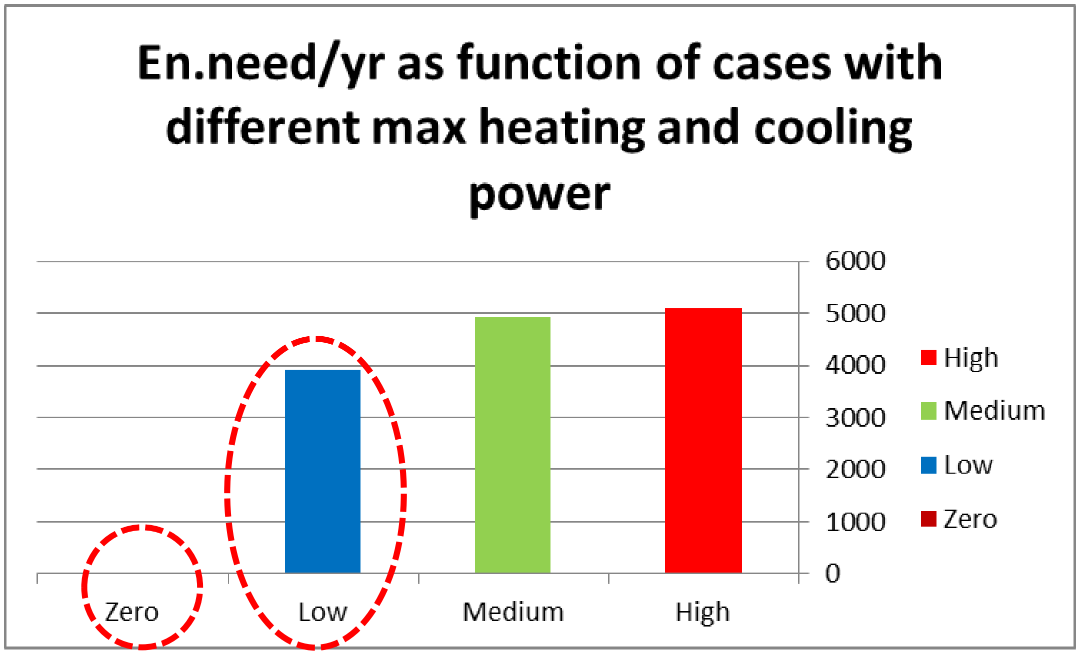
Just an illustration of a typical hourly calculated internal
air and mean radiant and operative temperatures and heating or cooling load




Using the spreadsheet available at EPB Center for hourly and monthly calculation method on EN ISO 52016-1

# Examples

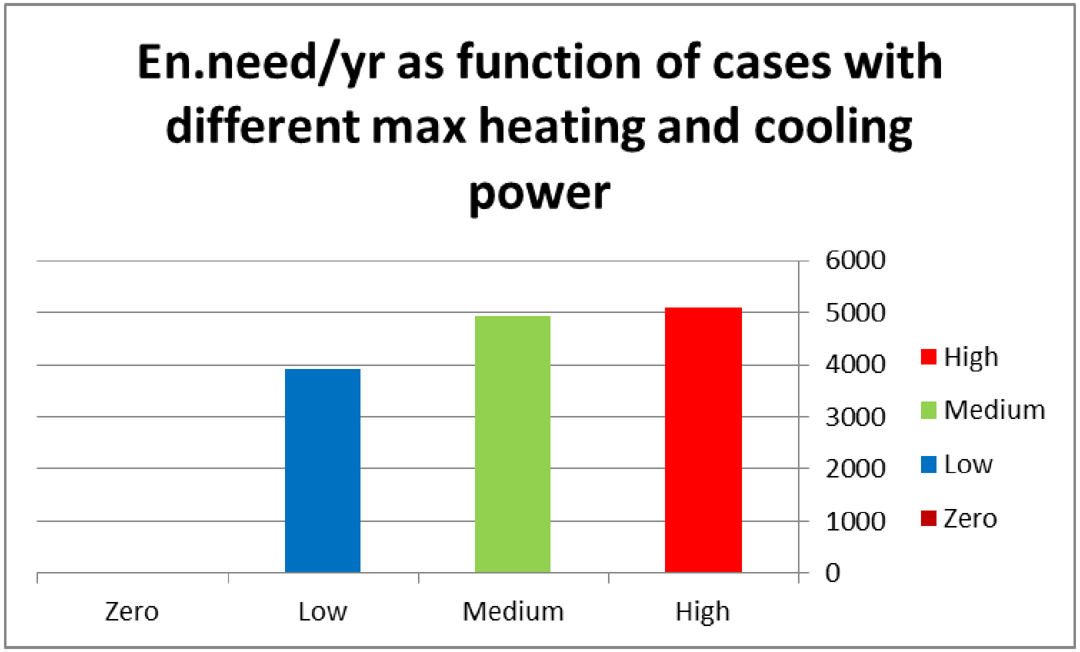
4 cases,
each with different maximum heating and cooling power




If there is *no detection* of or *compensation* for **an undersized system**:
the energy performance of
the case with the **lowest system capacity**
will have **the best energy performance**

# Examples

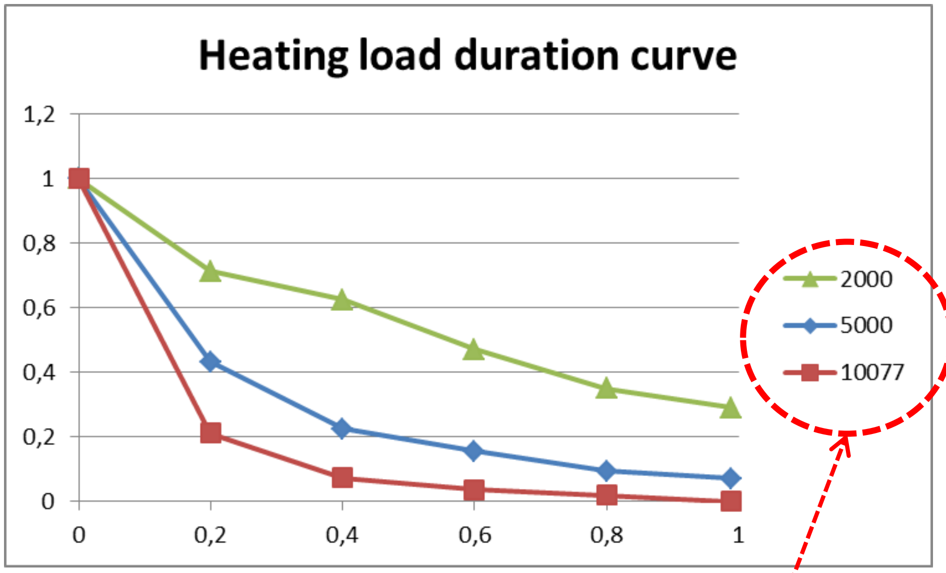
4 cases *(office space, moderate climate)*,
each with different maximum heating and cooling power



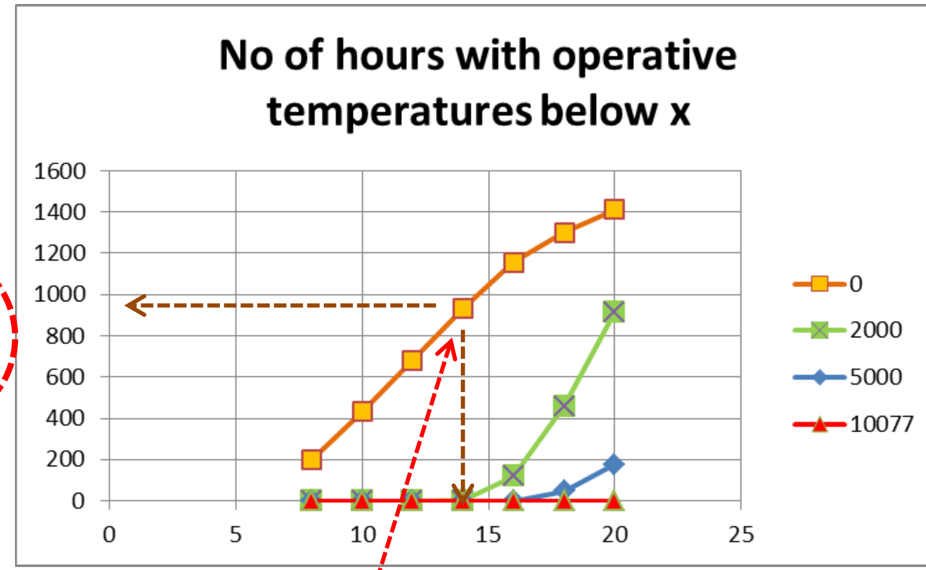

If there is no *detection* of or *compensation* for **an undersized system**:
the energy performance of
the case with the **lowest system capacity**
will have **the best energy performance**

*"The defect becomes an advantage!"*

# The 4 cases, heating part




January

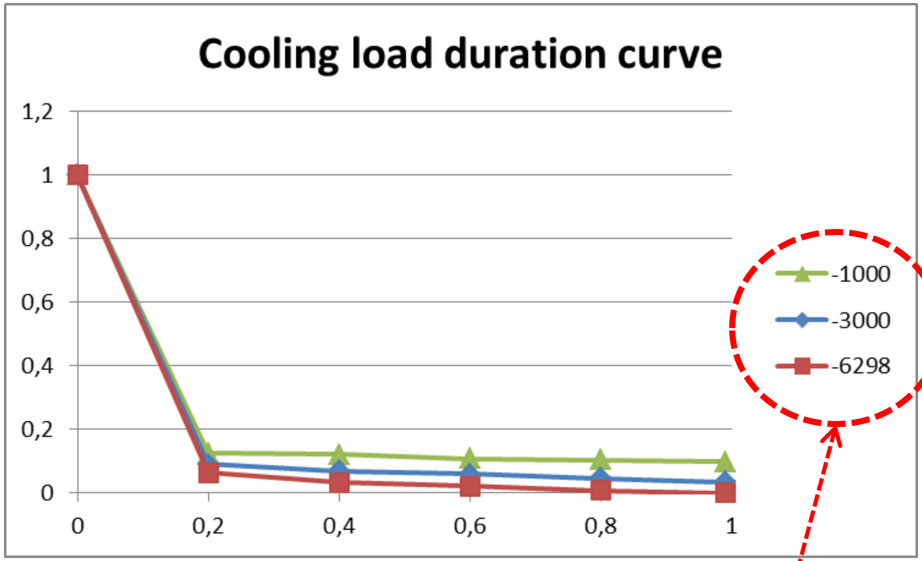



Full year

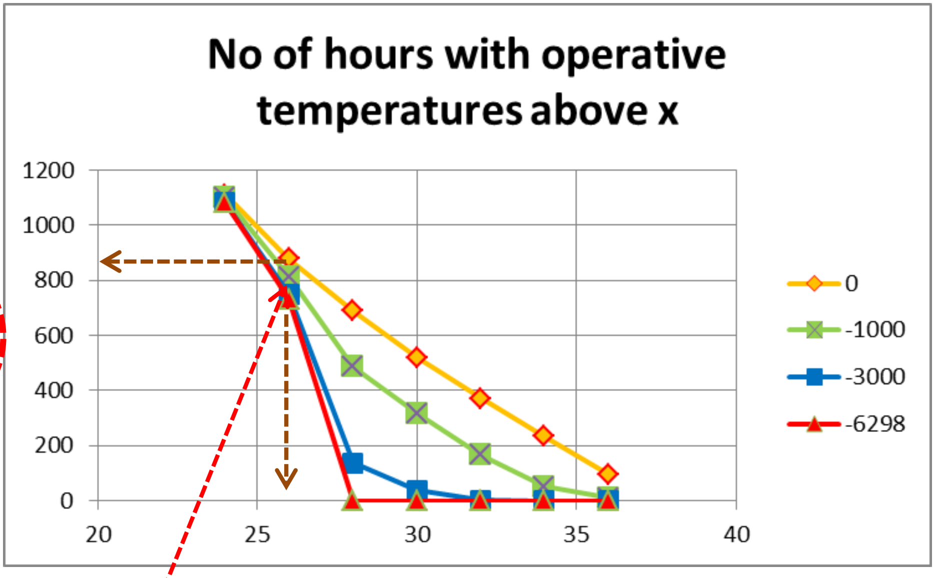
4 cases with different max.heating power

Number of hours per year with operative temperature below 14 °C
*(only hours counted with required high comfort level)*

# The 4 cases, cooling part




January




Full year

4 cases with different max.cooling power

Number of hours per year with operative temperature above 26 °C
*(only hours counted with required high comfort level)*

# Zero system capacity = absence of system

To keep a level playing field between buildings where some or all of the occupied spaces are

- *Not heated or cooled: **low energy use**, bad thermal comfort*
- *Adequately heated and cooled: **higher energy use**, adequate thermal comfort*

Different combinations are possible in the national or regional regulations:

- Often applied principle:
  - A **fictitious system** is assumed, with a conservative efficiency instead of absence of system
  - The energy performance is calculated as if the space is adequately heated and cooled
  - This works e.g. quite well if it may be assumed that in a later use phase of the building an adequate system will be added to such space

# To maintain a level playing field:

Different combinations are possible in the national or regional regulations:

- **Fictitious system** *(as mentioned on previous slide)*
- Fictitious system, but impact **weighted** by the degree of thermal comfort problems
- No fictitious system, but separate **comfort** indicator and/or comfort requirement
- Different **EP requirement** in absence of system

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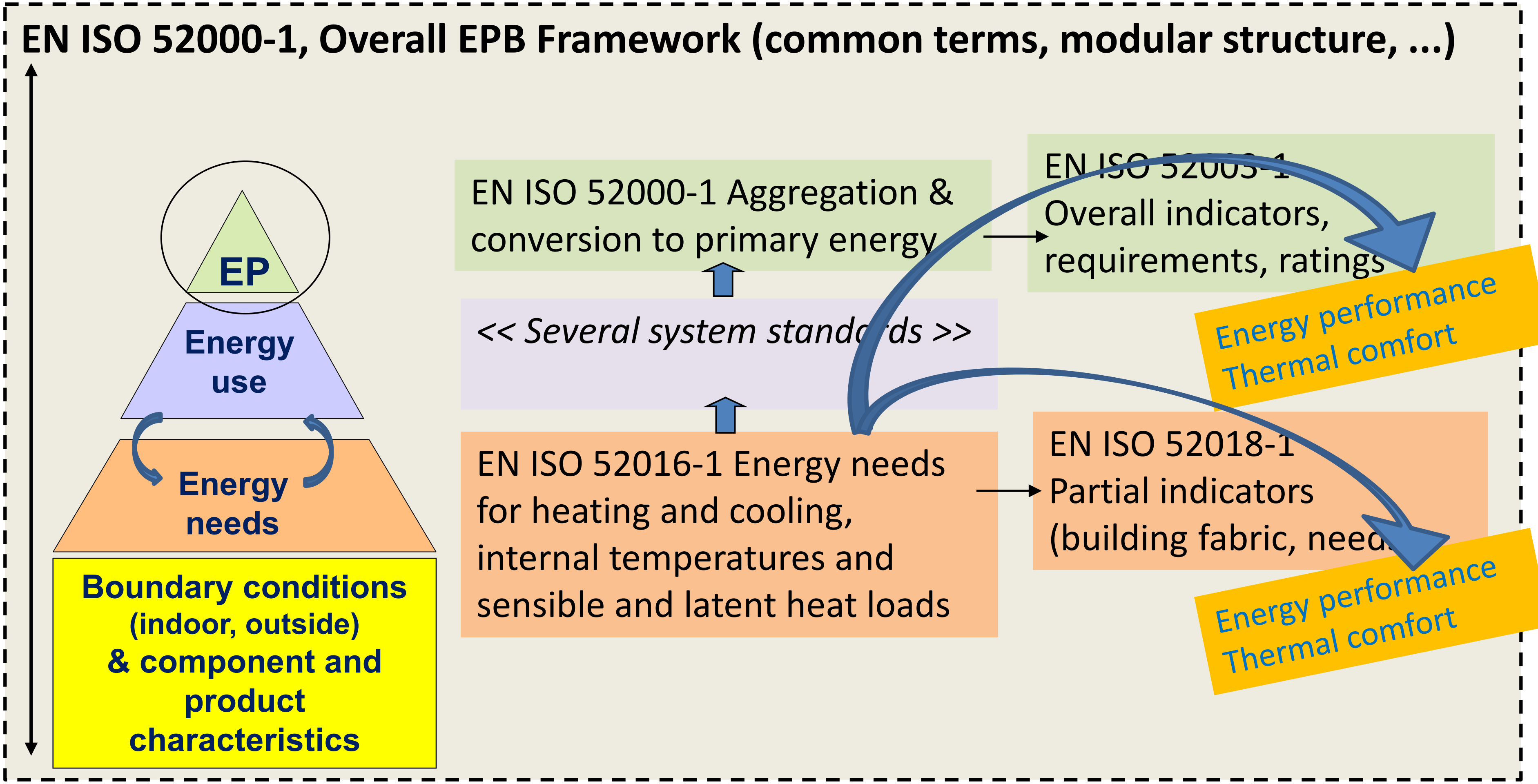
See postprocessing EPB technical report
CEN ISO/TR 52018-2

# Conclusion: important output from EN ISO 52016-1



# Finally: new standard in preparation

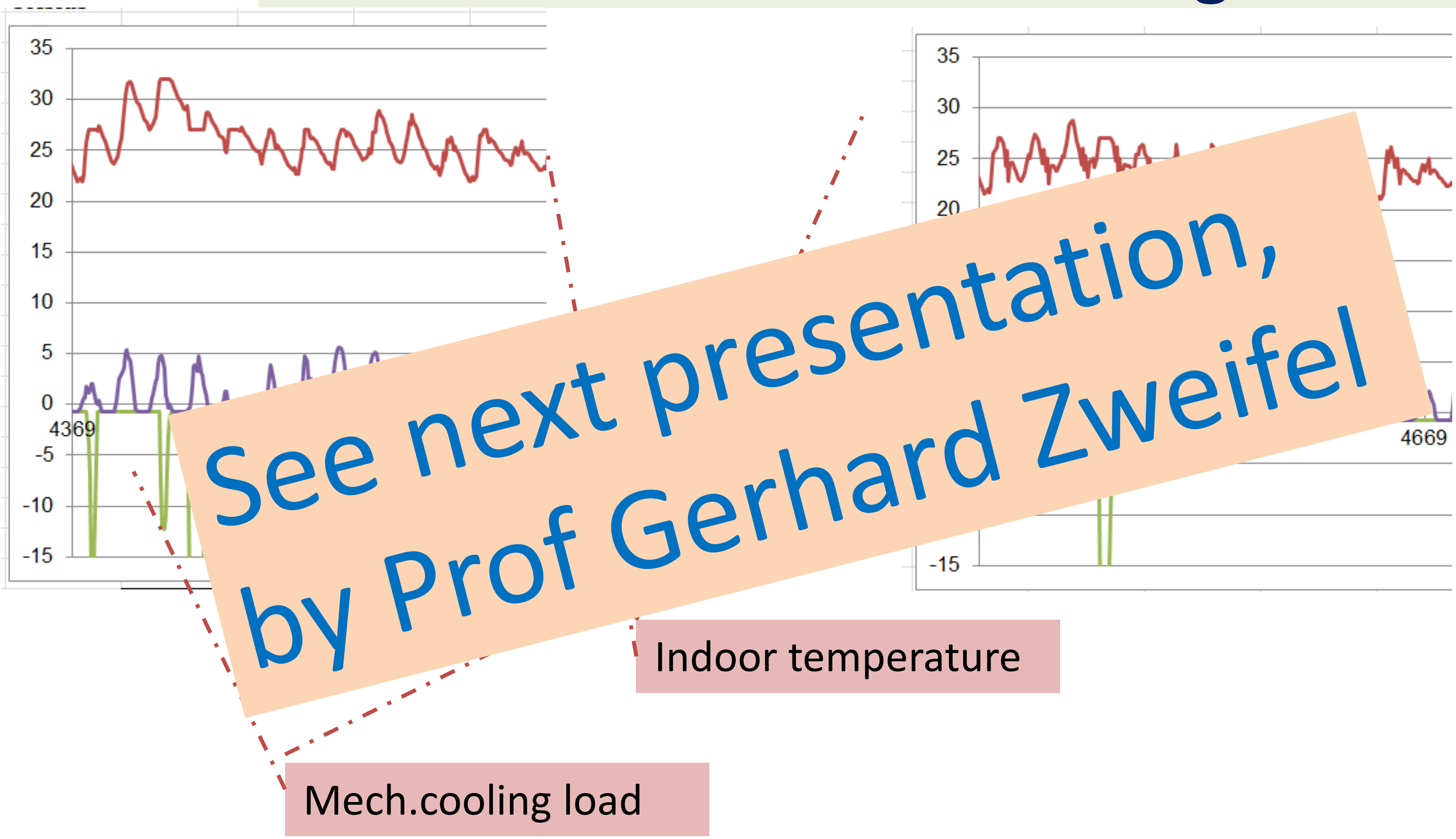
**EN ISO 52016-3**, *Energy performance of buildings -- Energy needs for heating and cooling, internal temperatures and sensible and latent heat loads -- Part 3: Calculation procedures regarding* ***adaptive building envelope elements***

- Under development (2018-2021)
- “Expansion” of EN ISO 52016-1, specifically for adaptive facade elements

Added value:

- Enables to calculate the impact of smart use of adaptive facade elements
- for better thermal comfort
- and lower energy use
- With default control strategies for fair comparison or tailored control strategy for added value

# Also in preparation, linked to ISO 52016-1 and ventilation: ventilative cooling




**With mech.cooling no ventilative cooling**

**With mech.cooling plus ventilative cooling**

# Conclusion

- One of the key EPB standards is (EN) ISO 52016-1 (2017)
  to calculate heating and cooling loads and needs and indoor temperatures
- (EN) ISO 52016-1 contains both a monthly and an hourly calculation method
- The hourly method in ISO 52016-1 applied with the main system properties taken into account:
  - Shows the effect of undersized systems on the indoor temperature
  - And can be used to get a quantitative impression of the resuting discomfort
- To avoid that the defect of an undersized system (or the absence of a system) becomes an advantage in the calculated energy performance different options can be adopted in the regulations
- New standards are under preparation that enable to calculate the impact of more dynamic technologies on energy and comfort

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*Your service center for information and technical support on the new set of EPB standards*

# Ventilative cooling and climate change – current standardization work, complementing the EPB standards


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Start: 21 September 2018 for 3 years


BUILD UP Webinar series

Webinar 5: *EPB standards linked to health and wellbeing*

*16 June 2020*

EPB CENTER

# My background

- Professor emeritus, Lucerne University of Applied Sciences and Arts (HSLU) (≤ 2019)
- EPB Center expert (> 2017)
- Involved in initiation, preparation and coordination of set of EPB standards (2012-2017)
- Convenor of CEN Working Group responsible for system related EPB standards:

  Ventilation/cooling

  CEN/TC 156
- Member of ISO Joint Working Group on the overall set of EN ISO EPB standards, in collabora-tion with CEN, and some related working groups

  ISO/TC 163 & ISO/TC 205, CEN/TC 371, ISO/TC 163/SC 2/WG 15/16

# Ventilative cooling – what is it?

Ventilative cooling = the cooling of buildings or zones in buildings by means of cooler outdoor air brought in on natural, hybrid or mechanical ways

(My words – no official CEN definition)

Hybrid means a partly involvment (timely or locally) of mechanical elements in combination with natural forces

# Ventilative cooling in EPB Standards – current situation

**3 existing documents with relevant information:**

- EN 16798-7: Energy performance of buildings - Part 7: Ventilation for buildings - Modules M5-1, M5-5, M5-6, M5-8 - Calculation methods for the determination of air flow rates in buildings including infiltration
- CEN/TR 16798-8: Accompanying technical report
- CEN/TR 16798-10: Energy performance of buildings - Part 10: Ventilation for buildings - Methods for the calculation of the energy performance of cooling systems - General - Technical report - Interpretation of the requirements in EN 16798-9 - Modules M4-1, M4-4, M4-9

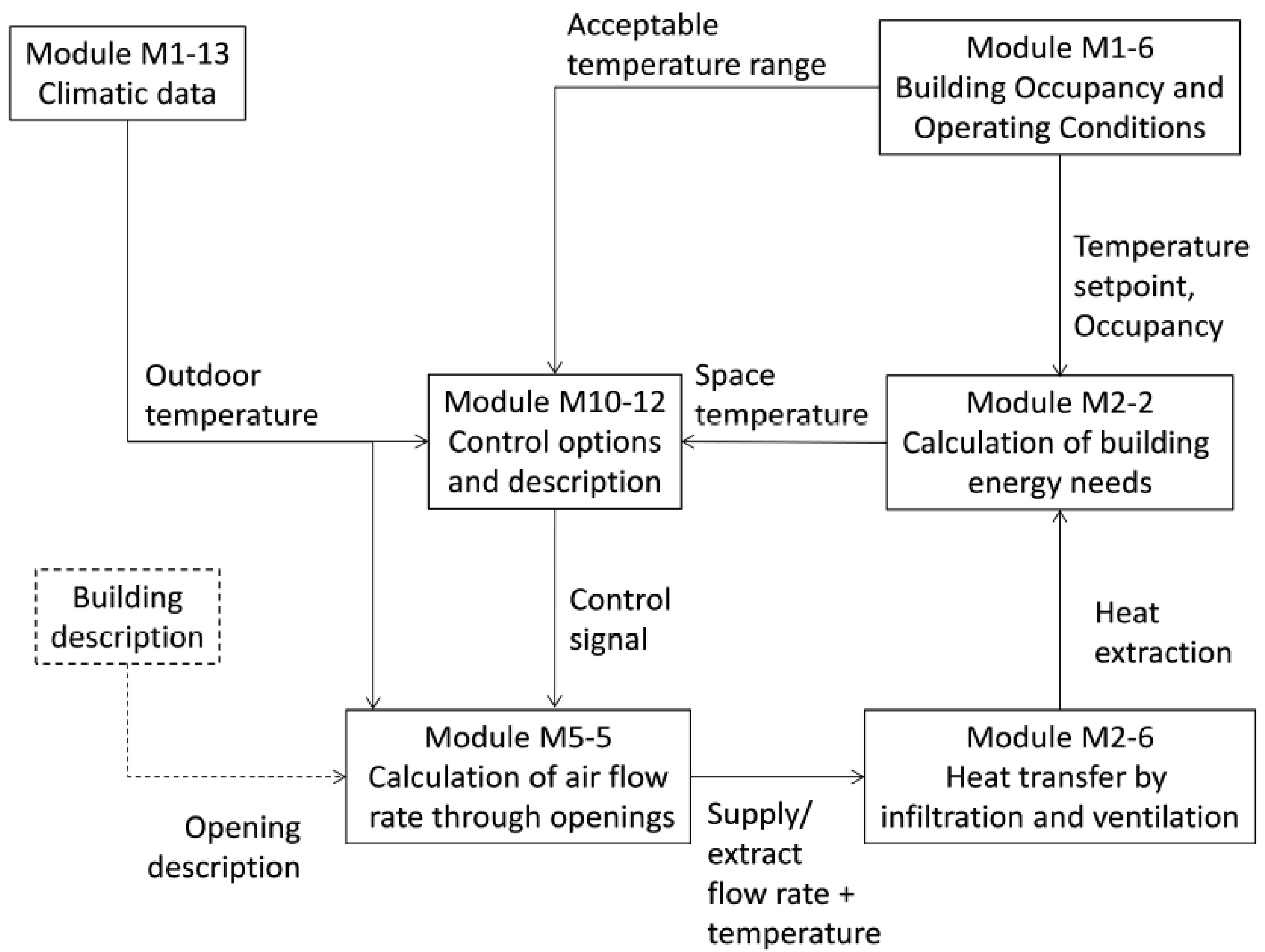
# EN 16798-7 – relevant contents

- Methods for calculation of air flow rates
  - Entering and leaving through open windows also applicable to vents and leakages
  - Passive and hybrid ducts
- Boundary conditions (driving forces):
  - Pressure difference due to temperature difference (stack effect)
  - Wind pressure
- No explicit application to ventilative cooling
  - CEN/TR 16798-8 gives some general hints on the application to ventilative cooling

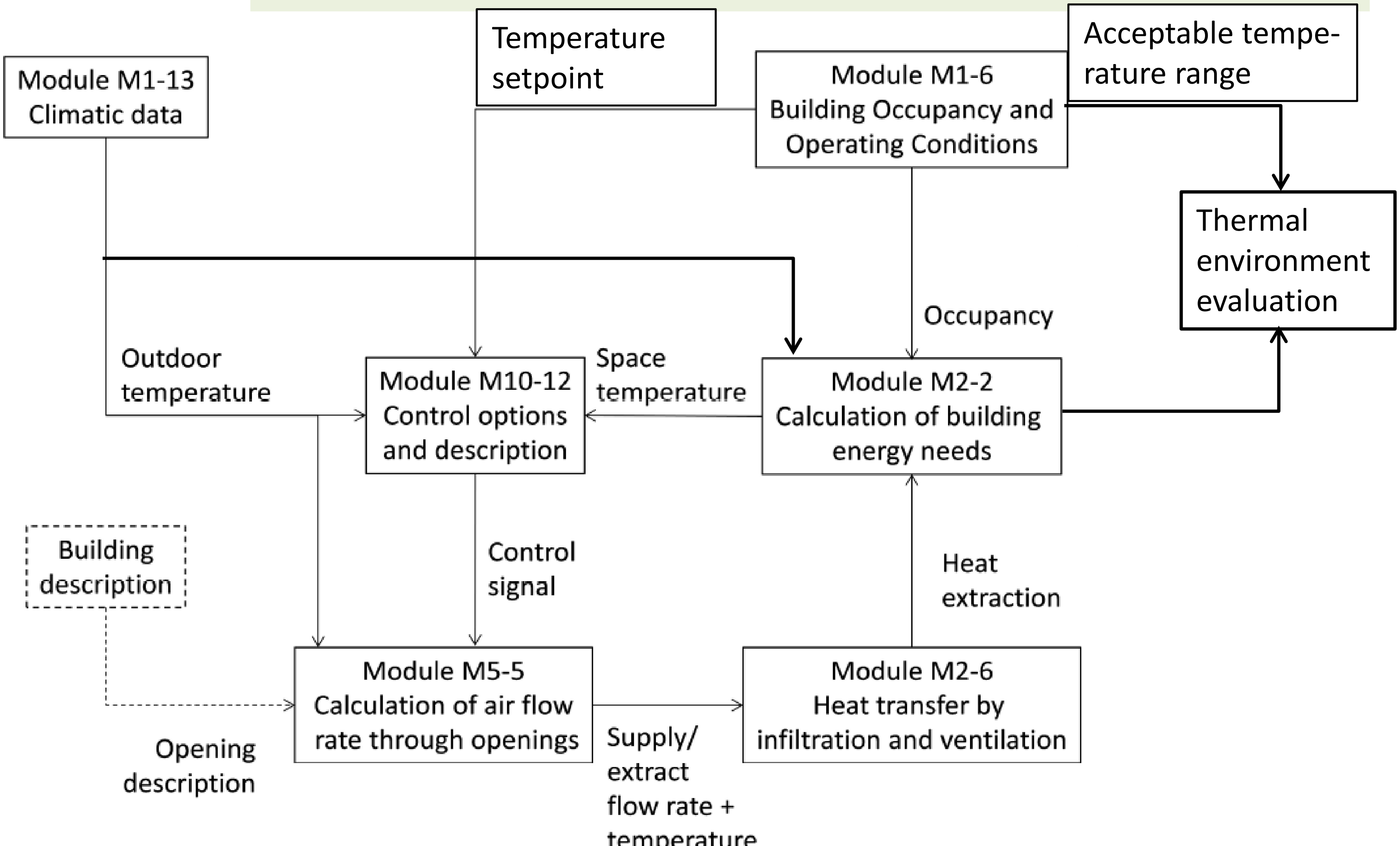
# CEN/TR 16798-10

- In this TR it is shown that the calculation method for ventilative cooling
  - given the modular structure of the CEN EPBD standards, is not possible to be covered in one single standard
  - nor is it a topic to be dealt with in one single Technical Comittee
  - involves the calculation of
    - air flow rates
    - calculation of the cooling need
    - coupled by a control scheme
    - involving further data and element descriptions

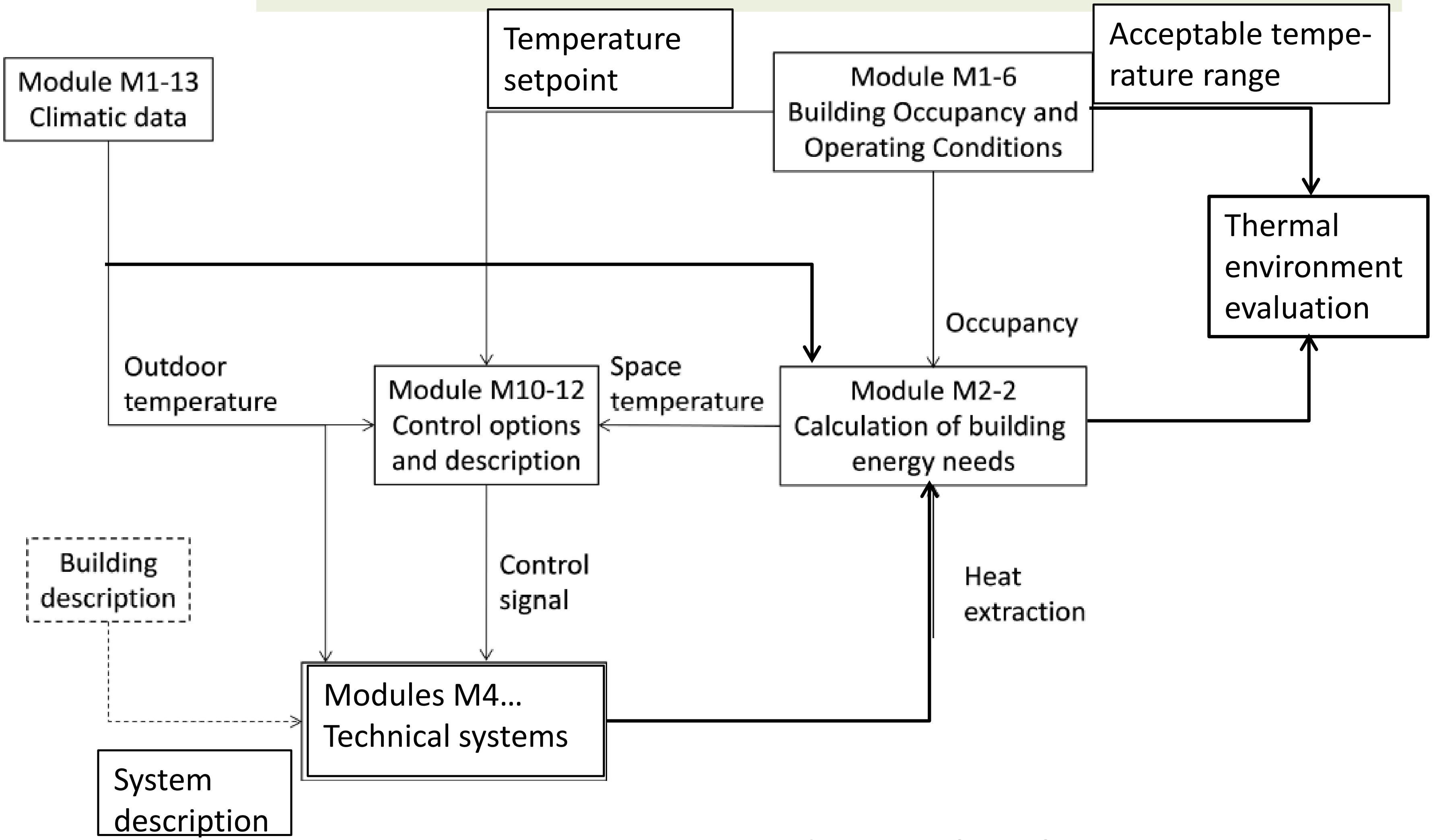
# CEN/TR 16798-10



# CEN/TR 16798-10

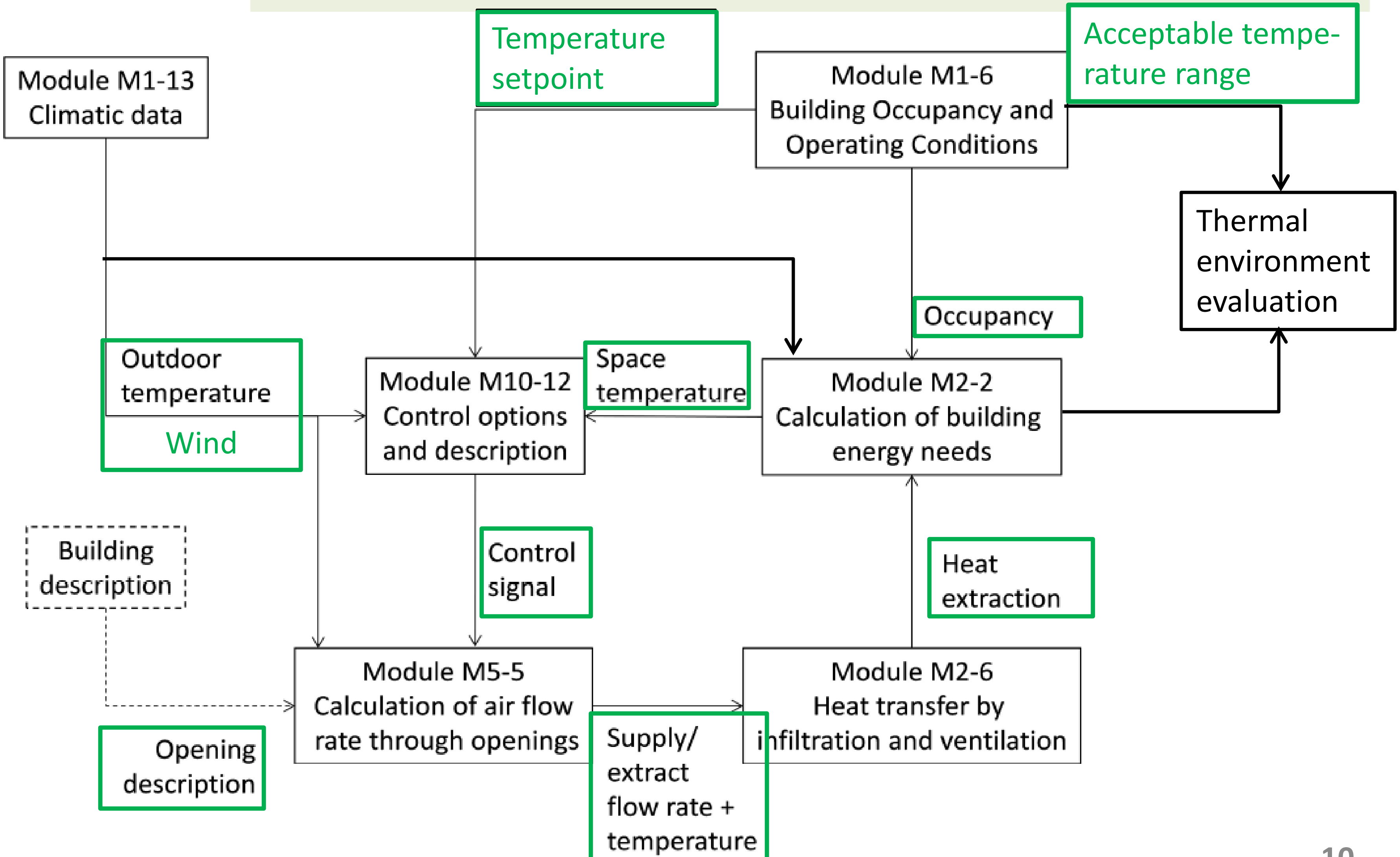


# CEN/TR 16798-10

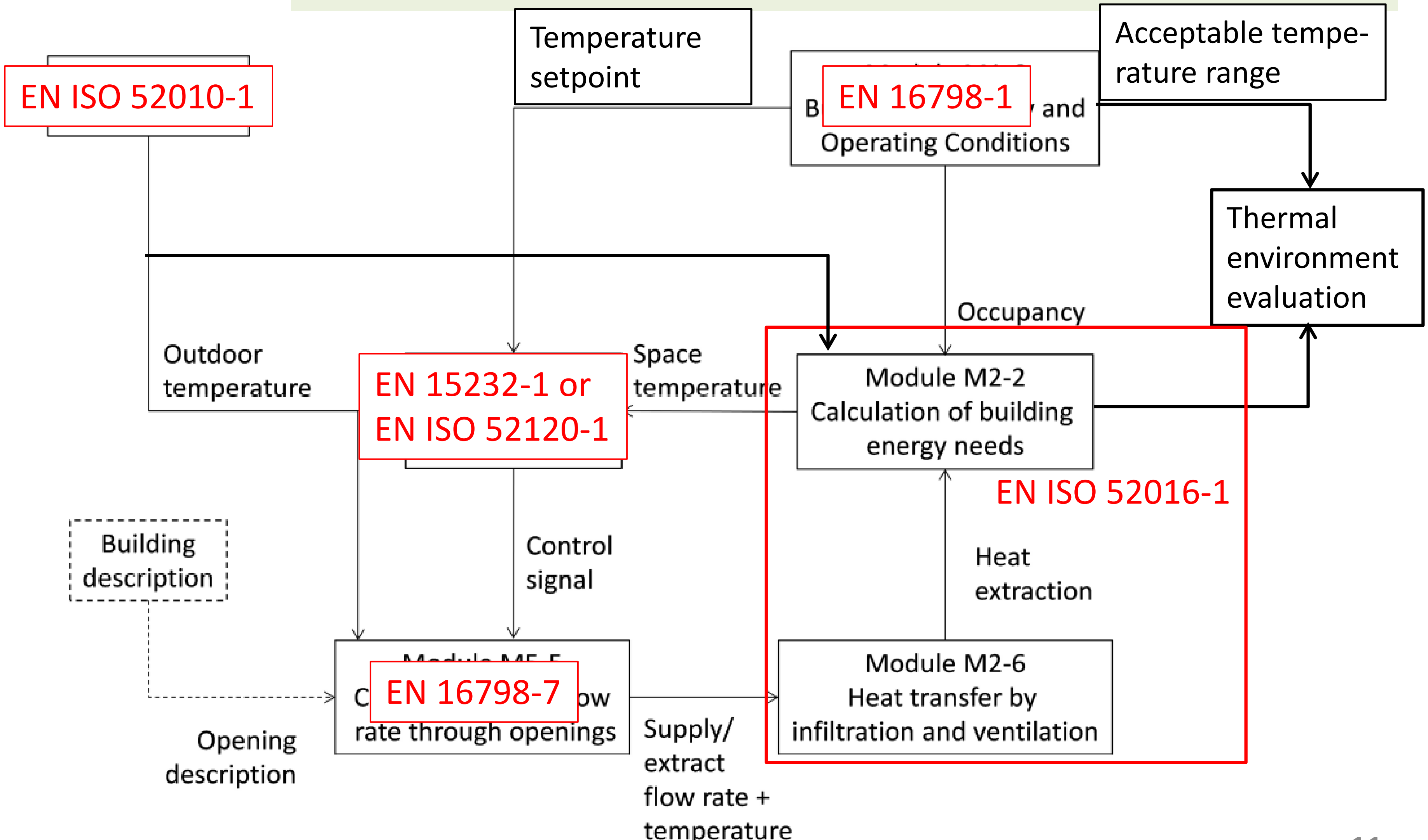



**Ordinary technical system**

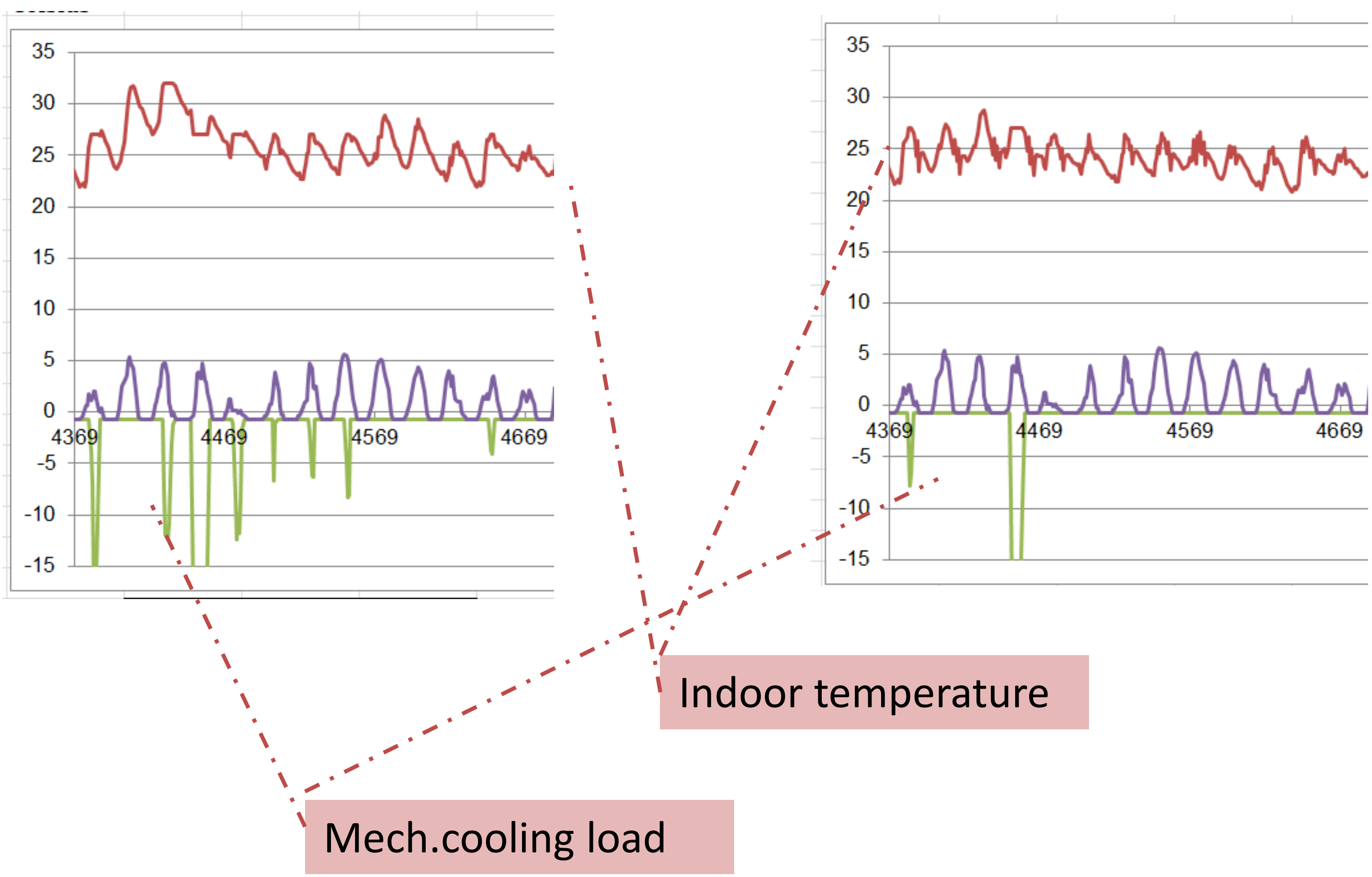
# CEN/TR 16798-10



# CEN/TR 16798-10



# Ventilative cooling




**With mech.cooling**
**no ventilative cooling**

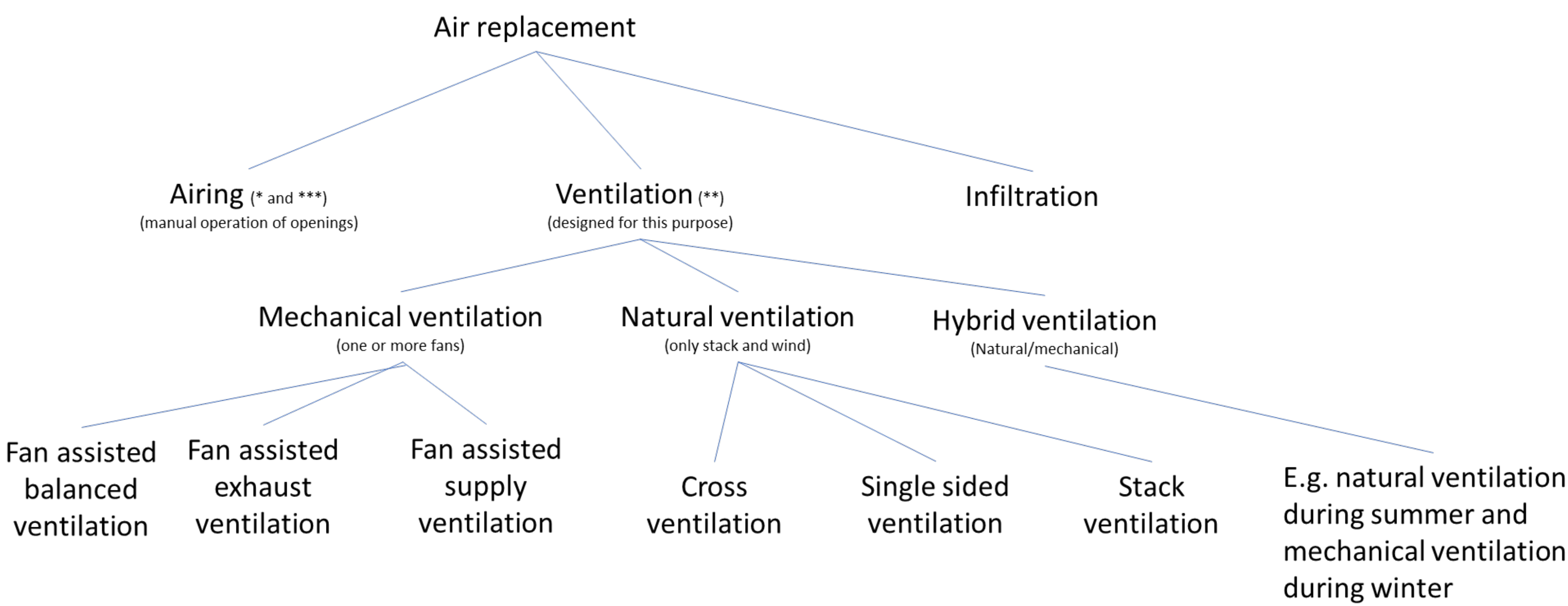
**With mech.cooling plus**
**ventilative cooling**

# CEN/TC 156: new work items

- 2 new preliminary work items
  - Technical Specification (TS): Natural and hybrid ventilation systems in non residential buildings
    - CEN/TC 156 WG 20
  - Technical Specification (TS): Ventilative cooling
    - CEN/TC 156 WG 21
- Work in progress
- No time limit yet (Since PWI)

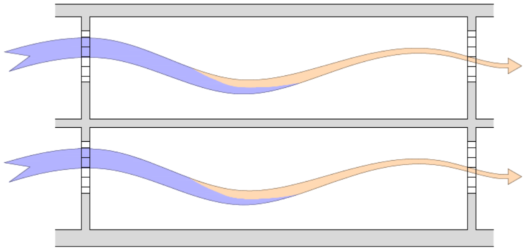
# TS on Natural and hybrid ventilation systems in non residential buildings

## Example of content: Typology of ventilation systems

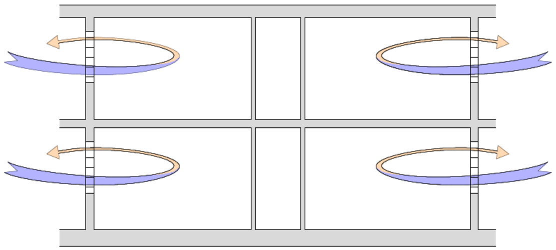


# TS on ventilative cooling

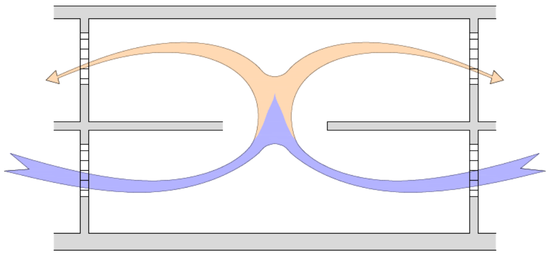
Example of content: Principles of Ventilative cooling



Cross ventilation



Single sided ventilation



Stack ventilation

Mechanical ventilation can be:

- Mechanical exhaust
- Mechanical supply
- Supply and exhaust (by ventilation fan or Air Handing Unit)

# Ventilative cooling - calculation

- For the evaluation of the effect of ventilative cooling -> hourly calculation method indispensable
- Even for possible monthly calculations:
  - Statistical analysis of hourly climatic data necessary
  - Analysis only valid for the selected climate and boundary conditions
  - Extensive tablework -> direct application of hourly calculation is simpler

# Climate change – new development in EPB standards

- EN ISO 15927-X Family:
  - 6 Standards with basics for the generation of different types of climatic data for building energy and load calculation
  - No data but procedures/methods
  - Many countries have generated data on the basis of these standards

# EN ISO 15927-4

- Title: Hygrothermal performance of buildings - Calculation and presentation of climatic data - Part 4: Hourly data for assessing the annual energy use for heating and cooling (ISO 15927-4:2005)
- Statistical procedure to produce a «typical» reference year of hourly data from a series of measured data (min. 10 years)
- Method «Finkelstein Schafer» statistics
  - Key parameters: temperature, solar radiation, humidity; 2nd priority: wind velocity

# EN ISO 15927-4 Development

- Standard currently under revision
  - Started 2020
- Goal: Inclusion of future climate development
  - Initiated and supported by «Adaptation to Climate Change – Coordination Group (ACC-CG)», mandated by EU
- Work started in ISO/TC 163 SC2 WG 16
  - CEN lead not accepted in ISO
  - First vague proposals for methodology
  - Open question: how to generate hourly data sets from Climate scenario models: mostly in daily resolution

# Future climate – influence on calculation methods?

- Climate change will strongly influence the results of building energy (and load and thermal comfort) calculations
- No direct influence on the calculation methods as such
- Example ventilative cooling:
  - No influence on strategies and their calculation
  - But: Will shift the boundaries of effectiveness of measures
  - Both calculation methods and data important

# Thank you!

*EPB Center is also 'available' for specific services requested by individual or clusters of stakeholders*


More information on
the set of EPB standards:

[www.epb.center](http://www.epb.center)

Contact: info@epb.center

Parts of this document have been produced under a contract with the European Union, represented by the European Commission (Service contract ENER/C3/2017-437/SI2-785.185).

# Q&A

Submit your question!