Welcome to BUILD UP

The European Portal for Energy Efficiency in Buildings

WEBINAR
Join Europe’s largest international portal to discuss, contribute and collaborate with other experts in this field.

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Check our Learn section!
• **Webinar 1** – 4th February 2020 (12h00-13h30 CET) – Guidance and examples for the EPB standards’ flexibility

• **Webinar 2** – 19th March 2020 (12h00-13h30 CET) – EPB standards overview: why, how, what!

• **Webinar 3** – 16th April 2020 (12h00-13h30 CET) – 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
Overview of the relations between building & product standards & regulations

Dirk Van Orshoven

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 3: EPB postprocessing
16 April 2020
My background

• Independent energy engineer, with a focus on EPB (and EE & SE, ...)

• Intensely involved in the original development of the Belgian EPB regulations (1998-2012-...)

• Involved in the European EPB projects EnPeR (2001-2003) and ASIEPI (2007-2010), exchanging a lot of national EPB information

• Co-author of EN ISO 52003-1 & -2 and EN ISO 52018-1 & -2
Energy performance of buildings — Indicators, requirements, ratings and certificates —

Part 1: General aspects and application to the overall energy performance

Performance énergétique des bâtiments — Indicateurs, exigences, apprécations et certificats —
Partie 1: Aspects généraux et application à la performance énergétique globale
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Part 2:
Explanation and justification of ISO 52003-1

Performance énergétique des bâtiments — Indicateurs, exigences, classification et certificats —
Partie 2: Explication et justification de l’ISO 52003-1
Position of “postprocessing”

**Overall framework**

- **EN ISO 52000-1**
  - BUILDING FABRIC
  - HEAT GAINS
  - CLIMATIC CONDITIONS
  - INDOOR ENVIRONMENTAL REQUIREMENTS

**Needs**

- ENERGY NEEDS HEATING, COOLING
  - **EN ISO 52016-1**

**Systems**

- HEATING, VENTILATION AND COOLING SYSTEMS

**Aggregation & conversion**

- CONVERSION TO PRIMARY ENERGY
  - **EN ISO 52000-1**

**Regulatory postprocessing**

- **Overall** indicators, EP requirements & ratings
  - **EN ISO 52003-1**
- **Partial** energy performances
  - **EN ISO 52018-1**
IMPORTANT WARNING!

• EN ISO 52003 and EN ISO 52018 make the link between the EPB assessment standards and the EPB regulations (requirements, ratings, etc.).

• All these regulatory matters are the sole responsibility of the public authorities.

• The standards leave the full freedom to the competent public instances to take all these decisions.

• The documents only provide supporting information and insight for the public decisions.

• The documents are of course not exhaustive!
Practical aspects

• The only aspect in the standards that is normative is the FORMAT of the reporting tables. The content is left completely free (open ended, ...).
  – The uniform tables can facilitate comparison of national choices made in different countries.

• These documents try to make implicit, “automatic” actions and choices explicit, so that the processes can occur in a more conscious manner.

• They can also serve as “institutional memory”, notably for novices in the field.
Further practical aspects

- The standards themselves (part 1) are kept succinct, restricted to the essentials. The technical reports (part 2) provide (extensive) additional considerations, illustrations, etc.
- Both parts are therefore best read in parallel, clause by clause.
- Nearly all of the content of these documents can also be relevant to private actors, but the wording in this webinar is rather for public authorities.
Simplified overview

§7. indicators

§9. requirements

§10. rating

other

other:
- recommendations
- etc.

§11. certificate & report

other:
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Overall EP (52003)
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Energy balance & fabric (52018)
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**Notes:**
- EPB: Energy Performance Buildings
- LENI: Lighting Efficiency Index
- Q_{Per}: Energy Performance
- η: Efficiency
- U_{g}: Conductance
- U_{W}: Resistance
- ε: Transmittance
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Thank you!

More information on the set of EPB standards:
www.epb.center
Contact: info@epb.center

EPB Center is also ‘available’ for specific services requested by individual or clusters of stakeholders

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Disclaimer: The information and views set out in this document are those of the author(s) and do not necessarily reflect the official opinion of the European Union. Neither the European Union institutions and bodies nor any person acting on their behalf may be held responsible for the use which may be made of the information contained therein.
Your service center for information and technical support on the new set of EPB standards

The process of setting EPB requirements

Dick van Dijk
dick.vandijk@epb.center

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 3: *EPB postprocessing*
16 April 2020
My background

• One of the experts at EPB Center
• Involved in initiation, preparation and coordination of the set of EPB standards (2012-2017)
• Co-convenor of ISO Joint Working Group of ISO/TC 163 and ISO/TC 205
  – responsible for the overall set of EN ISO EPB standards
  – In collaboration with CEN/TC 371
• Convenor of ISO/TC 163/SC 2 WG 15 that developed a few key EPB standards (EN ISO 52016-1, EN ISO 52010-1, EN ISO 52018-1)
Defining the objectives

Before elaborating the requirements:

• **identify the pursued goals**
  can be combination of several **independent objectives**
  – a healthy and comfortable indoor environment
  – energy efficiency
  – fabric and equipment preservation (*e.g. to avoid degradation due to moisture*)
  – other goals
Motivations for choices

• A great variety of considerations may come into play
• Public authorities have full freedom to take the decisions
• Economic considerations have often proven useful in the decision process
  – maximizing the societal benefits at the lowest overall cost: see next slide
One of the possible goals: comparable econ. strictness

This may lead to “optimal” results because:

• there is a sense of fairness: same economic “effort” for everybody

• it better achieves an overall societal cost optimum

• there is less risk that the political decision making is weakened by the economically unprofitable cases

But economic analyses also have limitations: e.g. no perspective beyond a time horizon of 20-30 years, whereas buildings typically last ...50...100... years
Objectives decided? Next step:

1) Which mix of EPB features and corresponding indicators?
   – for new buildings (or equivalent) and existing buildings/renovations
   – e.g. overall EPB, heating needs, U-value, etc.

2) Which ways to express requirements?
   – constant numeric value, or variable (reference building or formula)

3) Which actual strictness?
   – cost optimal (at which cost?), nzeb, etc.
Objectives decided? Next step:

1) Which mix of EPB features and corresponding indicators?
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2) Which ways to express requirements?
   – constant numeric value, or variable (reference building or formula)

3) Which actual strictness?
   – cost optimal (at which cost?), nzeb, etc.
(1) Requirement mix

• For which features?
  – and then: for which indicator?
• Considerations for new buildings (or equivalent)
  – definitely overall EPB requirements:
    • stimulates all aspects of the design, while leaving maximum freedom of choice
    • *E.g.* primary energy per m² floor area
  – additional partial EPB requirements?
    • as a function of the predefined objectives, e.g.
      – “demand reduction first” (needs)
      – focus on long-lasting components, in particular the fabric, i.e. thermal insulation and air tightness
    • maybe rather a limited number?
      – Otherwise risk of conflicting requirements
      – Partial requirements only as “safety net”? 
(1) Requirement mix new buildings

Examples


• Annexes B (default choices) of
  – EN ISO 52003-1: overall energy performance
  – EN ISO 52018-1: energy balance and fabric features
• Much more complex: restricting boundary conditions and less design freedom

• Consequently:
  – Overall EPB requirements, based on holistic approach, not always evident
  – → Often requirements on component/element level
  – Or requirements on combination of elements: more design freedom, but much more challenging to formulate in a regulation
  – Usually a long list in the regulation, but only a few requirements apply to each individual project
(2) Constant or variable numeric requirement?

- Often: constant values desired comparable technical-economic strictness
  - Depends on indicator, e.g.
    - Thermal transmittance (U-value) of a single component: **constant** requirement values usually OK
    - Mean thermal transmittance of envelope: **variable (tailored)** requirement values needed
  - Similar for overall energy performances or (heating/cooling) needs

*Tailoring numeric requirements to individual buildings is illustrated and further discussed in the next and in the final presentations*
(2) Ratios as indicators

• Ratios can provide insight or greatly ease communication: complex things summarized in simple single & telling number
  – **Variable** value requirements can be expressed as **constant** value if the indicator is a **ratio**
  – Often, a ratio may already be a quality indicator (rating)
  – Focus on differences between energy efficient designs or measures ➔ less distraction by differences between different models (or model vs measurement)

• Challenge: adapting the indicator over time to reflect technical and economic evolutions
(2) Ratios: example

Actual building:

- Small envelope
  - Mean U-value dominated by window

- Large envelope
  - Mean U-value dominated by opaque construction

Ratio: compare $U_{\text{mean}}$ with $U_{\text{mean,ref}}$ of reference building with same envelope dimensions:

$$\frac{U_{\text{mean}}}{U_{\text{mean,ref}}} < \ldots$$

Reference building:

- Small envelope
- Large envelope

⇒ Requirement *tailored & more design freedom*

More details in next presentation!
(3) Actual strictness

• Reflects the societal-political ambition level
• If based on economic considerations: hypothesis about future energy price evolution may have important impact
• Some possible cost scenarios:
  – anticipated private market price;
  – macro-economic energy price scenarios, e.g. incorporating external costs
  – equivalent cost of (the most expensive large scale form of) renewable energy, including extra costs for the grid storage, etc.
    \(\Rightarrow\) allows to achieve overall societal cost-optimal mix of renewable energy and energy efficiency
  – et cetera
Principle: assumed or actual presence of system

- One of (probable) policy objectives: a healthy and comfortable indoor environment
- Example: *compare two identical buildings:*

  - **A**
    - With heating system
    - Comfortable, at cost of energy performance
  - **B**
    - No heating system present
    - Uncomfortable, but good energy performance

- Is building B a more energy efficient building?
- **→** Policy choice: for building A and B:
  - in absence of a heating system: assume a default system
  - Same for cooling, lighting, DHW, ....
  - Same if system present but undersized.....
Your service center for information and technical support on the new set of EPB standards

Tailoring EPB requirements

Dirk Van Orshoven

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 3: EPB postprocessing
16 April 2020
Specific primary energy versus building shape factor

\[ f = \frac{A_{\text{env}}}{A_{\text{use}}} \, [\text{m}^2/\text{m}^2] \]

\[ E_{\text{Ptot}}/A_{\text{use}} \, [\text{kWh/m}^2] \]
Pressure to relax strictness
Pressure to relax strictness

\[ \frac{E_{\text{Tot}}}{A_{\text{use}}} \text{ [kWh/m}^2\text{]} \]

\[ f = \frac{A_{\text{env}}}{A_{\text{use}}} \text{ [m}^2\text{/m}^2\text{]} \]
4 sets of technical measures

$E_{\text{Ptot}}/A_{\text{use}} [\text{kWh/m}^2]$ vs $f = A_{\text{env}}/A_{\text{use}} [\text{m}^2/\text{m}^2]$

- package 1
- package 2
- package 4
- package 6

$90 \text{ kWh/m}^2$
Tailoring practically: 2 approaches

• Notional reference building approach:
  – Requirement = value of +/- same building with set of reference hypotheses
  – See next slide

• Formula approach
  – Requirement = f (several building variables)
  – Mathematical function: simple or complex, linear or not, etc.
EPB assessment method

set of reference hypotheses

development

application

project specific features

full EPB application

rqmt / ref.

EPB assessment method

set of reference hypotheses

development

application

project specific features

application of formula

rqmt / ref.

formula derivation

analytical way

statistical way

formula
IF

= 

THEN

~=
Major project variables for tailoring

- Building category
- Size of the building and its thermal envelope area
- Location
- External environment conditions
- Indoor environment and services:
  - temperature set-point profile for heating
  - temperature set-point profile for cooling
  - ventilation rate
  - illumination level
  - domestic hot water need
  - ...
- Energy carrier
- ...

11
“Mass” calculations

• They can be very useful and provide much insight:
  – To check the EPB assessment methods on a great variety of cases: no anomalies? ...? ➔ method robust?
  – To check the requirements:
    • As illustrated
    • Comparable technical-economic strictness for all?
    • With which set of technical measures can they be satisfied?
    • Check which projects have difficulty: cause? acceptable? ...?
    • All the more important when the requirements get very strict.
  – Performing automated cost optimality calculations (see later slide)
  – ...

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Practical process

- Automated calculations (running the calculation engine in batch mode)
- Substantial initial effort to set it up, but if well done (in a general manner from the beginning), it can serve many purposes, and be well worth the original investment.
- Collecting a REPRESENTATIVE sample of REAL geometries
  - Include “outlying” (but acceptable) cases
  - Doublecheck correctness of the geometric data! (otherwise source of anomalies)
Example of other automated calculation: cost optimality analyses
Thank you!

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

Ratings and certificates

Dick van Dijk
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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 3: EPB postprocessing
16 April 2020
From indicator to rating

Numerical indicator $\equiv$ Energetic quality (overall or partial)

**Examples of indicators:**
- Primary energy ($EP_{prim}$)
- Heating needs ($Q_{H;nd}$)
- $U$-value

A reference is needed:
- What is **good** energetic quality?
- What is **poor** energetic quality?

$\Rightarrow$ benchmarks
Overall energy performance

E.g.: two reference points

- $EP_{req}$
- $EP_{ref1}$
- $EP_{ref2}$
- $EP$
Also for any (partial) energy indicator X

For many indicators there is no requirement (no limit value)

See earlier presentation
Specific reference values

Required level, if any  
Actual level

$X_{\text{ref1}}$  
$X_{\text{ref2}}$

Limit  
$X$

Required level, if any  
Actual level

Limit  
$X$

Looks like a single reference. But...
Expressed as ratio

The same, but expressed as a ratio (normalized)
Overall energy performance rating scales

• Many options possible, e.g.:
  – Two reference values or single reference value
  – Continuous or discrete scale
  – ...

• In the standard: two methods are selected
  (= fully described)  
  (1) was already used in many countries
  (2) further developed version
    (recommended in dedicated European study)
  (1)&(2): each with variations

• But others are also allowed (w.request to describe)

Shown further on...
A specific rating method can still be graphically represented in various ways.

The next slides illustrate the two rating methods in the standard (EN ISO 52003-1) using a specific (recommended) graphical mode.
Method 1

Very energy efficient

- Zero net delivered energy
- may be expanded: A+, A++, A+++  
- min. required EP for new buildings

average EP for building stock

Not energy efficient

Method 1: two ref.points, ± linear scale

Specific variations within this method are allowed
Method 2

Very energy efficient

Zero net delivered energy

may be expanded: A+, A++, A+++ 

Reference

Not energy efficient

Method 2: one ref.point, logarithmic scale

Specific variations within this method are allowed
Method 2

\[ y = \sqrt{2^{(n-n_{ref})}} \]

\[ n_{ref} = 4 \]
Energy performance certificates

Warning:

• EP certificates ≠ EP certification
• EN ISO 52003-1 is **not** about the certification **process** (protocol) but only about the **content** on the EP **certificate**

Typical sections on EP certificate:

• Info on the type of EP assessment and type of building, type of indicator(s), on the protocol
• Report of the actual assessment (input, method, output), energy label, recommendations for improvement measures
Examples of energy label models

• From the technical report (CEN ISO/TR 52003-2)
Energy certificate

Building Energy Performance

Space to make reference to the energy certification procedure used

Very energy efficient

Not energy efficient

As built calculated

130 kWh/m²·a

Space to include additional information on the indicator and building energy use

Administrative information:
address of the building, conditioned area
date of validity
certifier name and signature

Example 1, with one indicator and with classes
<table>
<thead>
<tr>
<th>Energy certificate</th>
<th>Building Energy Performance</th>
<th>Administrative information:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Space to make reference to the energy certification procedure used</td>
<td>As built calculated</td>
<td>address of the building, conditioned area</td>
</tr>
<tr>
<td>Very energy efficient</td>
<td></td>
<td>date of validity</td>
</tr>
<tr>
<td>A</td>
<td>C</td>
<td>certifier name and signature...</td>
</tr>
<tr>
<td>B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D</td>
<td></td>
<td></td>
</tr>
<tr>
<td>E</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F</td>
<td></td>
<td></td>
</tr>
<tr>
<td>G</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not energy efficient</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Space to include additional information on the indicator and building energy use</td>
<td></td>
<td></td>
</tr>
<tr>
<td>As built calculated</td>
<td>In use measured**</td>
<td></td>
</tr>
<tr>
<td>130 kWh/m²·a</td>
<td>130 kWh/m²·a</td>
<td></td>
</tr>
<tr>
<td>150 kWh/m²·a</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Example 1, with one indicator and with classes

Example 2, with two indicators and with classes

*the calculated rating assumes standard conditions. It only counts the energy used for heating, ventilation, cooling, hot water and lighting (add others if applicable)

**the measured rating is under actual conditions. It counts all energy uses.
Example 1, with one indicator and with classes

Example 2, with two indicators and with classes

Example 3, with one indicator and without classes (continuous scale)
Thank you!

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Some highlights of EN ISO 52018

Dirk Van Orshoven

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BUILD UP Webinar series
Webinar 3: EPB postprocessing
16 April 2020
Energy performance of buildings —
Indicators for partial EPB
requirements related to thermal
energy balance and fabric features —
Part 1:
Overview of options

Performance énergétique des bâtiments — Indicateurs pour
des exigences PEB partielles liées aux caractéristiques du bilan
énergétique thermique et du bâti —
Partie 1: Aperçu des options
Energy performance of buildings —
Indicators for partial EPB
requirements related to thermal
energy balance and fabric features —

Part 1:
Overview of options

Performance énergétique des bâtiments — Indicateurs pour
des exigences PEB partielles liées aux caractéristiques du bilan
énergétique thermique et du bâti —
Partie 1: Aperçu des options

Energy performance of buildings —
Indicators for partial EPB
requirements related to thermal
energy balance and fabric features —

Part 2:
Explanation and justification of ISO
52018-1

Performance énergétique des bâtiments — Indicateurs pour
des exigences PEB partielles liées aux caractéristiques du bilan
énergétique thermique et du bâti —
Partie 2: Explication et justification de l’ISO 52018-1
Position of EN ISO 52018

Overall framework EN ISO 52000-1

EN ISO 52018
- BUILDING FABRIC
- HEAT GAINS
- CLIMATIC CONDITIONS
- INDOOR ENVIR REQUIREMENTS

ENERGY NEEDS HEATING, COOLING EN ISO 52016-1

HEATING, VENTILATION AND COOLING SYSTEMS

CONVERSION TO PRIMARY ENGERGY EN ISO 52000-1

Overall indicators, EP requirements & ratings EN ISO 52003-1
Partial energy performances EN ISO 52018-1

Systems

Needs

Aggregation & conversion

Regulatory postprocessing
Reminder: warning

• It is the responsibility of the competent authorities (regulators) to take all of the various decisions related to the public EPB requirements.

• The tables in Annex A are non-restrictive, thus allowing for full regulatory flexibility.

• EN ISO 52018-1 & -2 only provide informative support.
• Both parts are conceived to be read in parallel, clause by clause.

• Part 1: standard
  – Rather brief enumeration, with only the essentials.
  – Standardised table format for reporting of requirement mix (features and indicators)
    • And “default” values (Annex B)
Practical guidance

• Part 2: technical report
  – A more detailed discussion for each feature
  – Different aspects are analysed for each feature, e.g.:
    • possible motivations,
    • possible indicators,
    • comparable economic strictness of the requirements,
    • practical points of attention,
    • testing,
    • new construction and renovation issues,
    • exceptions,
    • other.
## List of treated features

<table>
<thead>
<tr>
<th>Clause</th>
<th>Partial EPB feature</th>
<th>Indoor environment</th>
<th>Energy efficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>summer thermal comfort</td>
<td>X</td>
<td>(X)</td>
</tr>
<tr>
<td>7</td>
<td>winter thermal comfort</td>
<td>X</td>
<td>(X)</td>
</tr>
<tr>
<td>8</td>
<td>energy “need” for heating, or variants</td>
<td>(X)</td>
<td>X</td>
</tr>
<tr>
<td>9</td>
<td>energy “need” for cooling, or variants</td>
<td>(X)</td>
<td>X</td>
</tr>
<tr>
<td>10</td>
<td>combination of “needs”</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>11</td>
<td>overall thermal insulation of the envelope</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>12</td>
<td>thermal insulation of individual envelope elements</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>13</td>
<td>thermal bridges</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>14</td>
<td>window energy rating</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>15</td>
<td>airtightness</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>16</td>
<td>solar control</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>
Point of attention: “Summer-winter” balance

- For “cool” climates for building categories that typically don’t have active cooling.
- A strong focus on reducing heating need (by explicit requirement or as a consequence of the overall EPB requirement), may (inadvertently) engender overheating problems in summer.
- Avoid for instance by:
  - Setting a requirement on an overheating indicator;
  - Setting a requirement on the cooling need (even if no active cooling is installed).
  - Include fictitious cooling in the overall EPB indicator (see later)
- Vice-versa for unheated buildings in warm climates
Specific heating need versus building shape factor

\[ \frac{Q_{H,nd}}{A_{use}} [\text{kWh/m}^2] = f = \frac{A_{env}}{A_{use}} \left[ \text{m}^2/\text{m}^2 \right] \]
6 sets of technical measures

\[ Q_{H,nd}/A_{use} [\text{kWh/m}^2] \]

\[ f = A_{env}/A_{use} [\text{m}^2/\text{m}^2] \]

- package 1
- package 2
- package 3
- package 4
- package 5
- package 6

45 kWh/m²

cost optimal points
\[ Q_{H,nd} \text{ versus } V/A_{\text{env}} \]
\[ U_{mn,max} = f_{tb} \cdot \left[ U_{op;el} + \left( U_{tp;el} - U_{op;el} \right) \cdot f_{tp/use} \cdot \frac{A_{use}}{A_{env}} \right] \]
Cut-off

\[ A_{\text{use}}/A_{\text{env}} = 1/f \]
Fictitious cooling

• Cooling can be taken into account in the overall energy performance, even if no active cooling is installed

• Challenge: potential misperception: active cooling is needed

• Possible solution: “conventional probability that active cooling will be installed later”
  – See next slide
Overheating indicator

- Overheating indicator
- Threshold
- Maximum
- Forbidden zone
Possible weighting factor for fictitious cooling (1)

- Conventional cooling probability
- Fictitious cooling curve
- Threshold
- Maximum overheating indicator
- Forbidden zone
Possible weighting factor for fictitious cooling (2)

- Conventional cooling probability
- Fictitious cooling curves
- Threshold
- Maximum
- Overheating indicator
- Forbidden zone
Overall scheme

- **Step 1:**
  - for all buildings (whether actively cooled or not), evaluate the risk of overheating
  - maybe impose a requirement

- **Step 2:** cooling probability
  - if installed: p=1
  - else: see previous graph

- **Step 3:** include the weighted cooling consumption in the overall energy performance & identical requirement
  - if cooling installed: with real system efficiency
  - else: with fixed (somewhat) favourable system values
Questions and comments

• Q&A right now.
• At any time in the future, use the contact form on the website.
Thank you!

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Question and Answer session

Please submit your question in the question box.