



Ventilative Cooling:

the holistic approach on buildings and systems developing the EPBD standards under Mandate 480

Jaap Hogeling

Manager international projects and standards
Chair CEN TC 371 Program Committee on EPBD
Fellow ASHRAE and REHVA

j.hogeling@isso.nl

ISSO / KBI ; Kruisplein 25; Rotterdam The Netherlands



International Workshop

Securing the quality of ventilation systems in residential buildings: status and perspectives



Definition of “Ventilative” cooling ?

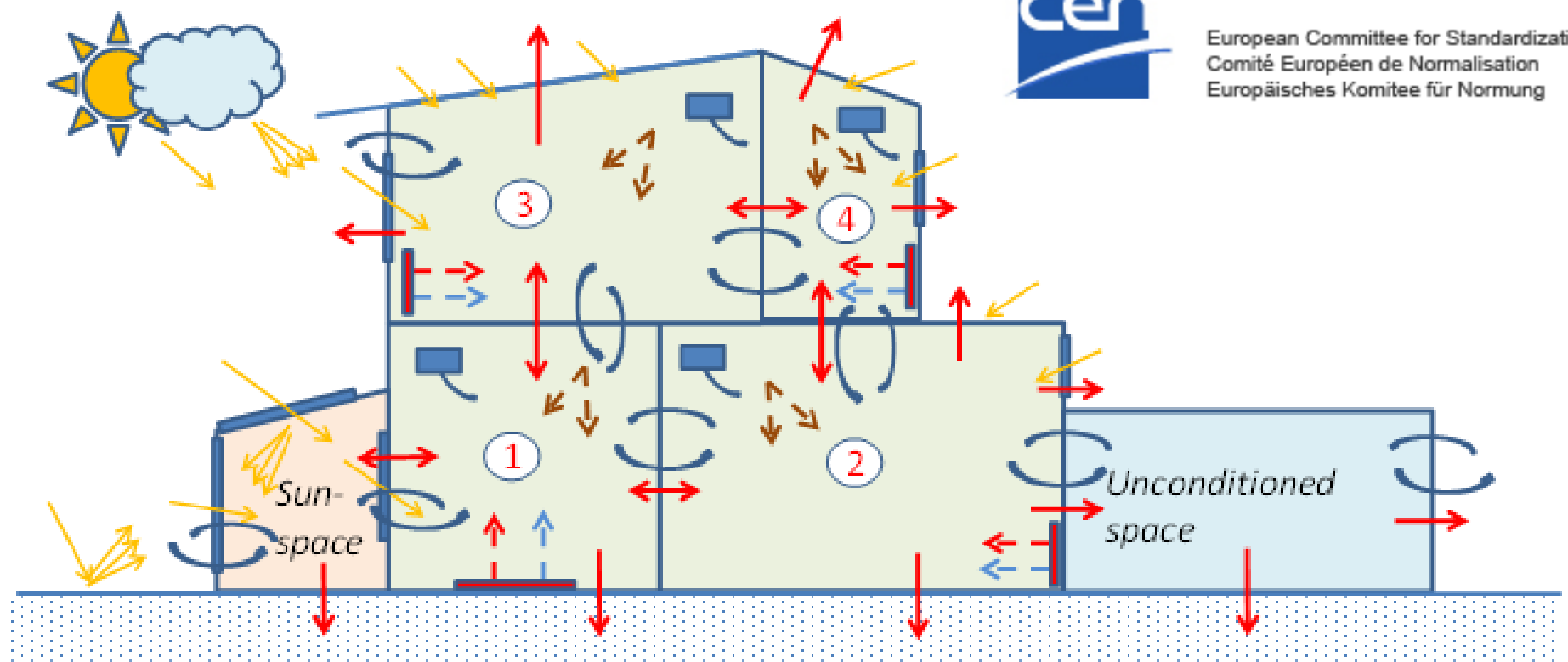
- Passive cooling: definition? *“Natural and free ventilation for passive cooling “: quoted from OA*
- **Ventilative cooling:**
 - Cooling by ventilation air from outside without any mechanical pre-cooling (natural or by a central or local system(allowing filtering and outside noise reduction))
 - Cooling by air entering a room by natural ventilation

Extended Ventilative Cooling definition needed?

- Cooling by ventilation air entering a room by a mechanical ventilation device or system without mechanical-cooling but allowing adiabatic / evaporative cooling (with or without HXS) or other “free” not primary energy using cooling principles (apart from the fan energy)
- Cooling by air entering a room through a non conditioned space (ground HXG, cellar(building mass))?
- etc?

Quotes in the Over-Arching standard

- “Natural and free ventilation for passive cooling “: to be indicated as **Ventilative cooling**
- More focus on “passive” cooling techniques and for the assessment of the energy performance of cooling systems: “passive” means using building mass and additional techniques as referred to as “extended ventilative cooling” ?



- 1 H&C calculation zones
- Heat transmission
- ↻ Air infiltration and ventilation air flows; vent.system
- Solar radiation
- ↻ Internal heat gains and recoverable system losses
- ↻ H & C system emission

Current existing EPBD standards relevant to “ventilative cooling”

EN 13791 Performance requirements for temperature calculation procedure without mechanical cooling (Detailed) and EN 13792 (Simplified)

EN 15255 Sensible room cooling load calculation - General criteria and validation procedures

EN 15265 Calculation of energy needs for space heating and cooling using dynamic methods – General criteria and validation procedures

EN15242 Calculation methods for the determination of air flow rates in buildings including infiltration

EN15241 Calculation methods for energy losses due to ventilation and infiltration

EN 15251 Indoor environmental input parameters for design and assessment of energy performance of buildings addressing indoor air quality, thermal environment, lighting and acoustics

These current standards are already applicable for ventilative cooling

- However this terminology has not been used in these standards
- The next presentations will, as I expect illustrate amongst others the use of these standards.

EN15242 Calculation methods for the determination of air flow rates in buildings including infiltration

- Describes method to calculate the ventilation air flow rates for buildings to be used for applications such as energy calculations, heat and cooling load calculation, summer comfort and indoor air quality evaluation. Applies to mechanically ventilated buildings; passive ducts; hybrid systems switching between mechanical and natural modes; window opening by manual operation for airing or summer comfort issues.

EN15241 Calculation methods for energy losses due to ventilation and infiltration

- Describes method to calculate the energy impact of ventilation systems (including airing) in buildings to be used for applications such as energy calculations, heat and cooling load calculation. Its purpose is to define how to calculate the characteristics (temperature , humidity) of the air entering the building, and the corresponding energy required for its treatment and the auxiliary electrical energy required.

EN15243 Calculation of room temperatures and of load and energy for buildings with room conditioning systems

- Defines procedures to calculate temperatures, sensible loads and energy demands for rooms; latent room cooling and heating load, the building heating, cooling, humidification and dehumidification loads and the system heating, cooling, humidification and dehumidification loads. Gives general hourly calculation method, and simplified methods.

M480: EPBD Recast Revision of EN15241

Calculation methods for energy losses due to ventilation and infiltration

- Consider rearrangement of content versus EN 15242
- Consideration of ISO work
- Add a TR (split normative text and informative explanations)
- Formatting according to new rules
- Provide EXCEL sheet, make the standard “software proof”
- Should include:
 - **Passive cooling**
 - Improved fan energy calculation, taking into consideration control strategies according to TC 247 and fan product standards /data
 - Improved calculation of different types of heat recovery devices (air-to-air HX, rotary and pumped circuit), delivering q_v -dependent efficiency, auxiliary energy depending on control
 - Improved humidification calculation for different humidifier types, including auxiliary energy (see also info in EN 15243)
 - Include the effect of controls and building/system automation



M480: EPBD Recast Revision of EN15242 Calculation methods for the determination of air flow rates in buildings including infiltration

- Consider rearrangement of content EN 15242 versus the EN 15241
- Add a TR (split normative text and informative explanations)
- Consideration of ISO work
- Formatting according to new rules
- Provide EXCEL sheet, to make the standard “software proof” and check the in-/out-put connections with the connected EPBD standards.
- Effect of testing on declared value on airtightness??



M480: EPBD Recast Revision of EN15243 Calculation of room temperatures and of load and energy for buildings with room conditioning systems

- Consider rearrangement of the standard:- splitting in separate parts (design and dimensioning, load calculation, energy calculation, possibly split to emission, distribution, generation...)- Making informative annexes normative text where appropriate. Integrate with the heating part as well.
- Consideration of coordination with ISO
- Add a TR (split normative text and informative explanations)
- Formatting according to new rules
- Provide EXCEL sheet to make the standard “software proof”
- Coordination of content with EN 15241
- Should include:- Calculation of cooling generation, taking into account information from informative annexes, national standards, product standards and data and control
- Include the effect of controls and building/system automation



The revision of these EPBD standards is possible: CEN received Mandate 480



EUROPEAN COMMISSION
DIRECTORATE-GENERAL FOR ENERGY

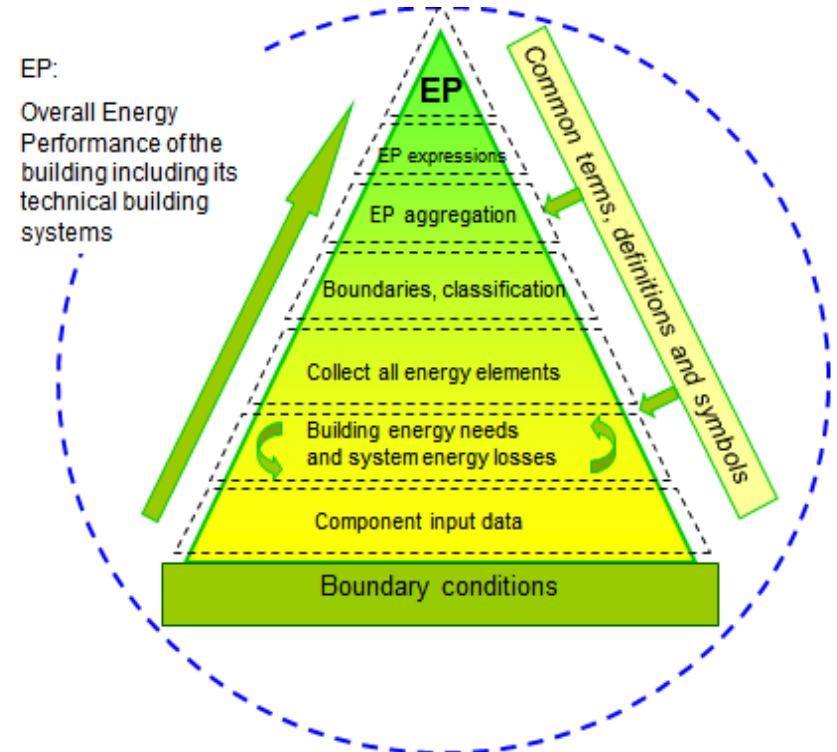
Directorate C - New and renewable sources of energy, Energy efficiency & Innovation
C.3 - Energy efficiency of products & Intelligent Energy – Europe

Brussels, 14th December 2010
M/480 EN

MANDATE TO CEN, CENELEC AND ETSI FOR THE ELABORATION AND ADOPTION OF STANDARDS FOR A METHODOLOGY CALCULATING THE INTEGRATED ENERGY PERFORMANCE OF BUILDINGS AND PROMOTING THE ENERGY EFFICIENCY OF BUILDINGS, IN ACCORDANCE WITH THE TERMS SET IN THE RECAST OF THE DIRECTIVE ON THE ENERGY PERFORMANCE OF BUILDINGS (2010/31/EU)¹

Current set of CEN EPBD (Energy Performance Buildings Directive) standards

- Total 42 standards: 31 EN- and 11 EN-ISO standards published in 2007-2008
- Presented as a “pyramid” structure

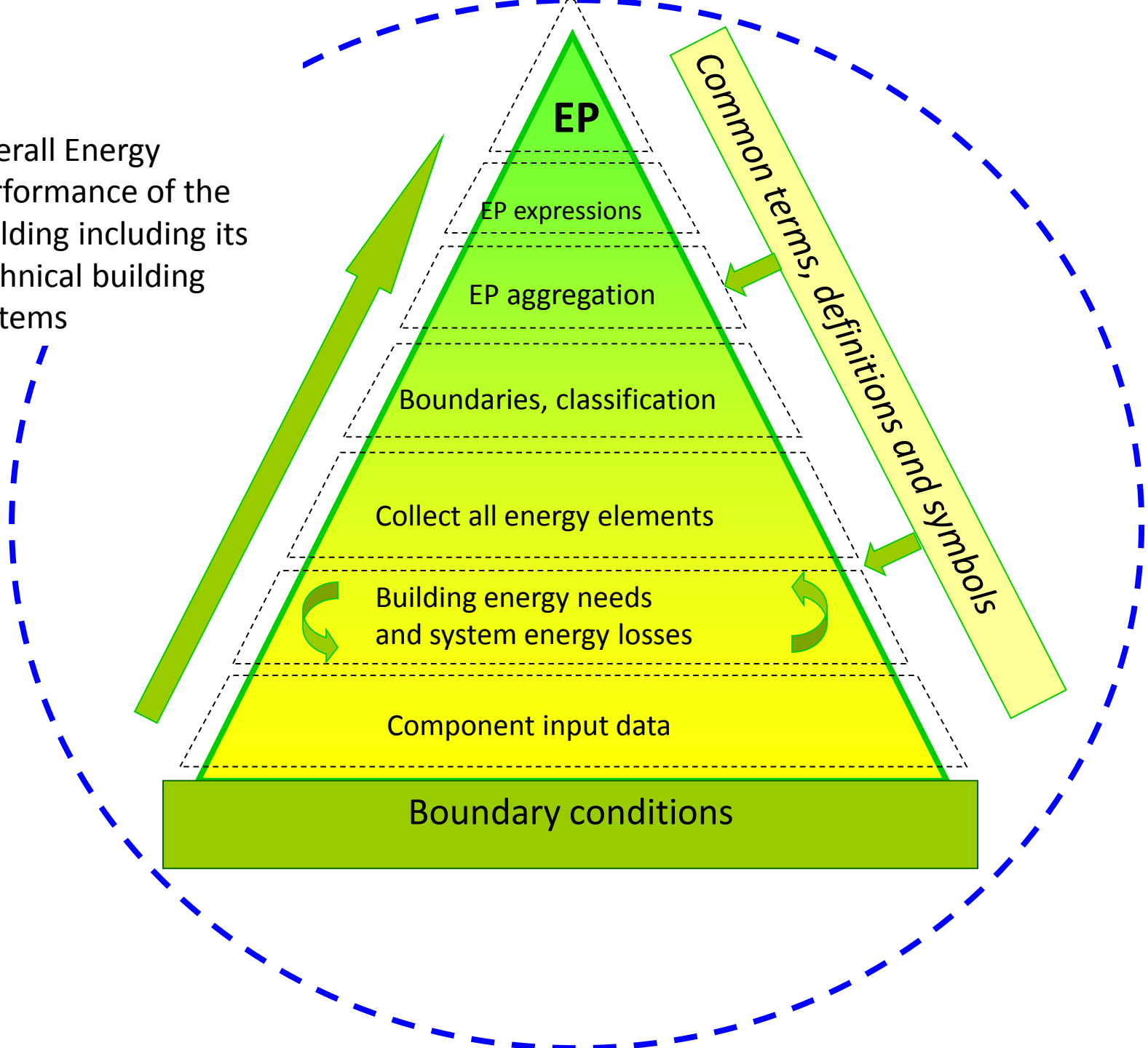


Most are **used** in many EU Member States, as required by national legislation based the EPBD implementation



EP:

Overall Energy
Performance of the
building including its
technical building
systems



Main issues for the further development the current CEN EPBD standards: CEN EPBD standards need to be improved to be more fit for code intended use (more fit for regulators):

Main Issues to be tackled

More consistent and in line with requirements to be specified by the Member States legislators

Best practices

More Focus on retrofit technics seems necessary

Other...

More modular structure and unambiguous

Clear split common method <versus> national choices e.g. : Climate data, primary energy factors, and other legal requirements are typical national/regional issues.

Software proof: all calculation descriptions will at least be checked by available spread sheet calculations

prEN15603 Energy performance of buildings — Overarching standard

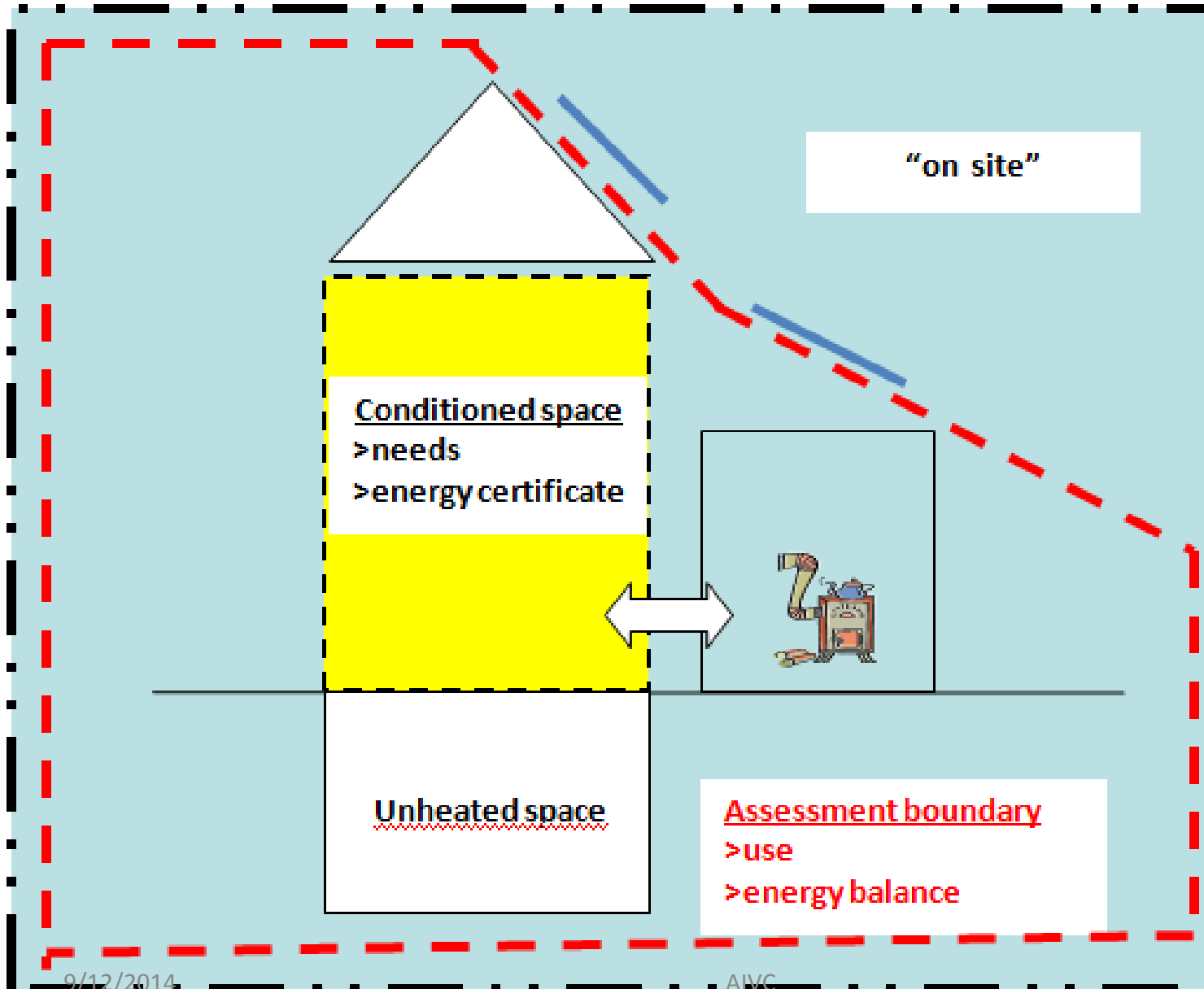
official public enquiry starts March 2013

- Common terms, definitions and symbols;
- Specifies a general framework for the assessment of overall energy use of a building,
- Calculation of energy ratings in terms of primary energy or other energy related metrics.
- The EP assessment is not limited to the building and takes the wider environmental impact of the energy supply chain into account .

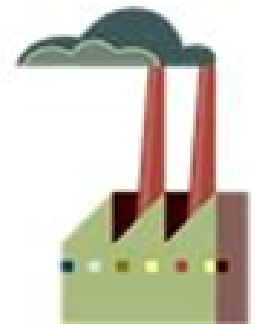
prEN15603 Overarching standard

- Calculated and measured energy rating
 - Procedure, set of equations per energy use,
 - Building energy needs
 - Technical building systems losses
 - Contribution Renewable energy
 - Issues like:
 - Climatic data, indoor environmental requirements
 - Time-steps (monthly, hourly, how to convert?...)
 - Operating conditions

Assessment boundaries



"nearby"



prEN15603 Overarching standard

- Framework of assessment of EP of buildings
- Assessment of Energy Performance:
 - Energy uses
 - Assessment boundaries/ partitioning of building
- Weighted energy ratings
 - Type of weighting , factors, primary energy factor, CO2 rating etc.
- types of factors and coefficients

A complex OA structure is needed Because... this is what we are calculating ...



The OAS provides an Overarching structure as base for:

- procedures for complex buildings
- simplified input procedures for simple small existing building cases
- Procedures for high performance (NZEB) buildings

Small existing building?



***You just calculate it
as one single piece***

***...as you would eat
a small pastry in
one single bite..***

= no partitioning required

Big building, arcade + office + residential?



*... but what if there is a big cake on the table?
You have to eat it slice by slice ...
→ Partitioning required for complex buildings!*



High performance or NZE-Building

The amount of energy involved is so small that any interaction may be relevant.

Example domestic hot water losses and cooling...

Also localization of gains is relevant.

Will Solar gains of the big window in the living facing south effectively heat upstairs north rooms?

Thermal zones or even room by room calculation may be required...

NZEB: Nearly Zero Energy Buildings

- Given EPBD art. 2 and 9 there is a need for definitions
- For CEN: first define and agree on all elements needed to describe NZEB in a transparent and unambiguous way
- CEN published in the prEN15603 the definitions and current CEN-default values for the various elements to be included in the definition of the Energy Performance of a building, needed as basis for a NZEB declaration

The Energy balance Step by Step

- Only if the requirement of each step is reached a building can be qualified as NZEB
- To prevent underperformance on:
 - Indoor environment
 - Thermal building performance
 - Technical system performance
 - and inadequate energy balance procedures

Hurdle 1:
Comfort



Hurdle 2:
Building needs



Hurdle 3:
Technical Systems



Hurdle 4:
Energy balance (PE)



Figure: Hurdle race to NZEB

Art 2, definition 2 EPBD Recast:

- ‘nearly zero-energy building’ means a building that has a very high energy performance, as determined in accordance with Annex I. The nearly zero or very low amount of energy required should be covered to a very significant extent by energy from renewable sources, including energy from renewable sources produced on-site or nearby;

This EPBD NZEB definition:

- distinguishes between energy from renewable sources produced “on site” or “nearby”. The following perimeters are linked to the definition of the assessment boundary:
 - **the conditioned space of the assessed object;**
 - **the building site (“on site”);**
 - **nearby;**
 - **distant.**

This EPBD NZEB definition:

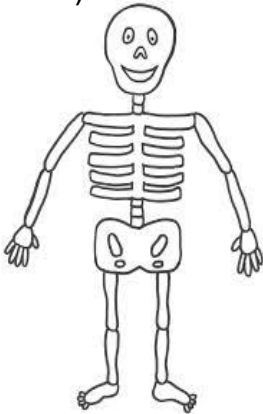
- Localisation of the technical building systems: either “on site” or “nearby” impacts the energy balance.
- Primary energy conversion factors are to be defined for “onsite” and “nearby”.
- More different buildings can be “on site” (e.g. school building, office building located on the same parcel of land).
- Rules in prEN 15603 to take into account the different situations in the energy assessment of each building

CEN structure and options prEN 15603

General CEN Structure

Common structure for defining

- conventions
- boundaries
- performance indicators (EP, RER)



A common **backbone** to

- define (Member States)
- understand (Building professionals) energy performance indicators

Options

(national annexes)

- policy
- Climate
- Building Tradition



Member State 1



Member State 2

Flexibility
> Local differences

What is the best practice?



CEN default option

- ❖ Harmonization
- ❖ Reproducibility
- ❖ Transparency

Accompanying informative Technical Report to the prEN15603

- The complexity of the building energy performance calculation requires guidance and good documentation and justification of the procedures.
- Informative text is required but it is separated from actual procedures in the OAS to avoid confusion and a unpractical heavy standard . (This is the case for all standards in the EPB set)
- Parallel to the prEN15603 an accompanying Technical Report is prepared: first draft available March-2013
- The current TR is a mixture of a guidance and reference document.

Scope TR

- Information to support the correct understanding, use and implementation of prEN15603:
 - Explanation on the procedures and background information and justification of the choices
 - Reporting on validation of calculation procedures given in the standard.
 - Explanation for the user and for national standards writers involved with implementation of the set of EPB standards, including detailed examples.
- Proposals for specific revisions or additions of the procedures given in **current prEN 15603. When commenting during Public Enquiry of the prEN 15603, these proposals should be taken into account.**

CEN TS :*EPB - Basic Principles*

for the developers of the set of EPB standards

- TS with basic principles that will provide guidance on the required quality, accuracy, usability and consistency of each standard and the rationalisation of different options given in the standards;
- providing a balance between the accuracy and level of detail, on one hand, and the simplicity and availability of input data, on the other. Based on the evaluation of assessed requirements for application.
- The TS **basic principles** is the basis for the TS **detailed technical rules** and the prEN15603 the **over-arching standard**

CEN TS: EPB *Detailed Technical Rules for the developers of the set of EPB standards*

- The Technical Specification with detailed technical rules, based on the basic principles, that will provide guidance for the over-arching standard (phase 1) and for each of the set of EPB standards under phase 2
- This TS contains detailed rules to be followed developing or reediting EPB standards.

Status and availability of the four publications:

- The prEN15603 will be officially released by CEN during March 2013.
- The two TS's and the prEN15603 are **for this moment (today)** not yet officially published by CEN, but distributed as CENTC371-committee documents and placed on Glass Cubes by CA3 on request of the LC, the TR will follow next week (the TR is needed to comment the prEN15603)

Phase 2 of M480 project

- Project Phase 2 will focus on the improvement and expansion of the current set of CEN-EPBD standards on the basis of the findings and set of requirements of Project Phase 1
- the actual revision of the standards will be carried out under the responsibility of the relevant CEN/TC's on the basis of a clear set of common principles and rules and priorities (the OAS+TR and two TS's) and guided by the over-arching standard.

Phase 2

includes the following issues

- general checking on the appropriateness of the current set of standard in particular for existing building given the extension of scope in the recast;
- More focus on models and input data which are suited to existing buildings;
- More focus on passive cooling techniques and for the assessment of the energy performance of cooling systems;

Phase 2

includes the following issues

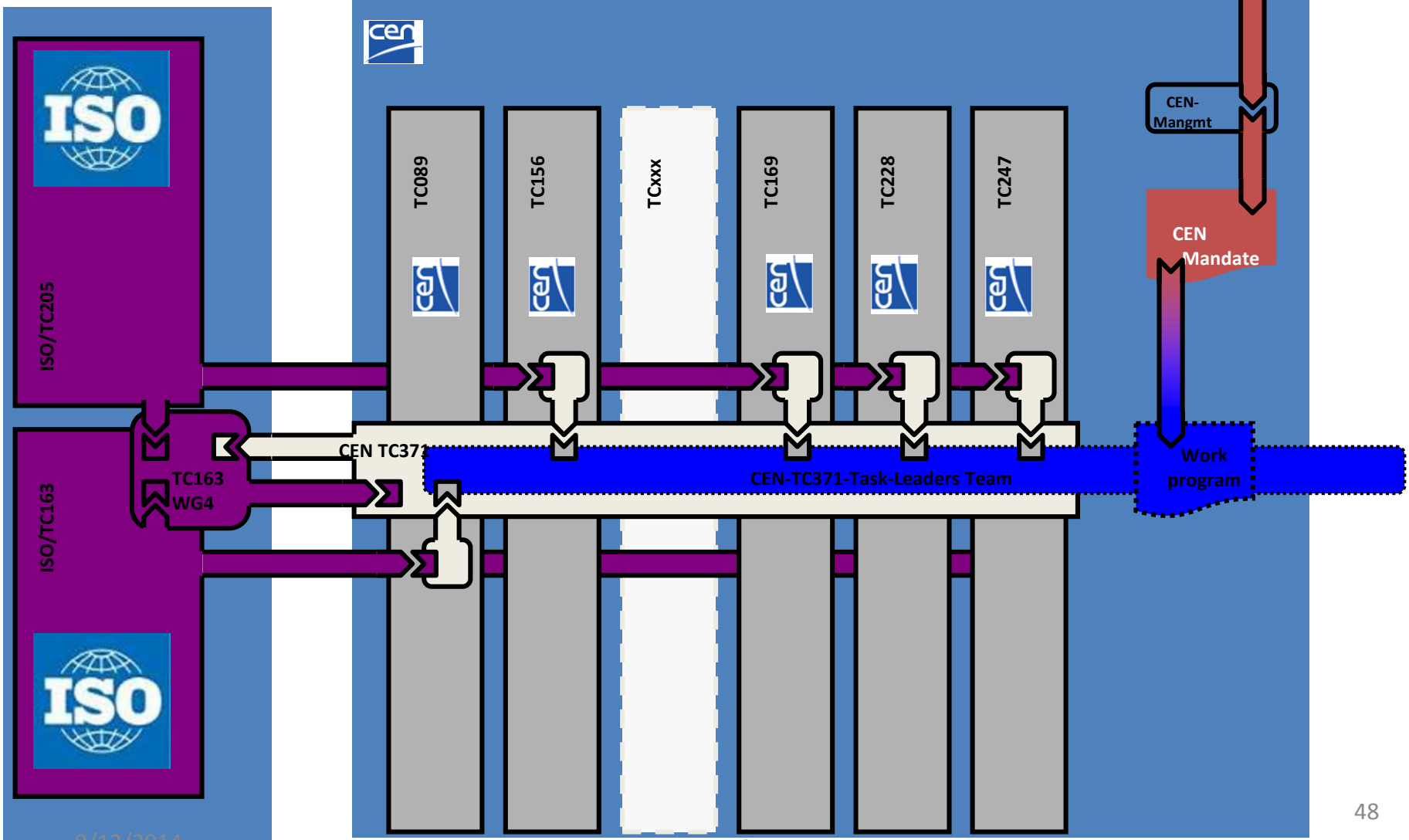
- Integration of the inspection standards on systems for heating, cooling and ventilation;
- Where needed, expansion of the procedures to NZE-buildings by way of renewable sources of energy, and procedures for energy producing buildings, with consideration given to alternative systems;
- Integrated approach for calculating minimum performance requirements for technical building systems and building envelope .

Planning Phase 2

- Call for experts closes 22 March 2013
- After resolving all the contractual issues we hope to start around summer 2013
- It is expected to reach and possibly finish the enquiry stage of the majority of EPB-standards before the end of 2014
- Keep in mind that many of the standards will not fundamentally change

Central coordination within CEN by small team of Task Leaders/experts in CEN TC 371-CAP

- CEN TC 371 organises this central coordination team in cooperation with the other relevant CEN TC's
- Regular report to the 5 TC's and TC371
- Project Teams on different clusters, related to the five CEN TC's:
 - TC 89, Thermal performance of buildings and building components: CT-leader Dick van Dijk (NL)
 - TC 228, Heating systems in buildings: CT-leader Johann Zirngibl (F)
 - TC 156, Ventilation for buildings: CT-leader Gerhard Zweifel (CH)
 - TC 247, Controls for mechanical building services: CT-leader Dan Napar (F)
 - TC 169, Light and lighting: CT-Leader Soh el Moghtader & Jan de Boer (D)



Summary

- **First phase** we produced the *Basic Principles*, **prEN15603 Overarching Standard**, TR to the OAS and *Detailed Technical Rules* ; they are at enquiry stage or going to public enquiry the next months.
- **Second phase** to revise the set of EPB-standards is under preparation
- Also phase 2 is to be considered to be a **dynamic process**; → **Transparent, practical procedures** for exchange of views and principles, cooperation and feed back of all interested parties- The *Build-up platform is used as public platform*
<http://www.buildup.eu/communities/epcalc>
- → **In Cooperation with CEN-EDMC-LC**
- → Where possible in cooperation with ISO-TC163/TC205 if feasible to manage.

Summary

- Two phase approach:
 - **Current First phase** to define the *basic principles, modularly structured overarching standard and common rules* for the 2nd generation of CEN standards to support the EPBD started in Dec. 2011 and will become at enquiry stage by the end of 2012
 - **Next Second phase** to revise the set of standards is under preparation
 - This is a highly **dynamic process**
 - → **Transparent, practical procedures** for exchange of views and principles, cooperation and feed back of all interested parties- *we use Build-up as public platform.*
 - → Continuous central **coordination** and **monitoring** of the progress in terms of consistency, efficiency and efficacy
 - → In close **cooperation** with **ISO-TC163/TC205** and in particular the **JWG of ISOTC205/163**