

How to deal with the CEN package in building regulation and software The Italian experience

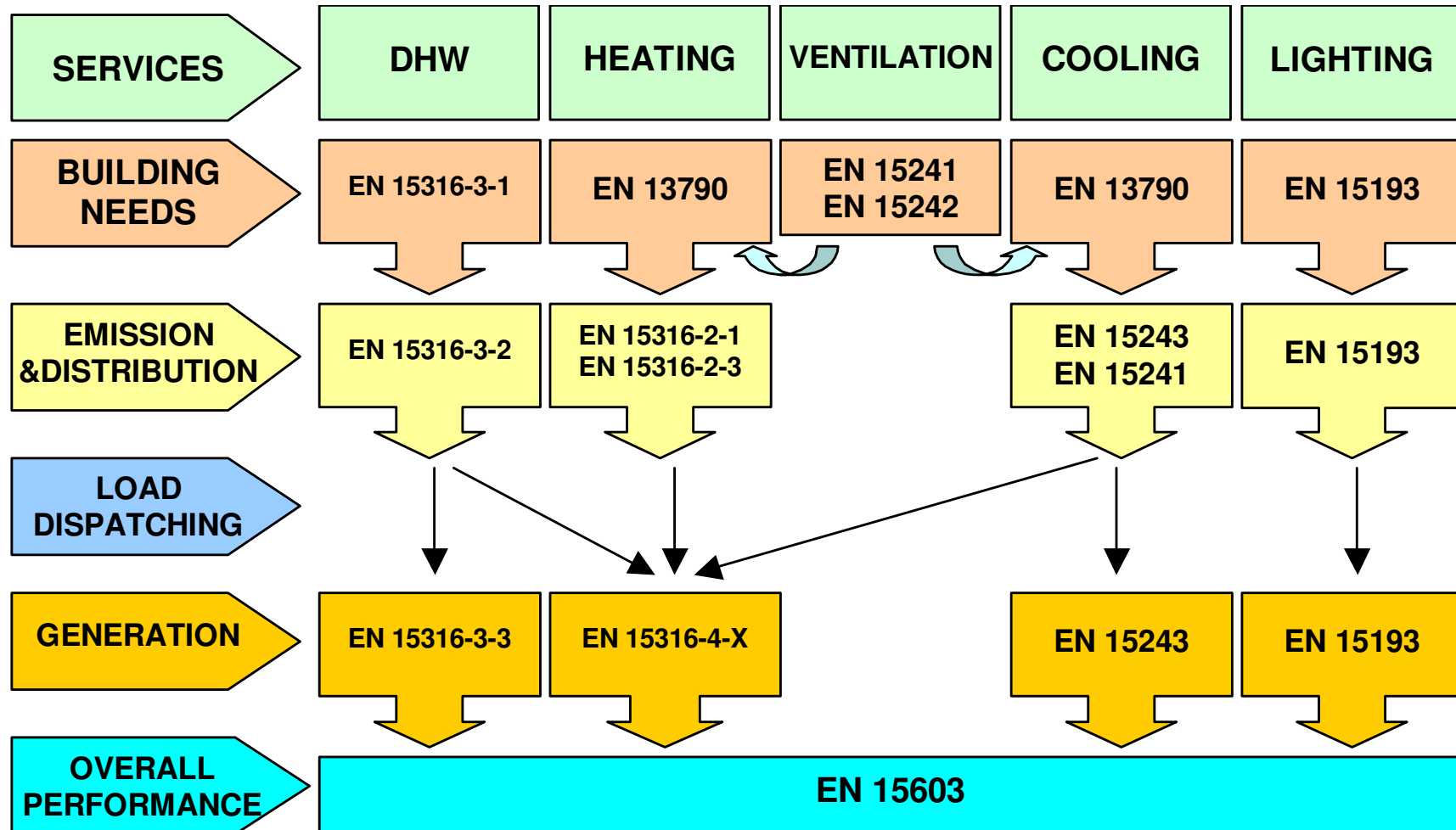
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CENSE

Leading the CEN Standards on Energy performance of buildings to practice

*Towards effective support of the EPBD implementation and acceleration in
the EU Member States*

EN set of standards



Issues about EPBD package

The package has a clear overall structure but...

- time step: hourly, monthly, yearly or bins?
 - several methods for the same topic...
 - sometimes there are only requirements to methods (cooling)
 - do you consider all services with the same details?
 - default data shall be checked or replaced by national data
 - besides energy, how to follow operating conditions (water temperature)?
- For calculation purpose, a fully consistent procedure without loose ends is required
→ **evidence comes when producing application software...**
- A national document is necessary to give guidance and to fix loose ends → **UNI-TS 11300**



Use of EN standards in Italy

Yesterday...

- Primary energy for heating calculation since 1993
 - Building → UNI 10389 based on EN 832, then EN 832/13790
 - Heating system → UNI 10348 and 10347 standards
- Italian experts participated in EN package development
- **Since 2003 → first drafts of EN standards were incorporated in a national recommendation → copy of EN draft standards for a smooth shift**

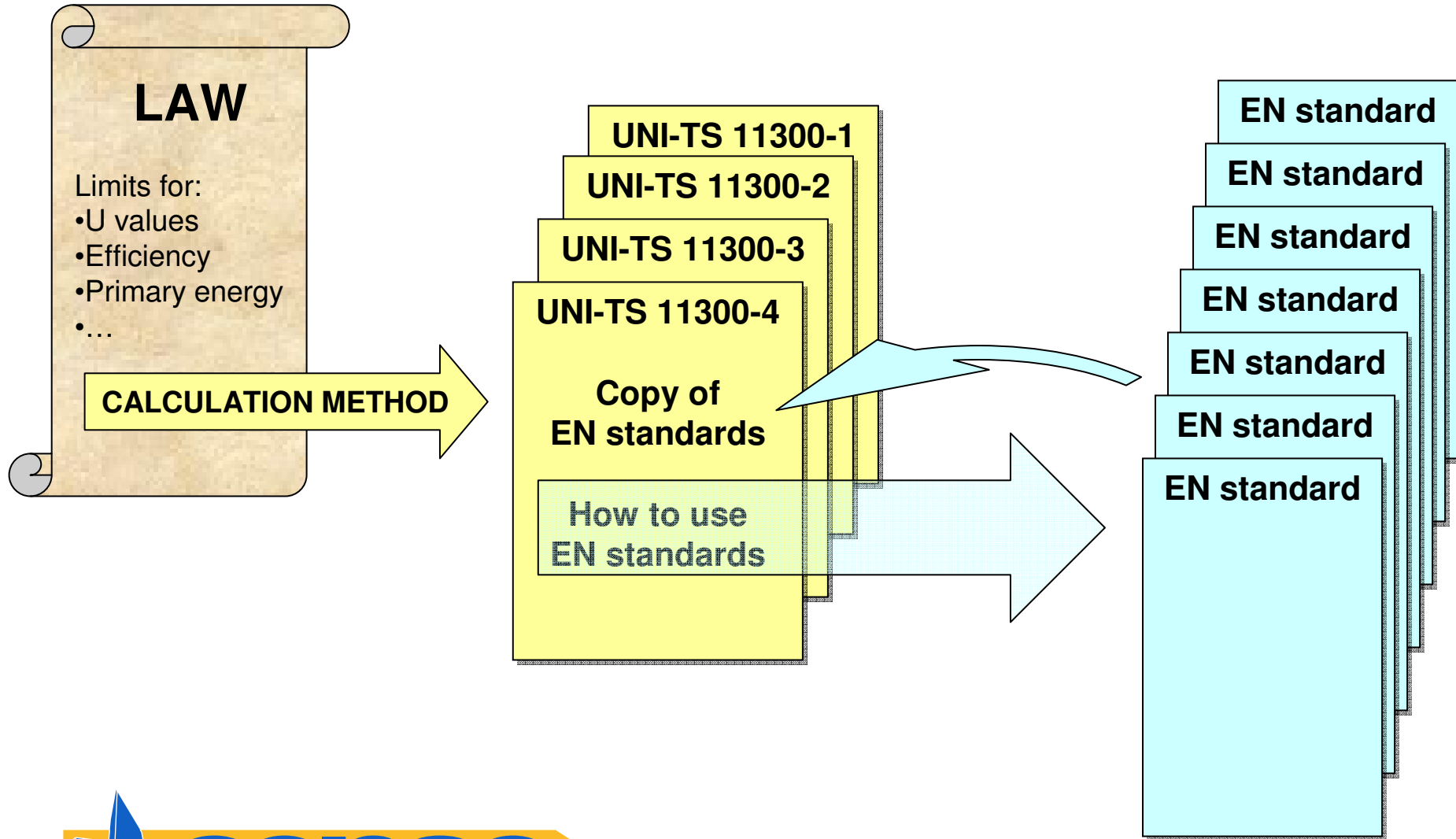
PRESENT SITUATION

- **UNI-TS 11300-1: building needs → how to use EN 13790**
- **UNI-TS 11300-2: simple heating and dhw: → copy of part of EN 15316 series**
+ complementary information (how to select methods)
- **UNI-TS 11300-3: cooling system → structured according to EN 12143**
→ monthly tabulated method → now under public enquiry
- **UNI-TS 11300-4: other generation systems and renewables → copy of EN 15316-4 parts → to be finished (*problems with heat pumps and other special generators*)**

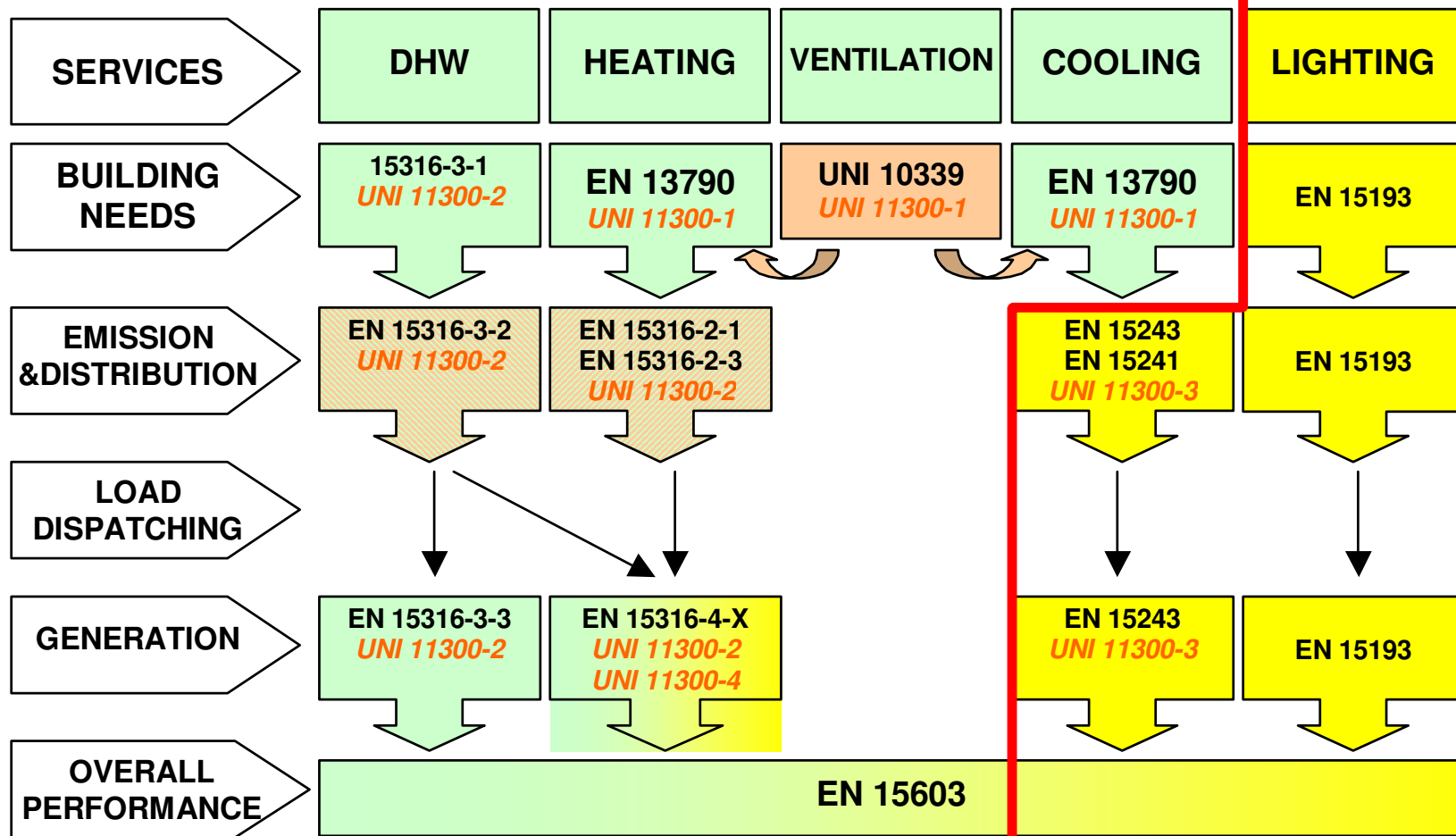
Next step: UNI-TS 11300 as a national annex specifying how to use EN standards



Structure for Italy



EN standards use: current status Italy



COLOR
CODE

EN COMPLIANT

DEVIATION FROM EN

NOT YET INCLUDED



Not all services may be relevant

- **Ventilation:** EN infiltration flow calculation is very complicated. You need to enter all internal partitions which is much more than taking into account only external structures.
- Italian approach for ventilation (UNI-TS 11300-1) is quite simplified:
 - **without mechanical ventilation**, you shall take into account a fixed air exchange rate (design calculation $0,5 \text{ h}^{-1}$, energy calculation $0,3 \text{ h}^{-1}$) for special activities (theatre, restaurant...) UNI 10339 provides the flow rate
 - **with mechanical ventilation**, you take into account the designed flow rates and the effect of any heat exchanger

... and this is done within EN 13790 application

- This might be acceptable because of local conditions
 - ventilation systems are very seldom in Italy
 - in Italy wooden or "dry built" houses are very seldom. The rule is plaster which provides a tight envelope, except for windows, doors and installations
 - the climate allows easy airing and ventilation needs are in the range $8...20 \text{ kWh/m}^2$

... should the infiltration provide more than $0,3 \text{ h}^{-1}$...you should change the windows !



Cooling calculation Italy

An hourly method is usually recommended but there is little experience about an entire building energy calculation with an hourly method.

Typically only some rooms are cooled in the Italian residential context.

There is no finished method in the EN package → there is only a frame for systems (subsystems concept) and requirements to methods → a national document is required again

Legal requirements are based on cooling needs (regions + Italy)

UNI-TS 11300-3 “cooling systems” is now at public enquiry

- Needs: EN 13790, monthly calculation method
- System: tabulated values for all subsystems
- Very simple... maybe even too simple?



Which time step?

Heating and dhw are usually calculated with monthly methods.

- There is a lot of experience in many countries on this topic.
- Monthly methods are accurate enough for “conventional” heating systems...

... but heat pumps require a bin calculation because of strong influence of operating conditions on performances

... and in Italy we have only monthly standardized climatic data

→ **UNI-TS 11300-4** (*will be at public enquiry in autumn 2009*)

→ connection via monthly bins

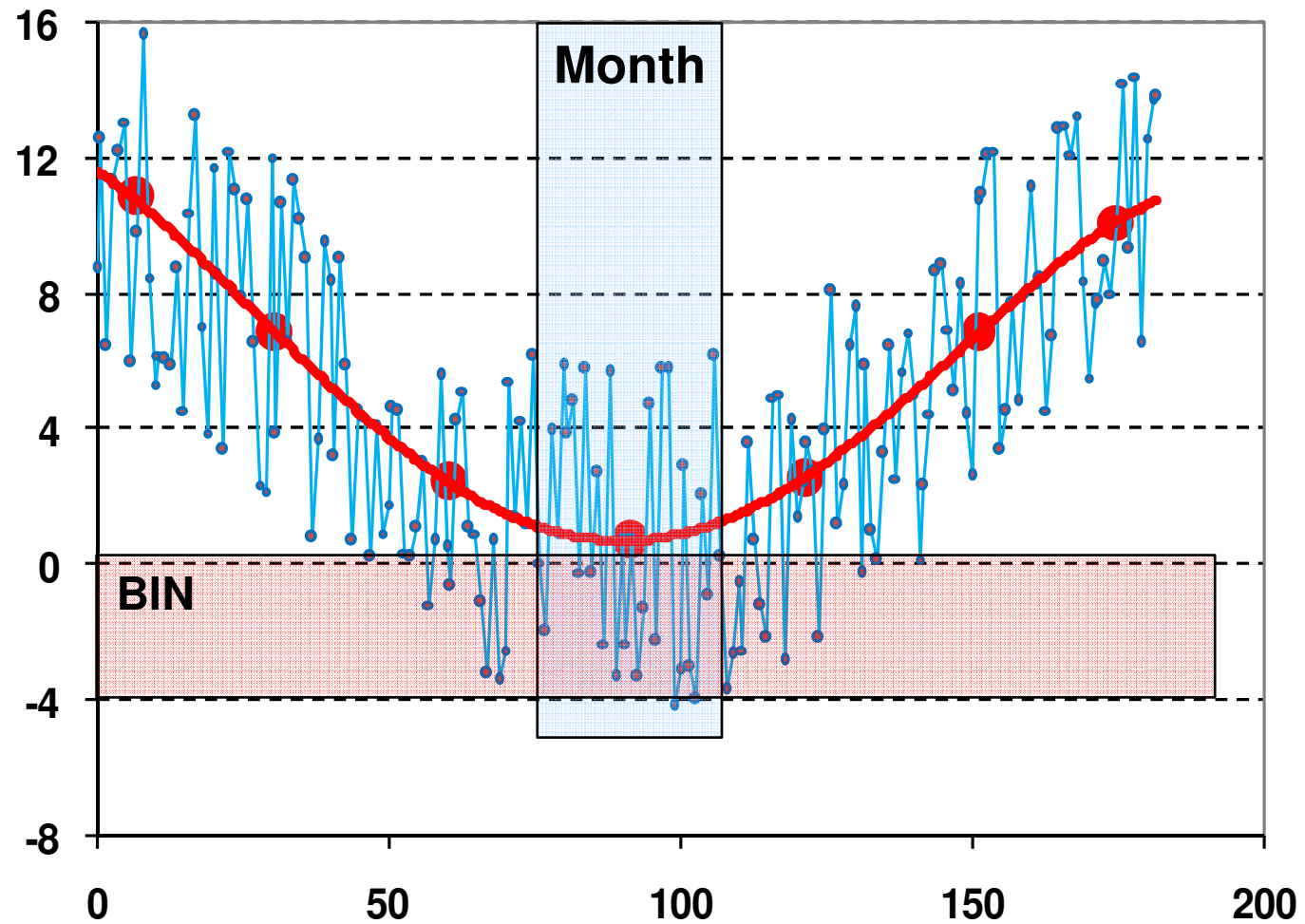
→ method to build monthly bins from monthly data

→ method to convert monthly energy data into bin data

→ method to convert monthly operating conditions into bin data



HEATING SEASON TEMPERATURE



Red line
Interpolation
according to
monthly
average
temperatures
(red dots)

Blue line
Typical real
climatic data

Multiple methods, why?

- No one method is “the solution”
 - Simple tabulated methods are straightforward but may lead to very bad mistakes
 - Detailed methods are usually correct but require a lot of work

Turn around:

- EN standards: specify a set of methods
- National annexes/standards: identify suitable boundary conditions to choose the method for each specific calculation



Other hidden complexities

The scheme looks fine but coming to details requires some care...

The starting point is to **define the building** (geometry input) ...

Building elements → rooms → apartment → building ...that's fine

... but then you have to **group rooms**

- ***according to apartments for energy declaration*** purpose:
... → rooms → **apartments** → building
- ***according to systems for energy calculation*** purpose :
... → rooms → system zones (hydraulic circuits) → distribution →
generators → primary energy

... and groups for the different services (DHW, heating, cooling...) may be not the same...



Loose ends in the standards

EN 15316-4-2 (heat pumps) gives a general procedure
... but there are loose ends

• **EN 15316-4-2**: “*determine COP for actual operating conditions*” ...

... and therefore **UNI-TS 11300-4** defines:

- how to calculate operating conditions according to source type
- the minimum set of COP data required from the manufacturer (based as far as possible on EN product standards)
- an interpolation rule for COP (interpolate on exergetic efficiency) according to source and sink temperature
- an extrapolation rule for COP according to source and sink temperature: max 10 °C with constant exergetic efficiency
- a calculation method for the effect of intermittency...



It is not only a question of formulas

- Understanding the standards needs expertise
- Describing a large building and the interrelation with its systems is a long and complex task
- It's easy to get lost with complex systems
Software should be structured:
 - to guide user input;
 - to give the feeling of “what is happening”.
- Intermediate results shall be available for energy diagnose purpose → to provide recommendations you need to know not only the result but also **why**.



Link between energy calculation and system sizing

A system designer has to perform two tasks

- **Dimensioning a system**, that is selecting size of components
 - Power calculation, flow rate - Example: heat load according to EN 12831
- **Calculating energy performance**
 - How do these selected components behave in actual operating conditions
 - For energy declaration and to check fulfillment of legal requirements

In the past these two tasks were separated.

Now, energy calculation may be used for design purpose as well

Example: generator sizing according to a load factor or to design energy signature method (monthly power / external temperature)

- Avoids large oversizing typical of traditional methods
- Takes into account gains and long building time constants
- Necessary for high performance generators because of high kW price
- Critical for the correct design of heat pump systems

An energy declaration requires design expertise to provide recommendations

→ Integrated tools for design and energy calculation ...



Link between calculated and actual performance

A connection between calculated and actual performance is required

- An essential part of the certificate is economic effective recommendations and this requires reliable simulation capacity and a reasonable link to actual performance
- Actual consumption is usually the only available data to check if calculation is correct.

EN 15603 → energy signature



Software validation

Italy: free market of software tools, but...

- Software has to be validated by CTI:
 - 5% tolerance relative to a “REFERENCE TOOL” by CTI
- Ongoing validation: 12 software houses applied
- Difficulties because of multiple methods:
 - Which methods shall be included in the validation? All or part of them?
 - Shall the calculation start at U value or structure layer definition?
 - ...

Exception: Lombardia (Milan region)

Use of official software is compulsory (CHANGED QUARTERLY!),
A special output file is needed for the energy declaration

**BEST VALIDATION: COMPARISON BETWEEN
CALCULATED AND ACTUAL VALUES**



Legal context, Italy

A stable and uniform legal context is needed

Italian regions have shown what shall NOT be done:

- many region have different sets of legal requirements
(U values, energy need, primary energy, efficiency, % primary by renewables...)
- one region has its own calculation method and changed it quarterly
(with 5..30 % jumps in results from one release to the next one...)

Results...

- difficulties for software manufacturers
(following all deviations for small markets is very expensive)
- big difficulties for designers, installers and industry
- no exchange of services ... no common market

Should be: harmonisation of calculation methods and legal requirements at European level. Only changes in figures allowed.



An energy certificate...

An energy certificate should be the logical completion of the work of the system designer

Will it be a serious job or just the next piece of paper?

To provide reasonably accurate energy consumption predictions and credible recommendations to users, we need:

- a common, complete, consistent, reliable **calculation method** (standards)
- integrated **energy and design calculation tools** (software)

→ *two reasons for software people to take part to standards development*

- true experts to perform energy certification
(registered people after 40 hours training are not necessarily experts)
- a stable and common (not too fragmented) regulatory frame



Energy Performance of Buildings

