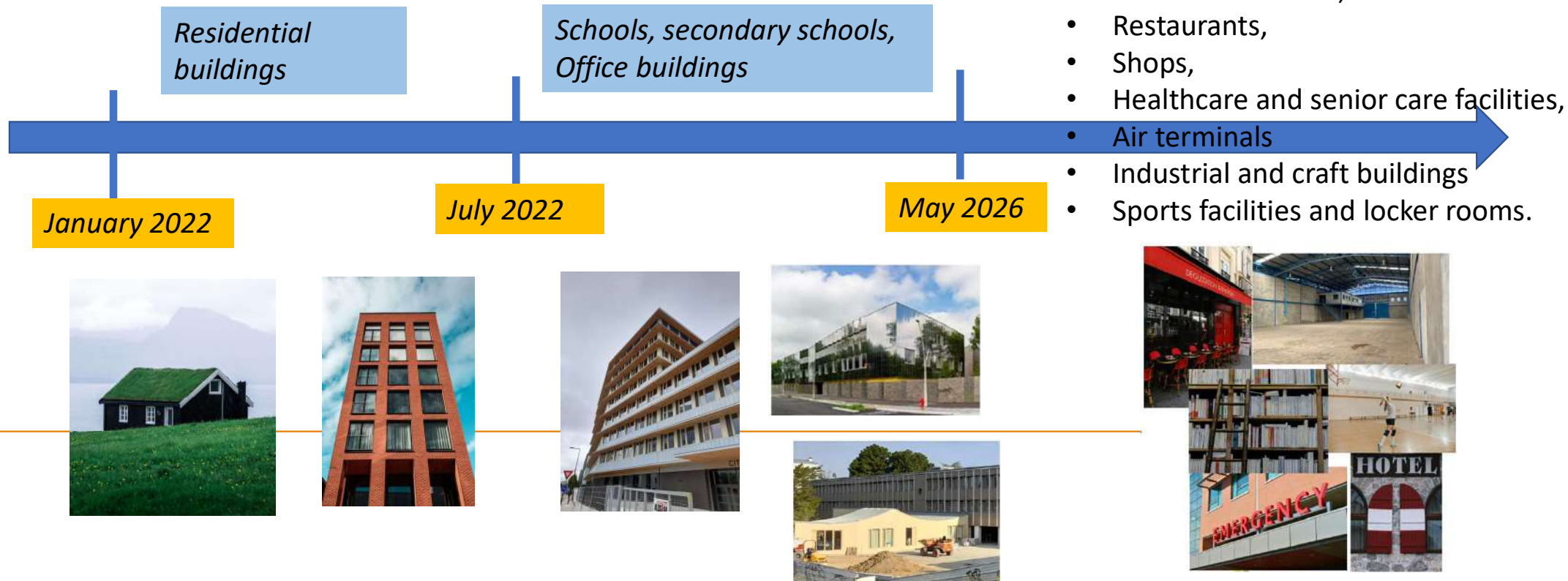


SUMMER COMFORT REGULATIONS FOR NEW BUILDINGS IN FRANCE

NB: French texts distinguish overseas territories, most of which have a tropical climate, and mainland France. The texts presented apply to mainland France, therefore to a temperate climate.

Summer confort in new buildings (RE 2020)

What type of new buildings? And since when?



Summer comfort in new buildings

The regulatory verification is based on a theoretical computer simulation of the building during the design phase

What is the metric? **The number of Degree Hours of discomfort:**

Degree hours = Σ (indoor operating temperature - adaptive comfort temperature)

Is the metric integrated over time, or "single time-step"/punctual?

We add up for the whole year the degree hours of discomfort. But only for the hours when the building is occupied.

Is the metric for a single zone, or entire building?

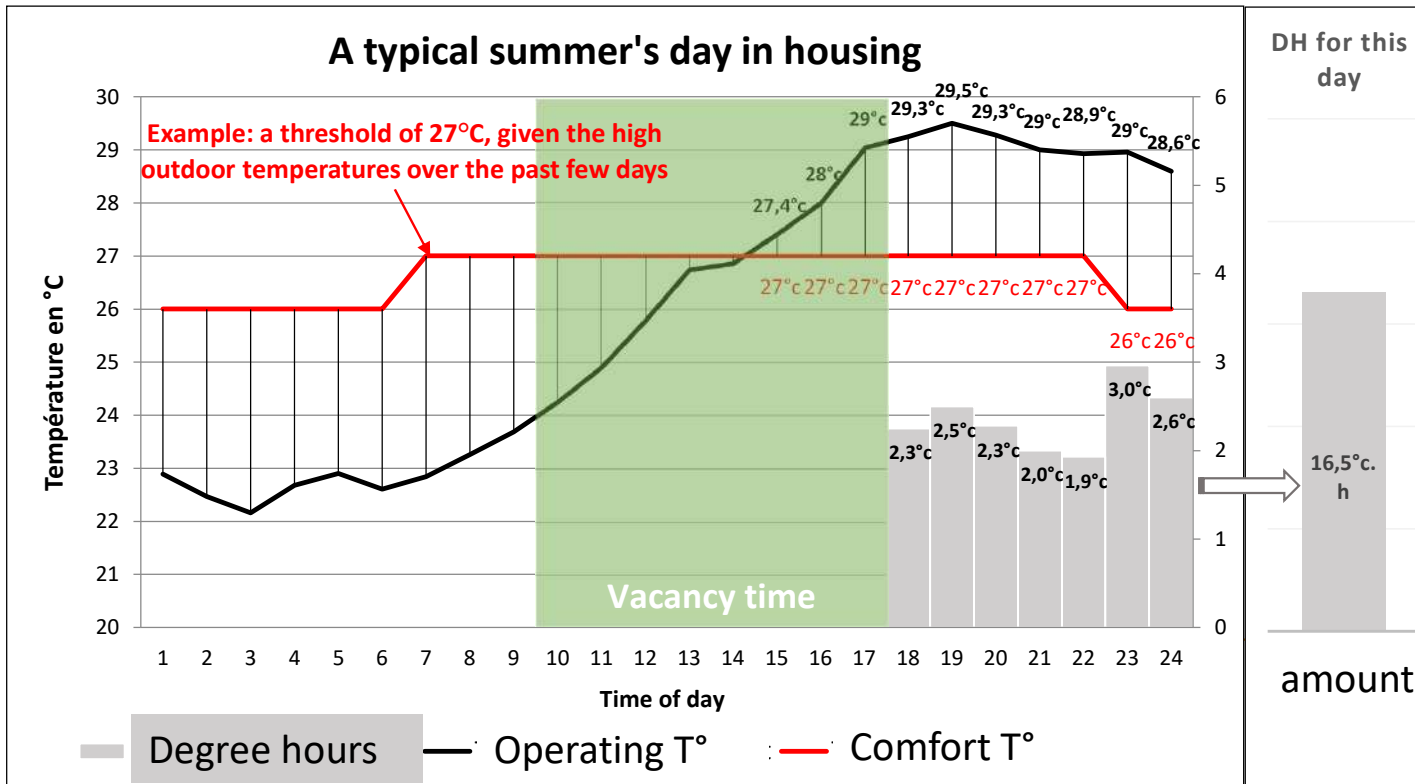
It's for the entire building. Except for collective residential buildings, where we have 2 zones: crossing and non-crossing zones.

Is the metric based on comfort, or health? **On comfort**

Summer comfort in new buildings

Degree hours = $\sum (\max(0 ; \text{indoor operating temperature} - \text{adaptive comfort temperature}))$

Every Hour, we test whether the situation is comfortable or not.



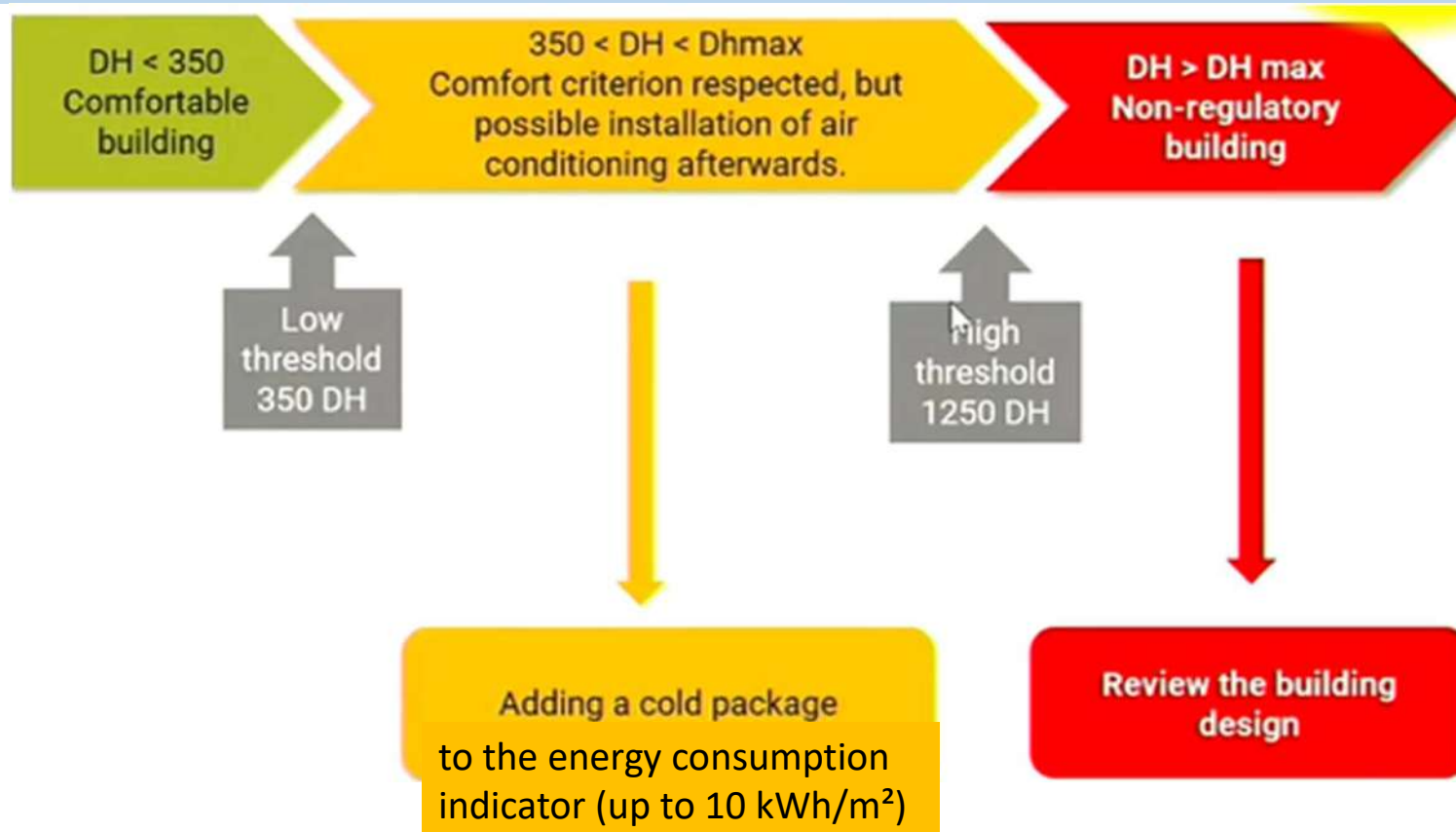
The DH indicator is like a counter that accumulates over the hot period, every uncomfortable degree of every hour of day and night.

Uncomfortable degrees = those that exceed a comfort T° that varies between 26°C (night) and 26°C to 28°C (day)

NB: the comfort threshold is not adaptive at night. It's set at 26°C.

Summer comfort in new buildings

This annual total of degree-hours is compared with two regulatory thresholds:
350 DH and 1250 DH (on average for dwellings)



1250 DH is equivalent to a constant temperature of approximately +2°C for five weeks above the comfort threshold

For air-conditioned buildings, DH are calculated by switching off the air-conditioning system; DH must meet the upper threshold in conjunction with the other factors (design, passive systems, cooling systems)

How is climate (geographical and temporal) accounted for?

For the DH simulation, we use a heatwave dataset covering the period from mid-July to the end of August, with extreme temperatures (for France) occurring between 1 and 15 August (just like during our first severe heatwave in 2003)

How are occupants taken into consideration?

Standard scenarios are built into the software for:

- managing movable sunshades
- and opening windows.

This can be controlled manually or automatically (depending on indoor and outdoor weather conditions)



Our 8 climate zones

+The RE 2020 regulations also contain a few prescriptive measures

- Maximum solar factors for windows (with differences between north-facing, horizontal and other orientations)
 - Every window must be able to open to at least 30% of its total surface area.
 - The access doors to a cooled area are fitted with a mechanism that ensures they close automatically after someone has passed through.
-

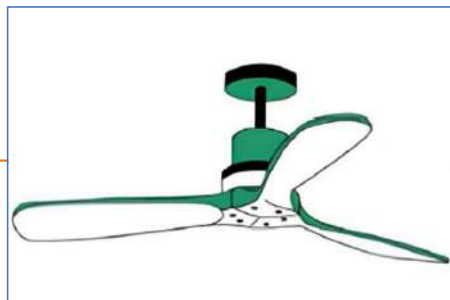
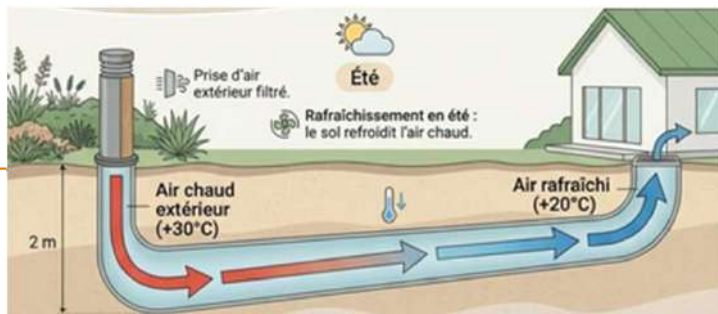
Does the metric assume mechanical cooling is present?

The temperature simulation takes into account all the passive or “semi-active” systems installed, which will consequently reduce the number of degree-hours.

Only the air conditioning is considered to be switched off during the simulation

Systems that can be modelled and can help reduce DH:

- Canadian well, adiabatic cooling, geocooling,
- The cross-ventilation of dwellings
- The building's internal thermal mass
- Solar factor of movable shading devices
- Air circulators → impact on perceived T°
- Shading control (automatic / motorised)
- Window-to-wall ratio
- External shading (canopies, buildings, trees)
- Orientation and tilt of windows
- Improved insulation and thermal bridging
- Light-coloured roof cladding



REGULATIONS FOR EXISTING BUILDINGS AND SUMMER COMFORT

NB: French texts distinguish overseas territories, most of which have a tropical climate, and mainland France. The texts presented apply to mainland France, therefore to a temperate climate.

REGULATION FOR EXISTING BUILDINGS

DPE (Energy Performance Certificate)

Obligation to display performance when selling or renting a property

- Briefly points out summer-related attributes of performance

Thermal regulations (RT) for existing buildings

Two application modes:

- Global RT : during a renovation of a property larger than 1000 m², with a cost greater than 25% of the building's value, if building originally constructed after 1948
 - Conventional temperature calculation and relative requirement
 - Energy calculation and relative requirement
 - requirements of means
- Element-by-element RT : when an owner decides to change or install an element, he must comply with a minimum performance level
 - requirements of means

Decree on works carried out

Obligation to implement thermal insulation when carrying out works such as façade renovation, roof refurbishment

- do not redo a roof without adding insulation to it

Also: obligations related to winter performance, such as mandatory insulation of roofs, etc.

> Part of summer efficacy is a result of that

GLOBAL EXISTING THERMAL REGULATION

Objective in terms of result

In order to limit discomfort and use of air-conditioning, the renovated building must ensure an acceptable summer comfort, as far as possible. Conventional indoor temperature (Tic) in summer must be below a reference temperature :

>> Calculation of Tic, conventional passive indoor temperature reached (Method TH-C-E ex method, based on past / medium climate / applied on entire building)

Tic must be \leq Tic reference if premises not intended to be air-conditioned (criterion of zone/altitude/exposure to noise)

Tic reference = that of the same building but correctly protected (reference solar factor for glazed elements (function of exposure to noise, orientation, tilt, climatic zone and altitude), reference solar factor for opaque elements 0.02)

Obligations of means

- In every room intended for sleeping, solar factor of openings must be \leq reference (except in specific cases where the dwelling is air-conditioned out of necessity)
- New openings must be able to open over \geq 30% of their surface

Specific obligations related to cooling

- In premises with a cooling system, it must only be put into or left in operation when the indoor temperature exceeds 26 °C (except specific cases)
- Requirements on energy : when a building is intended to be air-conditioned, the reference consumption is calculated with reference solar factor

EXISTING THERMAL REGULATION BY ELEMENTS

Obligations of means: solar factors

Roof windows installed or replaced must be equipped with movable solar protections resulting in a solar factor of 0.15. External movable solar protections are OK

In case of installation of a cooling system, equipments have to be upgraded:

- Openings (except north) must be equipped with solar protections
 - Residential premises: movable protection resulting in a solar factor ≤ 0.15 or class 3 or 4 (NF EN 14501). External movable solar protections are OK
 - Other premises: protection resulting in a solar factor ≤ 0.35 or class 2, 3 or 4 (NF EN 14501). External movable solar protections are OK

Exception: impossibility resulting from the application of urban planning rules.

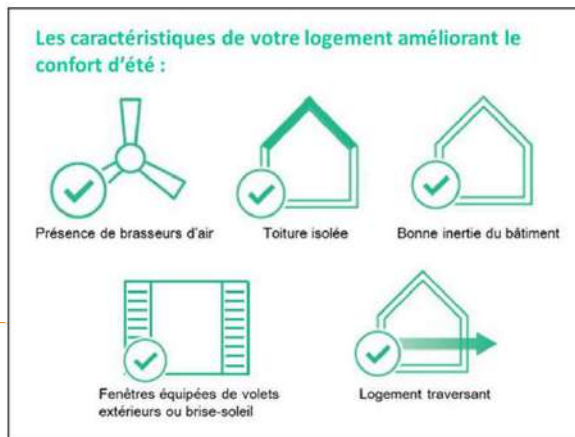
ENERGY PERFORMANCE CERTIFICATE

- Mandatory evaluation of passive summer comfort in dwellings (detached houses, apartments)
- The list of dwelling characteristics that favor summer comfort (solar protections, ventilation, thermal mass/inertia, orientation) is checked

> Very simple but talks of key elements

- A level is assigned on a 3-level scale

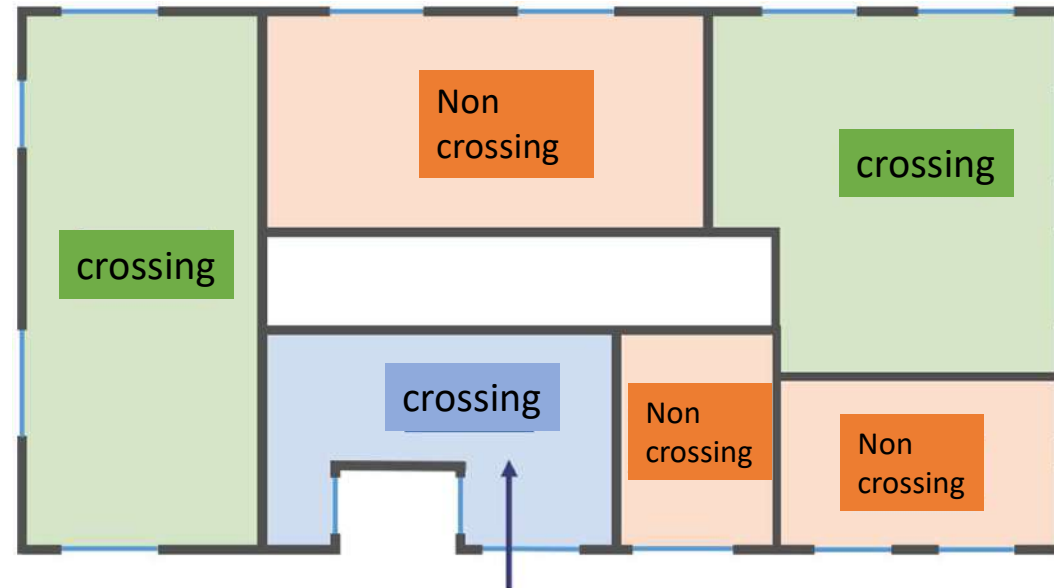
Standard recommendations for works aimed at improving summer comfort are provided



Annexes

The limitations of the French DH calculation engine

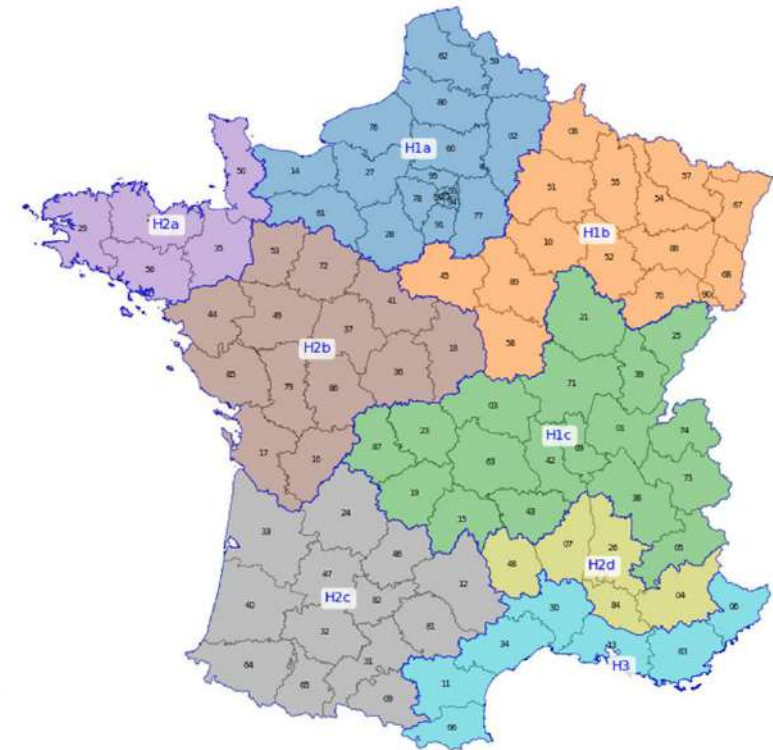
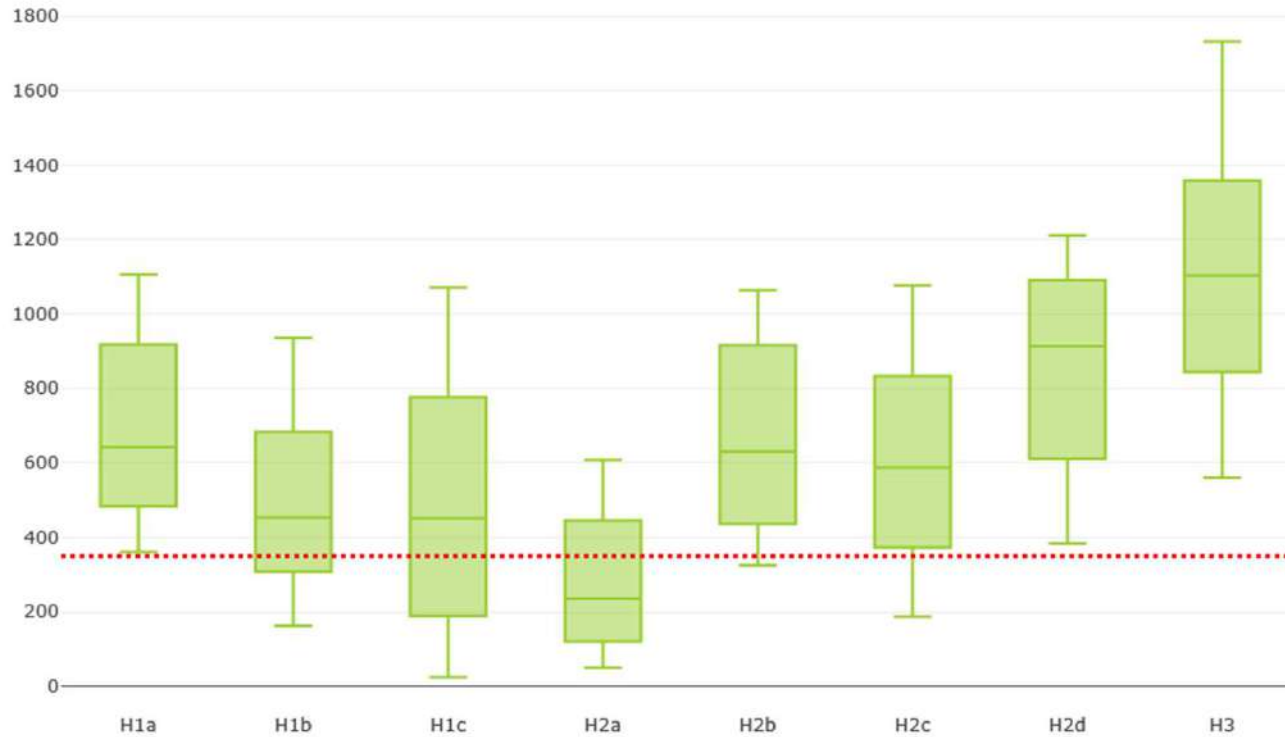
- Urban heat island effect not considered
- 'Average' DH value for several dwellings
- Definition of a crossing/non crossing dwelling
- Optimistic usage assumptions (shading, occupancy, etc.)
- Wall thermal lag not configurable
- Underestimation of shading that allows light to pass through
- Increase in glazed area with little impact



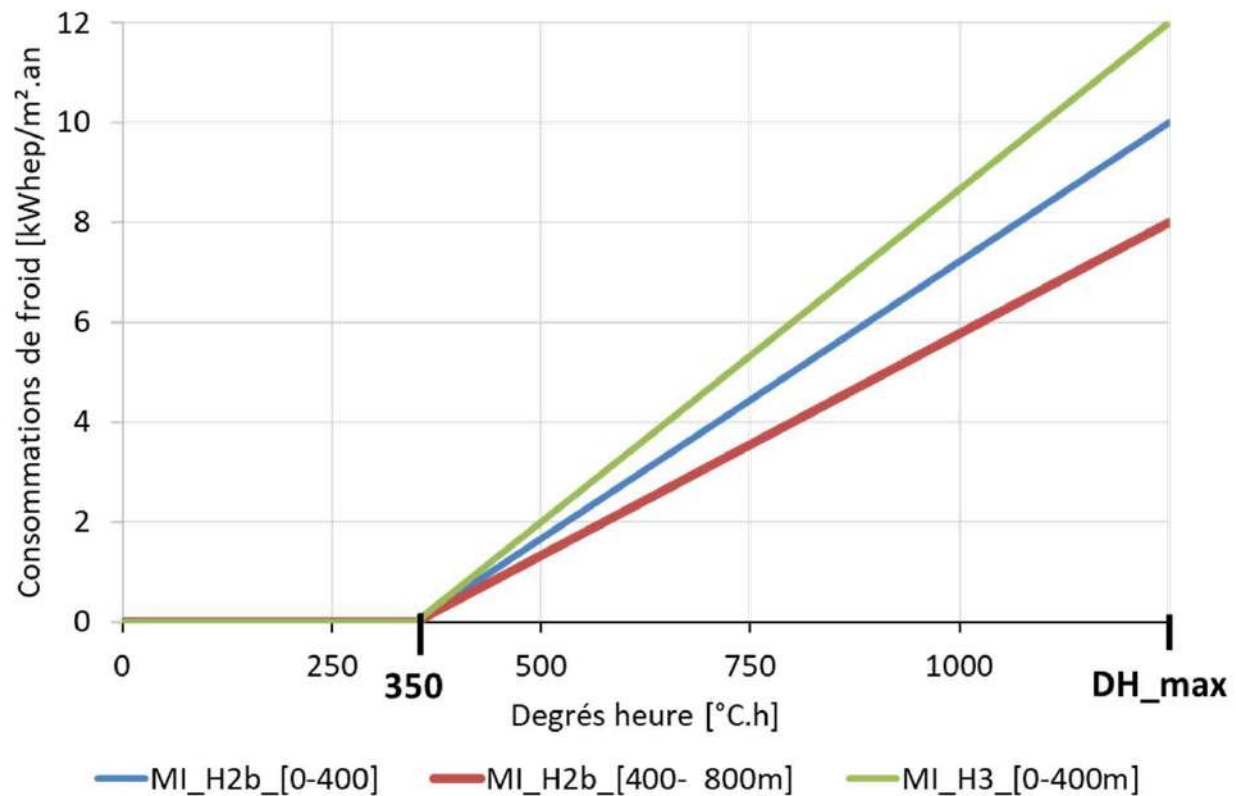
crossing area = At least 25% of the windows on a façade other than the main façade

The national database

Degrees Hours performances for 3095 collective housings achieved (Hxx are the different climate zones in France)



virtual air-conditioning consumption added if the threshold of 350 DH is exceeded in a detached house



Varies depending on:
the building's use

its geographical location (climate
zone and altitude)

Pénalisation du Cep

Quelques valeurs sur la pénalisation sur le Cep

- Pour un léger dépassement (**DH=500**), majoration de 1 à 3 kWhep/m².an

| [0-400m[| H1a | H1b | H1c | H2a | H2b | H2c | H2d | H3 |
|---------------------|-----|-----|-----|-----|-----|-----|-----|-----|
| Logements | 1,3 | 1,7 | 1,7 | 1,2 | 1,7 | 1,8 | 2,0 | 2,0 |
| Enseignement | 1,9 | 2,4 | 2,4 | 1,7 | 2,4 | 2,6 | 2,9 | 2,9 |
| Bureaux | 1,1 | 1,4 | 1,4 | 0,9 | 1,4 | 1,5 | 1,6 | 1,6 |

- Pour un dépassement moyen (**DH=700**), majoration de 2 à 7 kWhep/m².an

| [0-400m[| H1a | H1b | H1c | H2a | H2b | H2c | H2d | H3 |
|---------------------|-----|-----|-----|-----|-----|-----|-----|-----|
| Logements | 3,1 | 3,9 | 3,9 | 2,7 | 3,9 | 4,2 | 4,6 | 4,6 |
| Enseignement | 4,5 | 5,6 | 5,6 | 3,9 | 5,6 | 6,2 | 6,7 | 6,7 |
| Bureaux | 2,5 | 3,2 | 3,2 | 2,2 | 3,2 | 3,5 | 3,8 | 3,8 |

- Pour un dépassement important (**DH=900**), majoration de 4 à 11 kWhep/m².an

| [0-400m[| H1a | H1b | H1c | H2a | H2b | H2c | H2d | H3 |
|---------------------|-----|-----|-----|-----|-----|-----|------|------|
| Logements | 4,8 | 6,1 | 6,1 | 4,2 | 6,1 | 6,7 | 7,3 | 7,3 |
| Enseignement | 7,0 | 8,8 | 8,8 | 6,2 | 8,8 | 9,7 | 10,6 | 10,6 |
| Bureaux | 4,0 | 5,0 | 5,0 | 3,5 | 5,0 | 5,4 | 5,9 | 5,9 |