French building regulation sets 50 kWh/(m²a) a limit for primary energy use

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Foreword

Since 1974 several regulations have progressively strengthen thermal performances of buildings in France. But the latest one called RT 2012 based on requirements settled by the 2008 national convention "Grenelle de l 'Environnement" is a significant step towards nZEB buildings.

RT 2012 which has been in force since January 1st, 2013 applies to all new heated or cooled buildings, except

- provisional buildings
- buildings heated with an indoor temperature lower than 12°C
- buildings heated or cooled for other reasons than comfort, for example industrial processes
- farms
- churches
- buildings located in French overseas territories.

General

Three main requirements

RT 2012 building regulation includes mainly three major requirements which must be respected simultaneously.

1. The first one deals with the intrinsic features of the structure and the envelope of the building without considering the HVAC system and other technical facilities. Such features are specified with the **Bbio Factor (bioclimatic needs factor).**

2. The second one involves the maximum permitted **annual consumption of primary energy** of the building taking into account performances of HVAC system, DHW production and, if any, artificial lighting through the **Cep factor.**

3. The third corresponds to requirement for thermal comfort in summer based on the compliance with a maximum comfort calculated temperature Tic.

RT2012 also includes some specific prescriptive requirements (see example in the end of the article).

Two main categories of buildings

Two main categories of buildings are considered in the RT 2012 regulation.

Category CE2

Buildings belonging to category CE2 mainly depends on the usage type of the building, noise exposure and geographical location. It is defined in detail in the decree. Basically buildings built in noisy areas where it may be necessary to install air conditioning system in order to ensure thermal comfort in summer while the windows are kept closed are allowed to be included in category CE2.

Roughly it can be considered that dwelling, school and office buildings located in noisy areas in the hottest regions of France falls within CE2 category.

Category CE1

All others buildings belong to category CE1.

Bbio Factor

Bbio factor is a dimensionless number expressed by a number of points calculated using the following relationship:

Bbio =
2 x (Heating needs + Cooling needs) +
5 x (Artificial lighting needs)

in which heating, cooling and lighting needs of the building, are calculated by an hourly dynamic analysis software.

Energy consumption of ventilation system and lighting facilities are based on conventional values included in the software.

Bbiomax

Bbiomax is the maximum permissible value of *Bbio* for a given building project, the regulatory requirement being

Bbio building project < *Bbiomax*

Bbiomax satisfies the following relationship:

$$Bbiomax = Bbiomaxmoyen \times (Mb_{geo} + Mb_{alt} + Mb_{surf})$$

where

- *Bbiomaxmoyen* is a coefficient depending the use and the category (CE1 or CE2) of the building
- Mb_{geo}: geographical location coefficient
- Mb_{alt}: altitude location coefficient
- Mb_{surf}: a modulation factor, in terms of surface of the premises. Mb_{surf} is only used for housing, commercial buildings and sports halls.

For example, in case of sports halls building, Mb_{surf} is given by the following rule:

If Building Floor Surface (*BFS*) ≤ 1 000 m² then Mb_{surf} = –0.008 x *BFS* + 0.8.

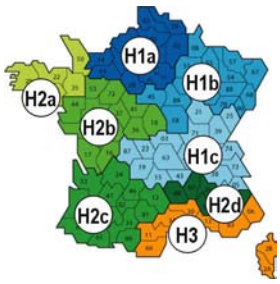
If *BFS* > 1 000 m² then Mb_{surf} =0

Bbio factor for an office building

- *Bbiomax* = 70 if the building belongs to category CE1, *Bbiomax* = 140 for category CE2.
- Mb_{surf} = 0
- Mb_{alt} (altitude location coefficient):

Altitude	Mb_{alt}
From 0 to 400 m	0
From 401 to 800 m	0.1
801 m and over	0.2

The values of Mb_{geo} (geographical location coefficient) are given in the table below depending on the area in the map:



Category	Geographical areas							
	H1a	H1b	H1c	H2a	H2b	H2c	H2d	H3
CE1	1.10	1.20	1.10	1.10	1.00	0.90	0.80	0.80
CE2	1.00	1.00	1.00	1.00	1.00	1.00	1.20	1.20

Cep coefficient

Cep coefficient represents the conventional annual consumption of primary energy of a building, reduced to the floor surface. The counting of floor surface is stated in a government ordinance.

Only two primary energy factors are applied, for electricity 2.58, and for all other fuels 1.

Cep, expressed in $Watts_{ep}$ /m² per year takes account energy used to meet the following needs of the building:

- heating
- cooling
- domestic hot water
- lighting
- auxiliaries (fans , pumps).

If any, energy produced on-site from renewables may be deducted from the calculation of *Cep*.

Regulatory requirement

The regulatory requirement is met if:

$$Cep \leq Cep_{max}$$

Cep_{max} is defined with the following equation:

$$Cep_{max} = 50 \times Mc_{type} \times (Mc_{geo} + Mc_{alt} + Mc_{surf} + Mc_{GES})$$

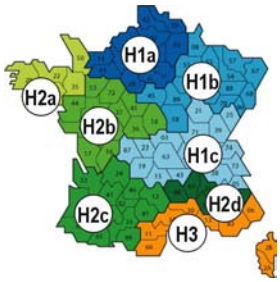
Where:

- Mc_{type} is a coefficient depending the type and the category (CE1 or CE2) of the considered building to which it belongs
- Mc_{geo} is geographical location coefficient
- Mc_{alt} is altitude location coefficient
- Mc_{surf} is a coefficient depending the floor surface for housing, commercial buildings and sports halls
- Mc_{GES} is a coefficient depending on the greenhouse potential of the fuel used.

Typical values of Mc coefficients

Housing buildings

Values of the various coefficients which have to be used in the Cep_{max} relationship, for housing buildings, are given below.



- Mc_{type} = 1
- Mc_{geo} values, depending on the region of the country, are given in the table below:

Geographical area

	H1a	H1b	H1c	H2a	H2b	H2c	H2d	H3
Mc_{geo}	1.20	1.30	1.20	1.10	1.00	0.90	0.90	0.80

- Mc_{alt} (altitude coefficient) depends on the altitude of the building location:

Altitude	Mc_{alt}
From 0 to 400 m	0
From 401 to 800 m	0.2
801 m and over	0.4

- Mc_{surf} is given by formula, depends if it is a detached house or a collective residential building
- Mc_{GES} is fuel greenhouse potential
- Wood fuel Mc_{GES} = 0.3
- When building is linked to a District Heating Network Mc_{GES} = 0 to 0.3 (depending the fuel used for the district heating plant)

Case of office buildings

- Mc_{type} = 1.4 if building belongs to CE1 category, 2.2 if CE2 category
- Mc_{geo} = values depend on both region of location and category of the building:

Geographical area	Category	H1a	H1b	H1c	H2a	H2b	H2c	H2d	H3
Mc_{geo}	CE1	1.10	1.20	1.10	1.10	1.00	0.90	0.80	0.80
Mc_{geo}	CE2	1.00	1.00	1.00	1.00	1.00	1.00	1.20	1.20

- Mc_{alt} (altitude coefficient) depends on the altitude of the building location:

Altitude	Mc_{alt}
0 to 400 m	0
401 to 800 m	0.1
801 m and over	0.2

- Mc_{surf} = 0
- Mc_{GES} When building is linked to a District Heating Network = 0 to 0.3 (depending the fuel used for the district heating plant)

Maximum Cep values for individual houses and non air-conditioned office buildings

The figures below show the maximum permitted values of Cep_{max} for individual houses and non-air conditioned office buildings (CE1 category) depending the geographical region. On sea level altitude = 0 m, in the case with Mc_{GES} = 1.

Individual houses:

Non air conditioned office buildings:

Maximum indoor temperature

The third performance requirement set by the new regulation is the respect of a maximum indoor operative temperature called *Tic* (for "Temperature intérieure conventionnelle"). This requirement is only requested for non air-conditioned buildings.

Tic is calculated by a module of the regulation software. Corresponding requirement is that hourly calculated value of Tic might not be upper than Tic_{ref}.

Tic_{ref} can never be less than 26°C.

The calculation method of Tic_{ref} is being revised. A new version should be available in the coming months.

Complementary prescriptive requirements

Besides the three main performances requirements described above some wherewithal exigencies are listed in RT2012.

Some of them are given below as examples.

- **Thermal insulation of walls**

Albeit the thermal quality of the building envelope is already considered in the *Bbio* coefficient some complementary exigencies are intended:

  - **U-value of a wall separating** an unheated room and an heated room must not be higher than 0.36 W/m²K
  - **Overall linear thermal transmission ratio** (thermal bridges) of the whole building must be less than 0.28 W/m^2_{floor} K:

$$\Sigma(\Psi,L) / m^2_{\text{Building overall floor surface}} < 0.28\ (W/m^2_{Floor}K)$$

  - **Thermal bridges between** intermediate floors and facades less than 0.6 W/m K

- **Air tightness of the building envelope**

Airtightness of the building envelope measured according to EN 13829 measuring method (Blower door) must be in accordance with the values of the next table.

	Q ($m^3/h,m^2$)
Individual or attached houses	0.6
Collective housing buildings	1.00

It must be underlined that surface being considered is that of internal walls, floor surface being excluded.

- **Natural lighting**

For housing buildings the total windows area must be more than 1/6 of the floor surface area of the flat.

- **Thermal comfort in summer**

In bedrooms Solar Heat Gain Coefficient of the windows is limited according to the orientation of the façade. Lower values of *SHGC* are required when the building is located in a noisy area.

Application of the regulation

All calculation must be compulsorily performed by an authorized software based on the official rules Th BCE-2012 established by Centre Scientifique et Technique du Bâtiment (CSTB). ■

Next Ventilation Conference in Shanghai China October 2015

Ventilation 2015

The 11th International Conference on Industrial Ventilation will be in Shanghai, China from October 26 to 28, 2015, organized by Tongji University and VTT Technical Research Centre of Finland, co-organized by Tsinghua University. Four main topics of the conference are:

- Occupational Health
- Ventilation and Sustainable Development
- Specialized Applications and Clean Air Technology
- Design and Control

You are invited to submit an abstracts (300–400 words) via online webpage http://www.ventilation2015.org. The abstract template and further information can be found also later on the website. October, 1, 2014 is the abstract submission deadline and May, 1, 2015 is the final paper deadline.

The Ventilation 2015 Conference will offer a platform to scientists, researchers, professionals like consultants, engineers, designers and architects together with policymakers for the exchange of scientific knowledge and technical solutions. The Ventilation conference will also offer the opportunity to view the state-of-the-art ventilation technologies. In addition, Shanghai as the conference place is the largest city of China, situated at the Yangtze River Delta, with East China Sea in the east and Hangzhou delta in the south. It is a very beautiful and prosperous city. It is a shining pearl in China as well as in the world. We are looking forward to meeting you in the Ventilation 2015 conference in Shanghai, China.

October 26-28, 2015, Shanghai, China