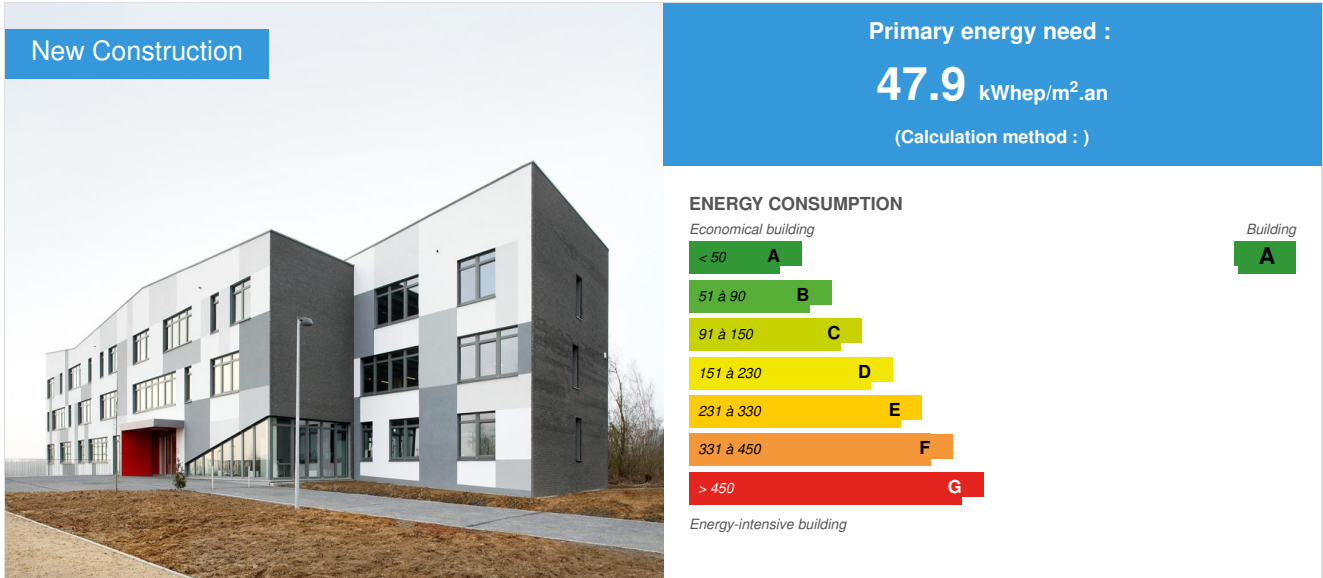


## Ecooffice

by Claire Lheureux / 2015-06-30 11:37:03 / Belgique / 12010 / FR



**Building Type** : Office building < 28m  
**Construction Year** : 2013  
**Delivery year** : 2014  
**Address 1 - street** : Avenue Robert Schuman, 71 1401 NIVELLES, Belgique  
**Climate zone** : [Cfb] Marine Mild Winter, warm summer, no dry season.

**Net Floor Area** : 3 690 m<sup>2</sup>  
**Construction/refurbishment cost** : 4 107 000 €  
**Cost/m2** : 1113.01 €/m<sup>2</sup>

Certifications :



Proposed by :



### General informations

A project studied from every angle!

The "Ecooffice" results from a research project for the realisation of a liability and sustainable commercial building DESBUREAUX the same cost as standard. It is certified liabilities and labelisé BREEAM "Very Good" for its sustainable building qualities.

This project is unique because all its parameters were studied and optimized manièresystématique by the partners to make a modèlereproductible, flexible and versatile. The research aimed to determine desoptima between functional requirements, technical choices, critèreséconomiques and principles of sustainable construction.

The parametric analysis focused on constructive energy and environmental aspects, through general themes as varied quel'implantation and building form,

structure and choice des matériaux, the isolation level, performance and choice of system design, lighting issues and natural light, etc.

In addition, a monitoring procedure has been set up by leCSTC: it began with the monitoring of future occupants in their bureaux actuels and will continue for three years after their installation in les nouveaux offices.

## Implantation

Work on the implementation and the shape of the building permis d'optimiser contributions in natural light while reducing déperditions de heat. The optimization of solar gains, natural lighting and ventilation des besoins has reduced the heating requirements in winter and the risks of overheating in summer.

The project was installed in the ground in a north-south orientation; it uses the existing height difference to separate son parking building. The remarkable trees have been preserved and integrated into the project.

Initially a simple compact rectangle shape in The Length was divided to form two strips, which were shifted to improve la pénétration of natural light in the heart of the plates. An atrium is encore venu strengthen this objective. In doing so, the blind nucleus (where rassemblement sanitaires and vertical circulations) was reduced in favor of espace périphérique offices.

## Functionality and template

The design process has incorporated from the outset à l'énergétique aspects and lighting. All work spaces and have natural lighting, a guarantee of defonctionnement economy.

The design of the structure, technical installations and des façades sought to preserve the greatest possible flexibility in usagede space. The template has been optimized and corresponds to trays of  $\pm 1\ 000\text{m}^2$ , who accommodate as well as landscaping bureaux cellulaires.

The party retained the north-south orientation, reducing faces is et ouest (the most difficult to control in terms of overheating). Façades sud the north and correspond to the same frame openings (randomly distributed manière semi), but the side facing to the north is slightly glazed qu'ausud. In front, a color scheme forms a set of pixels surdimensionnés répondant accents in the landscape.

## Architecture

The parametric analysis focused on the constructive aspects, energy and environmental, through themes as varied as implantation générale and building form, structure and material selection, leniveau insulation, performance and choice of technical facilities, issues of lighting and natural light, etc.

In the evolution of the architectural approach, the est naturellement liabilities associated with the logic of the building life cycle. He drove à investir the particular durability of structures, walls and walls, as projet. Réduire space technologies for the benefit of their architectonic A represents paradoxical challenge, which engaged them in a toujours plus built energy, low tech and less delivered technology. It is also in what cecadre adopted Trias Energetica logic - "less better, otherwise", which control first reduce the need (energy, but also desurface, materials, water, etc. .) by working on the form and matter, before considering the improvement of technical systems and the use has other forms of resources (renewable, etc.).

Work on the implementation and the shape of the building permis d'optimiser contributions in natural light while reducing déperditions de heat. The optimization of solar gains, natural lighting and ventilation des besoins has reduced the heating requirements in winter and the risks of overheating in summer.

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## Material

Several constructional variants were studied. The present variante lourde improved cooling needs combinaison avec intensive night ventilation and helps mitigate detempérature peak during heat waves.

A typical analysis LCC (Life Cycle Cost) allowed the comparison del'impact environmental  $\text{m}^2$  of facade on the basis of an LCA for deux différentes life (30 and 60) and considering different scenarios deremplacement.

The building is constructed of concrete frame and closed by a concrete block masonry remplissage en traditionnel. External insulation Neopor ENEPS is then reported and coated. The gables are covered with unparement concrete blocks.

The building meets the passive standard with walls having U des valeurs between 0.17 and 0.23 W /  $\text{m}^2\text{K}$ . The windows are fitted detriple glazed north, but double glazing to the south.

Ventilation is dual-stream, of course, and the wheel exchanger permet de regulate humidity. The inertia of the building is utilized by Ades partial false ceilings in the office areas.

## Primary energy

Geothermal (natural and nightcooling) = maximum energy saving significant investment mais coût and need an extra in summer. The solutions retenues are:

backup heating: gas condensing boiler and heater + ventilation: double flow with heat recovery wheel. VMC.surdimensionnée for intensive ventilation in summer (nightcooling) + extra cold: cold VMC Group.

## Comfort

The initial choice of a lightweight construction was abandoned in profit d'une heavy structure for its qualities of inertia and mechanical strength, but also for its cost to comparable environmental impact.

Particular attention was paid to occupant comfort, a guarantee of good use of the building. To allow bureaux par office regulation, the heat is distributed by a circuit traditionnelle et the extra hot water is provided by a condensing gas boiler. The system of ventilation is oversized to provide the necessary flow en ventilation night intensive summer and a cold group is expected in réserve pour possible heatwaves. Lighting installations are optimisées grâce choice of low-energy appliances and well positioned unerégulation by dimmers and motion sensors.

Passive and BREEAM certification label "Very Good" attest de l'efficacité of the solutions and sustainability of the building.

One of the standard criteria tertiary liability is checking du confort according to EN 13 251.

We must encode the building in a dynamic simulation program endécoupant trays by zones. This encoding also assess, Sur le long term performance in naturally ventilated buildings. Ce critère is based on the comfort of theory of adaptive T °.

This model takes into account the adaptability of a building (and occupation) to external conditions. The passive building into the mind of an "adaptive" building, which allows interaction between the occupant and interior le confort (opening windows, clothes fit for une période hot ...)

## Natural lighting

The lighting consumption are one of the commercial buildings plus importants positions.

Daylighting simulations encoding the building in logiciel radiance and 3D models in the lab tests CSEC réalisés sous un artificial sky (mirror-box) were used to investigate the influence of light on outside daylighting .

More? : [Http://a2m.be/eco\\_office.html](http://a2m.be/eco_office.html)

## See more details about this project

[http://a2m.be/eco\\_office.html](http://a2m.be/eco_office.html)

[http://a2m.be/2013\\_publication\\_febelcem\\_sur\\_ecoffice\\_et\\_haren.pdf](http://a2m.be/2013_publication_febelcem_sur_ecoffice_et_haren.pdf)

## Data reliability

3rd part certified

## Stakeholders

### Building users opinion

Below are reported the opinions of office occupants from a series of interview: - Not really a priori but positive surprise; - The work environment has improved; - The heat is correct, we have not got cold despite the harsh winter; - Automatic blinds are well regulated; - The space is very well thought out, everyone has enough space; - It feels good, it's good to live; - It is gratifying to work in a nice building, beautiful, representing the image of the company. Link to interview: <http://www.ecoffice-building.be/>

### Stakeholders

Function : Designer

A2M

[willem@a2m.be](mailto:willem@a2m.be)

<http://a2m.be>

Mission complete

Function : Other consultancy agency

CSTC

<http://www.cstc.be>

Monitoring, control and project studies

Function : Other consultancy agency

IMTECH

M.Hoebeke ; colin.hoebeke@imtech.be

Special Technical Bureau

Function : Contractor

Thomas & Piron et Holcim

## Contracting method

Other methods

## Owner approach of sustainability

As part of assisting innovative companies in the Walloon Marshall Plan 2.0 Green, the company Thomas & Piron has managed to bring together a consortium of architects, engineers, researchers and companies to study "in vitro" and detailed optimization of all parameters of a passive tertiary project. This pilot project has led to the construction of a passive and sustainable office building achieved at the same price as a standard desktop. It is occupied by the company Holcim. This project of "liability for all" is detailed on the [www.ecoffice-building.be](http://www.ecoffice-building.be) site. This project is certified Passive (certificate of a third party) and BREEAM assessed.

## Architectural description

Concept of "design facade" The facade is designed based on a module of 1.20 m The volume set is accentuated by the inclinations of the parapets. Finally, dressing plays with an impression of the site before work. The image has been pixelated to reach a resolution to the size of the building frame. The result illustrates the work done on the report of nature and architecture which is inscribed.

## Energy

### Energy consumption

Primary energy need : 47,90 kWh/m<sup>2</sup>.an

Primary energy need for standard building : 250,00 kWh/m<sup>2</sup>.an

Calculation method :

Final Energy : 25,88 kWh/m<sup>2</sup>.an

Breakdown for energy consumption :

Heating: 11.2 kWh / m<sup>2</sup>.year (43%)

ECS: 0.00

Lighting: 9.22 kWh / m<sup>2</sup>.year (36%)

Domestic: 0.00

Auxiliary 5.1 kWh / m<sup>2</sup>.year (20%)

Cooling 0.36 kWh / m<sup>2</sup>.year (1%)

More information :

The calculation method used is the PHPP 2007 software.

### Envelope performance

Envelope U-Value : 0,33 W.m<sup>-2</sup>.K<sup>-1</sup>

More information :

Structures and concrete floors sails (prédalle air deck with concrete cast in place) and coated outer insulation. The building meets the passive standard with walls having U values between 0.17 and 0.23 W / m<sup>2</sup>K. The windows feature triple glazing to the north, but double glazing to the south.

Building Compactness Coefficient : 3,32

Indicator : n50

Air Tightness Value : 0,30

## Renewables & systems

## Systems

### Heating system :

- Condensing gas boiler

### Hot water system :

- Condensing gas boiler

### Cooling system :

- Others

### Ventilation system :

- Nocturnal Over ventilation
- Double flow heat exchanger

### Renewable systems :

- No renewable energy systems

## Smart Building

### BMS :

The building is intelligent because first it was thought so as to have reduced requirements. Then the building intelligence resides in the same energy use. The precise regulation of the atmosphere (external blinds, ventilation, etc.)

### Smartgrid :

Followed by live internet interface of building consumption

Users' opinion on the Smart Building functions : Automatic blinds are well regulated. Link to interview: <http://www.ecoffice-building.be/>

## Environment

## GHG emissions

GHG in use : 12,86 KgCO<sub>2</sub>/m<sup>2</sup>/an

### Methodology used :

Calculation of CO<sub>2</sub> emissions from heating consumption, ECS, lighting and auxiliary using conversion factors of primary energy / CO<sub>2</sub> (0.198 kg CO<sub>2</sub> / kWh EP for gas and 0.29 kg CO<sub>2</sub> / kWh for EP electricity)

## Life Cycle Analysis

On the lifecycle Ecoffice building (for a lifetime of 60 years), the impact of the materials considered more important than the impact associated with energy consumption if we consider that the positions covered by the PEB or similar gra

## Water management

Consumption from water network : 550,00 m<sup>3</sup>

Water Consumption/m<sup>2</sup> : 0.15

Water Consumption/Work station : 2.21

As the exact number of building users is not yet known (some still to be rented), the volume of water consumed in the use phase was estimated based on the building's surface (approx. 4000m<sup>2</sup>) with 550m<sup>3</sup> of water / year. This figure comes from measurements collected for 71 office buildings in Belgium between 2006 and 2010 and the surface-consumer relationship that was deducted (internal study).

## Indoor Air quality

Room ventilation is ensured by a system D (with recovery and evaporative cooling). Ventilation is therefore constantly monitored. Air filter unit which maintenance should be ensured The double flow units are equipped with filters.

## Comfort

**Health & comfort :** The initial choice of a lightweight construction was abandoned in favor of a heavy structure for its qualities of inertia and mechanical strength, but also for its cost to comparable environmental impact. Particular attention was paid to occupant comfort, a guarantee of good use of the building. To enable desk-regulation, the heat is distributed by a traditional hot water circuit and the support is provided by a condensing gas boiler. The ventilation system is oversized to ensure the necessary flow rates in intensive night ventilation in summer and a cold group is expected in reserve for possible heat waves. Lighting installations are optimized through the selection of well positioned with low consumption appliances and regulation by dimmers and motion sensors. Passive and BREEAM

certification label "Very Good" attest to the effectiveness of the solutions and sustainable building character. One of the standard criteria tertiary liability is checking comfort according to EN 13 251. We must encode the building in a dynamic simulation program by cutting the trays by zones. This encoding allows to assess the long term performance in naturally ventilated buildings. This criterion is based on the comfort theory of adaptive T °. This model takes into account the adaptability of a building (and occupation) to external conditions. The passive building into the mind of an "adaptive" building, which allows interaction between the occupant and the interior comfort (opening windows, clothes fit for a warm period, ...) Daylighting simulations of a building in the software encoding radiance and 3D models in the lab tests CSEC made under artificial sky (mirror-box) were used to study the influence of skylights on natural lighting.

**Calculated thermal comfort :** Entre 0 et 95 heures au dessus de 25°C sur le temps d'occupation selon le local

**Acoustic comfort :** Within the framework of BREEAM, an acoustic control was carried out to ensure compliance with the criteria.

## Products

### Product

Steelroc

HOLCIM

-

<http://www.holcim.be>

**Product category :** Structural work / Structure - Masonry - Facade

Metal fiber-reinforced concrete



Neopor

BASF

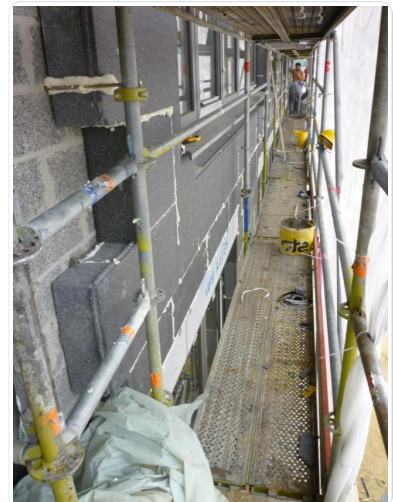
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<http://www.basf.be/>

**Product category :** Management / Others

EPS graphite insulation

Easy application



Dual flow ventilation unit

Swegon

info@swegon.fr

<http://www.swegon.com/>

**Product category :** HVAC, électricité / ventilation, cooling

CTA including a comfort ventilation High efficiency with low energy consumption (85% and 0.45 Wh / m<sup>3</sup> certified by PHI) despite significant usage rates (up to 9000 m<sup>3</sup> / h). This type of group is very suitable for passive tertiary buildings.



Validated

Gas condensing boiler

Remeha

info@remeha.be

<http://www.remeha.be>

Product category : HVAC, électricité / heating, hot water

Gas condensing boiler

Validated



Insulation for thermal breaks

Foamglas

info@foamglas.be

<http://be.foamglas.com>

Product category : Finishing work / Partitions, insulation

This product is used to achieve the thermal breaks junction walls (wall / roof, wall / floor slab; lambda value about 0.05 W / mK)

Validated



Chassis (frame)

Salamander

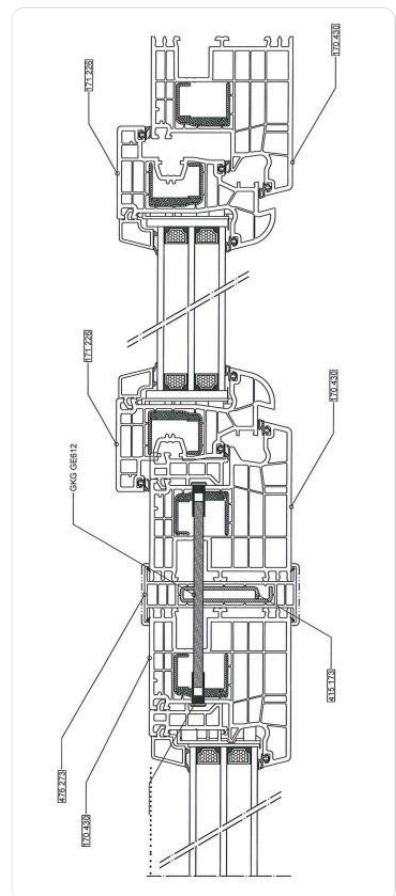
jckaes@sip.de

<http://www.sip-windows.com>

Product category : Finishing work / Exterior joinery - Doors and Windows

Performance PVC frame (Uf = 0.89 W / m<sup>2</sup>.K)

Validated



Triple glazing

Sprimoglass

-

<http://www.sprimoglass.be>

Product category : Finishing work / Exterior joinery - Doors and Windows

Triple glazing with high energy efficiency (Ug = 0.6, g = 0.61)



## Costs

## Construction and exploitation costs

Total cost of the building : 4 107 000 €

## Contest

## Reasons for participating in the competition(s)

**BâtimentZéro Energie**

Le bâtiment est, bien sûr, passif, ce qui signifie que les besoins de chaud et de froid sont réduits au minimum (environ 90% en moins par rapport à des bureaux traditionnels). Le bâtiment répond au standard passif avec des parois présentant des valeurs U comprises entre 0,17 et 0,23 W/m<sup>2</sup>K. Les fenêtres sont équipées de triple vitrage au nord, mais de double vitrage au sud. La ventilation est à double-flux, bien sûr, et l'échangeur à roue permet de réguler l'humidité. L'inertie de la construction est mise à profit grâce à des faux-plafonds partiels dans les zones de bureau.

De plus, un important travail a été également réalisé sur l'éclairage naturel afin de favoriser au maximum celui-ci : les profondeurs du bâtiment, le patio central et la distribution des fonctions assure une utilisation minimum d'éclairage artificiel. Les consommations d'éclairage constituent un des postes les plus importants des bâtiments tertiaires.

Des simulations d'éclairage naturel par un encodage du bâtiment dans le logiciel Radiance ainsi que les tests en maquettes 3D au labo du CSTC réalisés sous un ciel artificiel (mirror-box) ont permis d'étudier l'influence du puits de lumière sur l'éclairage naturel.

Une fois les besoins réduits au minimum, le travail a porté sur l'efficacité des installations. Ce processus permet d'amener les consommations du bâtiment au plus bas. De plus, un suivi (monitoring) des consommations réelles est lancé depuis la première occupation du bâtiment. Les résultats sont impressionnants.

**Smart Building**

Comme décrit ci-dessus, l'intelligence de ce bâtiment est de d'abord réduire les besoins et ensuite utiliser de l'énergie. Le suivi pertinent des données (chauffage, lumière, ventilation, surchauffe...) permet une régulation précise de l'ambiance (stores extérieurs, ventilation ..).

Géothermie (et nightcooling naturel) = économie d'énergie maximale mais coût d'investissement important et nécessité d'un appoint en été. Les solutions retenues sont : appoint de chauffage : chaudière gaz à condensation et radiateur + ventilation : double flux avec récupération de chaleur à roue. VMC surdimensionnée pour ventilation intensive en période estivale (nightcooling) + appoint de froid : un groupe de froid sur VMC.

**Santé et confort**

Dans l'évolution de l'approche architecturale, le passif s'est naturellement associé à la logique du cycle de vie du bâtiment. Il conduit à investir la durabilité particulière des structures, des murs et des parois, comme espace de projet. Réduire les technologies au profit de l'architecture a représenté un défi paradoxal, qui a engagé le projet dans une énergie toujours plus construite, low tech et moins livrée aux technologies. C'est aussi dans ce cadre qu'est adoptée la logique du Trias Energetica – « moins, mieux, autrement », qui commande de réduire d'abord les besoins (d'énergie, mais aussi surface, de matériaux, d'eau, etc.) par un travail sur la forme et la matière, avant de considérer l'amélioration des systèmes techniques et de recourir à d'autres formes de ressources (renouvelables, etc.).

**CONFORT**

Une attention particulière a été consacrée au confort des occupants, gage de la bonne utilisation du bâtiment. Pour permettre une régulation bureau par bureau, la chaleur est distribuée par un circuit à eau chaude traditionnelle et l'appoint est assuré par une chaudière au gaz à condensation. Le système de ventilation est surdimensionné pour assurer les débits nécessaires en ventilation intensive nocturne l'été et un groupe de froid est prévu en réserve pour d'éventuelles canicules. Les installations d'éclairage sont optimisées grâce au choix d'appareils à basse consommation bien positionnés et à une régulation par dimmers et capteurs de présence.

La certification passive et le label BREEAM « Very Good » attestent de l'efficacité des solutions retenues et du caractère durable du bâtiment.

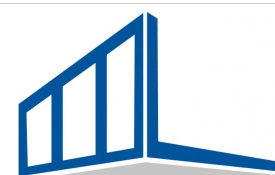
Un des critères du standard passif tertiaire est la vérification du confort suivant la EN 15 251.

On doit encoder le bâtiment dans un programme de simulation dynamique en découpant les plateaux par zones. Cet encodage permet également d'évaluer, sur le long terme, la performance dans les bâtiments ventilés naturellement. Ce critère est basé sur la théorie de confort de la T° adaptative. Ce modèle tient compte de l'adaptabilité d'un bâtiment (et l'occupation) aux conditions extérieures. Le bâtiment passif entre dans l'esprit d'un bâtiment « adaptatif », qui permet une interaction entre l'occupant et le confort intérieur (ouverture des fenêtres, ajustement des vêtements pendant une période chaude, ...)

## Building candidate in the category



Smart Buildings



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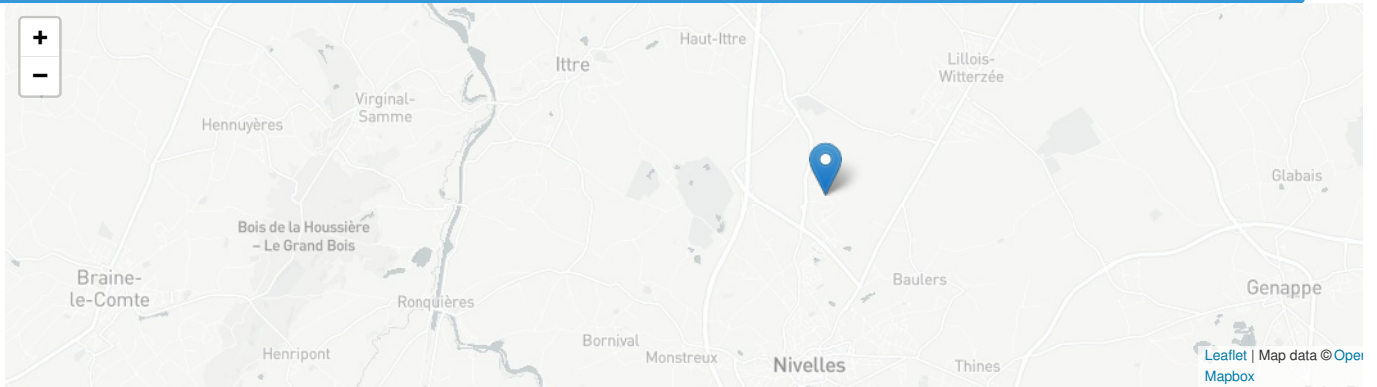


Bâtiment zéro énergie



Santé et confort

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