CLT multicomfort office building

by Victoria Bancila / ⏱ 2018-05-25 16:08:38 / International / 👁 9288 / 🏳 EN

New Construction

Primary energy need :

16.36 kWhpe/m².year

(Calculation method :)

ENERGY CONSUMPTION

Economical building   *Building*

< 50 **A**	**A**
51 à 90 **B**	
91 à 150 **C**	
151 à 230 **D**	
231 à 330 **E**	
331 à 450 **F**	
> 450 **G**	

Energy-intensive building

Building Type : Office building < 28m
Construction Year : 2014
Delivery year : 2016
Address 1 - street : DN 11 525300 RECI, COVASNA, Romania
Climate zone : [Dfb] Humid Continental Mild Summer, Wet All Year

Net Floor Area : 1 058 m² SHON
Construction/refurbishment cost : 1 587 000 €
Cost/m2 : 1500 €/m²

General information

In March 2014, Tecto Arhitectura was appointed to design the new office building for HSR factory in Reci, Covasna, as the first large scale project with CLT structure in south-east Europe. The main challenge was to create an office building for around sixty people that had to provide also an visual interface between two antagonistic spaces – an industrial platform used for production and a natural landscape with strong horizontal lines.

The project purpose was to design a flag-ship two-storey office building with a massive timber structure (according to the Austrian and Romanian building regulations), that follows also the standards for Multi Confort criteria (according to the guidelines enlisted by Saint Gobain). Nevertheless the project strategy was based on utmost ecological and long-term sustainability.

The team work between Tecto Arhitectura, the client and the project partners was to create an office building typology based on ecological and long-term sustainability as demonstration project and consequently to establish it in the market-financed office building market. The design work-flow followed four major objectives:

Mix timber construction: massive timber construction and glue laminated elements, industrially produced prefabrication.

Standards for Multi Comfort from Saint Gobain: individually room-controlled comfort and high-quality work environment, increased noise protection, passive construction method for insulation and airtightness, ventilation system with heat recovery.

Ecological concept: use of geothermal energy and high efficiency biomass cogeneration plant for heating and electricity, timber construction, optimization of utilities costs, green roofs, enhanced daylight autonomy, increased degree of recyclability for the entire building.

The rather ambitious goals set by owner in general as well as the additional provisions foreseen by the modules of subsidy could be realized to an even greater

extent.From the current perspective - subject to the short operation time – it can be said, that the project has been a great success. Besides that, the building was subject of various site measurements, tests and evaluation of users' satisfaction.

More than that, the office building has a very good energy efficiency, the energy certificate issued having a specific annual energy consumption (kWh/m2year) of 16.36 and a emission index equivalent CO2 (kgCO2/ m2year) of 1.22.

Already during the project development, a close cooperation between the partners was established. Without such engagement – also from the involved authorities, planners and builders, systems providers – at present it would not be possible to realize comparable projects and competitive construction costs. Therefore, such projects should be still considered as demonstration projects and analysed from this point of view.

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See more details about this project

- http://tecto.ro/portfolio/wood-offices-birouri-lemn/
- http://www.rigipstrophy.ro/proiecte/detaliu/36/cladire-birouri
- https://www.archdaily.com/886638/clt-multi-confort-office-building-tecto
- https://inhabitat.com/green-roofed-office-is-the-first-large-scale-clt-structure-in-southeast-europe/
- http://www.archilovers.com/projects/213726/first-clt-multi-comfort-office-building.html

Stakeholders

Contractor

Name : NIZAR CONSTRUCT/ BAVARIA ECOSYSTEM
Contact : Sacalus Stefan/ Kurt Theiss
http://www.nizar.ro/, www.bavariaecosystem.ro

Construction Manager

Name : TECTO ARHITECTURA
Contact : arh. Sergiu C. Petrea
http://tecto.ro/

Stakeholders

Function : Designer

TECTO ARHITECTURA

STR. BRAILITA, NO. 44, BUCHAREST

http://tecto.ro/
ARCHITECT

Type of market

Realization

If you had to do it again?

Already during the project development, a close cooperation between the partners was established. Without such engagement – also from the involved authorities, planners and builders, systems providers – at present it would not be possible to realize comparable projects and competitive construction costs. Therefore, such projects should be still considered as demonstration projects and analysed from this point of view.
Anyhow, the users were so satisfied that the owner, now expanding its business, contracted TECTO Arhitectura for a second office building, similar to this first one.

Building users opinion

"The Reci headquarter expresses credibility and confidence to all those visiting it. The image benefits are evident every time our partners praise the interior spaces having wide windows, effective ventilation and heating systems, which make us feel wonderful. Moreover, the spacious and properly equipped conference rooms give the premises for any meeting to be a successful one. On one hand, the building offers the optimum space for greeting partners and clients and, on the other hand, it also states the fact that the structure of the company is well consolidated, as the open space offices and their subtle organization encourage

collaboration among colleagues and closeness to all facilities. " (Adrian Radu, General Manager)

"The exterior combines the classical wood finish with our distinct shade of orange, in a linear geometry coming out of the green surroundings.
The structural solution puts emphasis on the specificity of our company, as the building sustains itself entirely on wood. Just imagining how working a day in such an office is can make one want to come work for our company. Besides, the atmosphere is so family-like! "
(Katalin Sárkány, Head Accountant)

„The building creates a cheerful and warm ambience, which makes you think about nature. Also, the welcoming and serene interiors accommodate both effectively working and enjoyable breaks."
(Anna Orosz, PR)

"What I like best about this building is the fact that it uses wood in a modern fashion. Many of the buildings in this area use wood as well, but none of them in a similar unconventional manner, making it unlike anything I have seen before. The wood pillars, beams and finishes complete the marble and glass surfaces, fashioning an impressive interior. "
(Melinda Tunya, Accountant)

Energy

Energy consumption

Primary energy need : 16,36 kWhpe/m^2.year

Primary energy need for standard building : 192,00 kWhpe/m^2.year

Calculation method :

CEEB : 0.0001

Breakdown for energy consumption : Heating 6,31;
Hot water 0,36;
AC 5,33;
Ventilation 2,30;
Lighting 2,05.

Envelope performance

Envelope U-Value : 0,12 W.m^{-2}.K^{-1}

More information :
Industrially produced prefabrication of wood-construction realized by KLH Massivholz in cooperation with Zimmerei Franz Galler.
Passive fire protection with Saint Gobain Rigips systems and Sika thermal resistant paints.
Use of complete systems for sealing the airtight building shell from Proclima – MOLL bauoekologi¬sche Produkte .
Innovative facade with extruded aluminium profiles and substructure from Pasteiner.

Building Compactness Coefficient : 0,46

Indicator : n50

Air Tightness Value : 0,60

Users' control system opinion :

Heating- Heat pump

Required
heating power (project): 122 W/sqm, totally needed 130 KW for the building

Actual
power consumption: 84 W/sqm, total required 88 KW for building.

Required
projected energy: 174 kWh/sqm*year, total required thermal energy building - 184.092 kWh / year

Real
power consumption: 109 kWh/sqm*year, total building 115500 kWh / year
(electricity: 115500: 4.5 = 25670 kWh).

Active
cooling – Heat Pump

Required
cooling power (project): 170 W/sqm, 180 kW required for the building

Actual
power consumption: 110 W/sqm, total needed 117 KW for the building.

Required
projected energy: 170 kWh /sqm*year, total required thermal energy building
180000 kWh / year

Actual
power consumption: 110 kWh/sqm*year, total building 117000 kWh / year
(electricity: 117000: 4.5 = 26000 kWh)

More information

Project's results
Specific annual energy consumption: 16.36 kWh/m2year
Specific annual energy consumption from renewable sources: 81.78 kWh/m2year

Heat Recovery Ventilation:
Required yield: maximum 6-7 shifts/hour.
CTA: maximum rated power 15,000 cm/hour.

Function:
The volume of cm/hour and the fresh air intake is automatically adjusted by the number of people (air consumption, CO2 sensor) and after cooling the rooms in summer.

Winter Heating season:
Theoretically: The heat recovery has a 80% efficiency at a nominal power of 15,000 cm/hour.
In real practice: The maximum volume reached an average of 6000 cm/hour, (40% of the projected power) with a 91% recovery of heating energy.

Summer cooling season:
Theoretically, the recovery system has a 30% rated output of 15,000 cm/hour
In real practice: The maximum volume has reached 9,000 cm/ hour (60% of the projected power) with a 45% recovery of cooling energy.

Real final energy consumption

Final Energy : 16,36 kWhfe/m^2.year

Real final energy consumption/m2 : 16,36 kWhfe/m^2.year

Real final energy consumption/functional unit : 16,36 kWhfe/m^2.year

Year of the real energy consumption : 2 016

Renewables & systems

Systems

Heating system :
- Geothermal heat pump
- Combined Heat and Power
- Low temperature floor heating

Hot water system :
- Heat pump

Cooling system :
- Geothermal heat pump

Ventilation system :
- Natural ventilation
- Double flow heat exchanger

Renewable systems :
- Heat pump (geothermal)

Renewable energy production : 100,00 %

Other information on HVAC :
Heat and cold storage in puffer systems with instant domestic hot water preparation systems, effective against legionella diseases.

Use of heat pumps from Bartl for cooling and soil regeneration during summer.
Use of new generation of earth collector from GeoKOAX which features up to 6.5 times as much carrier fluid volume as conventional probe systems. This permits a precise release of the required energy at a constant temperature and longer down-times of the heat pump, which are relevant for annual performance figures.

Smart Building

BMS :
HLC SYSTEM SPS (BMF) FREE PROGRAMMING

Systems are fully programmable and are suitable to be used to manage almost all services and ancillary functions.

They can be used for integrated management of energy system (interior climate and lighting), to irrigate green spaces and automatic shading control.

They can be customized for alternative usage scenarios and run simulations in real time.

They can store information for monitoring and have remote control functions

Users' opinion on the Smart Building functions :

"I enjoy coming to work daily as the wide, luminous windows allow the view over the surroundings. The fact that the offices are being used by other than a couple of people make the work setting more than a labour space, namely a place to interact with colleagues.

All in all, it's a modern and stylish building."

(Enikő Tóth, Purchaser)

Environment

Urban environment

The building is set in an industrial site, at the end of the platforms, aside the main entrance. The office building is the representative one among the site elements, relating to the neighboring social building and the natural environment. Besides the industrial buildings, there are no other constructions nearby.

Land plot area : 695 291,00 m^2

Built-up area : 1 655,00 %

Green space : 1 000,00

Products

Product

RIGIPS: / Fire rated and partition walls and ceilings, Active Air, Rigips fonic, Gyptone-Rw: 13, Rw: 55, Rw: 46, EI 90, EI30

RIGIPS SAINT GOBAIN

http://www.rigips.ro/

☑ http://www.rigips.ro/

Product category : Second œuvre / Cloisons, isolation

Acoustic, Durability, Design, Humidity and fire resistance

All products were highly valued and appreciated during use, through their result in comfort and efficiency.

GLASS PLAINCLEAR COOL-LITE SKN, PLAINCLEAR PLAINTHERM XN-Solar

SAINT GOBAIN

http://saint-gobain.ro/

☑ http://saint-gobain.ro/

Product category : Second œuvre / Menuiseries extérieures

Solar control, Acoustic, Security Solar factor g value 0.37, Thermal resistance 0.6

All products were highly valued and appreciated during use, through their result in comfort and efficiency.

Isover PLA120+100, Isover Akusto Twin, Isover Akusto 75, Isover TDPT 50-

ISOVER SAINT GOBAIN

http://www.isover.ro/

☑ http://www.isover.ro/

Product category : Second œuvre / Cloisons, isolation

All products were highly valued and appreciated during use, through their result in comfort and efficiency.

Thermal insulation, Durability, Phono insulation ΔRw (dB): 44, ΔRw (dB): 42, ΔLw (dB): 29, thermal resistance: 3.4+2.85, 1.9, 1.25, 1.5

Superflex 100, D2, Max

Weber

https://www.weber.ro/pagina-principala.html

🔗 https://www.weber.ro/pagina-principala.html

Product category : Gros œuvre / Charpente, couverture, étanchéité

Waterproof, Resistance

All products were highly valued and appreciated during use, through their result in comfort and efficiency.

SHADING DEVICES WAREMA E80 A6 S

WAREMA

https://www.warema.com/en/

🔗 https://www.warema.com/en/

Product category : Gros œuvre / Système passif

functional

All products were highly valued and appreciated during use, through their result in comfort and efficiency.

FRONT WA VAPOUR CHECK AND AIRTIGHTNESS PLOYETHILENE MICROFIBRE MEMBRANE

PROCLIMA

Proclima

🔗 https://proclima.com/products

Product category : Gros œuvre / Charpente, couverture, étanchéité

resistance, high quality

All products were highly valued and appreciated during use, through their result in comfort and efficiency.

Green terrace

Optigreen

https://www.optigreen.com/

🔗 https://www.optigreen.com/

Product category : Gros œuvre / Charpente, couverture, étanchéité

easy to maintain and install, aesthetic qualities

All products were highly valued and appreciated during use, through their result in comfort and efficiency.

Lighting devices, Efficient modular LED lighting systems

Zumtobel

http://www.zumtobelgroup.com/en/

🔗 http://www.zumtobelgroup.com/en/

Product category : Génie climatique, électricité / Eclairage

All products were highly valued and appreciated during use, through their result in comfort and efficiency.

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Industrially produced prefabrication of wood-construction

KLH Massivholz in cooperation with Zimmerei Franz Galler.

http://www.klhuk.com/

🔗 http://www.klhuk.com/

Product category : Gros œuvre / Structure, maçonnerie, façade

resistance, aesthetics

All products were highly valued and appreciated during use, through their result in comfort and efficiency.

Costs

Health and comfort

Life Cycle Analysis

Material impact on GHG emissions :
750

Eco-design material :

Timber is the only truly renewable construction material, with the lowest energy consumption of any building material across its lifecycle.

The use of timber in the construction of buildings aims to achieve negative net CO2 emissions.

The timber used for the construction of the office building stores approx. 750 tones of carbon for the life of the building.

Mix timber construction: massive timber construction and glue laminated elements, industrially produced prefabrication.

Water management

Smart sensor controlled faucets and water closets for water rationalisation.
Also, a vast 1000 sqm green roof improves thermal performance, preventing rapid temperature fluctuations and overheating effects throughout the day
It also protects against dust, acts as a buffer for heavy rains and completes the landscape because of the use of local plants and by returning to nature the footprint of the building.

Indoor Air quality

Formaldehyde concentration: In-house determination by Rigips Romania using "PPM Formaldemeter™" mesurement tool.

The volume of cm/hour and the fresh air intake is automatically adjusted by the number of people (air consumption, CO2 sensor) and after cooling load during summer.

Comfort

Health & comfort : Health, security and comfort were high valued during the design and construction process. This is why the office building complies with the multi comfort Saint Gobain standards.

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<p class="MsoNormal" style="margin-bottom:0cm;margin-bottom:.0001pt;line-height:
 normal">Saint Gobain MC Criteria

<td width="109" nowrap="" valign="bottom" style="width:81.75pt;border:solid windowtext 1.0pt;
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<p class="MsoNormal" align="center" style="margin-bottom:0cm;margin-bottom:.0001pt;
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<td width="198" nowrap="" valign="bottom" style="width:148.5pt;border:solid windowtext 1.0pt;
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0cm 5.4pt 0cm 5.4pt;height:21.0pt">
<p class="MsoNormal" style="margin-bottom:0cm;margin-bottom:.0001pt;line-height:
 normal"> Heating energy demand <span lang="EN-GB" style="font-family:"Arial Narrow",sans-serif;mso-ansi-language:
 EN-GB">kWh/m2year

<td width="109" nowrap="" valign="bottom" style="width:81.75pt;border-top:none;
 border-left:none;border-bottom:solid windowtext 1.0pt;border-right:solid windowtext 1.0pt;
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<p class="MsoNormal" align="center" style="margin-bottom:0cm;margin-bottom:.0001pt;
 text-align:center;line-height:normal">6.3

<td width="198" nowrap="" valign="bottom" style="width:148.5pt;border:solid windowtext 1.0pt;
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<p class="MsoNormal" style="margin-bottom:0cm;margin-bottom:.0001pt;line-height:
 normal"> Cooling energy demand <span lang="EN-GB" style="font-family:"Arial Narrow",sans-serif;mso-ansi-language:
 EN-GB">kWh/m2an

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windowtext 1.0pt;
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<p class="MsoNormal" style="margin-bottom:0cm;margin-bottom:.0001pt;line-height:<br> normal"> Air-tightness n50 (V/h)

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<p class="MsoNormal" align="center" style="margin-bottom:0cm;margin-bottom:.0001pt;<br> text-align:center;line-height:normal">NA



<td width="198" nowrap="" valign="bottom" style="width:148.5pt;border:solid windowtext 1.0pt;<br> border-top:none;mso-border-left-alt:solid windowtext .5pt;mso-border-bottom-alt:
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<p class="MsoNormal" style="margin-bottom:0cm;margin-bottom:.0001pt;line-height:<br> normal"> Day lighting

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<p class="MsoNormal" align="center" style="margin-bottom:0cm;margin-bottom:.0001pt;<br> text-align:center;line-height:normal">60%



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0cm 5.4pt 0cm 5.4pt;height:15.75pt">
<p class="MsoNormal" style="margin-bottom:0cm;margin-bottom:.0001pt;line-height:<br> normal"> Summer comfort (overheating % of
season

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<td width="198" nowrap="" valign="bottom" style="width:148.5pt;border:solid windowtext 1.0pt;<br> border-top:none;mso-border-left-alt:solid windowtext .5pt;mso-border-bottom-alt:
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0cm 5.4pt 0cm 5.4pt;height:15.75pt">
<p class="MsoNormal" style="margin-bottom:0cm;margin-bottom:.0001pt;line-height:<br> normal"> Between offices R'w

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<p class="MsoNormal" align="center" style="margin-bottom:0cm;margin-bottom:.0001pt;<br> text-align:center;line-height:normal">55 dB



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0cm 5.4pt 0cm 5.4pt;height:15.75pt">
<p class="MsoNormal" style="margin-bottom:0cm;margin-bottom:.0001pt;line-height:<br> normal"> Between offices L'n,w

<td width="109" nowrap="" valign="bottom" style="width:81.75pt;border-top:none;<br> border-left:none;border-bottom:solid windowtext 1.0pt;border-right:solid windowtext 1.0pt;
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`<p class="MsoNormal" align="center" style="margin-bottom:0cm;margin-bottom:.0001pt;<br> text-align:center;line-height:normal">< 62dB`

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`0cm 5.4pt 0cm 5.4pt;height:15.75pt">`
`<p class="MsoNormal" style="margin-bottom:0cm;margin-bottom:.0001pt;line-height:<br> normal"> Reverberation period`

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`<p class="MsoNormal" align="center" style="margin-bottom:0cm;margin-bottom:.0001pt;<br> text-align:center;line-height:normal">0.5`

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`0cm 5.4pt 0cm 5.4pt;height:15.75pt">`
`<p class="MsoNormal" style="margin-bottom:0cm;margin-bottom:.0001pt;line-height:<br> normal"> Exterior noise`

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`padding:0cm 5.4pt 0cm 5.4pt;height:15.75pt">`
`<p class="MsoNormal" align="center" style="margin-bottom:0cm;margin-bottom:.0001pt;<br> text-align:center;line-height:normal">< 20dB`

The means of obtaining these goals are: `<span lang="EN-GB" style="font-size:11.0pt;line-height:<br>107%;font-family:"Arial Narrow",sans-serif;mso-fareast-font-family:Calibri;`
`mso-fareast-theme-font:minor-latin;mso-bidi-font-family:"Times New Roman";`
`mso-bidi-theme-font:minor-bidi;mso-ansi-language:EN-GB;mso-fareast-language:`
`EN-US;mso-bidi-language:AR-SA">`Passive fire protection with Saint Gobain Rigips
systems and Sika thermal resistant paints.`<p class="MsoNormal" style="margin-top:0cm;margin-right:.7pt;margin-bottom:0cm;<br>margin-left:0cm;margin-bottom:.0001pt;text-align:justify;tab-stops:18.0pt">`Protection
against overheating with exterior and interior sensor controlled blinds from
Warema.`<p class="MsoNormal" style="margin-top:0cm;margin-right:.7pt;margin-bottom:0cm;<br>margin-left:0cm;margin-bottom:.0001pt;text-align:justify;tab-stops:18.0pt">`Additional
arrangements to reduce airflow noise protection.`<p class="MsoNormal" style="margin-top:0cm;margin-right:.7pt;margin-bottom:0cm;<br>margin-left:0cm;margin-bottom:.0001pt;text-align:justify;tab-stops:18.0pt">`Efficient
modular LED lighting systems from Zumtobel Lighting with sensor and BMS
control.`<p class="MsoNormal" style="margin-top:0cm;margin-right:.7pt;margin-bottom:0cm;<br>margin-left:0cm;margin-bottom:.0001pt;text-align:justify;tab-stops:18.0pt">`Floor
heating / cooling and heat recovery ventilation from ALKO.`<p class="MsoNormal" style="margin-top:0cm;margin-right:.7pt;margin-bottom:0cm;<br>margin-left:0cm;margin-bottom:.0001pt;text-align:justify;tab-stops:18.0pt">`Smart
sensor controlled faucets and water closets for water rationalisation.`<p class="MsoNormal" style="margin-top:0cm;margin-right:.7pt;margin-bottom:0cm;<br>margin-left:0cm;margin-bottom:.0001pt;text-align:justify;tab-stops:18.0pt">`Individually
room-control and BMS from Hanazeder Electronic for exterior and interior
shading, light control and water management systems

Calculated indoor CO_2 concentration :
10%

Measured indoor CO_2 concentration :
10%

Calculated thermal comfort : 20°C
Measured thermal comfort : Summer comfort overheating % of season< 5
Acoustic comfort : `<table class="MsoNormalTable" border="0" cellspacing="0" cellpadding="0" width="307" style="width:230.25pt;margin-left:17.75pt;border-collapse:collapse;mso-yfti-tbllook:<br> 1184;mso-padding-alt:0cm 5.4pt 0cm 5.4pt">`

`<td width="198" nowrap="" valign="bottom" style="width:148.5pt;border:solid windowtext 1.0pt;<br> border-top:none;mso-border-left-alt:solid windowtext .5pt;mso-border-bottom-alt:`
`solid windowtext .5pt;mso-border-right-alt:solid windowtext .5pt;padding:`
`0cm 5.4pt 0cm 5.4pt;height:15.75pt">`
`<p class="MsoNormal" style="margin-bottom:0cm;margin-bottom:.0001pt;line-height:<br> normal"> Between offices R'w`

`<td width="109" nowrap="" valign="bottom" style="width:81.75pt;border-top:none;<br> border-left:none;border-bottom:solid windowtext 1.0pt;border-right:solid windowtext 1.0pt;`
`mso-border-bottom-alt:solid windowtext .5pt;mso-border-right-alt:solid windowtext .5pt;`
`padding:0cm 5.4pt 0cm 5.4pt;height:15.75pt">`

<p class="MsoNormal" align="center" style="margin-bottom:0cm;margin-bottom:.0001pt;
 text-align:center;line-height:normal">55 dB

<td width="198" nowrap="" valign="bottom" style="width:148.5pt;border:solid windowtext 1.0pt;
 border-top:none;mso-border-left-alt:solid windowtext .5pt;mso-border-bottom-alt:
solid windowtext .5pt;mso-border-right-alt:solid windowtext .5pt;padding:
0cm 5.4pt 0cm 5.4pt;height:15.75pt">
<p class="MsoNormal" style="margin-bottom:0cm;margin-bottom:.0001pt;line-height:
 normal"> Between offices L'n,w

<td width="109" nowrap="" valign="bottom" style="width:81.75pt;border-top:none;
 border-left:none;border-bottom:solid windowtext 1.0pt;border-right:solid windowtext 1.0pt;
mso-border-bottom-alt:solid windowtext .5pt;mso-border-right-alt:solid windowtext .5pt;
padding:0cm 5.4pt 0cm 5.4pt;height:15.75pt">
<p class="MsoNormal" align="center" style="margin-bottom:0cm;margin-bottom:.0001pt;
 text-align:center;line-height:normal">< 62dB

<td width="198" nowrap="" valign="bottom" style="width:148.5pt;border:solid windowtext 1.0pt;
 border-top:none;mso-border-left-alt:solid windowtext .5pt;mso-border-bottom-alt:
solid windowtext .5pt;mso-border-right-alt:solid windowtext .5pt;padding:
0cm 5.4pt 0cm 5.4pt;height:15.75pt">
<p class="MsoNormal" style="margin-bottom:0cm;margin-bottom:.0001pt;line-height:
 normal"> Reverberation period

<td width="109" nowrap="" valign="bottom" style="width:81.75pt;border-top:none;
 border-left:none;border-bottom:solid windowtext 1.0pt;border-right:solid windowtext 1.0pt;
mso-border-bottom-alt:solid windowtext .5pt;mso-border-right-alt:solid windowtext .5pt;
padding:0cm 5.4pt 0cm 5.4pt;height:15.75pt">
<p class="MsoNormal" align="center" style="margin-bottom:0cm;margin-bottom:.0001pt;
 text-align:center;line-height:normal">0.5

<td width="198" nowrap="" valign="bottom" style="width:148.5pt;border:solid windowtext 1.0pt;
 border-top:none;mso-border-left-alt:solid windowtext .5pt;mso-border-bottom-alt:
solid windowtext .5pt;mso-border-right-alt:solid windowtext .5pt;padding:
0cm 5.4pt 0cm 5.4pt;height:15.75pt">
<p class="MsoNormal" style="margin-bottom:0cm;margin-bottom:.0001pt;line-height:
 normal"> Exterior noise

<td width="109" nowrap="" valign="bottom" style="width:81.75pt;border-top:none;
 border-left:none;border-bottom:solid windowtext 1.0pt;border-right:solid windowtext 1.0pt;
mso-border-bottom-alt:solid windowtext .5pt;mso-border-right-alt:solid windowtext .5pt;
padding:0cm 5.4pt 0cm 5.4pt;height:15.75pt">
<p class="MsoNormal" align="center" style="margin-bottom:0cm;margin-bottom:.0001pt;
 text-align:center;line-height:normal">< 20dB

Carbon

GHG emissions

GHG in use : 1,22 $KgCO_2/m^2$/year

Methodology used :
according to Renewable Energy Directive (RED)

Building lifetime : 50,00 year(s)

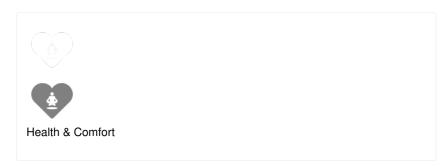## Contest

Reasons for participating in the competition(s)
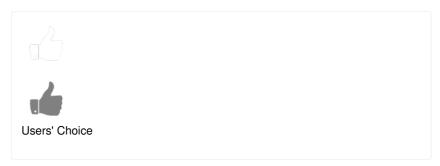
Building candidate in the category

Green Solutions

Energy & Temperate Climates

Health & Comfort

Users' Choice

Leaflet | Map data © OpenStreetMap Mapbox