Sensations project: construction of the first **100% wood structure program**

With a level of wood construction never seen before in France, Bouygues Immobilier's SENSATIONS construction program stands out for its ability to meet climate challenges. With its passive energy and low-carbon buildings, SENSATIONS is an exemplary residence, part of an economic and ecological approach to the housing of the future.

Starting date of the project	**October 2017**: start of the construction **June 2019**: delivery of the building
Project Localisation Places of implementation of the project at this stage and targeted geography if replicable.	Strasbourg, Bas Rhin. The four plots of land dedicated to the construction of this real estate complex are located in the Deux-Rives district, which is reclaiming former harbor land near the Rhine.
Project objectives Type of climate innovation of the project with a description of the problem/issue addressed	Facing climate change, traditional building design methods have reached their limits and it is no longer possible to design buildings isolated from their external environment. It is therefore necessary to integrate climate change resilient architectural solutions from the very first stages of design. With its SENSATIONS building programme, Bouygues Immobilier is following this logic of the housing of the future by proposing the first housing structure made of mostly natural, recyclable materials with low pollutant emissions. It is powered by a geothermal heat pump.

Detailed project description	Bouygues Immobilier's Sensations construction program aims to build France's tallest residential tower made entirely of wood. A pioneer of its kind, this project reaches a height of 38 meters, with a surface area of 9,282 m² distributed as follows 146 apartments, from studio to T5, and 6 commercial spaces, spread over 3 buildings of 8 to 11 floors.
	
	<u>Architectural description:</u>
	
	The project is avant-garde in many ways, particularly in its structure. The whole of the 3 buildings is almost entirely made of natural and biosourced materials, including the vertical circulation cores, i.e. the elevators and the staircases. In total, 3,500 m3 of wood were required to erect the whole. Like the floors, the load-bearing walls and the facade, they are made of cross-laminated timber (CLT panel), combined with a laminated wood. Only the flights of stairs and the load bearing first floor base are made of concrete, for regulatory reasons. Bathed in natural light, a guarantee of well-being and energy savings, most of the apartments are walk-through and systematically offer an outdoor living space: balcony, terrace or private garden.
	
	<u>Building energy:</u>
	
	• Heating is provided by a geothermal heat pump and a collective condensing gas boiler as a backup. This combination provides the energy needs of the building, to produce both heating and domestic hot water.
	• Cooling is carried out by natural-cooling via geothermal energy. In the RT2012 calculation engine, the cooling is simulated by a heat pump with a COP of 100 and an absorbed power of 20 kW corresponding to the power of the well pumps and circulator.
	• The ventilation is provided by a single flow humidity sensitive type B with low consumption boxes. The extractors are installed on the roof terraces of the building.
	• The structure of SENSATIONS meets a passive energy level, underlined by the NF Habitat HQE (High Environmental Quality) certification. Its performance levels meet the most stringent and advanced requirements: RT2012 level Bepas and BBCA level Excellence.
	
	<u>Environmental impact of the building:</u>
	
	• **Life cycle analysis:**
	  ○ False ceilings are able to eliminate 80% of the main volatile organic compounds (VOC);
	  ○ Floor coverings are made of natural and recyclable materials;
	  ○ Wall paints are classified A+ with low solvent emissions; In addition, fire and seismic risks have been anticipated: the technicality of cross-laminated timber panels (CLT) ensures the most drastic guarantees.

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- **Indoor air quality:** representing 9,282m² of surface area, the 3 SENSATIONS buildings pay particular attention to indoor air quality. The buildings have low pollutant emissions, guaranteeing a healthier environment that respects nature. The indoor air quality of the apartments is improved using low-emission materials covering the walls, ceilings and floors.

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<tr><td>Main project's drivers for reducing the greenhouse gas emissions</td><td>

Reduction levers	Details on the aspects of the project
☐ Energy and resource efficiency (including behaviour)	
☒ Energy Decarbonisation	Use of a geothermal heat pump Cooling by natural cooling
☒ Energy efficiency improvements	100% wooden structure
☐ Improving efficiency in non-energy resources	
☒ Emissions absorption: creation of carbon sinks, negative emissions (BECCS, CCU/S, ...)	Creation of carbon sinks via the wood used in the building structure
☐ Financing low-carbon producers or disinvestment from carbon assets	
☐ Reduction of other greenhouse gases emission	

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<tr><td>Emission scope(s) on which the project has a significant impact and quantification of GHG emission reductions per emission scope</td><td>

	Aspects of the project contributing to the reduction of emissions by emission category	Quantification of associated GHG emissions by emission category Please follow the quantification methodology used in the Afep guidelines.
Reduction of the company's carbon dependency		
Scope 1 *Direct emissions generated by the company's activity.*		
Scope 2 *Indirect emissions associated with the company's electricity and heat consumption.*		
Scope 3 *Emissions induced (upstream or downstream) by the company's activities, products and/or services in its value chain.*	Use of low carbon wood construction for the building structure.	The building emits 593 kgCO2eq/m² during the construction phase, i.e. 150 kgCO2eq/m² less than an average traditional building in France. This means that this building saves 1,400 teqCO
Increase of carbon sinks		
Emissions Absorption *Carbon sinks creation, (BECCS, CCU/S, …)*	Creation of carbon sinks via the wood used in the building structure	The EHSF of the CLT panel from KLH gives the value of biogenic carbon storage during the product's life. It is 92.3 kgCO2eq for 0.12 m3. Knowing that there are 3,500 m3 in the building, this makes 2,700 tCO2eq stored.
GHG emissions avoided by the company at third parties		
Avoided Emissions *Emissions avoided by the activities, products and/or services in charge of the project, or by the financing of emission reduction projects.*		

Clarification on the calculation or other remarks: /

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<tr><td>Modality of verification of the quantification.</td><td>

Calculation standard used (ADEME base, GHG protocol, etc.): It is the Life Cycle Analysis of the building that gave the quantities of CO_2.

Verification of the calculation (internal or external): This calculation was carried out by an external research unit and validated via the BBCA label

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<tr><td>Other environmental and social benefits of the project</td><td>

The Sensation program contributes to the following SDGs:

- SDG 12 Responsible consumption and production
- SDG 13 Climate action

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Project maturity level	☐ Prototype laboratory test (TRL 7) ☐ Real life testing (TRL 7-8) ☐ Pre-commercial prototype (TRL 9) ☐ Small-scale implementation ☒ Medium to large scale implementation **Remarks**: Sensations was the tallest wooden tower in France at the time of delivery, but it was able to draw on the entire wood industry to fit into these new construction methods.
Capacity and conditions of the project reproducibility, with associated climate impact mitigation potential	This project is entirely reproducible. All that is needed is a suitable piece of land to house the building.
Amount of investment made (in €)	The construction and operating costs of the project amount to €19 million.
Economic profitability of the project (ROI)	☐ ST (0-3 years) ☐ MT (4-10 years) ☒ LT (> 10 years) **Remarks:**
Engaged partnerships	Several stakeholders were involved in the construction of this eco-responsible building: • **Owner**: Bouygues Immobilier ; • **Project management**: KOZ Architectes (representative), ASP Architecture (associate), Ingénierie Bois (wood structure), Illios (fluids), Aïda Acoustique (acoustics); • **Control office**: Socotec; • **General contractor**: Eiffage Construction (Altibois timber frame).
Open comments from the project owner	The innovative and groundbreaking project has allowed the entire team (developer, project management and contractors) to make progress on this type of construction. It has shown the way for other works.
More about the project	
Contact the company carrying the project	j.brisebourg@bouygues-immobilier.com
Project URL links	https://www.construction21.org/france/case-studies/h/sensations.html
Illustrations of the project