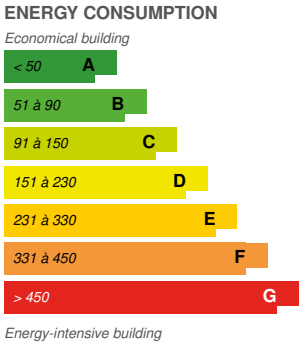
Experimental Building "Le Gabion"

by Nicolas Guignard / 2014-10-06 15:29:03 / France / 8500 / FR

Primary energy need :

50 kWhep/m².an

(Calculation method : RT 2005)



Building Type : Other building
Construction Year : 2013
Delivery year : 2013
Address 1 - street : Le pont neuf 05200 EMBRUN, France
Climate zone :

Net Floor Area : 550 m² Useful area (es)
Construction/refurbishment cost : 700 000 €
Cost/m2 : 1272.73 €/m²

General information

"Le Gabion" is a French association created in 1993 by Richard and Liliane Lacortiglia. Since its creation, the association aims to take into account the human and environmental dimensions in construction.

In 2002, their rent contract coming to an end, the association "Le Gabion" had to leave the premises. One individual had bequeathed a 11 hectares estate to the city of Embrun. Le Gabion submitted their project for that estate to one of the candidates for the city hall. The Mayor, once elected, left a part of the estate (6 000m²) for the association under an emphyteutic lease. The parcel hosts a mansion and offered construction opportunities.

The project is designed to be built as a "school-building site" and to be used as a pedagogical support for the various trainings: patrimonial conservation, construction with natural materials and experimentation.

Construction started in 2005 and was unveiled in october 2013, celebrating the 20 years anniversary of the association at the same time.

Program:

- On the ground floor, a 200m² woodworking workshop
- On the second floor, 150 m² of classrooms
- On the third floor, a still vacant space

Sustainable development approach of the project owner

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The main goal of this project was to provide support to social inclusion over a long period initially planned on six years of construction and to allow experimentations in order to demonstrate the untapped potential of natural and local materials. The building now serves as a training ground in eco-construction. Preparation work was done throughout the year 2002. A working group was gathered under the leadership of architect Marcel Ruchon to define specifications.

The association "Le Gabion" built the whole building, through the intermediary of persons in aid contracts, supervised by salaried staff of the association. The building first was built in different phases to realize several cycles of training (for instance: Foundations inserted in three times). This system has slowed down the construction. Once the ground floor done, decision was made to segmenting the construction of higher floors.

Territory and site:
- Insertion of the building in its immediate environment: When filing the building permit, the parcel was not subject to the land use plan which allowed to avoid architectural constraints. The constructible area of the plot was fairly small and determined the location of the building, oriented east-west. Therefore, solar shading on the east, created by the mountain, couldn't be spared.
- Bioclimatic design: The compactness of the building reduces the sources of losses. The inertia is provided by the dirt floor slab and some concrete walls and the concrete slab on the second floor, the clay bricks partitions and clay wall plaster on the interior and exterior sides. Thus, the inertia class of the ground floor is heavy and the inertia of the second and third floors is average. The glazed surface has been calculated so to foster a passive solar gain.

- Site and territory resources: The construction of this building had a direct local impact, especially with two companies specialized in straw-based construction, located in Embrun. The wealth of the territory in raw materials, allowed almost all necessary materials

Materials and building site:
Technics and operations: The constructive systems used in this project are based on the know-how rather than on the easy implementation of industrial materials. Therefore, for the same mechanical resistance, stapled solid wood beams were preferred glue laminated beams. The atypical character of the "heating" partitions made out of compressed clay bricks is its ability to leave, to the extremity of the wall, one hollow brick over two to facilitate the flow of the sheath in the end wall (curvature).
- Management of nuisances: Since all materials are natural and healthy, th construction of the building didn't induce any environmental nuisance. The site being isolated, no specific measure was taken to limit disturbance to the neighborhood. The presence of a high voltage line has made it impossible for a crane to be assembled for the east side operations. Fire safety during the construction phase was difficult to comply with because of the the timber frame combined with strawbale insulation, especially since the building is meant to be opened to the public.
- Flexibility with usage evolutions: The large surface of the ground floor can easily be set up depending on the training provided by the association. The destination of the second floor is not yet quite defined.
- Innovative approaches: The earth plaster and gypsum plaster tests realized with the Ecole Nationale des Ponts et Chaussées and the company Vieujot showed their potential for energy balance (2/3 of earth from the site and 1/3 of raw plaster or plaster alone). Also, the wood composite floor / concrete makes heavy use of wood and minimal use of concrete, while keeping the same mechanical, acoustic and thermal qualities as a 100% concrete floor. Two other non-negligible benefits of this type of floor are the main possible litters (over 10 m), relatively light weight and ease of crossing networks. The concrete part in the bracing and the recovery of compressive loads, so it reduces the sections of wood.

Energy and Waste:
- Reduction in consumption of energies: The cork based insulation in periphery of the ground floor slab and the straw bale insulation of the walls limit losses. Inertia retains then releases heat. Also, the two layers of coating (interior and exterior) and the position of doors and windows avoiding air leaks, participate in the tightness of the building. All these measures aim to reduce energy consumption.
- Service, maintenance, metrology: The building has been equipped, in 2013, with measuring devices in partnership with the Association for the Promotion of Renewable Energies - PPER -. The collected data will serve as a pedagogical support for training on heating the building.
Comfort and health:
-Hydrothermal comfort: Inertia provided by different walls supplemented by insulation reinforced with straw or cork is a compromise to retain heat and warm up quickly enough the building. In addition, the flet temperature with the heating walls is about 5°C greater than the actual temperature, which lowers the setpoint temperature.
- Visual Comfort: The big bay window offers a view of Embrun and the mountains in the south. It also helps providing the most of natural light.
- Sound insulation: Some walls are made of a wood frame with infill buffer straw bales to provide sound insulation. The floor on the second floor is also designed to limit the transmission of noise.
- Usability, aesthetics: The interior coatings were all done by employees with an iad contract, novices in the matter. To harmonize the overall look, a napped finish was chosen. The result is an appearance of the irregular walls, which highlights the experimental aspect of this building.
- Accessibility: The natural slope of the terrain make the ground floor and the first floor accessible by people with limited mobility.
Social and Economics
- Public Consultation: The construction of this building experimental generated nearly 150 aided contracts in the region of Embrun. Two thirds of the people were not trained in the building trades. They therefore took this opportunity to acquire new skills. These contracts are intended to any type of people, such as the unemployed, people with disabilities, young people with no training, long term unemployed people. The people of the region changed the way they look on people having insertion difficulties, mostly unskilled, thanks to aided contracts which enabled their inclusion among the active population. However, the project has not been well perceived in the beginning, by local companies that may have had a feeling of unfair competition regarding the work done by these people in precarious status competition. Companies have now changed their mind and the association “Le Gabion” became a member of CAPEB.
- Awareness of the users: The construction of the building is a support project for both actions that are "social" and "training" and is still currently a training.
- Project life: For five years, the building is frequently visited and generates a lot of interest. The association can raise awareness, provide information on the strawbale based construction and more generally the ecoconstruction to a large audience. In addition to creating vocations, Le Gabion also fosters the creation of companies in the ecoconstruction field throughout France.
- Overall cost / cost-sustainable profits: No calculation on the overall cost of the project were made. However, the materials used, natural and non-manufactured, as well as some technical equipment installed limit the maintenance costs and ensure sustainability.

Architectural description

Program:
- On the ground floor, a 200m² woodwork workshop.
- On the 1st floor, 1 150m² of classrooms
- On the 2nd floor, still vacant space
A small 45m² building, called the Grass Hut, has preceded the construction of the building to experiment different techniques. The first wish of the association was to build a building with an architecture of "gathering". Meaning to collect materials in the immediate environment such as the larch timber frame and strawbale insulation. Also, sobriety and simplicity of technical equipment were looked for.

The original layout of the building was 200m² floor including a woodworking shop in the ground floor, a storage material for construction of 75m² and 150m² of students accommodation upstairs. In the end, the need for training space led to leave out the hosting part of the project and dedicate this surface to classrooms. A cottage located nearby can accommodate trainees on short or long periods. The evolution of the project during construction led to the addition of an extra floor. The construction of the building is a very experimental evolutionary project. The change of destination and plans during the construction phase did not facilitate the coordination and implementation especially when it came to join the various constituent items of the roof.

See more details about this project

http://www.enviroboite.net/batiment-experimental-le-gabion-embrun-05

Stakeholders

Stakeholders

Function : Contractor

Association Le Gabion

M. Limousin, Directeur des travaux / 04 92 43 89 66

http://gabionorg.free.fr/

Function : Construction Manager

Les Pressés de la Cité

38250 Villard-de-Lans / m.ruchon@sfr.fr

http://lespressesdelacite-archi-urba.com/

Function :

Gaujard technologie

SCOP 84000 Avignon / 04.90.86.16.96 / contact@bet-gaujard.com

http://www.bet-gaujard.com/

Function : Thermal consultancy agency

ADRET

05200 Embrun / 04.92.43.10.29 / embrun@adret.net

http://www.adret.net/

Function : Company

M. Liotard

13130 Berre-l'Étang / 04.42.85.33.18

Function : Company

Scierie Mostachetti

05200 Embrun / 04.92.43.00.23 / florence.mostachetti@neuf.fr

Energy

Energy consumption

Primary energy need : 50,00 kWhep/m^2.an

Primary energy need for standard building : 180,00 kWhep/m^2.an

Calculation method : RT 2005

CEEB : 0.0002

Envelope performance

More information :

Frame / cover on the underside
Fermacell failures (joint between the plates with carpet of recovery) + isolation + straw larch shingle roof.

Walls / Envelope:
- Frame post and beam larch wood curtains with straw walls.
- Plaster exterior earth plaster, lath perforated horizontally, straw bales (47 cm x 37 cm x 100 cm) laid horizontally and vertically on the ground floor and 1st floor / 2nd floor, hollow box, openwork battens oblique coating inside earth- plaster.
- Wall stone base and insulation cork.

Low floor on grade: Hedgehog 20 cm roller Durance, slab clay, lime topping (80% lime and 20% cement).

Intermediate Floor:
- Working wood floor / concrete on 1st floor: Beams stitched by notches Studs, plasterboard soffit, straw insulation between joists and wood compression slab concrete floor + wood heating network and pozzolan.
- Floors on 2nd floor: Beams and joists with wood OSB + BA13 firewall sound insulation + + + OSB lino-type coating.

External doors and windows: Joinery larch conducted in person. Double glazing 4/6/4 lays north and double glazed argon for others.

Renewables & systems

Systems

Heating system :
- Electric heater
- Low temperature floor heating
- Others
- Wood boiler
- Solar thermal

Hot water system :
- Individual electric boiler
- Solar Thermal

Cooling system :
- No cooling system

Ventilation system :
- Natural ventilation

Renewable systems :
- Solar Thermal

Other information on HVAC :

Heating: Despite cold temperatures most of the year, the department of Hautes Alpes is very sunny. So with twenty-four solar thermal panels, inclined at 60° to avoid overheating in summer and to value winter solar gains, the building produces heating most of the necessary energy for the heating and hot water. They are installed on the ground, oriented to the south, and not on the roof because of its east-west orientation. The complement of energy is produced by wood stoves and an electric boiler on the ground floor.

Refreshments: No refreshing system is planned except for the natural over-ventilation. Solar thermal panels can also be used to refresh the walls and floors as the nights are very cool in the region.

24 solar panels powering wall and floor heating and DHW

Environment

Urban environment

Hautes-Alpes is the third smallest department of France. The town of Embrun is inhabited by 6,500 people and is the economic engine of the area. This touristic place accounts nearly 70% of secondary housing, explaining the high cost of living. The region of Embrun, a rural area with mountains, is subjected to a harsh climate, with night frost from November to March. Embrun has a train station, but this landlocked city in the valley bottom, provides a limited transportation

network.

Costs

Construction and exploitation costs

Total cost of the building : 822 000 €

Subsidies : 648 770 €

Health and comfort

Water management

- Management of water on the land: Apart from the construction of the experimental building, the plot was left blank. Earth, as permeable surface allows the water to seep into the ground and so regulates water amounts during heavy rains.

- Development of water recovery: A pit (6 m x 3 m x 2 m) is present on the plot but cracked. The association plans to repair for rainwater recovery purposes. The association installed, for pedagogical purposes, a small plant facility to treat gray waters from the Grass Hut building. Also, Veolia has recently built a treatment plant to purify greywaters by flitering and reject them into the Durance river, including those of the Gabion builing.

- Water and condition of the building: A cantilever is present above the ground floor. Inspired by half-timbered houses, the structural arrangement is intended to preserve the coating on the ground floor for minimizing runoff during rain. The debord roof also played this role. Also, when it rains, the clay swells, which creates a waterproof layer. The basement wall in local stone eliminates risks related to soil moisture in this area subject to the deposit of snow.

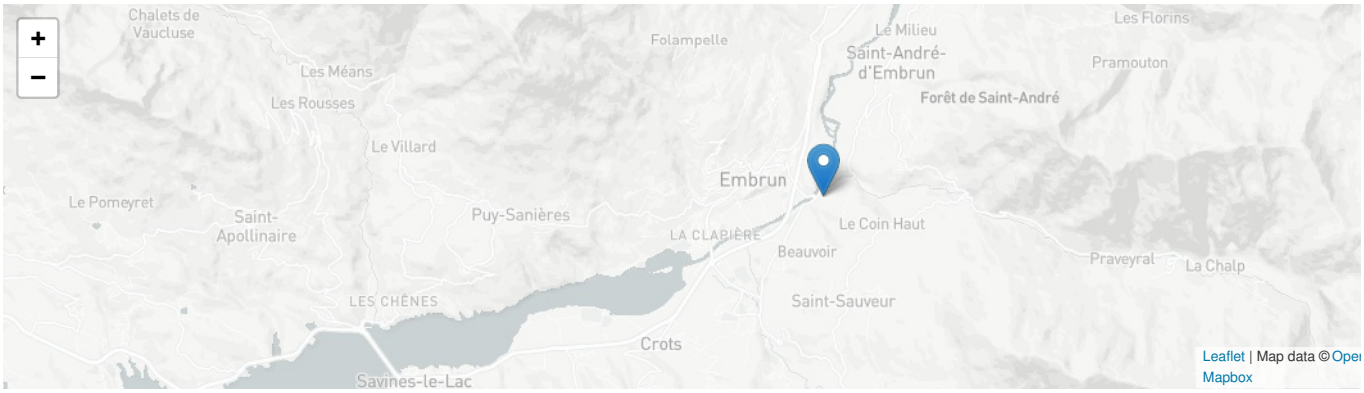
Indoor Air quality

The association will be interested in the behavior of the straw in the walls (bacterial life in the straw bales) knowing that the moisture level in the classroom is often superior to normal, due to natural ventilation. Indeed, during the winter period, when the windows are closed, the rate of air exchange is then insufficient and the rate of moisture increases. However, the moisture rate in straw walls does not affect its insulating power, since it 100% humidity, straw loses only 5% of its insulating ability. If the need appears, extraction slaved to the CO2 will be installed.

Carbon

Life Cycle Analysis

Eco-design material : Straw; Wood (larch in particular); cork; stone; clay, limestone



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