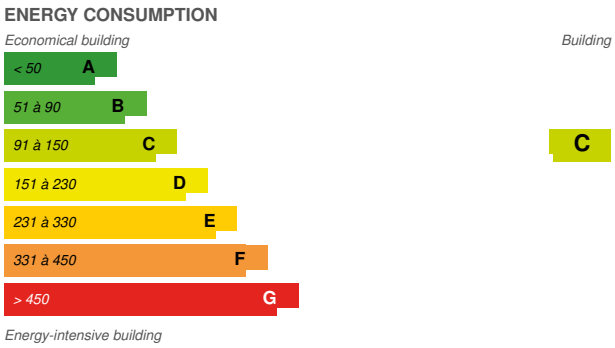
Capoeira

by Raphael Fourquemin / 2021-06-08 00:00:00 / France / 3453 / FR

Primary energy need :

134 kWhep/m^2.an

(Calculation method : RT 2012)



Building Type : Isolated or semi-detached house
Construction Year : 1900
Delivery year : 2017
Address 1 - street : 66 rue d'Etigny 64000 PAU, France
Climate zone : [Cfb] Marine Mild Winter, warm summer, no dry season.

Net Floor Area : 174 m^2 SHON RT
Construction/refurbishment cost : 113 446 €
Cost/m2 : 651.99 €/m^2

General information

The project consists of the transformation of an old restaurant of the churrascaria type, named “La Capoeira” and located in Pau, into a main residence on the basis of bioclimatic principles and of deconstruction and reuse of in-situ materials. This restaurant was transformed into a townhouse by removing part of the roof of the dining room which became a courtyard and by creating a south-facing greenhouse facade at the level of the kitchens and offices, thus delimiting the accommodation.

The house, located in the north at the end of the plot, is organized on two levels. On the ground floor, a large living room wraps around the greenhouse to compensate for the lack of opening in other directions.
The courtyard created in the center of the plot is put back into a natural state by the removal of the original concrete slab, and a revitalization of the soil with phyto-remediation is put in place to treat the oil pollution due to the space being a garage beforehand.
This yard comprises a rainwater collection tank and water-saving devices, including toilets with bio-controlled litter, which complete the management of water resources.

The project is based on maximizing the value of what already exists, both in terms of the organization of spaces and construction technique.
Thus, the house retains the original floors, framework and roofing, and develops in such a way as to maximize passive solar gains. These contributions are supplemented in the cold season by a rocket type mass stove, while the thermal mass of the building will ensure good conditions in the hot season.
Likewise, this approach leads to managing the site in such a way as to enhance the value of the materials resulting from the deconstruction by integrating them into the renovation. The facade created is in wood frame, part of which comes from the existing frame; the wooden frame and the mechanical tile roofing have been completely revised with the framework and the tiles removed from the dining room roof; all finishing materials as well as equipment are deposited and

reused in the house; materials deposited that cannot be reused identically are diverted to other functions.
Ultimately, the project provides for the integration of photovoltaic solar panels and DHW, resulting from the deconstruction, to complete the energy production systems.

Sustainable development approach of the project owner

My various professional experiences in an architectural agency in parallel with my studies in Paris made me aware of the phenomenal quantity of materials ending up in waste centers during projects. Coming from a modest family in the countryside where you keep everything because "you never know, it can always be useful", it was a real culture shock. At the same time, my student squat experiences ended up showing me the inanity of the productive system in which we live, and particularly with regard to construction. Leaving 5 million m2 of office space vacant in the Paris region, while demolishing enough to build thousands more, when the Abbé Pierre Foundation alerts us every year about the housing conditions of millions of people is quite simply ubiquitous.

... And again, that's not to mention the environmental cost.

It was therefore natural that, when my partner and I sought to settle in, we left with the following principles for our accommodation: a bioclimatic renovation in an urban environment, in deconstruction and reuse, with maximum experimentation and dissemination of the results.

In addition to the desire to reduce our carbon impact as much as possible, I wanted to train myself in re-employment in order to include it in my professional practice. This objective subsequently evolved through meetings to lead to the creation of the association IDRE-Interprofessionnelle de la Déconstruction et du Réemploi.

This is my first truly environmental building.

Unlike other projects, the design phase was much longer, in particular due to the constraints in terms of the availability of materials. Constant round trips between the listing and the project to check the quantities were necessary. On the other hand, a "flexible" design had to be fostered in order to be able to adapt to the future results of the deconstruction. This greatly facilitated the modifications on site, more numerous than usual to adapt to the materials. Finally, the organization required precise phasing and responsiveness to take advantage of opportunities.

In short, in the case of reuse, it is up to the architect (and the client!) to adapt to the materials and not the other way around.

The end result is a new construction in terms of quality and finish, sometimes even superior (isoplane fire doors in the bedrooms, professional equipment ...). But it is above all on the conservation of the building's memory within the site that the project stands out the most from the norm.

Architectural description

The two structuring elements for the whole project are the bioclimatic design and the heating system.

The building's urban location was the major constraint, with solar masks and large dividers but oriented to solar noon. This led to the design of a southern double-skin facade, designed with the thermal consultancy office to maximize solar gain. The interior organization of the spaces is driven by this facade.

Likewise, the choice of the mass stove was imposed in order to make the most of the thermal hyperinertia of the semi-underground building. In fact, this results in a central stove in the house, and not isolated from the ground in order to gradually raise the natural average temperature of the building. In order to further enhance its effect, the thermal battery has been positioned so as to also benefit from maximum solar radiation in winter.

The materials available on site also led to a specific architectural writing, and guided the choices for the purchase of materials (new or re-used).

Building users opinion

Overall good, except for the general acoustics of the house. The very open design to facilitate air circulation sometimes creates a discomfort when it comes to self-isolation.
Regarding the light, more than the level of lighting, it is the play of reflections on the stainless steel window coverings that contributes a lot to the interior atmosphere.

If you had to do it again?

Two things didn't work in this project. The first concerns the difficulties encountered during modifications on site. The need to make decisions quickly so as not to block progress sometimes leads to choices that lack consistency with the initial project. In this case, it was necessary to pour a screed of 100m2 which was not planned. It was made in concrete whereas a screed of raw earth or lime would have been possible, but only by being planned from the start. The second concerns end-grain flooring materials. The work to be done was very long and complex, and although the result is convincing on the aesthetic level, it is not on the technical level. In the present situation, part of the paving stones have tiled and peeled off from the screed. This is due to insufficient knowledge of the deformations of wood in this type of section.

Photo credit

Raphael Fourquemin Architect

Stakeholders

Contractor

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Construction Manager

Name : FOURQUEMIN Raphael architecte
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Stakeholders

Function : Thermal consultancy agency

FEBUS ECO-HABITAT

CAPDEQUI Yann : yann[a]peyrn.com

Thermal study in the project phase

Function : Company

LE GALL Philippe

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Training and support for lime and earth plasters

Function : Company

EnergEthic

FRELON Jean-Louis : jl.frelon[a]gmail.com

https://habitat-eco-action.fr/
electrical conformity check

Function : Company

SARL Couralet

Franck COURALET (entreprise fermé)

Ground floor cement screed

Function : Company

EURL Larmendieu

http://dartau-platrerie-isolation-arzacq.fr/contact/
Ground floor partition

Function : Manufacturer

BROQUART

contact[a]broquart.fr

https://www.broquart.fr/
Greenhouse glazing supply

Contracting method

Other methods

Energy

Energy consumption

Primary energy need : 134,00 kWhep/m^2.an
Primary energy need for standard building : 150,00 kWhep/m^2.an
Calculation method : RT 2012

CEEB : 0.0001

Breakdown for energy consumption : Wood heating: 6 cubic meters or around 12000kWh Others (DHW, VMC, lighting, LL, LV, fridge ...): 4800kWh electric in 2019

Initial consumption : 1,00 kWhep/m^2.an

Real final energy consumption

Final Energy : 92,30 kWhef/m^2.an

Real final energy consumption/m2 : 92,30 kWhef/m^2.an

Real final energy consumption/functional unit : 92,30 kWhef/m^2.an

Year of the real energy consumption : 2 019

Envelope performance

More information :
Materials and techniques:
- over-insulation of the lost attic with 40cm cellulose wadding;
- wood wool wall insulation (205mm south facade exterior wood frame; 120mm south facade interior wood frame greenhouse; 80mm IPI north facade); low floor insulation over 3m at the periphery of 40mm extruded polystyrene + 60mm expended glass ball. More details on the walls in the thermal study V5.0. Use of the building's thermal hyper-inertia (semi-underground), reinforced by the presence of a 6-ton mass stove on a low uninsulated floor. Exterior greenhouse glazing: 44.2 on DIY wood joinery (Do It Yourself). Interior greenhouse glazing: 4/16/4 standard on DIY wood joinery. North facade glazing: 4/12/4 original standard (1999)

Building Compactness Coefficient : 2,03

Indicator : n50

Air Tightness Value : 0,50

More information

The heaviest consumption station is an old generation 150l electric cumulus cloud, over 10 years old, initially installed for the site and planned to be replaced by a solar tank.

Renewables & systems

Systems

Heating system :
- Wood boiler

Hot water system :
- Individual electric boiler

Cooling system :
- No cooling system

Ventilation system :
- Free-cooling
- Humidity sensitive Air Handling Unit (Hygro B

Renewable systems :
- Wood boiler

Renewable energy production : 49,20 %

The bioclimatic greenhouse covers the 2 levels and allows hot air to circulate throughout the house by a chimney effect via the open stairwell (see thermal diagram). It significantly contributes to thermal comfort in winter by providing heat, but also in summer by ventilation of the south facade. The thermal study estimated the solar gains at 9,873kWh.

Solutions enhancing nature free gains :
Serre bioclimatique

Smart Building

Users' opinion on the Smart Building functions :

Not applicable for this project, but the occupants perceive the Smart Building functions possible today as a false good idea, which is why no connected technology has been installed.

Environment

Urban environment

Land plot area : 319,00 m^2

Built-up area : 32,00 %

Former industrial building from the 1930s in a dense urban fabric, on the main access road to the city (rue d'Etigny in the extension of the road to Bayonne), in front of the wooded park of the Chateau de Pau.

The back of the plot gives access to a dead end lane (impasse de la Garenne du Roy) in the heart of the island and to the gardens of buildings located to the north of the island (including shared garden). The alley is widely used by neighborhood children as a play area, traffic being slowed down by the poor condition of the road.

The area is served by the public transport network (bus), and is a 10-minute walk from the castle, 15 minutes from the market and the train station.

Products

Product

"Rocket" or "Dragon" type mass stove

Conçu par Ianto Evans, Architecte

https://www.rocketstoves.com/contact-2/

https://www.rocketstoves.com/

Product category : Génie climatique, électricité / Chauffage, eau chaude

Mass stove extremely simple in design, construction and use, with high performance and continuous collaborative development to further improve them.

The project stove is 20cm in diameter, with 7ml of thermal coil distributed between a bench and a wall, all with a mass of about 6t.
No technical survey was carried out on the model of this project, but surveys carried out on stoves of similar design show an efficiency of 80 to 95%.
In this case, a number of clues suggest that the performance is good:
- An outbreak of 1h30 to 2h00 of oak, or 3h00 of coniferous trees, allow radiation over 24h00
- 6 cubic meters allow you to "heat" the whole house, considering that it is not the air that is heated but the thermal mass of the house
- A heating season produces less than 40 liters of "ash" in the form of dust, quite valid as a pigment after rapid grinding.
- No visible smoke escapes from the extraction chimney, only a heat wave.
- The temperature at the outlet of the duct does not exceed 100 ° C
- The vapors are not irritating to the respiratory system in direct inhalation of short duration.

Advantages:
- Very economical to manufacture (600 € here)
- Very simple in design, therefore very accessible
- Easily repairable
- very pleasant to use (easy start, heated bench, stove)

Disadvantages:
- Fire hardly or not visible
- only works well in daily use and in large rooms (infrared)
- requires splitting the wood to a diameter of 6 to 8 cm

A visit to the owner of a similar stove made it possible to better grasp the advantages and disadvantages of the system.

"Pluvalor" integral rainwater recovery system

Conçu par József ORSZÁGH, Ingénieur chimiste

https://www.eautarcie.org/contact.html

https://www.eautarcie.org

Product category : Aménagement extérieurs / Gestion des eaux pluviales

Quote from the Eautarcie.org website:
"The PLUVALOR system is not a commercially manufactured system, but a concept accessible to all.
A cistern built according to the PLUVALOR principle is the artificial reconstruction of a natural rock cavity in which water is very well preserved.
...
Rainwater collected, stored and filtered according to the PLUVALOR system is suitable for all domestic uses, including and above all for drinking. In general, the quality of the rainwater treated in this way is far superior to that of most distribution water. The systems recommended everywhere have, as a finality, the saving of

city water thanks to the use of rainwater. On this point the PLUVALOR system differs from all the others. Without denying the possibility of this saving, the purposes are different:
- Safeguarding the user's health, thanks to the use of chemically non-disinfected water. Children are particularly sensitive to the harmful effects of disinfecting water with chlorine.
- Ensure superior water comfort. The use of non-chlorinated, naturally soft and very pure water makes showers and baths more pleasant. In fresh water cooking food (like beans and meats for example) is easier. The taste of herbal teas, tea, coffee and prepared drinks is much superior.
- Save products for laundry, dishes and cleaning. The absence of excess lime in the rainwater makes the dishes sparkling without any softening product. The total absence of lime deposits prolongs the life of household appliances and taps.
- The full recovery of rainwater reduces the pressure on natural water reserves. The reduction in the quantities of detergents also reduces the pollutant load of the wastewater discharged.

That implies:
- focus on the purpose of collecting rainwater (not to flush the toilet or wash the car)
- To accept the principle of adapting the quality of water to uses, by which we distinguish between water for non-food use and water that is safe to drink.
- To establish the recoverable potential of rainwater. First, we determine the amount of recoverable rainwater, then we size the tank. "

The main brake is psychological in 2 aspects:
- fear of drinking contaminated water, rainwater being perceived as "dirty"
- the difficulty of going to the dry toilet, a logical addition to avoid wasting water.

Costs

Construction and exploitation costs

Renewable energy systems cost : 600,00 €

Cost of studies : 3 000 €

Total cost of the building : 113 446 €

Additional information on costs :
The total budget of 113,446 € incl. Tax includes the following elements:
- Studies and support = € 17,303
- Intervention undertaken in supply and installation (partitioning, screed, EP tank ...) = 32347
- Purchase of materials (insulation, glazing, hardware, etc.) = 34843
- Purchase of tools (construction truck, woodworking machine, portable power ...) = € 17,426
- Organization costs of participatory projects (food costs, etc.) = € 7,312
- Miscellaneous = € 4,215

The budget does not include the cost of land (162,000 €)

Energy bill

Forecasted energy bill/year : 1 650,00 €

Real energy cost/m2 : 9.48
Real energy cost/Dwelling : 1650

Circular Economy

Reuse : same function or different function

Batches concerned by reuse :
- Structural works
- Structural framework
- Roofing
- Facades
- Locksmithing-Metalwork
- Indoor joineries
- Outdoor joineries
- Floorings
- Partitions
- Isulation
- Electricity
- Heating ventilation air conditioning
- Plumbing
- Landscaping
- others...

For each batch : Reused Materials / Products / Equipments :

Structural work: power supply, stone masonry

Frame: roof frame (rafters), wood frame double skin facade (greenhouse)

Cover: mechanical roof tile, zinc cover

Facades: cladding

Locksmith-Metalwork: metal staircase, IPN, cast iron posts, stainless steel window coverings, galvanized steel cover

Interior joinery: doors, kitchen, counter, vanity top, wardrobes, libraries ...

Exterior joinery: windows, fixed frames

Flooring: wooden floor

Partitions: BA13, BA15, BA18, rails and upright, and even screws (but it's annoying), earthenware

Insulation: glass beads in insulation under screed, various additional insulation in rigid rock wool 30mm

Electricity: cables, sheaths, switches, various sockets (elec, RJ45), TGBT, protection devices, lighting

HVAC: construction materials for the mass stove (rubble from demolition, raw earth from a neighboring earthworks site, single skin stainless steel pipes in the thermal coil, firebox insulation in expensed glass beads, steel container), ventilation, diversion of the EP network for low ventilation.

Plumbing: taps, various fittings, steel and PVC collars, rosettes, basins, WCs, urinals, 22/1 annealed copper ...

Outdoor facilities: Hollow concrete block, mechanical tiles, cast iron posts ...

others: various hardware (cremones, hinges, door and window handles, bolts, screws, sheet metal) professional furniture, decorative elements ...

Reused materials rate :

Big work:

power supply: 40ml cable 5G 16mm2; 100% of the lot

pebble masonry: 1m3 (resumption of masonry); 100%

Roof frame: 60ml rafters 10x8 (revision); 100%

timber frame: 34ml posts and beams 20x10, 60ml joist 15x10, 30ml rafters 10x6; 50% of the lot

Coverage: 35m2 mechanical tile cover (revision), 30m2 zinc cover on greenhouse; 100%

Fronts: 27m2 wood cladding (floor diversion); 100%

Locksmith-Metalwork: 1U metal staircase (100%), 5.5ml IPN 6x12 (reinforcement; 100%), 1.3m2 stainless steel window screens (100%), 11ml galvanized steel cover (100%)

Interior joinery (100%):

- 6 doors,

- kitchen: 5ml plan, 4.5m2 frontage, 1 counter

- various joinery: 1 washbasin, 4 wardrobes, 3 bookcases ...

Exterior Joinery: 15%

4 windows 50x75 and 4 fixed frames 50x195 in wood and re-used glazing

Flooring (78%): 142 m2 wooden floor

Partitions:

54m2 BA13, BA15, BA18, rails and upright (15%)

earth rendering: 50m2; Thickness 3 to 5cm (100%)

Insulation: 5m3 of expanded glass beads in insulation under screed

Electricity: 85%

HVAC: 90% (100% mass stove construction materials)

Plumbing: 90%

Outdoor facilities: 100%

others: undetermined

Field of use and material origin :

Big work:

power supply: 40ml cable 5G 16mm2; In-situ

pebble masonry: 1m3 (resumption of masonry); In-situ

Roof frame: 60ml rafters 10x8 (revision); In-situ

timber frame: 34ml posts and beams 20x10, 60ml joist 15x10, 30ml rafters 10x6; In-situ

Coverage: 35m2 mechanical tile cover (revision); In-situ

30m2 zinc cover on greenhouse; Leboncoin.fr

Fronts: 27m2 wood cladding (floor diversion); In-situ

Locksmith-Metalwork: 1U metal staircase; In-situ

5.5ml IPN 6x12; In-situ

1.3m2 typed in stainless steel window: diversion of kitchen extractor hood; In-situ

11ml galvanized steel cover: diversion of 50x50 ventilation flues cut from sheet metal and folded

Interior joinery (100%):

- 6 doors; In-situ

- kitchen: 5ml plan: diversion of falling timber of various species (oak, ash, redwood, exotic woods, softwood rafters ...) assembled and glued to make a worktop (see photo); diverse provenance, but mostly in-situ

- 4.5m2 of facade: diversion of acacia floor; Leboncoin.fr

- 1 counter; In-situ

- various joinery: In-situ

Exterior Joinery: In-situ wood; glazing: Leboncoin.fr

Floor coverings: 142 m2 wooden floor; 50% In-situ; 50% Leboncoin.fr

Partitions:

54m2 BA13, BA15, BA18, rails and upright: In-situ

earth rendering: 50m2: In-situ sand; clay: neighboring site

Insulation: 5m3 of expanded glass beads; neighboring site

Electricity: In-situ

CVC: In-situ, Emmaus, local scrap dealer, Leboncoin.fr ...

Plumbing: In-situ

Outdoor facilities: In-situ

others: In-situ

Environmental assessment

Impacts avoided : water, waste, CO2 :

The reuse of materials on this project * made it possible to avoid:

Emission of 23.8 tonnes eq CO2

The use of 516m3 of water

The production of 6.6 tonnes of waste

The impact calculation was made on the basis of environmental data from the INIES database

* (counted: zinc, doors, partitions, TGBT, pebbles, wood frame, wooden cladding, parquet, tiles, ventilation grid, wanitary, basin, taps, cables, switches)

Social economy

Social economy and professional integration :

The project did not appeal to the structures of the ESS, except in anecdotal way through the donation and purchase of materials at Emmaus.

However, not to mention professional integration, this project enabled several craftsmen and building professionals to be made aware of deconstruction, via several site visits organized by local associations (Pavillon de l'Architecture de Pau, CPIE Béarn. ..).

The result was the creation of an interprofessional association which works today in the dynamics of the ESS and in the perspective of professional integration through the setting up of training courses (Association IDRE - Interprofessionnelle de la Déconstruction et du Re-Employment)

Health and comfort

Water management

Consumption from water network : 65,00 m^3

Water Consumption/m2 : 0.37

Water Consumption/Dwelling : 65

A complete rainwater recovery system of the Pluvalor type has been installed, but not yet operational (tank break-in time 6 months, use from September 2021). It consists of a 1m3 settling tank with pre-filter , followed by a 10m3 concrete tank with submersible pump, which supplies the whole house with water via a series of filters (socks, activated carbon, purifier). The system allows the drinking water, and a water autonomy of about 2 months. The system is completed by a dry toilet type TLB.

Indoor Air quality

See eco-materials.

Comfort

Health & comfort :

Homogeneous temperature in the house, stable via thermal hyper-inertia, absence of cold walls.

Low temperature radiation. Complementarity day / solar greenhouse and night / mass stove.

Relative humidity rate always between 60 and 70% on the ground floor and 45 to 65% in R + 1.

Specific point of cellar / cellar: insulation from the living rooms. Maximum summer temperature: 19 ° C; Temp. mini winter: 13 ° C, relative humidity fixed at 98% (ideal for mushroom cultivation, correct in wine storage, poor in fruit and vegetable storage)

No noticeable drafts in the house during normal operation.

During the day, bright light in winter, medium to low in summer (no precise reading).

Large opening onto the exterior garden via the greenhouse (3mx4m): strong interior / exterior relationship with greenhouse as an intermediate space. Use of the greenhouse in mid-season as a winter garden (family use). Two of the upstairs bedrooms have a balcony overlooking the greenhouse for individual use by children.

Calculated thermal comfort : Données étude thermique: Max été: 25,8°C (étage, hors serre solaire); Min hiver: 17,5°C (hors serre)

Measured thermal comfort : Les températures intérieures mesurées correspondent à celles prévues par l'étude thérmique, sous condition d'une utilisation correcte du système solaire passif (serre solaire et surventilation).

Acoustic comfort :

The plot overlooks a very busy road, especially during office hours, sometimes generating significant noise pollution.

The double skin generated by the greenhouse and the interior facade greatly reduces these nuisances. The glazing used (44.2 and 4/16/4) makes it possible to avoid acoustic transmission between the spaces (operation equivalent to triple acoustic glazing).

For example, the concrete slab in the garden (20cm thick) was demolished in February 2021 using a rock breaker, while a 2 month old baby was napping in the house (rock breaker distance / bed <10m). The baby has not woken up.

Carbon

GHG emissions

Building lifetime : 150,00 année(s)

Life Cycle Analysis

Eco-design material :

Most of the materials purchased new for this project are bio-sourced or eco-designed:

- Local solid timber

- OSB 3 formaldehyde free

- Fermacell

- Isonat wood wool

- Acoustic insulation "Metisse" (recycled textile fiber)

- Isocell cellulose wadding

- Hard vegetable oils (Biorox, 3 Matons, Rubio ...)

- Earth / straw plaster

- Lime plaster

- Natural vegetable paint Primavera from Colorare

The objective of using these materials was above all to preserve good indoor air quality, as well as a good response to hygrometric variations, which are sometimes significant in the region.

However, the majority of the materials used on this project were not supplied as new, but came from the deconstruction of the original building or from the second-hand market.

Contest

Reasons for participating in the competition(s)

Reuse / diversion of in-situ construction materials.

Bio-climatic operation

Renewable energies

Building candidate in the category

Bâtiments résidentiels / prix de la rénovation

Date Export : 20230421095635