Ardèche Department Hotel

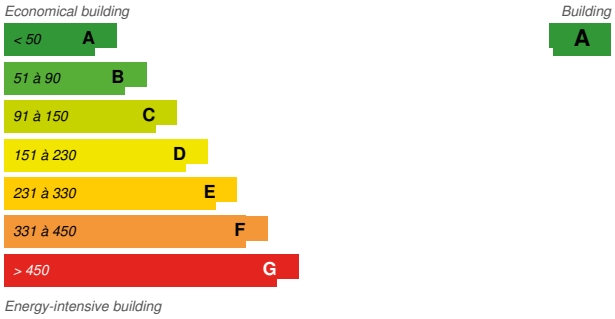
by Nicolas ESTRANGIN / 2020-11-24 17:13:10 / France / 4956 / FR

Primary energy need :

89 kWhep/m².an

(Calculation method : RT existant)

ENERGY CONSUMPTION



Building Type : Office building < 28m
Construction Year : 1985
Delivery year : 2020
Address 1 - street : Quartier La Chaumette 07000 PRIVAS, France
Climate zone : [Cfb] Marine Mild Winter, warm summer, no dry season.

Net Floor Area : 5 644 m² SHON
Construction/refurbishment cost : 3 400 000 €
Cost/m2 : 602.41 €/m²

General information

The hotel in the Department of Ardèche is an assembly of buildings from different eras (19th and late 20th centuries), with a complex geometry, which before renovation presented considerable comfort issues, particularly in mid-season. The cause: insulation and airtightness defects and too large glass surfaces.

Comfort and energy performance closely linked

The challenge of the energy renovation of the tenement was therefore to make the use comfortable for the agents and elected officials of the Department while greatly reducing all energy consumption (heating, cooling, lighting, ventilation, specific electricity, etc.) by a strong action on the glazed surfaces, the type of glazing installed, the solar protections, the thermal insulation of the envelope with treatment of thermal bridges and airtightness, and the almost complete repair of the installations HVAC including the resumption of the building's GTC.

Renovation on an occupied site with validation of the choices in the use phase

The site, very constrained in terms of space, and a continuous occupation of the building required tight organization and planning so that the site generates the minimum of nuisance while remaining within the execution times desired by the control of work. The efficiency and sobriety approach put in place has been extended since the beginning of 2020 with a mission to develop HVAC equipment, in support of the operator, to define, with supporting measures, the settings, optimum equipment to achieve the performance objectives defined at the start of the project.

Sustainable development approach of the project owner

The Hôtel du Département had a thermal balance far below the requirements set by the community as part of its policy of energy control and optimization of its built heritage. The thermal renovation of the building should make it possible to reduce its energy consumption but also to improve the comfort of users and users of the site.

A thermal diagnosis carried out in 2009 and the use of data from maintenance made it possible to target two types of problems related to the challenges of the project:

- Problems related to the building: generalized insufficiency of the insulation of the walls and significant overheating due to the large and very numerous glazed surfaces. The north / south orientation of the facades implied a worsening of the thermal amplitude between the premises, especially in the intermediate seasons, despite the individualized temperature control (thermostat per office).
- Problems linked to HVAC installations: inefficient production equipment, very dilapidated distribution networks, transmitters with numerous malfunctions and limited regulation systems due to the nature of the distribution principles. The air handling units and their cooling equipment were obsolete.

The objective given to the project management was a consumption after renovation of <40 kWhEP / m²SHON.year for heating, air conditioning and associated auxiliaries (RT calculation, excluding lighting and internal uses).

The operation therefore focused on improving the thermal performance of the envelope on the one hand (joinery, curtain walls, walls, roofs and attics) and on the technical production, distribution and emission systems (hot and cold) on the other hand. The use of air conditioning had to be justified by a dynamic thermal simulation (STD) initiated at the sketch and updated at each design phase. A summer comfort strategy based on the results of these calculations has been implemented in order to meet the following objectives:

- 25 ° C maximum for an outside temperature <30 ° C, outside T ° -5 ° C maximum for an outside temperature> 30 ° C (within the limit of 28 ° C).
- Tolerance at more than 28 ° C for a maximum of 50 h / year in the most unfavorable rooms.

For winter comfort, the STD has chosen 19 ° C as the occupancy setpoint temperature with a uniform general thermal environment (hygrothermal comfort) as a stake.

Other sustainable development objectives were associated with this project both for limiting the environmental impact of the operation and for the comfort of users and site operators:

- Durable / resistant materials and low maintenance cost.
- Glass structures (mainly curtain walls) which can be easily cleaned in connection with the policy to reduce MSD (musculoskeletal disorders) for service agents.
- Easy access and maintenance of the regulators as well as the cut-off elements of HVAC systems and more generally of all technical equipment.
- Maintaining the brightness of the work premises.
- Effective solar protection on the facades facing south and west.
- Low nuisance site (odors, dust, noise) to allow it to take place on an occupied site without unduly disrupting the daily life of the building.

In order to support the effective implementation of the energy performance of the equipment, the Centralized Technical Management (GTC) and supervision system has been taken over and extended to all site equipment.

Architectural description

For the renovation part, no development work was planned in the operation except for occasional modifications to the finishing work related to thermal equipment (technical rooms, adaptations to terminal devices, etc.) and regulatory compliance work. mandatory.

The architect nevertheless took advantage of the resumption of curtain walls (reduction of surfaces and increase in energy performance) to dress the facades with a set of colors intended to break the monotony of the windows and their spandrels, thus giving life to the building. renovated.

He also designed the extension in elevation of the Chaumette wing (creation of an additional level in wood frame).

If you had to do it again?

For budget reasons, a complete approach to controlling electricity consumption could not be deployed on the operation from the start. However, the funds are now available and this action will be able to take place at the end of 2020 (lighting, office automation, various outlets). Likewise, the installation of photovoltaic panels could not be done for lack of a sufficient budget: priority was given to comfort in the building and to the reduction of energy consumption.

Photo credit

Denis Dessus Architect / Enertech Agency

Stakeholders

Contractor

Name : Département de l'Ardèche

Contact : Renaud TESTUD - 04 75 66 71 15
https://www.ardeche.fr/

Construction Manager

Name : Agence d'Architectes Denis DESSUS
Contact : Denis DESSUS - 04 75 64 51 56
http://www.dessus.org/site/

Stakeholders

Function : Thermal consultancy agency

Enertech

Christophe PLANTIER - 04 75 90 18 54

https://www.enertech.fr/
Dynamic thermal simulation, project management in connection with the energy issues of the project, development and monitoring of post-delivery equipment

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Function : Other consultancy agency

3D Ingénierie

Project economics

Function : Structures calculist

Betebat

Type of market

Global performance contract

Energy

Energy consumption

Primary energy need : 89,00 kWhep/m^2.an

Primary energy need for standard building : 110,00 kWhep/m^2.an

Calculation method : RT existant

Breakdown for energy consumption : Consumption assessed by STD (coefficient Ep / Ef = 2.58 for electricity):- heating: 13 kWhep / m²SHON- air conditioning: 17 kWhep / m²SHON- auxiliaries + ventilation: 17 kWhep / m²SHON

Initial consumption : 364,00 kWhep/m^2.an

Real final energy consumption

Real final energy consumption/m2 : 85,00 kWhef/m^2.an

Year of the real energy consumption : 2 019

Envelope performance

Envelope U-Value : 0,83 $W.m^{-2}.K^{-1}$

More information :
Chaumette Wing:- Stone walls: ITE mineral wool on stone walls 65 cm, Rtotal = 3.9 m².K / W- Exterior walls (gardener's room): ITI mineral wool, R = 2.65 m².K / W- Wooden raised walls (new): mineral wool, R = 4.2 m².K / W- Roof terrace: addition of 4 cm PUR, R = 1.8 m².K / W (+ conservation of the existing waterproofing)- High floor: PU 18 cm, R = 7.8 m².K / W- High floor (gardener's room): underside of mineral wool concrete slab (30 cm), R = 7.5 m².K / W- Exterior joinery: aluminum with thermal breakers, Uw = 1.6 W / m².K (Ug = 1.1 W / m².K), air tightness class A * 4.Main building :- Curtain walls (opaque spandrels): mineral wool panels, R = 3.45 m².K / W + treatment of thermal bridges. Ue = 0.79 W / m².K including thermal bridges.- Concrete walls: addition of ITE mineral wool in addition to the 5 cm of existing insulation, Rtotal = 4.8 m².K / W- Roof terraces: addition Radd = 4.5 m².K / W (10 cm in addition to the 6 cm of existing insulation => Rtotal = 6.25 m².K / W (+ conservation of the existing waterproofing)- Low floors on the outside: addition to the soffit Radd = 2.9 m².K / W in addition to the 10 cm of existing insulation => Rtotal = 5.5 m².K / W.- Low floors in underground car parks: no additional resistance in low floors (existing: 10 cm rock wool, Restimated = 2.5 m².K / W)- Exterior joinery (excluding curtain walls): aluminum with thermal breakers Uw = 1.6 W / m².K (Ug = 1.1 W / m².K), airtightness class A * 4.- Curtain walls (glazing): reduction of glazed surfaces, thermal bridge breakers on the primary structure (Pth reduced to 2.6 W / m².K), low-emissive glazing Ug = 1.1 W / m².K, solar factor FS = 0.28. Overall performance of the curtain wall: Ue = 1.80 W / m².K instead of 4.60 W / m².K initially.Careful work on airtightness:- junctions between joinery and frame treated with butyl tape, and Illmod Trio type seal from Illbrück- crossings in low slab and high slab systematically treated airtight- glass elements and curtain wall infill maintained by pressure hoods and compression gasketsAir permeability before work: n50 = 2.24 vol / h. Objective after renovation: n50 = 2 vol / h. Value obtained: n50 = 1 vol / h.

Indicator : n50

Air Tightness Value : 1,00

More information

The drop in gas consumption over winter 2019-2020 compared to the 2010 reference year is spectacular: - 78%. However, given the ongoing adjustments to HVAC installations, the context of 2020 and the leniency of that winter, it is estimated that the reduction in gas consumption should stabilize at around 70% over time. (factor 3.3 compared to the initial).Regarding specific electricity and interior lighting: all the lighting that has been replaced by low-consumption lighting (high optical efficiency, LED, etc.). Systematically, the circulation areas whose false ceilings have been redone due to the replacement of the distribution networks have been fitted with these new high-performance lighting, with presence detection. The unit power and the quantity of new luminaires installed give an average power per unit area of less than 2 W / m² for 100 lux on the ground.A more complete and complementary audit work on lighting, IT and various outlets is underway at the end of 2020 with a view to making the necessary replacements and adjustments to amplify the reduction in electricity consumption.

Renewables & systems

Systems

Heating system :

- Condensing gas boiler
- Water radiator
- Fan coil
- Others

Hot water system :

- Individual electric boiler

Cooling system :

- Water chiller
- Reversible heat pump
- Fan coil

Ventilation system :

- Single flow
- Double flow heat exchanger

Renewable systems :

- No renewable energy systems

Other information on HVAC :

The general philosophy for the intervention on HVAC systems was to implement robust and long-lasting equipment, properly installed and then adjusted to guarantee the energy savings as calculated in the design phase.

The following equipment is found in the building:
- SWEGON double-flow air handling unit (GOLD RX 03, RX 04, RX 07, RX 20, RX 25, top 07 models) with rotary heat exchanger. Filters F7 on supply air and F5 on return air and fresh air. SFPv efficiency between 0.46 and 0.57 W / m³.h. Winter heat exchanger efficiency between 81 and 86%.
- Heating + air conditioning Chaumette: VRV system with R410A from DAIKIN. Outdoor unit power = 15 kW; internal cassette power = 1.9 kW. EER> 3.4 and COP> 3.9.
- Production of chilled water in the main building: 5 production units of the BlueBox brand with cooling capacities 7.2 kW, 12 kW, 19 kW, 31 kW and 113 kW with buffer tank for each. EER between 3.22 and 3.88. These groups also supply the cold batteries of certain AHUs.
- Main building heating: replacement of the two initial gas boilers by two Atlantic Guillot condensing boilers, Varino model, with a downward revision of the thermal power delivered initially oversized to adapt to the losses of the isolated building (2 x 150 kW). Resumption of networks in the boiler room and replacement of all fan coils by high-performance models (Ciat brand, Comfort Line type U model, 2 tubes, some can be ducted). Installation of thermostatic valves, with adjustable kvs and low temporal variation, on the transmitters kept. Reduction of the temperature regime and complete resumption of regulation.

Environment

Urban environment

Sparse urban environment. Buildings located near a wood, served by a bus line and accessible on foot from the city center located a few hundred meters away. Nursery and nursery school nearby.

Products

Product

Product category :

Costs

Construction and exploitation costs

Total cost of the building : 3 400 000 €

Subsidies : 1 600 000 €

Additional information on costs :
Cost relating to energy performance: € 2,000,000 (59% of the total cost)
Cost per m² relating to energy performance: 358 € / m²SHON

The Enertech thermal design office was commissioned for an EXE mission and site supervision on everything relating to energy performance (envelope = insulation and airtightness, systems).

The financial assistance granted comes from the ERDF (€ 1.6 million).

Health and comfort

Indoor Air quality

Double-flow ventilation with filtration:
- with F5 pockets for recirculated air and fresh air
- with F7 pockets for supply air

No other specific action to reduce the sources of pollution upstream: paints, glues and stains, floor coverings, cleaning products, etc.

Comfort

Health & comfort :

A dynamic thermal simulation (STD) carried out at the APS stage made it possible to orient the “summer comfort” strategy. Beforehand, to better understand the initial functioning of the building and in particular the internal contributions linked to the occupancy of the building, a mini-campaign of measurements of 45 days relating to the ambient (delta between facades) and external temperatures, the temperatures of the fluids , the electricity consumption and the occupancy rate was carried out by Enertech in the building.

The following actions have been selected to improve summer comfort after renovation:
- To protect against the sun's rays in summer, exterior sun shades with motorized adjustable slats or manual aluminum roller shutters have been installed on the Chaumette wing.
- For the main building (curtain walls), individually electrically operated blinds integrated in the glazing for the east, south and west facades were implemented. These same glazing units are solar controlled with a solar factor (FS) of 0.28 and a light transmission factor of 60%. The glass surfaces of the curtain walls have been reduced by approximately 1/3.
- Freecooling on summer nights from the air handling units, at hygienic flow, as long as the outside temperature is lower than the inside temperature. The air handling unit exchanger is then bypassed to evacuate a maximum of calories to the outside.

The concrete or stone walls have been insulated from the outside to maintain maximum inertia in the heated or cooled volume.

Visual comfort is ensured by large glazed surfaces all facades on the main building.

Carbon

Life Cycle Analysis

Eco-design material : Raising R + 3 Chaumette wing in wood frame

Contest

Reasons for participating in the competition(s)

The effective division of gas consumption by more than 3 of this imposing administrative building was made possible thanks to a strong action on the insulation of all horizontal and vertical walls, a very advanced treatment of the air tightness of the building (final value guaranteed by test: n50 = 1 vol/h), a complete overhaul of the HVAC installations with the installation of a new regulation and an optimization of the operation of these installations by measurement by associating the operator.

Improving occupant comfort in summer was another major objective of the operation. The actions undertaken concerned the control of glazed surfaces, the addition of solar protection, the conservation of inertia thanks to insulation from the outside and the deployment of active over-ventilation on summer nights by the air handling units to cool the masses.

More globally, a quality of ambience was sought to provide better working and reception conditions for the occupants and users respectively. How ? By the use of a very efficient double-flow ventilation to offer a good air quality (and lower heating consumption !) and by maintaining a significant access to natural light.
With a real cost of the purely energetic renovation amounting to 360 €HT/m²SHON, in occupied site, this operation is largely reproducible.

Building candidate in the category

Energie & Climats Tempérés

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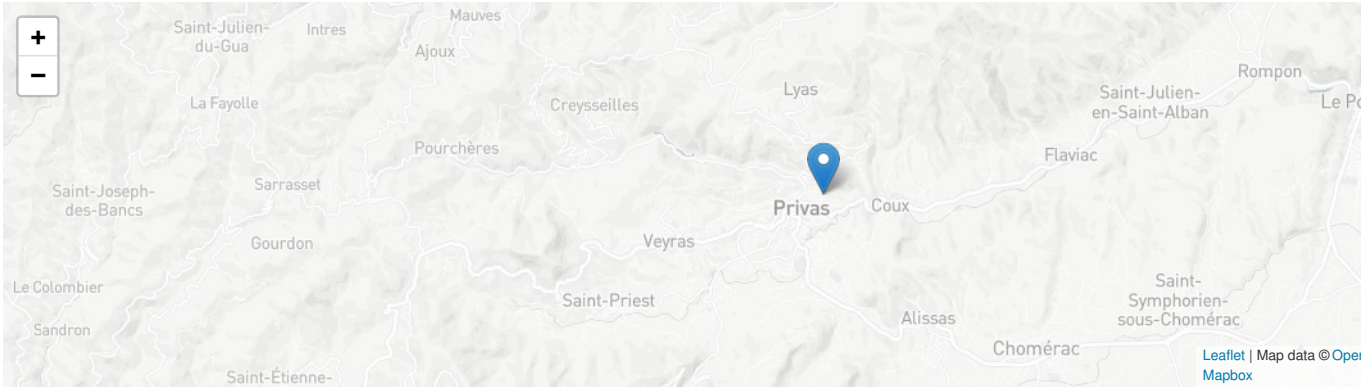

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