Chengdu School

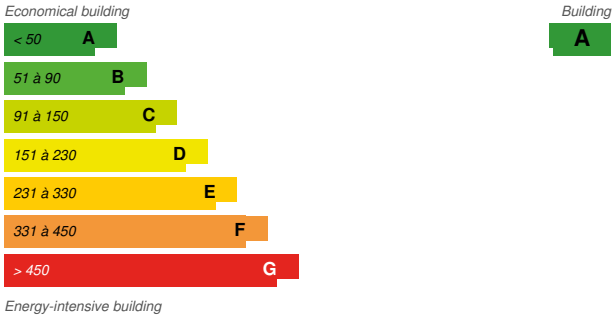
by Hugo Stragier / 2017-05-23 09:33:06 / France / 8704 / FR

Primary energy need :

37 kWhep/m².an

(Calculation method : RT 2005)

ENERGY CONSUMPTION



Building Type : School, college, university
Construction Year : 2013
Delivery year : 2014
Address 1 - street : 74 Rue Ray Charles 34000 MONTPELLIER, France
Climate zone : [Cfb] Marine Mild Winter, warm summer, no dry season.

Net Floor Area : 2 644 m²
Construction/refurbishment cost : 8 800 000 €
Number of Pupil : 300 Pupil
Cost/m2 : 3328.29 €/m²

Certifications :

Bepos 2013

General information

The Chengdu * school group, with very strong energy performance, is integrated into one of the new eco-districts of the City of Montpellier, the Parc Marianne district. This school group of 3,080 m² includes a kindergarten and an elementary school for a total of 11 classes. The school is connected to the heating network of the city of Montpellier fed by the wooden trigeneration plant.

The BEPOS school (positive energy building), constructed in a constrained site (large effects of masks linked to neighboring buildings) has 290m² of solar panels on the roof, which allows 20% more energy to be produced than the total consumption of The school was designed and built in such a way that the comfort is optimal in summer as in winter while reducing the energy needs. The school group is equipped with various innovative equipment (room-by-room control, GTC for heating, solar shading, natural ventilation, CO2 sensor, counting and counting, dimmable lighting, window contact to stop heating in case Opening ...) allowing it to guarantee such results. Support for the various users of the building was realized to allow an appropriation of the functioning of the building and to participate in the optimization of comfort and energy savings. A user guide was set up as well as an explanatory comic book for the students. This school was awarded the

Ecocité call for proposals launched by the State.

* The city of Chengdu in China (10 million inhabitants) has been twinned with the city of Montpellier since 1981. When the foundation stone of the Chengdu school was laid, the mayor of Chengdu was present and asked architects to Build in Chengdu the Montpellier school on the same bases!

Sustainable development approach of the project owner

Objectives: Building with Energy Positive (BEPOS) + 20% all energies combined in a constrained plot: plot of 2000m2 and large mask (R +12 and R + 8 in the south), very constrained delays. Contractual objectives: 1 heating requirements of 13kWh / m2SHORT / year maximum, 2-autonomy natural lighting 70% minimum, 3-production renewable energy: 120% minimum consumption, 4-level air tightness less than 0.8m3 / h / m2 This is the 3 ° BEPOS built by the city of Montpellier; The 1st BEPOS was carried out in-house by the services of the City of Montpellier and the 2 ° BEPOS was carried out by competition architect and market works in separate state bodies.

Architectural description

The school group Chengdu is located in the ZAC Parc Marianne of the city of Montpellier. It is entirely in keeping with the dynamics of the place by presenting an urban and attractive architecture. The heights, the plays of full and void, the colors, the materials, the architecture in "stratum" participate in its integration. Built in a constrained area (small plot of 2000m², adjacent to high buildings), this school has been optimized to accommodate the pupils of the 11 classes of the school group and has an interesting compactness to limit thermal losses of this building. The school rises on 3 levels and has intermediate levels with the playground and a bioclimatic garden. Each element of the frame has been designed to optimize the space and contribute to the comfort of the users. The solar protection of the premises is ensured by large roof overhangs and adjustable sun breezes. The south orientation of the main facade of the school allows a great deal of natural light and heat in winter. The circulations are located in buffer zones to the north of the building. The 300m² of photovoltaic sensors have been integrated into the roof of the R + 2.

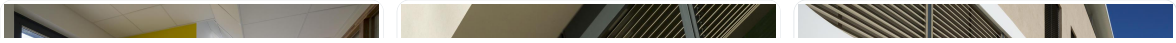
Building users opinion

Testimony of Catherine Pertin, Director of the Chengdu School Group

1) What do you think of the summer and winter comfort of the building?
Overall the building is comfortable for teachers and students. The solar shading and the inertia of the building contribute greatly.
On the other hand, there is an "aquarium effect" in the nursery yard since the buildings were built around.
2) What do you think of lighting? Quality / function of the detectors?
It's good. It is also interesting to be able to have the hand on the solar shadows or on the light especially when there are projections made in class.
3) What do you think of solar shading? Quality / Functioning?
The operation is good and the material is of very good quality (Comparison with the Montpellier school built in Chengdu in China). The settings are fine and being able to have a hand on it is a plus. The level of comfort is very good and the sensors for the solar shading work perfectly, they reorient themselves automatically every 6 hours.
4) Are windows open regularly? The heating stops at that time?
The windows are rarely opened, it can happen when they are substitute teachers. To stop the heating when a window is opened effectively it works.
5) What do you think of the acoustics of the building?
Compared to the exterior, it is special because there are many building sites around but I think the acoustics remains better than in a conventional building.
At the level of the interclass acoustics, there have never been any problems, it's really good. For the refectory, it is also very well compared with other establishments.
6) At the restaurant, do you use ceiling fans?
Yes it is a good thing, it gives a refreshing effect.
7) In relation to your experience, what is the difference between BEPOS and conventional?
This is important for the children and the teaching staff. It's nice for a team to have a new venue that also produces more energy than it consumes.
8) Is the Guide sufficient to understand the operation of the building?
The teaching team is the same as that since the opening of the school, we quickly and perfectly assimilated this guide. In addition, a functional guide more suited to children has been created, it is highly appreciated by everyone.

See more details about this project

http://WWW.coste.fr/projet.html?projet=ec169



Stakeho

Stakeholders

Function : Designer

AGENCE COSTE ARCHITECTURES

ANDRE ARIOTTI - 04 67 61 00 81 - ariotti@coste.fr

http://coste.fr
Architect

Function : Contractor

VILLE DE MONTPELLIER

MICHEL IRIGOIN - 04 67 34 70 00 - michel.irigoin@ville-montpellier.fr

http://www.montpellier.fr
Contracting authority - Director for Energy and Technical Means

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Function : Company

BOUYGUES BATIMENT SUD EST (BBSE)

Olivier DEQUATRE

http://bouygues-batiment-sud-est.fr
GENERAL ENTERPRISE

Function : Thermal consultancy agency

ETAMINE

Sébastien Randle - 04 37 45 27 - sebastien.randle@etamine.coop

http://www.etamine.coop
Thermal studies

Function : Other consultancy agency

BETOM Ingénierie

Thierry AGUILAR

http://www.betome.fr

Contracting method

General Contractor

Type of market

Realization

Energy

Energy consumption

Primary energy need : 37,00 kWhep/m^2.an

Primary energy need for standard building : 87,00 kWhep/m^2.an

Calculation method : RT 2005

Breakdown for energy consumption : - in kWh EP / m² / year Heating: 17.1; Cooling: 0; DHW: 2.3; Lighting: 12.3; Ventilation: 4; Auxiliary (pumps): 0.3; Other (unconventional consumption): 23.4.

Real final energy consumption

Final Energy : 27,00 kWhef/m^2.an

Real final energy consumption/m2 : 27,55 kWhef/m^2.an

Real final energy consumption/functional unit : 27,55 kWhef/m^2.an

Year of the real energy consumption : 2 014

Real final energy consumption/m2 : 27,74 kWhef/m^2.an

Real final energy consumption/functional unit : 27,74 kWhef/m^2.an

Year of the real energy consumption : 2 015

Envelope performance

Envelope U-Value : 0,51 $W.m^{-2}.K^{-1}$

More information :
Thermal envelope
Exterior wall
ITI: RdC giving on public space, constraint ZAC:
-Mur concrete 20cm
-Complex Placomur 13 + 160
-λ = 0.032 W / m · K; Acermi n ° 03/081/361
-R = 5.00 m².K / W

ITE: other external walls:
-Polystyrene 20cm: Sto-panel polystyrene PS 15 SE
-λ = 0.038 W / m.K; technical sheet
-R = 5.3 m².K / W
-Mur concrete 20cm0.18
Low floor on solid ground
Slab insulation:
Concrete 20 cm
-Insulating 10 cm KNAUF Therm Slab Reach
-λ = 0.038 W / m.K; Acermi 11/007/730
-R = 2.6 m².K / W 0.29
Low floor outside
-Concrete: 30cm
-Polystyrene: Sto-panel polystyrene PS 15 SE 15cm (identical external wall)
-λ = 0.038 W / m.K; technical sheet
-R = 3.95 m².K / W 0.25
roofing
Current area:
-Team concrete 30 cm
-20 cm insulation Eurothane
-λ = 0.024 W / m.K; Acermi N ° 03/003/127
-R = 8.6 m².K / W
+
-6 cm insulation Topox Cuber
-λ = 0.031 W / m.K; Acermi No 08/107/532)
-R = 2.05 m².K / W

-Sout Rtotal = 10.65 m².K / W

"Gutter" area:
-Team concrete 30 cm
-20 cm insulation Eurothane
- (λ = 0.024 W / m · K; Acermi No. 03/003/127)
-R = 8.6 m².K / W0.10
Glazing
Aluminum joinery with break of thermal bridge
Reinforced insulated glass Argon 4/16/4
Thermal calculations joinery:
Uw mean R-1 = 1.538 W / m².K
Uw medium Ground floor: 1.529 W / m².K
Uw mean R + 1: 1.542 W / m².K
Uw mean R + 2: 1.476 W / m².K
Uw = 1.60

Exterior solar shading, adjustable and liftable.
Automatically managed to optimize free winter intake and summer protection (temporary waiver by users).

Building Compactness Coefficient : 0,44

Indicator : I4

Air Tightness Value : 0,61

Users' control system opinion : Lack of complaint, the equipment works as expected.

More information

Corrective actions after delivery of the building: 1-optimization of boiler heating and temperature control, 2-optimization of fan speed variation, 3-optimization of presence / brightness detector settings; 4-change of communication gateway between heating control and GTC; 5-change of inverter under warranty; 6- Domestic hot water (DHW): the efficiency of the first storage tank on a heat pump system did not exceed 25% (see: significant distance from the delivery points) to remedy this and, given the very low DHW requirements, Replaced by an electric balloon.

Renewables & systems

Systems

Heating system :

- Urban network

Hot water system :

- Individual electric boiler

Cooling system :

- No cooling system

Ventilation system :

- Double flow heat exchanger

Renewable systems :

- Solar photovoltaic

Renewable energy production : 125,00 %

https://www.construction21.org/france/data/sources/users/7500/chengu-photo-vue-du-ciel.docx

Other information on HVAC :

Heating
Heat exchanger in Montpellier, distribution by radiator, temperature control room by room thanks to a temperature and presence sensor; Action by 2-way valves; Heated volume network

Domestic hot water: by electric water heaters with reinforced insulation for the kitchen.
2 small electric water heaters for very low use
NOTE: the efficiency of the first storage tank on a heat exchanger did not exceed 25% (see: significant distance from the delivery points) in order to remedy the problem, and in view of the very low DHW requirements, it was replaced by an electric storage tank

CIAT ventilation - technical data sheet
VT04 / VT05 ind ACTA 1 WestCTA 2 EstCTA PsychomotorCTA restorationVMCTOTAL
Pabs (W) 2558 3233 198 2428 2708687

CIAT - technical sheet
VT04 / VT05 ind ACTA 1 WestCTA 2 EstCTA PsychomotorCTA restoration
Efficiency interchange80.20% 78.40% 85.90% 74.00%

Biomass heat networks at 90% minimum

Solutions enhancing nature free gains :
Brise-soleil automatique orientable et relevable

https://www.construction21.org/france/data/sources/users/7500/fiche-bepos---gs-chengdu-012016.docx

Smart Building

BMS :
Optimized thermal design of the building according to Dynamic Thermal Simulation. Photovoltaic solar photovoltaic production. Site connected to the heat network. Optimization and management of solar contributions by adjustable solar shading. Ventilation

Users' opinion on the Smart Building functions : Easy to understand and use.

Environment

Urban environment

Land plot area : 2 000,00 m^2

This project has the will to integrate itself in its environment without being not hidden in the eyes of the public. It is important that such equipment can be perceived and seen by everyone. A school is a primary program in a neighborhood. It is federative, it assumes a preponderant social role. The proposed site, relatively "enclave" in the very center of the Parc Marianne ZAC, is located in the heart of a residential environment. It has a rectangular shape and has a building area that is constrained by its grip and height. The relatively small building surface area and the architectural recommendations of the ZAC naturally led us to propose a project that was installed on the entire right-of-way: - Implementation of the project on the entire available floor area - "Full" peripheral base on the north and east facades - Courtyard and classrooms in the South - Use of the possibility of semi buried rooms to propose for a perfect internal organization This school project is therefore anchored in a truly urban neighborhood. It has to respond to its environment close both by its architecture and by its volumes. ZAC of about 2000 dwellings and plot with buildings in R + 12 and R + 8 south side.

Products

Product

Steering of adjustable venetian blinds

SOMFY

50, avenue du Nouveau Monde 74307 Cluses Cedex

https://www.somfy.fr/

Product category : Table 'c21_china.innov_category' doesn't exist SELECT one.innov_category AS current,two.innov_category AS parentFROM innov_category AS oneINNER JOIN innov_category AS two ON one.parent_id = two.idWHERE one.state=1AND one.id = '10'

Automatic regulation of opening / closing of exterior windows in four zones.

A product very well perceived by the users, the quality and the usefulness of the equipment are felt in summer as in winter

Air-tightness of the building

ENEXCO

contact@enexco.fr

http://www.enexco.fr/

Product category : Table 'c21_china.innov_category' doesn't exist SELECT one.innov_category AS current,two.innov_category AS parentFROM innov_category AS oneINNER JOIN innov_category AS two ON one.parent_id = two.idWHERE one.state=1AND one.id = '10'

During the entire construction phase, ENEXCO accompanied all the parties concerned by the air-tightness of the building: 1 - Educational stage with a slideshow showing the importance of airtightness 2 - Definition and tests with the companions responsible for the installation of the glazing, the good gasket placed between the carpentry and the frame (four tests were necessary to validate the good product) 3- Test Air-tightness test on a classroom including smoke test, with depression in the room to visualize abnormal air intakes 4 - Testing on a third of the building with the same procedures and measurements Airtightness (less than 0,8 Vh / m^2 under 4 Pa) 5 - Test on the whole school and after the various corrections obtaining a value of 0,5

Excellent pedagogical and technical contribution (notably to show the corrections to be carried out during construction phase), allowing the choice of the right materials and the right procedures to achieve the optimum result.

Presence and brightness sensor

BEG

Mr RENAUDI Claude, claude.renaudi@orange.fr

http://begfrance.fr/

Product category : Table 'c21_china.innov_category' doesn't exist SELECT one.innov_category AS current,two.innov_category AS parentFROM innov_category AS oneINNER JOIN innov_category AS two ON one.parent_id = two.idWHERE one.state=1AND one.id = '17'

Room-by-room control of the lighting according to the external natural light and the presence of the occupants: the lighting only switches on if these two conditions are met
In the classrooms, the detectors are in two zones (on the corridor side and on the window side) and the auxiliary dry contact is controlled by the presence detector and, in the absence of the heating, switches off from 9.00 am

Provision by the manufacturer of a remote control allowing remote adjustment of these detectors and training for the agents of the city in charge of its maintenance.

Water flow regulator

NEOPERL

info@neoperl.ch

http://www.neoperl.ch/fr/retail/home/distribution.html?cId=NL&fId=FR

Product category : Table 'c21_china.innov_category' doesn't exist SELECT one.innov_category AS current,two.innov_category AS parentFROM innov_category AS oneINNER JOIN innov_category AS two ON one.parent_id = two.idWHERE one.state=1AND one.id = '14'

Installation on all valves of flow regulators at 8L / min (showers), 6L / min (offices and washing point) and 1.7L / min (washbasins)

Control of the flows obtained by the technician in charge of the water and regular checks of the possible scaling (especially on flow regulators at 1.7L / min)

Double flow air handling unit

CIAT

Stéphan GIRARD; s.girard@ciat.fr

http://www.ciat.fr/

Product category : Table 'c21_china.innov_category' doesn't exist SELECT one.innov_category AS current,two.innov_category AS parentFROM innov_category AS oneINNER JOIN innov_category AS two ON one.parent_id = two.idWHERE one.state=1AND one.id = '19'

Implementation of dual-flow air treatment plants with energy recovery by wheel: recovery efficiency of 80%

Optimization of the operation of these two-flow power plants was obtained in particular by the installation of filters of type G5 in place of initial filters F7 which made it possible to reduce very significantly the losses of load of the equipment and thus to minimize electrical consumption.

Remote management of climate equipment

SAIA

9 avenue du Marais Parc des Algorithmes Bâtiment Sophocle 95100 Argenteuil

http://www.saia-pcd.com/fr/saia-burgess-controls-ag/

Product category : Table 'c21_china.innov_category' doesn't exist SELECT one.innov_category AS current,two.innov_category AS parentFROM innov_category AS oneINNER JOIN innov_category AS two ON one.parent_id = two.idWHERE one.state=1AND one.id = '18'

Implementation of a system for the regulation and counting of all school consumptions with room-by-room control of the control system (indoor temperature, unoccupied stop, modulation of air flow by CO2 detection probe, shutdown In case of window opening). Measurement of all school heating, electricity and water consumption: dealers' counters (purchase and resale of electricity, heat network and two water meters (green space and building))

By means of a touchscreen to the boiler operators, this control allows to be able to permanently know (on site or remotely on the Internet) the correct functioning of the equipment, to visualize on a synoptic the equipment installed and to be alerted in case of a " Anomaly of operation (by mail). This tool, parameterized in particular by the technician of the energy department of the city of Montpellier, allowed a rapid appropriation of these equipments. The BEPOS control of this building is carried out monthly for all energies combined and verified that this building was BEPOS + 20% over a full year.

Assignment of assistant to project manager from the upstream to the downstream

IZUBA

Stéphan BEUDEL, stephane.beudel@izuba.fr

http://www.izuba.fr/

Product category : Table 'c21_china.innov_category' doesn't exist SELECT one.innov_category AS current,two.innov_category AS parentFROM innov_category AS oneINNER JOIN innov_category AS two ON one.parent_id = two.idWHERE one.state=1AND one.id = '33'

An AMO has been chosen by the city (IZUBA) to define the contractual performance of the MOE (four target values to be achieved including BEPOS + 20%, air tightness, daylight factor and BBC 20 %) 2 - each criterion not obtained was subject to a penalty of 15000 (e) in case of non-compliance 3 - this AMO accompanied the city throughout the construction phase as well as during exploitation the first years

This support has been extremely beneficial for the city to ensure the quality and performance of both the building and equipment as well as to help us start up the installations and monitor the performance required

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Photovoltaic panels

SUNPOWER FRANCE SAS

12, allée du Levant 69890 La Tour-de-Salvagny; tél : 0 805 090 808

http://www.sunpower.fr

Product category : Table 'c21_china.innov_category' doesn't exist SELECT one.innov_category AS current,two.innov_category AS parentFROM innov_category AS oneINNER JOIN innov_category AS two ON one.parent_id = two.idWHERE one.state=1AND one.id = '29'

In order to be BEPOS + 20% the Chengdu school is equipped with 290m ² of photovoltaic panels installed on two distinct roofs. The 177 modules produced 75.8 MWh in 2015, despite a restrictive zone (many masks). Photovoltaic production is closely monitored. In order to detect an inverter fault an interface, available online,

has been set up to monitor production in real time and check the efficiency of the inverters. Cleaning of the panels is carried out once a year to ensure better productivity.

Photovoltaic panels guarantee the BEPOS performance of the school. A monitoring of production is therefore important.

Costs

Construction and exploitation costs

Global cost : 9 400 000,00 €

Renewable energy systems cost : 220 000,00 €

Global cost/Pupil : 31333.33

Subsidies : 1 300 000 €

Energy bill

Forecasted energy bill/year : 14 484,00 €

Real energy cost/m2 : 5.48

Real energy cost/Pupil : 48.28

Health and comfort

Water management

Consumption from water network : 168,00 m^3

Water Consumption/m2 : 0.06

Water Consumption/Pupil : 0.56

Specific green space meter: consumption 0 m3 in 2015

Indoor Air quality

The ventilation is controlled piece by piece, by action on a register according to the data provided by the CO2 probes, presence detectors and windows opening.

Comfort

Health & comfort : A comfortable building for the users.

Measured thermal comfort : En hiver 19°C (consigne chauffage); en été température inférieure à 28°C sauf cas exceptionnel.

Acoustic comfort : According to the Director of Chengdu School, acoustics is better than in a conventional building.

Carbon

GHG emissions

GHG in use : 1,70 $KgCO_2/m^2/an$

Methodology used :

Consumption building

Building lifetime : 50,00 année(s)

Contest

Building candidate in the category

Green Solutions

Energie & Climats Tempérés

Coup de Cœur des Internautes

Date Export : 20230628090950