


## Chongqing Bojian Center

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**New Construction**

Primary energy need :

### 69.02 kWhpe/m<sup>2</sup>.

(Calculation method : Primary energy needs )

**ENERGY CONSUMPTION**

*Economical building* *Building*

< 50	A
51 à 90	B
91 à 150	C
151 à 230	D
231 à 330	E
331 à 450	F
> 450	G

*Energy-intensive building*

**Building Type** : High office tower > 28m  
**Construction Year** : 2008  
**Delivery year** : 2013  
**Address 1 - street** : 401120 ,  
**Climate zone** :

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**Net Floor Area** : 19 935 m<sup>2</sup>  
**Construction/refurbishment cost** : 78 548 300 ¥  
**Number of Work station** : 600 Work station  
**Cost/m2** : 3940.22 ¥/ m<sup>2</sup>

**Certifications :**



### General information

Chongqing is located in the southwest of Sichuan basin, and the climate is typically hot in summer and cold in winter. The main characteristics of the area are lack of solar radiation, humid climate, abundant rainfall, low wind speed. The average annual temperature in Chongqing is 16-18°C. The average temperature of the hottest month is 26-29 °C. In summer, temperature reaches 38-40 °C, lasting 120-140 days. Some region is even 42, 43 °C. The average temperature of the coldest month is 4-8 °C. The annual average precipitation is relatively abundant, most of the area is 1000-1350mm, and the precipitation is mostly concentrated in May- September, accounting for about 70% of the total annual precipitation. The annual average relative humidity is 70% - 80%. The annual sunshine duration is 1000-1400h, of which the percentage is only 25% - 35%, which is one of the areas with the least sunshine in the whole country with less sunshine in winter and spring only about 35% of the year.

The project is located in North New District, besides Jinkai Road and Cuiyu Road, with convenient transportation. The construction land is square. The orientation of the building is north-south. The East-West elevation difference is 7 meters; the East is high and the west is low; the north-south direction is 5 meters high; the

Car  
GH  
GHG  
Build

south is high and the north is low. The eastern side is the mili Hill residential area; the south side is adjacent to a small hospital; the western side is the planned urban green space, and the north side is the other enterprise headquarters land.

The project is office building. The total construction area is 19935.45 m<sup>2</sup>, of which the floor area (9 floors) is 10215.24 m<sup>2</sup>, and the underground area (4 floors) is 9720.21 m<sup>2</sup>. The first floor is a flat top. The height of the building is 48.3m. The underground 1st floor (semi underground space) is the dining hall and the fire control room. The underground 2nd and 3rd floors are the garage, and the underground 4th floor is the equipment rooms.

Chongqing Bojian Center is a high standard office building meticulously bred by Chongqing Bojian Real Estate Consulting Co., Ltd. and Bo Jian Architectural Design Co., Ltd. It's mainly used as the headquarters and office of Bojian Architectural Design Co., Ltd. and related design and supporting enterprises. On the north side, the 3rd and 6-7th floors of the attached building are occupied, as well as the 7th floor and above of the main building in the south, and the remaining floors are available for hire.

The project uses several energy-saving and environmental protection technologies to achieve the objectives of green building. It has a comprehensive consideration of energy saving, water saving, material saving, land saving, operation management and indoor environment, in line with National Second-Star Green Building requirements. For the problem of slope and height difference under mountain conditions, project the adopts design of bottom overhead, layered building, building retreat, etc., combined with mountain ramp and atrium space. Considering the climate characteristics of hot summer and cold winter zone, the layout and orientation of the main residential units are easy to form a good "hall wind" effect and make full use of natural wind. Combined with the characteristics of resources, the selection of technology, equipment and system, the project makes indoor environment, wind environment, light environment, as well as sound environment, etc. meet the requirements of green building. It achieves the goal of work comfort and energy-saving. The energy saving rate is more than 50%.

## Data reliability

3rd part certified

## Stakeholders

### Contractor

Name :

Contact : 023-67001848

<http://www.china-bojian.com>

### Construction Manager

Name :

### Stakeholders

Function : Thermal consultancy agency

dingyongqq@163.com

<http://www.cqu.edu.cn>

### Contracting method

Lump-sum turnkey

### Owner approach of sustainability

Through the combination of passive design, active technology, resource conservation and indoor environment design, Chongqing Bojian Center has realized the high efficiency and greening of the project during the whole life of the design, construction, and operation.

Chongqing Bojian Center adopts the design of the bottom overhead, the patio, the outer corridor and the patchwork atrium to change the architectural form and the internal flow passage, which promotes the natural ventilation effect. For the characteristics of weak solar radiation and short sunshine time, the patio and skylight are adopted. Technology such as a light guide tube effectively improves natural daylighting; for the problem of slope and height difference under mountain conditions, the design of bottom overhead, layered building, building retreat, etc., combined with mountain ramp and atrium space. Reasonable design of the vertical design of the building; systematic consideration of the building orientation and shape, combined with the local wind environment, the use of the tunnel wind system, fully tap the natural ventilation potential of mountain buildings, give play to the advantages of Chongqing's climate resources, and effectively reduce the air conditioning load.

Project uses energy-efficient air conditioning equipment. The partial load performance coefficient (IPLV) of the air conditioning system is between 5.00 and 5.45, which is significantly higher than the national standard for IPLV not less than 3.95.

The indoor space with transformable functions in the office layer is flexibly partitioned to ensure that the disassembly process does not affect the use of the surrounding space, and the materials can be recycled. To restore the authenticity and simplicity of the building, the whole building uses fair-faced concrete as the main building material. The partial building façade and the low landscape wall are mixed with dry hanging handmade stone materials. Taking into account the abundant rainfall in Chongqing, the project has set up permeable ground, vertical greening, and stagnant rainwater to reduce drainage pressure. On the other hand, it has used rainwater recycling and reused rainwater for greening irrigation and water storage roofing; Various greening forms such as platform greening, vertical greening, pedestrian trail greening and roof greening, summer sunshade and winter lighting have improved the indoor light environment and thermal

environment.

## Architectural description

### 1 Value of technological innovation

Aiming at the problem of slope and elevation difference in mountainous area, the vertical design of the building has been carried out reasonably, such as the design of bottom overhead, layered building, building retreat, etc., combined with mountain ramp and atrium space. It restores the unique life style of the mountain city of Chongqing, puts forward solutions for complex terrain construction problems, and ensures the safety of mountain buildings. The project innovatively adopts greening wall surface combined with breathing green exterior shading system. Vertical greening has a sunshade function in summer: lush plants in summer can reduce solar radiation energy entering the room; plant transpiration can drive air circulation on the facade and reduce convection heat. It has a daylighting function in winter: the winter plants are withered, it is easy for sunlight to enter the room. Moreover, the indoor light environment and thermal environment are improved. These measures can enrich the spatial structure level of urban landscaping and the urban three-dimensional landscape art effect. The indoor space with transformable functions in the office layer is flexibly partitioned to ensure that the disassembly process does not affect the use of the surrounding space, and the materials can be recycled. Moving the wall partition changes the layout at any time, creating a perfect reading space, rest and reading without interference. Using a bookshelf or a display case to make a short break is also a practical way to create a dual-use. Moreover, some partitions are made of paper, recycling bins, etc., reflecting the combination of art, humanity and environmental protection. The project takes the Chongqing Hanging House on the top of the mountain as the design starting point and combines the low-tech ecological means to create a unique office volume belonging to Chongqing, forming a Chongqing impression building with the modern architectural language as the mother. The vertical greening of the building can not only purify the air, significantly increase the content of negative oxygen ions, promote air circulation, but also enrich and improve artistic accomplishment and cultivate life sentiment.

### 2 Industrial promotion value

Aiming at the problem of slope and elevation difference in mountainous area, the vertical design of the building has been carried out reasonably. The project innovatively adopts greening wall surface combined with breathing green exterior shading system. Combined with the characteristics of resources, the selection of technology, equipment and system, the project makes indoor environment, wind environment, light environment, as well as sound environment, etc. meet the requirements of green building. It achieves the goal of work comfort and energy-saving. The energy saving rate is more than 50%. This project is the successful integration and application of green building technology. It will lead the rapid development and even change of the green building industry chain, including the green building design consulting industry, green building materials research and development industry, green building equipment research and development industry, green building construction industry and so on.

### 3 Social value

Through the combination of passive design, active technology, resource conservation and indoor environment design, Chongqing Bojian Center has realized the high efficiency and greening of the project during the whole life of the design, construction, and operation to reduce energy consumption, improve energy efficiency, reduce operating costs, and apply green technologies based on integration, improve compatibility, and adopt the strengths of each family to create a low-cost, green building for the entire office building. Chongqing Bojian Center has played a decisive role in promoting the green building concept in Chongqing and leading the development direction of the industry.

## If you had to do it again?

Chongqing Bojian Center is actively exploring the green building system suitable in Chongqing area, using combinations of passive design, active technology, resource saving and indoor environment design, through the simulation analysis, multi scheme comparison, project combined with own characteristics, rational distribution of many kinds of natural resources, such as geothermal resources, wind resources, and rainwater resources. It has realized the high efficiency and greening of the project in the whole life cycle of design, construction and operation.

### 1 Tunnel ventilation system

The project uses the corridor in 3th floor underground as the tunnel-air heat exchanger, installs the gallery type and overhead tunnel air duct, introduces the outdoor fresh air and carries on the heat exchange, pressurizes through the terminal machine room of the gallery, and transports to each floor through the air supply shaft. The west side of the building is adjacent to the city valley, which is the source of the wind. The wind blows from the open area on the west side to the base, forming a better natural wind field. Section A and Section B form a natural angle, designed for open space, and open to the Northwest direction. So, the natural wind is introduced into the deep part of the building. The project rationally utilizes geothermal resources and improves air conditioning system efficiency by pre conditioning fresh air conditioning.

### 2 Natural ventilation

The main wind direction of the project is northwest wind, the wind speed around the site is small, and the instantaneous wind speed is less than 5 m/s. The shape of the construction land is regular, but there is a big height difference in the east-west and North-South directions. The height difference is 7 meters in the East-West direction, high in the East and low in the west, 5 meters in the North-South direction, high in the South and low in the north. In order to adapt the building to the site and meet the special requirements of natural ventilation of the building itself in local microclimate, the building refers to the hanging-foot building of Chongqing traditional building and adopts the design of the bottom overhead. The overhead floor is 6-10m high and covers an area of about 800 m<sup>2</sup>. This design has changed the flow path inside the building, forming strong airflow and promoting the ventilation effect of the courtyard.

### 3 Natural lighting

In order to reduce the energy consumption of building lighting, the project adopted different ways to improve natural lighting in the ground and underground parts of the building. On the ground floor, the project has patios in the middle of the building, skylights in the corridors of the nine-storey office area, and extensive side lighting in offices and conference rooms in the underground part, the project has set up a high window in the semi basement dining room, and light guide tube is installed in garage.

### 4 Water-Saving

Rainfall is abundant in Chongqing. The non-traditional water source used in this project is rainwater. The roof has a storage tank with a volume of 88m<sup>3</sup>, which is used for greening and irrigation. The utilization rate of the water is 28.63%, and the green irrigation method is drip irrigation. In this way, water is saved effectively.

## Building users opinion

Each year, the owner's property service feedback investigation was carried out, including indoor thermal comfort, air quality and other related content. 2000 questionnaires were issued in 2017, and 1812 valid questionnaires were recovered. The satisfaction rate of indoor thermal comfort reached 87.21%; more than 86% of the building users think that the air quality in the building is good and odorless, and they are satisfied with the overall air quality of the building; 82% of the building users think that the illumination in the building is moderate and they are satisfied with the overall light environment of the building; 80% think that there is

only a slight noise in the building, and they are satisfied with the sound environment of the building. Some users indicated that the control of air conditioning and traffic noise should be strengthened, and the sound insulation effect of the room should be strengthened, and the production of glare and stroboscopic lamps should be controlled in daylighting.

## Energy

### Energy consumption

Primary energy need : 69,02 kWhpe/m<sup>2</sup>.

Primary energy need for standard building : 85,00 kWhpe/m<sup>2</sup>.

Calculation method : Primary energy needs

Final Energy : 69,02 kWhfe/m<sup>2</sup>.

Breakdown for energy consumption :

HVAC 20.01 Kwh/m2/year

Lighting system 36.58 Kwh/m2/year

Power equipment 4.14 Kwh/m2/year

Others 8.28 Kwh/m2/year

### Envelope performance

Envelope U-Value : 1,45 W.m<sup>-2</sup>.K<sup>-1</sup>

More information :

The project is separated into two section, A and B:

U-value Wall Roof

Section A 1.94 0.59

Section B 1.45 0.59

Building Compactness Coefficient : 0,27

Indicator : GB/T 7106-2008

Air Tightness Value : 6,00

### Real final energy consumption

Real final energy consumption/m2 : 69,02 kWhfe/m<sup>2</sup>.

Year of the real energy consumption : 2 017

## Renewables & systems

### Systems

Heating system :

- Heat pump

Hot water system :

- No domestic hot water system

Cooling system :

- VRV Syst. (Variable refrigerant Volume)

Ventilation system :

- Canadian well

Renewable systems :

- Other, specify

### Smart Building

BMS :

The outdoor engine of the air-conditioning system of this project adopts intelligent multi-level energy regulation, which is efficient and energy-saving. The refrigeration and heating capacity of the outdoor engine can be automatically and effectively adjusted, and the amount of cooling (heat) can be supplied on demand according to the load requirements of different indoor air-conditioning conditions. Each indoor machine is equipped with a line controller for debugging and controlling a single indoor machine. At the same time, a centralized controller can be set up according to the use of the situation to centralize the control and management of multiple indoor machines. The system adopts the advanced temperature control technology, the cooling medium distribution technology and the

intelligent control technology as well as the highly sensitive and accurate temperature and pressure network system. According to the user's demand, the system can accurately induce the change of the cold and heat load of the indoor environment, and make the temperature adjustment quickly and accurately. The electrical fire monitoring system of this project adopts intelligent bus transmission communication. The alarm host is located in the fire control room. Copper-core power cables and conductors are selected according to the economic current density. Two SCB10 energy-saving transformers in the substation are connected with each other and can be switched on and off flexibly according to the load variation. By reasonable load distribution, the average load rate of the transformer is about 83%, so that the transformer can work in the high-efficiency and low-consumption area as far as possible. Frequency conversion speed control is adopted in motor control. When the load rate changes, the motor can automatically adjust the speed to suit the load change, so as to improve the running efficiency of the motor under light load.

## Environment

### Urban environment

The project is located in North New District, besides Jinkai Road and Cuiyu Road, with convenient transportation. It is 10 kilometers away from Jiangbei Airport in Chongqing and 9.8 kilometers away from Chongqing north railway station. The construction land is square. The orientation of the building is north-south. The East-West elevation difference is 7 meters, the East is high and the west is low, the north-south direction is 5 meters high, the south is high and the north is low. The eastern side is the mili Hill residential area, the south side is adjacent to a small hospital, the western side is the planned urban green space, and the north side is the other enterprise headquarters land.

The geological condition of the project site is good, and the rock is stable. No harmful geological phenomena such as dangerous rock, fault, landslide has been found. The site is a geological disaster-prone area, which is conducive to project construction. The environmental carrying capacity of the selected site area is large, and the amount of pollution produced by the project is small. At the same time, the pollutants discharged by the project are all up to the standard after treatment, and will not pollute the surrounding environment. The project is close to the "Garden Expo Garden" station of rail transit, the "Garden Expo Garden East Gate Station" and the "Meilishan Station" with seven bus routes surrounding the Expo Center. Within 500 meters from the main entrance and exit, there are seven bus : 628, 684, 878, 559, 623, 633 and 831.

### Land plot area

Land plot area : 4 100,00 m<sup>2</sup>

### Green space

Green space : 1 178,00

### Parking spaces

A total of 189 parking spaces are set up in the project, which are located on the ground floor of two floors and three floors, with 0.3 parking spaces per person.

## Products

### Product

399 B4 3

<http://www.hisensehitachi.com/>

Product category :



3 503

<http://www.cqmaloo.com/>

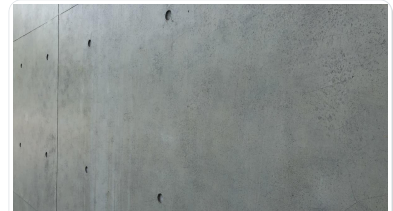
Product category : HVAC / Illuminazione



5 1 100-8405

<http://www.agc.com/cn/index.html>

Product category : Opere strutturali / Struttura - Involucro - Finitura



## Costs

### Construction and exploitation costs

Cost of studies : 78 658 300 ¥

Total cost of the building : 78 548 300 ¥

Subsidies : 199 000 ¥

### Energy bill

Forecasted energy bill/year : 1 183 000,00 ¥

Real energy cost/m<sup>2</sup> : 59.34

Real energy cost/Work station : 1971.67

## Building Environmental Quality

### Building Environmental Quality

- indoor air quality and health
- energy efficiency
- integration in the land
- mobility
- products and materials

## Health and comfort

### Water management

Consumption from water network : 14 251,00 m<sup>3</sup>

Consumption of harvested rainwater : 4 079,85 m<sup>3</sup>

Water Self Sufficiency Index : 0.22

Water Consumption/m<sup>2</sup> : 0.71

Water Consumption/Work station : 23.75

### Indoor Air quality

This project uses the VRF air condition system with air purification section, which ensures the cleanliness of the air out of the air and provides a strong guarantee for the high efficiency and cleanliness in the room. The average indoor air quality of the whole year is as follows:

CO2 Concentration mg/m3	510.44
Formaldehyde Concentration mg/m3	0.0279
TVOC Concentration mg/m3	0.018
Benzene Concentration mg/m3	Not Founded
PM2.5 Concentration µg /m3	39.4

Each year, the owner's property service feedback investigation was carried

## Comfort

Calculated indoor CO2 concentration :

CO2 mg/m3 510.44

Calculated thermal comfort : 16.17°C 68.11% 19.72°C 62.42% 24.91°C 63.07% 23.33°C 57.83%

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