

North Base of Customer Service Center of State Grid Corporation of China (Phase I)

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Primary energy need :

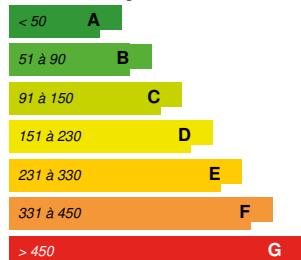
470.76 kWhpe/m².

(Calculation method : Primary energy needs)

ENERGY CONSUMPTION

Economical building

Building



Building Type : Office building < 28m

Construction Year : 2013

Delivery year : 2015

Address 1 - street : 300309 ,

Climate zone : [Dfb] Humid Continental Mild Summer, Wet All Year

Net Floor Area : 143 290 m² Other

Construction/refurbishment cost : 177 216 000 €

Cost/m² : 1236.76 €/ m²

Certifications :



General informations

This building received a mention for the Sustainable Construction Grand Prize of the Green Solutions Awards International 2020-21.

State Grid Customer Service Center is located in the north of Zhijing East Road, Dongli Lake Resort, Tianjin, covers the total construction area of 142,800 square meters, its above-ground area is 115,400 square meters and underground area is 27,400 square meters, with floor area ratio of 1.05, the project green area of 61,700 square meters and greening rate of 41.1%, it is a large park integrating production, office and life, responsible for the task of power supply service hotline in 13 provinces and cities of China. The project upholds the purpose of green, energy saving, environmental, sustainable, penetrates smart, healthy, comfortable and pleasant concept to the whole process from planning and design to building operations, and then to project operation, it aims at building a comprehensive ecological office park in Tianjin that integrates technology into nature and science and technology into architecture.

The main building structure in the park is mainly constructed in the reinforced concrete frame system, steel structure is used for the corridor between Operation Monitoring Center, the public service building, call center and operation monitoring center. The overall function of the park is mainly office-oriented with a variety of life service functions, it undertakes all the production of full business personnel, including centralized call center, interactive network services and business development, as well as the comprehensive services of accommodation, catering, culture, entertainment, sports, leisure, parking, property management. Including operation monitoring center, call center, production area service center, living area service center, shift change dormitory and other 10 buildings, they are divided into two divisions from north to south, the production office area is to the North, and the **supplementary area** is to the South.

To build new cities and new benchmark projects, taking the advanced concept of green building as the guide, combined with the environmental climate characteristics of the project area and the existing situation around the site, the State Grid Customer Service Center proposes four concepts of building "green ecological park, green energy park, green service park and green smart park". This introduces a number of modern construction technologies, various new building materials and parts for the North Base (Phase I) project of State Grid Customer Service Center, adopts more than 40 green construction technologies from the three aspects of ecology, economy and energy, and creates a unique technology office park for the employees in the park; Meanwhile, it integrates several management and operation system, forms a set of modern office park operation mode, which is suitable for local ecological laws and meets the physical and mental needs of employees. So far, the project has won multiple awards relying on its outstanding performance beyond general office projects, including Silver Award for the 4th APEC Energy Smart Community (ESCI) Best Practice Award, China Construction Engineering Decoration Award, China Green Building Decoration Demonstration Project (Samsung) and Three-Star Green Building Operation Certification, thus becomes a pioneering Model in Green Office Building.

Data reliability

3rd part certified

Photo credit

Customer Service Center of State Grid Corporation of China
Tianjin Scientific Academy of Residential Building

Stakeholders

Contractor

Name :

Construction Manager

Name :

Stakeholders

Function : Developer

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 <http://www.sgcc.com.cn/>

As the construction unit, our company always leads to integrate the concept of green and sustainable development into all link of the project, reasonably balance the environmental friendliness and economic benefits, coordinate the consulting company, design

tjjpj@126.com

 <http://www.sarb-jk.com/>

As a building consulting services company, through analyzing the project construction concept, site environment characteristics and building function requirements, our company proposes professional, reasonable and specific measures and suggestions of green

Owner approach of sustainability

As a practice platform of integrating green, ecological and innovative ideas, this project takes the principles of building a green and livable park, adopts various green building technologies, and takes sustainable development as the primary development goal in land saving, material saving, energy saving and water saving. The project was structure optimized at the beginning of the architectural design, so as to reduce the use of building materials such as reinforcement, concrete, meanwhile, during the construction process, it selects local building materials preferentially, so as to reduce carbon emissions during transportation. At the same time, it vigorously promotes green construction, which effectively reduces the loss of reinforcement and the loss of concrete mortar. In addition, the project starts from energy saving, carbon reduction, and ecological sustainability, uses multiple renewable energy sources, such as solar PV power generation, with its power generation accounting for 4.33% of the total power consumption in the whole park, solar hot water can ensure a 100% hot water supply, the heat production of the ground source heat pump system accounts for 65.98% of the total heat used in the park, and cold production volume accounts for 82.84% of the total cooling volume in the park, which greatly reduce energy consumption and carbon emissions. During the construction process, this project adopts energy-saving construction equipment, measures the electricity consumption in the operation area, living area and office area separately, sets the power consumption indicators, and strictly controls the electricity consumption without exceeding the rated standard to reduce electric power consumption. After the operation, this project takes section measurement of electricity consumption in the park relying on the smart park micro-energy network platform, and makes real-time monitoring

of electricity consumption, so as to take active measures to rectify after timely discovering the excess power consumption, it also establishes automatic energy consumption calculation program to observe the energy consumption index of the whole park in real time. The project makes real-time optimization, operation and adjustment of the centralized energy stations in the park to make full utilization value of renewable energy.

Architectural description

The primary innovation point of this project comes from the continuous exploration on clean energy utilization and the depth consideration on sustainable energy utilization, based on the own power technical advantages of the State Grid Corporation, it has successfully built a local energy Internet based on electric energy for the park. The local energy internet consists of 8+1 subsystems, including photovoltaic power generation system, base-load water chiller system, optical storage micro-network system, ground source heat pump system, ice storage air conditioning system, heat storage electric boiler system, solar air conditioning system, solar hot water system and energy network operation control platform subsystem. The project is centered on electric energy, through the large-capacity-scale application of the renewable energy and demand side management technology, such as solar energy, energy storage, geothermal energy, dual storage, etc, it realizes multi-point access and network sharing for energy and effectively completes the intelligent interaction of energy services. Its annual energy replacement is 7,922,000 kWh, saves standard coal of 3,168.6 tons and reduces carbon dioxide emission of 27,897.8 tons. In terms of clean and low-carbon energy and ecological civilization construction in the park, the operation in local energy Internet projects have made remarkable achievements.

In addition, the project relies on the smart park comprehensive decision-making and control platform, realizes comprehensive integration of weak electronic systems such as smart buildings, smart energy, and smart environment, it builds the park into an intelligent service-oriented innovation park with thorough perception, ubiquitous Internet of things, highly integration and intelligent linkage, realizes 'efficient efficient safe operation, high quality lean office and high quality comfortable life'. Comprehensive decision-making control platform of intelligent park realizes the comprehensive integration and intelligent linkage of various subsystems, and creates a safe and efficient, intelligent and interactive, green, healthy, comfortable and convenient office and living environment.

If you had to do it again?

In June, 2015, State Grid Customer Service Center built and operate local energy Internet, realize the unified regulation, comprehensive analysis and optimized operation of the energy system in the park through energy network operation regulation and control platform. Based on the regulatory approach, there exists the following problems: Firstly, after scheduling generation, it only can be implemented as schedule, and cannot be adjusted in time according to actual operating environment temperature, overall balance of hot and cold, and emergencies in operation, which has worse adaptive deviation correction ability; Secondly, the regulation plan can only regulate the various energy subsystems, and start / stop control of the main machine and the secondary pump cannot be conducted, which has low regulation accuracy; Thirdly, the host control still depends on the local control system, and cannot fully control the host equipment operation through the energy network operation and control platform, which has poorer control capacity of energy comprehensive coordination and optimization, and is not conducive to the economic operation.

To realize the mutual coordinated control between the various energy subsystems, and reach the goal of the fine operation of the energy system, first, increase adaptive adjustment control strategy, take real-time correction. Number one, after the recent scheduling plan, adjust the number of hosts input by each subsystem in real time according to actual operating conditions and system load; number two, take user-side availability in the park as control variable input, fix production by demand to real-time adjust equipment output power and equipment start-stop stations on the production side, so as to realize the closed-loop control. Second, realize fine hierarchical coordination control. Use hierarchical coordination control technology, build and operate the third-level control system of the control main system layer, coordination control layer and energy production local control layer, refine the local control layer into system and host equipment layers.

Building users opinion

There are rich and diverse designs, scattered landscaping and water landscape in the park, not only are beautiful, but also play the role in purifying the air; The park uses natural light scientifically and rationally, reduces effectively energy consumption of lighting, heating and air conditioning, etc. and reduces the consumption of natural resources and the emission of harmful gases, meanwhile, it improves the lighting conditions of the building and provides a healthy and comfortable light environment; There are appropriate temperature and humidity, air flow rate, and good ventilation condition in the park, which meet indoor needs for fresh air, so that the room can maintain a stable thermal condition; It also takes multiple main and passive building technical measures of air monitoring and purification, automatic shading, enclosure structure, acoustic damping configuring indoor of this project, ensures comfort and ecology of the site environment from physical environment of the sunshine, outdoor wind and noise, so as to minimize the impact on the microclimate environment in the park area, and maintain a quiet, pleasant indoor environment with minimal energy consumption, which greatly improve the efficiency and quality of staff life.

Energy

Energy consumption

Primary energy need : 470,76 kWhpe/m².

Primary energy need for standard building : 574,61 kWhpe/m².

Calculation method : Primary energy needs

Final Energy : 188,04 kWhfe/m².

Breakdown for energy consumption :

HVAC (cooling and heating period 10 months per year) 66.68kWh/ /a

General lighting socket equipment (7 * 24 hours office and living operation) 73.13kWh/ /a

Data center computer room 24.88kWh/ /a

Dining room and kitchen (for three meals, about 2900 people per day) 7.67kWh/ /a

Other 8.70kWh/ /a

Envelope performance

Envelope U-Value : 0,57 W.m⁻².K⁻¹

More information :

Roof 0.5W/ m2 k

Exterior wall 0.57W/ m2 k

Partition wall between non heating air conditioning room and heating air conditioning room 1.06W/ m2 k

Floor of non heating and air conditioning room and heating and air conditioning room 1.27W/ m2 k

Outer window 2W/ m2 k

Building Compactness Coefficient : 0,20

Indicator : GB/T 7106-2008

Air Tightness Value : 3,00

Real final energy consumption

Real final energy consumption/m2 : 181,06 kWhfe/m².

Year of the real energy consumption : 2 020

Renewables & systems

Systems

Heating system :

- Individual electric boiler
- Geothermal heat pump

Hot water system :

- Solar Thermal

Cooling system :

- Water chiller
- Geothermal heat pump

Ventilation system :

- Natural ventilation
- Single flow

Renewable systems :

- Solar photovoltaic
- Solar Thermal
- Heat pump (geothermal)
- Solar absorption chiller

Renewable energy production : 3,71

Other information on HVAC :

The project is located in Tianjin, owns temperate continental monsoon climate, it prevails southeast wind in summer, mainly southwest or Southeast winds in spring and autumn, and northwest wind in winter. Based on the above climate characteristics, the building orientation is uniformly set to the north-south direction, basically compliance with optimal distribution orientation of the local buildings, which can effectively avoid the dominant wind direction in winter, the curtain wall has an open part, which is benefit for natural ventilation. The structure coefficient of all buildings in the park meets the energy saving requirements. With the conditions of transition season and summer dominating wind direction, all main functional rooms can form good penetrating natural ventilation; Internal ventilation of the active space of each major personnel is good, which is benefit for indoor environmental thermal comfort and health of staff; As a whole, the general building plan layout and building orientation of the project are adopted through reasonable optimization, which can better use natural ventilation to improve the indoor environment during the transitional season and the summer.

When being designed, the project introduces the atrium design to guide the airflow tissue internal circulation; meanwhile, the automatic shading device for external window can further realize the adjustment effect of indoor light intensity and sunshine radiation intensity while ensuring the natural ventilation effect, which can improve the indoor hot and wet environment and reduce the air conditioning energy consumption.

Smart Building

BMS :

Intelligent system: The project has a perfect intelligent system, including dozens of systems, such as comprehensive cabling, cable TV, information release, safety prevention, automatic alarm, construction equipment management, and property operation management, and builds a unified intelligent park management, operation and maintenance platform, which can uniformly dispatch, analyze and manage various facilities and equipment in the park. Taking the comprehensive decision-making platform of the smart park as the brain of the smart park, the whole decision-making platform contains 43 intelligent subsystems, it can analyze, diagnose and process all kinds of perceptual information on the site, and effectively integrate the weak electricity, production, information management, intelligent improvement and other business systems in the park by deploying more than 17,000 monitoring points. At present, the intelligent management platform has produced 3,373 linkage configurations, 178,543 intelligent control, and 11,082 fitness appointments, which had formed an all-dimensional and multi-dimensional data collection and demonstration effect, provides data support for the fine management, precise guarantee and precise services in the park.

Building Control System: The building control systems in the park mainly include the centralized monitoring system of the fresh air unit; monitoring system of air-

conditioning and ventilation concentration; indoor temperature and humidity, CO₂ collection system; centralized monitoring system for air exhaust, water supply and drainage equipment; fan coil networked temperature control system; as well as building energy efficiency management system. It can realize the real-time monitoring of the indoor ambient air quality in the park by centralized monitoring system, indoor temperature and humidity collection system, and carbon dioxide monitoring device linked with fresh air system, adjust the operation strategy of the project HVAC and fresh air system at any time to realize the functions of automatic humidity adjustment, air purification start and stop control; Meanwhile, the property management department formulated a regular testing and cleaning plan for air conditioning system and implements it on time, which ensures smooth air conditioning system inside the building.

Gauging device: The project sets electric power and energy management system, feeder circuit of user substation and LV main distribution cabinet are set with multifunctional electric energy meter, which adopts modern computer communication technology to constitute power monitoring management network, classifies electricity load and measures separately to be used for property fee assessment; Floor lighting and socket distribution cabinet are set with meter according to building function partition to be used property assessment.

Smartgrid :

During the planning and construction process of the North Park of the State Grid Customer Service Center, There are many drawbacks in traditional energy supply schemes aiming at energy supply demand in the park: Overreliance on fossil energy sources causes resource tension, environmental pollution, and climate change; Different energy supply systems are independent of each other and lack of unified planning, which lead to large investment in infrastructure construction, facility utilization rate and low energy efficiency; Insufficient intelligence level of energy supply, lack of coordination and effective control of cold, heat and electricity supply, which cause that we have to start mainly depends on labor, causes low automation, low operation efficiency and high cost; Energy supply and demand imbalance leads to weak production capacity, and causes supply overexcess or shortage. To solve this series of problems, in accordance with the principle of demand-oriented, it adheres to the principle of maximum resource endowment, plans and designs from the four aspects of energy structure, energy utilization, energy regulation, energy services, it also develops and builds a Local Energy Internet, which realizes clean, low-carbon, intensive and efficient, multi-energy optimization, regulation and comprehensive supply.

The Local Energy Internet is centered on the electricity, flexibly accept multiple renewable energy sources, and extensively integrate energy, information, and business streams to realize the coordinated control of energy production and energy consumption, and form an energy Internet with distributed access, demand perception, ubiquitous Internet of Things, and network sharing. Northern Park Local Energy Internet of State Grid Customer Service Center takes power as the sole external energy, efficiently apply category 4 renewable energy of regional solar energy, air heat energy, and geothermal energy, fully integrates 8 distributed energy conversion devices in the Park. Among them, renewable energy utilization includes distributed photovoltaic power generation system (installed capacity 1009kWp), ground source heat pump system (refrigeration capacity 4900 kW, heat making 4922 kW), solar hot water system (heat making 1411kW), air source heat pump (heat making 1932kW); Energy storage regulation and utilization includes ice storage system (7737kW, 5416kW, 10000RTh), heat storage electric boiler system (6568kW, effective heat storage 88GJ), energy storage micronet system (energy storage capacity 50kW*4h); Regular energy saving utilization includes base load chiller (refrigeration capacity 2461 kW); At the same time, new clean power generation devices such as photovoltaic power trees, power bikes, floor tiles (first used in China) in engineering practice are produced; In accordance with the principle of "adjustable, controlled, and accurate", it deploys comprehensive energy operation control platform as dispatching control center, Through operation strategies such as peak regulation and storage, optimal scheduling, coordination and control, it fixes production as demands to realize unified dispatching of cold, heat, electricity and hot water in the park, and ensure balance of energy supply and demand.

The innovative concept and technology of the park smart energy micro-network taking electric energy as the core are reflected in the architectural design, energy supply mode, multi-energy coordination and control, and evaluation index system of the park, including:

1, Theory Innovation

- 1) It has established a local energy Internet architecture model with electric energy as the center, expands the concept of the power system bus line, and builds the energy bus structure model according to the transmission medium and the electric / cold / hot / hot water requirements to facilitate the description of the power balance relationship of each bus node.
- 2) It has implemented multi-objective optimization strategy and hierarchical coordination control technology combining local scheduling plan and hour-level correction, develops local energy Internet operation regulation and control platform to realize the comprehensive energy system to determine production, intelligent coordination and optimal control. According to the cold and heat source characteristics, combined with user demand, load forecast, capacity forecast, historical data, it forms schedule plan before 24 hours, which is automatically issued by the system at 23 points per day; On the basis of the recent scheduling plan, it takes hourly automatic correction according to the actual operation situation.
- 3) It proposes the comprehensive evaluation index system and evaluation method of local energy Internet, which is consist of 148 indicators in four categories, local area, subsystem, equipment and environment.

2, Technology Innovation

It develops a local energy Internet operation and control platform, realizes the prediction on multiple energy loads of cold, heat, electricity, and hot water, operation optimization, regulation and control, online monitoring, operation analysis and operational maintenance of system full life circle.

3, Business Model Innovation

It proposes that taking electric energy as the core of various energy conversion and trading, and the business model for unified operations management realizing the park energy system, the energy companies can provide integrated energy system solutions and value-added services for the park. This model changes the mode generally adopted in China, which conducts management through setting up energy companies by energy category (Natural gas, power grid, heating, etc.), and makes the management and operation of energy systems more efficient.

The application of the project results has achieved very good results, it provides new ideas and technical solutions for energy supply in parks and new towns, the proposed business operation model can benefit investors, operators, government and users, and has great attraction for the investment and cooperation of energy enterprises, users, or third-party enterprises, there are very good prospects for financial support or investment in a public-private partnership.

The successful construction and operation of the Local Energy Internet Project of State Grid Customer Service Center has won many honors. Through the identification of expert panels, the achievements of this project are thought to be innovative in the aspects of local energy internet typical architecture model description and model method, coordination and optimization control of integrated energy system, and local energy internet evaluation index system, and achieve international leadership level; At the same time, the project won the Silver Award of APEC Energy Smart Community Best Practice Award, First Prize of China Power Innovation Award and First Prize of Science and Technology Progress of State Grid Corporation. In September 2018, the APEC Sustainable Energy Center awarded the title of the first "APSEC International Training Base" to the State Grid Customer Service Center; it had received about 3,000 experts and peers at home and abroad, such as representatives of APSEC economies, members of the Eighth China International Power Supply Conference, Bangladesh Power Industry Officials Training Class, and North China Energy Regulatory Bureau, was highly recognized.

Users' opinion on the Smart Building functions :

Since running of the project, the park provides more convenient information on office and life interaction services directly to users with the Smart Park APP Mobile Client, users install the Park Service Management application "Palm Park" APP, on the handheld to realize the reception, view, control, reservation and warranty of the operation information of the park. The interaction with the background of the park management system realizes the reception, view, control, reservation and warranty of the operation information of the park, which increases users' participation in the daily operation control of the park, according to the APP Evaluation Survey of the Smart Park, most of the employees in the park are very satisfied with the information level and service quality of the park.

GHG emissions

GHG in use : 118,00 KgCO₂/m²

Methodology used :

Green Building Construction Management Technical Specification in Tianjin Standard for Building Carbon Emission Calculation

GHG before use : 1 067,00 KgCO₂ /m²

Building lifetime : 50,00

, ie xx in use years : 9.04

GHG Cradle to Grave : 1 185,00 KgCO₂ /m²

Green Building Construction Management Technical Specification in Tianjin Standard for Building Carbon Emission Calculation

<https://www.construction21.org/china/data/sources/users/284/20210325081440-zzzzzzz.docx>

Water management

Consumption from water network : 284 280,00 m³

Consumption of grey water : 283 525,00 m³

Consumption of harvested rainwater : 754,86 m³

Water Self Sufficiency Index : 0.5

Water Consumption/m² : 1.98

Water Consumption/Work station : 81.22

Domestic and Drinking Water Quality and Control:Water tank disinfection device shall be set for domestic water tank, underground fire water tank and roof fire water tank.Water tank and all living pipes shall be washed and disinfected according to specification.The water tank shall be provided with ventilation pipe, overflow pipe and air discharge pipe,meanwhile these ports shall be assumed with 18 order stainless steel to prevent living organisms from entering the pool.The water tank shall be provided with a maintenance manhole,maintenance manholes shall be covered with covers, and holcover shall be locked.Water tank overflow discharge hole shall be adopted indirect drainage mode.Assuming dirt-proof partition valve and pipe filter for the supply pipe.Strengthening anticorrosion layer shall be made on the outer wall of the buried pipeline.

Water quality and control of non-traditional water sources: Medium water tank is set with self-cleaning and disinfection device.The following measures shall be taken to prevent accidental connection, misuse and drinking:Outer wall of medium water pipeline shall be painted and marked in accordance with relevant standards;Water pool (tank), valve, water meter, water supply bolt and water intake shall have obvious "medium water" mark;Lock devices shall be provided in public places and green reclaimed water intake;Acceptance shall be inspected section by section to prevent misconnection.rainwater underground infiltration in the outdoor greening area doesn't need to be direct discharged,waste roof rainwater shall be recycled to rainwater recovery pump house, and abandoned roof rainwater and road rainwater shall be directly discharged into the base rainwater pipe network, and drainage to the municipal rainwater pipe network after the collection.The rainwater recovery scope of the Project is the single roof rainwater in the base except the operation monitoring center.Significant permanent is signed on the rainwater return pipe,which can't be installed the faucet,when the water intake interface is installed, strict measures must be taken to prevent accidental drinking and misuse.

Water quality monitoring system introduction:The project property company has a special special management system for water supply and drainage.All water supply facilities within the park,including pipes, valves, water meter equipment, etc.,are uniformly managed by the property company.2, users shall not change the water supply pipeline and equipment in the park without the approval of the Minister of the Property Engineering Department.3, users who need to add water meters or pipelines to their dedicated areas shall be installed under the professional supervision of the Engineering Department.4, when return water supply pipeline and equipment are in use, if running and leakage and other faults, close the valve in time and repair as soon as possible.5, accurately copy the water meter reading every month, find abnormal water consumption, immediately find the reason and handles it in time..6. In case of a running water accident, the duty and maintenance personnel should immediately arrive at the accident site, confirm the cause of the fault, close the valve immediately, and report to the head of the engineering professional team to organize emergency repair.7.The supervisor of the engineering team should regularly check whether the water supply system has safety risks, and complete the maintenance of the equipment on time according to the maintenance plan.

Water supply and drainage system equipment, including water meters, pipes, valves, toilet equipment, fire hydrant, sewage well, etc,shall be carried out a periodic and comprehensive maintenance, and keep a good maintenance records semiannually.1, maintenance personnel shall at least inspect the park water system pipeline well and public area toilet once a week, and make good records.2.For facilities during inspection, fault shall be eliminated immediately. If temporary remedial measures must be taken, immediately notify the supervisor to send relevant personnel to repair and make maintenance records.Inspection content: whether the pipeline control valve, pipeline insulation, water meter well hygiene, sewage well sanitation, toilet facilities are in good operation and flexible, whether there is water leakage, rust and damage.4, patrol inspection is an important means to timely detect equipment and facilities defects, grasp the equipment status and condition, and ensure safe operation;All patrol inspection personnel must conscientiously implement and make records according to the prescribed inspection contents and inspection items.5, inspection personnel shall cover the manhole well in time after inspecting the water meter well, sewage well and fire well.

Indoor Air quality

Indoor CO₂ concentration mg/m³ 941.1mg/m³

Indoor Formaldehyde concentration mg/m³ 0.41mg/m³

Indoor TVOC concentration mg/m³ 0.34mg/m³

Indoor Benzene concentration mg/m³ 0.11mg/m³

Indoor PM2.5 concentration µg /m³ 45µg /m³

Pollution source control method: To reduce the pollution impact on the environment,mechanical ventilation system is provided in toilet, restaurant, and underground garage of the project,the fume emission system of catering kitchen shall install lampblack purification facilities and ensure required operation during

operation to ensure that the removal efficiency of the lampblack purification facilities meets the requirements, and the minimum concentration of lampblack is less than 2.0mg/m³; Operating public construction reserved lampblack emission channel in the design, so that range fume can guide building roof emission through reserved smoke shaft. Considering the employee health impact during future use, safe and pollution-free construction and decoration materials are used in the construction and decoration process of the Project.

Cleaning measures and monitoring system: The primary air system of the project adjusts humidity automatically with air purification function; Meanwhile, the project develops intensive places of customer service area personnel concentration in Building 2,3,it sets carbon 2 sensor monitoring device connected with fresh air system, while ensuring the indoor hygiene standards, it reduces fresh air volume and saves energy consumption for handling outdoor fresh air; Property management department formulate regular air conditioning system inspection and cleaning plan and implement them on time, to ensure smooth air conditioning system inside the building. Air conditioning system has air purification device in air duct, return air inlet and other parts, which are used to dust, sterilize, decompose harmful volatile gases and eliminate odor. At the same time, the intelligent office service content of the project includes information release, office coordination, office environment management, mobile service, card management, and basic data management. Its environmental management system can monitor CO₂ concentration and meteorological parameters in real time, automatically adjust indoor temperature and humidity and fresh air volume to provide a green and comfortable working environment for the employees.

Comfort

Health & comfort :

Average indoor temperature in January 20°C

Average indoor humidity in January 50%

Average indoor temperature in July 26°C

Average indoor humidity in July 65%

Thermal and wet environment control measures: Considering the staff ' indoor thermal comfort and health, the project sets up the environmental monitoring equipment(Such as: carbon dioxide concentration detector, temperature and humidity sensor, etc.) in main functional rooms indoors to realize real-time monitoring of the office environment, when the indoor CO₂ concentration exceeds the standard, ventilation system to start up the ventilation; When the indoor temperature and humidity exceeds the comfort limit value, The HVAC system automatically adjusts the air temperature to improve staff comfort.

Building user satisfaction with thermal comfort: After the stable actual operation of the project, a user satisfaction questionnaire was conducted on the users. Questionnaire is prepared by GB/T50785-2012 of Evaluation Standard for Indoor Thermal and Wet Environment in Civil Buildings. The survey content includes totally 8 aspects of Background (Personnel Sex, Service Time, Working Hours, Age), Personal Work Room Location, Thermal Comfort, Indoor Air Quality, Lighting Quality, Acoustic Environmental Quality, Building Cleanliness, and Control System. Statistics showed comprehensive satisfaction of 88.1%, as a whole, it has a high user satisfaction.

Calculated indoor CO₂ concentration :

941.1

Calculated thermal comfort : 20°C 50% 26°C 65%

Acoustic comfort :

The surrounding roads of the Project are all traffic trunk, traffic noise generated by passing vehicles may take some influences. During the building operation period, main noise sources include underground ground source heat pump system and water pump in underground water supply pump room, air conditioning room and elevator operation room, as well as noise generated by indoor equipment operation and noise of lampblack fan and cooling tower. The project takes measures of noise reduction, installs hollow double glazing for each construction unit, sets up a large area of shrubs and other three-dimensional greening around the plot, it selects low-noise equipment, takes measures of sound insulation treatment for strong noise equipment, anti-shock cushions and equipment room to reduce equipment noise during use and reduce the adverse effects on the periphery. To ensure a quiet and comfortable environment, the Project has a reasonable plane layout to reduce the impact of adjacent noise. Equipment with large noise sources such as energy stations are arranged in the underground special equipment room. Pump room floor adopts shock absorption floor and sound-proof inner wall to reduce the noise impact on the office environment. The project selects low-noise equipment of cold changing unit, heat exchange unit, air conditioning unit, fan, water pump and other equipment, and adopts seismic isolation measures, sound insulation and sound absorption treatment. Its machine door is fire proof insulation door. Through the analysis on noise insulation at low, medium and high frequency, and combined with indoor sound absorption consideration and the influence of indoor air conditioning noise, indoor noise value is 41.64dB (A) in day under window closed, and 33.14dB A at night, which meets the allowable noise level of the office not greater than 55dB (A) under window closed state.

Products

Product

Power generation floor tiles

Product category :

Power generation floor tiles: Power generation and floor tiles drives the storage gear in the brick through collecting the pressure from a pedestrian stampede. The rotation of the gears transforms the kinetic energy into electric energy by electromagnetic induction, part of them are collected for floor tile own system work, most of the remaining electrical energy can be used directly for other purposes, or may be stored in the battery for other purposes.

Innovative electrical equipment and rainwater collection equipment used in the Project, it makes procurement by the principles of green ecological sustainability, the performance parameters, installation method, quality, quality and use experience of the selected products are all well evaluated by the designer, construction workers and users. During the operation of the park, all products have no use problems due to product quality reasons, are fully consistent with the management purpose of efficient operation and high-quality service in the park. In particular, innovative green advanced technology equipment such as floor tiles, power

generation bikes and photovoltaic trees in the park, bring a fresh use experience and interesting viewing to users, park users and visitors as well as initiate the significance of the scientific science education of the green Life.



Power bike

<http://shshanghao.cn.b2b168.com/>

Product category :

Cycling on a bike through users, wheel rotation drives the generator roller rotation, and tail-wagging, electricity is generated by mechanical energy and ultimately generated, connecting with the park power pipe network, part of the electric energy can be absorbed locally, another part can be stored in the park power system.



Photovoltaic tree

<http://www.tj.sgcc.com.cn/>

Product category :

Combine the photovoltaic power generation system with various bionic trees to form multi-purpose power generation plant with various function combinations, this is deepening application of traditional PV power generation system. Depending on scenario and requirements, it can be designed for different shapes and colors, at the same time, it has both power generation, intelligent control, environmental protection, beauty, practical and other functions. And can comprehensively improve the level of technology and intelligence with other intelligent facilities.

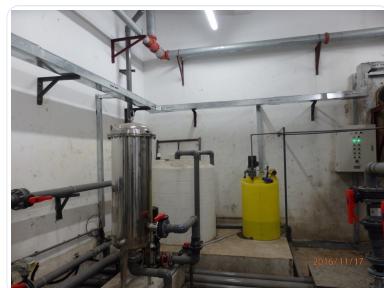


Rain Recovery

<http://www.zgjfgs.com>

Product category :

system: Effectively collecting rainwater can reasonably save cost and balance the system of rainwater pretreatment, rainwater water storage, rainwater depth purification, rainwater water supply, water supply and system control. It adopts large number of new patents, specialized devices, materials, which is convenient to solve special problems in rainwater collection, such as abandonment, water storage, water supply, etc. It avoids electrical equipment in collection design, and more uses rainwater self-flow characteristics to complete the automatic discharge, purification and collection of pollutants, to achieve real energy saving, environmental protection, high service life and low cost characteristics. The whole system is controlled by the rainwater controller for collection, purification, water supply, water supply and safety protection.



Costs

Construction and exploitation costs

Renewable energy systems cost : 43 750 000,00 €

Cost of studies : 27 380 000 €

Total cost of the building : 177 216 000 €

Subsidies : 8 500 000 €

Energy bill

Forecasted energy bill/year : 33 696 700,00 ¥

Real energy cost/m² : 235.16

Real energy cost/Work station : 9627.63

Urban environment

Public transit: The North Gate Bus Station and Guodian Customer Service North Park are set with Guodian Customer Service North Park North Gate Bus Station and Guodian Customer Service North Park Bus Station, its China electric customer service North Park bus station has 2 bus routes access to this station. At the same time, To meet the subway demands, the project sets connecting bus, which can tranship staff from Airport metro station and Park. Employees can also register for the shuttle bus, check the bus route, and check the bus number statistics through self-service and make evaluation and complain about the bus service.

Supporting service facilities: As a comprehensive service park, the construction functions of the project collect a variety of public service types, develops tens of restaurant, Rest, Fitness Venue and Reading Room; The fourth R & D building has large restaurants and a multi-functional hall with reporting, performance and other functions.

Green Park: To better combine the natural landscape to artificial architecture, there builds large lot of green landscape in the project site with 41% greening rate in the site, it takes the compound layer greening planting method of jand grass, mainly plants cedar, national locust, green peach, lilac and other more than 90 kinds of plants. And integrating a variety of greening forms, R & D Building-uses indoor vertical greening with automatic drip irrigation system, there are planting ivy eper on the outdoor walls of 7,8 and 9 of R & D Building, which takes the comprehensive effect on reducing the facade summer temperature, purifying the automobile exhaust gas and beautifying the environment; At the same time, the large outdoor landscape water body not only enriches the site environment, but also improves the micro-climate of the site and the ecological environment quality of the site. Based on the comprehensive consideration of rainwater utilization of the whole land, the designs of the outdoor rainwater system of the project use rich sponge city facilities, including permeable concrete ground, lower concave green space, rainwater reservoir, landscape water body and other facilities, the roof, square rainwater enters the rainwater collection system after the abandonment of the flow, it was used for outdoor greening pouring, road washing after post-processing, road rainwater gives priority to introducing the concave green space to reduce the drainage pressure of the municipal rainwater pipe network. At the same time, the park adopts an intelligent irrigation system, integrating sensor technology, communication technology and computer automatic control technology. By deploying intelligent irrigation systems within the smart park, it makes water replenishment on automatic green belt of the park on time and quantitatively, which improves labor productivity efficiency and saves water. Intelligent irrigation system can choose automatic irrigation, regular irrigation and manual irrigation modes, it also can conduct more sophisticated precision irrigation, set the upper and lower irrigation limits according to the vegetation type to automatically start / stop of irrigation operation.

Land plot area

Land plot area : 149 880,00 m²

Green space

Green space : 1 860,00

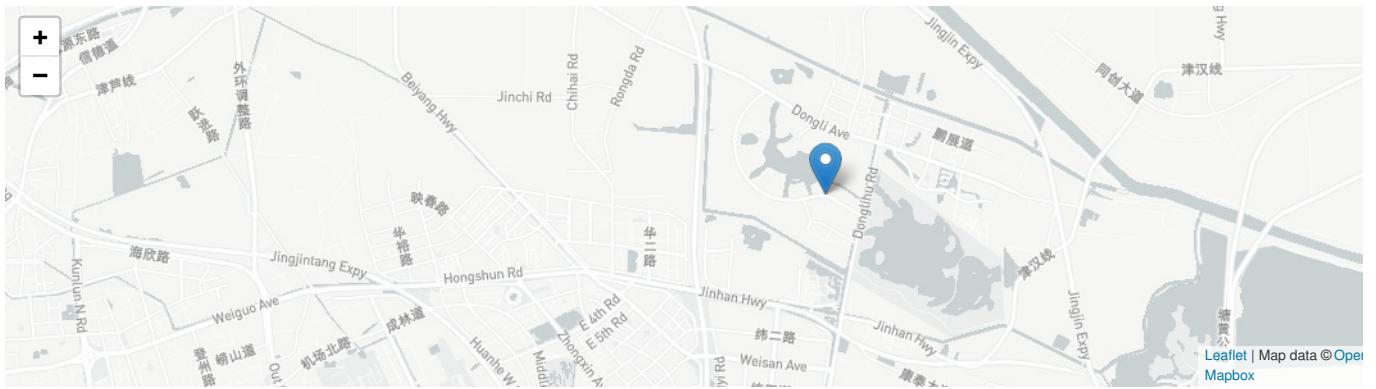
Parking spaces

Combined with the park orientation, actual use function and working form of employees, the project takes practical mode for parking, non-motor vehicle parking spaces with awning are set in 5 to 9 of R & D buildings, totally 2160, there are 2,597 motor vehicle parking spaces on the first floor and above ground, which all meet the standard limit of Tianjin area. Motor vehicle parking space includes electric vehicle charging pile, bus parking space, and special vehicle parking space, and obligate construction conditions of mechanical duplex parking space. There are about 0.6 parking spaces per person and 0.7 parking spaces / person. Parking entrance is permitted by license plate recognition, after entering the parking lot, conduct parking is guided through the remaining parking prompts and parking route instructions. At the same time, parking lot in the Park Unicorn Smart Park is set with comprehensive management and decision-making platform, employees can view the parking space information in real time through the Smart Park APP.

Building Environmental Quality

Building Environmental Quality

- Building flexibility
- indoor air quality and health
- water management
- renewable energies
- maintenance
- integration in the land
- mobility
- products and materials



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