

Low Energy Demonstration Building of Ministry of Science and Technology

Picture



Fig.1 Appearance of the building

Basic Information

Location: Ministry of Science and Technology, Beijing
Climate: North China, Continental Monsoon
Project brief: The building integrates more than 60 technologies from Chinese and American experts. It has eight floors above ground and two floors under ground with total 13000 m² construction areas.
Client: Ministry of Science and Technology
Architect: Beijing Urban Planning & Design Institute
Timetable: Start Project: October 2002
End date project: January 2004
Area: 13000 m²

Cost: RMB 97 million

Design features

Bioclimatic

features: "Cross" shape building structure, to fully make use of natural lighting but with less heat loss, it save 5% energy compared with other shape. Solar protection provided by outdoor horizontal sun shading blind.

Materials/

Construction: Sure-block composite block exterior wall. Roof: Polyurethane waterproof insulation foam and super-light inorganic roof vegetation soil

Technical

features: Liquid state polyethylene is filled into the walls to be the insulation layer
Natural ventilation system
Renewable energy system: PV system, solar water heating system
Horizontal controllable sun shading devices
Low VOC painting, green stone and wood
Comprehensive storm water utilization
Roof planting technology
Non-CFC cooling system
Water efficient equipment

U-values: Design: $k=0.62 \text{ w/m}^2\text{K}$ and Actual: $k=0.54\sim 0.47 \text{ w/m}^2\text{k}$ for walls,
 $k=1.42\sim 1.70 \text{ w/m}^2\text{k}$ for glazing
 $k<0.30 \text{ w/m}^2\text{k}$ for roof

Project Details

Context and site: Sino-US Science Collaboration Building Energy Efficiency Demonstration Project with Green and Intelligent Building Practice

Green and Energy Efficiency Design Aim: Save 70% Energy Consumption; Multi technologies supplementing each other in coordinated fashion; Building automation control system optimizes building energy performance; Make a harmonious, please and creative environment for occupants.

Function & form: High rise (eight floors), office building

Structural system: Steel frame for main body

Energy efficiency control:

Thermal insulation

of building enve-

lope:

Exterior façade: Sure-block composite block exterior wall.

Window: Thermal break aluminum frame with high performance low-E glass (Fig.2).



Fig.2 Thermal break aluminum frame with high performance low-E glass

Shading and daylight reflection: All south windows have outdoor horizontal fixed shading device to hold solar radiation (Fig.3); Reflectors are utilized for daylighting deep space



Fig.3 Outdoor horizontal fixed shading device

Roof insulation: Polyurethane waterproof insulation foam and super-light inorganic roof vegetation soil.

Vegetation: Vegetation ratio: 31%; Roof garden: 70% of roof area (Fig.4)



Fig.4 Roof garden

Space heating
cooling, venti-
lation, air con-
ditioning:

Multi-stages AC chillers (Fig.5): 2x100 cool tons load; Running at needed cool load; COP=4.83; Refrigerant is R134a.



Fig.5 Multi-stages AC chillers

Ice storage system (Fig.6): Utilizing peak-off power; Capacity 5×400 kwhr.



Fig.6 Ice storage system

Variable flow terminal air conditioners

Otis energy efficiency elevators, operation with actual load

VF water supply system

Energy efficiency lighting system: EF lighting fixtures: design LPD=6.7 w/m²k, actual LPD lower < 4 w/m²k; Digital dimming ballasts, ranging 0~100%; Photo sensors, occupancy sensors.

Renewable Energy use:

15 kW roof PV system (Fig.7) can generate over 5% of the building power consumption in cost.

Solar water heating system (Fig.8)



Fig.7 15 kW roof PV system

Fig.8 Solar water heating system