

Agenda 21 Demonstration Energy-Efficient Office Building

A collaboration between the U.S. Department of Energy (USDOE) and China's Ministry of Science and Technology (MOST), the Agenda 21 Demonstration Energy-Efficient Office Building in the western part of downtown Beijing is the first LEED Gold-rated building in China. This energy-efficient demonstration office building and design center adopts U.S. energy-efficient materials, space-conditioning systems, controls, and design principles that were judged to be widely replicable throughout China.

GREEN FEATURES AND SUSTAINABLE TECHNOLOGIES

BUILDING'S GEOMETRY AND ORIENTATION

Cross-shaped building design maximizes daylighting potential with windows located predominantly on the north and south facades for better solar control.

TWO HIGH-EFFICIENCY SCREW CHILLERS

Secondary system of cooling plant is a two-pipe fan-coil. The dedicated outside air system has a roof-mounted constant-volume air-to-air heat exchanger which brings outside fresh air to the design room air conditions.

HIGH-EFFICIENCY LIGHTING

Efficient fixtures, daylighting, automated occupancy controls, digital dimming ballasts, and light shelves on the southern facade enable a very efficient lighting system. Eighty percent of the lighting fixtures are T-8s, and the rest are T-12s.



RECESSED WINDOWS

Windows on the west, east, and south facades are recessed into the walls, hence their reduced height. The south-facing windows have combination light shelf/ exterior shading devices located two-thirds of the way up the windows. The exterior shades extend outward about 0.4 m to guard against direct solar radiation during the cooling season, while the light-colored light shelves extend inward 0.2 m to allow daylight to penetrate deeper into the perimeter offices.

HEAT EXCHANGE SYSTEM

A heat exchanger converts heat from the district heating system to the hot water used in the building's two-pipe fan-coil system.

PROJECT DETAILS

LOCATION

Beijing

NAME

Agenda 21 Demonstration Energy-Efficient Office Building

ARCHITECT

Gao Lin

ARCHITECTURAL DESIGN

Beijing City Planning Institute Design Bureau

SIZE

13,000 m² (total site area)

34.1 m (building height)

TYPE

Commercial

BUILDING DETAILS

9-story office building

8 stories above the ground level

2 levels below grade

Small penthouse on the 9th floor

RATINGS

Awarded the first LEED Gold rating in China

Top award for best green building in China (Awarded by China's Ministry of Construction, 2004)

MEASURABLE RESULTS

NET ENERGY COST SAVINGS

60%

SPACE COOLING ENERGY COST SAVINGS

30%

ELECTRICITY ENERGY COST SAVINGS

40%

HEATING ENERGY SAVINGS

80%

ICE STORAGE SYSTEM EFFICIENCY

80%

PAYBACK PERIOD FOR ENERGY COSTS

2.2 to 10.2 years

ICE THERMAL ENERGY STORAGE (TES) SYSTEM

The TES system in the basement makes ice from 11 p.m. to 7 a.m. It stores electricity for cooling in the ice tanks during off-peak hours when the electricity price is low and then discharges it during the peak hours when the electricity price is high.

PHOTOVOLTAIC (PV) SYSTEM

The PV system on the roof consists of 168 modules, 120 of which are horizontal and 48 inclined at 45°, with a total solar energy collector area of 108.6 m². The electricity is used to meet some of the building's electrical loads.

SMALL FLAT-PLATE SOLAR HOT-WATER SYSTEM

With a collector area of 20 m², the system provides hot water for use in bathrooms and lavatories.

OTHER NOTABLE GREEN INNOVATIONS INCLUDE THE FOLLOWING:

- Light-colored well-insulated exterior walls/roof surfaces
- Double pane windows with low-E glass and thermally broken vinyl-clad aluminum frames
- Roof and exposed floor insulated with polyurethane foam
- Bi-level light switches as a simplified daylighting strategy

ADDITIONAL HIGHLIGHTS

The Agenda 21 Demonstration Energy-Efficient Office Building uses “state-of-the-shelf” technologies (technologies that are advanced but already commercialized) and techniques that are either currently cost-effective, or likely to be so under market conditions that are likely to develop. The project also enables the future incorporation of emerging technologies into small portions of the building on a limited basis.

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