Asia Business Council

National Library Building

Innovative architecture, "green" features incorporated through bio-climatic design techniques, and advanced mechanical and electrical engineering were combined in the construction of Singapore's National Library Building. The building consists of two blocks separated by a day-lit internal street and connected by bridges at the upper levels. Through urban sky courts, green spaces are also created throughout the building.

GREEN FEATURES AND SUSTAINABLE TECHNOLOGIES

PLANNING AND SITE LAYOUT

A vast atrium sits as a thermal stack over the internal street to create passively cool, breezy transition spaces, thus reducing the demand for air-conditioning.

DESIGN OF FACADES

To reduce solar heat-gain through the façade, a 30° solar cut-off was adopted (no direct sunlight into the building when the sun is 30° or more above the horizon) to heavily shade the building. Some of the world's biggest sunshades on a curtain wall, projecting up to 1.8 m from the face of the glass, wrap around the building and control solar radiation and glare, yet maximize daylight.

DOUBLE-GLAZED GLASS FAÇADE

About two-thirds of the building façade is double-glazed with high quality low-emissivity glass to minimize heat transfer while permitting visible light transmission without glare problems.

EFFICIENT CHILLER AND PLANT CONFIGURATION

The chiller plant is configured with large non-essential chillers and small essential chillers serving different parts of the building. Depending on load demands, the small chillers automatically double up to support the large chillers.

PRIMARY/SECONDARY CHILLED WATER CIRCUIT

The chilled water system employs a primary and secondary chilled water circuit with variable speed drive installed for the secondary chilled water pump.

Photos Courtesy of National Library Board Singapore

VARIABLE AIR VOLUME (VAV)

The air distribution to the library interiors, offices and commercial spaces use VAV boxes that allow for better zone temperature control.

VARIABLE SPEED FAN

The temperature is modulated with a variable speed fan installed with the cooling tower, based on the condenser supply and return temperature.

PROJECT DETAILS

LOCATION
Singapore

NAME
National Library Building

ARCHITECTURAL DESIGN
T.R. Hamzah & Yeang Sdn Bhd

PROJECT ARCHITECT
DP Architects Pte Ltd

SIZE
102.8 m (building height)
6,000 – 8,000 m^2 (green space)
58,783 m^2 (total GFA)

TYPE
Public

BUILDING DETAILS
16-story
2 main blocks connected by a series of "sky bridges"
3 basement levels

RATINGS
Only building re-certified under existing building category Green Mark Platinum in 2009
Awarded ASEAN Energy Efficiency Award 2007
Won the Singapore Silver Award in the 2007 Universal Design Awards (sponsored by Singapore's Building and Construction Authority)
First building in Singapore to be certified Green Mark Platinum by Singapore's Building and Construction Authority under new building category in 2005

MEASURABLE RESULTS

ENERGY SAVINGS

31%

DESIGN ENERGY SAVINGS

17% lower than the National Library Building's design benchmark

ELECTRICITY ENERGY SAVINGS

31 % lower than the national average of 220 kWh/sqm/annum for non-green buildings

ENERGY EFFICIENCY INDEX (EEI)

151kW/hr/m^2

CO_2 SENSORS

CO_2 sensors installed at the Air Handling Units (AHUs) ensure that the percentage of fresh air in the supply air is maintained at acceptable levels in all areas.

CARBON MONOXIDE MONITORING

When the level of carbon monoxide exceeds the standard limit, the car park ventilation system is activated where fresh air is pumped in while the exhaust air is extracted.

NIGHT SETBACK

This allows an increased air-conditioned temperature to be maintained in the building during unoccupied hours.

DISPLACEMENT VENTILATION SYSTEM

The Drama Centre in the building is equipped with a displacement air-conditioned system that supplies conditioned air through a supply vent below each of the circle seats at a slightly higher temperature and at a lower velocity to the areas where the audience is seated.

START-STOP ESCALATORS

The escalators are stationary when not in use. At the same time, pressure sensors located underneath the escalator mat, will detect human traffic towards the escalators, and initiate their movement accordingly.

RAIN SENSORS

As part of the auto-irrigation system, rain sensors are installed so that the irrigation system is not operated during rainy days.

AUTOMATIC BLINDS

The north-west side of the reference library reading area is automated with roller blinds. These blinds will roll up or down with the help of automated lux sensors to prevent glare and solar radiation in the library space.

LIGHTING CONTROL SYSTEMS

Besides lighting sensors to switch off the lights in some of the public spaces during the day, daylight sensors at the perimeter of the library areas also monitor the amount of natural light entering the building, allowing the artificial lighting to switch off. The libraries, exhibition and office spaces are largely naturally lit. A sophisticated Integrated Lighting Control System allows for strategic programming of the internal and external lights. Localized intelligent switching provides after-hours lighting only for occupied areas.

LANDSCAPED AREAS/GARDENS

About 10% of total GFA is designated as "green spaces" to create urban "sky courts". Fourteen landscaped areas/gardens are also located throughout the building. Thus, the surface temperature of the roofs and heat transfer into the building interior is reduced. The indoor thermal environment and thermal performance of the building is also improved.

OTHER NOTABLE GREEN INNOVATIONS

- Laneway sunshades
- The events plaza is naturally ventilated and the wind tunnel effect will displace heat at the height of 102 mts by the means stack to keep the plaza cool at all times.
- The extended façade fins between the two blocks minimize direct sun radiation and keep the façade cool while still allowing daylight to enter the library space.

For more information, visit www.AsiaBusinessCouncil.org