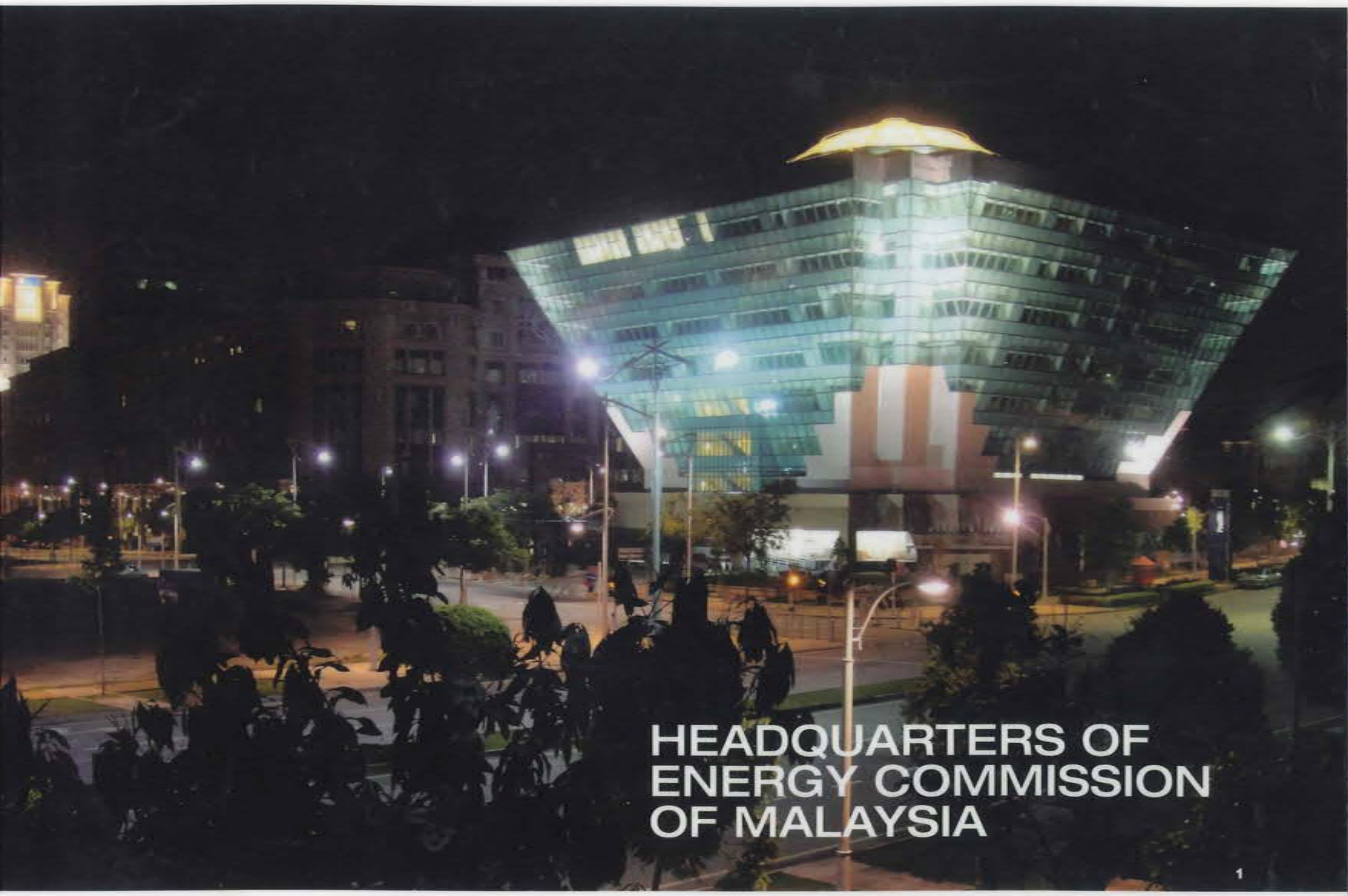
MALAYSIA



HEADQUARTERS OF ENERGY COMMISSION OF MALAYSIA

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1 Perspective view
2 Roof integrated solar (PV) panels **3** Atrium

PROJECT DATA
Project Name
Headquarters of Energy Commission of Malaysia
Location
Putrajaya, Malaysia
Status
Commissioning
Expected Completion
Immigration by June 2010
Site Area
4,000 m²
Gross Floor Area
14,690 m² excl. car park
Number of Rooms
150 rooms
Building Height
41.8 m
Client/Owner
Energy Commission of Malaysia
Architecture Firm
NR Architect
Principal Architect
Dr Soontorn Boonyatikam (Thailand)
Main Contractor
Putra Perdana Construction Sdn Bhd
Mechanical & Electrical Engineer
Primetech Engineers Sdn Bhd
Sustainability Consultant
IEN Consultants Sdn Bhd
Civil & Structural Engineer
Perundin SM Cekap
Landscape Architect
KRB Enviro Design Sdn Bhd
Quantity Surveyor
ARH Jurukur Bahan Sdn Bhd
Images/Photos
Gregers Reimann

The diamond-shaped Headquarters of Energy Commission of Malaysia seeks to be a highly sustainable scheme that makes use of passive design, energy efficiency and renewable energy to meet its targets—first, to achieve an annual energy consumption of 85 kWh/m2/year (as compared to a normal office building in Malaysia, which has an energy index of 250 kWh/m2/year), and second, to obtain the highest environmental Platinum label for Green Mark from Singapore.

For this purpose, a sustainability consultant company, IEN Consultants, was engaged. The sustainable principal architect was identified during a Green building study tour in Singapore and Thailand, where the client was impressed by the sustainable buildings undertaken by Thai architect Soontorn Boonyatikam. The principal building design was developed during design charrettes with participation from all consultants.

The diamond building form came about due to the advantages such a design will bring. The façade tilt of 25 degrees is sculpted after the solar path in Malaysia, where such a building façade will be self-shading to the north and south orientations. For aesthetics, the same façade tilt angle was maintained for the east and west façades that also benefit from less direct solar radiation impact due to the inclined façade. It has also been found out that the diamond shape helps minimise air filtration, i.e., preventing breezes from passing though the building. As such, energy will not be wasted on cooling uncontrollable air 'leakage' from outside. Also breezes striking the tilted façade will flow below to help ventilate the car park area at the basement. Additionally the inverted pyramid shape allows for a smaller building footprint which gives room for more landscape area on the ground level.

Daylight design also played a major role in the design of the atrium, which is optimised for daylight utilisation at all floors by stepping in the atrium, increasing the atrium windows deeper into the atrium and placing special

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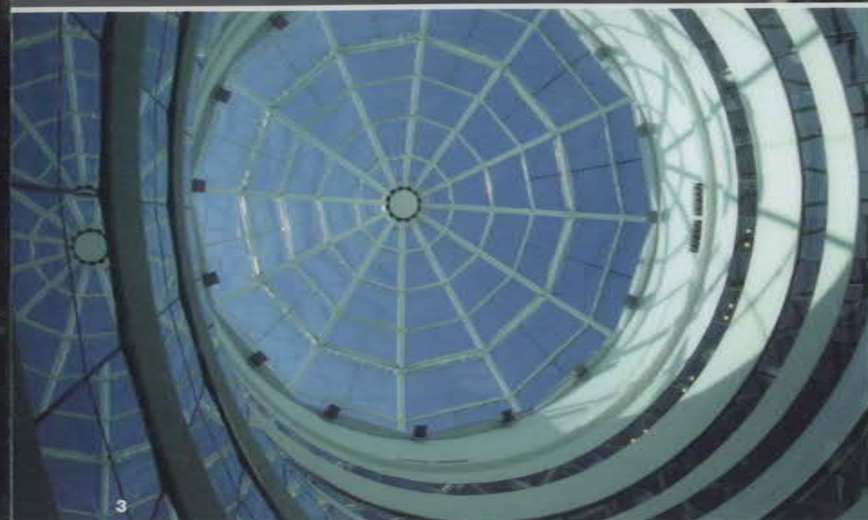

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tannenbaum reflectors with a 'Christmas tree' reflector profile to funnel daylight to the lowest two floors. Moreover, an automated atrium blind ensures that daylight levels are kept adequate—and not excessive—throughout the day, except of course during heavily overcast conditions. Also set in place is a general lighting system that cannot be switched on when light sensors say there is enough daylight. Instead, occupants are to use individual task lights.

Other-energy efficient features include:

- Efficient lighting (T5 tubes) with daylight responsive controls.
- Solar collectors for hot water.
- Heat recovery on shower drains; about 30–40 percent of the hot water energy is recovered for heating incoming water to the shower head.
- Floor slab cooling (water pipes embedded in concrete floor slabs). This reduces the transport energy of cooling, as chilled water is a much more efficient medium than air to transport cooling around. The floor slab cooling system runs only at night and gives off radiant cooling passively in the daytime. This allows the maximum cooling demand for the building to be reduced by about 50 percent.

As such, simulated annual energy consumption (EEI) for the building is 80 kWh/m2/year including PV and 88.7 kWh/m2/year excluding PV. Renewable energy in the form of PV is integrated into the building roof via installation of 71.4 kWp thin films.

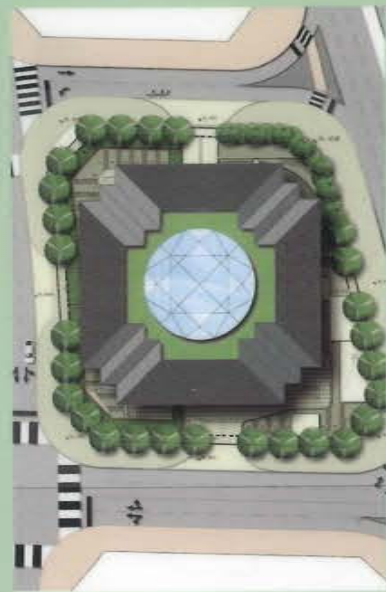
The project also aims to reduce potable water consumption by 35 percent through rainwater harvesting for toilet and irrigation; grey water harvesting for irrigation; and using water-efficient fixtures such as waterless urinals. The use of materials is reduced by doing away with suspended ceilings, which aids daylight penetration and also allows the floor slab cooling system to work more efficiently. Recycled content and low-VOC materials will be used for carpets and plasterboards, giving occupants a healthier indoor working environment.

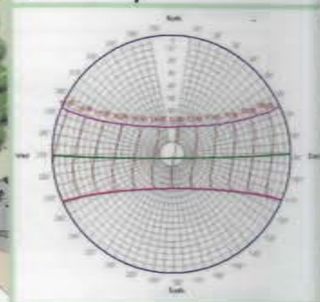
Scientific Findings for ST Building

by **Gregers Reimann (IEN Consultants Sdn Bhd)**

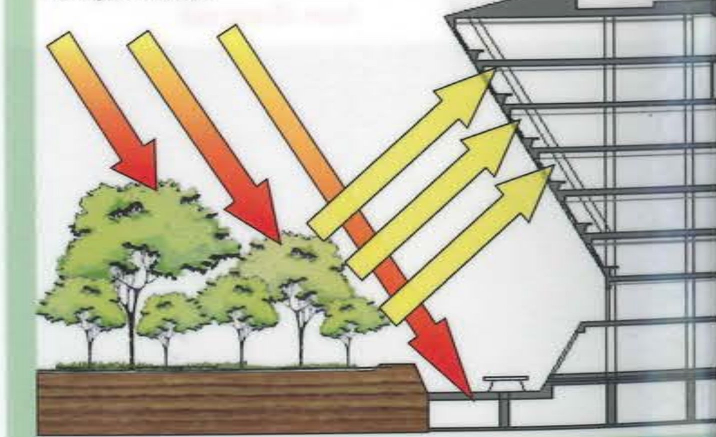
SOLAR GEOMETRY

The solar path was used to sculpt the building geometry. The 25-degree tilt angle of the façades ensures that north and south façades are fully self-shaded during the hottest mid-day hours. For the east and west façades, the tilting façade helps to reduce the solar impact by 41 percent.





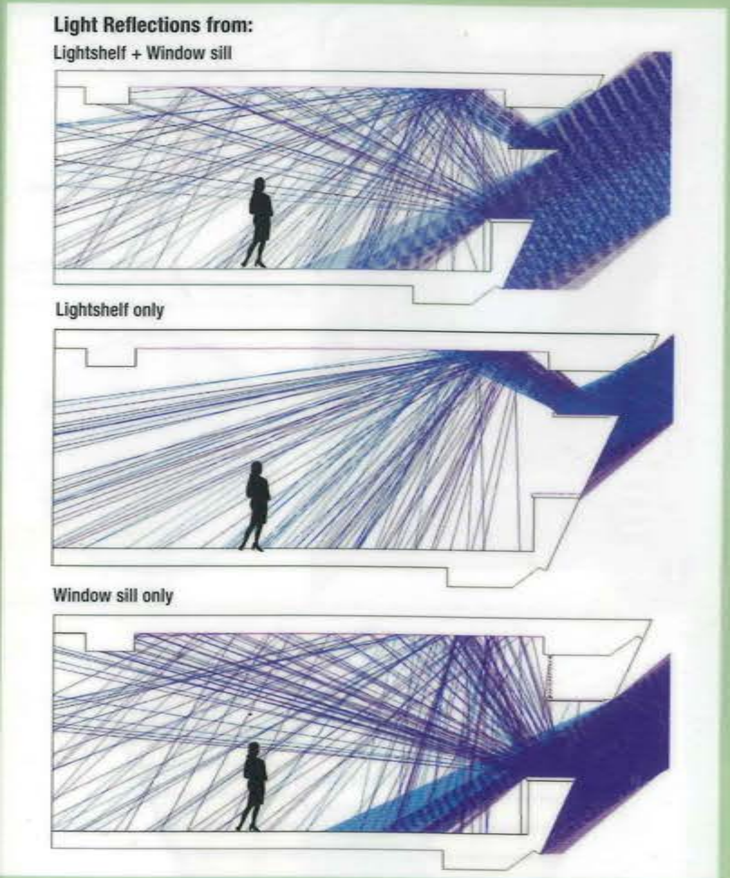
25° Façade Tilt Angle

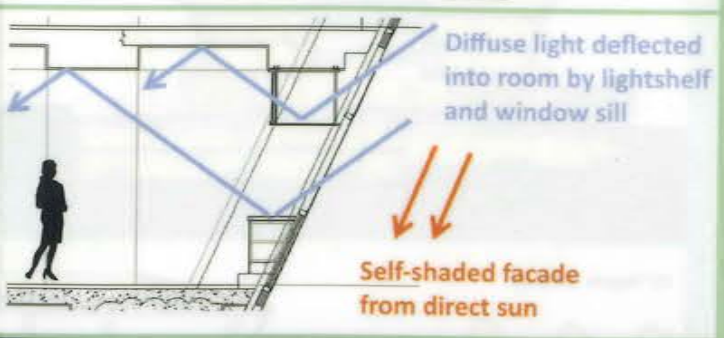


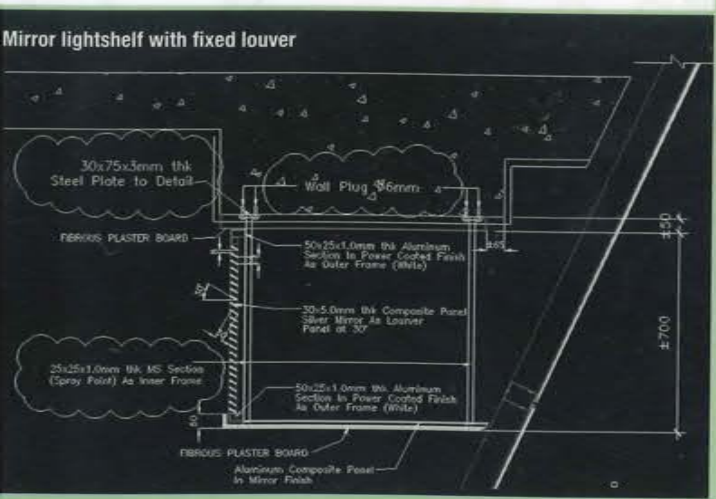
The tilted glazing admits more of the desirable diffuse light reflected off the landscape for glare-free daylighting use in the building.

FAÇADE DAYLIGHT DESIGN

The building is 50 percent daylit. The façade daylighting system consists of a mirror lightshelf and a white painted window sill. Both deflect daylight onto the white ceiling for improved daylight distribution until 5 metres from the façade and 2 additional metres of corridor space. Fixed white louvres with top surface mirror finish on the top side are mounted with a 30-degree tilt angle above the lightshelf for glare protection while still allowing daylight to be deflected onto the ceiling. To increase daylight throw into the rooms, the suspended ceiling was omitted giving a floor to ceiling height of 3.7 metres.



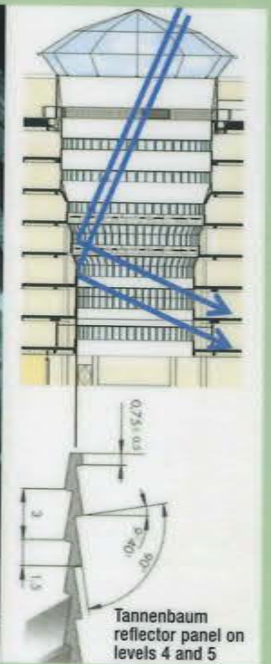


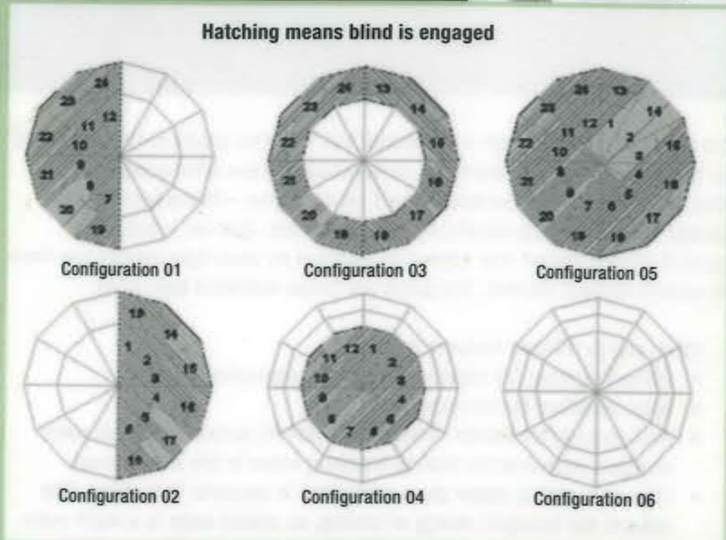


ATRIUM DAYLIGHT DESIGN

The atrium has been carefully designed to optimise daylight utilisation for each floor employing the combination of the following three strategies:

1. Automated blinds with six different configurations to maintain the appropriate daylighting levels at all times. The blinds with 30 percent light transmittance are adjusted every 15 minutes and follow three different control strategies for morning, mid-day and evening
2. The window size becomes larger deeper into the atrium to cater for lower daylight levels



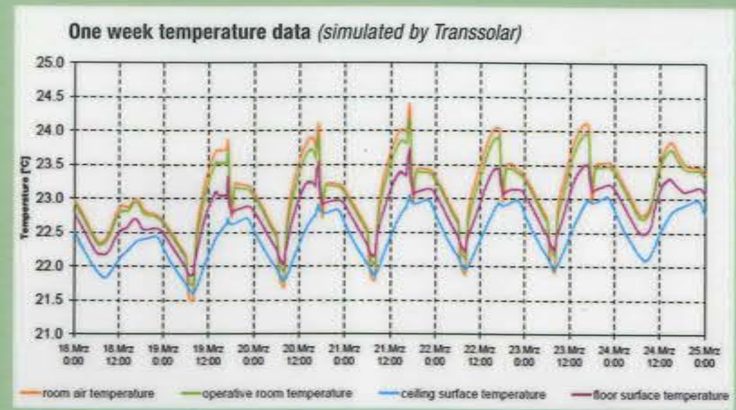


3. A band of Tannenbaum reflector panels are applied to the 4th and 5th floors to deflect daylight across the atrium to the 1st and 2nd floors where daylight levels are the lowest. The 'Christmas tree' profile reflectors have an inclination of 10 degrees and reflect about 85 percent of the light in semi-diffuse manner, hence, avoiding visual glare issues for the building occupants.

FLOOR SLAB COOLING

Flexible 22-millimetre PERT pipes are embedded in the RC slabs during construction to make the building structure function as a thermal storage system. At night 18-degrees Celsius cold water is circulated in the slabs cooling them down to about 21 degrees Celsius. During the day time, the system is shut off, and floor slabs passively absorb heat gain from people, computers, solar gains, etc. The advantages of the floor slab cooling system are:

- Reduces cooling transport energy by 64 percent because it is more efficient to transport cooling with water than with air
- Shifts much of the cooling to the slabs, so the AHU system can be downsized by about 30 percent
- Shifts 30–40 percent of the cooling to night time, so the building can save cost from the lower off-peak energy rates and from reduced maximum demand charge



Floor slab cooling pipes laid before pouring concrete

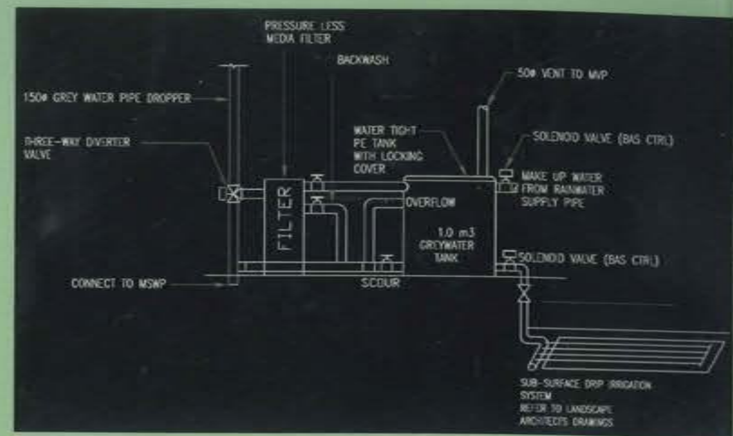
Manifold for pipes coming out of RC slab

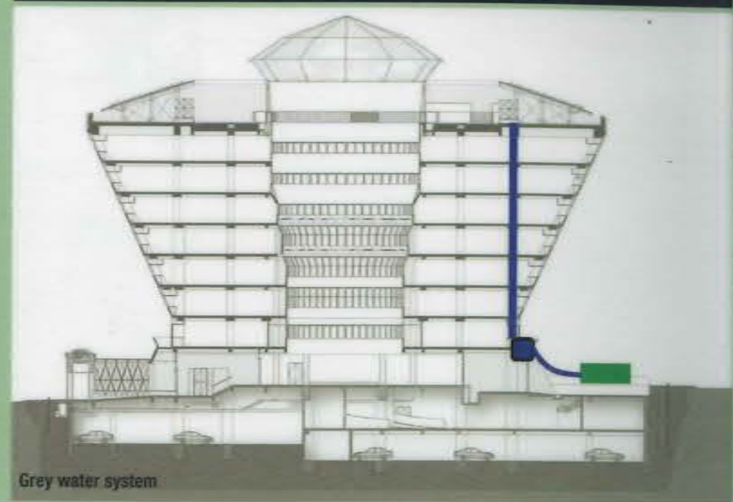
Suspended ceiling omitted so as not to restrict slab cooling

GREY WATER SYSTEM WITH MINI WETLANDS

All water from the sinks and floor traps (grey water) is piped separately through a sand filter to a collection tank from where it is reused for irrigation of a mini-wetlands instead of going to the sewerage. This way 2,000 to 3,000 litres of water are recycled every week day.

Mini wetlands





Grey water system

PERFORMANCE SUMMARY

The building, which will be in operation in June 2010, is targeting the highest environmental building rating under Green Mark, namely a Platinum certification. The main environmental performance comprises:

- 57 percent electricity savings (CO2 emission savings correspond to taking 324 cars off the road*)
- 71.4 kWp solar PV plant (CO2 emission savings correspond to taking 30 cars off the road*)
- Water efficient fittings, rainwater harvesting and grey water recycling (water saved corresponds to consumption of 12 households)
- Conducive working environment (50 percent daylighting, good air quality and low ventilation noise levels thanks to radiant cooling)

Additional savings come from the 35 percent savings on the district cooling consumption for the building.

** "cars off the road" unit corresponds to an average car driving 12,000 km per year.*