

Is WTC the most energy efficient building in Sri Lanka?

The World Trade Center, Colombo is not only CEB's winner of the most energy efficient building for the year 1998, but an integrated business complex comparable with the world's best buildings. The selection of WTC [owned, managed and operated by Overseas Realty (Ceylon) Limited], for this prestigious award came as no surprise considering our quest for 'quality at no extra cost' policy. With quality as the guiding force in every phase of its operations, the WTC's method in its pursuit of excellence is continuing improvement.

Standing at a gross height of 156 m, the 39 story twin towers is more than great office space at a prime address. It is a world of conveniences, indulgences and a novel experience. It is simply "Colombo's ultimate business address" with its 'one-stop-shop' concept which includes facilities and services such as banking, shopping, trading, communication and office support facilities, shopping, entertainment and an excellent working environment that measures up to any international standard.

It would be of interest for most of us to see how this 'intelligent' building equipped with state-of-the-art technology and infrastructure facilities achieved its efficiency levels without compromising quality and standards.

How energy efficiency is achieved at WTC

Energy conservation or more appropriately energy efficiency in a commercial building means achieving the desired efficiency by energy management thus conserving energy without compromising productivity, comfort levels and safety and lowering costs for the occupants. Several factors have contributed to energy efficiency at the World Trade Center, Colombo, which comprises the 39 storied twin towers, integrated with a 4 storied commercial Low Block, a 3 storied Podium and 9 staggered levels of car parking space, adding up to a gross floor area of 1.26 million sq. ft., a conditioned area of 1,009,653 sq. ft., and a rentable area of 707,591 sq. ft., (excluding public/service areas).

There are four important factors that have contributed to this achievement.

1. Designers' Contribution;
2. Integration of efficient operating/management systems;
3. Implementation of energy audits/energy management systems;
4. The continuing education of building operators and occupants emphasizing on the importance of energy management and conservation.



Designers contribution

World Trade Center (WTC) building has been designed to International Code requirements, which entitled the adherence to stringent codes and standards thus achieving energy efficiency. To elaborate further, the following basic elements are highlighted.

Building envelope - glazing

The entire envelope consists of a glazed area of 170,116 sq. ft., and wall area (precast) of 236,182 sq. ft., thus making the glass to wall ratio of (1): (1.4). One might say that installing glazed panels for better aesthetics will result in the penetration of UV radiation/heat resulting in an increase in cooling demand. However at the design phase, architects worked very closely with M & E Engineers to ensure selection of energy efficient systems. It is obvious that the perimeter glass will bring more daylight, which in turn will reduce artificial lighting required to maintain standard intensity of light. The glazing properly treated to achieve better shading co-efficient and U value, will limit solar heat penetration. Curtain walls, skylight and the perimeter glazing installed in World Trade Center building has a very good shading co-

efficient and a U value. This will screen the solar radiation while facilitating penetration of sufficient daylight into the building.

The lighting energy consumption saving due to the day lighting technique generally can be greater than the cooling energy penalty from extra glazing when the building envelope is carefully designed. Glazing at the WTC has been designed to ensure effective day lighting, minimizing solar radiation gain thus reducing the cooling demand. The other important element is the introduction of perforated, semi-glazed horizontal slatted window blinds with reflective ability for effective control of direct sun light.

Building envelope - precast

Designers have taken care in designing the external envelope with composite perimeter walling comprising precast/gypsum board composite cavity wall filled with glass wool lining on precast panel within the cavity. This has contributed to further thermal resistance to the whole construction.

Air conditioning system

Consultants of this project adhered to energy efficient codes in designing mechanical and electrical systems, (air conditioning in particu-

lar). The elements addressed in the design stage (which led to potential savings in operations) are indoor design conditions, ventilation system equipment sizing, fan/pump system design criteria, air distribution system, temperature control, air handling system insulation and A/C equipment performance etc.

To highlight few examples, designers opted for energy efficient variable air volume system (VAV), instead of constant volume system (CV) for the central A/C system. Air handling units too are provided with inlet guide vanes (IGV) for airflow and control valves (CV) for chilled water control and these IGV's and CV's are automatically controlled through the building management system to ensure desired comfort levels.

WTC is equipped with fully computerized efficient management systems

- Building Management System
- Elevator Management System
- Asset/Maintenance Management system

Building management system (BMS)

This is a local area network (Arcnet Lan) based system comprising network controllers (18 nos.) and operation work station (PCs). Equipment is interfaced with the

LAN controllers through direct digital controller (stand-alone - remote)

Main functions of the BMS are:

- Monitoring of operations of equipment
- Controlling operating parameters of the equipment (eg. start/stop, valves etc.)
- Collecting historical data and retrieval
- Trouble shooting (fault tracing)

Advantages of BMS over the conventional systems are:

- Flexible system for expansion/modification with simple field wiring.
- User friendly operations through software models (eg. windows).
- Capability of accommodating a large number of monitoring points compared to the conventional system (due to the network operation).

• Historical data can be used as a maintenance and performance-monitoring tool.

• Operating parameters of equipment can be used for fault/trouble shooting.

Elevator management system (EMS)

High tech micro-processes control/software based elevator management system integrated to the elevator/escalator system is designed to work with the system which could control lift car operation modes and continuously update the information to ensure maintenance of constant surveillance of the elevator system performance. EMS installed at the WTC allow property managers to control access and to modify system operating parameter to tailor elevator performance to match the building traffic pattern on special needs resulting in better elevator service, operational costs (conserving energy) and more building profits. Following unique features as incorporated in the design ensures energy efficient operation and minimum wear and tear, hence improv-

ing lift cycle cost of the elevator/escalator system.

- Power regenerative control system

• Up peak/down peak facility - (facility available to adjust the waiting time until the car is loaded for start up journey during peak times. This enables maximum utilization of the system hence saving energy)

- Starting current being proportional to the load in the car.
- System deactivation during parking.

• Anti nuisance circuits - curtailing elevator operations for unnecessary calls

Asset maintenance management

The computerized asset management system installed in the WTC, has the facility to monitor, alter, modify or update the activities of maintenance, serving, control of costs, etc. This has four main modules:

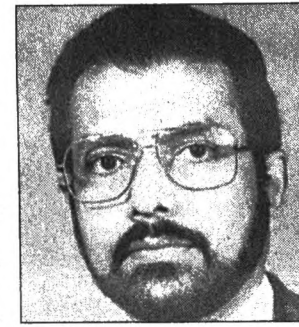
- Property module
- Asset register history module
- Maintenance programme module
- Cost control module

This advocates preventive/predictive maintenance by implementing planned maintenance management, maintenance systems to achieve the following objectives.

- To ensure the safe & reliable operation of plant and equipment covering all services.
- To increase performance and improve efficiency.
- To provide management with the means to control maintenance costs.
- To reduce operating costs and increase profitability.
- To improve life cycle costs.

Energy - management auditing

It is imperative that property managers achieve the parameter set out by the designers/manufacturers (in relation to code requirements, wherever applicable) to ensure cost effective, energy efficient



By W.B. Elmo F.J. Fernando Fie (Aust). Cp Eng, Frics, F.Asce, Aciarb Manager (Projects & Engineering)

building operations. Having said that, it is important to determine what influences the building energy use and usage of energy against these factors and then to set targets for improving the demand of energy requirements of the building.

Main energy centers at the WTC are identified as air conditioning, lighting, vertical transportation, pumping etc. These centers are influenced by the constant "energy drivers" such as tenant occupancy levels, control settings, and variable "energy drivers" such as outside temperature, sun shine, wind speed, humidity.

Energy audits are carried out daily for the main centers, collating data available from BMS and these consumption patterns are compared against the set targets, which had been developed over a period of item, following the commissioning.

The basic programme that had been implemented by the WTC operators are:

- Controlling the lighting in common areas - i.e. de-lighting with a structured schedule
- Revision of mode/time of operation of AHU's in public areas in the main podium - for normal office hours and the non-working hours with a provision for cooling the lobbies in the night.
- Programming of the operating hours with rescheduling START/SHOP of the equipment in A/C plant - (to improve the energy consumption patterns by optimizing BMS operations.)
- Load management - the maximum demand is controlled by diversifying the loads, central A/C system, major

pumps, fans in particular.

Continuous education of building operators and occupants with importance of energy management and conservation

Although the plant/equipment installed at the WTC are automated is still requires to be operated correctly to achieve cost effective operations. WTC operators/maintenance team received "hands on" training at the installation/commissioning stage. They receive continuous training and education of the changing environment within the WTC as the building continuously upgrades its technology by employing the latest developments in the field. Tenants are kept aware of the importance of energy conservation without compromising standards of operations in the building.

Occupants play a vital role in achieving these targets. This takes place in different stages.

At the time of the fit out - As a basic exercise, tenants are advised on appropriate occupancy densities (No. of persons per unit), space planning in relation to conditioned air supply patterns. Educating them of the efficient energy operations and making them feel that they are part of our team enables us to achieve our objective very clearly.

Operational stage - tenants are encouraged to have separate switching arrangements for lighting to operate work stations/cubicles to achieve cost effectiveness of energy within their premises. This facilitates maximum usage of daylight as and when necessary.

Despite winning this award the management and staff of Overseas Realty believe that the company can continue to improve in providing the best solutions to people's office needs at minimal cost. This constant quest for improvement keeps the WTC on top of the property marketers ladder and a role model for the next millennium.