



# Singapore Management University Implements Open, Interoperable Solution for Their New City Campus



Located in the heart of the city, the Singapore Management University's (SMU) City Campus is the first of its kind in the historic Bras Basah district. The SMU campus is part of an ambitious city planning exercise to revitalize community life in the heart of the city. When the university moved from its old Bukit Timah campus to the new city campus they wanted to utilize a state-of-the-art Intelligent Building Management System (IBMS).

SMU got their first taste with open, interoperable systems at their Bukit Timah campus with a LONWORKS based system. Mr. Ho Thim Seng, Facilities Director of SMU, is constantly seeking methods for improving comfort, safety and efficiency on the campus. According to Mr. Ho, "The controller hardware installed is only the first part to good controls. The expertise to manage, fine tune the processes and build upon that which is made available by these controls is what makes a truly energy efficient and intelligent campus."

## The Challenge

Unlike commercial office buildings that operate with a more or less constant load through fixed office hours, universities are dynamic and constantly changing. The student population moves within the campus and

energy loads (especially for cooling) are shifted from one location to another. The number of classes and lecture halls in use varies one day to the next – the university's timetable is nowhere near as predictable as a commercial office building's. Efficient management and control of air conditioning equipment is especially important since energy used for cooling traditionally takes up to 60% or more of the energy consumption bill. Proficient management of varied and changing load patterns presented here can only be handled by intelligent automated controls that are built upon the latest technological innovations and that can react to these changes.

## The Solution

The Air-Conditioning and Mechanical Ventilation (ACMV) follows the LonMark Open System specification, utilizing devices from different vendors to gain maximum effectiveness and long-term benefits. The system is not locked into a single vendor and future expansion is made easier. Quantum Automation, a Singapore based systems integrator selected products from different suppliers to implement the ACMV system. The ACMV system is made



up of eight chillers in two different plants with a combined maximum capacity of 5550 tons, over 110 air handling units, 1500 variable air volume (VAV) boxes, mechanical ventilation fans

and dampers. The system is capable of managing the ACMV system to optimize cooling from the chiller plants in order to maximize energy efficiency.

One of the vendors selected for the ACMV system is Matrix Controls. Their application specific direct digital controller plays a critical role in managing the ACMV

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system. This campus-wide system is made up of eight chillers in two different plants with a combined maximum capacity of 5550 tons, over 110 air handling units, 1500 variable air volume (VAV) boxes, mechanical ventilation fans and dampers. The distributed control system provides essential coordination and feedback from a user friendly front-end to optimize energy efficiency and real-time load control. The distributed control system installed in the chillers in each plant supports local control to shifting load patterns, eliminating the need for expensive central controllers.

Echelon's *i.LON(r)* 600 Internet Servers provide seamless connectivity to an IP backbone in order to maximize the investment in the IT infrastructure, thereby eliminating the need for homerun wiring across the huge campus. Quantum Automation delivered a web-based Human Machine Interfaces (HMI) for the IBMS system so that facility personnel can use a single user interface to view and interact with the system. While fully integrated, the web-based HMI can also view other subsystems using different protocols.

Expanding on their control network infrastructure, Mr. Ho decided to achieve additional energy savings through lighting control. Because the lighting control system installed in halls, theatres, group study rooms and other parts of the campus uses the same protocol it was easily integrated into the Electronic Facility Management System (EFMS). Lecturers and speakers now have complete control over the lights in their rooms, ensuring that facilities will be well-lit, safe and secure. Further integration is supported by linking lighting controls with access controls. Unauthorized access to facilities can trigger alarms and activate an "all lights on" event to help locate intruders. When authorized personnel access facilities, lights are automatically switched on. When people leave rooms and lecture halls, lights are automatically turned off after ten minutes to help reduce energy bills.

Further expanding on their investment in network infrastructure, SMU connected other elements to the system, including electric power metering (main incoming), sub-metering, fire alarm monitoring, lift monitoring and synchronization of the campus wide digital master clock system to ensure students get to their classes on time.

### The Results

The City Campus was completed in July 2005, so it is too early to determine the true impact of the various energy saving solutions. "Chilled water temperature variation is less than 0.5 degrees Celsius even during chiller cut in or cut out, which is impressive considering other systems usually vary by as much as 1.5 to 2.0 degrees", said Mr. Tan Yat Seng, Facilities Engineer and ACMV expert, highlighting some of the benefits of good controls. His expertise in fine-tuning applied to the LONWORKS based systems at the old Bukit Campus of SMU resulted in approximately 20% savings in electrical consumption. And he believes that even more savings can be achieved in the new City Campus, where more devices and systems are linked together, providing even more choices and flexibility in implementing energy saving strategies.



### Contact:

[www.echelon.com](http://www.echelon.com)



550 Meridian Avenue  
San Jose, CA 95126, USA  
Tel: +1 408-938-5266  
[www.lonmark.org](http://www.lonmark.org)