Established in 2000, the Singapore Management University (SMU) sets its mission to generate leading-edge research with global impact and to produce broad-based, creative and entrepreneurial leaders for the knowledge-based economy. As part of its continuous drive to be a world-class academic institution, SMU aims to host a Green Campus as defined by the Building and Construction Authority’s Green Mark (Platinum) certification.

Since 2007, SMU has actively taken steps to improve energy efficiency and to find ways to cut down energy wastage in the campus. SMU established the following management systems to manage the energy and water use in a systematic and structured way:

- ISO 50001: Energy Management System
- Singapore Standard 577: Water Efficiency Management System
- Singapore Standard 564: Green Data Centre-Environmental and Energy Management system

With consistent efforts and systematic approaches over the years, SMU has managed to reduce electricity consumption by more than 30 percent from 2006 to 2015, whilst its student population almost doubled in the same period.

A GREEN CAMPUS DESIGN

SMU’s architectural design of the modern City Campus blends seamlessly with the surrounding historical buildings, like the Singapore Art Museum, the Cathedral of the Good Shepherd, and the National Museum.

Considering Singapore’s climate, passive environmental features are an essential part of the building design. For example, all west-facing facades of SMU buildings are shaded by a veil of plants growing from each storey of the buildings. This effectively reduces solar heat gain by the SMU buildings whilst providing a high level of natural day light. Sky lights and windows are widely used in the buildings to provide natural day lighting to the study areas, offices and lobby areas, reducing the dependence on artificial lights. The ground floors of buildings in the SMU City Campus are designed with natural ventilation in mind.
SMU is one of the pioneering buildings in Singapore’s Central Business District area to use “NEWater” - reclaimed water produced by Singapore’s national water agency PUB - in the buildings’ central air-conditioning system.

AN EMPHASIS ON ENERGY

A popular adage states that “You can’t manage what you don’t measure”. This aptly applies to energy management in SMU. Energy is a critical component of SMU’s operational cost. Hence SMU needs to boost the energy efficiency and improve energy performance in order to help SMU maximize the use of its energy-related assets to reduce energy consumption and costs.

ISO 50001 provides a framework for organizations to measure, review, analyse and monitor energy use and consumption in various areas, with a view to find ways to systematically improve organisational operations for effective use of energy.

On 4 March 2013, SMU became the first public-funded, autonomous university in Singapore to achieve certification to the ISO 50001 Energy Management System (EnMS) standard.

With the structured and systematic approach, SMU aims to institutionalise its energy conservation processes. In addition to the ISO 50001 Energy Management System, SMU has also established the Singapore Standard SS 564 Green Data Centre - Environmental and Energy Management Systems and the SS 577 Water Efficiency Management System.

Hundreds of power meters had been installed in SMU campus to monitor the energy consumption in
Through the energy conservation measures implemented, SMU has achieved significant reduction in energy consumption per annum since 2006. This is notwithstanding the rapid growth in student population over the years and the increases in occupancy and activity levels on campus. Although the total student population on campus has increased by 97.5 percent, the total energy consumption by the campus has been reduced by 31.4 percent. The average yearly energy used by each SMU student has been reduced from 4,226 kWh per student in 2006 to 1,481 kWh per student in 2015 -- a reduction of about 65 percent.

A CAMPUS-WIDE APPROACH

SMU has an Environmental Policy, which requires all its stakeholders to progressively adopt the environmental perspective in the management and operations of the University’s activities. A Green Procurement Policy is also in place to guide the staff to use green/non-toxic materials.

Recycling facilities are provided on the campus. Office occupants are provided with additional bins to dispose paper that can be recycled. Recycling campaigns are conducted to promote and encourage waste minimisation, while waste reduction programmes are disseminated across the campus through the intranet.

A number of green building products certified by the Singapore Green Building Product labelling scheme have been selected and widely used in SMU campus for building construction, upgrading and system retrofitting projects. The following table illustrates some notable examples:

<table>
<thead>
<tr>
<th>COMPANY</th>
<th>PRODUCT</th>
</tr>
</thead>
<tbody>
<tr>
<td>EcoSpec Global Technology Pte Ltd</td>
<td>Water Treatment System</td>
</tr>
<tr>
<td>Grundfos (S) Pte Ltd</td>
<td>Water Pumps</td>
</tr>
<tr>
<td>Danfoss Industries Pte Ltd</td>
<td>Variable Speed Drives</td>
</tr>
<tr>
<td>Big Ass Fans Singapore</td>
<td>Ceiling Fans</td>
</tr>
<tr>
<td>Panduit Singapore Pte Ltd</td>
<td>Network Cables</td>
</tr>
<tr>
<td>ABB Pte Ltd</td>
<td>Transformer</td>
</tr>
<tr>
<td>Schneider Electric Singapore Pte Ltd</td>
<td>Switchboards</td>
</tr>
</tbody>
</table>

For every new building construction/renovation and system upgrading projects in SMU, it is a “must” for the project teams to conduct comprehensive life-cycle analysis – this is to reduce the operational cost and minimize the environmental impact over the building/system’s whole life cycle.
Modular design approaches are also adopted for managing major energy systems upgrading projects in SMU, to ensure that the energy systems are always designed to be right-sized for the needs of the building operation and can be easily scaled up when the demands from the building operations increase.

LEARNING IN NATURE

The SMU campus has porous structures that engage the surroundings with open courtyards and free-flowing walkways, and allow for an easy and natural integration with activities of the city. The campus design and structure reflect and support the character of SMU’s curriculum and its style of teaching.

SMU city campus was designed to be a campus in the park. During the development and construction stages, SMU did whatever was necessary to preserve the original landscape and greenery of the site. Heritage trees were relocated, and transplanted back on campus grounds. The façade of the buildings were cladded with double and low-E glazing glass.

SMU building façades are shaded by a veil of plants growing from each storey in response to the west orientation, which effectively reduces solar heat gain to the building while still providing a high level of daylight.

The SMU campus was built with 3 tiers of landscape in mind:

- Tier 1: Gardens on the building roofs reduce solar heat gain through the building roofs
- Tier 2: Campus Green on the ground floor, which works as the green “lung” for the SMU city campus
- Tier 3: Water features and courtyards built at basement levels, which provide light, natural ventilation and greenery for basement spaces.

The SMU Campus greenery is part of the 4km-long Butterfly Trail that starts at the gates of the Singapore Botanic Gardens, continues to Orchard Road, passes through the SMU grounds and ends at Fort Canning Park. “Hosts” and “Nectar” plants are found in this plot to provide food and shelter to caterpillars and butterflies.

SMU has many street-level linkages and has direct connections to MRT station and bus stops. There are also sheltered bicycle lots and green lots for hybrid cars in the campus to encourage faculty, staff and students to use green transport.

SMU will continue to advocate green building designs in future expansion to its campus, while also looking at adopting smart building innovations and technology to further enhance its sustainability efforts.

Developer: Singapore Management University
Architect: KNTA Architects
Engineering Firm: Kurihara Kogyo Co., Ltd
ESCO consultant: Johnson Controls Pte Ltd

All images courtesy of Singapore Management University.
SMU LEADS THE WAY

In sustainable institutional design and performance

The road to going green is marked with a relentless drive towards energy efficiency and waste reduction. We designed our campus to embrace the natural ecosystem as part of our architecture to realise sustainability. We also guide our stakeholders to adopt an environmental perspective in their operational and management decisions. Here at SMU, building a green campus goes hand-in-hand with nurturing the leaders of tomorrow.

Energy savings over past 9 years:

>30% reduction in energy use despite doubling of student numbers

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