The Smartest Green Building

San Francisco Public Utility Commission Sets an Example

It is no surprise that an intriguing, eclectic and progressive city such as San Francisco would be home to the smartest green building in the world. The newly constructed San Francisco Public Utility Commission (SFPUC) has raised the bar quite high. For energy efficiency and sustainability the SFPUC building is hard to beat. It uses 55% percent less energy and consumes 32% less electrical demand than the ASHRAE baseline standard.

The SFPUC provides retail drinking water, wastewater and green hydroelectric and solar power services to San Francisco and Bay Area municipalities. It is the third largest municipal utility in California, serving 167 miles and 2.5 million customers. Services are managed by 2,300 employees and an annual operating budget of $700 million.

LEED Platinum

Not only is SFPUC’s new headquarters the smartest building, it is also LEED Platinum certified. Achieving Platinum certification was no easy feat. LEED elements were incorporated early into the design process to provide a healthier work environment, reduce the environmental impact and provide the economic benefits of a more sustainable, energy-efficient building.

“SFPUC is committed to energy and water efficiency, renewable generation and green buildings. The goal for the building was to consume as few resources as possible and thereby create a model for development of sustainable hi-rise buildings in urban areas with creative planning”, states Masoud Vafaei, Owner’s Project Engineer with the SFPUC. “To meet our aggressive target for energy efficiency beyond California’s energy code, required the right design, right tools and the right team.”

The project's LEED design features included a highly efficient exterior building enclosure, renewable energy, recycled water and efficient space planning. Specific LEED design elements include:

- Exterior sun shades for daylighting and glare management
- Natural ventilation with the use of operable windows
- Reduced lighting power densities with workstation task lighting
- Wind turbines along the façade
- Three roof top solar platforms with 684 panels
- 45% daylight harvesting
- Light shelves integrated into the window walls for daylighting
- Faucet sensors, waterless urinals and on-demand water heaters
- Living Machine wastewater recycling for flushing use
- Rain Harvesting for irrigation
In addition to its LEED and Smart Building Certifications, the building architect, KMD, was honored with two awards from the San Francisco American Institute of Architects (AIA). The project won for its ‘Integrated Project Delivery’, a best practice that results in improved coordination and a timely delivery.

**System Integration**

Adhering to the LEED process and standards put the “green” in the building, but what makes it smart? The Integrated Building Management System™ (IBMS) integrates data from every building system and allows for read or write capability of 13,500 data points. The integration of systems increases the functionality between the building systems, and also provides a suite of software applications and operational tools monitor and manage the building’s performance in real-time.

“The design team worked together to make this project an innovative masterpiece of building design. Without the team collaboration, there would have been missed opportunities,” states Vafaei.

During the design of the IBMS, a “compliance statement” was issued to all system designers. This statement required the use of open communication protocols and databases, as well as submittals of points list, IP addresses, control drawings, and all other pertinent information on the building’s systems. The compliance statement was instrumental in configuring and integrating the systems.

**IBMS**

The IBMS can monitor and manage every data point from every building system; that in itself sets a new benchmark. The systems monitored and managed by the IBMS include:

- Elevators
- Waste Water Treatment System
- Mechanical Direct Digital Controls
- Digital Network Lighting Controls
- Power Monitoring and Control System
- Fire Alarm and Detection System
- Solar Energy Collector Metering
- Wind Energy Power Generator Metering
- Interior & Exterior Shade Control System
- Weather Station Monitoring System
- Window Washing System
- Water Reclamation

The IBMS collects and converts the building systems data into a standard format. The “standardized” data is utilized by a variety of software modules to provide information and manage building operations.

“The integration of all the data points of all the building subsystems is a new model for monitoring and managing a building’s performance – it has not been done before to this level of detail and sophistication,” states Andres Szmulewicz of Smart Buildings, LLC, the firm that served as IBMS Designer for the project.
The IBMS has some typical BMS applications such as document management, trending, system scheduling and data archiving, but also several applications not available in traditional building management systems including:

- **Demand Response** – Three demand response (DR) modules were designed for three different levels of energy curtailment. The DR modules can initiate any of the curtailment strategies by sending commands to the appropriate sub-system data points.

- **Building Performance Analytics** – The analytic module utilizes a rule-based fault detection and diagnostic application to optimize the performance of the HVAC systems. It provides ongoing commissioning, keeping the largest energy consumption system at optimal performance. A building can typically expect a 10-25% energy savings in the HVAC systems from the use of these advanced software tools.

- **Alarm Management** – This module allows for alarm management across all subsystems, identifying priority alarms and correlating alarms to one event.

- **Public Information and Education** – The IBMS reports savings and efficiencies via a public dashboard. Visitors, tenants and occupants are able to track sustainability initiatives and goals against actual, real-time use. This display helps to promote, educate and encourage conservation.

In addition, the IBMS can integrate into an existing facilities management system (FMS). The FMS has applications such as work orders, asset management, inventory, preventative maintenance, etcetera. The IBMS and the FMS will exchange data with each other. For example, an alarm in the IBMS will trigger a work order in the FMS; or the FMS may trigger a preventative or predictive maintenance service order based equipment run time data obtained from the IBMS.

“There are several benefits to this approach and deployment. One is that with a central Meta database, it is easier to create relevant information that will support improved building operations and engineering. It also allows us to integrate the systems functionally, where an event or condition in one system can trigger action in another system. We become more proactive and less wait, break and fix and thereby improving the quality and lifecycle of our equipment,” states Vafaei.

**Dashboards**

The data in the IBMS is transformed onto dashboards. Dashboards provide information specific to a user group. For example, a dashboard may provide facility operators with high level information on alerts and alarms for a particular system, area, and time period. Or, a dashboard may allow individual departments to track their energy consumption and sustainability initiatives.
There are over 450 dashboards providing facility engineers, operators, facility managers, business managers and executives, employees, visitors and the public with information specific to their needs. Users of this information are armed with the tools necessary to contribute to building optimization, performance and efficiency.

The SFPUC has constructed a top notch energy efficient and sustainable building. The IBMS assures that advanced software tools will provide the SFPUC long term capabilities to manage building operations, energy, sustainability and ongoing costs.

About the Author:
Jim Sinopoli is Managing Principal of Smart Buildings, LLC, an engineering and consulting company. Smart Buildings served as the Master Systems Designer, working with the project team to design and develop the IBMS.