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GREEN INTELLIGENT BUILDINGS

A Platinum Oasis
IN THE DESERT

It's one thing to aim for LEED® Platinum status for your company's new offices. It's another to do it in a region of the world where nobody is familiar with a design and documentation process of that complexity. Borrowing sustainability goals from the U.S. and on-site support from a group in India, this controls company integrated multiple protocols, touchscreen phones, solar chillers and more for the Middle East's first LEED building of any level.

BY JOANNA R. TURPIN

For many commercial building owners and developers in the U.S., obtaining a Silver, Gold, or Platinum LEED® certification is highly desirable. Not only does this typically result in a structure that uses energy and water more efficiently, but it is appealing to tenants who want to lease space in an environmentally friendly building.

Other countries around the world are beginning to take note of the successful LEED certification program, and many buildings in Europe and Asia are now being constructed under the USGBC's stringent guidelines. Pacific Controls' (PCS) new facility in Dubai is one of those facilities, and its Platinum-rated building is the first LEED-certified building in the Middle East.

Designed using an integrated approach, the five-story, 120,000-sq-ft PCS headquarters, which was finished in September 2006, features solar thermal air conditioning, water-efficient equipment, high-efficiency chillers, solar photovoltaic for building lighting, VSDs for centrifugal fans and pumps, and CO_2 monitoring for IAQ.

Keeping all these systems running smoothly requires a state-of-the-art BMS, which was not a problem, given that PCS specializes in marketing IP-enabled, converged BMS and machine-to-machine (M2M) solutions. As the official Tridium partner in the Middle East, it was a given that PCS would use the Niagara Framework to integrate all its building systems to the Cisco IP backbone.

DUBAI GOVERNMENT GETS BEHIND GREEN

Considering its vast oil reserves, the Middle East is probably not the first place that comes to mind when looking for green buildings. However, Dubai and the UAE are experiencing exponential growth, and the real estate industry is booming like never before. As a result, the Dubai government has started committing to sustainable development and energy savings built on economic progress, social development, and environmental improvement.

In keeping with these new initiatives, Dilip Rahulan, chairman and chief executive officer of PCS, stated that it was the company's corporate social responsibility to build a headquarters that would act as a showcase for sustainable development in the region. "When we decided that we wanted to invest in the Dubai headquarters building, we took this as a challenge and decided to showcase our building as something very unique in terms of what technology we promote and market. We decided it was mandatory to achieve a green building status, and when we realized that our technology could bring about higher levels of status, we decided to go for Platinum."

This was easier said than done, because there were no companies in the area specializing in the LEED certification process or in green building techniques. PCS asked USGBC to identify certified consultants in the area, and several were found in Europe and India. Additionally, India has a government body called Confederation of India Industry (CII), which has a green building development center that was of particular interest to PCS.

PCS' new facility in Dubai, the first LEED® building in the Middle East, features solar thermal A/C, water-efficient equipment, VSDs and CO_2 monitoring.

"They were the closest and the most affordable, so we approached them and asked them to take an assignment in Dubai," said Rahulan. "After some negotiation, they finally agreed to participate in our project. They actually assigned a team of senior LEED-certified professionals to visit Dubai every month and conduct workshops for the contractor, the architect, and the client. They hand-held us through the whole process, which turned out to be very challenging."

The biggest challenge was simply that a building of this type had never before been built in the Middle East, so the contractor and architect were not aware of the significance of following the LEED guidelines. In addition, PCS did not have the necessary personnel in-house to know how the LEED process worked or its cost implications.

Another challenge was procuring the necessary materials to comply with the LEED guidelines, as one of the criteria for the USGBC is that most of the materials should be available within a 500-mile radius of the site. Many of the materials were available, but they needed to have a recycled content.

"We would have to explain to the supplier that we needed to have a batch of materials made with recycled content, and then they'd produce the documentation stating the amount of recycled content that was in the product," said Nigel MacKenzie, chief technical officer, PCS. "The process is not really well known in the region, but soon there will be organizations that can identify vendors who know the kinds of materials that are required for this type of application."

This process will occur sooner rather than later, as the government of Dubai has stated that all the major projects in Dubai now have to be built to the LEED criteria. As a result, the larger consulting firms in the area have expanded their staffs to bring on additional LEED-qualified assessors in order to keep up with the instant demand from the building community.

This is terrific news for PCS, because many of those in the building community want to know about the BMS that the company markets and also utilizes in its headquarters.

BUILDING A BACKBONE

From its inception, it was decided that the PCS headquarters needed to have an IP backbone that would converge all the building systems onto that backbone and support open software standards such as Obix, BACnet, Lon, Modbus, and OPC. Because of its openness, Tridium's Niagara Framework made perfect sense for the application.

"The Framework was always in there from the beginning. The devices that we wanted to use could connect to the Niagara Framework, and it also is an open software standard, so we were able to achieve integration with the example of Cisco telephony, which is a high level integration," said MacKenzie.

Niagara provides all the functions in the PCS building, such as alarming, scheduling, logging, archiving, and the graphical user interface. Multiple protocols have been used for the different subsystems, including BACnet IP for the chillers and AHUs, LonWorks for light dimming, Modbus for on/off light control, power metering, and plant control, including pumps, VFDs, fans, flow, pressure, and CO_2 sensors.

All HVAC equipment, lighting, access control, IP telephony, and facility management (FM) software are fully integrated. The system is Web-based and situated on a fully converged IP backbone that is secured by the Cisco firewall and other high-level security features.

Employees using their Cisco touchscreen phones as an interface can turn on lights and change the setpoint of the A/C, thanks to the integration that was achieved by using XML and Web services. Via the Niagara Framework, technical alarms can also be routed to the right people, through e-mail or text messaging.

The integrated FM package keeps tabs on service agreements and maintenance contracts, and it's possible to track how well they're operating. "We can also get high-level reports that let us know how the building is performing," said MacKenzie. "Basically they're snapshots that show us how much energy is being consumed, levels of emissions, and so on. The BMS software of today cannot do that, it's lagging behind. We're looking to go beyond that."

MECHANICAL CONNECTIONS

All the mechanical and electrical equipment is connected to the BMS. The building requires cooling only, and its design load is 400 tons. One hundred tons is provided by a solar thermal absorption chiller from LG Korea, while the remaining 300 tons is provided by two 150-ton high-efficiency watercooled screw chillers from Carrier Europe. The chillers have BACnet IP interfaces, allowing them to be connected to the network, and their setpoints are reset based on the cooling demand in the building. The Italian-made cooling towers, AHUs, and fresh air units also came with a BACnet connection.

VFDs are fitted on all major rotating equipment such as cooling towers, fresh AHUs, and chilled water pumps, and they are connected to the BMS, which controls them on a demand basis. The 25 CO_2 sensors are located in conference rooms and on the return airside of the AHUs and are connected to the Niagara Framework via networked I/O modules. If the CO_2 level increases in any of the areas being monitored, then the fan speed of the fresh AHU increases to provide more fresh air. Temperature and humidity sensors are located in the return airside of all the AHUs, and control

algorithms have been set up in the field controllers to monitor and control these variables.

The lighting control panels are run on Modbus and are controlled by and connected to the Niagara Framework. The lighting in the building is zoned, and it is controlled in some cases with occupancy sensors and in some cases by time-of-day. The IP-based access control and cameras provide surveillance and are completely tied together with the framework. Forced entry alarms and door-held-open alarms are sent to the BMS, and cards can also be assigned to turn lights and A/C on and off.

The building's 100-seat auditorium has a comprehensive A/V system and IP projectors. The A/V equipment is connected to the backbone using IP/IR converters, while the user interface is a PDA or Cisco touch screen phone.

Showing its commitment to alternative energy, PCS has a 50 kW solar PV panel array, which is linked to the lighting distribution panel. The PV array is connected through smart inverters, which are networked together and connected to the IP backbone, allowing integration with the BMS.

"The array comes on automatically in the morning using the BMS and scales down towards the evening when the generation goes down, seamlessly getting the power from the grid whenever necessary. This generates enough electricity to light the building during the day," noted Rahulan.

The solar thermal absorption chiller is another alternative energy solution of which Rahulan is particularly proud. "Solar energy in our country should be exploited to the maximum. Solar thermal has been in existence for a long time, but it's never been deployed to the extent where chillers could be effectively run. We decided to take the challenge and build a plant that has cogeneration capability."

PCS's absorption chiller system uses hot water to provide cooling to the building. Water pipes run through the solar panels, heating the water to between 85° and 95°C, which results in 95% efficiency in terms of hot water production, said Rahulan. "At night, we can use a calorifier that runs on diesel or gas in order to top up the temperature."

To fully optimize the absorption chiller, the water needs to be at least 90°, which will then generate close to 100 tons of cooling. That provides 25% of the base load to the building, then the calorifier can work through the night to keep the chiller running. "People come and see the absorption chiller system, and they're quite astounded," said MacKenzie. "There's a certain amount of space that's needed, which we fortunately had. But even if you don't have

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space, these panels can be mounted on the roof of covered carparks, for example. If people are allocating external space for carparks, you can cover those with these panels, and it works."

PCS has been in its building for a year, and MacKenzie said all systems have been working as planned. Unlike other buildings in the area, the PCS headquarters isn't overcooled, so it is possible to work comfortably in the building without freezing. Keeping the temperatures at a comfortable level also results in energy savings. MacKenzie noted that in the winter the costs to run the building are only $450 a day.

Embarking on the mission of constructing the first green building in the Middle East was

very challenging, but also extremely rewarding, said Rahulan. "Sustainable development is an issue that's never been dealt with in the Middle East before. We are proud to say that we managed to achieve the first Platinum-rated green building in the Middle East and only the 16th in the world."

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