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A City's Quest for the Gold

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Like ice hockey or soccer, a design-build project is a true team event, not a solo performance. The City of Richmond, Calif., exceeded its original LEED® (Leadership in Energy and Environmental Design) Silver certification goal, achieving LEED Gold for the renovation of City Hall and the former Hall of Justice (now known as 440 Civic Center Plaza (CCP)), thanks to the teamwork and innovations of the design-build team. Among the achievements that enabled the city to go for gold, City Hall will achieve a projected 17.2 percent annual energy savings and 440 Civic Center Plaza will achieve a projected 24.6 percent annual energy savings above California's baseline for energy performance. Moreover, a rooftop photovoltaic system generates almost 19 percent of the energy required to run 440 CCP.

One key to increasing energy performance and the LEED rating was the design of a 12-kilovolt electrical infrastructure with a single primary electric service from the utility, which feeds multiple buildings and optimizes the contribution of the photovoltaic system. The system was designed by Contra Costa Electric, the project's engineer of record for all electrical systems.

The city's goals are not only to save energy and money, but to also reduce its environmental impact and improve the community's economic vitality and quality of life.

The city's Civic Center Master Plan is the basis for the rehabilitation of Richmond Memorial Civic Center and the redevelopment of adjacent sites. The multiple-phase revitalization project is being developed by Richmond Civic Center Partners LLC, and implemented by a design-build team led by Charles Pankow Builders, Ltd., which includes Nadel Architects and C. Overaa & Co. Inc. Construction. Phase 1B construction was completed in November 2009 at a project cost of US$91 million. The project included complete interior renovations and system upgrades of 72,000-square-foot City Hall and the 53,000-square-foot 440 CCP building, improvements to the Civic Center Auditorium and the renovation of Civic Center Plaza.

Crossing borders

The city engaged a design-build team because of the complexity of the project. The buildings required gutting and upgrading of all systems while maintaining the historical building façades and there were many unknowns prior to demolition. The city realized the greatest potential to achieve their goals, including LEED Silver certification, required the design-build project delivery method rather than the conventional design-bid-build method.

Collaboration was essential from the start, observed Bret Firebaugh, Pankow's project sponsor.

"Our approach is to develop a realistic budget and assemble a qualified team that collaborates in working the design to the budget, with the goal of delivering the best value for the owner," he said.

The owner's representative and the design-build team—including the design-build project sponsor, architect, electrical and mechanical contractors, and major subcontractors—met frequently throughout the project. The team was a flat hierarchy of authority. Each member provided input in their individual disciplines and collaborated in developing overall project solutions for consideration by the City of Richmond.

The team developed and coordinated the construction and installation processes in detail. To facilitate planning and installation, the team used 3-D coordination and plotted all of the equipment from the mechanical, electrical and plumbing contractors to avoid system collisions. For example, in both City Hall and 440 CCP, the basement ceilings were only 7 feet 11 inches from the concrete decks. With 7 feet as the minimum headroom clearance to meet code, contractors had a maximum of 11 inches of vertical space to install the mechanical and electrical conduit.

A single-site solution

"Our overall goals for the electrical, telephone and data systems were reliability, redundancy and future growth capability," said Sue Hartman, information technology

director for the City of Richmond. "Our top requirements were a fiber backbone, 72-hour back-up power generation and sustaining our legacy telephone switch during installation of our new VoIP [voice over Internet protocol] system."

The original schematic design called for each building to have an individual service from the utility, which is standard for a commercial building site. However, the engineers proposed an innovative alternative—a 12-kilovolt infrastructure with a high-voltage meter and a single primary electric service from the utility to reduce costs, improve reliability and increase sustainability, including a higher LEED score. This solution treats the site as a single facility rather than a block of separate buildings.

Electrical service is provided to City Hall, 440 CCP and the auditorium, as well as future connections for three other city-owned buildings, through integrated switchgear and an interconnected duct-bank system. The duct-bank system also routes the fiber optic and Category 6 telecommunications cables to all of the buildings. Every office on the site and all systems—including the 911 call center and fire alarm system—are served by the integrated duct bank. In addition, the interconnected switchgear and duct banks enable any one of these buildings to supply the others in the event of a power or telecommunications outage. This solution also allowed the team to use a single 600-kilovolt generator to provide emergency back-up for the entire site, which yielded additional savings.

The 12-kilovolt service includes future capacity for a planned new police station that will be located one block from this site, and duct banks were installed to the boundary of this site to feed the new building. In addition, the city can tie in an existing library simply by extending the conduit and pulling more cable.

The city saved approximately US$400,000 to US$450,000 as a result of this single-site solution. Because it serves multiple buildings, the utility considers it an essential service, which increases its overall reliability.

Let the sun shine

The team used the large roof of the auditorium for an 85-kilowatt photovoltaic (PV) system. Due to the 12-kilovolt interconnection among buildings, this system is able to provide green power for 440 CCP—almost 19 percent of the total energy required to power this building, which earned three LEED credits. A 45-kilowatt PV system on the roof of City Hall generates 5 percent of the total energy required to run this building, earning one LEED credit. Chevron Energy Solutions was the design-builder of the PV systems and Contra Costa Electric was the engineer of record.

In addition—because both PV systems feed the 12-kilovolt electrical infrastructure—green power can be provided to City Hall, 440 CCP or the auditorium (as well as future buildings), depending on which building has the higher load. This design provides flexibility in the use of PV output, ensuring that none of the power is wasted and the system always operates as efficiently as possible.

PV systems, especially in California, are a simple, straightforward approach to generating energy. They typically comprise a series of plug-and-play panels, whose power cables are run through an inverter and a meter for verification purposes and then right into the building switchgear. However, to gain optimal performance, building and site loads must be matched to the generation profile of the PV system, which generates most of its power from 10 a.m. to 4 p.m. Because most

of these public offices are operational from 8 a.m. to 5 p.m., the electrical engineers were able to match the building loads and site load to the generation profile.

A light on LEED

Earning LEED points for lighting is always a challenge and this project was no different, except for one key characteristic—the degree of collaboration among design disciplines, including Nadel, the Lighting Design Alliance (which developed the television-production-level lighting design for the City Council chamber) and Contra Costa Electric. Multiple design iterations were required to marry architectural design and sustainability, earning a total of four LEED credits for use of sustainable lighting fixtures and controls and reduction of light pollution.

One goal was to enable every individual in the building to control the task lighting in his or her own workspace, which was a challenge because of the large open floor-plan. The solution was to provide each workspace with individually-controlled task lighting using switches, occupancy and motion-sensing devices, and to minimize overall floor lighting levels. The multiple zones are controlled via a switching interface with the building management system, enabling full control from a single point.

Ingenuity was also required to earn the LEED points for light pollution reduction. For example, LEED requires that light levels outside the site boundary are not to exceed 0.10-foot candles. This was a challenge on the large park-like plaza, which uses high fixtures to provide light on walkways, benches, tables and green spaces. To solve this problem, the team used special light cut-off fixtures and shielding, as well as horizontal lighting on landscape features. In addition, the team designed the landscape lighting system to use as much street lighting as possible to light the perimeter of the site.

Although landscape lighting for the parking lot was not initially part of the project, it was suggested to incorporate it into the project. This secured an additional LEED credit because the associated increase in the total area decreased energy use per square foot.

An ingenious solution

There were many unknowns prior to demolition. Thus, the team started demolition before the construction documents were completed. For example, the existing central telephone and data hub on the basement level of 440 CCP had to be maintained as fully operational during the project—including the period when the existing concrete floor was demolished, a water barrier was installed and a new concrete floor was poured.

The team devised an ingenious solution—suspend the existing electrical and telecommunications equipment during the process.

Once the new telephone, fiber optic and server rooms were completed in City Hall, these systems were cutover to City Hall and routed to the basement level of 440 CCP to continue feeding this building, as well as the 911 call center.

In addition, the team installed permanent electrical panels and new circuits during the basement demolition to ensure a smooth cutover and avoid rework. After construction in the basement was completed, these were connected to the new electrical service. As a result, the cutover from existing to new power was completed in 15 minutes.

Advancing to the goal

Electrical plus mechanical systems typically influence about 75 percent of total LEED points. It should be noted that in this case, the historical nature of the buildings created challenges for the mechanical system design. Nevertheless, the energy efficient heating and cooling systems contributed to earning 12 credits under Energy & Atmosphere in 440 CCP, six credits in this category in City Hall and additional credits for thermal comfort, outdoor air delivery monitoring and increased ventilation.

Other notable sustainable features include daylighting of 75 percent of all regularly occupied spaces; greater than 45-percent reduction in use of potable water thanks to dual-flush toilets, waterless urinals, automatic faucets and water-flow regulators; and diversion of more than 1,000 tons (greater than 84 percent) of on-site generated construction waste from landfills.

This phase of the Civic Center Revitalization master plan was completed on schedule and within the budget. The design-build team earned a total of 45 LEED points for the project, earning a Gold rating—a fitting achievement for the City of Richmond, which is dedicated to becoming "an environmentally sustainable city." The city's goals are not only to save energy and money, but to also reduce its environmental impact and improve the community's economic vitality and quality of life.

In pursuit of these goals, the city has implemented a broad range of initiatives, including waste reduction, energy efficiency, alternative and renewable energy, sustainable land use and transit planning, and green jobs. With the successful completion of this phase of the Civic Center Revitalization, Richmond's leaders have taken another major step toward becoming an environmentally sustainable city. **FMJ**

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