

Bonneville Power Ross Admin. Building

Vancouver, Wash.

Market: Office/Utility

Size: A seven-acre site hosting a 15,700-sq.-ft. office building and a 22,400-sq.-ft. maintenance building for storage of vehicles and equipment.

Components: Offices, training rooms, workshops, tool and vehicle storage, and a storage yard for power poles.

Team:

Design: Soderstrom Architects
Structural/civil engineers: KPFF Consulting
MEP, Lighting Design: Interface Engineering
Energy Modeling: Guttman & Blaevoet Consulting Engineers
PV System Engineer: Paradigm Engineering
Landscape Architect: Simpl Landscape Architects
GC: Skanska

One of four regional federal power marketing agencies within the U.S. Dept. of Energy, the Bonneville Power Administration (BPA) is a federal agency created by Congress in 1937 to market electric power from the Columbia River's Bonneville Dam, and to construct facilities necessary to transmit that power. Congress has since designated BPA to be the marketing agent for power from all of the federally owned hydroelectric projects in the Pacific Northwest.

Text: Jim Crockett

Photos: Stephen Cridland



| PROJECT ZERO |

BONNEVILLE POWER

WITH A MANDATE TO UPGRADE ITS FLEET OF OPERATIONAL FACILITIES, BPA NEEDED A FACILITY THAT NOT ONLY COULD OPERATE 24/7, BUT COULD SERVE AS A TEMPLATE FOR FUTURE PROJECTS.

Getting a Read on Replicable NZB

After an initial foray delivered less-than-favorable results, a switch to a net-zero scheme may prove a blueprint for 20 more BPA replacement facilities.

A Portland-area base for the Bonneville Power Administration's (BPA) transmission line and substation maintenance crews, substation operators, control technicians, and support engineers,

always looking for ways to address weaknesses in the system."

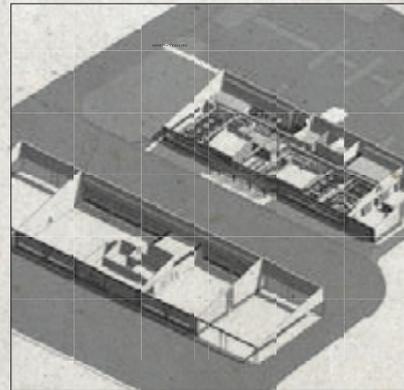
Energy, since LEED certification, preferably Gold, was also a goal, did play a major role in design. In fact, each building has a modeled energy use index (EUI) of 30, although Shea believes they may hit closer to 20. The 300kW PV array, however, was sized to make the project net zero now on an annual basis.

How it All Started

Soderstrom, actually, was a previous BPA client, having developed a master plan for the agency to upgrade and replace its fleet of buildings in the Oregon/Washington area. The Ross facility represented the second replacement building. Soderstrom was not involved in the first project, but after constructing that initial structure, BPA had a better idea of what it wanted, and what it, definitely, did not want, as that first foray did not produce the replicable formula it sought.

But as far as the program and architectural goal, another driver was culture and uniting said engineers with the work crews, who Shea said had always been separated. "They really wanted to tear down that wall, so to speak. So now the linemen and engineers are all in one building, and they all meet in the morning before heading off."

the Ross facility is designed to the highest seismic resistance criteria for complete functionality after an earthquake. In fact, according to Mike Shea, a principal with Portland-based Soderstrom Architects, the ability to be a true 24/7/365-operation, in order for the entity to be able to launch emergency repairs on power lines and substations, was the very driver that made net zero a reality. "It's no secret the Pacific Northwest is due for an earthquake in the not-so-distant future," says the firm principal. "So what BPA really wanted was a mission-critical facility with on-site power capability, for if there is an earthquake, the linemen will be ready," says Shea, adding BPA is an organization run for, and by engineers, "so they're



TIMELINE

► **June 2011:**

MHQ system-wide master plan completed

► **June 2015:**

Project start.

► **July 2015:**

Design basis completed

► **September 2015:**

Design concept

► **October 2015:**

Design development

► **January 2016:**

Construction documents

► **July 2016:**

Construction begins

► **November 2017:**

Substantial completion

► **January 2018:**

Occupancy.

Key Stats:

Cost: \$13,000,000

Admin. Building: 15,678

sq. ft.; **Maintenance**

Building: 22,442 sq. ft.

EUI per LEED modeling

protocol: 35 kBtu/sq.

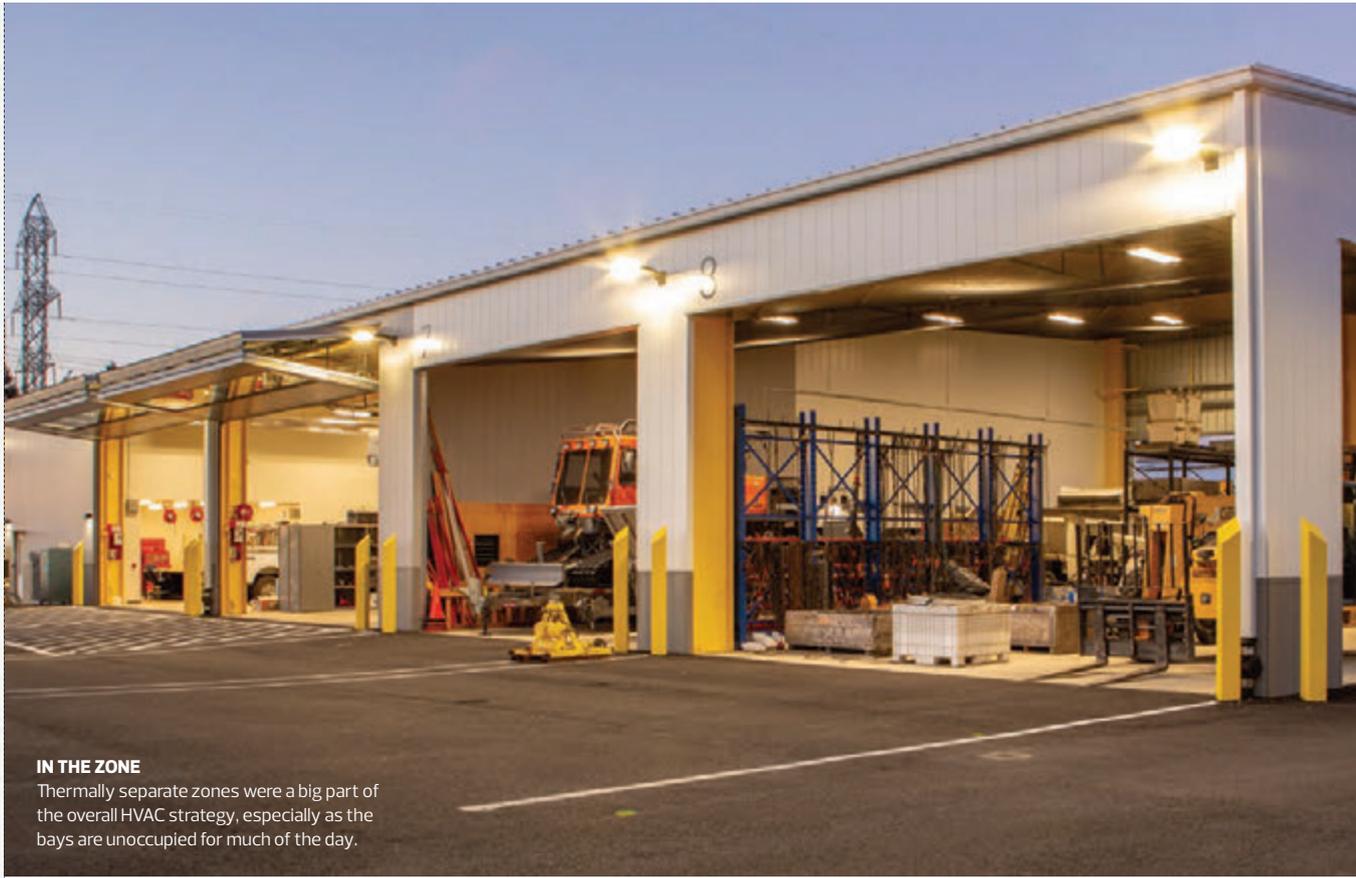
ft./year; **Maintenance**

Building: 39 kBtu/sq.ft./

year.

Energy modeling and research played important roles in pre-planning the project, although Shea sees lots of areas where the process can be improved, particularly with the former. Modeling, in this case, was driven by the customer's desire to achieve LEED Gold. "We had a good sense of what we needed, but the modeling effort didn't go as deep as we would have liked in being able to drill down at system level, to do different analysis with PV, for example."

One pre-planning aspect that was very much in focus was BPA's commitment to analysis of building controls. The organization has a long history with control systems, and not always a positive one, so BPA put heavy emphasis on ensuring that would not be the case here.



IN THE ZONE

Thermally separate zones were a big part of the overall HVAC strategy, especially as the bays are unoccupied for much of the day.

ENVELOPE

In contemplating both the look and constitution of the envelope, it was a matter of marrying practical functionality with sustainability on a tight budget. Soderstrom has delivered many low-energy buildings in its portfolio, so that wasn't an issue. In fact, they first experimented with solar power back in the '80s, so dealing with an off-grid power system was not unfamiliar—nor was delivering a net zero project, as the firm did so with the Village for Sustainable Living student housing project at the Oregon Institute of Technology. The challenge here, says Shea, was to be contemporary, but cost effective. "What we ended up discussing, as far back as that master plan, was a pre-engineered, panelized metal building system whose

form would be simple and even repeatable, as BPA would be embarking on an aggressive, as many as two-a-year construction program."

The building is clad with MBCI insulated metal panels delivering R30. Wall performance was further augmented with another R30 layer inside the wall cavity—actually good old-fashioned BATS insulation, but Knauf's EcoBatt, for healthier IAQ and environmental impact.

Blower door tests and infrared cameras were used to ensure tight and fully insulated construction. Even the doors of the vehicle storage building (Schweiss BiFold) are top performers, delivering R30 vs. the more typical R12 or R18.



HVAC

The office building uses radiant slab heating and cooling with DOAS ventilation and heat recovery via an ERV. The maintenance building uses infrared radiant heating in the vehicle storage/work bays and HVLS fans for cooling. The HVAC and lighting systems are also seismically tested and certified to be immediately operable after a major quake.

The combination of radiant, augmented with DOAS ventilation, works especially well in the mild Pacific Northwest climate. In fact, Shea says, it can operate in economizer mode for most of the year. The firm had considered a number of other options including natural ventilation, but ultimately, opted for what was most economical

for this particular facility and client. "We looked at geothermal, ground source heat pumps and VRF," says Shea. In fact, the latter tech, according to the architect, actually would have been a little less expensive than their hybrid system. The client, however, had reservations about the need to eventually replace the number of compressors in each unit in about 30 years. Ground source heat pumps proved entirely too expensive. However, of note, adds Shea, is that geothermal, if done on a more campus-wide basis, would have been much more affordable. In fact, the firm had great success with such tech at OIT, although they were blessed there with a natural geothermal well.

Since the vehicle storage facility would include the large operable doors, Shea said they did consider natural ventilation. In fact, the shape of the buildings themselves reflects that fact, as the area is blessed with significant prevailing winds off the Columbia River; the idea was to create a negative pressure within one of the structures by the shape and orientation of the buildings, to draw air in, and through, the buildings. Ultimately, research revealed winds were not prevalent enough. Security also was a concern. The idea, however, was worth exploring, as Shea says it had been successfully implemented on the net zero Hood River Middle School in the region.



Instead, Soderstrom focused on creating thermally separate zones, especially as the vehicle facilities are unoccupied for much of the day while crews are out on repairs and maintenance. Also, the ERV system delivers much of the benefits they would have gotten from natural ventilation.



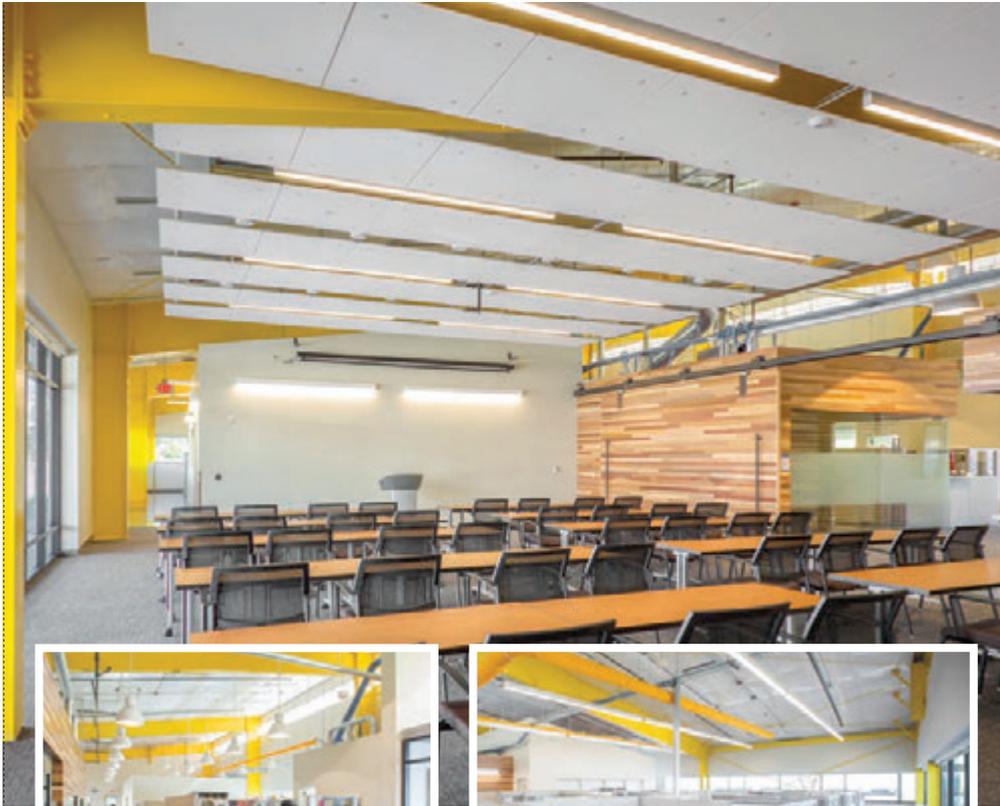
DAYLIGHTING + LIGHTING

A concerted effort was made to bring daylight into the space, particularly via clerestory windows due to the high-bay nature of the building. "We wanted to make use of it. Anecdotally, we know it helps productivity, and it also helps lower energy consumption." In fact, Shea is pleased at just how well the daylighting effort is going. "There's lots of daylight all the time. In fact, there's no real need to even run the lights, except for maybe December."

Windows feature a "bird friendly" grid etched into the glass to prevent birds from colliding with the glass surfaces.

Lighting is all LED. There are not a lot of daylighting sensors, as Shea says they preferred occupancy sensors, due to the more migratory nature of the staff.

Interiors are bright and highly reflective to help bounce natural light. As far as color, Soderstrom did employ very visible yellow Ductsox throughout the space. Not only is it a more cost-effective product, especially to add a splash of color, but Shea says it also helps make the space quieter, an important issue, as acoustics in high-bay spaces, and metal buildings, as whole, can be an issue.





COMMISSIONING INSIGHTS

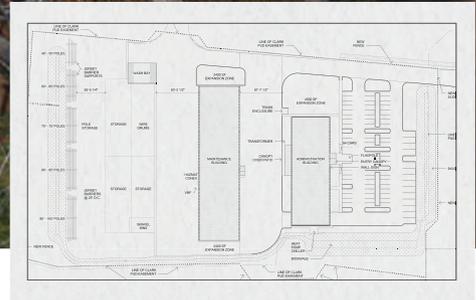
BPA put a high priority on the design and commissioning of control systems in the complex. Such foresight, however, adds Shea, takes an enlightened—or experienced—client to understand the value of pre-planning and integration and continuous commissioning.

WATER

Low-flow plumbing fixtures were used throughout, but the outside water management strategy was more notable. Prior to the building's construction, in compliance with more aggressive Washington State laws and impact fees, a significant stormwater retention system was excavated. "It's extensive, but it's also

expensive, as this is a seven-acre site," says Shea. "But I sure was glad we had it, as when we were constructing the buildings, it was one of rainiest winters we've experienced in a while."

The parking lots contain some areas for drainage, but the architects opted out of more permeable solutions as there was some concern about the quality of the soil, as the area, prior to the project, was kind of a dumping area. The area was remediated, but the firm just didn't want to chance anything.



BPA PUT HEAVY EMPHASIS ON ENSURING THAT CONTROL SYSTEMS WERE DONE CORRECTLY, AGGRESSIVELY INVOLVING CONTRACTORS AND THE CONTROLS MANUFACTURERS IN THE PROCESS.

POWER

Looking back, and ahead, Shea is hopeful they'll be working again with BPA on future replacement facilities, as the client was pleased with their work on the project. "I think what we've done here can be a template," says Shea. The firm certainly is compiling lessons learned. For example, the 400-plus module, 300kW PV array (Solar World) more than adequately met the site's power needs. In fact, Shea said they could have easily added more panels if they wished to become a net positive site. While not necessary here, he says it could be done elsewhere, even as a catalyst and generator for surrounding areas that might wish to help create a larger microgrid where greater resilience is desired.

At the same time, Shea says there are things that need to be worked out. For example, no battery storage was incorporated at this time. It's nothing to do with the technology itself, he says, but rather issues about system integration. "Who knows, maybe by the time of construction for the fourth or fifth building, it may be possible. But right now, it's just too much of a risk for a facility with such a mission-critical role."

While there was room on the roof for additional PV, they opted out of doing so in their effort to keep things simple and costs down. That said, the choice to use a radiant HVAC system did play a big role in increasing flexibility, as they were able to avoid the need to store HVAC equipment on the roof—the chiller for radiant cooling is on the ground level, also making it easier to maintain.

SIDEBAR

Looking Ahead

Perhaps the best news of the day is that Soderstrom will be able to help BPA log and act on such lessons learned, as in a separate contract, the organization has commissioned the firm to conduct a post-occupancy evaluation. It begs the question asked here previously in the pages of the magazine, about the notion of out-of-the-box design-build-maintain-operate contracts as the logical route of contracts of the future. Shea says the idea could appeal to larger clients, especially those dealing with a campus, or have expanding building programs—and possibly even real estate holding companies with large portfolios. That said, for smaller projects, it's not likely to fly. He, however, is intrigued by the notion, and at the very least, says it provides a starting point for designers, contractors and owners to begin dialogue for more in-depth, long-term planning and operations—discussions that might not happen without such consideration. He certainly hopes the good will they've earned on the project, including their role in creating a master plan, puts them at the top for consideration of the rest of BPA's replacement program, which could involve 20 other projects. At the very least, it certainly has proved a great reason for the firm to push net zero capabilities as a differentiator.

▼ WIND WOES

Given all the operable doors, incorporation of a natural ventilation scheme was in play, but prevailing area winds did not cooperate.



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