CASE STUDY

OHLONE COLLEGE NEWARK CENTER

FOR HEALTH SCIENCES AND TECHNOLOGY

DISPELLING THE COST MYTH

BY GUY ESBERG

Community colleges often operate in the shadows of larger universities. But Ohlone College Newark Center near San Jose, Calif., has been casting some big shadows of its own since opening in 2008.

The LEED Platinum college, which incorporates sustainable strategies to reduce energy use, represents a radical shift from the historically utilitarian approach to community college design. Original plans called for a traditional community college design. Original historically utilitarian approach to community college design. Original.

promoted a new strategy emphasizing energy-efficient technologies as learning tools.

Nearly every aspect of design and construction, including a geothermal heating and cooling system and two enthalpy wheels, fit within the original $58 million budget. Additional funding through a state grant and community contributions covered the $2 million photovoltaic array. The successful implementation of the Newark Center’s sustainable technologies helps dispel the perception that these technologies are too expensive to be practical—particularly for public institutions with tight budgets.

The campus’ energy-efficient and sustainable operation prompted California Lt. Gov. John Garamendi to recognize it as exemplary. “You have set the standard for California public buildings,” Garamendi said. “I want every other campus and building to be designed and built to the very highest environmental standards. And when they say it can’t be done, I’m going to ask, ‘Have you been to Ohlone?’”

Project Overview
When Ohlone College’s new president and district superintendent, Douglas Treadway, arrived in the summer of 2003, he put the Newark Center project on hold for a year to evaluate its direction.

“He brought us all together to determine if we were in alignment about environmental issues, if we were properly addressing long-term needs both in building quality and educational opportunities and whether or not we could afford to operate the campus in the future given increasing energy costs and future funding uncertainties,” said Patrice Birkedahl, Ohlone development director.

Once the evaluations were completed, Treadway tasked the design team with creating a precedent-setting campus in terms of sustainability and as a learning tool. Students can observe the center’s enthalpy wheels in motion and view real-time energy and environmental data via screens in the lobby and mezzanine.

The Newark Center’s energy-efficient design proved its value during its first full year of operation in 2008. Its energy consumption is a fraction of California’s tough Title 24 requirements, and it provides a light, airy and comfortable environment for students and staff.

Site and Design
Located on an 81-acre former brownfield parcel once used as farmland, the site is adjacent to a San Francisco Bay estuary and state-protected wetlands.

The center is driven by the concept of a learning estuary, which is an identity based on the paradigm of technological advancement within an ecologically sustainable environment. The theme resonates with the college’s educational programs, which include environmental sciences, biotechnology and health sciences.

Ohlone College Newark Center is located on the southeastern shore of San Francisco Bay and participates in the stewardship of the bay. The center’s use of sustainable technologies and focus on the environment complements its academic programs, which include environmental sciences, biotechnology and health sciences.

BUILDING AT A GLANCE

Name
Ohlone College Newark Center for Health Sciences and Technology

Location
Newark, Calif.

Owner
Ohlone Community College District

Principal Use
Community College
Includes
Classrooms, labs, fitness center, café

Employees/Occupants
3,500 students

Gross Square Footage
130,000

Total Cost
$58 million (excluding cost of land)
Cost Per Square Foot: $446

Substantial Completion/Occupancy
January 2008

Delivery Method
Construction Management At Risk

Occupancy
100%

Distinctions/Awards
LEED Platinum
2008 U.S. Environmental Protection Agency, Environmental Awards, Environmental Hero
2008 Community College Facility Coalition (CCFC), Design Award of Merit
2009 Building Design+Construction Building Team of the Year Competition, Gold Medal
and passive sunshades. A combination of glass curtain wall and storefront, cement plaster, glass fiber reinforced concrete (GFRC) and metal elements form the exteriors.

The Newark Center’s building form expresses its instructional and service programs, and is shaped in response to the local climate. The combination metal and membrane roofs extend as “folded planes” and drape over the edge of the building sections, serving as rain screens.

Airtightness testing has been around for more than 20 years. Various energy programs and fluctuating energy bills have provided homeowners an incentive to improve the airtightness of their homes. Energy tax credits can also be received by the homeowner but only if the house airtightness has been verified that it is less leaky after remodeling than before.

In England, airtightness testing of buildings over 10,000 square feet was the first regulation initiated to reduce energy consumption. Efforts to make commercial buildings more energy efficient in the U.S. has only recently been incorporated into various “green” initiatives. Tests of commercial buildings show that they tend to be more leaky than the average house, based on air leakage per square foot of surface area. That means that commercial buildings are less energy efficient than the average house.

To measure the actual airtightness of a large building means more air is needed to maintain a reasonable test pressure. The Energy Conservatory, a leader in airtightness testing, has kits available to directly measure more than 18,000 cubic feet per minute of air leakage. Multiple kits and fans can be used simultaneously to generate more air for accurate and reliable measurements of air leakage for testing before and after retrofitting.

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The exterior concrete panels blend with the hills east of the campus, while the blue and green windows complement the sky, water and indigenous vegetation.

A central lobby connects classrooms and labs in four wings. The lobby features enthalpy wheels, energy conservation monitors and geothermal and PV panel displays, which relate to the school’s environmental sciences, sustainable design and technology programs. The building form protects an adjacent courtyard from prevailing winds while maximizing the benefits of daylighting.

The courtyard provides views of the wetlands and estuary.

Alternative Energy Sources

The project engineers and architects investigated alternative energy production and conservation systems. Those systems that performed best when analyzed through an energy modeling program led to the recommendation of three key energy components:

- A closed-loop, ground coupled heat pump geothermal heating and cooling system.
- Two energy recovery enthalpy wheels, and
- A photovoltaic array.

Although the energy modeling program showed the recommended systems would reduce energy purchases by an extraordinary level, convincing the board to approve them was another matter, said Alfatech Principal Michael Lucas, P.E.

While geothermal systems were not a new concept to the board, horizontal coil geothermal systems were not common in the Western states at the time. “Although it’s a system used widely in Europe and is gaining popularity in the Eastern U.S., it’s rarely seen in the West,” Lucas said.

Lucas proved that the capital cost would not be significantly greater than a traditional chilled-water HVAC system. But ultimately, Lucas had to put his professional reputation on the line to secure the board’s approval.

LEED PLATINUM CERTIFIED — AUGUST 2008

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NEW FEATURES

Water Conservation

- Drought-tolerant landscaping, weather monitoring system for irrigation, waterless urinals, high-efficiency plumbing, motion sensor faucets

Recycled Materials

- Insulation exclusively recycled blue jeans (denim), numerous recycled construction materials

Daylighting

- Throughout building

- Individual controls

- Local occupancy sensors

- Alternative Energy Sources

A closed-loop ground coupled heat pump geothermal heating and cooling system, two energy recovery enthalpy wheels, photovoltaic array

BUILDING TEAM

Building Owner/Representative

Ohlone Community College District: Douglas Treadway, President and District Superintendent (now retired)

Architect

Perkins+Will: Karen Cribbins-Kuklin, AIA, LEED AP, Associate Principal

MEP Engineer

Alfatech Consulting Engineers, San Francisco: Michael Lucas, P.E., Principal

Bond Program Manager

Stegeman & Kastner: Don Eichelberger

Construction Manager and General Contractor

Turner Construction: William Jangraw

Structural Engineer

SOHA: Stephen Lau, P.E., President

Civil Engineer

Sandis: Ken Ocoll, P.E., Principal

Landscape Architect

Conger Moss Guillard: Project Team Leader: Chris Guillard, Principal

LEED Consultant

Davis Langdon U.S.: Kathleen Smith, LEED AP

KEY SUSTAINABLE FEATURES

Water Conservation

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The board was also skeptical about the photovoltaic system because of its initial cost, while few members, if any, understood the concept of the enthalpy wheels. Eventually, the benefits of these integrated systems combined with the solidarity of opinion between the design team, Treadway and his staff, faculty and students won over the board.

**Geothermal Heating & Cooling**

The heating and air-conditioning needs of the 130,000 ft² facility are fully met by an underground geothermal ground loop system. The Newark Center’s system makes use of the stable (61°F) temperatures below ground to reject building heat on hot days and to absorb the earth’s heat on cold days.

Twenty-six miles of pipe located 12 to 16 ft underground and filled with water either transfers heat to the earth or extracts it from the earth based on the outdoor air temperature. Conventional air-to-air heat pump systems consume significantly more energy than geothermally assisted systems because they must reject heat to outdoor air temperatures in excess of 100°F in the summer, and absorb heat for heating from air temperatures sometimes below 32°F in the winter.

The use of geothermal heating and cooling increases the life of HVAC equipment since the water source heat pumps use water close to the ground temperature of 61°F. This temperature lowers the HVAC equipment’s operating head pressure, extending the life of equipment when compared with conventional systems.

Because of the campus’ proximity to San Francisco Bay and the resulting short distance between ground level and the subterranean aquifer, an unusual horizontal or slinky underground piping system was used in place of the more common vertical bore method. The horizontal system minimized the possibility of penetrating the aquifer and creating pathways for potential contaminants to enter it. The system’s 26 miles of pipe are filled with water that transfers the adjusted temperature through a heat exchanger.
energy recovery systems’ payback period is two to three years. Since enthalpy wheels are most effective when located at or near the center of a building, their large size often creates major and often functionally unrealistic challenges for the architect.

At the Newark Center, however, the architect’s close collaboration with other members of the design team made it possible to locate the wheels on the mezzanine level at both ends of the main reception area, maximizing the air circulation effectiveness of the wheels and minimizing ductwork.

Because of the Newark Center’s mission to use the facility as a working example of advanced energy technologies, “we placed the wheels in a highly visible area to pique peoples’ curiosity,” said Karen Cribbins-Kuklin, AIA, Perkins+Will associate principal and lead project architect.

The Newark Center includes many classrooms and laboratories requiring large amounts of fresh air to comply with occupancy and lab air change rate codes. Due to the large volume of laboratory air and the enthalpy wheels’ placement and design, the entire building receives the amount of fresh air required for laboratories, or 300% of that required by California Title 24. This level of fresh air improves indoor air quality, minimizing air quality-related complaints by occupants, while avoiding the problems associated with operable windows. Occupants have commented that the amount of fresh air makes them feel as though all of the windows are open.

Photovoltaics

The primary method of alternative power generation at the Newark Center is its solar photovoltaic array. Covering 38,000 ft² of roof area and generating 450 kW of peak ac power, it is the second...
largest solar generation system in the Silicon Valley region. In its first year of operation the solar array generated 710 MWh, not only enough to make Newark Center a net zero energy campus during four months of 2008, but also enough to sell its unused solar energy to the public utility.

The center’s enthalpy wheels and geothermal system prevent the generation of 421 tons of CO2 per year (equivalent to more than 1 million vehicle miles not driven), while the photovoltaic system produces enough electricity to meet the demand of more than 120 homes annually.

**Other Sustainable Strategies**

The building design takes maximum advantage of daylighting, from facility orientation to window placement to the use of high performance glass that transmits high levels of daylight while minimizing glare.

The building’s design and orientation were influenced by sun, wind and weather patterns. The exterior concrete panels blend with the hills east of campus, while the blue and green windows complement the sky, water and indigenous vegetation.

The irrigation system uses a weather monitoring system that calculates the rate of evaporation based on variables such as temperature and wind. Other water conservation features include waterless urinals, high-efficiency plumbing and motion sensor faucets, which reduce the annual water consumption by more than 900,000 gallons a year.

Since the geothermal system eliminates the need for large (300 ton) chillers and cooling towers, water lost to evaporation is reduced by more than 740,000 gallons a year.

**Domestic Hot Water**

Natural gas is used to meet the Newark Center’s domestic hot water demand, but a different energy source could have further reduced the building’s energy consumption.

The building generated more power than it consumed during four months of 2008 (net zero energy). In hindsight, an electric boiler with additional PVs or thermal solar panels with hot water storage would have moved the project closer to total net zero energy consumption.

**Energy Model**

Although extensive energy modeling was performed using the most sophisticated software available, the facility’s actual energy performance is far better than the computer predictions.

Engineer Michael Lucas believes some of the discrepancy results from the enthalpy wheels handling more of the load than expected. This may be due to the large air volume, (50,000 cfm) being handled by the energy recovery wheels. The upper and lower limits of the HVAC system’s operating dead band seem to have been expanded by the enthalpy wheels’ ability to precool and preheat the building’s incoming air. As a result, the water source heat pump compressors cycle less frequently than expected.

**Conclusion**

The Ohlone Newark Center dispels the perception that sustainable building strategies are inherently more expensive than traditional methods. As a bond issue-funded project, no cost overruns were allowed and no allowances for special equipment were available.

The effective integration of alternative energy systems and resource conservation techniques has combined to produce energy savings that have not only contributed to the fulfillment of the center’s environmental responsibility goals but have also lowered energy purchase expenditures.

In 2008 the energy-saving features of the Ohlone Newark campus resulted in:

- Annual reductions of 86% in purchased electricity and 72% in natural gas consumption (used for domestic hot water) compared to the same building designed according to Title 24 standards.
- A combined energy cost of $0.45/$7.5.
- Energy use equivalent to 12% of the required level for colleges and universities to qualify for the ENERGY STAR and
• Four months of net zero energy operation.

Equally important is the proof that institutions of higher learning throughout the country can use resource conservation and alternative energy production techniques that benefit the environment, and may even keep classrooms open during future energy challenges.

ABOUT THE AUTHOR

Guy Esberg has worked in the facilities design and construction fields since 1977. He has written about and lectured on energy conservation and alternative sources throughout his career.