



When Ohlone Community College's Fremont Campus was constructed in the early 1970s, the process of building into the steep hillside site activated dormant water springs that subsequently caused chronic water damage and mold growth in some of the buildings.

Ohlone commissioned CannonDesign to provide planning and design services for a \$120 million Academic Core Project that would replace four water-damaged buildings at the campus core with three buildings totaling 190,000 sf. CannonDesign began the design of the project in 2013, with construction starting in 2016 and with the building opening in January of 2020 for classes to start. Ohlone required that this project achieve a LEED Gold certification, but with innovative engineering and design features, the team was able to achieve LEED Platinum for V3.0.

The new buildings house a learning commons, visual and performing arts spaces, science teaching labs, lecture halls, classrooms, and a new central utility plant. Located on a very challenging, hillside site, the buildings seamlessly link lower campus to upper campus. The three new buildings transform the student experience. The science center, music and visual arts center, and learning commons promote an active pedestrian experience while opening the campus to sweeping views of the Bay. The academic core helps Ohlone break the "commuter campus" mold by encouraging students to stay and linger. There are both formal and informal "collision" learning spaces

(including a large stadium step staircase) in the common areas between the buildings that allow students to gather outside of the classroom and socialize, or work in small group sessions.

Energy Efficiency

The Academic Core Buildings had a strict requirement to exceed the 2013 California Energy Code and ultimately have a goal of being a Net Zero facility along with achieving a Gold certification level for LEED V3.0. These requirements made it imperative that we also exceed the requirements of ASHRAE 90.1-2007, which the 2013 California Energy Code allowed us to easily achieve. Because of the extended design time and construction selection process, we were actually required to upgrade to the 2016 California Energy Code and this was also easily achieved.

In order to demonstrate compliance with the Energy Code and the LEED Energy credits, we needed to use EnergyPro modeling software to comply with the Energy Code and EQuest Energy Modeling Software to demonstrate the LEED Energy savings. The process of energy modeling started at the earliest stages of the project: the orientation was maximized with energy modeling was used to ensure optimum energy efficiency of the building envelope. Shading and daylight

studies were completed to optimize external shading devices and overhangs, and to address heat gain into the building as the design evolved.

The three new buildings used only LED lighting, which at the time the project was designed was still a newer technology. This early design choice reduced the electrical cost, mercury use and provided superior dimming capability. Advanced lighting controls were provided to enable efficient daylight harvesting, occupancy sensing, time-based control scheduling, load shedding, task tuning, and personal control. A plug load control system was used to disable outlets based on occupancy of the buildings to reduce energy use of the buildings.

The HVAC systems for the project add to the energy efficiency by using the central utility plant's heating and cooling method which uses a total of three R-134A 250 ton heat recovery water cooled chillers connected to a geothermal bore field to provide the necessary chilled water and heating water for the entire campus. As illustrated in the attached diagram, this plant provides simultaneous heating water while also producing chilled water for the air handling units serving the building. The science laboratories within the project include a variable air volume tracking system which allows for fume hoods to operate at a lower airflow rate when the sashes are in the closed position, further saving energy, especially within the organic chemistry laboratory spaces and all laboratory support spaces.



← Central Utility Plant

Operation and Maintenance

The long-term effect of Ohlone's operation and maintenance budgets was an important driver of this project. The key part was to replace a series of buildings where the HVAC systems consist of water-cooled heat pumps that were at the end of their lives and also becoming troublesome to maintain. Because of these on-going maintenance costs, the college made this project a priority with a goal to reduce the maintenance and operations costs in the future. The decision to provide a central utility plant for the campus would allow for the reduction of equipment that would require on-going, costly maintenance. The building provided air handling units on the roof of the buildings to allow for maintenance staff to easily maintain equipment without having to interrupt the building occupants.

Cost Effectiveness

The electrical design integrates the 2-megawatt PV array already installed on the campus to meet the annual electrical needs for the facility providing for a net-zero facility. The project has been in use for well over a year and the energy efficiency measures have proven to be cost effective. In addition, the consolidation of heating and cooling equipment to central locations has allowed the maintenance staff to maintain the building systems efficiently.

Environmental Impact

This LEED Platinum facility and a net-zero facility reduces the overall impact to the environment by reducing greenhouse gases through the use of the campus PV Array. This type of achievement doesn't happen without early planning and collaboration with the entire project team. The buildings were planned to take into effect the natural elevation changes of the mountainside the facility is built on. These buildings were also used to increase the walkability of the lower end of the campus with the upper end of campus to provide greater student access between the significant elevation changes of the campus.

By incorporating all of these energy efficient strategies and performing detailed energy modeling, we were able to show a proposed EUI of 36.2 kbtu/sf for the building and an improvement of 69.8% reduction in energy use over the CBECS baseline design. This energy efficiency design allowed the project to achieve 19 points for the LEED V3.0 optimize energy credit.

Indoor Air Quality (IAQ)

In keeping with the theme of providing a healthy environment for the building occupants, the indoor air quality measures became a strong focus. All of the air handling units are provided with a minimum of two filter banks with MERV 8 and MERV 13 filters provided in each unit. Since this is a LEED Platinum building, the ventilation systems are designed to meet and often exceed the requirements in ASHRAE 62.1-2009. Also, as a part of the LEED process, the project was able to achieve credits for increased ventilation. All of the laboratory spaces are exhausted and maintained at a negative pressure and the anatomy dissection spaces have dedicated exhaust systems. To minimize infiltration of outside air into the building, each building is maintained at a positive pressure. The air handling systems are designed with a pre-occupancy purge cycle to allow the building to purge any VOCs from the building materials when the systems are in an un-occupied mode.

Thermal Comfort

This project was designed with occupant thermal comfort in mind from the earliest stages of design. The project was mindful to provide circulation spaces along the exterior south exposures in combination with solar shades to address thermal comfort of the occupants. As a prerequisite of LEED V3.0, the project was designed to meet the requirements of ASHRAE 55-2004 and a full analysis was completed to show

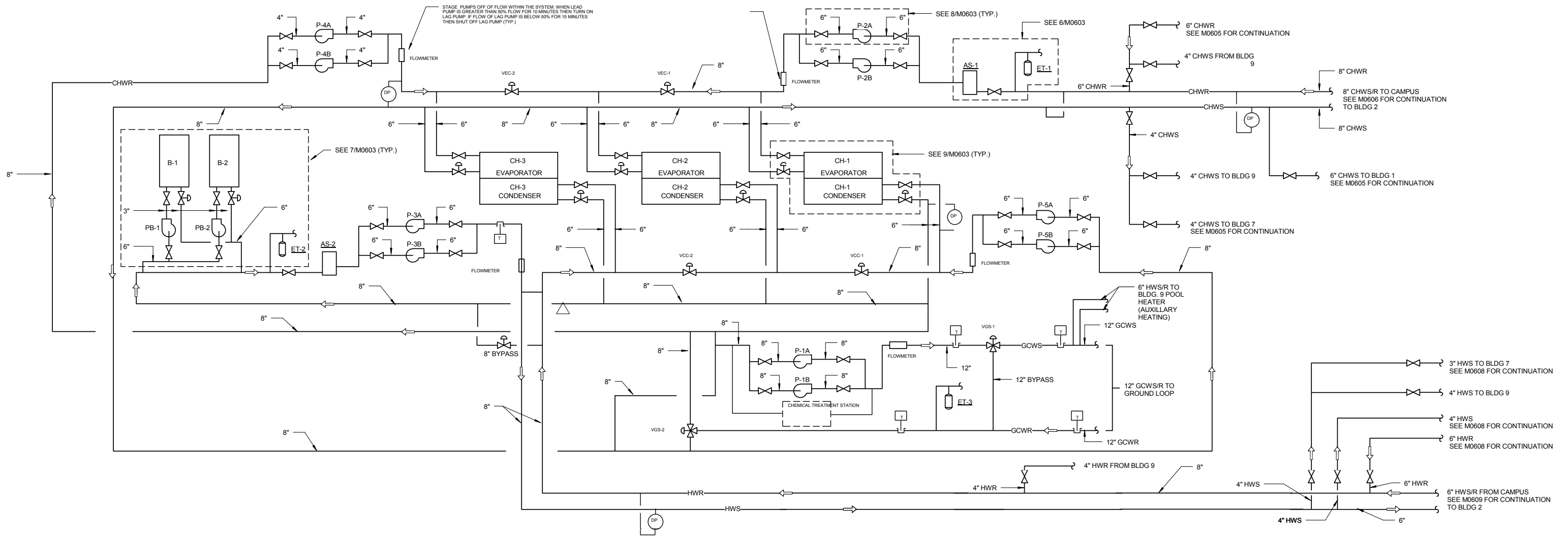
compliance with this standard. In addition, the college has committed to conducting a thermal comfort survey as a part of the LEED Platinum certification and act upon the results of the survey. The use of the reversible heat pump chillers allows for the necessary reheat load to be provided to improve the thermal comfort for the occupants while maintaining indoor air quality levels.

Innovation

This project was able to use many innovative technologies, such as LED lighting and solar heating for domestic hot water, but the truly most innovative part of the project was the design of the central utility plant. This central utility plant employs an earth-coupled bidirectional cascade chiller system with heat-recovery chillers to generate chilled water and heated hot water for campus distribution. The chilled water system is designed to maintain a Delta T of 20 degrees F, and the heating water design is operation at a 130-degree maximum discharge water temperature. The earth-coupled system acts as a heat sink and allows heat energy to be stored and extracted in the ground for later use. The system utilizes a tertiary pumping arrangement for the heating and chilled water systems to each building and as future buildings are connected to the central utility plant. The secondary pumps are sized to pump water through the campus distribution loops, while the tertiary pumps in each building will pump the water through the individual buildings. Although the central utility plant will initially serve only the three new buildings, most of the 12 existing buildings will be connected over the longer term. The geothermal bore field was designed to be phased as buildings are brought on-line. Chilled water and heating water distribution piping are stubbed out to points on the site so that they can connect to the additional buildings in the future.

↓ Student Collaboration Space





COOLING ONLY TABLE												
Energy Transfer Evaporator Loop Pump	Borefield Pump (P-1A & P-1B) (1)	Chilled Water Loop Pump (P-2A & P-2B) (2)	Heating Water Loop Pump (HWP-1A & -1B)	Energy Transfer Cond Loop Pump (P-3A & P-3B) (2)	Energy Transfer Evap Loop Pump (P-4A & P-4B)	Condenser Crossover Valve (VCC)	Evaporator Crossover Valve (VEC)	Energy Transfer Loop Mode Valve (VGS)	Chiller/ Heater 1	Chiller/ Heater 2	Chiller/ Heater 3	
Cooling Only Chiller 1 Lead	ON	MODULATING	OFF	MODULATING	OFF	CLOSED	CLOSED	TO COND LOOP	ON	COOLING	OFF	OFF
Cooling Only Chiller 2 Lead	ON	MODULATING	OFF	MODULATING	OFF	OPEN VCC-1	OPEN VEC-1	TO COND LOOP	OFF	COOLING	OFF	OFF
Cooling Only Chiller 3 Lead	ON	MODULATING	OFF	MODULATING	OFF	OPEN VCC-1 & VCC-2	OPEN VEC-1 & VEC-2	TO COND LOOP	OFF	OFF	ON	COOLING
Cooling Only Chiller 1 & 2	ON	MODULATING	OFF	MODULATING	OFF	OPEN VCC-1	OPEN VEC-1	TO COND LOOP	ON	COOLING	OFF	OFF
Cooling Only Chiller 1 & 3	ON	MODULATING	OFF	MODULATING	OFF	OPEN VCC-1 & VCC-2	OPEN VEC-1 & VEC-2	TO COND LOOP	ON	COOLING	OFF	COOLING
Cooling Only Chiller 2 & 3	ON	MODULATING	OFF	MODULATING	OFF	OPEN VCC-1 & VCC-2	OPEN VEC-1 & VEC-2	TO COND LOOP	OFF	COOLING	ON	COOLING
Cooling Only Chiller 1, 2 & 3	ON	MODULATING	OFF	MODULATING	OFF	OPEN VCC-1 & VCC-2	OPEN VEC-1 & VEC-2	TO COND LOOP	ON	COOLING	ON	COOLING

HEATING ONLY TABLE												
Operating Mode	Borefield Pump (P-1A & P-1B) (1)	Chilled Water Loop Pump (P-2A & P-2B) (2)	Heating Water Loop Pump (HWP-1A & -1B)	Energy Transfer Cond Loop Pump (P-3A & P-3B) (2)	Energy Transfer Evap Loop Pump (P-4A & P-4B)	Condenser Crossover Valve (VCC)	Evaporator Crossover Valve (VEC)	Energy Transfer Loop Mode Valve (VGS)	Chiller/ Heater 1	Chiller/ Heater 2	Chiller/ Heater 3	
Heating Only Chiller 1 Lead	ON	MODULATING	OFF	MODULATING	OFF	OPEN VCC-1 & VCC-2	OPEN VEC-1 & VEC-2	TO EVAP LOOP	ON	HEATING	OFF	OFF
Heating Only Chiller 2 Lead	ON	MODULATING	OFF	MODULATING	OFF	OPEN VCC-2	OPEN VEC-2	TO EVAP LOOP	OFF	HEATING	OFF	OFF
Heating Only Chiller 3 Lead	ON	MODULATING	OFF	MODULATING	OFF	VCC-1 & VCC-2 CLOSED	VEC-1 & VEC-2 CLOSED	TO EVAP LOOP	OFF	OFF	ON	HEATING
Heating Only Chiller 1 & 2	ON	MODULATING	OFF	MODULATING	OFF	OPEN VCC-1 & VCC-2	OPEN VEC-1 & VEC-2	TO EVAP LOOP	ON	HEATING	ON	HEATING
Heating Only Chiller 1 & 3	ON	MODULATING	OFF	MODULATING	OFF	OPEN VCC-1 & VCC-2	OPEN VEC-1 & VEC-2	TO EVAP LOOP	ON	HEATING	OFF	HEATING
Heating Only Chiller 2 & 3	ON	MODULATING	OFF	MODULATING	OFF	OPEN VCC-2	OPEN VEC-2	TO EVAP LOOP	OFF	HEATING	ON	HEATING

MIXED COOLING/HEATING TABLE													
Operating Mode	Borefield Pump (P-1A & P-1B) (1)	Chilled Water Loop Pump (P-2A & P-2B) (2)	Heating Water Loop Pump (HWP-1A & -1B)	Energy Transfer Cond Loop Pump (P-3A & P-3B) (2)	Energy Transfer Evap Loop Pump (P-4A & P-4B)	Condenser Crossover Valve (VCC)	Evaporator Crossover Valve (VEC)	Energy Transfer Loop Mode Valve (VGS)	Chiller/ Heater 1	Chiller/ Heater 2	Chiller/ Heater 3		
Heating/Cooling Heating Priority Chiller 1 & 2 Off Chiller 3 Heating	ON	MODULATING	ON	MODULATING	OFF	MODULATING	VCC-1 & VCC-2 CLOSED	VEC-1 & VEC-2 OPEN	TO EVAP LOOP	OFF	OFF	ON	HEATING
Heating/Cooling Heating Priority Chiller 1 Off or Cooling Chiller 2 Off Chiller 3 Heating	ON	MODULATING	ON	MODULATING	OFF	MODULATING	VCC-1 & VCC-2 CLOSED	VEC-1 & VEC-2 CLOSED	TO EVAP LOOP	OFF	OFF	ON	HEATING
Heating/Cooling Heating Priority Chiller 1 & 2 Cooling Chiller 3 Heating	ON	MODULATING	ON	MODULATING	ON	MODULATING	VCC-1 OPEN & VCC-2 CLOSED	VEC-1 OPEN & VEC-2 CLOSED	TO COND LOOP	ON	ON	ON	HEATING
Heating/Cooling Priority Chiller 1 Cooling Chiller 2 Heating Chiller 3 Off	ON	MODULATING	ON	MODULATING	ON	MODULATING	VCC-1 OPEN & VCC-2 CLOSED	VEC-1 OPEN & VEC-2 OPEN	TO EVAP LOOP	ON	ON	OFF	HEATING
Heating/Cooling Priority Chiller 1 Cooling Chiller 2 & Chiller 3 Heating	ON	MODULATING	ON	MODULATING	ON	MODULATING	VCC-1 OPEN & VCC-2 OPEN	VEC-1 OPEN & VEC-2 OPEN	TO EVAP LOOP	ON	ON	ON	HEATING

NOTES:
 (1)- BASED ON DEDICATED SYSTEM SUPPLY TEMPERATURE SENSOR
 (2)- BASED ON DEDICATED SYSTEM DIFFERENTIAL PRESSURE TRANSMITTER SENSOR