CORDOBA SUSTAINABILITY VOCATIONAL SCHOOL

Cordoba, Argentina *University of Cincinnati: Educational Building Division*

Summary

Location: Cordoba, Argentina
Climate Zone: Cfa, Humid Subtropical
4C (US equivalent)
Lot Size: 0.9 Acres
Building Size: 30,000 SF
Occupancy: 250
Construction Cost: $12.7 million
Target Source EUI: 16 kBTU/sqft

Specifications

HVAC:
Hot Water Heat Pump
On Site PV:
Energy Used: 190,564 kwh/yr
Energy Created: 195,904 kwh/yr

R Values:
Walls: 15 ft2·°F·h/BTU
Roof: 2.8 ft2·°F·h/BTU
Foundation: 11 ft2·°F·h/BTU
Windows: 1.5 ft2·°F·h/BTU

Partners

University of CINCINNATI

U.S. DEPARTMENT OF ENERGY SOLAR DECATHLON

Sol design + consulting

Brief

With the decrease in the cost of solar energy and as part of the renewable energy initiatives in Argentina, the city of Cordoba is exploring the expansion of solar energy harvesting as part of its national initiative for electric power generation from renewable sources of energy passed in December 2006. The mission of the Cordoba Sustainability Vocational School (CSVS) is to provide college and career preparation to students that heavily focuses on science, math, and physics. The school will have dedicated labs where students can experiment and learn how to work with and install photovoltaics, solar thermal collection, and kinetic energy strategies such as wind and hydroelectric turbines. The CSVS further expands on their vision to educate the next generation on renewable energy initiatives by opening its doors to the community by having lectures on the principles of alternative energy production, practical instruction on how to install solar harvesting technology in their homes, and plenty of outdoor room to allow for casual gathering for the whole family.

Site

Located in Cordoba, Argentina, the site is within a residential neighborhood that allows the school to engage with the residents in learning about sustainable practices to improve energy efficiency in the community. The site is approximately one acre. It is currently a park with only a few concrete benches, play structures, and a few small trees that makes the demolition process of construction relatively painless. The design will leave about 50% of the site open as a public outdoor space to help alleviate the loss of the park. The weather in Cordoba is very temperate with no dry season and hot summers. Temperatures are highest in January, reaching averages of 74.8 degrees Fahrenheit, with the lowest temperatures reaching averages of 49.6 degrees Fahrenheit in July. Cordoba also experiences consistent hours of sunlight throughout the year. Cordoba's climate zone is labeled as Cfa and the U.S. equivalent of that climate zone is 4C which includes cities in Texas.

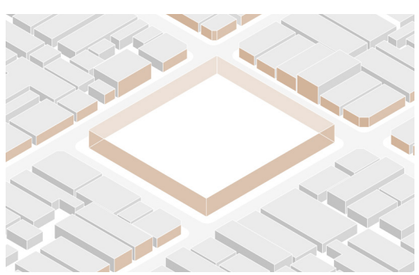
Design

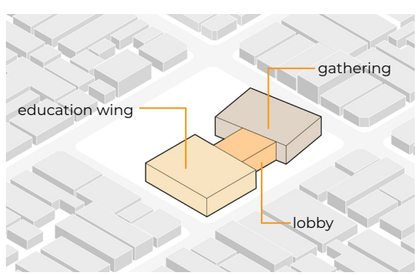
In response to the strong street scale created by the surrounding buildings in the neighborhood, the school is placed tightly against the street edge. The south half of the site is open for a community park and gathering space. The building program is separated into three major areas: an academic wing that houses labs and classrooms, a public wing that accommodates the cafeteria/auditorium space, and an administrative volume that links the two major building masses. Specific design strategies include: siting, orientation and massing driven by energy and environment, natural ventilation, solar collectors on the rooftop, daylighting, optimizing material for a strong structural design, and utilizing outdoor spaces. These design strategies and technologies were combined to produce a building that responds equally to site, program, and the environment.

Map of Argentina

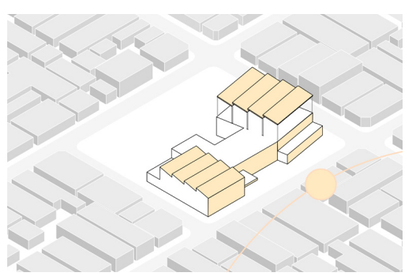

Immediate Site Location


Neighborhood Building


Site



Program


Environment

Project Highlights

Architecture

The CSVS "horseshoe" building footprint is split into three wings along the East-West axis, maximizing daylight and allowing for secure student versus public circulation. A trombe wall on the north facade acts as a thermal mass behind retractable glazing to help maintain low energy usage.

Engineering

The team implemented a complex design to manage passive and active building systems as well as enhancing occupant comfort. For example, the usage of outdoor to indoor spaces increase the air quality while decreasing the cost for additional electrical energy and mechanical ventilation.

Market Analysis

With construction costs estimated to be under $13 million and annual operational costs minimized through the energy strategies, the school will be able to apply their life cycle cost savings to provide technology and education to the community.

Durability & Resilience

Tying to the government's power grid is not allowed; therefore, the school will have on-site battery storage to support electrical usage. Solar thermal collectors on the sawtooth roof will be used to support the hot water loop to allow for a continuous stream of heated water without additional energy usage.

Embodied Environmental Impact

Using locally available and sourced material, there will be significantly less carbon emissions used for construction. The envelope is mainly CMU and brick because they're prevalent materials in Cordoba. All natural materials displaced during the site excavation will be repurposed on the site and the neighboring parks.

Integrated Performance

All engineering and architectural disciplines were combined to implement an active and passive design strategy that's goal together is to provide a comfortable environment and net-zero energy system. The thermal chimney was a passive design to help regulate the internal environment using the external conditions.

Occupant Experience

Large windows, north facing clerestory, and vast outdoor spaces allow the occupants to enjoy fresh air and sunlight throughout the school day which promotes better mental health. The open lab spaces ignite collaboration while the compact classrooms allow students to focus on their lectures.

Comfort & Environmental Quality

Advanced controls are utilized throughout the building. The design features thermal comfort, adequate illuminance levels, acoustic conditions, enhanced use of sunlight, and easy access to fresh air to optimize occupant's experience.

Energy Performance

CSVS's energy use has been estimated to be 16 kBTU/sqft. The building will be designed with high efficiency lights and sensors that will adjust the brightness according to the amount of natural light coming through and also power down when not in use. These choices will result in an estimated 135,000 kwh/year.