U.S. DEPARTMENT OF ENERGY
SOLAR DECATHLON

Building the Next Generation

University of Missouri
Mixed-Use Multifamily Building

CoMO Community Co-op

Project Summary

CoMO Community Co-op is a multi-family housing design for families, professionals and communities wishing to enhance affordable, dynamic living options in Columbia, Missouri. To accomplish our goals of sustainability and to improve the quality of life for the building residents, the design emphasizes harmony between the building and surrounding landscape, humans and energy. Our design includes passive design strategies, low-energy mechanical equipment, and the harvesting of solar energy for use on site; combined with other strategies that encourage comfortable living environments while achieving net-zero energy use. By utilizing a series of urban agricultural gardens, solar arrays, rainwater collection systems, and native vegetation, this habitat provides an opportunity to educate it's residents and neighbors about sustainability and wellness through holistic practices and shared responsibility. Wellness includes, but is not limited to, nutrition, physical activity, mental health, and general physical safety. The high performance, mixed-use building contains a fitness center, shared office space, greenhouse facilities, and a community gathering space with a kitchen that supports shared goals around sustainable living.

Design Strategy

Our team began this design prioritizing efficiency in footprint and orientation, arranging the courtyard-style building on an East-West axis to maximize roof area for PV panels and opportunities for passive design strategies in heating, cooling, and daylighting. Community engagement, wellness, and education is emphasized through the use of the courtyard, urban agricultural opportunities on site and the community center. The courtyard is a safe place for kids to play outside and allows for daylighting into the residential spaces while the agricultural plots, fruit orchard, and water retention basin north of the building connect this community of residents to the surrounding neighborhood. SIPs wall and roof panels along with high efficiency windows create a tight, resilient exterior envelope. The unit footprints and cores are stacked for maximum efficiency of utilities. The use of DIRTT pre-fabricated, adaptable interior wall systems allows for design flexibility and re-purposing after initial configuration. These elements combine to create a environmentally conscious dwelling that is rich with human experience.

Project Data

- Location: Columbia, Missouri
- Climate Zone: 4A (Mixed-Humid)
- Lot Size: 4.72 Acres
- Building Size: 119,000 ft^2; 3 story
- 50 - 3 Bedroom/2 Bath Units
- 18 - 2 Bedroom/2 Bath Units
- Occupancy: maximum 835, < 245 expected residents
- Residential: HERS Rating: 68 w/o PV, -23 w/ PV
- Commercial: EUI Target: Less than 75, target of 70.1 kBtu/sf2/yr
- Estimated Monthly Energy Costs: $38 w/o PV;$0 w/ PV
- Estimated Cost: $14,903,842.34

Technical Specifications

- Walls: R-40, Foundation: R-15, Roof: R-50
- Window Performance: U-value: 0.25; SHGC: 0.22 - 0.32; VT: Infiltration : 0.1 @ 50 MPH (cfm/ft^2)
- HVAC: Ground Source (Geothermal) Heat Pump System, Estimated maximum per unit capacity: 9,000 Btu cooling, 9,800 Btu heating
- SIPs wall & roof construction
- Roof Mount PV: 1009 panels x 330w = 332.97 kWDC: 492,021 kWh annual production
- 100% LED Lighting
- DIRTT interior wall systems
- Rainwater collection systems
- Stormwater mitigation through landscape
- Sustainable transportation support systems
- Recycling & Composting Program

2021 Design Challenge

Project Highlights

Architecture

This design encourages seamless integration with nature and basic human needs; allowing passive ventilation and natural daylighting into the interiors, views to inspiring exterior spaces, common facilities to share food and knowledge. The continuous vertical footprint of units and cores maximize utility efficiency and the flexible interior spaces accommodate future adaptation.

Engineering

Cutting-edge technology works harmoniously throughout this design to balance the use of passive and active systems. Water collection, retention, and recycling is integrated for on-site urban agricultural plots and pollinator pathways.

Market Analysis

This is a community-responsive design that contributes as a model for what sustainability can be. The life-cycle cost of the project will be reduced significantly through zero energy strategies. Annual utility savings - and eventually earnings - supplement the upfront costs. Locally sourced materials and the use of pre-fabricated elements reduce construction costs and schedules. Local companies and community organization partners will benefit from the procurement of construction materials, solar arrays and the positive environmental impact.

Durability and Resilience

On-site energy collection and storage from solar arrays will allow day-to-day operations to continue despite temporary grid outages. Design strategies include strong resistance to disasters like tornadoes, severe storms, and high winds, typical for this location.

Embodied Environmental Impact

Exterior SIPs wall & roof systems limit on-site waste. Pre-fabricated, flexible, and recyclable interior construction systems allow the design to evolve with the needs of the occupants. All materials are sustainably sourced.

Integrated Performance

Building orientation, central courtyard, and roof placement optimize use for passive cooling, thermal mass, and daylighting while also providing ideal conditions for the solar array. Minimizing the on-site building footprint allows for large urban agricultural plots and innovative water systems for collection, retention, and recycling.

Occupant Experience

Community engagement, wellness, and education is emphasized through the use of the courtyard, urban agricultural opportunities on site and flexible spaces in the community center. A co-op allows users to make collective decisions about how the space should be run, which also can enhance the communal setting. Pre-fabricated interior systems offer flexibility with simple, user-friendly services.

Comfort and Environmental Quality

Advanced systems allow monitoring of the building to ensure comfortable and healthy spaces. Low VOC materials, cross-ventilation and daylighting contribute to the interior quality.

Energy Performance

Net zero energy status will require integrative use of passive and active strategies to meet our annual EUI target of 70.1 kBtu/sf^2/yr. Natural daylighting and ventilation, thermal mass and an impeccable exterior envelope complement the vast solar array and the innovative water solutions with urban agricultural production.