Energy Efficient University Building Lawrence, KS, United States

Project Description

The Center for Design Research building, located on the historic Chamney Dairy Farm in Lawrence, Kansas, is a response to the emerging culture and support of sustainability at the University of Kansas. In congruence with the center's mission, which is to provide a location for interdisciplinary work between multiple schools, the building provides a facility that aids in the education of the university and community on sustainable strategies, material innovation and building efficiency.

The design for the building implements sustainable strategies to maximize the potential of existing resources, minimize environmental degradation, create an environment that is safe, comfortable and efficient and provides an iconic representation of sustainability for the University of Kansas. The building provides a space for professional collaboration and community education while displaying a wide range of sustainable strategies. In doing so, it showcases the advances of green building technologies and products, serving as a standard for the future development of the University and Center for Design Research.

Noteworthy features of the 2,000 sf building include: an underground cistern which helps to reduce potable water demands and storm water runoff while also supplying the toilets; a 34 foot long living wall of ferns on the interior which is watered with rainwater collected from the roof; an interactive display in the entrance that reveals the energy performance of the building in real time; a wind turbine coupled with a broad array of rooftop solar collectors tied into a "smart meter" system; the first regional car charging station and a façade of local Kansas limestone. Limestone was used to insulate and clad the building envelope as well as provide a heat sink in the form of a trombe wall located behind the glazed south façade.

The Chamney Farm complex dates back to 1912, and the main house and barn still stand today. To complement the existing stone language of the Chamney Farm complex, more than 100 tons of stone tailings were reclaimed from Kansas quarry sites. By using stone tailings rather than cutting new stone, natural resources are conserved thereby reducing the load on landfills. Small and odd shaped tailings were reclaimed and hand cut into thin stackable pieces used for cladding both interior and exterior walls. To further diminish site waste, all scrap stone pieces from the cladding process were integrated as exposed fill along the north side of the building. The southern façade of the building is a combination of a limestone wall and a customized curtain wall system. Located behind the southern opening, the trombe wall absorbs the sun's energy during the day and radiates the stored energy at night.

The Center for Design Research is a model of sustainability for the campus and community alike. It is expected that The Center for Design Research will be LEED Platinum and the first Commercial Certified Passive building in North America.

Innovative Building Materials and Construction Technologies

KU Research - There is fascinating research going on in basement laboratories and garages all around campus. A goal of this building is to share with the public some of the outstanding ideas the KU faculty are exploring.

Public Outreach - The easily accessible location and high visibility allows for the project to publicly demonstrate the latest technologies throughout the design of the building.

Intelligent Building Orientation - A narrow footprint positioned within the site maximizes passive strategies and takes advantage of a south face.

North Side - In keeping with the Passive Institute's design strategies, there are zero openings on the north side of the building .

Heavy Frame Construction - The skeletal frame is over three times thicker than conventional wall systems. This enables more insulation to be used in the cavities that exist between the frame materials.

Glass and Steel - The widespread use of glass and steel, as in the floor surface and handrails, is because both of these materials are highly recyclable.

Material Responsibility - Accurate records are kept of all the materials and environmentally friendly substitutes are implemented when possible. For example, the concrete contains an average of 20% fly ash, a waste product of coal burning, without compromising structural qualities.

Thermal Mass - Not unlike the heat build up that occurs in a vehicle left in the sun with its windows up, the trombe wall - the interior stone wall - uses this passive strategy to take on and store heat in the winter when the glass is not shaded and radiate the stored energy at night as heat.

Water Reclamation - Rainwater collected from the roof is diverted to an underground cistern and used to irrigate the living wall, helping to reduce potable water demands and storm water runoff. It also supplies the toilets.

Cross Ventilation - Airflow can be manipulated to exhaust warm air out of the building through operable skylights along the north wall of the building. With built-in rain sensors they close automatically.

Reclaimed/Recyclable Materials - Helping to conserve natural resources and reducing the load on landfills, a variety of reclaimed/recycled materials have been incorporated, such as stone tailings. Tailings are the leftover pieces from the stone fabrication process that are ordinarily of no use and are taken to a dump site.

Cut Stone - In an effort to complement the existing stone at the Chamney Farm complex more than 100 tons of stone were cut and reclaimed from Kansas quarry dump sites.

Accounting for Waste - Integral to the LEED process is being responsible for every aspect of the building construction including how much waste was generated. The waste stone from cutting the tailings into the proper shapes was used along the north side for fill. There are multiple layers of stone pieces below the finished surface.

Living Wall - An installation of plants along the building's north wall improves the indoor air quality of the space while utilizing rain-water harvested from the roof top. It contains over 10,000 ferns!

Low V.O.C. Finishes - Helping to improve the indoor air quality of the interior spaces, the entire line of cabinetry and tables are made of glass and aluminum, specified from Valcucine, a global leader in sustainable design.

Real Time Display - Second by second display of energy consumption within the building is provided through a digital dashboard. Users can see the immediate impact they have on the building's energy consumption.

Electric Car Charging Station - One of the first such stations in the region, the charging station allows for community members to plug in their electric cars at this building.

Alternative Transportation - Routes and facilities, such as a bicycle rack and preferred parking for green vehicles, will help to reduce vehicular traffic.

Energy Efficient LED Lighting - Light emitting diodes help to reduce the building's overall power consumption by almost 80%. They are the latest advancement in lighting technologies.

Wind Turbine - Located to the west of the building, this tower will convert wind energy that exists at the site into electricity for distribution.

All Construction Joints are Sealed - All of the joints between materials are caulked, foamed, and covered with tape. Air loss at windows and doors have been kept to a minimum by using good installation practices and purchasing the best performing window/frame combinations. The building was pressurized following construction to confirm its tightness.

Blown Cellulose Insulation - Engineered lumber framing allows for more insulation, resulting in a higher R-value. Cellulose is 75-85% recycled paper fiber produced from newspaper waste. The building is super insulated with values over four times the conventional levels.

Super Insulated Basement - The building used ten inches of solid rigid insulation board; all of the joints between the boards were taped and sealed. This was followed with a ten mil. barrier that wrapped the entire building.

White Roof - Most roofing materials are dark in color but the industry trend, to avoid the heat island effect, is to use a light color to reflect heat in climates where air conditioning in the summer months is necessary.

Green Roof - The sedum roof top plants are functioning as storm water detention; helping to insulate the building and reduce the heat island effect.

Photovoltaic Panels - Capturing light energy (photons) from the sun, these roof top panels will help reduce the building's energy needs almost completely.

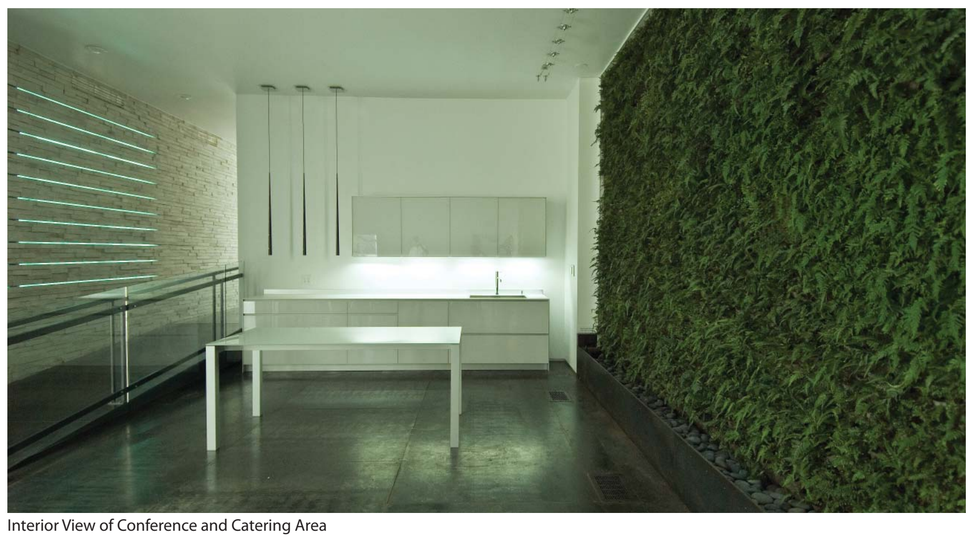
Low Flow Fixtures - All of the fixtures in this building use controlled water quantities and the toilets use water harvested from the roof. The mirror is located away from the lavatory to avoid prolonged water usage at the sink.

Energy Recovery System - The large hoods on the north side are for the ERV's (Energy Recovery Ventilators) and are the backbone of a very sophisticated heating and air conditioning system that provides a constant supply of fresh air into the building.

Smart Metering - With this new metering system the excess energy produced during the day can be credited back for consumption at night when the sun is not shining or the wind blowing.

High Tech Shades - The broad southern facade is made up of electrochromic glass, a smart glass that assists in maintaining thermal comfort by mitigating solar heat gain through automated tinting technology. It lets the sun light in during the winter and keeps it out in the summer.


Exterior view from the Southeast


Interior View of Conference and Catering Area


Exterior View from the Southwest


Exterior View from the Southwest


Exterior View from the East


Exterior View from the West


Interior View of Entry


Interior View of Entry and Mechanical Display


Interior View of Entry and Mechanical Display


Interior View of Trombe Wall Cavity


Exterior View from the South


Exterior View of North Facade at Night