Catalyst

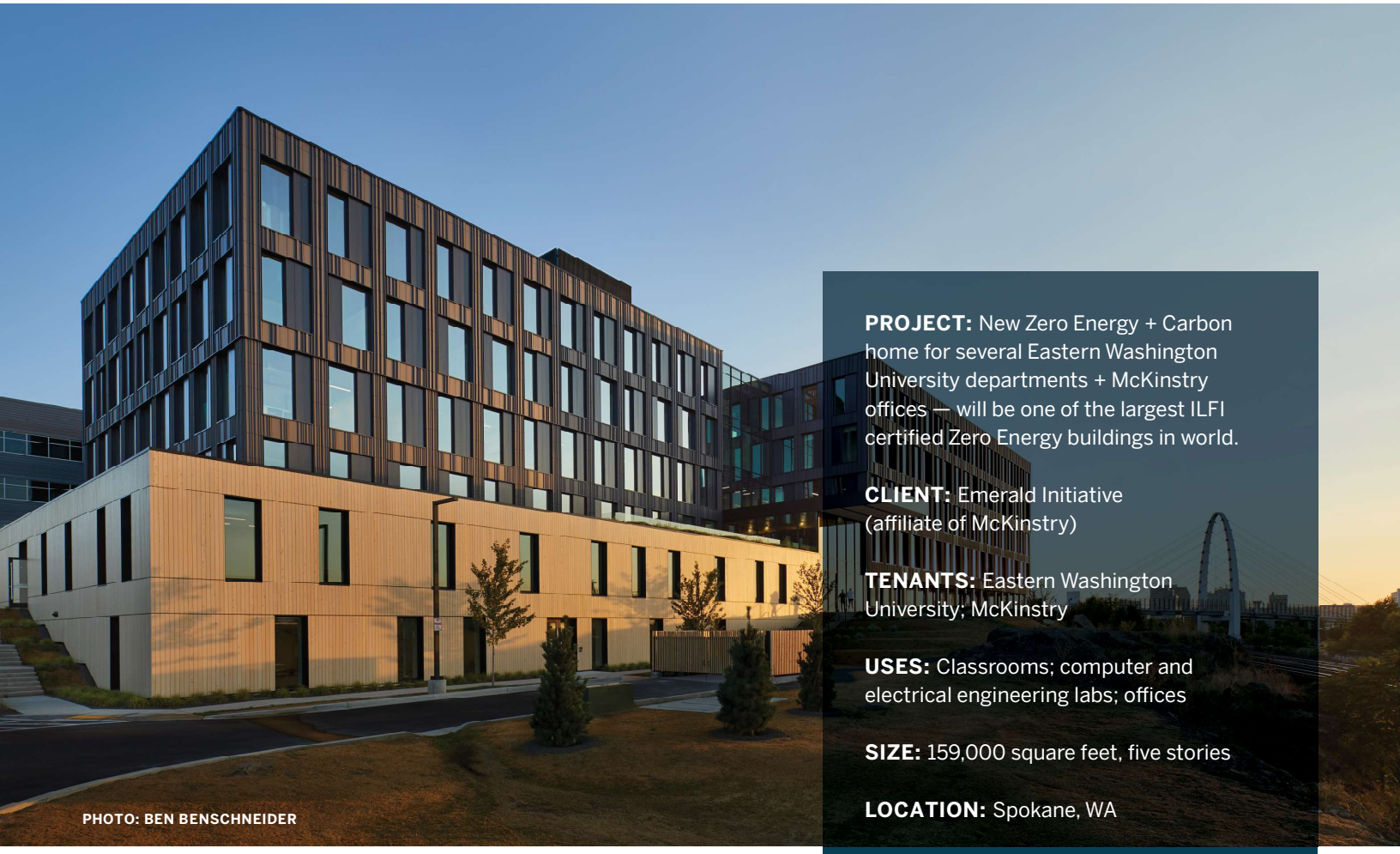


PHOTO: BEN BENSCHNEIDER

PROJECT: New Zero Energy + Carbon home for several Eastern Washington University departments + McKinstry offices — will be one of the largest ILFI certified Zero Energy buildings in world.

CLIENT: Emerald Initiative (affiliate of McKinstry)

TENANTS: Eastern Washington University; McKinstry

USES: Classrooms; computer and electrical engineering labs; offices

SIZE: 159,000 square feet, five stories

LOCATION: Spokane, WA

COMPLETION: 2020

PARTNERS:
Avista
Katerra
Eastern Washington University
Michael Green Architecture
Edo

MCKINSTRY'S ROLE:
- Developer (through Emerald Initiative, McKinstry's development affiliate)
- Complete MEP engineering and construction
- Zero Energy + Carbon design, modeling, and operations
- Daylight modeling
- Commissioning
- Measurement and verification
- Manufacturer (Overcast Innovations Cloud appliance)

CLIMATE SOLUTIONS LEADERSHIP

Developed by McKinstry affiliate, Emerald Initiative, Catalyst signifies a new era of scalability in Zero Energy + Carbon buildings:

- Large scale, non-boutique
- Serving mainstream tenants
- Delivered at no net cost increase
- Substantially lower embodied carbon
- Electric grid beneficial, creating a net positive carbon relationship
- Creating asset value with Zero Energy + Carbon elements

McKinstry believes we are in the midst of a climate crisis, much of which is attributable to building operations and construction, and that radical innovation must be applied to solve it. Similarly, we are in a construction affordability crisis, which limits financial resources generally. A major reason for developing Catalyst is to demonstrate that innovation can drive out waste, and enable climate positive, outstanding buildings which cost on par with typical construction.

ENERGY DISTRICT PLANT,
LOCATED IN ADJACENT MORRIS CENTER

DRIVING OUT WASTE

The development of Catalyst provided a testbed for three key innovations identified by McKinstry for reducing waste in this type of construction:

- Sharing of heating/cooling systems across a campus, enabling thermal waste transfer and economy of scale, substantially increasing efficiency while reducing cost
- Use of timber for structure and decking, instead of heavier steel/concrete construction
- Mass assembly and alignment of disparate interior mechanical, electrical, fire, low voltage, and IT systems

These three major innovations, involved primary building systems, make a better building while enabling Catalyst to achieve its ZE + ZC targets with no net cost increase.

SOUTH LANDING ENERGY DISTRICT

Catalyst is served by the all-electric South Landing heating and cooling plant. This groundbreaking system combines eight different mechanical devices to provide heating and cooling to five buildings, including Catalyst, within the larger South Landing district. Each component plays a particular role, including heat recovery, thermal storage, and peak demand to maximize the efficiency of the total system, at the lowest possible cost — **resulting in a net efficiency that is four times greater than a typical boiler/chiller type heating/cooling system** that would be typically seen in a building such as Catalyst. With this many components, it is very challenging to determine the exact right combination of component sizing and design. The McKinstry engineering team used a proprietary parametric analysis tool to assess of 40,000 different system combinations, identifying which provided the greatest efficiency for the least cost. The district system also includes a thermal storage system, which will enable it to be used as a testbed in partnership with Avista Utilities to investigate minimization on electric grid peak demand. More details of this system can be seen in our separate South Landing Eco-District project profile.

MCKINSTRY ENGINEERING TEAM:

Matt Nielsen, Mechanical engineer of record

Jason Maulin, Mechanical engineering

Michael Beckett, Mechanical engineering

Katie Hills, Mechanical engineering

Paul Highley, Electrical engineer of record

Nick Edney, Senior electrical engineer

Manik Joshi, Electrical and renewable engineering

Caroline Traube, Energy modeling

Ivan Jose, Energy modeling and ZE/ZC certification

Brad Liljequist, ZE/ZC design strategies, management, and certification

WHAT MAKES IT SPECIAL

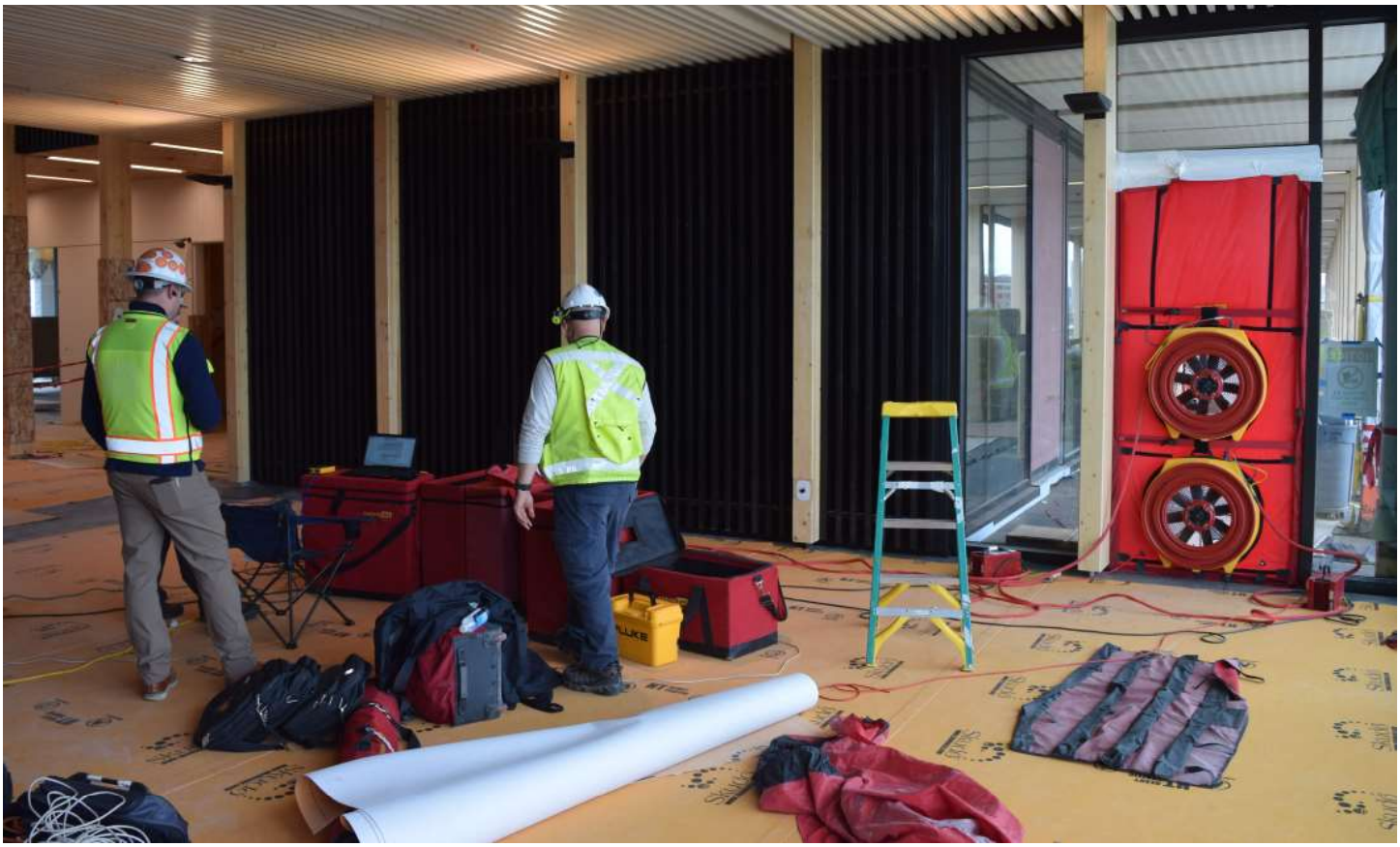
- One of the world's largest ILFI certified Zero Energy buildings; pursuing dual Zero Energy + Zero Carbon certifications
- Zero energy and carbon performance delivered at typical construction cost
- First building in western hemisphere to use ILFI's innovative Zero Energy offsite renewable pathway; 1,100,000 total kwh/year renewables
- Modeled EUI reduced 78% from baseline — 25 kbtu/sf/year
- Heating and cooling provided by all-electric South Landing district system — 4x more efficient than typical system
- Extremely well insulated: R-35/50 walls/R-71 roof, nearly twice that required by code. Triple paned windows.
- Exceeds PHIUS air sealing standard (most stringent in world) by factor of two: achieved 0.035 cfm/sf @ 75 pascals
- Cross laminated timber construction cuts embodied carbon substantially from typical steel and cement construction
- Natural design strategies: deep daylighting (shallow floor plates/window orientation/13.5' floor to ceiling), night flush cooling, east/west orientation to maximize solar thermal benefit/impact
- Extensive tenant energy engagement program, including FF+E specifications and active management

ZERO ENERGY DESIGN

In addition to the deeply innovative South Landing heating/cooling plant, Catalyst itself features an array of innovations to help it achieve its aggressive ZE + ZC EUI target. These include:

- **East/west orientation and shallow floor plates.** Catalyst was intentionally designed with fairly shallow, 90' floor plates, oriented east-west, to maximize solar heating benefit and minimize overheating potential, while enabling deep daylighting.
- **Very high levels of insulation.** Insulation is provided at nearly twice the level required by code, through a combination of rigid mineral wool, metal insulated panels, and polyisocyanurate foam panels. Walls = R-35 - 50, Roof = R-71.
- **High performance, triple paned windows.** Manufactured by Euroline, the fiberglass framed windows provide extremely low U values (U=0.12 center of glass). The U value, solar heat gain coefficient, and visible transmittance are optimized for maximum benefit depending on orientation, balancing solar gain, solar resistance, and daylight needs.
- **Air sealing exceeds Passive House International US standards by factor two.** Catalyst was the tightest building ever tested by RDH, our envelope consultant — 0.035 cfm/sf @ 75 Pascals of pressure. Dedicated focus on air sealing by the Katerra construction team was critical for this success.
- **Highly efficient dedicated outdoor air ventilation system.** Heating and cooling at Catalyst is distributed separately from ventilation, allowing a more efficient system overall. Ventilation air is run through a heat recovery ventilator, which tempers outside air with inside exhaust air at 80% efficiency. The system includes an HRV bypass damper to reduce system static pressure when the outdoor air temperatures match those desired inside.
- **Night-time outside air cooling.** Spokane has an ideal diurnal temperature range for summertime night cooling. The ventilation system brings cool nighttime air into the building. The superior envelope retains this temperature well into the day, reducing mechanical cooling demand.
- **Deep daylighting and views.** Supported by the better daylight opportunity created by the shallow floor plates, floor to ceiling windows were also placed to maximize daylight penetration, and diversify reflected light. In areas where enclosed offices were required, wall height was limited, and Overcast Clouds (see below) located to function similar to a light shelf, reflecting light into the interior.
- **LED lighting and vacancy controls.** Variable output LED lighting and outlets are controlled throughout the building with vacancy sensors integrated into the Overcast Clouds.

CATALYST EXCEEDED THE UBER-STRINGENT PHIUS AIR SEALING STANDARD BY A FACTOR OF TWO.



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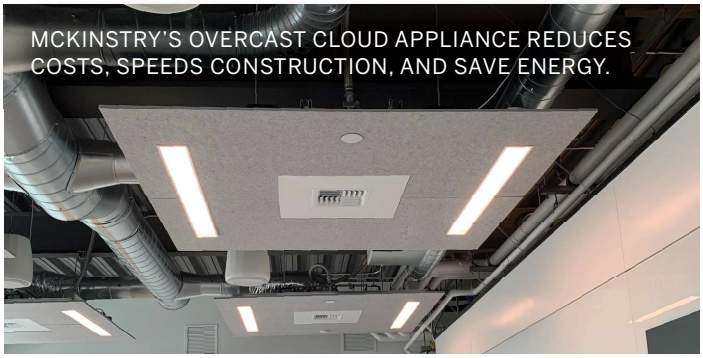
LOW CARBON AND GORGEOUS

REDUCING CARBON IN CONSTRUCTION

Buildings generate carbon through their operations (either directly through combustion of natural gas, or through use of electricity generated from combustion based sources), and during the act of construction (known as "embodied carbon"). As buildings become more and more efficient, the share of total carbon attributable to construction increases. The majority of embodied carbon in buildings comes from steel, and in particular cement, used in the structure of the building. However, there has been a recent renaissance in the use of timber and wood in construction — known as "mass timber". Wood has a substantially lower carbon footprint than steel and cement. Modern innovations in timbers fasteners, and better understanding of slow burn/failure rates of heavy timber, allows wood to be used in many types of construction and still provide safety, meeting up-to-date fire codes. Catalyst uses timber post and beams for the primary structure, and cross-laminated timber floors and walls, eliminating major use of steel and concrete in the building. McKinstry engineers carefully coordinated HVAC and electrical trunks with beam locations through use of regular crenellations along beam tops, below the floor above.

MULTI-SERVICE HUB – THE OVERCAST CLOUD APPLIANCE

Seeking synergies in reducing cost and achieving zero energy + carbon, McKinstry engineers and designers created a whole new building component, the patent pending Overcast Cloud. The Cloud pulls together a number of elements — heating and cooling point of use distribution, LED lighting, vacancy and IT sensors, acoustic attenuation, wifi, and other systems in one integrated unit. Overcast Clouds are manufactured on an assembly line, reducing cost and speeding install through plug and play connections. Reduced cost enables more typically expensive efficient components such as active chilled beams, which are utilized at Catalyst.



MCKINSTRY'S OVERCAST CLOUD APPLIANCE REDUCES COSTS, SPEEDS CONSTRUCTION, AND SAVE ENERGY.

ZERO ENERGY = BETTER ASSET

The best Zero Energy + Carbon buildings intentionally use their high-performance elements to provide a better building. Catalyst is an excellent example of this:

- Cross-laminated timber is low carbon and also quite beautiful, biophilic and warm
- Thoughtful daylighting improves views out of the building
- Air sealing substantially improves the durability of the building, providing a much higher degree of envelope weather resistive barrier quality control/inspection, and limiting condensing moisture.
- The outstanding envelope and daylighting means that the building remains functional without power. Physically, due to solar gain, the building cannot drop below temperatures in the 50 degrees F, even with very cold outside air. A small amount of battery backup enables operations of core systems.

ZERO ENERGY OPERATIONS

Given the building's extreme system efficiencies, the largest single load at Catalyst will be plug-in equipment (i.e., plug, or occupant loads). Through McKinstry's Edo subsidiary, we have created an active management program which starts with a detailed equipment review and study, to understand all tenant provided equipment, and help create suggested equipment purchases where higher performance and efficiency is available. Each device's energy use is understood and means of control identified.

RENEWABLES AT SCALE

To achieve Zero Energy + Zero Carbon performance, solar arrays are being designed and installed by McKinstry Renewables. A very dense 213 kw array is being installed on Catalyst itself, but consistent with the ILFI offsite renewables pathway, the balance of required renewables are being located on underused rooftops at other McKinstry locations, including the SIERR building and new Spokane shop. In all, the renewable power system will generate 1,100,000 kwh/year, sufficient to fully offset Catalyst's energy use.

DUAL ILFI ZERO ENERGY + ZERO CARBON CERTIFICATIONS

Catalyst is pursuing both the ILFI Zero Energy and Zero Carbon certifications. These certifications are based on 12 months of actual Zero Energy and Zero Carbon performance, thus will occur in the future.

PHOTO: BEN BENSCHNEIDER