

Location
Rocky Mountain Institute
Innovation Center
22830 Two Rivers Road
Basalt, CO 81621

Size: 15,610 sf

About Rocky Mountain Institute

Rocky Mountain Institute (RMI)—an independent nonprofit founded in 1982—transforms global energy use to create a clean, prosperous, and secure low-carbon future. It engages businesses, communities, institutions, and entrepreneurs to accelerate the adoption of market-based solutions that cost-effectively shift from fossil fuels to efficiency and renewables. In 2014, RMI merged with Carbon War Room (CWR), whose business-led market interventions advance a low-carbon economy. The combined organization has offices in Basalt and Boulder, Colorado; New York City; Washington, D.C.; and Beijing.

RMI.org



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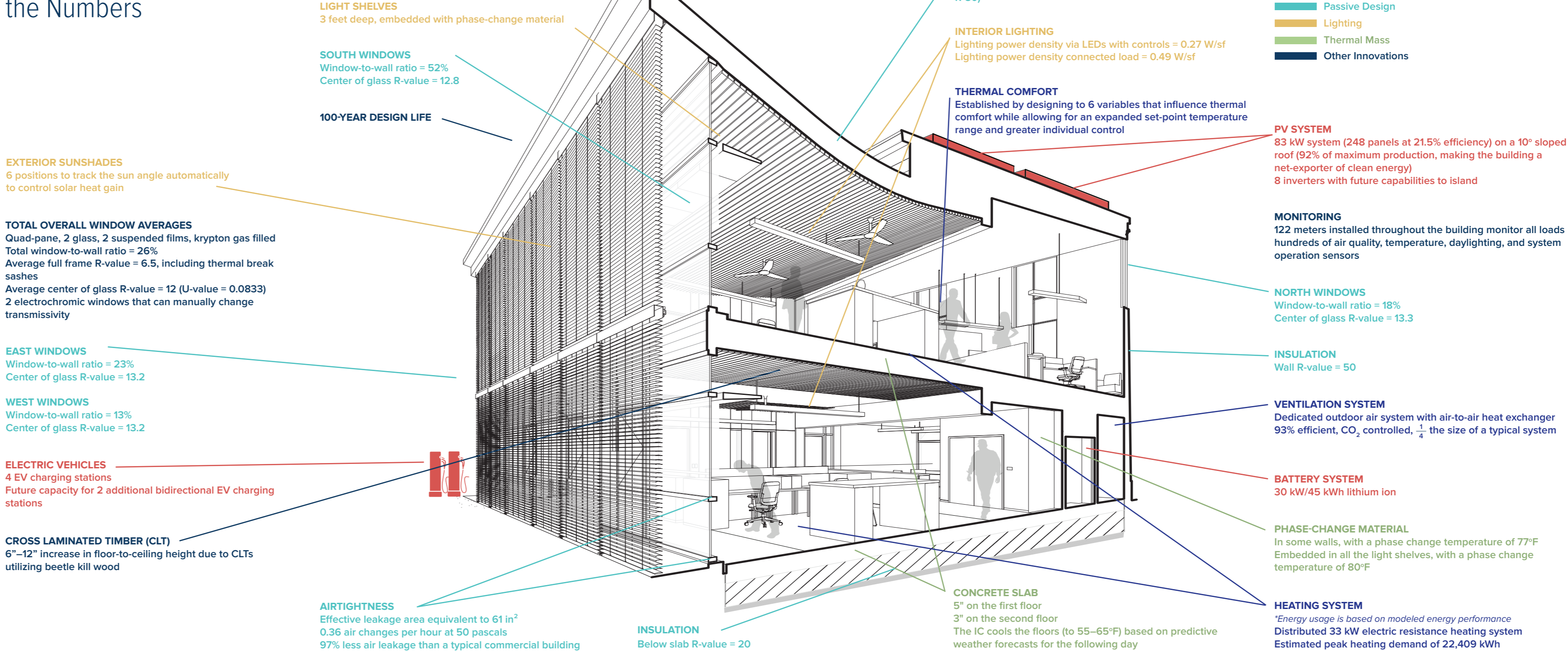
Overall Performance and Highlights

- 17.2** Expected energy use intensity (EUI) thanks to passive integrative design
- 74%** more efficient than the average office building in this climate (according to Energy Star)
- 1 of only 200** Net-zero commercial buildings in the U.S. as of 2016
- Net+** Produces more renewable energy than it uses in a year plus enough to power 6 electric vehicles
- #1 Zone 7** The most energy-efficient building in the coldest climate zone in North America. Top 20 most efficient buildings in the country as of 2016
- 6 factors** defined our breakthrough thermal comfort strategy
- 100 year life** Designed for a 100-year life
- IPD** Used integrated project delivery (IPD)

Honors and Certifications

- LEED Platinum (NC v2009)
- Passive House Institute Certified
- PHIUS+ Source Net Zero project
- Exceeds Architecture 2030 Challenge goals
- Anticipating ILFI Net Zero Energy Building Certification
- Anticipating Living Building Challenge Petal Recognition
- Anticipating Energy Star target score of 100

Innovation Center by the Numbers



Rocky Mountain Institute Innovation Center



All photos by Tim Griffith unless otherwise noted.

Welcome to RMI’s Innovation Center

Designed first as a comfortable workplace, it is also a “living lab” that shows the process and performance behind one of the nation’s most-efficient buildings.

Why? If we’re going to protect the Earth’s climate, we need to start by slashing the energy needed to power our buildings—which currently use nearly three-fourths of America’s electricity—and then power those buildings with cleaner sources of energy. The Innovation Center shows how.

This building achieves net-zero energy, generating more energy than it needs, allowing it to also power six electric vehicles. As of 2015, fewer than 200 commercial buildings in the U.S. had earned this distinction. In fact, the Innovation Center is one of the top 20 most energy-efficient buildings in the country and uses 74% less energy than the average building in this climate.

The building’s modest additional upfront cost to achieve net-zero energy (10.8%) will pay for itself through energy savings in less than four years. This level of performance is achieved thanks to integrative, passive design. A committed team used “integrated project delivery”—a contract model that promotes collaboration, shared goals, and an innovative risk/reward system to make it all possible.

Passive Design

The Innovation Center achieves net-zero energy through whole-system design. We started by considering what occupants need from the building—a comfortable, pleasing, and productive space. Then we designed the best way to fulfill that need most efficiently, while emitting far less carbon.

Passive Design Features

1. Aggressively insulate from the elements
2. Capture solar heat gain in winter
3. Shade from solar gain in summer
4. Provide natural ventilation
5. Reduce temperature swings using thermal mass
6. Use daylight as the primary light source
7. Seal all gaps for airtightness
8. Maximize electricity generation from rooftop solar PV
9. Maximize views of surrounding nature

Daylighting

Daylighting is an important passive design feature that helps achieve net-zero energy by replacing most of our electric lighting needs.

The Innovation Center’s window-to-wall ratio, roof design, and southern orientation allow the building to be entirely daylight, reducing the need for energy-intensive internal lighting. Daylighting also increases productivity and reduces stress. Lights are automatically adjusted according to how much natural light is present.



In addition to providing daylight and views, these windows also help maintain a comfortable temperature. In particular, the windows on the south have been optimized to let in more light and heat than the windows on the north, which insulate more effectively.



Along the south façade, three-foot-deep interior light shelves redirect daylight and minimize glare, reducing interior lighting needs. The high, curved ceilings help distribute the light more evenly from south to north.



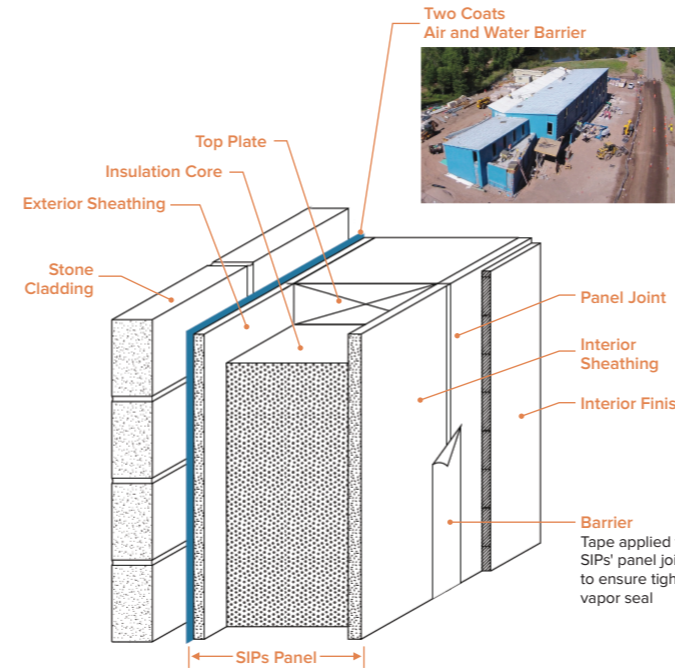
Heat gain is controlled and maintained with automated exterior sunshades. Manually operated interior blinds are installed both above and below the light shelf.

Airtightness

Airtightness is a crucial passive design feature for improving energy efficiency because airtight buildings require significantly less heating and cooling.

The Innovation Center is one of the most airtight office buildings measured in the U.S. It has an effective air leakage area equivalent to the size of a basketball, which makes the office 97% more airtight than a conventional commercial building. Advanced materials combined with carefully constructed wall and roof details avoid leakage, making the building’s remarkable airtightness possible.

The building’s quad-pane windows combine two panes of glass with two film layers. The gaps are filled with krypton gas, which insulates twice as well as air. The frames have large thermal breaks. Special attention was paid to sealing the construction details between the windows and the wall assembly of structural insulating panels (SIPs).

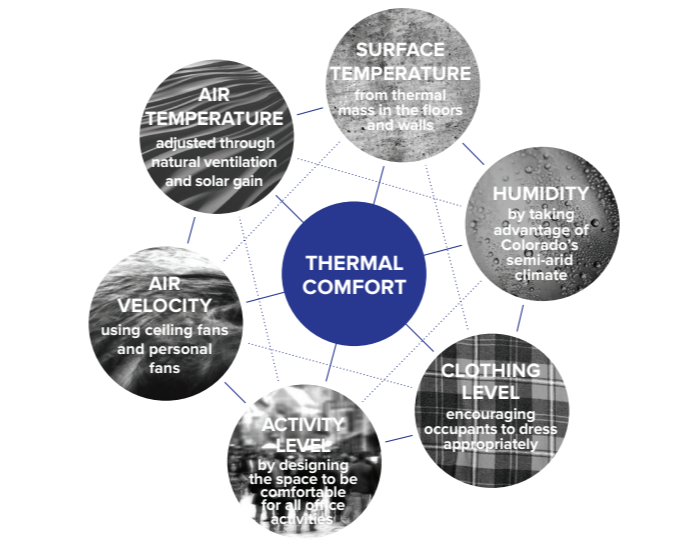


Innovative Thermal Comfort

The building redefines how occupants experience and control their individual comfort. Integrative design eliminated mechanical cooling and reduced the heating system to a small, distributed electric-resistance system.

The only mechanical systems are for ventilation and localized backup heating—through passive design, the mechanical heating load is reduced to the equivalent energy used in one mid-sized home in this climate zone.

Most buildings rely on blowing hot or cold air using large central HVAC (heating, ventilation, and air conditioning) systems to maintain a set temperature, which often wastes energy and is not that tuned to how comfortable a person feels. In contrast, the Innovation Center addresses all six factors that determine individual comfort, requiring dramatically less energy.

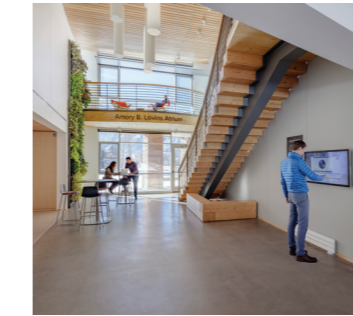


These strategies reduced the size of the mechanical room by reducing the size of the heating system and eliminating any cooling system.

Thermal Mass

Thermal mass—materials that can absorb and later release a large amount of heat—allows the building to store the sun’s heat over time without overheating during the day.

Thermal mass is critical to both passive heating and cooling because it stabilizes interior temperature despite significant daily and seasonal outdoor temperature swings, saving energy.



Thermal mass also allows the building to absorb excess heat generated from internal sources such as computers, lights, and people. In fact, because this building is so efficient in its use of heat sources, the thermal mass, which is designed to keep occupants comfortable by helping to regulate interior temperatures, partially relies on the heat those occupants generate!



As in many conventional buildings, the concrete floors throughout the Innovation Center serve as thermal mass. What you can’t see is that the Innovation Center has added, unique thermal mass in the form of phase-change material hidden in the light shelves and walls.



This phase-change material is a vegetable-based wax. During warm afternoons, it absorbs excess heat by turning into a liquid. During summer nights, it releases the stored heat into the cool air and solidifies.

Cooling & Air Quality

Many of the same design elements that keep the Innovation Center warm in the winter also keep it cool in summer: passive design elements and advanced materials. With more than triple the code-required levels of insulation, the building’s interior is shielded from hot summer temperatures.

Opening low-south and high-north windows with automated controls creates cooling air currents. During particularly hot days, an automated night flush brings in Colorado’s cool night air to cool the mass.

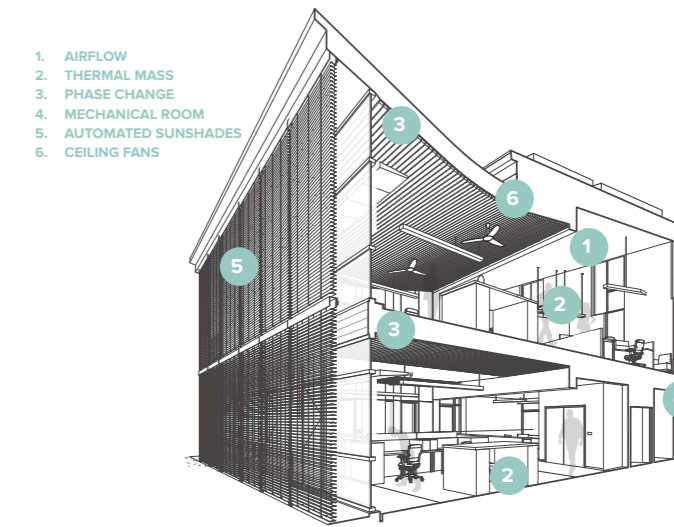
Concrete floors serve as thermal mass that reduces interior temperature swings by storing excess heat that is absorbed throughout the day and releasing it at night.

Phase-change materials behind the drywall and in the light shelves are a more active form of thermal mass, changing states between liquid and solid as temperatures change. When interior temperatures exceed 77 degrees, this material melts and absorbs thermal energy without increasing temperature.

Air-to-air heat exchangers maintain indoor air quality and temperature by passively transferring 93% of warmth or coolth from the outgoing air to the incoming air. These devices are controlled by carbon dioxide levels measured in the air to provide the appropriate amount of ventilation air.

Exterior automated sunshades on the south wall accept heat gain in the winter and block the sun’s heat in the summer.

Large, energy-efficient ceiling fans along with personal and wall fans keep occupants cooler through the convective heat transfer induced by moving air.



On-Site Renewable Energy

A rooftop solar photovoltaic (PV) system produces on-site renewable energy. Thanks to the Innovation Center’s integrated, energy-efficient design, the PV system provides more than 100% of the building’s energy needs right here on the roof.



This 83 kW solar PV system covers the roof and generates enough clean electricity to power the entire building plus six electric vehicles. The panels are an industry-leading 21.5% efficient in converting the sun’s energy to electricity.

A 30 kW/45 kWh lithium-ion battery storage system—located in the mechanical room—reduces the building’s peak energy demand, stores renewable energy to power the building during cloudy days or nighttime, and reduces RMI’s demands for grid-provided fossil fuel-based electricity.

That’s enough battery capacity to charge:

