

Moving Toward a Net-Zero Energy Future: the Research Support Facility

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Approximately 40% of the energy consumed today in the United States comes from building construction. But the real estate industry is determined to lower that number by adopting and implementing ever more sustainable designs, building materials and construction techniques.

Established in 2000, the U.S. Green Building Council's (USGBC) Leadership in Energy and Environmental Design (LEED) rating program provides building owners and operators with a structure for recognizing and employing practical standards for green design, construction, operations and maintenance. In August 2011, the USGBC celebrated the certification of its 10,000th commercial building, marking significant progress in the quest for a more sustainable tomorrow. However, the next definitive step toward decreasing energy consumption goes beyond LEED certification in pursuit of a net-zero energy future.

A net-zero energy building produces as much energy or more than it uses. However, simply adding PV to an inefficient building and labeling it net-zero does not address national and international energy concerns. A game-changing net-zero structure is one in which the building's design creates ultra-efficiencies that reduce energy needs to a minimal before applying renewable energy.

The U.S. Department of Energy's Research Support Facility (RSF) at the National Renewable Energy Laboratory (NREL) in Golden, Colorado, is on-track to achieve a net-zero energy designation because it is designed to be one of the most energy efficient buildings in the United States. With a goal of 35 KBTU/square foot per year, the RSF consumes approximately 33% of the energy used by a typical office building of similar occupancy. The Facility accomplishes this low energy use through a uniquely collaborative combination of passive and active strategies. Simple, direct architectural solutions create efficiencies throughout the building's 222,000 gross square feet. A 60-foot floor bay width, coupled with stationary parabolic mirrored shades, low desk partitions and appropriate site orientation greatly increase the introduction of natural daylight deep into open office areas. This significantly reduces the need for energy-intensive artificial lighting.

Operable windows and an under-floor air distribution system work in concert with overhead radiant heated ceiling-slabs to provide optimal comfort for occupants with minimal energy use. The NREL-developed transpired solar collector on the south face of the building introduces air heated by the sun into the building's labyrinth, a thermal mass storage device that is used to pre-heat air for the building in winter. The Research Support Facility has both operable and automatic windows to encourage cross-ventilations, introduce fresh air and decrease the energy used in unnecessarily conditioning indoor air during mild spring and fall months. At night, the automatic windows flush warm air that has accumulated during the day and

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introduce into the building the cool, night air intrinsic to Colorado. This can be accomplished because of the optimally insulated, high mass structural material that is the building's envelope.

The RSF's roof is optimally sloped to accommodate the installation of photovoltaic (PV) panels. These panels, coupled with the PV on the adjoining parking lot and an adjacent 1800 car garage, are expected to produce more energy than used by the building and a third wing now under construction. In fact, the design of the 138,000-gross-square-foot expansion, scheduled for completion later this year, builds upon the lessons learned from the original project. It is currently projected to be 11% more energy efficient at a lower cost per square foot than its acclaimed predecessor.

The Research Support Facility was delivered through the U.S. Department of Energy's newly minted performance-based design-build process which required that all disciplines work together to contribute to the sustainable solution. A national competition charged teams with providing the greatest value and the highest level of sustainability for a firm-fixed price of \$64 million, including design, construction and finishes.

Completed in June 2010, the RSF has been certified LEED Platinum by the U.S. Green Building Council, achieving all 59 targeted points. In 2011, the project was named a Top Ten Project by the American Institute of Architect's Committee on the Environment (COTE). The Research Support Facility's design is a simple, honest and elegant solution to reaching net-zero energy and a significant milestone on the road to a net-zero energy future.