

Campus showcases high-performance buildings

EurekaAlert!

Researchers at the Energy Department's National Renewable Energy Laboratory (NREL) are transforming the way the world uses energy—and those transformations become apparent the moment one sets foot on the NREL campus in Golden, Colorado. Here, research teams have applied their expertise to develop office and laboratory spaces that also serve as demonstrations for how high-performance, sustainable buildings and campuses should be designed, constructed, and operated.

The recent construction on the NREL campus was a significant undertaking, in which integrated project teams from a wide variety of disciplines—construction managers, sustainability professionals, and building research engineers, to name a few—focused on the design and construction of innovative facilities that would meet the needs of a growing laboratory while also meeting ambitious energy performance requirements.

"Energy has not been a foremost consideration on similar projects. They look at scope, schedule, and budget; then when the design is done, they determine how much power they need," said NREL Deputy Director for SITE Operations Drew Detamore, who led the campus development efforts. "Here, we added energy to the decision-making process from the beginning. Every decision that was made along the way took into consideration the impacts it would have on the energy model for the building."

In order to ensure that energy performance goals could be met, NREL developed a unique performance-based design-build approach to partner with design, engineering, and construction industry leaders on the projects. The design-build approach incorporated rigorous project controls and methodologies to provide NREL with facilities that featured best-in-class energy efficiency and sustainability practices.

"The design-build approach with our project partners was critical to the process," Detamore said. "We came into it focused on what we wanted projects to do over what we wanted them to be, and the design-build approach allowed that line of thinking to work effectively. You have to place a priority on performance over design, and then you can do what we've done at NREL. You must have strong project-management people involved who understand the process and are willing to let go of the design. As a result, we have buildings that meet all of our performance goals, are well designed, and happen to be very attractive."

Showcasing the Right Way to Build Buildings

The Energy Systems Integration Facility is the newest laboratory facility on the NREL campus and the only one in the nation focused on utility-scale clean energy grid integration. The facility was recently designated as a LEED® Platinum building.

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Developing a high-performance, sustainable campus at NREL to serve as a highly productive environment that would support the mission of the laboratory was important. NREL also wants its campus and buildings to serve as a model for how commercial buildings and campuses should be built and to be a tool to help show others how.

"Our goal is to provide leadership to both the public and private sectors to show that this can be done, it is being done, and here's how you do it," NREL Senior Energy Efficiency Research Engineer Shanti Pless said. "We've made these buildings as efficient as possible and have learned a lot along the way. We want to share those lessons learned and best practices with the buildings industry to facilitate the movement of this type of design and construction into the mainstream."

All design and construction on the NREL campus used strategies and materials that are available to anyone. All products used are off-the-shelf and could be accessed for any building. Implementation of similar design-build techniques could be done on any project anywhere. The most important piece of the puzzle is to apply good technologies, along with a solid planning and design process, and integrate them effectively to work well together.

"These buildings are highly replicable," Pless said. "A project developer can take what we've done here and apply it in the marketplace. It performs as promised, is cost effective, maintainable, and marketable. These results combine to make energy-efficient buildings very approachable in any environment."

To facilitate the continued growth of energy-efficient and zero-energy building projects everywhere, NREL regularly hosts visits to its campus by project developers, architects, builders, and other commercial building industry professionals. These visits give NREL an opportunity to show firsthand what these buildings can do, how they perform, and how they can be replicated.

"When we show this to people they can quickly begin to visualize how they can replicate it, and by doing that we are having a meaningful impact on the commercial buildings industry," Pless said. "Proving it can be done is an important step. It is one thing to say you can do it, another entirely to prove it and demonstrate it. Here at NREL we've done just that."

A Living Laboratory

NREL campus electricity activity can be viewed using the "NREL Energy Story" tool, a real-time visualization of the energy production and consumption on the NREL campus. The green dots represent energy production and the orange dots represent energy consumption. It allows for big-picture analysis of the entire NREL campus as well as detailed analysis for specific areas such as lighting or plug load within a section of a building.

The campus also provides NREL research staff with opportunities to validate their research in a real-world environment with occupied, operational buildings in an

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effort to quantify and maximize building performance.

Researchers in NREL's Commercial Buildings research program have installed meters in all new buildings and are collecting a massive amount of performance data. They are now developing tools that can put this data into action to the benefit of building developers and operators everywhere.

"We are trying to align building decision makers with the data that we are collecting," Pless said. "By creating useful tools to help them take advantage of building data, we are providing them with the critical information that they need to make good decisions that will further enhance building performance and occupant comfort."

NREL has developed a new tool called the "NREL Energy Story" that serves the dual purpose of telling the story of NREL's sustainable campus to the public as well as serving as a management tool that allows NREL engineers to analyze campus energy performance in real time and identify problems quickly.

"We've essentially created an energy management tool for our campus with an education component layered into it," said NREL Strategic Energy Analysis Center Principal Project Lead Mark Ruth. "It allows us to improve our story at the same time we are telling our story. It's a one-of-a-kind tool that provides great benefit both internally and externally."

The tool is a real-time visualization of energy production and consumption on the NREL campus. It includes modules for electricity, heating and cooling, and fuels. It provides a big-picture view of the entire campus, as well as detailed analysis of specific areas such as lighting or plug loads within a section of a building. For the public, it compares NREL's campus energy use to that of a typical campus that lacks the type of high-performance buildings found at NREL. It also includes a series of infographics that can show users what the potential impacts and cost savings of energy efficiency applications could be for the nation, or for a home.

"This tool helps the public understand the impact of their energy choices, which will hopefully guide their decision making in the future to use energy more wisely," Ruth said. "We strive to be a 'living laboratory' here at NREL, and this tool helps to bring this to life in a way that everyone can understand. It clearly demonstrates how the lab improves its own energy use and the potential benefits others can realize if they to implement these strategies in their homes or communities."

NREL Leads with Six LEED® Platinum Buildings

People sit at rows of tables having lunch inside the NREL Café. In the rear of the photo one man stands while holding a plate of food, speaking to two seated men. Behind him is a wall of windows that allow those inside the building to see the building adjacent. [Enlarge image](#)

NREL employees enjoy lunch in the NREL Café. The Café is designed with recycled materials and utilizes available light to create a comfortable space for NREL

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employees. The facility also was recently designated a LEED® Platinum building.

Recently, at a dedication ceremony held on the NREL campus, the U.S. Green Building Council (USGBC) recognized NREL's efforts with Leadership in Energy & Environmental Design (LEED®) Platinum certification for three of its newest campus facilities, including the recently opened Energy Systems Integration Facility (ESIF).

The USGBC's LEED® program is a green building certification that recognizes best-in-class building strategies and practices. Building projects must satisfy prerequisites and earn points to achieve different levels of certification. A Platinum certification is the highest level in the program.

In addition to the ESIF, the USGBC also recognized NREL's new Café and South Site Entrance Building for achieving Platinum status. With these new certifications, NREL can now lay claim to six LEED® Platinum certified buildings on its Golden campus, including the award-winning Research Support Facility, which was recently verified to have performed for a full year as a net-zero energy building.

"We are extremely proud of the campus we have designed and built here at NREL and the recognition that we have received for our efforts," said NREL Deputy Director and Chief Operating Officer Ken Powers. "This campus will provide our world-class research staff with the resources and facilities they need to support our clean energy mission, as well as serve as an example of how these technologies and strategies can be effectively applied." **Sustainability as a Core Value**

NREL is a recognized leader in sustainability, with practices that are incorporated into the mission and fully integrated into all facets of the operation of the laboratory. When planning the design of the NREL campus, it went without saying that sustainability would be a key consideration.

Sustainability professionals were part of all integrated project teams throughout the process, and efforts to make the NREL campus as sustainable as possible guided every decision. The use of sustainable building products, technologies, and practices helped to garner the points necessary to achieve the LEED® Platinum certification for all new buildings.

"We underwent a lot of growth in a short period of time, and all of the people involved in making that happen adopted the mission and value system of the laboratory in regards to sustainability throughout the process and never lost focus on it," NREL Sustainability Program Director Frank Rukavina said. "It makes our job, as sustainability professionals, a lot easier when everyone involved understands the priority and is on board from the beginning to make these building projects as sustainable as possible."

Examples of sustainability practices incorporated into the new buildings are numerous. For the newly Platinum certified buildings, these include comprehensive recycling and composting programs, native and xeriscape vegetation, locally sourced food for the new cafeteria, water conservation efforts for the commercial kitchen in the new cafeteria, storm water recycling strategies, and building

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materials made of recycled materials.

"Everyone looks to NREL to be a leader on these issues now and in the future. We have a responsibility within our basic mission to set the best possible example and to be a model for what a campus could be and should be," Rukavina said. "We've excelled because we've committed to it and we've created a campus that showcases our mission and our values as an organization. We have a population here at NREL that takes energy efficiency and sustainability personally and seriously. This drives us to continued excellence and challenges us to always be as sustainable as we possibly can."

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