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ENERGY STAR®

New Building Design Case Study

RAFI Office Building, North Carolina, USA

The Rural Advancement Foundation International-USA (RAFI-USA) is a private, non-profit organization located in Pittsboro, North Carolina. RAFI-USA promotes sustainability, equity, and diversity in agriculture through policy changes, practical assistance, market opportunities, and access to financial and technical resources. In 1997, the Foundation's members needed a new building to house its staff offices, rental offices for like-minded non-profits, and space for a conference center. They wanted a building that would embrace their commitment to sustainability and preserving the natural environment.

Project architect Alicia Ravetto envisioned a sustainable building design, and she worked with the building owner to reduce the environmental impact of the new structure. Their strategies included maximizing energy performance to reduce greenhouse gas emissions, managing water consumption required for staff use and landscaping, using finishes and materials low in volatile organic compounds to improve the indoor air environment, and recycling materials from the existing building to minimize landfill debris during construction. The resulting energy-efficient "green" building provides a pleasant and productive working environment for employees.

Teamwork from the Start

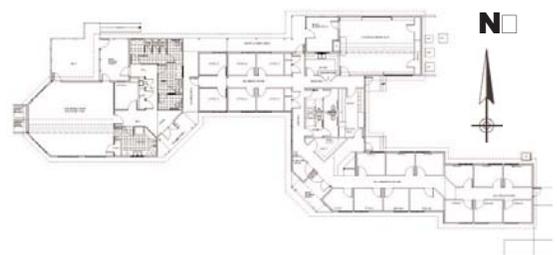
A full-day design charrette (brainstorming meeting) was conducted at RAFI's site in downtown Pittsboro. Participants included architects, engineers, RAFI staff and board members, municipal officials, and community leaders. They did a walk-through of the 2.8-acre site to analyze land features, and toured the 1830 two-story building to evaluate options for reusing the aged structure. Afterwards, they gathered under massive old oak trees and produced a list of priorities that later became part of the building program.



Dan Pollitt Conference Center — Southwest view. Effective building shape, location, and orientation optimize energy efficiency with increased daylighting and passive solar opportunities.

Materials, Land Use, and Natural Light

The design team focused on the re-use of materials and the building's siting and orientation to fulfill RAFI's commitment to sustainability. The existing structure was carefully deconstructed and all re-usable materials were incorporated in the new one. To minimize site impact, the architect located the new building on the existing footprint and preserved mature hardwood trees. Driveway and parking areas were designed to minimize storm water runoff by using gravel instead of impervious surfaces. The new one-story design was elongated on the east-west axis to maximize natural lighting in the offices and meeting rooms. All offices were designed to face south and be supplemented by ambient indirect and task lighting.



“Setting an energy use target at the outset, simulating energy use during design and construction, and tweaking designs as necessary kept the RAFI building on track to achieve its energy performance goal.”

— Alicia Ravetto, AIA

Target Finder—Your Tool for Setting an Energy Use Target

Use Target Finder during:

- design to set an energy use goal
- schematic design to regularly evaluate the effectiveness of energy efficiency strategies.

EPA's Target Finder, a software tool available on the ENERGY STAR Web site, assigns an energy performance score (1 to 100) to your design energy consumption and the target, making it easy to compare the two. The scoring system helps designers see how their design energy ranks on the scale from best to worst performing buildings. Target Finder's energy use intensity is derived from actual energy consumption data.

Energy Efficiency Leads to Energy Performance

Alicia Ravetto incorporated energy efficiency strategies that would achieve the performance goal established for the RAFI project. She set an energy use target early in the design, which helped her focus the discussions with engineers. They used the target as a guide to determine lighting power density and to select an HVAC system that would meet the needs of the building and not be oversized. Ms. Ravetto used Energy 10, an energy simulation software program, to model the building's consumption and evaluate various energy efficiency measures. As changes were made that affected energy use, the design team monitored the process to ensure that RAFI's goal was achieved.

The most effective energy strategies were daylighting, passive solar, energy-efficient lighting, natural cross ventilation, R-19 insulation in the walls and R-30 insulation in the ceiling, and a high efficiency HVAC system. Energy simulation indicated that these techniques would reduce lighting loads by 70 percent, cooling by 50 percent, and minimize heating requirements, compared to the baseline building. Ms. Ravetto subsequently compared her design target to the actual energy performance of similar buildings, using the Environmental Protection Agency's (EPA) online software tool—Target Finder. Target Finder ranked the energy performance, predicted by the energy modeling, among the top in its class.

The Benefits

In July 2002, once the facility had been operating for one full year, Ms. Ravetto benchmarked the new building's actual energy performance using EPA's online energy performance rating system. This rating compares the energy use of an existing building against a national database of similar facilities. RAFI-USA scored a 90 out of 100, distinguishing it as the first office building in North Carolina to earn the prestigious ENERGY STAR®. Annually, it consumes 25.1 kBtu/SF and costs \$0.60/SF to operate. The architect and owner are delighted that the design energy target came very close to the building's actual energy use. By managing resources and implementing energy-efficient strategies, the RAFI building prevents the emission of 300,000 pounds of carbon dioxide compared to an average facility. The environment benefits and so do the occupants.



Conference room with South-facing clerestories for daylighting. Interior daylighting with supplemental energy-efficient lighting reduces long-term operating costs and improves indoor environmental quality.

“Energy analysts often speak of a building's performance in terms of the energy it uses,”¹ while the purpose of a structure is usually to serve human needs. “The building should offer an environment conducive to helping occupants be more productive in whatever type of work they are engaged in.” In RAFI's new building, employees benefit from daylighting, natural cross ventilation, and individually controlled temperature and airflow. These features contribute to a productive, comfortable working environment. Such an achievement is truly an investment in the environment through sustainability, as expressed in the Foundation's mission statement and delivered by the architect's design.

“I think Target Finder is a wonderful tool for the very early stages of design; I encourage all architects and designers to use it. Target Finder is a fast and easy way to establish your new building's energy use target from a national database of actual consumption.”

— Alicia Ravetto, AIA

¹ Krepchin, Ira. Integrated Building Design. *Esource*. September 2000.