



Energy Efficiency & Renewable Energy



Replicability: A Campus Perspective



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NREL is a national laboratory of the U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, operated by the Alliance for Sustainable Energy, LLC.



Reproducible processes and strategies to generate site and program specific creations.

What is transferable?

- Precedent projects knowledge sharing and lessons learned
- Contract and financial mechanisms
- Energy performance based design-build process
- Design, construction, and operations integration
- Project management and methodologies
- Whole systems building strategies
- Technology assemblages
- Recognition of a dynamic progression

NREL South Table Mountain Campus



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What drives specific solutions?

- Programmatic needs
- Climate adaptation
- Population occupancy
- Energy targets
- Budget
- Sustainability measures
- Federal mandates
- Regional construction methods



What is in your tool box?

- Open Studio Identify energy targets
- Load Calculation and Sizing Simulation of building design alternatives
- Modeling Forecast performance outcomes
- Spreadsheet Analysis
 Assessments of technology integration / systems
- Guiding Principles

Identification of criteria and integrated design for high performance buildings

- Economic Assessment Building Life-Cycle Cost
- Real-time Performance Monitoring Platform for capturing real-time data for calculation and performance evaluation
- Building Agent

Post-occupant evaluation

Thermal Cameras

Maps existing performance

6



RSF 1 to RSF 2



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RSF 1 and RSF 2 Energy Model Comparison



RSF 2

- 138,000 sq.ft.
- 525 occupants
- \$39 million expansion

Building 17% more efficient than RSF 1

Cost savings of 5% per sq.ft.

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Small Improvements, Big Difference

- Displacement ventilation in conference rooms, improving thermal comfort
- Natural nassive cooling in stair

 Better thermal breaks in the window frames, leveraging the latest in commercial windows and aluminum frames, driving down energy consumption and increasing comfort



Photovoltaics





- More efficient solar panels were purchased at a lower cost
- 13% efficient PV to 19% efficient PV
- PV contractor involved with installation
- Installation technique improvements
- Standing Seam Roof

Small Improvements, Big Difference

- Larger transpired collector, creating more "free" warmed air
- Pre-fab wall panels with less window area, while still fully day lighting office spaces





Small Improvements, Big Difference

- Increased user friendliness of operable windows
- Daylighting controls in day-lit stairwells, allowing enhanced energy savings during the day
- Toplit skylights for daylighting in conference rooms in the core







