GREENSTONE ON FIFTH

Greenstone on Fifth Community Building at Blue Ridge Apartments in Charlottesville, Virginia is a 3,531 square foot, two-story commercial building that was certified in the **EarthCraft Light Commercial** (ECLC) green building program in 2014. Greenstone on Fifth partnered with Southface to analyze building design and performance and identify areas for improvement through the U.S. Department of Energy-sponsored Advanced Commercial Buildings Initiative. Actual building performance data was collected with circuit-level energy monitors and temperature sensors deployed for one year post-occupancy. Southface studied hourly energy simulation modeling and building monitoring data to assess the actual performance of energy efficiency strategies implemented at Greenstone.

BUILDING SPECIFICATIONS:

Where:	Charlottesville, VA
Building Use:	Office & community space
Year Built:	2014
Square Feet:	3,531
Floors:	2
Certified ECLC:	2014
ECLC Level:	Certified

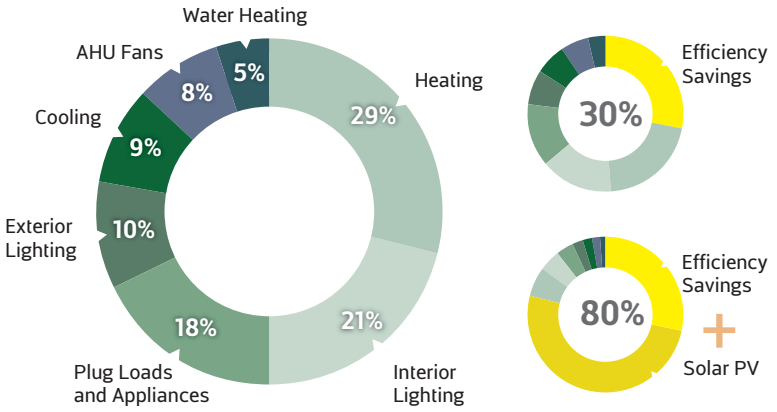
Where is energy being used in Greenstone?

Heating accounts for the largest energy end-use, at 29%, followed by interior lighting and plug loads and appliances at 21% and 18%, respectively.

Findings

The all-electric Greenstone is currently **saving 30%** in electricity consumption relative to a code-equivalent building (*ASHRAE 90.1-2007*), without accounting for the installed rooftop solar photovoltaic (PV) array. Including the rooftop solar PV, Greenstone is **saving 80%** in electricity consumption relative to a code-equivalent building.

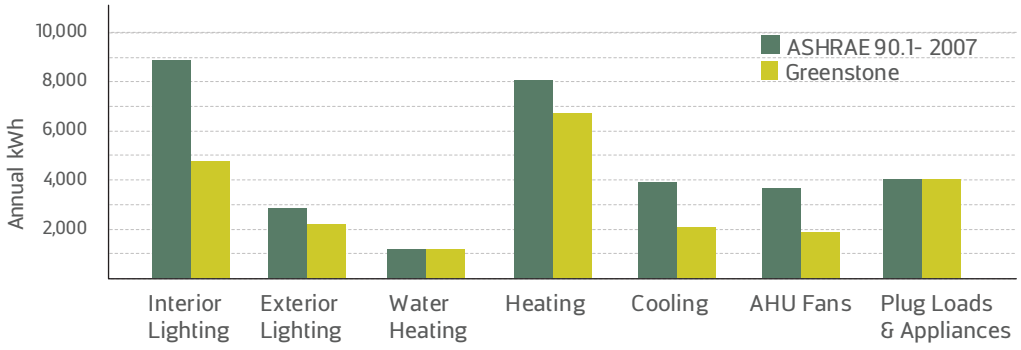
Figure 1. Energy use segemented by end-use and comparisons of Efficiency and Solar PV Savings added to the energy picture.



"The ECLC certification and ACBI research informed the design, construction and management of our building. Through these research-based solutions we realized operational savings, giving resources back to the community and applying smart environmental solutions for future projects"

Jimmy Holland, Community Housing Partners

Figure 2. Overall efficiency savings are driven by reductions in interior lighting, cooling, air handler fans, heating, and exterior lighting energy use.



What is driving energy savings?

INTERIOR LIGHTING

Occupancy sensors using passive infrared and dual technology are installed in the bathrooms, kitchen, classrooms and offices. These detect movement and turn lights on and off accordingly.

HEATING & COOLING

All three heating and cooling systems are ENERGY STAR® rated, and are greater than 15 SEER (Seasonal Energy Efficiency Ratio) and 3.5 COP (Coefficient of Performance) – SEER and COP are metrics of heating and cooling efficiencies, respectively.

BUILDING ENVELOPE

EarthCraft Light Commercial certification requires air tight building enclosures with maximum air leakage of 0.5 Envelope Leakage Ratio (ELR).* Greenstone's building was measured at an impressive 0.19 ELR.

Circuit Level Monitoring –*Areas for Improvement*

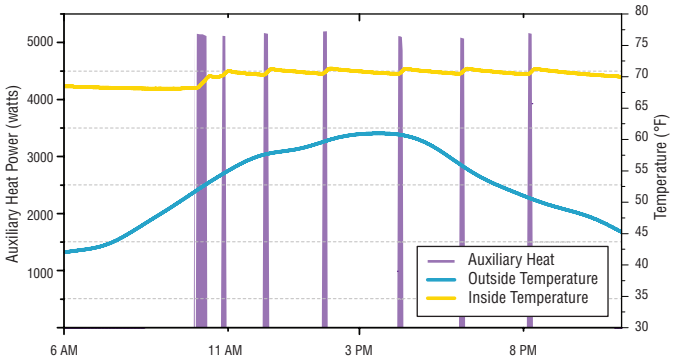
HEATING

The Greenstone building is heated by three heat pumps, all equipped with back-up electric strip heat. These systems are designed to utilize the heat pump as the primary source of heating. In cases of low outdoor temperatures, typically 40°F or lower, the back-up electric strip heat is activated to provide a supplementary source of heat. The primary source, the heat pump, is substantially more efficient compared to the back-up electric strip heat. For this reason, it is important the strip heat is only activated when necessary (typically 40°F or lower).

- Through circuit-level monitoring, it was discovered that the back-up strip heat was turning on when the outdoor temperature exceeded 40°F (*Figure 3*)

  Under these conditions, the back-up strip heat operated throughout even moderately cool days and accounted over 20% of Greenstone's total annual energy use. This presents further oppurtunity to save on energy costs.

Figure 3. Auxillary heat power consumption compared to outside temperature. Strip heat power consumption (purple line) on a day when outside temperatures (blue line) never fell below 42°F.



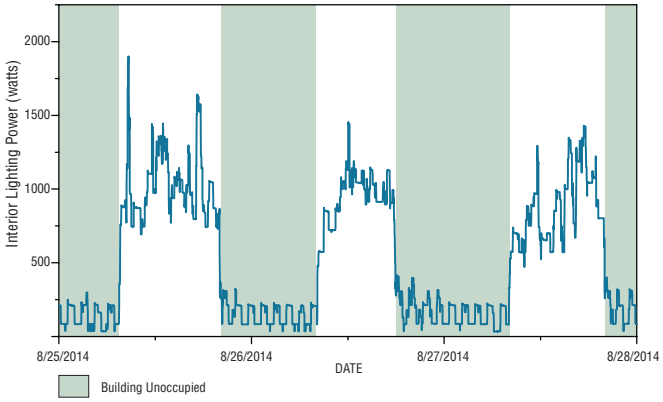
HEATING SOLUTION

- Replace thermostats with thermostats designed to function with a heat pump and built-in algorithms to minimize electric strip heat activation.
- Configure existing thermostats to trigger back-up electric strip heat only at exterior temperatures less than 40°F.

LIGHTING

Sixteen percent of the building's lighting energy consumption occured when the building was unoccupied. Data indicates lights are turning on and off when the building is unoccupied (*Figure 4*), possibly due to falsely triggered occupancy sensors.

Figure 4. Total interior lighting power with spikes highlighted during several evenings when the building is unoccupied.



LIGHTING SOLUTIONS

- Conduct an evening walk-through to identify lights left on or falsely triggered.
- Retrofit occupancy sensors with vacany sensors to prevent false triggers.
  - Vacancy sensors= Manual ON; Auto OFF
  - Occupancy sensors= Auto ON; Auto OFF
- Avoid placing sensors within 6 feet of air vents (Air flow may cause false triggers).

* Envelope Leakage Ratio (ELR) is the air leakage of the building at 75 Pascals of pressure, divided by the building envelope area.