



Viridiant Lecture Series: three years of data: latest findings on virginia's energy efficient housing stock

Preliminary findings from a multi-year study undertaken by the Virginia Center for Housing Research (VCHR) at Virginia Tech and Housing Virginia. The analysis builds on VCHR's study "The Impact of Energy Efficient Design and Construction on LIHTC in Virginia" that reported significant energy and utility savings as well as affordability, comfort, and quality of life benefits for residents living in ECMF certified developments.



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EarthCraft multifamily performance

- 320 EarthCraft Multifamily (ECMF) Low-Income Housing Tax Credit (LIHTC) units were tracked for three years.
- Actual energy usage for developments in the study was 16.6% less than estimated and approximately 30% less than new standard construction.
- Resident behavior among units was striking in its variability, leading some to conclude that education of residents is the next step in reducing energy usage variability.

green building cost effectiveness

- The difference in the total cost between green and non-green Low-Income Housing Tax Credit (LIHTC) developments is not statistically significant nor does cost statistically correlate to energy usage in the unit.



impact of green building incentives

- Results suggest that Virginia Housing Development Authority (VHDA) green building incentives in the Low-Income Housing Tax Credit (LIHTC) program have been successful in promoting affordable housing development that saves residents on average 45% on their annual energy costs at little cost difference compared to standard housing.

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Preliminary findings from a multi-year study undertaken by the Virginia Center for Housing Research (VCHR) at Virginia Tech and Housing Virginia. Over the last three years, researchers have measured and evaluated energy use, construction cost, and occupant behavior data in 15 EarthCraft Multifamily (ECMF) certified developments. The analysis builds on VCHR's study "The Impact of Energy Efficient Design and Construction on LIHTC in Virginia" that reported significant energy and utility savings as well as affordability, comfort, and quality of life benefits for residents living in ECMF certified developments.

Since the early 2000's, firms and local policy have increasingly emphasized green building certification, training, and construction processes and committed to sustainable principles. At the same time, the Virginia Housing Development Authority (VHDA) implemented some of the most aggressive green building standards in the nation within the Low-Income Housing Tax Credit (LIHTC) program. VHDA has done this by providing a significant scoring incentive for applicants who choose to develop in compliance with green certification standards.

This lecture examined this program, its policy, and the effect on energy efficiency for a limited LIHTC Virginia sample.

In part one, Housing Virginia, Viridiant (formerly EarthCraft Virginia), and The Virginia Center for Housing Research (VCHR) at Virginia Tech recently collected, mapped and modeled correlates across 320 energy efficient LIHTC Virginia units based on variables for: 1) estimated energy usage, 2) actual energy usage, 3) incorporated construction technologies and 4) resident behavior. Actual energy usage for developments in the study was 16.6% less than estimated and approximately 30% less than new standard construction. Resident behavior among units was striking in its variability, leading some to conclude that education of residents is the next step in reducing energy usage variability.

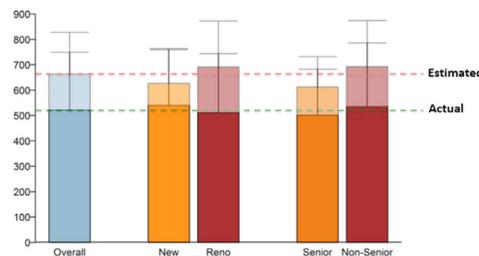


Figure 1. Actual energy usage for developments in the study was 16.6% less than estimated and approximately 30% less than new standard construction.

As a next step, the researchers further studied variability in the green building stock, including costs

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and energy usage, and implications for educating residents as well as construction and property managers of Virginia's affordable housing stock. The work began by collecting and appending previous data with financial information on the cost variability of green versus non-green housing, setting a basis to motivations for an energy efficient property portfolio, and then focused on energy efficient building resident behavior variability.

Results suggest that VHDA green building incentives in the LIHTC program have been successful in promoting affordable housing development that saves residents on average 45% on their annual energy costs at little cost difference compared to standard housing. Over three years, results of sampled LIHTC units include: 1) saving more energy than estimated in design and construction, saving more energy than observed in year one (Y1) and saving more energy than new standard construction estimates; 2) from low-income to extremely low-income housing units, residents can save between 3.1% and 8.3% of total annual housing costs from energy efficiency respectively; 3) building technology and resident behavior continue to be strongly correlated over 3 years; 4) education on high performance home technologies is an opportunity for significant energy usage and cost savings as residents with education had a lower average energy usage monthly and annually (over three years) by 14.8% and a lower energy bill by \$10.56 per month;

and 5) the difference in the total cost between green and non-green LIHTC developments is not statistically significant nor does cost statistically correlate to energy usage in the unit.

Part three examined the effect of energy efficiency on the residential supply chain. Findings showed that the new construction portion of the residential construction industry has seen a significantly-reduced ease of entry since the Great Recession. Much of the labor left the industry entirely and those who remained were forced to adjust to increasingly complex and difficult levels of local regulations and code requirements from land regulations and proffers to building science. As a result, those who survived have become nimble, able to change quickly and able to work across multiple markets. The older days of building a small crew up from a niche market are no longer feasible. There is little room in the price of housing for other areas of profit, as indirect and soft costs are rising, leaving less and less room for direct costs. Residential construction, due to code changes and other regulations, has been successful in keeping housing reasonably affordable while adapting to new requirements and the costs of those requirements. Thus, we continue to balance putting more into the home while still maintaining affordability.



	Energy Use (kWh)	Energy Cost (\$)*
W. Education	536.1	60.95
W/o. Education	628.9	71.51
Diff. (Monthly)	-92.8	-10.56
Diff. (Yearly)	-1,113.6	-126.72
Saving (%)	-14.8%	-14.8%

***Note: costs calculated at price of \$0.1137/kWh, which was the VA state average for 2015.**

Figure 2. Results suggest that education on unit technologies and system concepts can play a significant role in reducing energy use in high performance housing.