

Home Energy Performance Study

David Hinson, Mackenzie Stagg, Elizabeth Farrell Garcia, Rusty Smith, Mike Hosey, 1/6/2021
College of Architecture, Design and Construction / Rural Studio Front Porch Initiative

Abstract

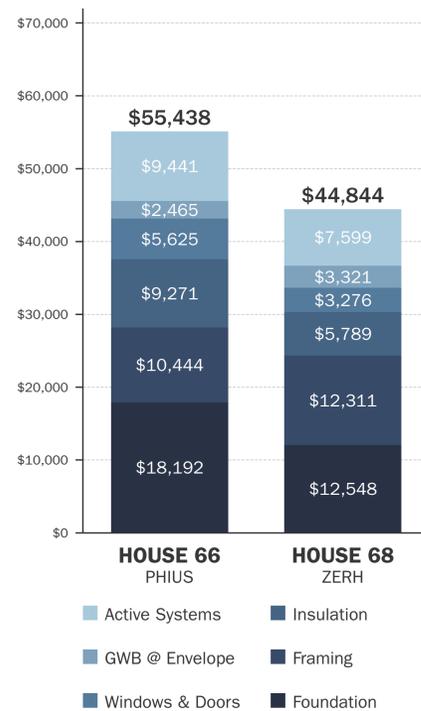
Though home energy use should be considered in every residential project, it is particularly critical for low-wealth individuals and families. While higher-budget projects can rely on return on investment for energy-saving features, “affordable housing” projects built by not-for-profit organizations frequently rely on reductions in construction costs to keep purchasing process low for homeowners. However, this can result in higher maintenance and operations costs over the useful life of the home. Could linking home performance to the mortgage carry of an individual homeowner provide opportunities to create a housing stock that considers the total cost of homeownership? This poster describes a research initiative designed to seek the balance point between up-front investments in improved energy performance and home affordability in support of a pilot, systems-based approach to more affordable homeownership.

Process

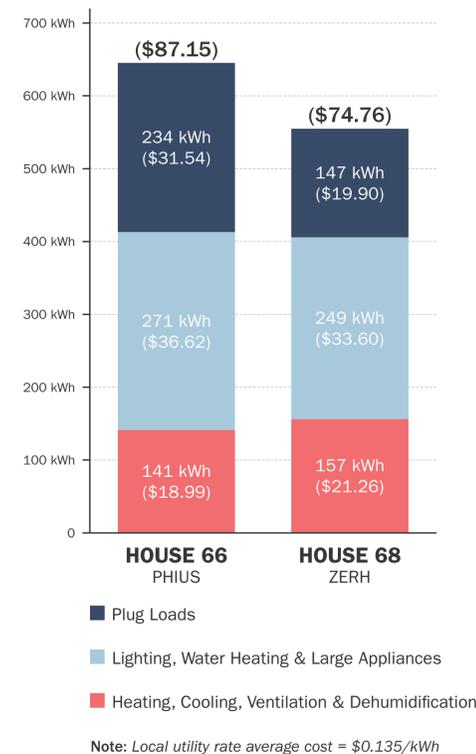
In a design-build format, the authors and their students have revised and constructed multiple versions of the same small, two-bedroom prototype home developed for the context of a mixed-humid climate: one built to the Passive House U.S. (PHIUS) standard and the other to the Department of Energy’s Zero Energy Ready Home (ZERH) standard. By constructing two prototype homes on the same street and with similar orientation, but with different building assemblies, the authors are able to evaluate the initial cost of construction associated with achieving these two performance standards while simultaneously comparing the monthly energy savings afforded by each approach.

Each home underwent a rigorous process of modeling, testing, and monitoring. Post-occupancy engagement with the homeowner allows for a deeper understanding of the design of end-user education programs that empower families to leverage the high-performance potential of their homes.

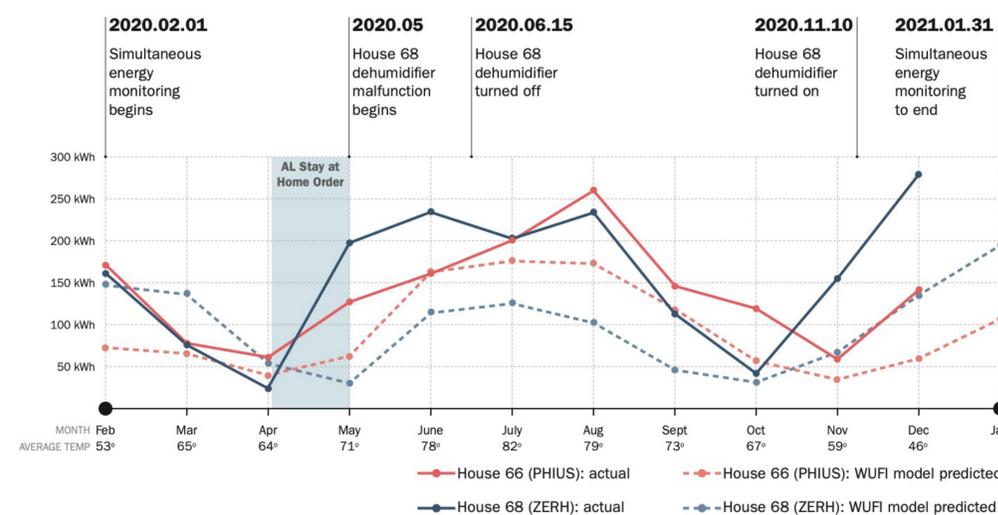
TOTAL COST OF KEY ELEMENTS



AVERAGE MONTHLY ENERGY USE (kWh)



ENERGY MONITORING TIMELINE



Construction Costs and Energy Consumption

In this ongoing study, the research team analyzed construction cost differences between the two homes, and continues to collect monthly energy consumption data to analyze effectiveness of specific building assemblies in terms of energy efficiency outcomes.



House 66
Designed to meet Passive House U.S. (PHIUS) standards.



House 68
Designed to meet Zero Energy Ready Homes (ZERH) standards.

Credits

Buster's House Prototype Student Design Team

Olivia Backer, Carley Chastain, Ben Malaier, Janine Mwenja (with guidance from Auburn University Rural Studio faculty & staff)

House 66 Student Team (Hinson & Hosey, faculty leads)

Spring Studio: Lauren Ballard, Meghan Bernhardt, Fox Carlson, Emma Clark, Katherine Ferguson, Jed Grant, Haley Hendrick, Jeff Jeong, Mary Ma, Kate Mazade, Ashley Mims, Walker Reeves, Rowland Sauls, Jordan Staples, Matthew Wigard, David Estella, Howard Murrell, Conner O'Danile, Deaton Owens, Wes Vansant, J.D. Hart, Luke McNeece, Cana Turberville, Eric Brennan, Chase Sprague, Nick Malcom, Neil Morris, Corey Pope, K.C. Terry; Summer Seminar: Heath Barton, Emma Clark, Noah Dobosh, Melissa Ensley, John Going, Mason Handey, Dee Katoch, Mack Mahoney, Ashley Wiley, Joshua Williams, Valencia Wilson

House 68 Student Team (Hinson & Hosey, faculty leads)

Spring Studio: Claire Bruce, Justin David, Ozzy Delatorre, Adam Fehr, Jonathan Grace, Emily Hiester, Dongting Huan, Reed Klimoski, Mingtao Liu, Emma Porter, Sierra Anderson, Sterling Applegate, Taylor Blackwell, Christopher Burford, James Clifford, Bradley Davidson, Colin Fields, Sean Galvin, William Harrelson; Summer Seminar: Erik Aguilar, Carol Allison, Craig Barker, Elizabeth Bowman, Caty Bowman, Zack Burrough, McClean Gonzalez, Davis Johnson, Emme Mora, Kamron Sullivan, Nieman Ugbesia

House 66 & 68 Faculty, Consultant & AOHFH Team

Faculty: David Hinson, Mike Hosey, Mackenzie Stagg; Consultants: David Bitter (CPHC), Bruce Kitchell (PHIUS+ Rater), Alexander Bell (energy modeler), Rob Howard (Mitsubishi Electric), Alex Cary & Warner Chang (IBHS), Eric Oas (Oasis Heating & Air); AOHFH Team: Mark Grantham (Executive Director, AOHFH), Jaqueline Dixon (Contractor of Record)

Data Collection Team

David Hinson, Mackenzie Stagg, Elizabeth Farrell Garcia, Anthony Spafford, Bruce Kitchell, Betsy Burnet