



Challenges and Opportunities for Basic Efficiency Measures in Low-income Homes: A Southeast Alaska Case Study

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- The two participating households



Photo by Rachel Dodd, NREL 22115



Introduction

- Juneau, AK: 80% renewable energy by 2045 (CBJ, 2018)
- Thermalize Juneau 2021: community campaign to incentivize ductless heat pump adoption
- Initial objective: Evaluate energy savings and non-energy benefits from low-emissivity (low-e) storm windows
- Final objective: Identification of measures and information that could improve outcomes for energy efficiency measures in low-income homes

Background

- 80% of household energy in Juneau used for space heating (AEA, 2012)
- Inflation Reduction Act (IRA): \$369 billion for fighting climate change
- Modern storm windows: potentially lower cost alternative to window replacement.
 - Permanent, not seasonal
 - Decrease air leakage
 - Low-e coating improves insulative properties

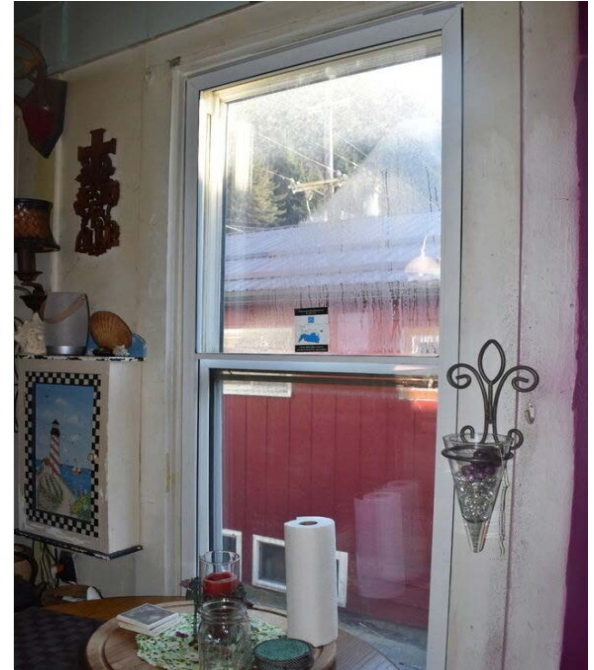


Photo by Vanessa Stevens, NREL 21537

Methods

- Two homes with previous retrofits completed by the regional housing authority
 - Ductless Heat Pumps
 - Weatherization
- Completed: Energy audits with air leakage tests
- Local builder went to homes to measure windows for storm window order
 - Neither home had operable egress windows in bedrooms, which meant the homes were not up to code



Photo by Vanessa Stevens, NREL 21537

Energy Models

- Local energy auditor completed a baseline model of the homes prior to window install.

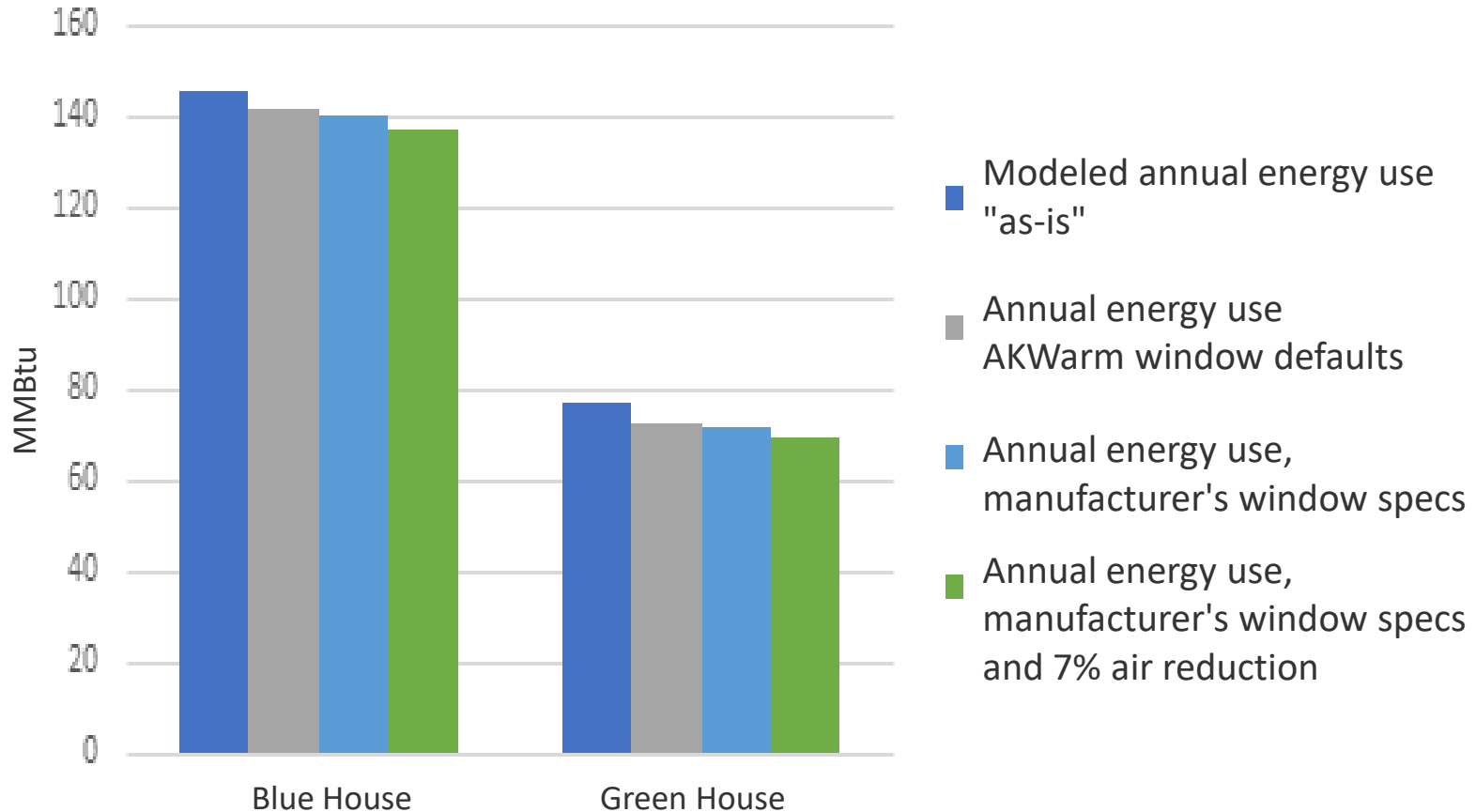


Photo: Vanessa Stevens, NREL 21537

- Project staff utilized the information gathered from the audits to model the potential energy savings through the project.
- AKWarm, a software supported by the Alaska Housing Finance Corporation, was used.
- REM/Rate modeling software was also used to create energy models for both homes.

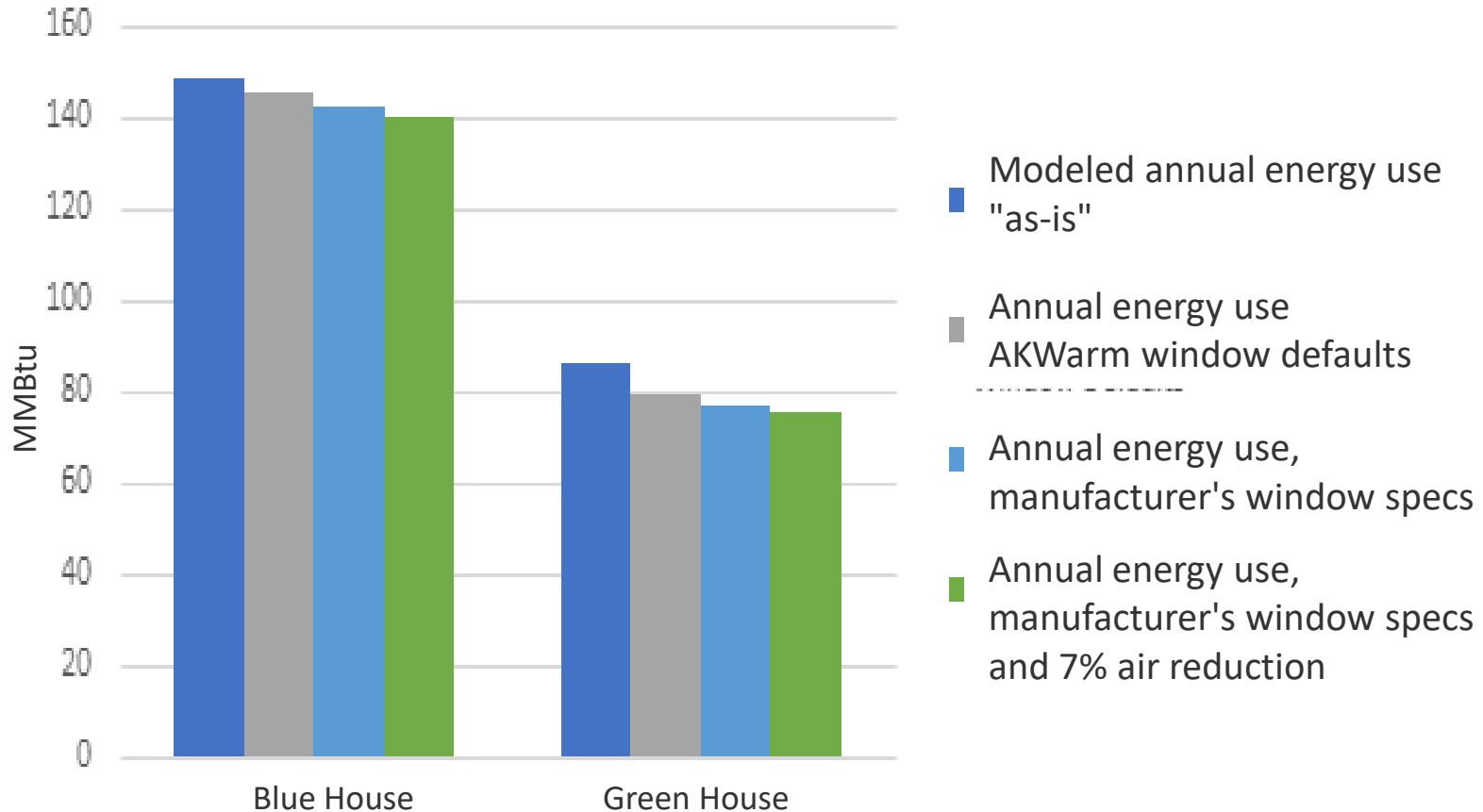
AKWarm
Energy
modeling
efforts in
the four
different
scenarios

AKWarm Heating Energy Use



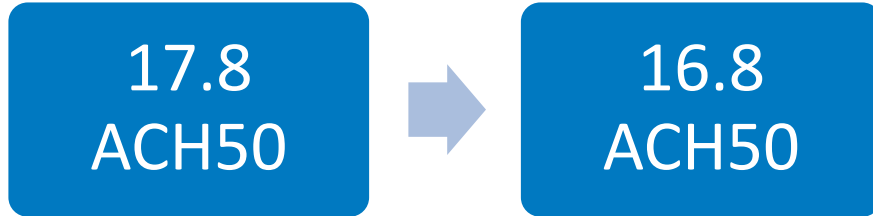
REM/Rate
Energy
modeling
efforts in
the four
different
scenarios

REM/Rate Heating Energy Use



Air Leakage

- 7.9 ACH50 average for Juneau
- Blue House



- Green House

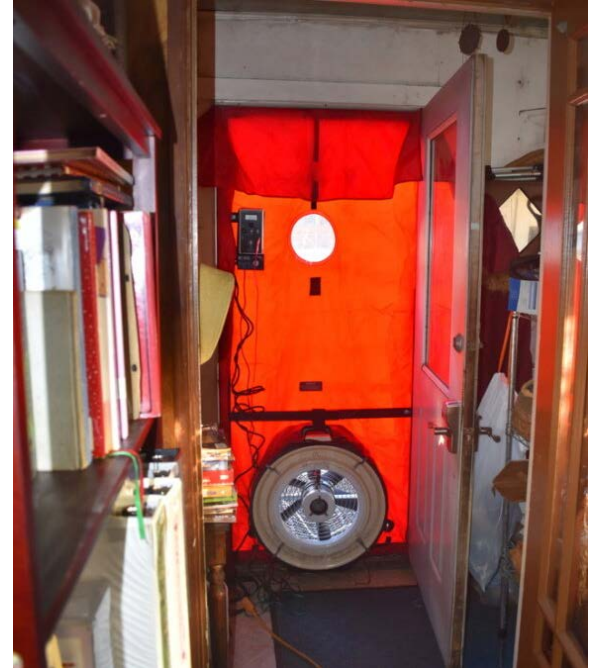


Photo: Vanessa Stevens, NREL 21537

Energy Use

Blue House

- Pre-install of windows
 - 50 bags of wood pellets
 - Did not use the DHP
- Post-install of windows
 - Pellet stove broke
 - Tried the DHP some
 - Used electric heaters sparingly



Photo by Vanessa Stevens, NREL 21537

Energy Use



Photo by Vanessa Stevens, NREL 21537

Green House

- Pre-install of windows
 - Toyo oil fuel bills not provided
 - DHP: 438 kWh
- Post-install of windows
 - Toyo oil fuel bills not provided
 - DHP: 1,043 kWh



Occupant Interviews

Pre-installation, homeowners

- Had a basic understanding of storm windows
- Believed their home could benefit from storm windows

Post installation, homeowners were

- Satisfied with new windows
- Impressed by the triple pane egress windows
- Happy with storm windows

Discussion

- Notable takeaways for efficiency programs:
 - Health and safety must be addressed initially and not left to the end
 - Must not be assumed every install will be simple
 - Essential to include older and low-income homes in field validation and deployment studies
- The study could not quantify the effect of window retrofits on energy use, and air leakage was inconclusive
- Occupant interviews indicated the window retrofits were successful in increasing occupant comfort of both homes



Photo: Vanessa Stevens, NREL21537

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Q&A

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