slipstream

Reimagining HVAC in New Manufactured Housing

Slipstream, partnering with the University of Central Florida–FSEC Energy Research Center, Washington State University Energy Program, and Northwest Energy Works received nearly $1,000,000 from U.S. Department of Energy to reimagine HVAC in new manufactured housing (MH) over three years.

The project's focus is evaluating, refining, and testing new approaches for delivering space heating and cooling in manufactured homes to improve energy efficiency, durability, and indoor air quality without significantly increasing production and MH siting costs.

We selected four innovations to move into the innovation testing phase based on their feasibility for industry adoption and potential energy savings.

Partial Factory-Install of Ducted Heat Pumps: This innovation tests a potential near-term solution to technical and market barriers to full factory installation of high-efficiency heat pumps *(Figure 1)* by exploring a partial factory installation of ducted heat pumps. The air handler, refrigerant lines, and indoor heat-pump coil are installed at the factory and the outdoor unit is shipped loose for field installation during siting. Field testing of this concept will focus on demonstrating the comfort and energy benefits of the system.

Improved HVAC Quality Assurance Protocols: This innovation seeks to streamline quality-assurance protocols for proper HVAC-system assembly and operation in the factory, at siting, and/or inspection. We will field test improved in-factory protocols to test for duct leakage, as well as rapid field diagnostics for duct leakage, airflow, and other HVAC-related issues during home siting or inspection. We plan to refine the protocols and obtain manufacturer, installer, and inspector feedback and document the final protocols for wider adoption.

Improved Cross-Over Duct Designs: This innovation strives to improve the design of the conventional below-the-floor crossover duct connection required for multi-section homes by employing metal elbow connectors and a super-insulated flex duct-in-duct approach. If the initial mock-up is successful, this innovation will be refined and tested with manufactured home retailers.

Comparative Testing of Different Cross-Over Approaches: We will identify and test multi-section homes with both types of duct systems—through-the-rim *(Figure 2)* and traditional flex-duct crossovers—for leakage and compare air delivery with factory duct design calculations. This activity will also synergistically serve as a test vehicle for the improved HVAC QA protocols innovation.

RESEARCH PARTNERS

UCF FSEC Energy Research Center
UNIVERSITY OF CENTRAL FLORIDA

neem
Northwest Energy Efficient Manufactured Housing Program

Washington State University

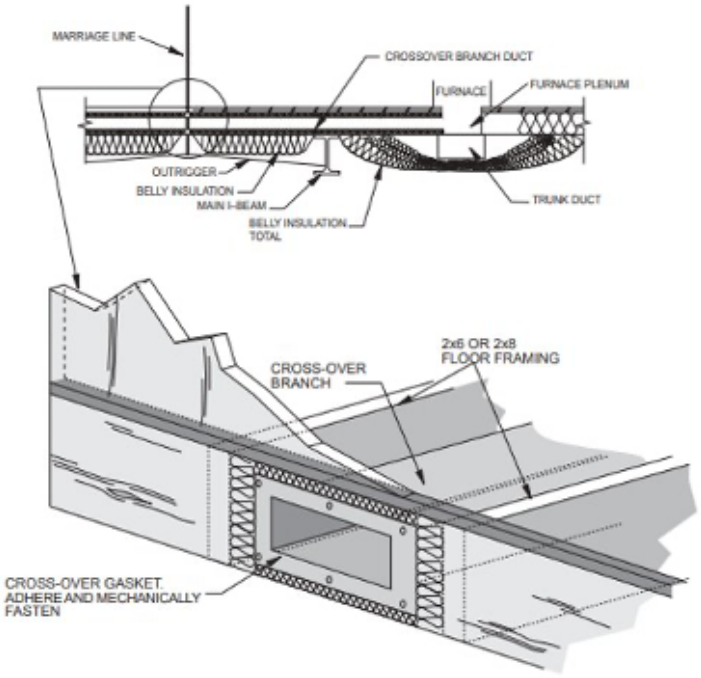

Figure 1: Example through-the-rim crossover-duct design.

Source: 2004 Northwest Energy Efficiency Manufactured Home Program In-Plant Inspection Manual

Figure 2: Example heat pump installed on a manufactured home. Photo courtesy of Brady Peeks, Northwest Energy Works

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Partners

Slipstream: Nonprofit with experienced researchers and field testers with more than 40 years performing MH retrofits and training.

University of Central Florida–FSEC Energy Research Center: Four decades of application-oriented energy efficiency and renewable energy buildings research. Conducted pioneering work for high performance manufactured homes.

Washington State University Energy Program: More than 30 years working to improve the efficiency, durability, and indoor air quality of new manufactured homes.

Northwest Energy Works: Administers the Northwest Energy-Efficient Manufactured Housing Program (NEEM), the longest running residential energy efficiency program of its kind in the nation.

Want to learn more?

If you would like more information about the study please contact Slipstream:

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Project Team Research Examples

- HVAC Innovations in New Manufactured Housing Feasibility Assessment
- HVAC Innovations in New Manufactured Housing Energy Modeling and Cost Effectiveness
- Minnesota manufactured home market characterization
- Field investigation and construction modifications to prevent persistent HVAC-related failures, 5 manufacturers
- Monitored field and laboratory studies in manufactured homes: ventilation, energy use and savings, crawl space, ducts
- Retrofit of Blown Attic Insulation in Existing HUD-Code Manufactured Homes: Needs Assessment Report, U.S. DOE Building America Office of EERE
- Manufactured Home Performance Case Study: A Preliminary Comparison of Zero Energy and Energy Star