

University of Minnesota – 2011 Annual Report

Overview

The current University of Minnesota Cold Climate Housing research is focused on building technology and environmental issues specific to the north central region of the United States. An informal network of researchers from a wide range of disciplines are focused on the design, construction, renovation, and operation of buildings in cold climates. There are several new initiatives at the University to increase research efforts in the housing arena. The Affordable Housing Initiative, led by the Center for Sustainable Building Research, has been funded by a non-profit foundation to support the Minnesota Housing Agency's Green Communities efforts. The Bioproducts and Biosystems Engineering department has developed an "advanced building systems center" built around the existing Cold Climate Housing and Bioproducts Marketing and Management programs. The Institute for Renewable Energy and the Environment and the university-wide Institute on the Environment have both announced support for programs focused on building energy conservation and efficiency. The University of Minnesota Extension has a full-time Regional Extension Educator in Housing Technology and the Cold Climate Housing (CCH) program has a position focused on affordable housing technologies. CCH and CSBR continue to serve as a focal point for regional research, technology transfer, and outreach to the home design and building industries.

Part 1: Current Activities in Research

Industry support has continued to drop in 2011, primarily due to the housing downturn. However, we are currently pursuing industry support for the newly created Integrated Space & Water Heating Systems Laboratory. And support is being solicited for both below-grade and above-grade research at the Cloquet Residential Research Facility. The CCH staff continues to be active with the home building industry on both mandatory and voluntary building standards. The primary issues of concern are moisture management, basement insulation, and green building. Below are two highlighted, ongoing research initiatives for 2011.

A. NorthernSTAR Building America Team

In 2010, the University of Minnesota was selected by DOE and NREL as one of fifteen teams nationwide to help develop cost-effective solutions to reduce the energy use of housing while improving comfort, durability, and indoor air quality. These Building America teams work with research partners made up of key members from the building industry in the production and research of advanced residential buildings. The NorthernSTAR Team began to conduct systems engineering research in 2011 intended to develop technologies and strategies that would reduce energy consumption by 15 to 30% in existing homes and 30 to 50% in new homes. The 2011 NorthernSTAR project portfolio included:

- Integrated Space & Water Heating Systems
 - Full-Scale Laboratory Systems Evaluation
 - In-Situ Testing in Low-Income Weatherization Homes
- Energy Audit and Retrofit Delivery Assessment
 - Improved House Characterization with Audit Tool Analysis and Comparison
 - Innovative Active Calibrated Modeling
 - Streamlining Test Protocols and Procedures
 - Evaluation of Model Retrofit Delivery Systems
- Foundation Insulation Systems
 - High-R Insulation for New Homes: Analysis & Assessment
 - Interior Retrofit Applications and Excavationless Exterior Insulation Retrofit
- Project Overcoat (Exterior Thermal & Moisture Management System)
 - Energy and Ice Dam Mitigation for 1-1/2 Story Homes

- High Performance New Homes
 - Field Demonstration and Market Assessment
 - Window Selection Guide

B. In-situ COPs of Ground Source Heat Pumps

This project is a focused evaluation of the in-situ performance of 40 residential-scale ground source heat pumps (GSHP) in Minnesota. This information is extremely limited and has significantly impeded both the market penetration and potential advancements of this technology. The data collected from the in-situ monitoring can be used to establish an operating COP, thus allowing for a comprehensive assessment of the overall life-cycle costs, along with potential energy savings and emissions reductions. This can then support a thorough life-cycle analysis and the development of potential financial and policy incentives that would support widespread adoption of GSHP systems.

Part 2: Current Activities in Teaching

The Residential Building Science and Technology degree program continues to attract new interest and new students. However, the program is considered too small by administrators and will need to be reconfigured. It is unclear if a building science track will be added to the current engineering program or be incorporated into a new “sustainability science” degree program. Also, programs in architecture, housing, and construction management have seen large increases in enrollment. A new Masters in Sustainable Design in the College of Design has been very successful and some of those students are enrolling in the RBST courses.

Part 3: Current Activities in Outreach

Requests for outreach continue to be strong. While many requests for training are connected to green building initiatives, there is still strong interest in Best Practices for Moisture Control. The CCH and CSBR staffs continue to do a variety of affordable housing technical assistance projects. CCH faculty remain highly engaged in national technology transfer activities including Building America, Healthy Homes, and conferences including EEBA, Affordable Comfort, B4, and the Energy Design Conference. Bill Angell, Director of the Midwest Universities Radon Consortium, continues to offer a full slate of radon measurement and mitigation courses, including a new online course for builders on Radon Resistant New Construction.

A. High-Performance Homes for Cold Climates This initiative is focused on high-end training needs of the building industry to design and construct highly efficient, durable, and safe new homes. A pilot workshop on foundation insulation and moisture management was very well-received. A new course is being developed for 2012 focused on the opportunities and benefits for contractors to employ building performance testing.

B. Smart Green Remodeling: A Systems-Guided, Performance-Based Approach: As communities try to improve their housing stock, especially the vacant and boarded foreclosed homes, there is a need for a holistic approach that can address both current deficiencies and the long-term desired outcomes of a healthier, more durable, and efficient home. Green remodeling programs are expanding opportunities to produce these outcomes and have less impact on the environment. However, major changes and upgrades can either make things better or worse, especially in homes that have existing performance (air quality, moisture, durability, energy-efficiency) issues. This workshop helps designers and remodelers apply building performance approaches to home renovations that can increase their profits and marketability, reduce call-backs and liability concerns, and result in homes that are far better for their inhabitants and the planet.

Major Plans for 2012

We will continue to develop the “advanced building systems research and resource center” design and research agenda within the new departmental structure. We believe next year will be a good year for housing research activities, especially in the areas of energy upgrades and moisture transport relating to durability and

indoor air quality concerns. We look forward to rebuilding some of our capacity and strength in our interdisciplinary research and technology transfer efforts.

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