

## 1991 LCMR WORK PROGRAM

Date: July 1, 1993

LCMR Status Report

### I. TITLE: Evaluating Performance-Based Standards for Energy-Efficient New Homes

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**A. Legal Citation:** M.S. 91, Chapter 254, Article 14, Subdivision 13(j)  
Energy Efficiency Standards for Residential Construction.

This appropriation is to the commissioner of administration for a grant to the University of Minnesota, Cold Climate Housing Center, for the development of performance-based standards for energy efficient new home construction and procedures for implementation. This appropriation must be matched by \$75,000 of nonstate funds. This appropriation is available only as cash flow permits.

Appropriation: \$ 75,000

Balance: \$ 0 (estimated as of June 30, 1993)

**B. Compatible Data Language:** NA

**C. Status of Match Requirement:** This appropriation must be matched by \$75,000 of nonstate funds.

Match Requirement: \$75,000

Funds Raised to Date: \$77,351

The Builders Association of Minnesota has committed \$30,000 to support this project. Minnegasco has committed \$45,000 to support this project under their Conservation Improvement Program filing G-008/M-90-295.

**II. Narrative:** This project would fund the continuation of a portion of the Cold Climate Housing Center's building industry education program, with an emphasis on evaluating performance-based standards for energy-efficient new home construction. This project will be a partnership of the home building industry, utility industry, state government, and university researchers.

**A. Statement of the Problem:** During the 1991 Legislative Session, a bill (House File 911) was introduced which proposed performance-based energy standards for new residential construction. This project will evaluate these performance standards and the implications they will have on home buyers and the building industry. Because new materials and construction methods may be required, a pilot training program will be developed to provide needed information to the building industry.

**B. Importance:** Residential energy use accounts for approximately one-fourth of all energy used in the U.S. In Minnesota, residential energy costs amounted to \$1.74 billion in 1988, greater than two percent of the state's gross product. Improving building energy standards is an important means to improve the energy efficiency of our housing stock.

**C. Extent of the Problem:** While the building industry generally supported the intent of the proposed legislation, concern and anxiety was expressed on several issues. What would the impact be on new home affordability? Are there proven measures and methods to meet the standards proposed? Are reliable equipment and materials readily available to meet these standards? This project will attempt to answer those questions through a comprehensive study. Then develop a program to communicate the answers to the home building industry.

**III. Objectives:** The project is divided into two parts: a) to evaluate the impact of performance standards as proposed in H.F. 911 and study the implications for the building industry of such performance-based standards and b) the development of a pilot builder training program. An advisory team of diverse interest (representing the building industry, utilities, and state government) would be chosen to further define the issues to be studied and to provide guidance on the development of the pilot training efforts.

**A. Evaluation of the Proposed Performance-Based Standards**

**1. Narrative:** The key issues to be analyzed are the effectiveness of various design and construction approaches to meet such standards, the potential energy savings over existing standards, and the cost impact to builders and consumers.

**2. Procedures:** An advisory committee (10-15 members) will be convened to provide general direction for the project. They will be asked to develop a list of specific concerns as well as benefits of performance-based standards that will be incorporated into this study. From the advisory committee, a research oversight panel (6-8 members) will be selected to devise the specific research plan. While the advisory committee will determine areas to be addressed and the oversight panel will assist in developing the final research plan, this study will likely include the following general components.

a. A review of existing performance-based energy standards and a summary of key issues in the development and implementation of performance-based standards:

- review of the Model Conservation Standards, the Canadian Home Builders Association R-2000 Exemplary Standards Program, and the Alaskan Craftsman Home Program and the Energy Crafted Homes Program,
- summarize developmental issues and critical information needs, and
- identify various potential implementation avenues, including voluntary vs. mandatory approaches.

b. An evaluation of existing state energy standards and the level of energy efficiency in current construction for both predicted energy performance and actual energy consumption:

- develop 4 or 5 house prototypes based on actual construction,
- collect as-built drawings and specifications for 10 to 12 homes of each type (total sample of approximately 50)
- compare these existing building code energy standards,
- use computer building energy simulation tools to predict energy performance, and
- monitor a subset (approximately 20) of these homes for energy consumption and other critical performance indices.

c. Using this information, the impact and implications of the proposed standards on the home buyer and building industry will be analyzed:

- use computer building energy simulation tools to identify potential energy savings, and
- develop a survey to identify and quantify incremental costs of energy-saving features.

**3. Budget:** The study portion of this project will be approximately \$85,000. This will include \$40,000 of LCMR funds and \$45,000 of matching funds. The LCMR balance is \$0 (estimated as of June 30, 1993).

**4. Timeline:** This study would take approximately sixteen months from 12/91 to 4/92. This proposed timeline is based on the general procedures outlined above and may be subject to change when the final research plan is completed and approved by the research oversight panel.

	Jul	Oct	Jan	Apr	Jul	Oct	Jan	Apr	Jul
a. advisory/oversight committees meet			* * * *						
b. select prototype houses for study			* * * *						
c. evaluate house using existing code				* * * *					
d. determine impact & incremental cost					* * * * *				
e. select actual houses to study			* * *						
f. monitor energy of actual houses			* * *	(pilot)			* * * *		
g. prepare draft report							* * * *		
h. review and final report									* * *

**5. Status:**

- a. First status report - July 1992  
(incorporated into status report below)
- b. Interim status report - January 1993  
(incorporated into status report below)
- c. Final report - July 1993
  - An advisory committee of 18 members representing industry, utilities, and state offices provided valuable guidance on key issues throughout this project. A research oversight committee was established and met several times to refine research objectives and field monitoring protocols. The final results of the project have been presented to the advisory committee.



## **1991 RESEARCH PROJECT ABSTRACT**

FOR THE PERIOD ENDING JUNE 30, 1993

This project was supported by Oil Overcharge Funds

**TITLE:** Evaluating Performance-Based Standards for Energy-Efficient New Homes  
**PROGRAM MANAGER:** Patrick H. Huelman  
**ORGANIZATION:** University of Minnesota  
**LEGAL CITATION:** M.S. 91, Chapter 254, Article 14, Subdivision 13(j)  
**APPROPRIATION:** \$75,000

### **STATEMENT OF OBJECTIVES**

Energy efficiency is a unique strategy that can provide both a healthier environment and a stronger economy. Failure to achieve better energy efficiency in our housing stock has adverse environmental, economic, and strategic implications for all Minnesotans. However, making today's homes more energy efficient is more complex than additional insulation and high-efficiency furnaces. Home builders need construction details which will make a new house energy efficient and avoid the potential problems that can be associated with highly efficient dwellings.

This project was divided into two parts: A) To evaluate the impact of performance standards and study the implications for the building industry of such performance-based standards. This project reviewed several programs using performance-based approaches and analyzed the effectiveness of various design and construction upgrades to meet such standards, the potential energy savings over existing standards, and the cost impact to builders and consumers. B) The development of a pilot builder training program involved a close working relationship with the industry to provide information on key energy performance issues and assess the training needs in this area. Several pilot training activities were developed to address the critical materials, equipment, and techniques required to build affordable, durable, and healthy energy-efficient homes.

### **OVERALL PROJECT RESULTS**

A sample of actual houses built in 1990 was selected and screened as a basis for the homeowner survey and field monitoring. The homeowner survey provided valuable house, occupancy, and operational information along with utility bill history and demographic data. The mean Home Heating Index was 4.89 Btu/dd-ft<sup>2</sup> and PRISM analysis showed a mean Normalized Annual Consumption for heating of 943 therms. Several prototype houses representing 1990 new construction have been developed with specific construction details and specifications based on a builder survey. These prototypes were used in the building energy computer modeling programs to evaluate insulation and ventilation impacts.

A sample of 27 houses was randomly selected from the eligible households for follow-up field monitoring. A comprehensive energy monitoring effort was completed on 7 of these houses. The monitoring included a detailed analysis of the house dimensions, thermal properties, airtightness characteristics, ventilation capacity and delivered air flow, house depressurization, and mechanical system performance.

A number of important training components were implemented under this project including a regular feature article in the "Minnesota Builder" magazine and several pilot builder workshops at the Builders' State Convention.

### **PROJECT RESULTS USE AND DISSEMINATION**

A complete Project Summary has been compiled to serve as the basis for future research bulletins and papers. A comprehensive "Guide to a Performance-Built House" has been developed that can be used for a variety of training initiatives. An overall training approach has been developed and is being used for a comprehensive statewide training proposal by the Builders Association of Minnesota.