Environment and Natural Resources Trust Fund
2009 Phase 2 Request for Proposals (RFP)

LCCMR ID: 102-D2

Project Title: Cutting New Home Energy Consumption in Half

Total Project Budget: $ $478,771

Proposed Project Time Period for the Funding Requested: 2 Years - 7/109 to 6/30/11

Other Non-State Funds: $ $0.00

Priority: D2. Residential Energy Conservation

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Sponsoring Organization: U of M

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Region: Statewide

County Name:

City / Township:

Summary: A comprehensive evaluation of EPAs Advanced New Home Construction program to demonstrate its technical feasibility, market potential, and policy implications to facilitate and accelerate adoption of low-energy houses in Minnesota.

Main Proposal: 1008-2-045-proposal-UMN-Huelman Proposal.doc

Project Budget: 1008-2-045-budget-UMN-Huelman Budget.xls

Qualifications: 1008-2-045-qualifications-UMN-Huelman Qualifications.doc

Map:

Letter of Resolution:

PROJECT TITLE: Cutting New Home Energy Consumption in Half: Technical Feasibility, Market Analysis, and Policy Implications

I. PROJECT STATEMENT

Homes are responsible for 22% of our state's energy consumption, 17% of our greenhouse gas emissions, and a $3 billion drain from our state's economy. To meet new state and national mandates, residential energy consumption can be cut in three basic ways: conservation, efficiency improvements, and substitution of alternative energy sources. While conservation and substitution have clear potential, most studies suggest that systematic efficiency improvements in the building sector will deliver the **most cost-effective and durable** long-term energy and emission reductions. The 2007 report "Design to Win" laid out a comprehensive formula for achieving aggressive reductions in global climate change by 2030. The report identifies 16 interventions across all sectors and the single intervention with the largest emission mitigation potential by 2030 was the *"avoidance of lock-in emissions from inefficient new buildings and appliances"*. Furthermore, they calculated that this intervention would produce **three times** the emissions reduction as compared to retrofitting existing buildings and appliance replacement over the same time period. While energy efficiency is a usually a tenet of "green building", recent national reports suggest that these buildings are not nearly as efficient as we had hoped. The bar simply is not high enough and many are falling short due to poor overall design and execution. In Minnesota, several solid programs, including Energy Star for Homes (ESH), Building America, Green Communities, and MN GreenStar are paving the way to improved energy performance in new homes. However, their steps are small and incremental. Some builders and buyers are expressing an interest in taking bolder next steps. The knowledge and technology to make deep reductions in energy use is readily available. It simply has not been implemented and executed. This project will focus on how we can achieve, both technically and economically, that next level of home performance needed to meet our statewide energy and emissions goals.

Later this year, the EPA will roll-out a pilot program based on its very popular Energy Star for Homes along with the lessons learned from DOE's highly successful Build America program. This new program – tentatively titled "Advanced New Home Construction (ANHC)" – will **cut energy use in half** compared to typical code compliant houses. The existing pool of labeled Energy Star Homes in the metropolitan area can provide a rich resource of modeled and verified premium new homes – in essence, a platform from which this project can launch to reach a much higher level of energy performance. By inserting the more aggressive requirements of the ANHC into these existing ESH profiles, the resulting projections will more reliably reflect the building styles and practices of real Minnesota homes. Once the technical feasibility and potential benefits have been established, the market forces and policy implications that will hasten or hinder the adoption of these practices can be investigated. The EPA ANHC program designers have committed to providing this project team with technical assistance on the performance modeling and cost-benefit analysis. They also have offered survey design assistance for the market analysis through access to their Minnesota builder network.

The cleanest energy for Minnesota's future is the energy we don't use. Studies have repeatedly shown that energy needs can be reduced for a fraction of the cost that it takes to produce energy from alternative sources. This project will elucidate the fundamental changes necessary to produce superior, low-energy houses that will provide durable, cost-effective, and ongoing dividends to owners, the economy, and the environment over the life of the building. We simply can't afford to keep "locking-in" new homes that capture anything less than the potential that already exists within current knowledge, technology, and economics. **Small evolutionary gains must be replaced by a revolutionary systems-approach to designing and building low-energy houses.**

II. DESCRIPTION OF PROJECT RESULTS

This project will comprehensively evaluate EPAs new Advanced New Home Construction (ANHC) program to demonstrate its potential for Minnesota homes. Even though the information and technologies are currently available to cut home energy use in half, this potential is not being driven by policy makers, embraced by the building industry, or realized by homeowners. To overcome these barriers as quickly as possible, this project will demonstrate the technical feasibility, conduct a market analysis, and frame the policy implications and incentives needed to move future homes in this direction.

Result 1: Demonstrate Technical Feasibility of EPAs ANHC for MN **Budget: $ 229,726**

A thorough technical feasibility analysis of EPAs ANHC program will be conducted to see how it fits the building styles and practices of Minnesota homes. In addition to energy performance results and benefits,

critical constructability, durability and air quality issues will be identified and evaluated in the technical report.

Deliverables **Completion Date**

1. Develop and Validate Energy Star Homes (ESH) Database Platform **September 30, 2009**

The first step will collecting the extensive data available from a representative platform of 200+ existing Energy Star Homes that have been previously modeled, verified, and documented with assistance from RSR.

2. Update ESH Database with As-Built Testing Results and Utility Data **December 31, 2009**

The existing house data will be verified and reevaluated with as-built testing results. Utility bills for the houses will be collected, analyzed, and added to the ESH platform and database.

3. Apply ANHC Criteria for Comparison to ESH Database **June 30, 2010**

The ANHC program requirements will be overlaid on the ESH platform and re-modeled. The results will be compared to the original ESH modeling and usage data to identify the overall savings potential of the ANHC.

Result 2: Conduct a Market Analysis of the EPA ANHC Model **Budget: $ 162,765**

A comprehensive evaluation of market attitudes, behaviors, and signals for "significant" energy technologies, including market-based and government-initiated incentives, will be conducted. Based on a comprehensive literature review, a mixed methods approach of interviews and surveys of both builders and likely home buyers will be administered. Results will be integrated with systems models developed in the policy section below.

Deliverables **Completion Date**

1. Interview Development and Administration **June 30, 2010**

Structured survey instruments for interviews with stakeholders, builders, and consumers will be reviewed by an expert panel prior to administration. Summary data and interpretive reports, including evaluative matrices and qualitative information will be provided.

2. Survey Development, Administration, and Analysis **December 31, 2010**

With survey partner, Wilder Research, quantitative surveys will be developed, tested, and administered based on existing literature and interview findings from above. Summary data and interpretive reports of the analyses will be provided for stakeholders. This data will be incorporated into the policy design and impact models.

Result 3: Develop Policy Implications & Incentives for EPA ANHC Model **Budget: $ 86,280**

A systems-based analytical model will be created addressing multiple alternative policies related to energy and environmental performance of new homes. This framework will allow the state to examine several alternative policy designs in a consistent and transparent manner, thus demonstrating the impact and interactions between unique combinations of policies and identifying potential synergies or conflicts. Impacts of the ANHC will be specifically assessed. These models will address the many diverse components that must be coupled together in a consistent manner in order to understand the behavior of the entire system. Upon project completion the reports will provide access to all economic and environmental models developed in the project.

Deliverables **Completion Date**

1. Systems Analysis **March 31, 2011**

Key aspects of the ANHC and various policy designs will be simulated by altering key constraints, technical parameters, and pricing within the model to address environmental and economic impacts.

2. Final Report **June 30, 2011**

A summary document will be prepared, with recommendations for both governmental and private sector action.

III. PROJECT STRATEGY AND TIMELINE

A. Project Partners: In addition to the University of Minnesota partnership, there will be three external partners. EPAs ANHC program development team will assist with technical issues, survey design, and builder network development. Residential Science Resources will help create the platform database from existing Energy Star Homes. RSR has verified more than 1400 ESH in MN and are the primary contractors for Xcel Energy's Home Efficiency Program for New Construction. Wilder Research will be contracted to execute the market surveys for stakeholders, builders, and likely home buyers.

B. Project Impact: This project will facilitate and accelerate the market penetration of high-performance, low-energy houses in Minnesota that use one half of the energy of their code compliant counterparts.

C. Time: This project will take approximately 24 months to complete all three phases.

D. Long-Term Strategy (if applicable): Not Applicable

Project Budget

Cutting New Home Energy Consumption in Half:

Technical Feasibility, Market Analysis, and Policy Implications

IV. TOTAL PROJECT REQUEST BUDGET 7/1/2009 to 6/30/2011

BUDGET ITEM	AMOUNT	% FTE
Personnel: Patrick H. Huelman, PI, Energy analysis	$ 49,909	17%
Timothy Smith, Co-PI, Market analysis	$ 39,040	13%
Steven Kelly, Co-PI, Policy analysis	$ 19,585	6%
Thomas Schirber, Research Manager	$ 99,246	50%
2 Graduate Students (1 for Energy, 1 for Markets and Policy)	$ 157,944	50%
Undergraduate Students	$ 13,047	25%
Contracts: Residential Science Resources: Technical Consulting on ESH	$ 15,000	
Wilder Foundation Research Group: Builder & Market Surveys	$ 70,000	
Equipment/Tools:	$ -	
Acquisition (Including Easements):	$ -	
Restoration: *List # of acres.*	$ -	
Other: Dedicated software, supplies & expenses	$ 10,000	
Travel (both in-state and out-of-state)	$ 5,000	
TOTAL PROJECT BUDGET REQUEST TO LCCMR	$ 478,771	

V. OTHER FUNDS

SOURCE OF FUNDS	AMOUNT	Status
Remaining $ From Previous Trust Fund Appropriation (if applicable):	$ -	
Other Non-State $ Being Leveraged During Project Period:	$ -	
Other State $ Being Spent During Project Period:	$ -	
In-kind Services During Project Period:	$ -	
Past Spending:	$ -	

PROJECT TITLE: Cutting New Home Energy Consumption in Half: Technical Feasibility, Market Analysis, and Policy Implications

Project Manager Qualifications and Organization Description: Three University of Minnesota entities will be collaborating on this project. Patrick Huelman, Cold Climate Housing Coordinator, will be Project Manager.

The **Cold Climate Housing (CCH**) program was created in 1986 in response to potential durability and indoor air quality concerns in houses that came to light during the early 1980s and became nationally recognized for its "house as a system" approach. Today CCH continues this mission to provide the building industry with research-based information that will help them understand how buildings work and how to build high-performance houses that simultaneously provide comfort, efficiency, durability, and healthy indoor air. Collectively, the current CCH faculty have close to 100 years of experience in education of the building industry, private contracting, building science research, university teaching, code development, and consulting with government agencies and industry. CCH staff have trained thousands of builders, remodelers, code officials, and consumers. They have a strong publishing record on energy, moisture, radon, indoor air quality, and other building science issues in national peer-reviewed journals, as well as the popular press.

Patrick H. Huelman, is an Associate Professor in Residential Energy and Building Systems and Cold Climate Housing Coordinator. He is the lead faculty for the Building Science and Technology degree and a principal investigator of the Cloquet Residential Research Facility for hygrothermal testing. Pat will be the Project Manager and orchestrate all phases of this collaborative effort. He will lead the technical feasibility study. Pat has successfully managed more than 35 grants totaling more than $2 million, including three successful LCMR grants in the early 1990s. His areas of expertise include energy-efficient design, building and insulation systems, foundation systems, moisture control, ventilation strategies, and indoor air quality.

Tom Schirber, is a Fellow with the CCH program in Affordable Housing Technologies. Mr. Schirber is developing collaborations around affordable housing issues including neighborhood revitalization, building technology research, green building, and implementation of cost-reducing housing production strategies. Prior to coming to the University, Tom was project manager of Wilder Foundation's Home Ownership Development Collaboration. He assisted Twin Cities Habitat for Humanity and key CDCs in core neighborhoods in St. Paul with capacity building and production improvement. As a Community Housing Liaison at Wilder he served as a community organizer and catalyst implementing collaboration and broad community participation to increase the supply of affordable housing and support services.

The **Center for Sustainable Enterprise Development (CSED)** is an interdisciplinary research center created to address the interaction between business and governmental policy development, with a specific focus on issues of resource networks (natural, human, and social), product design and stewardship, and the role of public-private partnerships in effectively improving society's capabilities to address sustainable progress.

Timothy Smith is Associate Professor of Environmental Sciences, Policy, and Management and Director of the CSED. Dr. Smith's current research and consulting efforts focus on organizational adoption of energy efficiency, renewable energy, and other environmental performance enhancing technologies, as well as the effectiveness of marketing communications around "green" messaging and life cycle assessment. Sponsoring organizations include: US Dept. of Energy, US Dept. of Agriculture, MN Dept. of Commerce, MN Pollution Control Agency, 3M, AT&T, Andersen Windows, and Louisiana Pacific, and Pentair.

The **Center for Science, Technology and Public Policy (CSTPP)** fosters an understanding of the role of science and technology in society, particularly relationships to economic growth, health, the environment, education, and national security. CSTPP examines the effects of science and technology on society and on the political and economic relationships of nations. It is located within the Humphrey Institute that is nationally recognized for its role in examining public issues and shaping public policy at the local, state, national, and international levels and for providing leadership and management expertise to public and nonprofit entities.

Steve Kelley is a Senior Fellow at the Humphrey Institute and Director of the CSTPP. He served in the Minnesota Senate from 1997 to 2006 and the Minnesota House of Representatives from 1993 to 1996. Steve was chair of the Senate Education Committee for four years and was the chief author of numerous bills, including legislation that led to the creation of the Initiative for Renewable Energy and the Environment and several education policy bills. He served on utility committees in the House and Senate and authored many bills on telecommunications and information technology. Steve was a public member of the Minnesota Board of Medical Practice from 1984 to 1992 and served as its president for one year.