

Optimal Energy Efficient Design for Residential Construction and Renovation

Principal Investigator: James Goedert, Construction Systems
<http://www.const.unl.edu/faculty/goedert.shtml>



Abstract

This is a collaborative proposal between the College of Engineering, the College Architecture, industry partners, and governmental and non-governmental entities to develop innovations that increase the energy efficiency of new and existing residential housing stock in Nebraska. The members of this research team have worked both independently and collaboratively over the last few years to develop expertise with significant results toward improving the quality and visibility of energy related research in Nebraska. The most obvious result is the ZNETH house that is nearing completion. This project has exposed over 100 students in the last six months to residential energy efficiency. It has been featured in numerous invited presentations, published in conference proceedings, the subject of several tours and reported in the news media. The objective of this research is to investigate, design and test alternative building envelopes, systems and sensor technologies that show promise for optimizing the life cycle cost of residential construction and renovation in Nebraska. The optimized design for ZNETH II will utilize lessons learned from ZNETH I, the City of Lincoln Project, and other project from around the country. The ZNETH II design resulting from this proposal will be used in a full scale model that will be monitored to validate the simulated results of this study. This model will be the second in a repeating series expected every two years featuring the most current knowledge and technical innovations as developed and/or adopted by this team of researchers.

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This is a proposal to accelerate the development and adoption of technologies that will radically improve the energy efficiency of residential housing in Nebraska. The goals of this proposal are to develop residential design with building envelope materials, components, systems and construction techniques to enhance building energy conservation and to develop a plan to enable technology transfer and continued funding for technology advancements of high performance residential buildings to expand economic opportunities for Nebraska and the nation. Construction of the first ZNETH project in Nebraska is nearing completion and will be used to test a number of technologies. It features several envelope options, solar PV panels, geothermal applications, and was issued the first residential wind turbine permit for the city of Omaha. It has exceeded all expectation in terms of public exposure with numerous TV & radio news broadcasts, newspaper and magazine articles, tours for business, industry, home owner associations, and professional societies including: Nebraska Society of Professional Engineers, American Society of Heating Refrigeration and Air-conditioning Engineers, Advancing Productivity Innovation and Competitive Success, American Institute of Architects, and the Nebraska Chapter of the U.S. Green Building Council. Since January of this year, over 1000 people have toured the ZNETH project. This is a proposal to design a second ZNETH using lessons learned from the first ZNETH in Omaha, the Archspace house in Lincoln and other projects from around the country in an attempt to reduce energy consumption by more than 40% while increasing construction costs by less than 10%. The team will investigate a new envelope configurations and thicknesses to optimize a design that meets the previously stated criteria. The team will also develop a ten year strategy for continuously improving the energy efficiency to meet the 2035 goals for residential construction by 2020 while minimizing the increase in capital cost. The strategy will include a ZNETH project every two years featuring the improvements in a prominent location accessible to the public. The strategy will also include a method for disseminating information to architects, engineers, planners, developers, contractors and homeowners through a number of venues that may including news, tours, presentations and seminars.