



State Energy Program — Special Projects

*30% Better — Nebraska's
Upgraded Commercial Building
Energy Code*

FINAL REPORT

Nebraska Energy Office

DOE Award Number: DE-FG26-08NT05551

CFDA Number 81.119

Period of Performance: September 10, 2008 — December 31, 2013

Project Overview

The Department of Energy's Office of Energy Efficiency and Renewable Energy, through the Office of Weatherization and Intergovernmental Program, announced a competitive grant funding opportunity seeking innovative state programs designed to foster energy efficiency and renewable energy policies, practices, technologies and programs. The State of Nebraska received an award in the area of Advanced Building Energy Codes that maximized energy efficiency or renewable energy supply in the shortest time with the least cost, and that would alter, in a fundamental way, the manner in which the market mediated energy decisions. Such strategies were demonstrated through the *30% Better - Nebraska's Advanced Commercial Building Energy Code (30% Better)* program.

At the conclusion of the State Energy Program Special Project *30% Better* funding cycle, the Nebraska Energy Office had not only achieved, but exceeded, its stated goals. The diverse portfolio of projects and methodologies developed and implemented under the *30% Better* program have benefited public entities, private companies, non-profit organizations, and private citizens across this state and furthered the Energy Office's missions to promote the efficient, economic and environmentally responsible use of energy.

Project Goals and Achievements

The Nebraska Energy Office outlined the goals below for the *30% Better* program. All goals were effectively accomplished and surpassed.

- ◆ **GOAL:** Adopt a commercial building energy code in Nebraska that is 30% beyond the building and lighting requirements set forth in ASHRAE 90.1-2004 and 2006 International Energy Conservation Code (IECC) and a Code that meets the mechanical system requirements of the ENERGY STAR® program or the Consortium for Energy Efficiency's *High-Efficiency Commercial Air Conditioning and Heat Pump Initiatives*.
- ❖ **ACHIEVED:** As comparative studies were completed, and then utilized by the Nebraska Legislature, it became increasingly clear to Energy Office that moving from IECC 2003 to IECC 2006 would be a setback for the state. The Legislature, based on the input from Energy Office, promptly made the adjustment of pending legislation to forego IECC 2006 and made the leap to IECC 2009, becoming an early adopter of that code on a statewide basis.

- ◆ **GOAL:** Adopt and implement advanced building codes by utilizing the State's previous successful process of updating the statewide energy building code to the 2003 International Energy Conservation Code (IECC) for residential and commercial buildings.
- ❖ **ACHIEVED:** As an on-going component of the Nebraska Energy Office mission, a study was completed for the IECC 2009 code, highlighting the positive aspects of adopting the IECC code at the 2009 level. An additional study specifically for the *30% Better* program also strongly indicated that a move to IECC 2009 would be the wisest course of action. Utilizing the knowledge, tools, feedback and experience from the previous code update, Energy Office approached the Legislature to change pending legislation. A legislative hearing was held, and the Unicameral voted to adopt the IECC 2009 as the *Nebraska Energy Code*. The additional benefit to Nebraska was one code – for both the residential and commercial sectors.
- ◆ **GOAL:** Implement the advanced commercial building energy code at the local level and demonstrate how other states and localities can achieve similar success with upgraded codes and enhanced enforcement techniques.
- ❖ **ACHIEVED:** It was not the intention of the State of Nebraska to develop its own commercial building code, but to expand on existing standards and energy efficiency programs. Through the funds awarded by DOE, Nebraska became an early adopter and implementer of the advanced building proposals and design guides of ASHRAE and International Code Council (ICC). With executive level commitment to advanced building codes from Nebraska Governor Dave Heineman, and the previous experience of the Energy Office staff in effecting legislative change in building codes, Energy Office was instrumental in changing the statute from the 2003 IECC to the 2009 IECC.

Project Implementation

Project Summary

The Energy Office welcomed the opportunity to work with partners and stakeholders to maximize the impact of the *30% Better - Nebraska's Upgraded Commercial Building Energy Code* program and invest in projects that would benefit the state long after the projects were completed. To



achieve success, Energy Office’s approach to accomplishing the program goals was to invest in a variety of project types.

Best Practices and Lessons Learned

Early engagement and close collaboration with the executive and legislative branches of state government resulted in successful passage of the updated *Nebraska Energy Code*.

- ◆ Creating and maintaining alliances with the local codes staff, architects, engineers, builders, and other

stakeholders produced popular and effective training classes and a regional conference.

- ◆ Willingness on the part of Energy Office to share the successful processes that led to the adoption of advanced energy building codes and innovative “best practices: in enforcement techniques encouraged regional and national energy code “buy-in.”
- ◆ Potential Impact: For the 15-year period after the adoption of the new advanced commercial building energy codes (projected to be effective in 2011), the estimated impacts are quantified below.

Construction Impact: 18,735 new commercial buildings* covering 478,267 million square feet with a value of more than \$7.5 billion.

ENERGY USE SAVINGS				
Electricity		Natural Gas		
5,752,661,514 kwh		98,140,405 therms		
ENERGY COST SAVINGS				
Electricity		Natural Gas		
\$356,089,680		\$94,410,960		
TOTAL COST SAVINGS				
\$450.5 Million in Energy Cost Savings				
ENVIRONMENTAL SAVINGS				
	Carbon Dioxide	Nitrogen Oxide	Sulfur Dioxide	Mercury
Electrical Savings	14,128,536,653 lbs	27,388,425 lbs	54,063,510 lbs	123,078,195 Milligrams
Natural Gas Savings	1,149,027,742 lbs	1,472,107 lbs	5,887 lbs	0 Milligrams
Cumulative Savings	15,277,564,395 lbs	28,860,532 lbs	54,069,397 lbs	123,078,195 Milligrams

*Since the typical lifespan of commercial buildings is 50-70 years, benefits would continue to accrue beyond the 15-year period noted above.



Key Partners

Nebraska Public Power District
Omaha Public Power District
Johnson Controls
American Institute of Architects -Nebraska Chapter
Britt/Makela Group
Nebraska Energy Office

Grant Activities

The Energy Office developed the funding plan based on the objectives listed below and considered DOE's objectives when developing plans to administer the program.

- 1) Adopt a commercial building energy code that is 30% beyond the building and lighting requirements set forth in ASHRAE 90.1-2004 and IECC 2006 and a Code that meets the mechanical system requirements of the ENERGY STAR® program or the Consortium for Energy Efficiency's *High-Efficiency Commercial Air Conditioning and Heat Pump Initiatives*.
- 2) Adopt and implement advanced building codes by utilizing the State's previous successful process of updating the statewide energy building code to the 2003 International Energy Conservation Code for residential and commercial buildings.
- 3) Implement the advanced commercial building energy code at the local level and demonstrate how other states and localities can achieve similar success with upgraded codes and enhanced enforcement techniques.

The program was implemented in three phases:

- Phase 1: Comparative Codes Study
- Phase 2: Education, Information and Code Adoption
- Phase 3: Training, Enforcement and Replication

Deliverables

Phase 1: Comparative Codes Study

The Comparative Study was initially set to compare IECC 2003 and 2006. At the same time, IECC 2009 came out, so the study was expanded to include the new codes. It became apparent that for many jurisdictions in the state, IECC 2009 was the better choice. The original goal of the *30% Better* program was to move the state to IECC 2006, but after studying the positive impacts, the state Legislature skipped over IECC 2006, and became an early adopter of IECC 2009 at the state level.

Phase 2: Education, Information and Code Adoption

Building Codes

The Building Codes goal focused on providing information, training and technical assistance on residential and commercial building energy codes to city and county code officials and members of the construction industry. The Energy Office staff worked to update the state's building energy code from the 2003 International Energy Conservation Code to the 2009 IECC through state legislation. The Energy Office offered trainings and technical assistance to ensure energy code compliance, enforcement and inspections.

History

In 1998, the State of Nebraska started updating its energy codes. The initial step was the passage of legislation requiring all newly constructed state-owned and state-funded buildings to meet the requirements of the 1998 IECC. The second step was accomplished in 2003 when a study was completed showing the economic and energy impacts of upgrading the statewide energy code to the 2000 IECC. That study, which focused on the residential sector, showed the adoption of the code would result in more than \$59.6 million (in 2003 dollars) saved over the life of houses built before 2015, even if there was no growth in the housing market. This meant a Nebraska homeowner would save up to \$295 a year, depending on where the homeowner resided.

This information gave legislators sound, undeniable data to use as the basis for passing legislation that led to the unanimous adoption of the 2003 IECC as the *Nebraska Energy Code*. The law was signed by the Governor in 2004 with an implementation date of July 1, 2005. Code enforcement and training was included in the legislation.

Significant Results

The Energy Office formed a Building Codes Advisory Council consisting of commercial builders, home builders, code inspectors, engineers, architects, utilities, and HVAC technicians. The Committee met regularly to discuss code adoptions, enforcement, trainings, and compliance. The Energy Office also worked closely with the Nebraska Legislature to draft and support the successful passage of LB 329 "Update to the International Energy Conservation Code and change Nebraska Energy Code provisions." The bill, which updated the Nebraska Energy Code from the 2003 IECC to the 2009 IECC, was approved and signed into law on April 14, 2011 and took effect on August 27, 2011. The



Energy Office drafted and promulgated rules and regulations for the 2009 IECC. Training and technical assistance was provided to local code jurisdictions on the code adoption. Trainings were also held for the construction industry. The Energy Office continues to work with local code jurisdictions to assist them in assessing code compliance and enforcement and provides technical assistance and training regarding specific code issues beyond the funding this grant provided.

Phase 3: Training, Enforcement and Replication

Funding received under the award, along with leveraged funding from another building codes grant and matching funds from Omaha Public Power District, was used for a hands-on **REScheck**[™] training for the IECC as part of the 2012 Great Plains Energy Codes Conference. Energy Office organized and hosted the event held in Omaha, Nebraska in October 2012. The conference focused on the 2009 International Energy Conservation Code, 2012 IECC beyond code programs, and innovative ideas for code compliance. Nearly 175 builders, code officials, architects, engineers, HVAC installer/distributors, government officials, product suppliers, and Home Energy Raters from 21 states, the District of Columbia, Canada and Guam attended. Some highlights of the conference include:

- ◆ Keynote addresses from prominent code experts.
- ◆ Tours of energy efficient buildings.
- ◆ A hands-on **REScheck**[™] training for the IECC to code officials, builders, engineers and other industry professionals.
- ◆ Presentations from Trane, National Fenestration Rating Council, Lutron and the Weidt Group on products and projects for energy efficiency and code compliance.
- ◆ 28 educational sessions in four tracks with 38 speakers who are experts in their field. All conference presentations are on the Energy Office website at http://www.neo.ne.gov/home_const/iecc/iecc_codes.htm
- ◆ An interactive case study session in which participants heard the details of a non-compliant building in Nebraska and discussed ideas for compliance.

Pictures from the conference on the Energy Office's Facebook page: <http://www.facebook.com/NebrEnergyOffice?ref=hl>

Grant funds were also used to provide an analysis of 2012 IECC titled "Energy Impact Study of the 2009 IECC and 2012 IECC Energy Codes for Nebraska." The study found the 2012 IECC performs best with average savings in whole house energy costs at 11% with savings ranging from

\$171 to \$553 per year, depending on house size and locations. A copy of the study can be found at:

http://www.EnergyOffice.ne.gov/home_const/iecc/documents/NEcodesreport3-14-12.pdf.

After publication, the website received 18,674 hits in the first quarter.

The grant also provided funding for ten IECC compliance trainings at locations throughout the state. In addition, three **REScheck**[™] and three **COMcheck**[™] trainings were held in 2012 with a total of 76 attendees. Four American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) trainings were held with a total of 125 attendees and three building science trainings were held with 69 participants. Approximately 200 quick reference codes official guidebooks were also purchased with these funds and distributed to codes jurisdiction staff across the state.

Energy Office staff worked with two national appraiser training services, the Nebraska Realtor's Association and the Nebraska Board of Appraisers, to coordinate the delivery of Green Building/Energy Efficiency training for Nebraska's appraisers. Training was delivered at three sites, Lincoln, Omaha, and LaVista, to a total of 102 appraisers.

VandeMusser Design was contracted to provide the HVAC load and sizing calculations for the development of a Nebraska specific "rule of thumb" HVAC table. Prepared as a "quick-check" in card form, the Manual J Tool was made available for distribution to the state's code jurisdictions.

Project Successes

- ◆ State legislation resulted in one state code for residential and commercial – IECC 2009.
- ◆ A staff member from Energy Office served on the IECC 2009 and 2012 Code Development Committee.
- ◆ The final study was completed and submitted to the Energy Office.
- ◆ The Manual J Tool was provided to the code jurisdictions within the state.
- ◆ Trane Trace training was provided to one staff member as a knowledge segment for code compliance.
- ◆ Blower Door training with an on-site demonstration was provided to code officials in conjunction with the Nebraska Code Officials Association meeting. A separate training class was held for builders.



Financial

The funds for the *30% Better* grant were expended per guidelines and regulations. Federal funds provided 66 percent of expended funds; 28 percent came from matching funds. An additional 6 percent of funds were applied to the program via conference registration fees and conference sponsors.

	<u>Budget</u>	
Federal Share Expenditures	\$303,065.00	
Total Recipient Share Required	\$129,912.00	
Total Federal Program Income Earned	\$23,790.00	
Total Budget	\$456,767.00	
<u>DOE Award</u>		
<u>Account</u>	<u>Budget</u>	<u>Expenditures</u>
Personal Services	\$120,274.00	\$73,079.92
Operating Expense	\$27,000.00	\$45,798.66
Travel Expense	\$8,170.00	\$9,392.70
Contractual Expense	\$147,621.00	
Comp CBEC Study		\$143,056.00
Other Contractual Services		\$29,605.10
Contractual Service-Travel		\$3,441.60
3rd Party Reimbursement		\$(1,308.98)
Total Expenditures	\$303,065.00	\$303,065.00
<u>Matching Funds</u>		
<u>Account</u>	<u>Budget</u>	<u>Expenditures</u>
Total NEO Admin Expenses/Balance	\$64,912.00	\$98,702.00
American Institute of Architects:	\$5,000.00	\$5,000.00
Nebraska Public Power District:	\$30,000.00	\$30,000.00
Omaha Public Power District:	\$20,000.00	\$20,000.00
OPPD Expenses included with NEO Costs:	\$10,000.00	
Total Expenditures	\$129,912.00	\$153,702.00
Conference Registrations		\$(13,130.00)
Conference Sponsors		\$(10,660.00)
Total		\$(23,790.00)
Total Matching Funds	\$129,912.00	\$129,912.00