Great Plains Energy Codes Conference

Show Me the Costs!
Energy Code Adoption Using Hard Data

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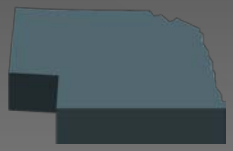
Show Me the Costs!

- Nebraska Energy Code History
  - In 1980 the Nebraska Legislature passed the first state-wide energy code. In 1983 the Nebraska Legislature adopted the 1983 Model Energy Code (MEC) as the Nebraska Energy Standard
  - In 1992 the U.S. Congress adopted the Energy Policy Act. Under that law each state is required to adopt the most recent editions of energy code for commercial construction and provide documentation on energy code updates regarding residential construction. It also required that buildings constructed with certain federal funding must meet minimum federal energy code requirements
  - In 1989 and 1996 Nebraska's Legislature considered updating the state-wide energy code. Both times, homebuilder's associations claimed that more progressive energy code requirements were too costly and would make it more difficult for first-time homeowners to buy a house. The legislation did not advance from committee



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- Nebraska Energy Code History
  - In 1999 the Legislature passed LB 755 which required that any building **constructed in-whole or in-part with state funds** and **state-owned buildings** must meet the minimum requirements of the 1998 International Energy Conservation Code (IECC)
  - In 2002 the U.S. Dept. of Energy funded a Life Cycle Cost Analysis, completed by the University of Nebraska College of Architectural Engineering, that studied the impact that passage of the 2000 IECC would have on new homes constructed in Nebraska
  - In 2003 the Legislature passed LB 643 which updated the requirements for buildings **constructed in-whole or in-part with state funds** and **state-owned buildings** to meet the requirements of the 2000 IECC
  - In 2004 the Legislature passed LB 888 updating the **state-wide energy code** to the 2003 IECC
  - In 2011 the Legislature passed LB 329 updating the **state-wide energy code** to the 2009 IECC

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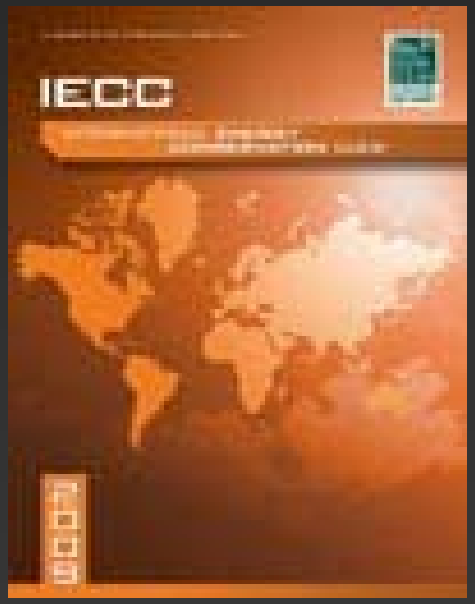
Since 2002 the Nebraska Energy Office has completed, and provided to the Legislature, Energy Impact Studies of each of the International Energy Conservation Code updates as they are published. Studies have been completed on:

- The 2000 IECC
- The 2003 IECC
- The 2006 IECC
- The 2009 IECC
- The 2012 IECC



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- The Energy Impact Study residential analyses included:
  - Evaluation of 4 home styles consistent with typical construction in Nebraska, in 3 or 4 locations in the state with diverse climate considerations
  - Occupant loads, thermostat settings and appliance loads based on national standards recommendations
  - RS Means Residential Cost Data for each building component and location
- The Initial Study included:
  - A Nebraska average Energy Code analysis that took into account that many jurisdictions were exceeding the requirements of the 1983 MEC in their local codes
  - Energy cost savings per home and state-wide based on Nebraska utility rates for each location
  - A life cycle cost analysis performed over a 30 year period
- Each Study was completed by an Independent Analyst
- The Initial Study was reviewed by a second Independent Analyst

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- The Initial Energy Impact Study concluded:
  - An upgrade to the 2000 IECC from the 1983 MEC would generate dollar savings from reduced energy use in excess of any mortgage payment increases due to higher construction costs. ***The difference for a Nebraska homeowner was between $50 and $295 a year in savings, depending on location***

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- The Initial Energy Impact Study also concluded:
  - An upgrade to the 2000 IECC from the current average code used across the state produces first year net savings in every case. While the savings were not as dramatic, they were compelling: ***The difference for a Nebraska homeowner was between $25 and $124 a year in savings, depending on location***

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- The Study reviewing the 2006 IECC requirements for residential construction concluded:
  - Homes constructed according to the requirements of the 2003 IECC consumed less energy annually for heating and cooling in the Chadron and Norfolk climates
  - The 2003 IECC also consumed the least energy in Omaha for houses with 18% window to wall ratio. Omaha houses with window to wall ratios in excess of 15% or below, the 2006 IECC would result in less energy consumption
- The Study reviewing the 2009 IECC requirements for residential construction concluded:
  - Homes constructed according to the requirements of the 2009 IECC consumed less energy annually for heating and cooling in Omaha, Chadron, and Norfolk. The reduction in whole-house energy consumption ranged from 3 to 12%
  - The energy savings were greatest in the Omaha climate zone and were much smaller in Chadron. Most of the energy savings are due to new requirements for duct sealing and high-efficacy lighting. In the colder climate zones, the 2009 IECC actually requires less insulation than the 2003 IECC, which offsets a portion of the savings due to these new measures

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- The cost analysis for upgrading a typical 1852 sq. ft. ranch home from the 2003 IECC to the 2009 IECC concluded:
  - For a home constructed in Omaha with 15% window to wall ratio and a conditioned basement, the total estimated increase in construction cost is $476 for meeting the requirements of the 2009 IECC
  - This same home could expect to experience $164 in annual energy savings, providing a less than 3 year simple payback for the homeowner
  - In most other cities, and in Omaha homes with a window to wall ratio greater than 18%, the construction cost for the 2009 IECC requirements is actually lower than for the 2003 IECC. Since the energy study also showed energy savings for those cases, this provides instant payback for the typical homebuyer
- The following chart shows the construction cost difference per specific code requirement in the 2009 IECC

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Code Change	Construction Cost Change	Notes
Exterior walls	$0 to -$756	$0 for Omaha homes with 15% window to wall ratio
Basement walls	$0 to -$112	$0 for all homes except Chadron 18% window to wall ratio
Ceiling	$0 to -$739	$0 for Omaha homes with 15% window to wall ratio
Floor	+$499	Not applicable to most NE homes – only required if basement unconditioned
Programmable thermostat	+$19	Required for all homes.
High efficacy lighting	+$22	Required for all homes.
Duct sealing and testing	+$185	Required for all homes.
Air sealing and testing	+$250	Required for all homes.
Estimated total (Omaha, 15% window to wall ratio, conditioned basement)	+$476	$476 additional construction cost for 2009 IECC
Estimated total (all cities, 18% window to wall ratio, conditioned basement)	-$1,019	$1,019 reduced construction cost for 2009 IECC

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- The Study reviewing the 2012 IECC requirements for residential construction concluded:
  - The findings of this study indicate that the 2012 International Energy Conservation Code would result in less energy consumption for homes in all areas of the state. The benefit can be assigned to two major areas: lighting and heating. There is little change in cooling energy use. Lighting energy accounts for approximately 5% of the total reduction. The remainder of the savings is attributable to heating. The largest contribution to the savings in heating energy is achieved by increasing airtightness to 3 ACH50
  - The average savings in whole-house energy cost was 11%. Depending on house size and location, the savings range from $171 to $553 per year, with an average annual savings of $311

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- In 2009 the Nebraska Energy Office contracted with Leo A. Daly to complete a Nebraska Specific Advanced Commercial Building Energy Code Study. The study focused on the energy and cost savings associated with the construction of ten common building types in three representative climate zones of Nebraska: Chadron, Norfolk, and Omaha. The buildings included:
  - Large Office Building with 38% window-to-wall ratio
  - Large Office Building with 18% window-to-wall ratio
  - Small Office Building with 38% window-to-wall ratio
  - Small Office Building with 18% window-to-wall ratio
  - Small Retail Building
  - Retail Strip Mall
  - Large Big Box Retail
  - Elementary Education Building
  - Secondary Education Building
  - Warehouse

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- The buildings were modeled and were found to be capable of achieving the 30-percent energy reduction by employing common building industry energy savings strategies
- The specific strategies varied for each building type to achieve the 30-percent compliance. The strategies included but were not limited to:
  - High Efficiency HVAC Systems
  - Energy Recovery Systems
  - Enhanced Wall Insulation
  - Increased Roof Insulation
  - High Performance Glazing
  - High Efficiency Lighting
- Building occupancy densities and operational schedules for each model were defaulted to ASHRAE-recommended values
- The estimated capital, operating, maintenance and replacement costs for energy-affecting systems were also included in the 20-year comparative life cycle cost analysis
- An analysis regarding the environmental impact of the related reduction in carbon dioxide, nitrogen oxides, sulfur dioxide, and mercury was also included

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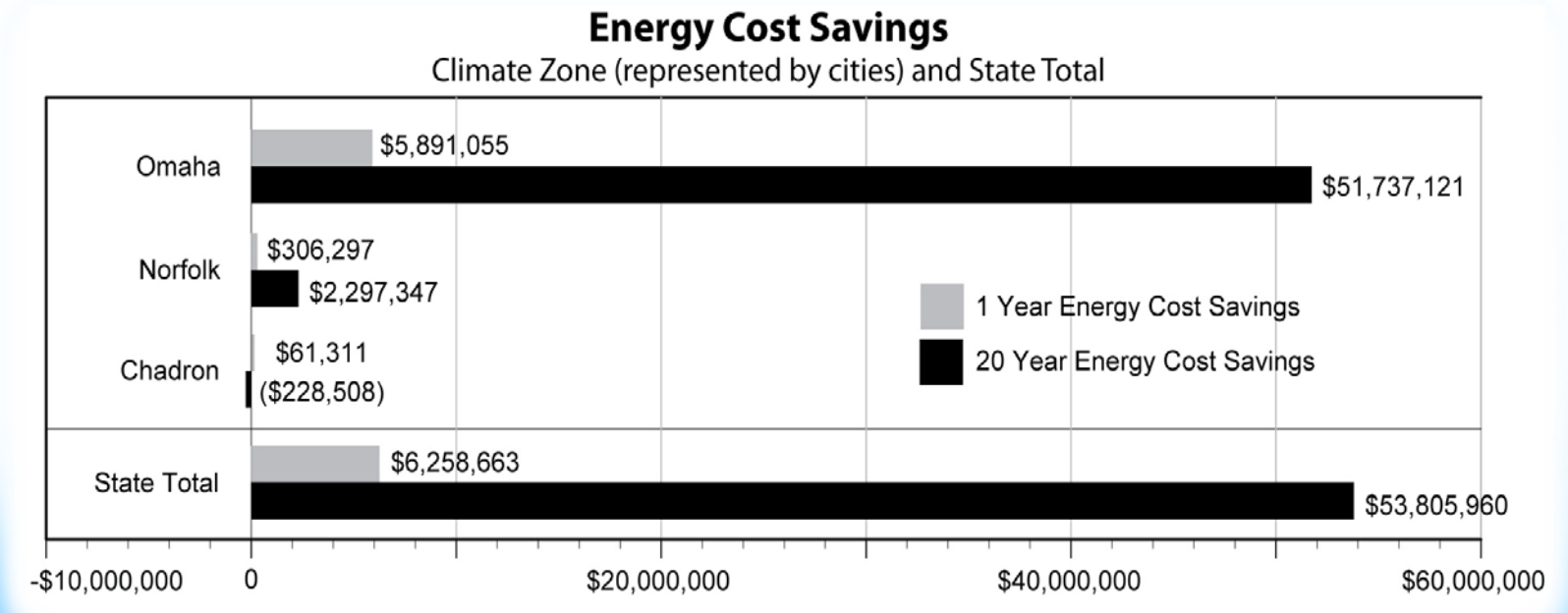
- The Nebraska-Specific Advanced Commercial Building Energy Code Study concluded:
  - An Increase of Between 1.28 and 3.36 Percent in Building Cost Achieves 30 Percent in Energy Savings
  - After 20 Years, Energy Cost Savings in Commercial Buildings Totals $53.8 Million



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- *The completion of Energy Code Analyses that incorporate both the implementation costs and energy savings costs has allowed Nebraska to:*
  - *move forward with the adoption of with appropriate, cost-effective Codes*
  - *assist local jurisdictions and entities in their efforts to provide beyond-code alternatives*
  - *provide new homeowners with affordable and comfortable homes that will continue to offer savings well into the future*