Updating State Energy Codes for New Homes Would Deliver Significant National Savings

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If every state in the nation adopted up-to-date residential building energy efficiency codes—only 10 states have done so—the energy savings realized over a decade from all houses built in just one year would total about 2.4 billion kilowatt hours (kWh). That's enough to power all the homes in Tucson, Ariz., for a year.

Those sizable estimated savings were calculated by a pair of economists at the National Institute of Standards and Technology (NIST). Their analysis* used the newly developed residential database in NIST's Building Industry Reporting and Design for Sustainability (BIRDS) software to measure the energy, environmental and cost performance of newly constructed homes located in 228 different cities and climates zones in the United States.

Credit: NIST

Freely available from NIST, BIRDS is a combination of software tools and building databases for evaluating the costs and benefits associated with alternative building designs, technologies and codes and standards (http://ws680.nist.gov/Birds). Just released, BIRDS Version 2 includes all the capabilities from BIRDS Version 1—which was focused on commercial buildings—and has added a database for residential building analysis.

The economists' simulation tallied significant reductions in energy consumption that could be reaped if all states adopted the 2012 version of the International Energy Conservation Code (IECC). Updated about every three years, the IECC is a model efficiency standard often incorporated into state regulations.

National adoption of the 2012 IECC by states with energy codes based on older editions of the IECC would trim annual energy consumption by an

average of nearly 20 percent for newly constructed houses. Over the course of a decade, savings from just the houses built in a single year would translate into 2.4 billion kWh in total energy consumption avoided over those built to comply with the current mix of energy codes. In turn, these energy savings would translate into additional environmental and economic impacts that also can be calculated using BIRDS for analyzing sustainability performance over time horizons ranging from one to 40 years.

The energy cost savings associated with these energy consumption reductions realized over 10 years, the NIST economists estimate, would total $1 billion—a 15 percent drop compared with the status quo. And it would reduce the houses' total carbon footprint by 9.3 million metric tons (an 11 percent decrease), avoiding the equivalent of a year's worth of carbon emissions from about three coal-fired power plants.

According to the analysis by Kneifel and O'Rear, other observations of nationwide adoption of the 2012 IECC include:

- The volume of new home construction is the "key driver" of the magnitude of reductions in energy use, energy costs and carbon emissions, with Texas and North Carolina realizing the largest benefits in all three sustainability categories.
- States in colder climates would realize greater percentage reductions in energy use, energy costs and carbon emissions than those in warmer zones.
- Factors such as electricity and natural gas prices and energy fuel mixes also impact the relative reductions across the United States.

"With the addition of the residential database, BIRDS becomes a more comprehensive tool for addressing questions about building energy efficiency and sustainability," Kneifel says. "There is a perspective that there are costs to building more sustainably. BIRDS offers an integrated approach that allows a user to weigh both the economic and environmental costs and benefits of a building, using practical metrics, data and tools."

The researchers continue their work on further improving BIRDS. In 2016, BIRDS Version 3 will be released by NIST. It will include yet another database, which will focus on low-energy home designs based on NIST's Net Zero Energy Residential Test Facility as well as additional options for customizing user input and output.

*J.D. Kneifel and E.G. O'Rear, *Benefits and Costs of Energy Standard Adoption in New Residential Buildings: National Summary*, NIST Special Publication 1194, June 2015. DOI: http://dx.doi.org/10.6028/NIST.SP.1194