BIRDS is for sustainability: New NIST tool for evaluating building performance, trade-offs

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Designing a building that simply meets local code requirements is not necessarily the optimal way to do it when you consider all the long-term costs. Now, building professionals in more than 200 U.S. cities can use a new database developed by the National Institute of Standards and Technology (NIST) to evaluate whether it pays to exceed code requirements for energy efficiency by tallying expected costs, kilowatts expended, carbon emissions and other impacts over a planned commercial building's lifetime.

Called BIRDS (Building Industry Reporting and Design for Sustainability), NIST's new database and software tools are designed to assess three major determinants of building sustainability: energy, environmental and cost performance.

Focusing initially on 11 building prototypes that account for about half of U.S. new commercial construction annually, the online data package features an innovative "whole building measurement system." An integrated set of metrics gauges sustainability of materials and energy usage, assesses carbon footprints and 11 other indicators of environmental performance, and tabulates economic costs over nine different investment horizons.

BIRDS complements NIST's popular tool known as BEES (Building for Environmental and Economic Sustainability) that allows a user to

measure economic and environmental impacts of building products, ranging from concretes to roof coverings to floor coverings.

Due to the complexity of a building and the hundreds or thousands of products that are required to construct and operate the structure, it is not feasible to use typical life-cycle assessment approaches to estimate its environmental performance.

Instead, BIRDS implements a novel hybrid life-cycle assessment (LCA) approach to evaluating the environmental performance of abuilding. The new tool combines two separate LCA approaches—"top-down" environmental input-output data and "bottom-up" process-based data—to calculate a more accurate environmental impact.

NIST's aim is to make LCA and life-cycle costing—analytical methods now mostly plied by specialists—more accessible with hands-on tools anyone can use to answer "what if" questions when planning or designing a new office building, retail store, or any of nine other types of commercial structures.

"BIRDS simultaneously considers environmental, energy and economic performance," explains Joshua Kneifel, the NIST economist who led development of the database and its measurement tools. "Measuring a building's sustainability performance required us to pay special attention to establishing consistency among its many dimensions."

"The metrics are solidly based on science," says Ravi S. Srinivasan, University of Florida assistant professor of low and net-zero energy buildings who beta-tested the tool. "Yet, BIRDS is very easy to use. By including operating energy use—as well as addressing the question, 'Can I get my money back?'—it helps moves life-cycle assessment out of the realm of primarily academics and researchers."

Performance trade-offs are inevitable during design and construction. BIRDS can help architects, builders, prospective owners, building code regulators and others strike an attractive balance between sometimes competing considerations.

"Buildings are complex systems, and how they perform is not simply the sum of their many parts," Kneifel explains. "With BIRDS, anyone can measure and compare operating energy use through detailed simulations, materials use through innovative life-cycle inventories, and building costs over time."

One key question that users can tackle with BIRDS is whether exceeding the energy efficiency requirements of local building codes yields a positive result—as defined by each user. Operating energy use can be assessed for five increasingly more stringent building energy standards. Four are successive versions (1999, 2001, 2004 and 2007) of a commercial building energy standard issued by ASHRAE,* a building technology standards organization.

As of December 2011, 40 states had adopted one of the four as the basis for their energy code for commercial buildings. Ten states did not have a building energy code, leaving cities and towns to adopt their own.

BIRDS's fifth and most energy-efficient standard is a 2009ASHRAE standard for high-performance green buildings.

Although bound by state or local codes, which set the minimum for [energy efficiency](#), builders, regulators and others can use BIRDS to judge whether going beyond the current code would deliver operating energy savings that exceed the initial investment in energy upgrades.

Both the economic and environmental performance of buildings depends on the structure's function, size, location, and the efficiency of its energy

technologies. BIRDS includes city-specific construction and energy costs and other local data, and allows users to home in on a particular city, state or climate zone, or they can broaden their perspective to a region or the entire nation.

Similarly, the new tools open a window on the cascading effects of design decisions—how building to one or another energy standard affects everything from cost to water use to impact on air quality.

"The ultimate goal of BIRDS is to help people make informed choices," Kneifel says. He encourages building professionals and others to check out the database and test their own "what if" building scenarios.

BIRDS will grow more robust and add new capabilities in future versions, first by adding the building types needed to fully represent the nation's stock of 5 million commercial buildings. Coming versions will include new houses and, then, energy retrofits for existing homes and commercial buildings. Additional flexibility will be incorporated to give users greater ability to customize the analysis to their specific situation and interests.

More information: * ASHRAE Energy Standard for Buildings Except Low-Rise Residential Buildings (ASHRAE-90.1-). For more information: www.ashrae.org/resources —publications/bookstore/standard-90-1#2007

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