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Tech Briefs

BEES software weighs performance data on green solutions • Green roofs grow in numbers by popular demand

What's the Buzz: Use BEES to Design Greener, Lower-Cost Buildings

Designers are increasingly asked to address the issue of "green" building materials. How do you identify environmentally preferable products? Is a product environmentally preferable if it has recycled content? Is it not preferable if it offgasses during use? Are mainstream products always less preferable than products marketed and perceived as "environmentally friendly"? Do environmentally preferable products always cost more? Not necessarily, according to the BEES (Building for Environmental and Economic Sustainability) software.

BEES 2.0, an updated, expanded version of the powerful software designed to help the construction industry select cost-effective "green" building products, can be downloaded to your computer for free (www.bfrl.nist.gov/oae/bees.html). BEES Version 2.0 is aimed at designers, builders, and product manufacturers, and it includes comparative environmental and economic performance data for over 65 building products.

The National Institute of Standards and Technology (NIST) Building and Fire Research Laboratory began developing the decision-making tool in 1994 to help the design community measure a product's environmental and economic impact. The idea was to provide key science-based information often lacking in product-selection decisions. The NIST research has been supported by the U.S. EPA Environmentally Preferable Purchasing Program and the White House–sponsored Partnership for Advancing Technology in Housing (PATH).

BEES 2.0 evaluates generic products for framing, exterior and interior wall finishes, wall and roof sheathing, ceiling and wall insulation, roof and floor coverings, slabs, basement walls, beams, columns, parking-lot paving, and driveways. Each product category contains U.S. average performance data for competing products. For example, the "floor covering" category surveys ceramic tile, linoleum, vinyl tile, different types of carpets, marble, and terrazzo. Similarly, exterior wall alternatives include brick, stucco, and aluminum, cedar, and vinyl siding. Future BEES versions will evaluate brand-specific products, allowing for benchmarking against generic product performance. (To that end, manufacturers are encouraged to submit brand-specific product performance data through the new BEES Please program—contact: blippiatt@nist.gov.)

BEES measures the environmental performance of building products using the internationally standardized and science-based Life-Cycle Assessment method. All stages in the life of a product are analyzed: raw material acquisition, manufacture, transportation, installation, use, and recycling and waste management. The environmental-impact analysis measures the product's impact on global warming, acidification, eutrophication (the unwanted addition of mineral nutrients to the soil and water), indoor air quality, resource depletion, and solid waste. In addition, the new software assesses ozone depletion, smog, ecological toxicity, and human toxicity for a number of products.

Due to its comprehensive, multi-dimensional scope, BEES can account for shifts of environmental burdens from one life-cycle stage to another, or one environmental medium (land, air, or water) to another. The tool highlights the trade-offs that must be made to genuinely reduce overall environmental impacts.

BEES measures economic performance using similar life-cycle thinking. Economic performance is measured using the ASTM standard Life-Cycle Cost method, which covers the costs of initial investment, replacement, operation, maintenance and repair, and disposal. Environmental and economic performance scores are combined into an overall performance score. The BEES user specifies the relative importance weights used to combine environmental and economic performance scores and may test the sensitivity of the overall scores to different sets of relative importance weights.

Applying the BEES approach to the scores of products included in BEES 2.0 leads to several general conclusions. First, environmental claims based on single impacts, such as recycled content alone, should be viewed with skepticism. These claims do not account for the fact that one impact may have been improved at the expense of others. Second, measures must always be quantified on a functional unit basis as they are in BEES, so that the products being compared are true substitutes for one another. One roof covering product may be environmentally superior to another on a pound-for-pound basis, but if that product requires twice the mass as the other to cover one square foot of roof, the results may reverse. Third, a product may contain a negative-impact constituent, but if that constituent is a small portion of an otherwise relatively benign product, its significance decreases dramatically. Finally, a short-lived, low-first-cost product is often not the cost-effective alternative. A higher first cost may be justified many times over for a durable, maintenance-free product. In sum, the answers lie in the trade-offs.

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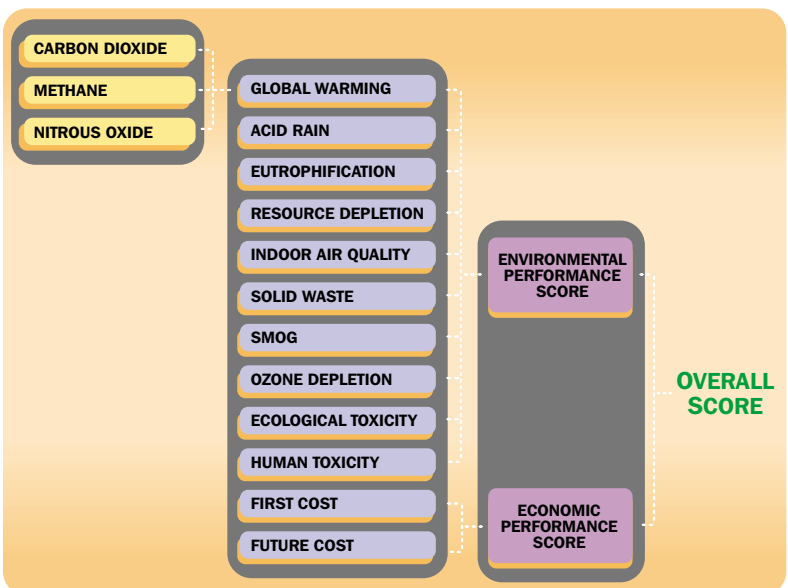

Computing the BEES Overall Performance Score: Environmental and economic performance scores are combined into an overall performance score.

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