

Green Building Research at the National Institute of Technology

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ABSTRACT

For over seven decades, the National Institute of Technology and Standards (NIST) and its predecessor organization, the National Bureau of Standards has done research on energy conservation in buildings. In 1993, NIST formerly created a “Green Building Research Program” to assist the building industry in addressing concerns with indoor air quality, ozone depletion, global warming, and sustainability.

The purpose of this talk will be to briefly describe the results of two specific research efforts that have been carried out since the creation of the Green Building Research Program. The first has been done by NIST staff; the second by a new industry association that NIST helped create.

NIST developed a software tool with the acronym of BEES (**B**uilding for **E**nvironmental and **E**conomic Sustainability) that gives designers, builders, and product manufacturers a technique for selecting cost-effective “green” building products. It is based on consensus standards and designed to be practical, flexible, and transparent. Version 2.0, just released this year, includes actual environmental and economic performance data for over 65 generic building products.

BEES uses the internationalized-standardized and science-based life-cycle assessment approach. All stages in the life of a product are analyzed: raw material acquisition, manufacture, transportation, installation, use, and recycling and waste management. Up to ten environmental impacts are measured across these life-cycle stages: global warming, acid rain, resource depletion, indoor air quality, solid waste, eutrophication (the unwanted addition of mineral nutrients to the soil and water), ecological toxicity, human toxicity, ozone depletion, and smog. Life-cycle assessment accounts for the shifts of environmental problems from one life-cycle stage to another, or one environmental medium (land, air, or water) to another.

BEES measures economic performance using the standard life-cycle cost method, which covers the costs of initial investment, replacement, operation, maintenance and repair, and disposal. The method sums these costs over a fixed period of time. Alternative products for the same function can then be compared on the basis of their life-cycle costs to determine the least-cost means of providing that function over the fixed period of study.

BEES uses the standard for Multiattribute Decision Analysis to combine environmental and economic performance into an overall performance measure. The user has to specify the relative importance weights used to combine the environmental and economic

performance scores and may also test the sensitivity of the overall scores to different sets of relative importance weights.

In 1993, a number of building product manufacturers who were emphasizing the environmental characteristics of their products approached NIST about creating a new industry association focussed on sustainability. NIST hosted the first official meeting of the group that year. They subsequently formed the U.S. Green Building Council that today has more than 200 organizational members from across the U.S. Their first chairman was from the HVAC industry, the Carrier Corporation. There is now a broad cross-section of companies, universities, non-profits, and government organizations represented among the membership.

Over the past seven years, the Council has collected and distributed significant amounts of information on case study buildings where the focus on sustainability has enhanced the productivity of building occupants and profitability of the enterprise within the buildings. However, their single most significant accomplishment to date has been the creation of LEED (**L**eadership in **E**nergy and **E**nvironmental **D**esign). This is a technique for rating the “greenness” of a proposed building during its design phase. In concept, it is similar to the development of BREAM in the U.K.

LEED is built around five broad areas:

1. Planning Sustainable Sites
2. Improving Energy Efficiency
3. Conserving Materials and Resources
4. Enhancing Indoor Environmental Quality
5. Safeguarding Water

In each of the areas, there are from 7 to 12 credits that can be earned for the proposed building. These credits are achieved from adhering to or exceeding certain standards and specifications or including certain design features in the building. The designer self-certifies the credits that are achieved. The building is given a special designation if more than 50% of the credits are achieved:

50-60% Bronze

61-70% Silver

71-80% Gold

81% or more Platinum

The talk will describe the details of both BEES and LEED. Both are downloadable from the Web at the following sites:

BEES – www.bfrl.nist.gov/oe/bees.html

LEED – www.usgbc.org