Building for Environmental and Economic Sustainability (BEES®)

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BEES Sponsors

- NIST Building & Fire Research Laboratory
- U.S. EPA Environmentally Preferable Purchasing Program
- U.S. Department of Agriculture
BEES

- Overall Model
- Global Warming Scores
- Environmental Impact Weights
- BEES Applications
BEES Model

- Takes Life-Cycle Approach

- Based on Consensus Standards
  - Life-Cycle Costing (ASTM E917)
  - Environmental Life-Cycle Assessment (ISO 14040)
  - Multiattribute Decision Analysis (ASTM E1765)
BEES Model: Environmental Impacts

- Global Warming
- Acid Rain
- Eutrophication
- Fossil Fuel Depletion
- Indoor Air Quality
- Habitat Alteration
- Smog

- Ozone Depletion
- Ecological Toxicity
- Human Health
  - Cancer
  - Noncancer
- Criteria Air Pollutants
- Water Intake
**BEES Model:**

**User Choices**

- Transport distance
- Weights to combine scores
- Discount rate
Global Warming Scoring

Carbon Cycle Assumptions

- **Raw Materials Acquisition**
  - Account for recently sequestered carbon

- **Use**
  - Account for carbon emissions

- **End of Life**
  - Do not account for carbon storage/emissions
  - Begin research on topic

New
BEES 4.0 Data

- 230+ Building Products
- 100+ Biobased Products
  - Gasoline Fuel Additives
  - Diesel Fuel Additives
  - 2-Cycle Engine Oils
  - Hydraulic Fluids
  - Transformer Fluids
  - Lubricants
  - and more…
Implications Example A: Significant Drop in Score

Environmental Performance

<table>
<thead>
<tr>
<th>Acidification</th>
<th>Crit. Air Pollutants</th>
<th>Ecological Toxicity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eutrophication</td>
<td>Fossil Fuel Depletion</td>
<td>Global Warming</td>
</tr>
<tr>
<td>Habitat Alteration</td>
<td>Human Health</td>
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</tr>
</tbody>
</table>

![Graph showing environmental performance of alternatives](image)

**BEFORE**
Implications Example A: Significant Drop in Score

Environmental Performance

- Acidification
- Crit. Air Pollutants
- Ecological Toxicity
- Eutrophication
- Fossil Fuel Depletion
- Global Warming
- Habitat Alteration
- Human Health
- Indoor Air
- Ozone Depletion
- Smog
- Water Intake

Score
-0.0100
-0.0000
0.0000
0.0100
0.0200
0.0300
pts/unit

Alternatives
Gypsum Board
Anonymous BioPanel #2
Trespa Athlon

P&M Altree Panels
Trespa Virtuo
Implications Example A: Significant Drop in Score

Global Warming by Flow

- Carbon Dioxide
- Carbon Tetrachloride
- Carbon Tetrafluoride
- CFC 12
- Chloroform
- Halon 1301
- HCFC 22
- Methane
- Methyl Bromide
- Methyl Chloride
- Methylene Chloride
- Nitrous Oxide
- Trichloroethane

Graph showing carbon dioxide equivalent emissions for different materials.
Implications Example A: Significant Drop in Score

Global Warming by Life-Cycle Stage

- Raw Materials Acquisition
- Manufacturing
- Transportation
- Use
- End of Life

Alternatives

Gypsum Board
Anonymous BioPanel #2
Trespa Athlon
P&M Altree Panels
Trespa Virtuon

After
Implications Example B: Insignificant Drop in Score
Implications Example B: Insignificant Drop in Score

Environmental Performance

- Acidification
- Crit. Air Pollutants
- Ecological Toxicity
- Eutrophication
- Fossil Fuel Depletion
- Global Warming
- Habitat Alteration
- Human Health
- Indoor Air
- Ozone Depletion
- Smog
- Water Intake

Score

pts/unit
0.0500
0.0400
0.0300
0.0200
0.0100
0.0000

Natural Cork Parquet
BPS Scan Brdlm
UTTSoyNylonBrdlm

Forbo Linoleum Alternatives

AFTER
Environmental Impact
Weighting

Weights

Global Warming
Acidification
Eutrophication
Fossil Fuel Depletion
Indoor Air Quality
Habitat Alteration
Water Intake
Criteria Air Pollutants
Human Health
Smog
Ozone Depletion
Ecological Toxicity

Cancer
Noncancer

Environmental Performance Score
Environmental Weights: BEES Stakeholder Panel
BEES Stakeholder Panel: Weights by Time Horizon

Ozone Depletion
Acidification
Indoor Air Quality
Smog Formation
Noncancerous Effects
Habitat Alteration
Eutrophication
Ecological Toxicity
Cancerous Effects
Water Intake
Criteria Air Pollutants
Fossil Fuel Depletion
Global Warming

Short (<10 years)
Medium (10 years to 100 years)
Long (>100 years)
BEES Application 1: Building Industry

24,000+ users from 80 countries
BEES Application 2: USDA BioPreferred Program

biobased content
functional performance
cost performance
environmental performance
availability

Item Designation
USDA Label
For More Information...

www.bfrl.nist.gov/oae/bees.html