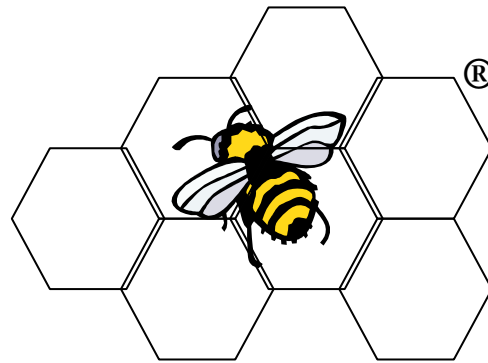


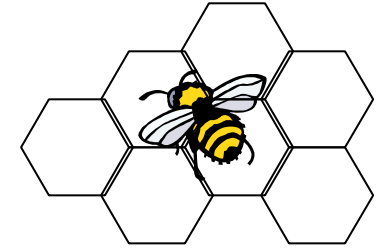
# *Building for Environmental and Economic Sustainability (BEES<sup>®</sup>)*



*Barbara Lippiatt*

*National Institute of Standards and Technology (NIST)*

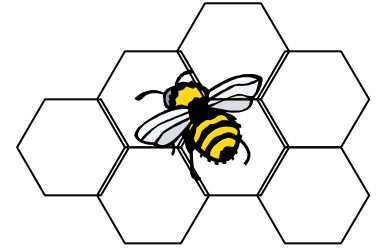
*U.S. Department of Commerce*



## *BEES Sponsors*

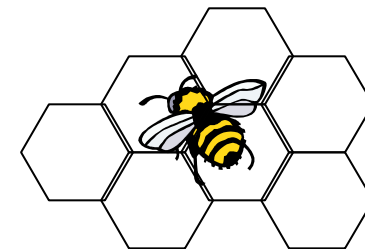
- *NIST Building & Fire Research Laboratory*
- *U.S. EPA Environmentally Preferable Purchasing Program*
- *U.S. Department of Agriculture*

# BEES



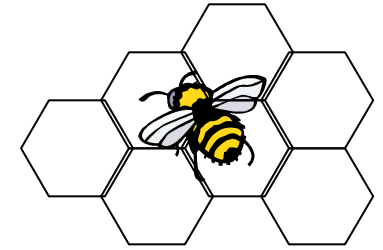
- *Overall Model*
- *Global Warming Scores*
- *Environmental Impact Weights*
- *BEES Applications*

# *BEES Model*



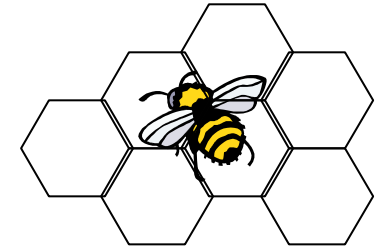
- ***Takes Life-Cycle Approach***
  
- ***Based on Consensus Standards***
  - *Life-Cycle Costing (ASTM E917)*
  - *Environmental Life-Cycle Assessment (ISO 14040)*
  - *Multiattribute Decision Analysis (ASTM E1765)*

# *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



Transportation

**Analysis Parameters**

No Weighting

Environmental vs. Economic Performance Weights

Environmental Performance (%):  vs. Economic Performance (%):

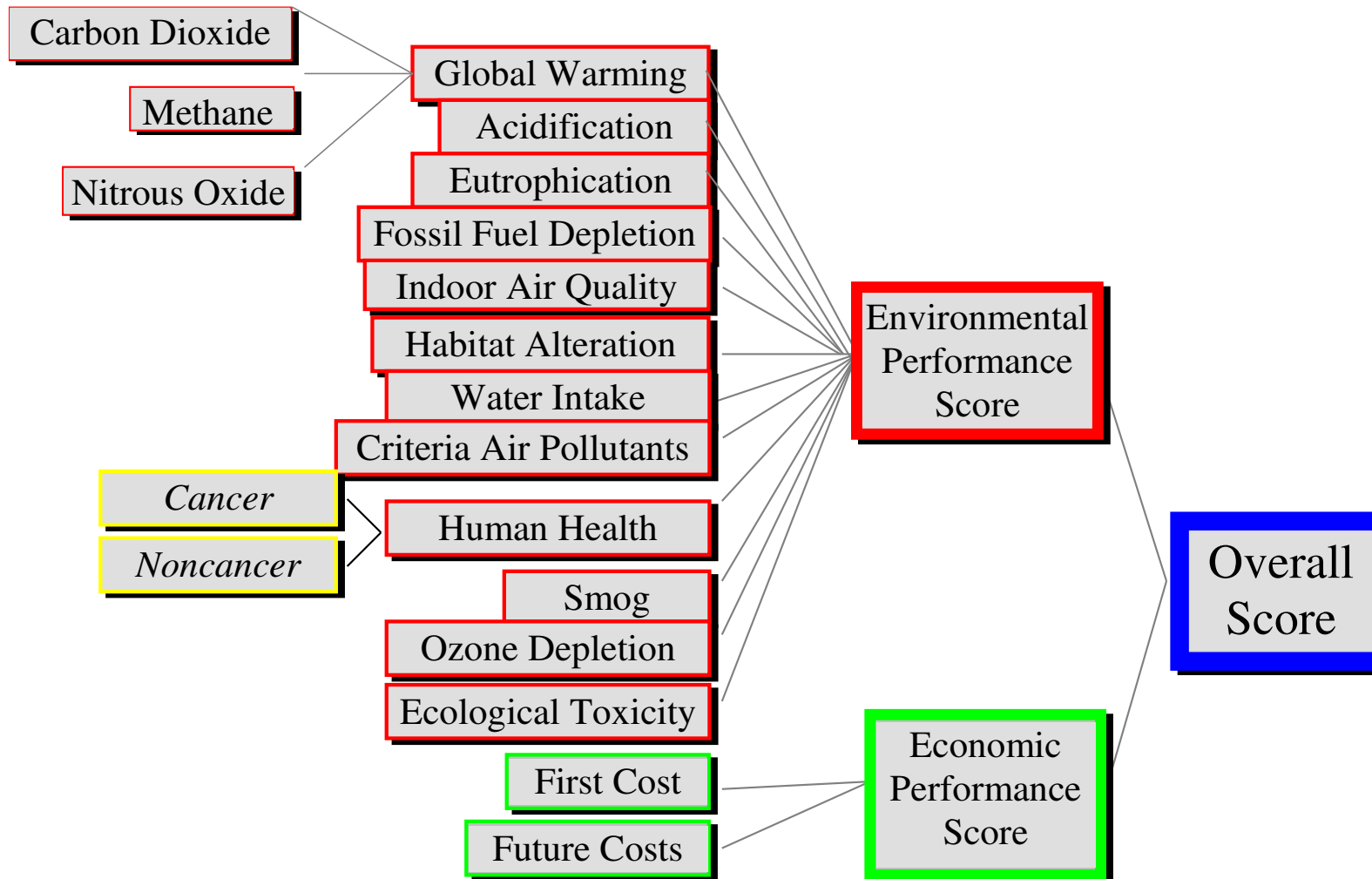
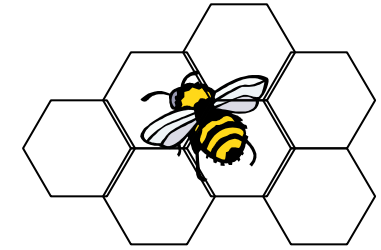
Environmental Impact Category Weights

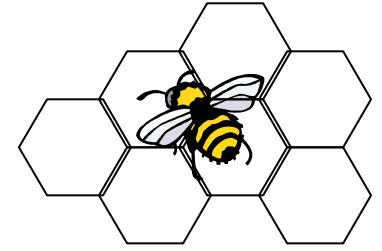
User-Defined   
 EPA Scientific Advisory Board  
 BEES Stakeholder Panel  
 Equal Weights

Discount Rate (%): (Excluding Inflation)


- *Transport distance*
- *Weights to combine scores*
- *Discount rate*

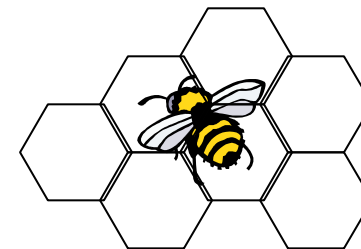
# BEES 4.0 Model





## Carbon Cycle Assumptions

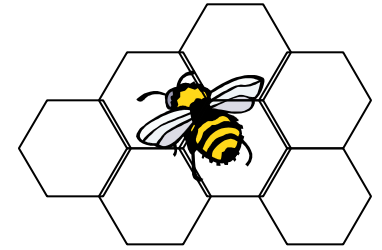
- *Raw Materials Acquisition*
  - Account for recently sequestered carbon
- *Use*
  - Account for carbon emissions
- *End of Life* 
  - Do not account for carbon storage/emissions
  - Begin research on topic



## *BEES 4.0 Data*

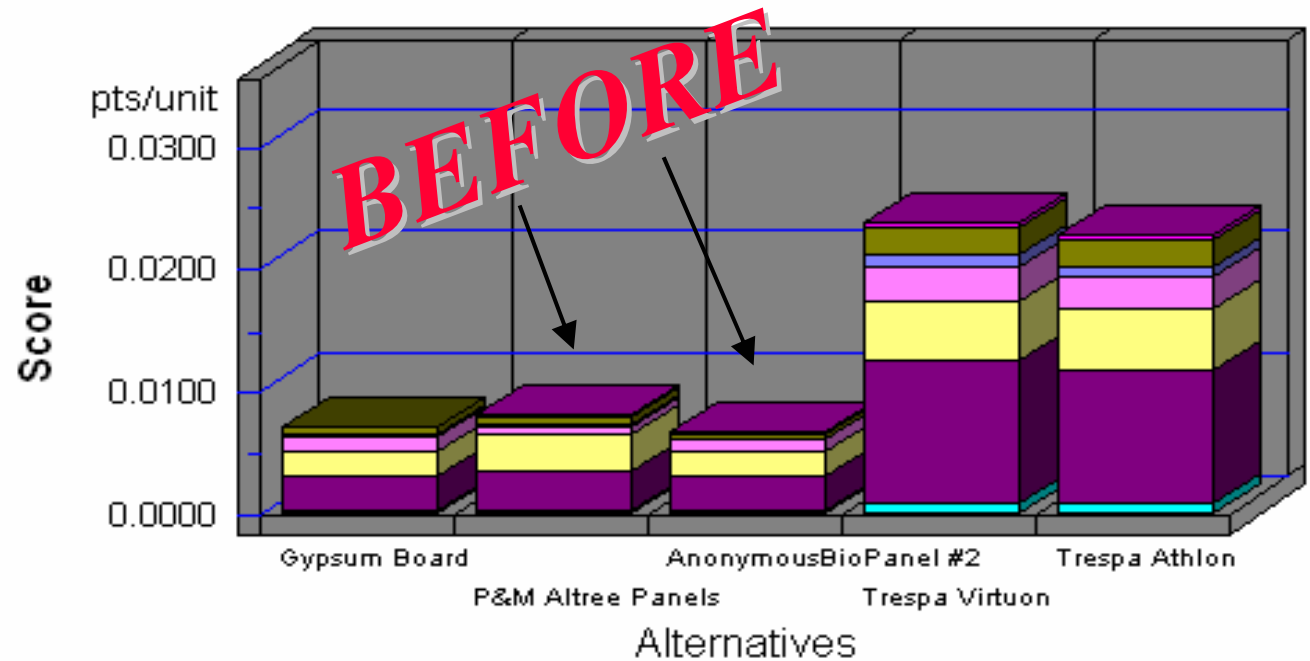
- ***230+ Building Products***
  
- ***100+ Biobased Products***
  - *Gasoline Fuel Additives*
  - *Diesel Fuel Additives*
  - *2-Cycle Engine Oils*
  - *Hydraulic Fluids*
  - *Transformer Fluids*
  - *Lubricants*
  - *and more...*

# Implications Example A: Significant Drop in Score

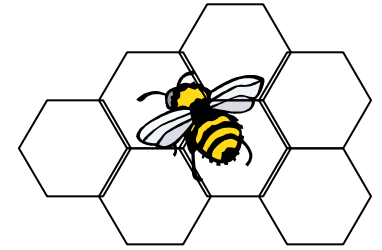


## Environmental Performance

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

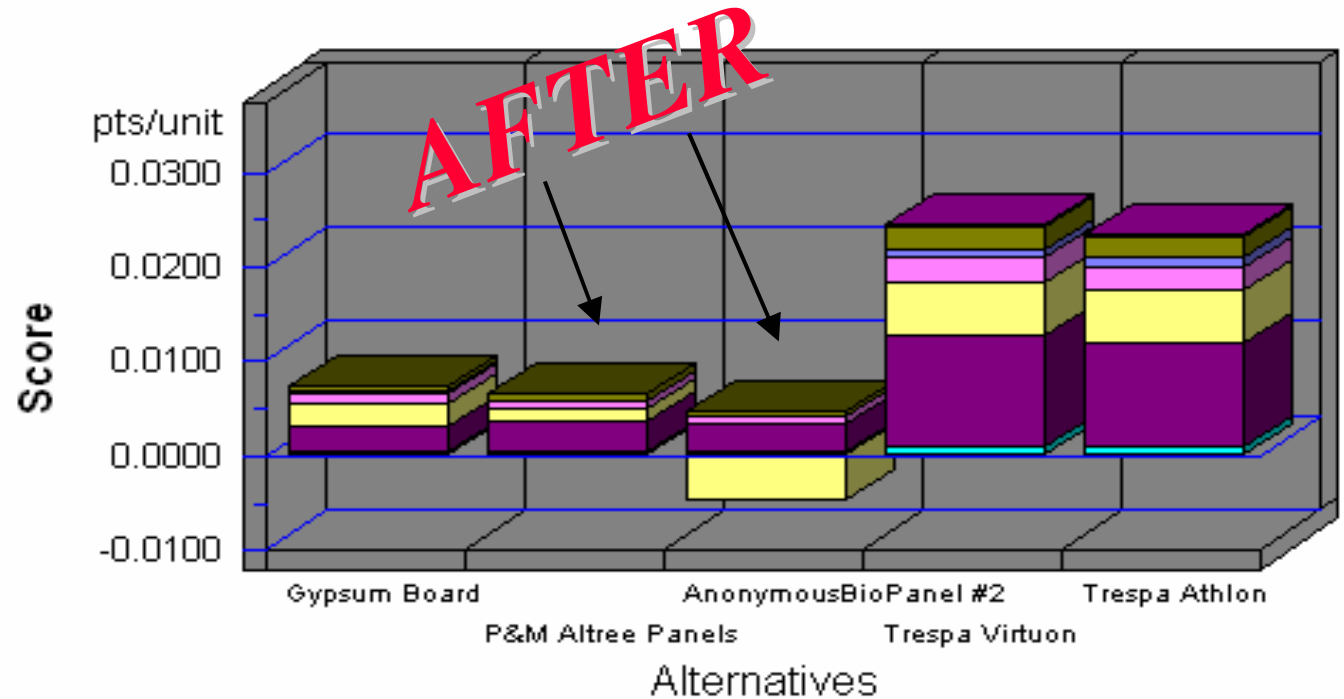


# Implications Example A: Significant Drop in Score

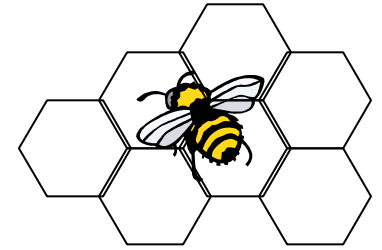


## Environmental Performance

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

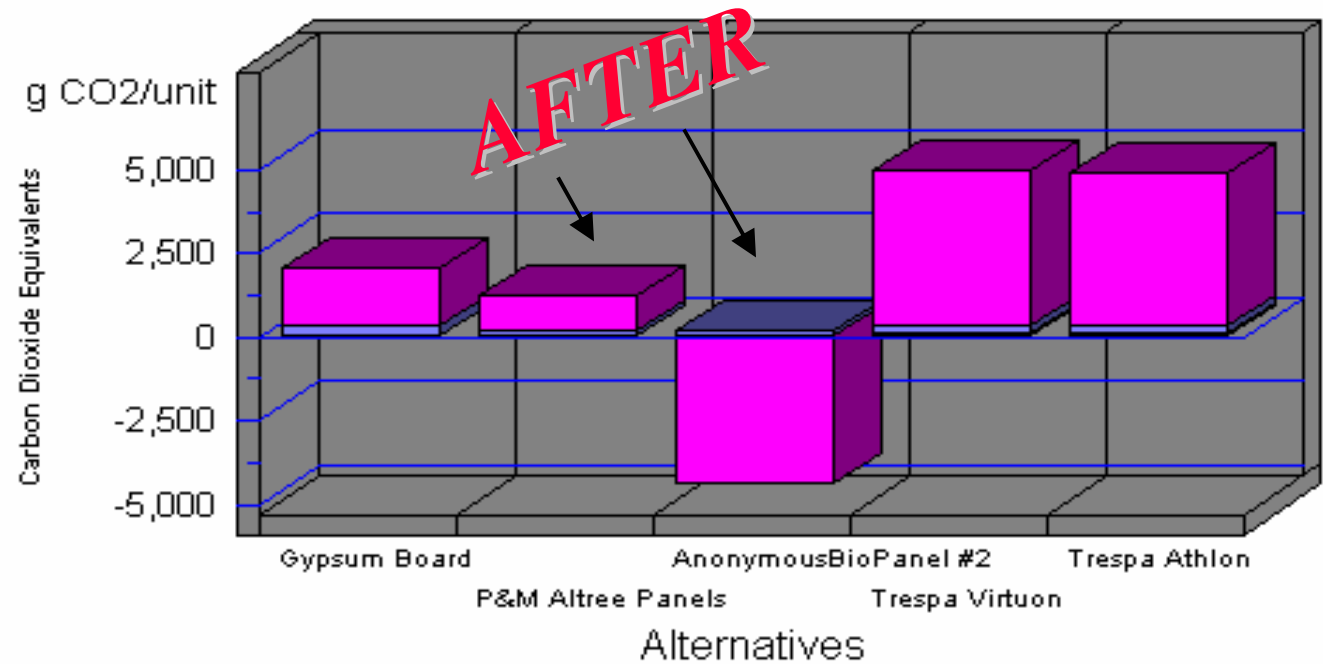


# Implications Example A: Significant Drop in Score

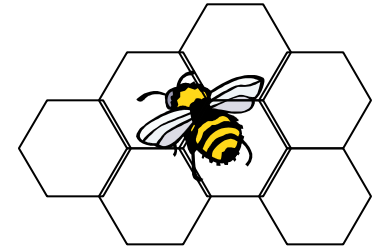


## Global Warming by Flow

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

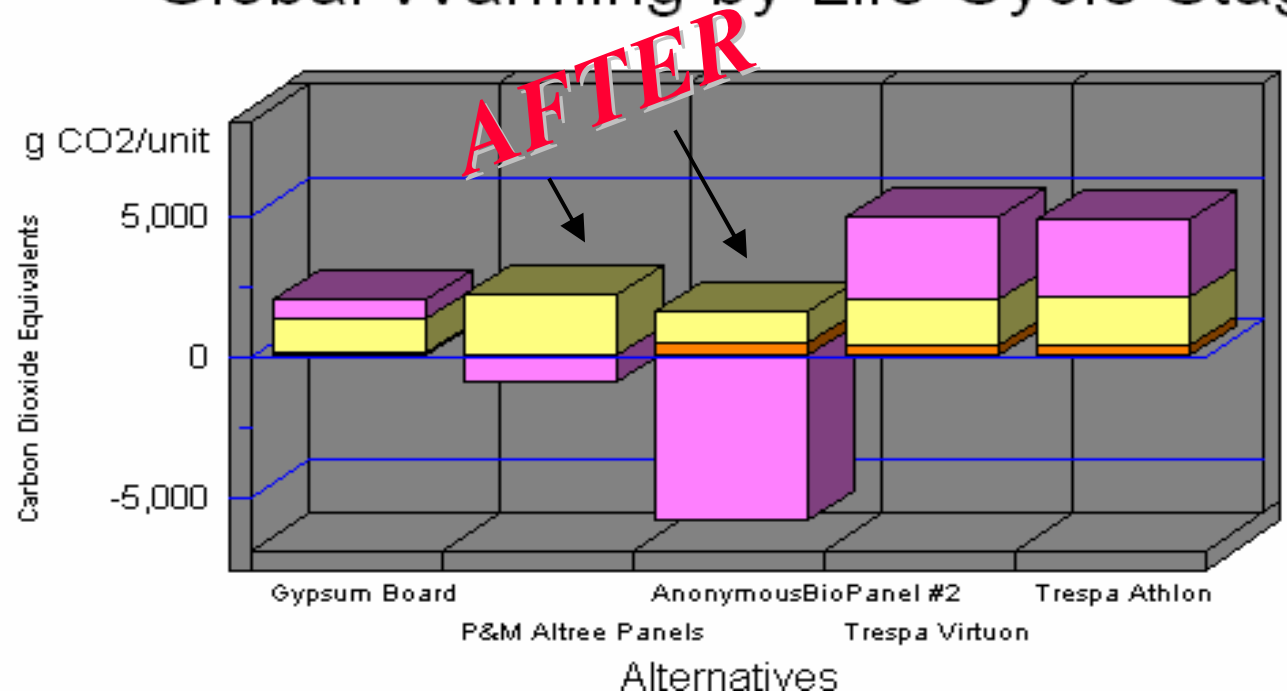


# Implications Example A: Significant Drop in Score

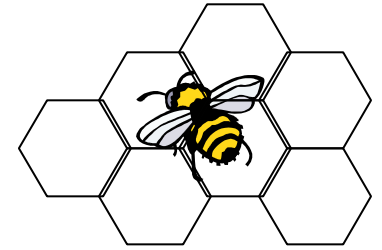


Global Warming by Life-Cycle Stage

Raw Materials Acquisition
Manufacturing
Transportation
Use
End of Life

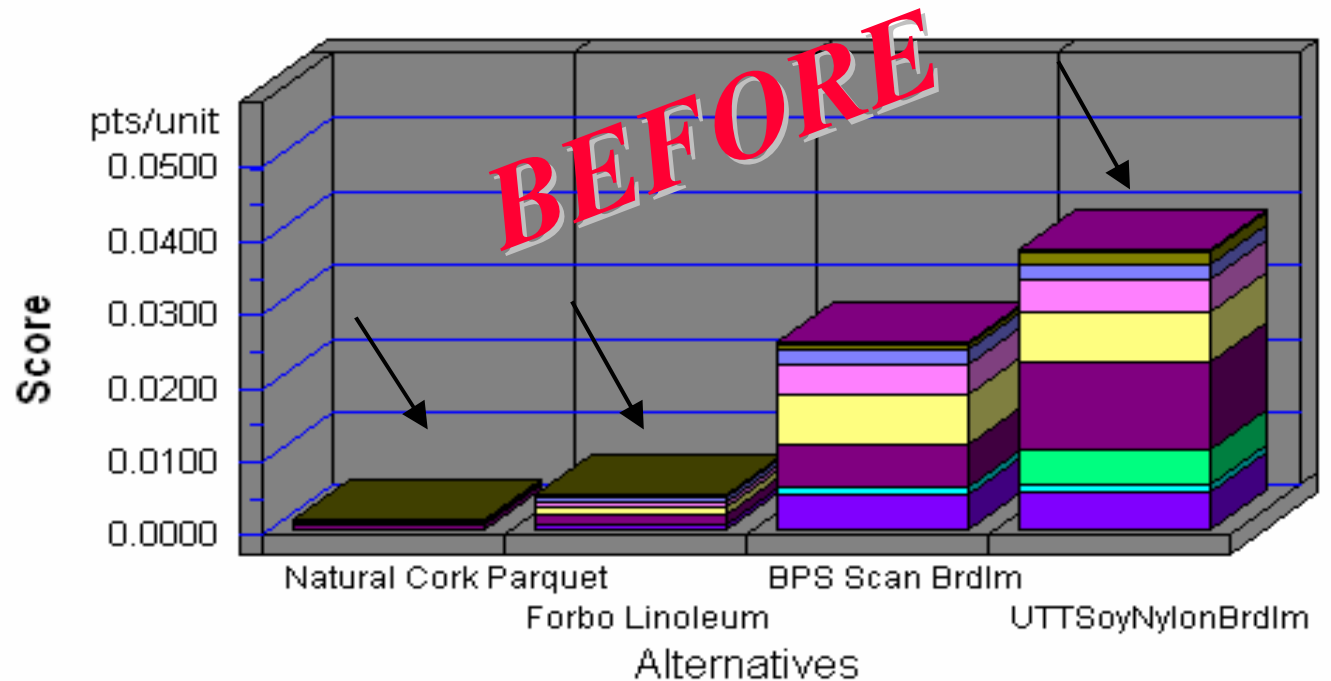


# Implications Example B: Insignificant Drop in Score

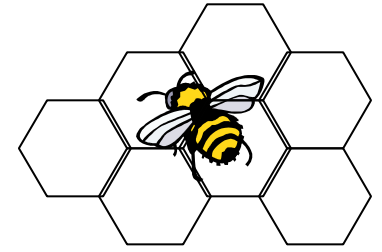


## Environmental Performance

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

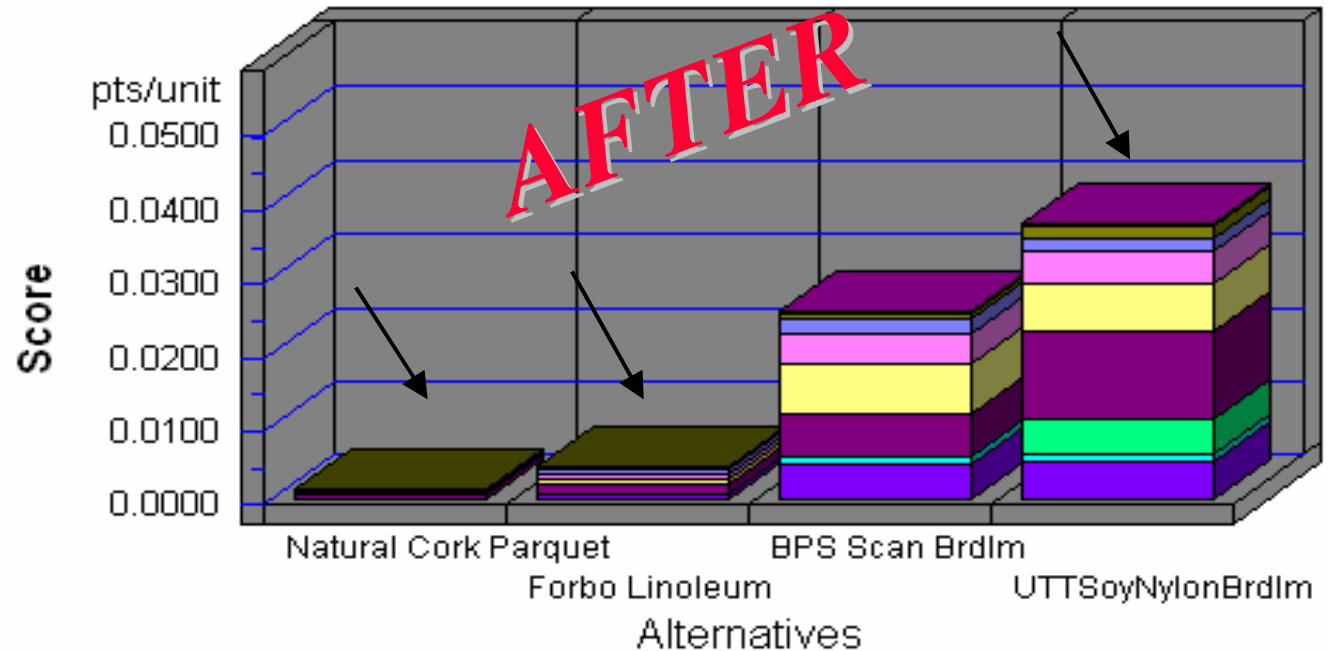


# Implications Example B: Insignificant Drop in Score

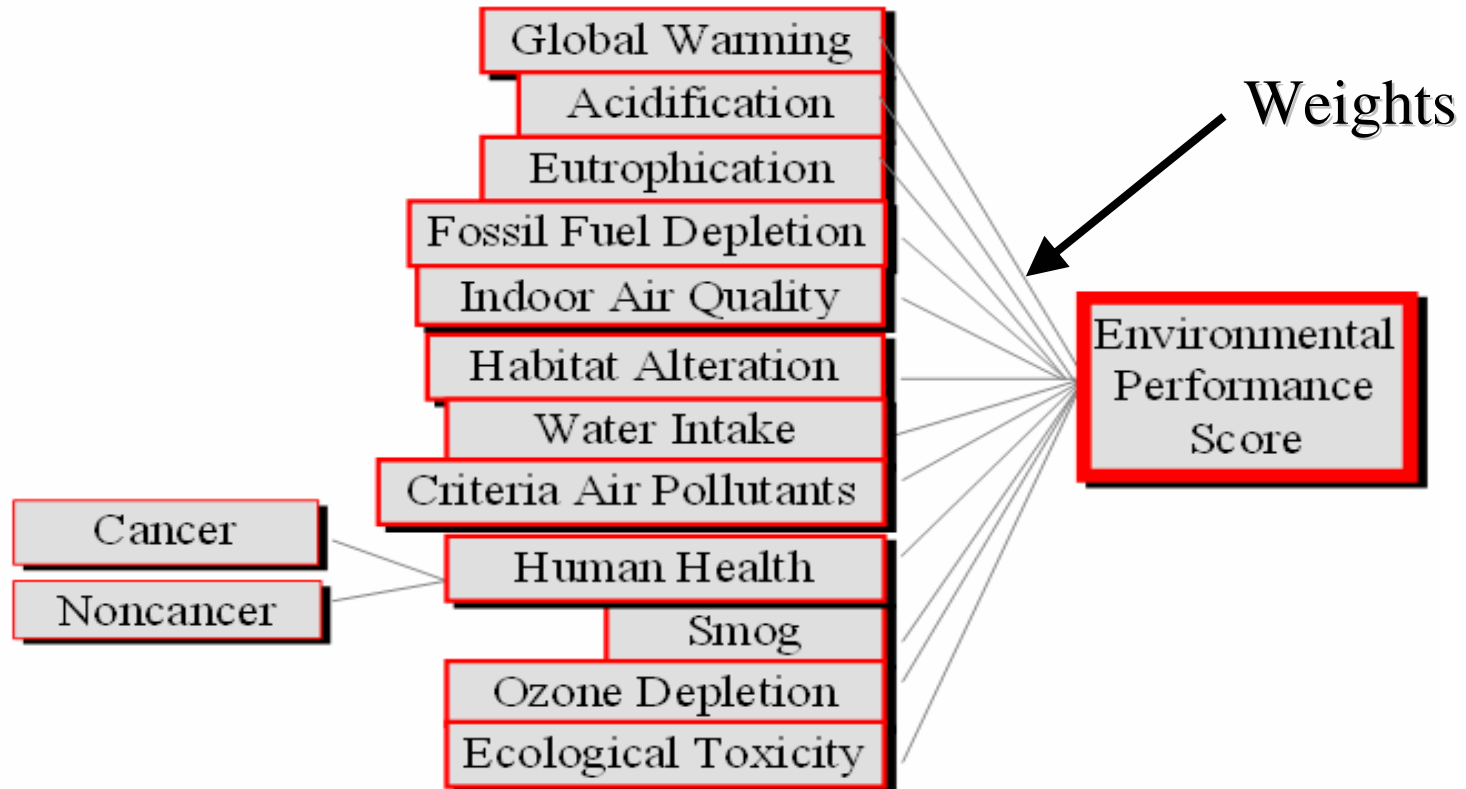
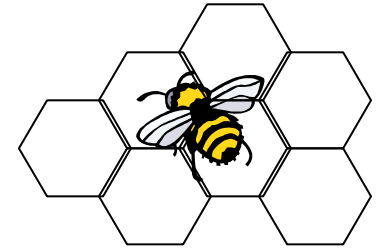


## Environmental Performance

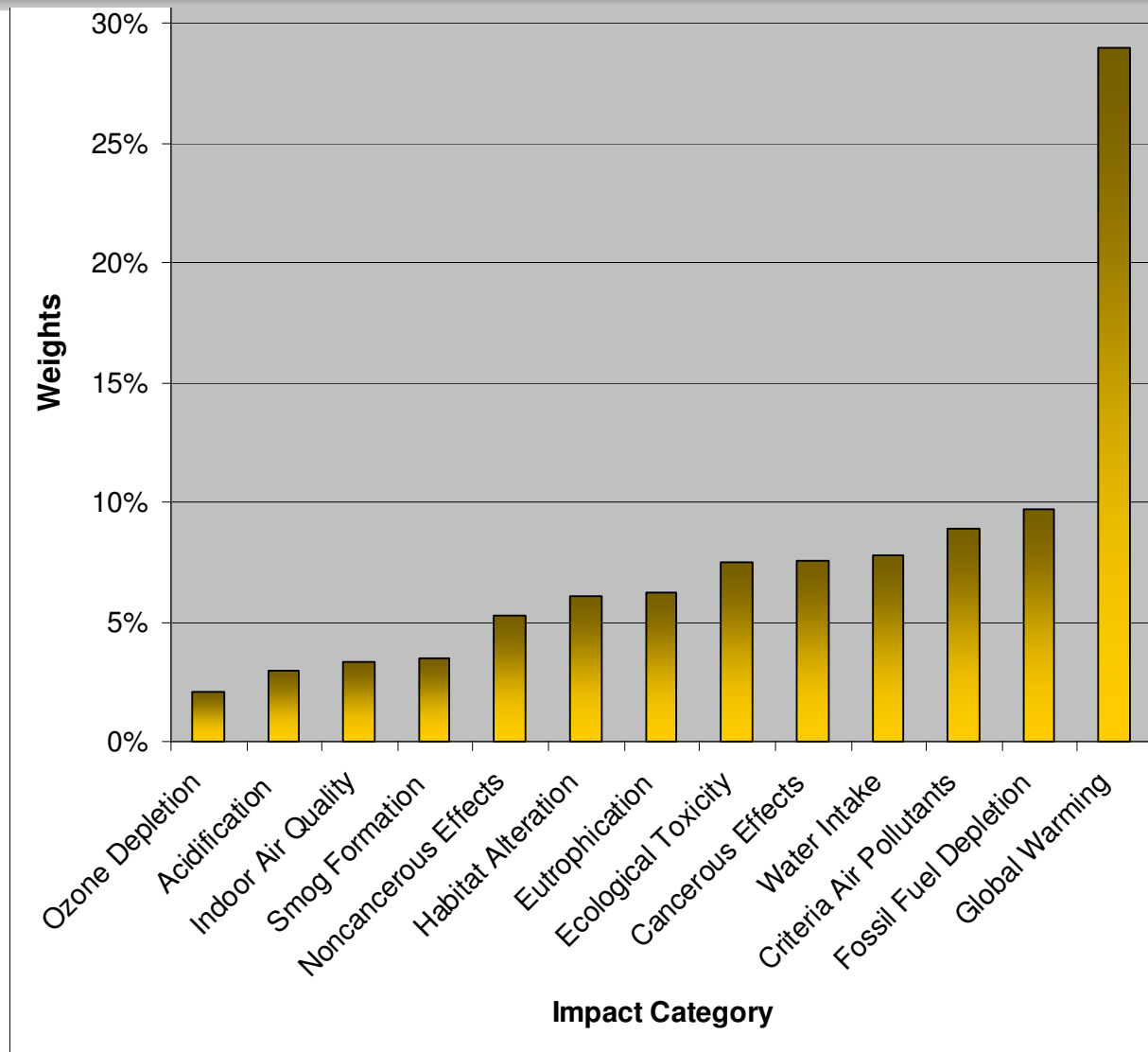
	Acidification
	Crit. Air Pollutants
	Ecological Toxicity
	Eutrophication
	Fossil Fuel Depletion
	Global Warming
	Habitat Alteration
	Human Health
	Indoor Air
	Ozone Depletion
	Smog
	Water Intake



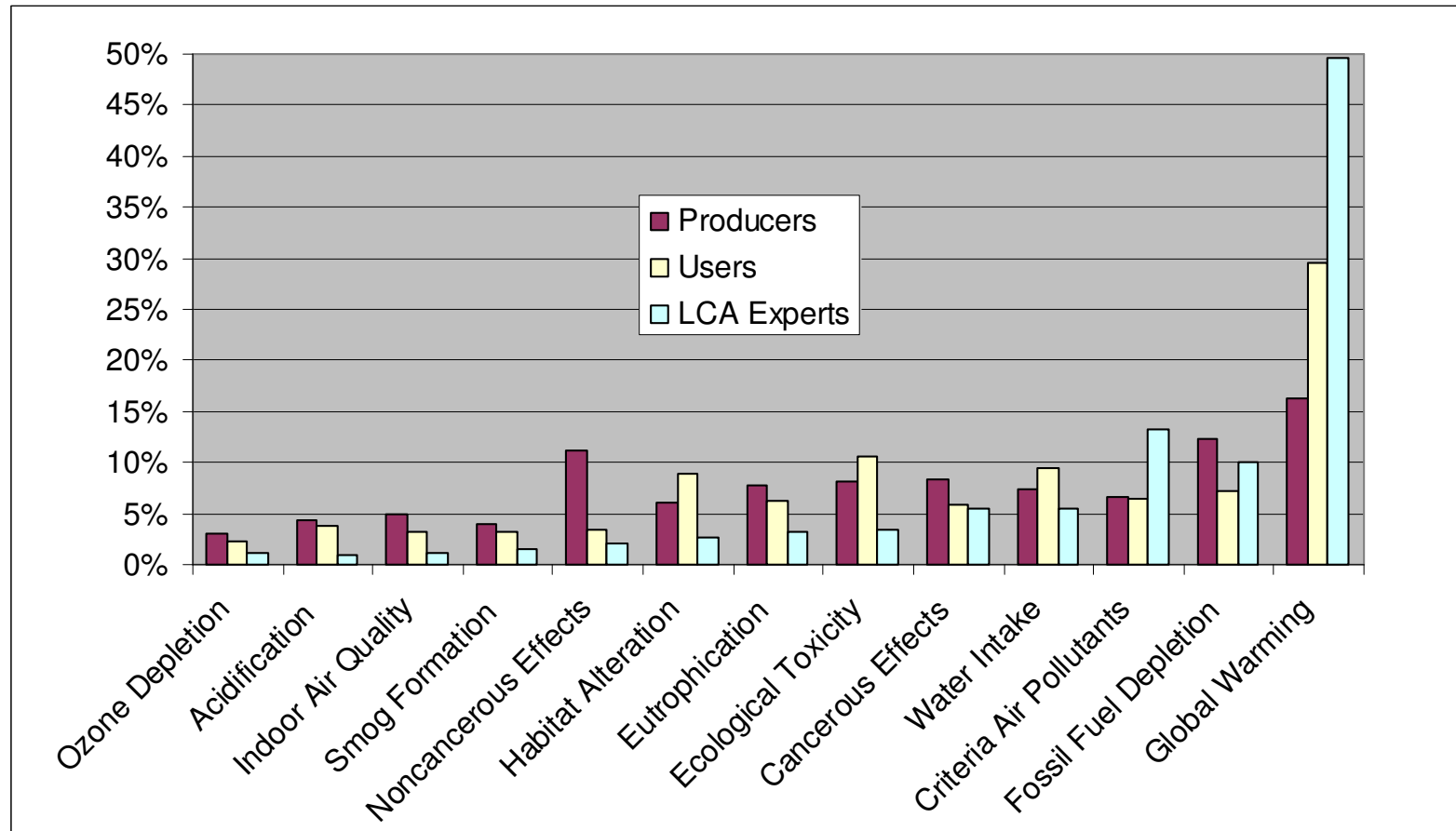
# Environmental Impact Weighting



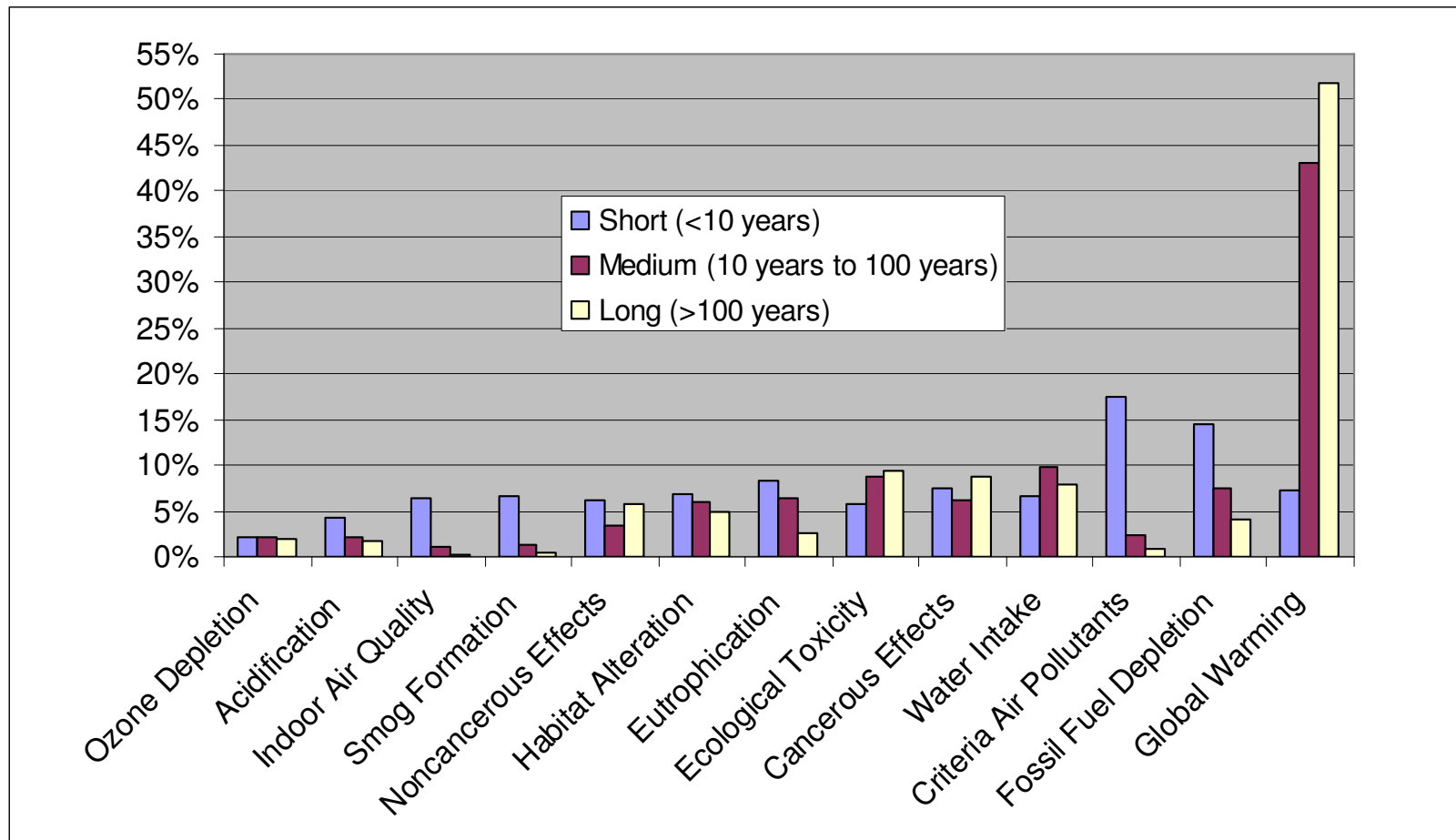
# *Environmental Weights: BEES Stakeholder Panel*



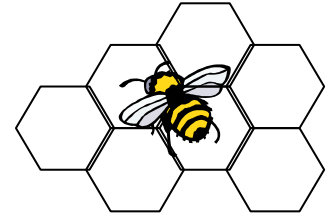
# *BEES Stakeholder Panel: Weights by Voting Interest*



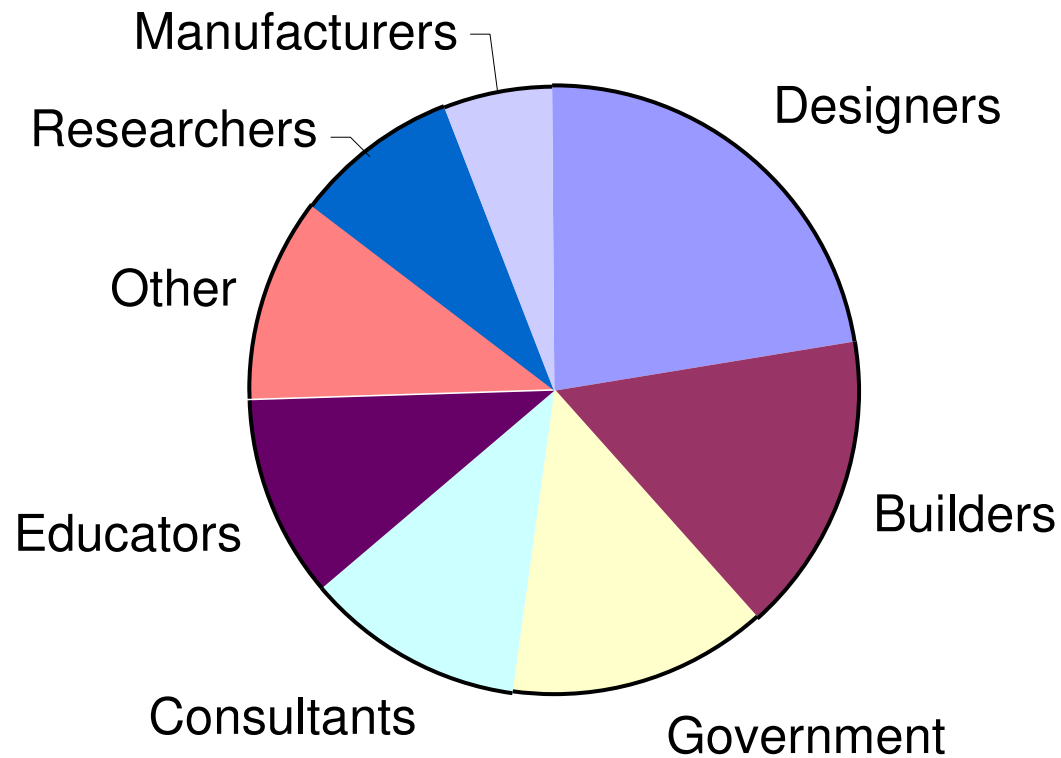
# *BEES Stakeholder Panel: Weights by Time Horizon*



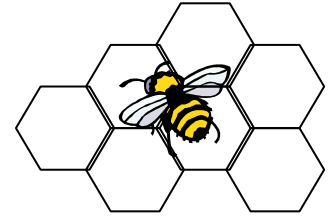
# *BEES Application 1: Building Industry*



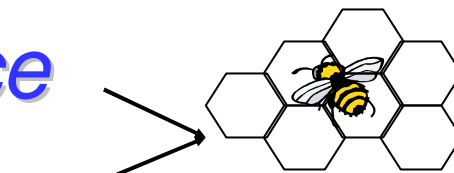
*24,000+ users from 80 countries*



# *BEES Application 2: USDA BioPreferred Program*



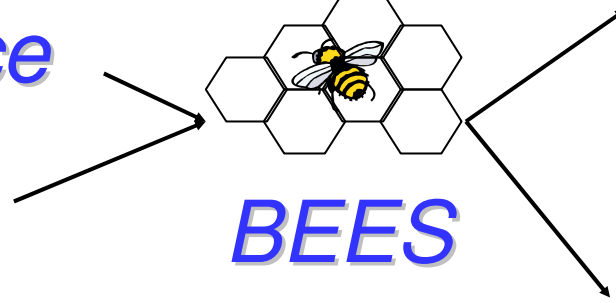
*biobased content*  
*functional*  
*performance*  
*cost performance*  
*environmental*  
*performance*  
*availability*



**BEES**

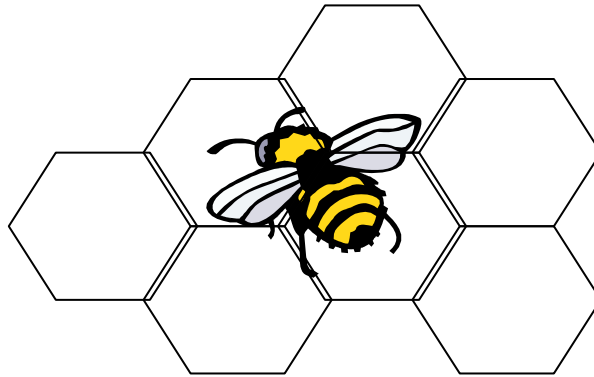
*Item  
Designation*

*USDA Label*



*For More Information...*

---



[www.bfrl.nist.gov/oae/bees.html](http://www.bfrl.nist.gov/oae/bees.html)