Highlights from the September 2010 US International Conference on Sustainable Concrete Pavements

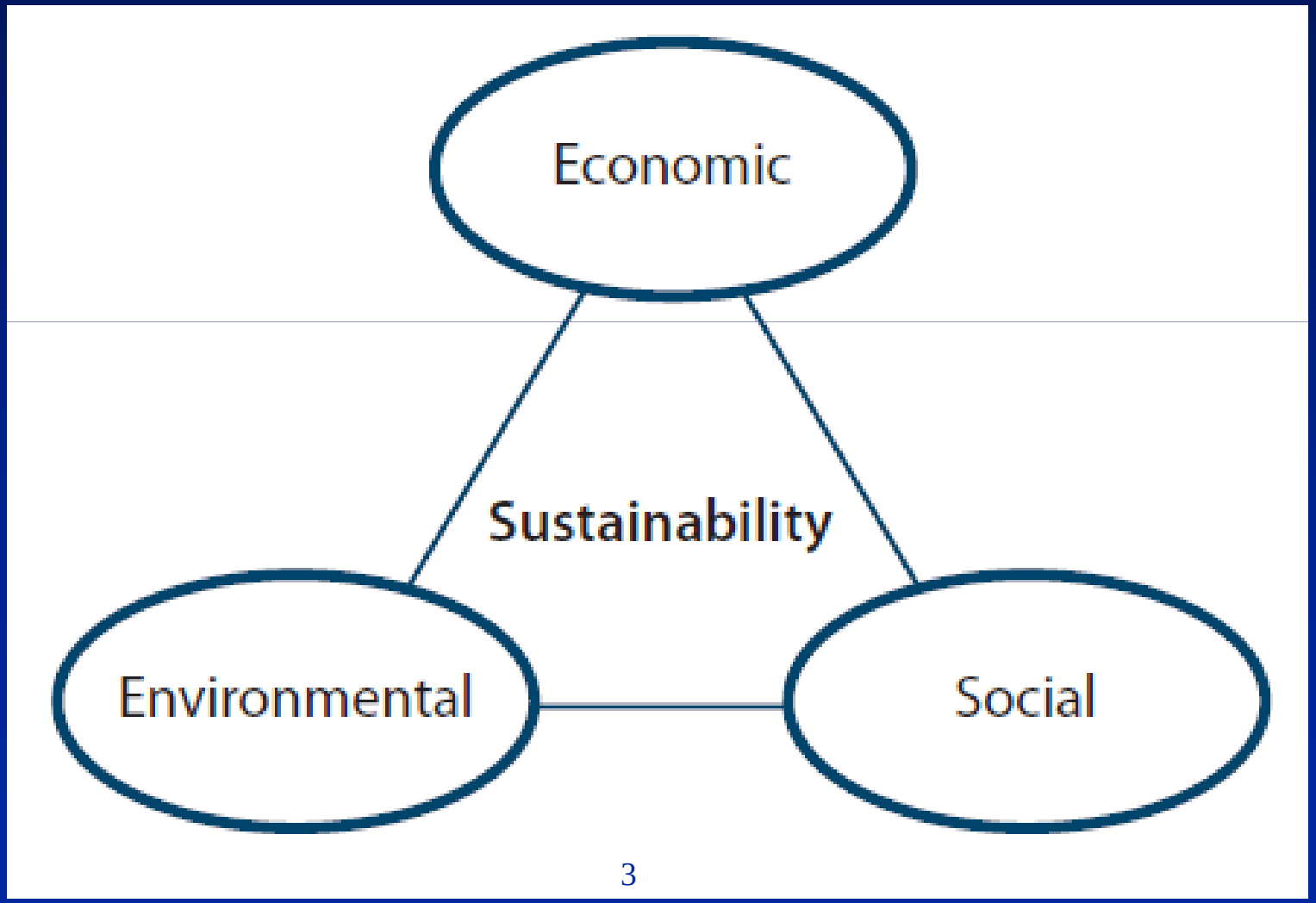
Shiraz Tayabji, Fugro Consultants

Sustainability Defined

"Meet the needs of the present without compromising the ability of future generations to meet their own needs"

[WCED 1987]

Sustainability Considerations Require Finding a Balance



Great Participation

Total Attendees – 210+

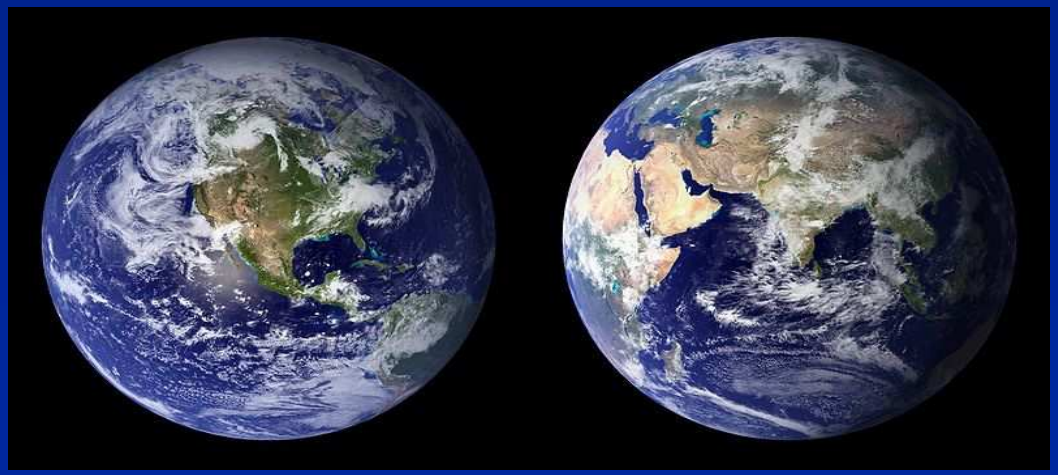
- **Countries (13)**
  - Argentina, Australia, Belgium, Brazil, Canada, Costa Rica, Denmark, Mexico, Nigeria, South Africa, South Korea, Sweden, USA
- **US States (36 states)**
  - Alabama, Alaska, Arizona, California, Colorado, Delaware, Florida, Georgia, Hawaii, Idaho, Illinois, Indiana, Iowa, Kansas, Louisiana, Maryland, Massachusetts, Michigan, Minnesota, Missouri, Nevada, New Jersey, New York, North Carolina, Ohio, Oklahoma, Pennsylvania, Rhode Island, South Carolina, South Dakota, Tennessee, Texas, Utah, Virginia, Washington, & Wisconsin

Great Technical Program

- **28 papers accepted for presentation plus Plenary Session & Forum presentations**
- **8 sessions**
- **Two forums on Agency practices**
- **And, a strong poster program**
  - **15 highway agencies**
  - **3 universities**

Some Discussion Items

- **Are our current practices sustainable?**
- **Is there room for improvements?**
- **Will the improvements cost more?**
- **How do we measure the benefits of sustainable technologies?**



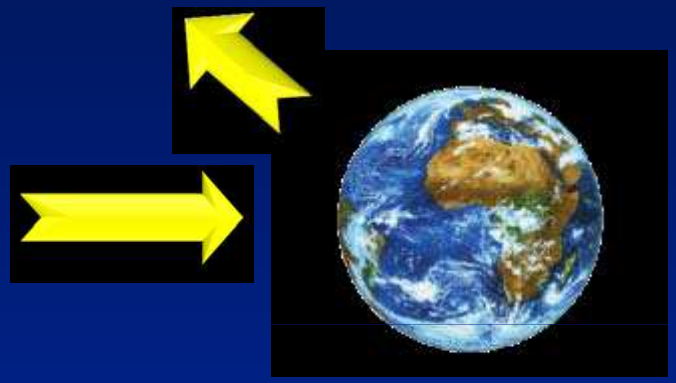
Specific Discussion Items

- **Overall – Sustainability applications to PCCP**
- **Sustainable concrete pavement designs**
- **Sustainable concrete paving materials**
- **Sustainable concrete mixes**
- **Sustainable construction practices**
- **Industry innovations**
- **Assessment of sustainable strategies**

Green cements from sequestered CO2, portland limestone cements, high-volume flyash cements, Greenroads, Eco-efficiency analysis

Surface Reflectivity –Global Cooling

Concept is that earth is not a closed system

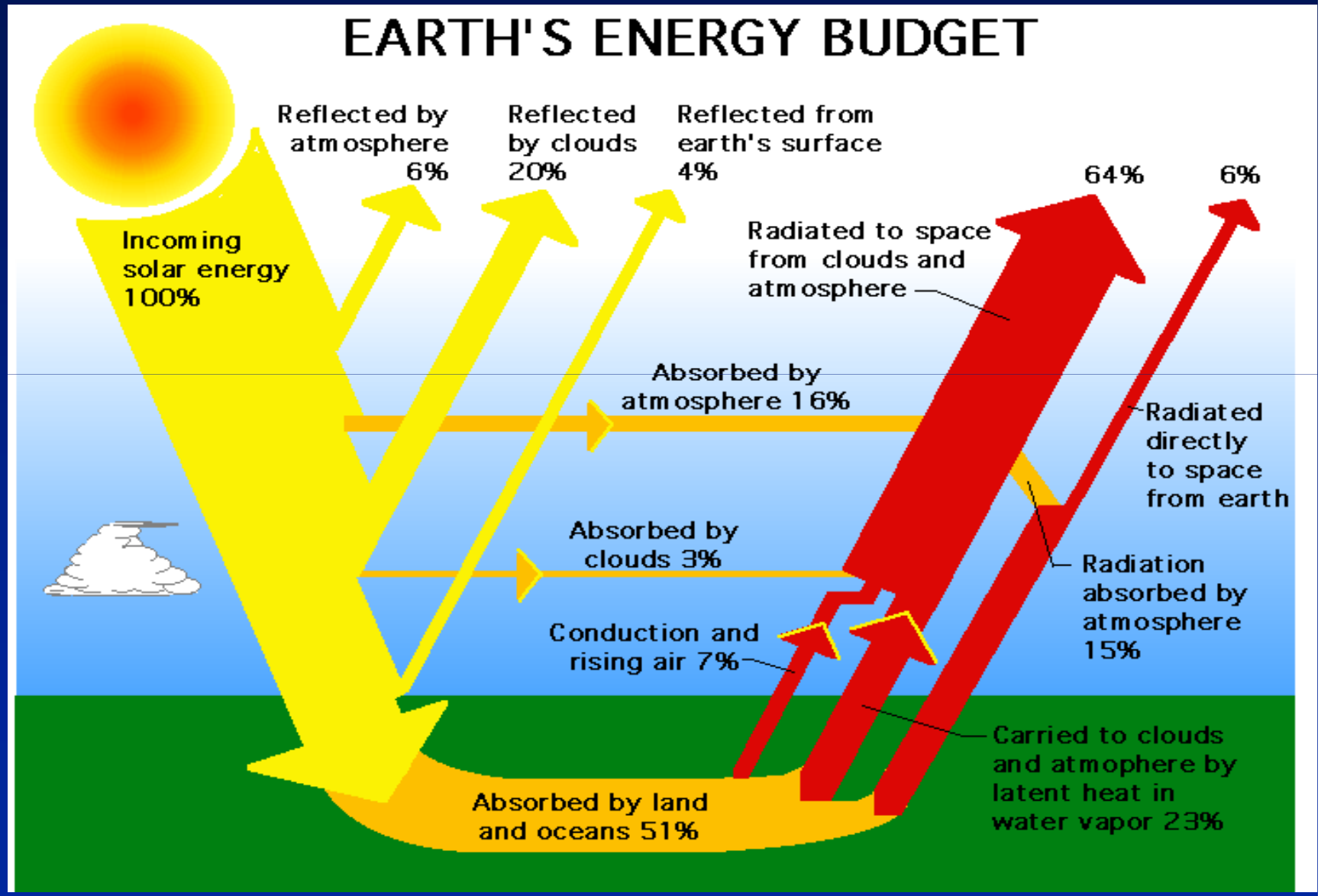


Reflective materials on earth's surface (snow, ice, concrete) return more of sun's energy back into space – reducing temperatures

This amounts to the equivalent of CO2reduction (offset)

Keynote Presentation: Dr. Surabi Menon
Lawrence Berkeley National Laboratory, CA, USA

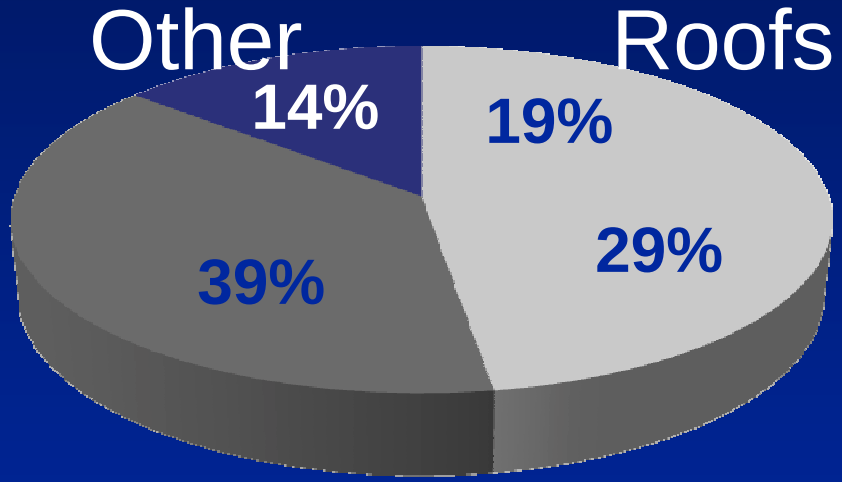
Why Global Warming?



Source: http://www.nasa.gov/images/content/57911main_Earth_Energy_Budget.jpg

Pavements in the city

Sacramento ~ 1 km^2



Urban fabric above tree canopy

10 Source: LBNL Heat Island Group

Courtesy: H Gilbert

Global Cooling

Cities 1% of global land area

60% cities=roofs/pavements

Cool roofs and pavements (concrete) can increase urban albedo by 0.1

If implemented in 100 largest cities in world, this can offset **44Gt of emitted CO2($1.1 trillion at $25/ton) –proposal to UN considered.**

Are Concrete Pavements Sustainable?

- Long pavement lives?
- Minimal maintenance requirements?
- 100% recyclable?
- High reflectance (Lighting visibility)?
- Lower heat island effects?
- Safe and quiet?

Environmental/Societal/Economic Benefits

Can We Make Concrete Pavement More Sustainable?

- Reduce reliance on portland cement
  - Develop green cements
- Optimize concrete mixture design
  - Less reliance on portland cement
- Optimize concrete pavement design
  - Long-life & using local/recycled materials
- Make construction more efficient
  - Processes less damaging to the environment

Why Do Materials Matter?

- Cement production is responsible for ~1.5% of U.S. total CO_2
- Portland cement is responsible for approximately 90% to 95% of the CO_2 and 85% of the embodied energy in concrete
- One ton of cement => One ton of CO_2
- Also, aggregate supply diminishing

Reducing Fuel for Construction

- Recycle – zero-waste
- Local first – minimize transportation
- Select the materials deliberately
  - Understand what is available
  - Import only what you need

Service Life Considerations

- At least 80% of the energy and emissions associated with pavements is incurred during use (service life)
  - Fuel efficiency
    - Traffic flow
    - Rolling resistance
  - Albedo
    - Heat island
    - Lighting costs
  - Noise

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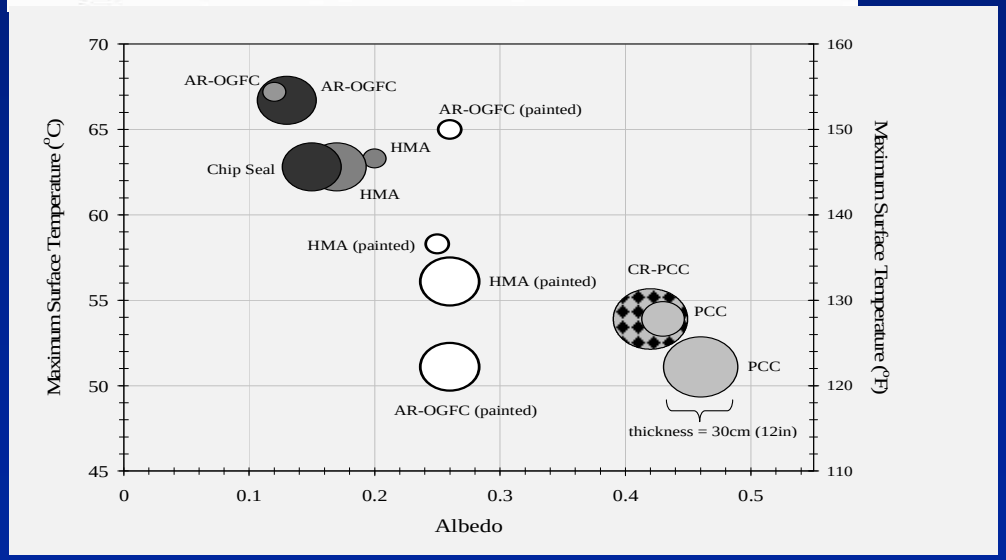


Surface Reflectivity -Lighting

Enhanced Nighttime Visibility:

Improved pedestrian and vehicle safety

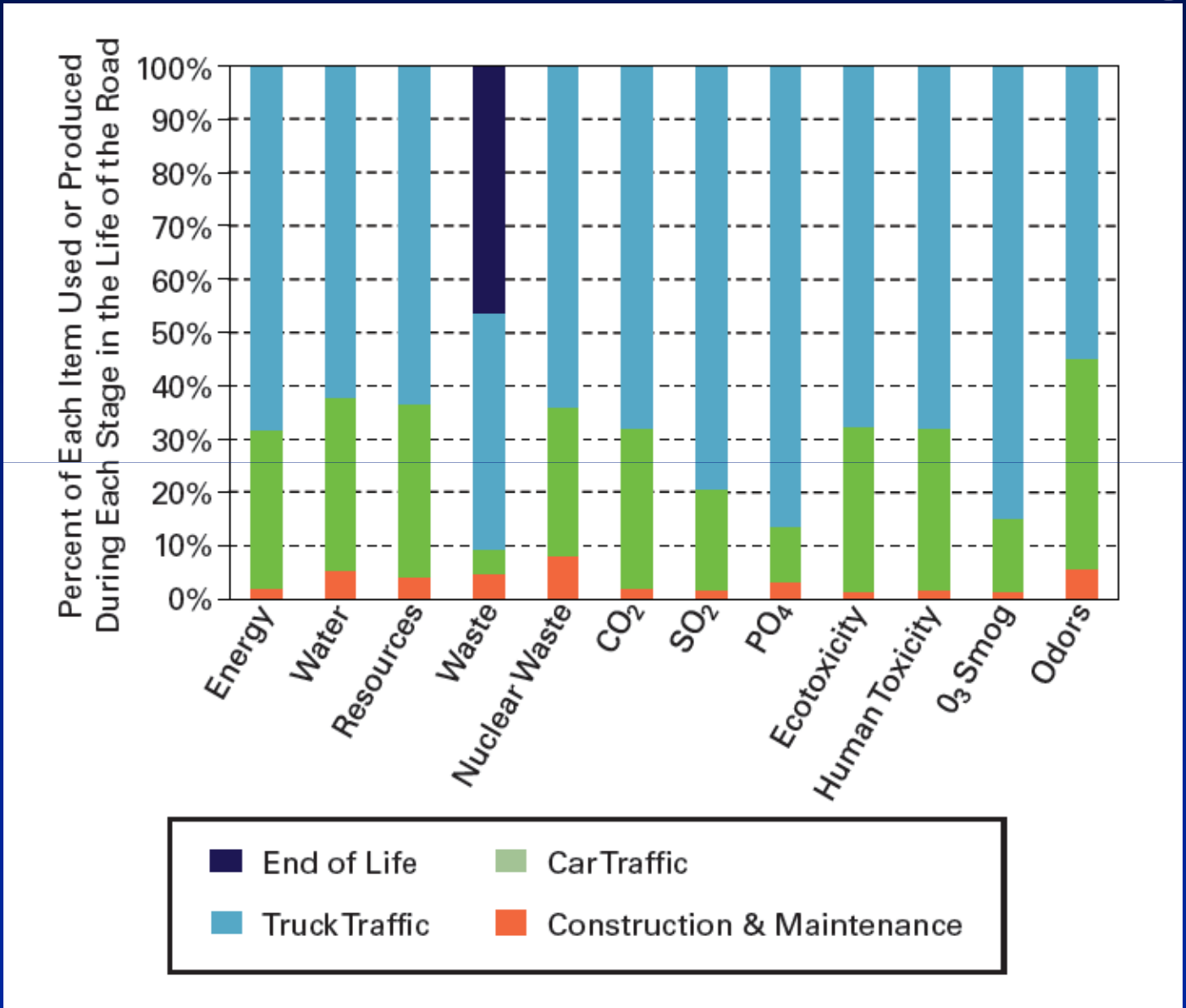
Reduced lighting & energy requirement:
Less fixtures/watts

Up to 33% reduction

Huge budget impact!

Concrete cuts highway lighting costs. Studies show proper lighting levels can be reached on concrete with 50% fewer fixtures than needed for dark-colored pavement.

What should we be doing?



Need to Quantify Sustainability Benefits

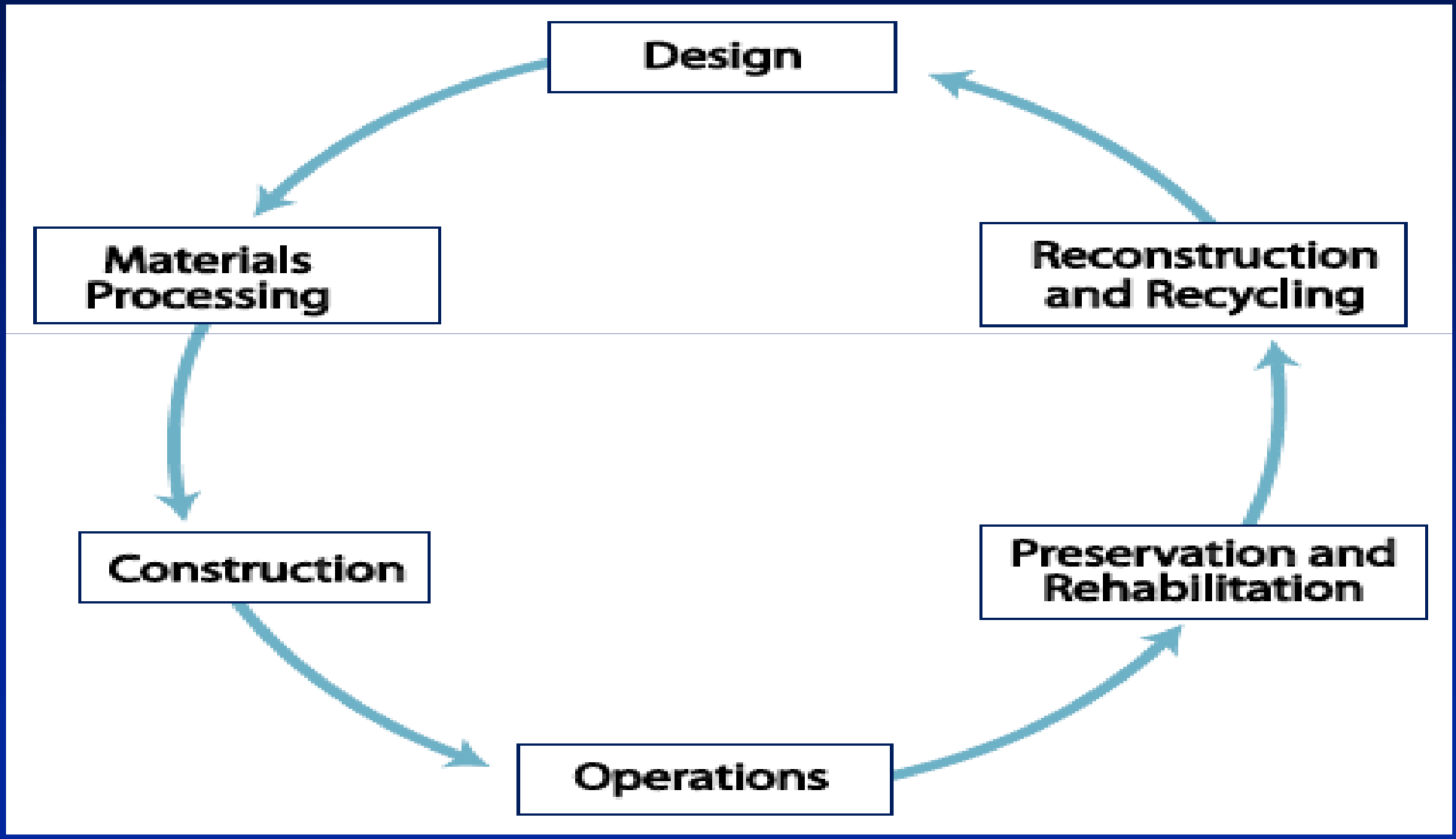
- To prove an improvement is an improvement
- To assess the relative value of change
- To provide incentive for change

- Sustainability metrics are being developed and will be required in the US for Federally funded projects in the near future

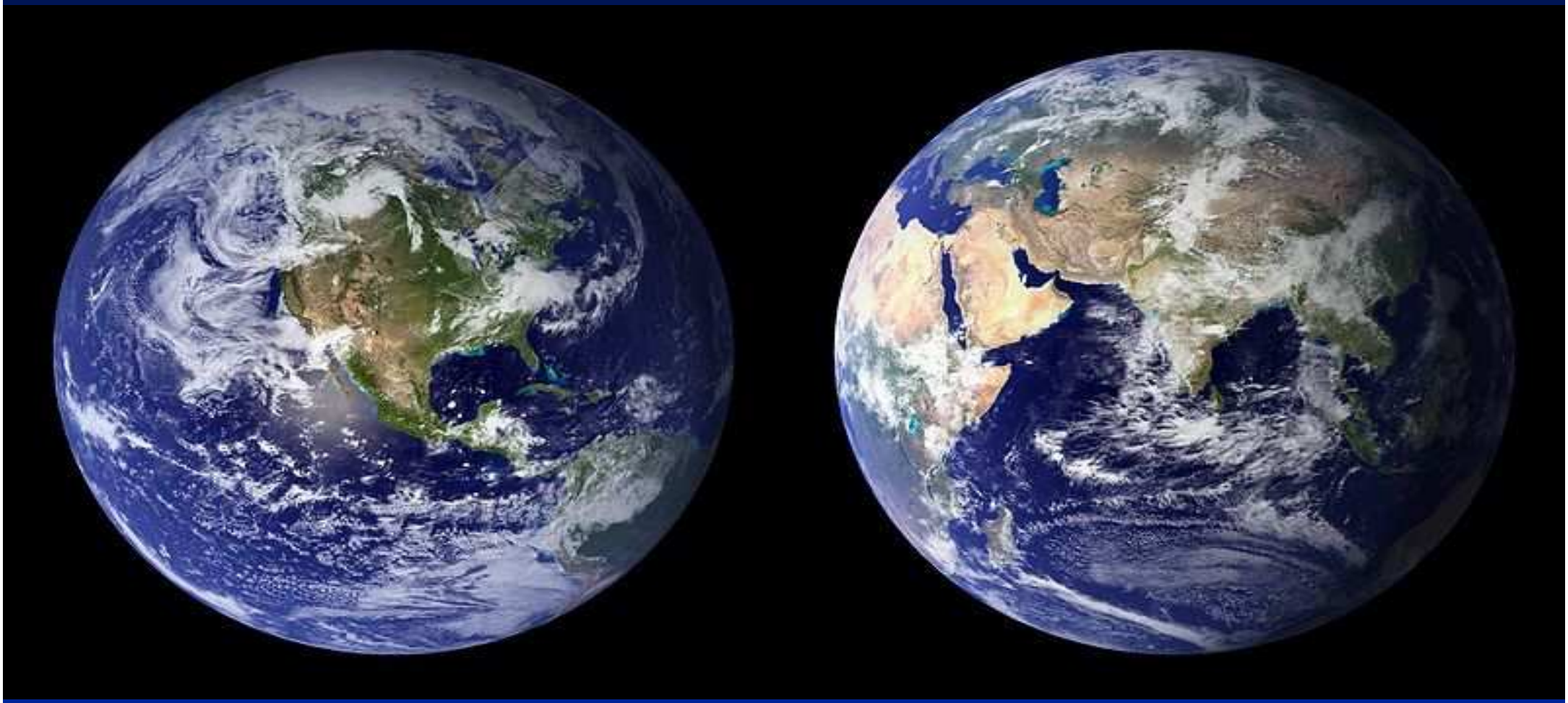
How Do We Measure Life Cycle Impacts?

- "Greenwashing" is rampant – almost everything is now labeled as sustainable or green
- Rating systems
  - Green Roads
  - LEED (but not for roadways yet)
- Life cycle inventory (LCI)/life cycle assessment (LCA)
  - ISO 14000
  - Need to establish regional data and usable software tools
- Measuring social impact - how?

Cradle-to-Cradle Life Cycle Assessment



Climate change and our future



Achieving sustainability will enable the Earth to continue supporting human life as we know it.

Source Wikimedia,"Blue marble" images of earth from NASA


Thank You!