Green Buildings

Motivating Video

Features of Green Buildings

Courtesy of Heartland Builders, Grand Rapids, MI

WHY BUILD GREEN?

Slide from www.usgbc.org

IMPACTS OF U.S. BUILDINGS ON RESOURCES

40% primary energy use*

72% electricity consumption*

39% CO_2 emissions*

13.6% potable water consumption**

Sources:
*Environmental Information Administration (2008). EIA Annual Energy Outlook.
** U.S. Geological Survey (2000). 2000 data.

Slide from www.usgbc.org

Global CO_2 Emissions by Sector

#1. Buildings

#2. Transportation

#3. Industry

Source: Energy Information Administration (2006). Emissions of Greenhouse Gases in the United States.

Slide from www.usgbc.org

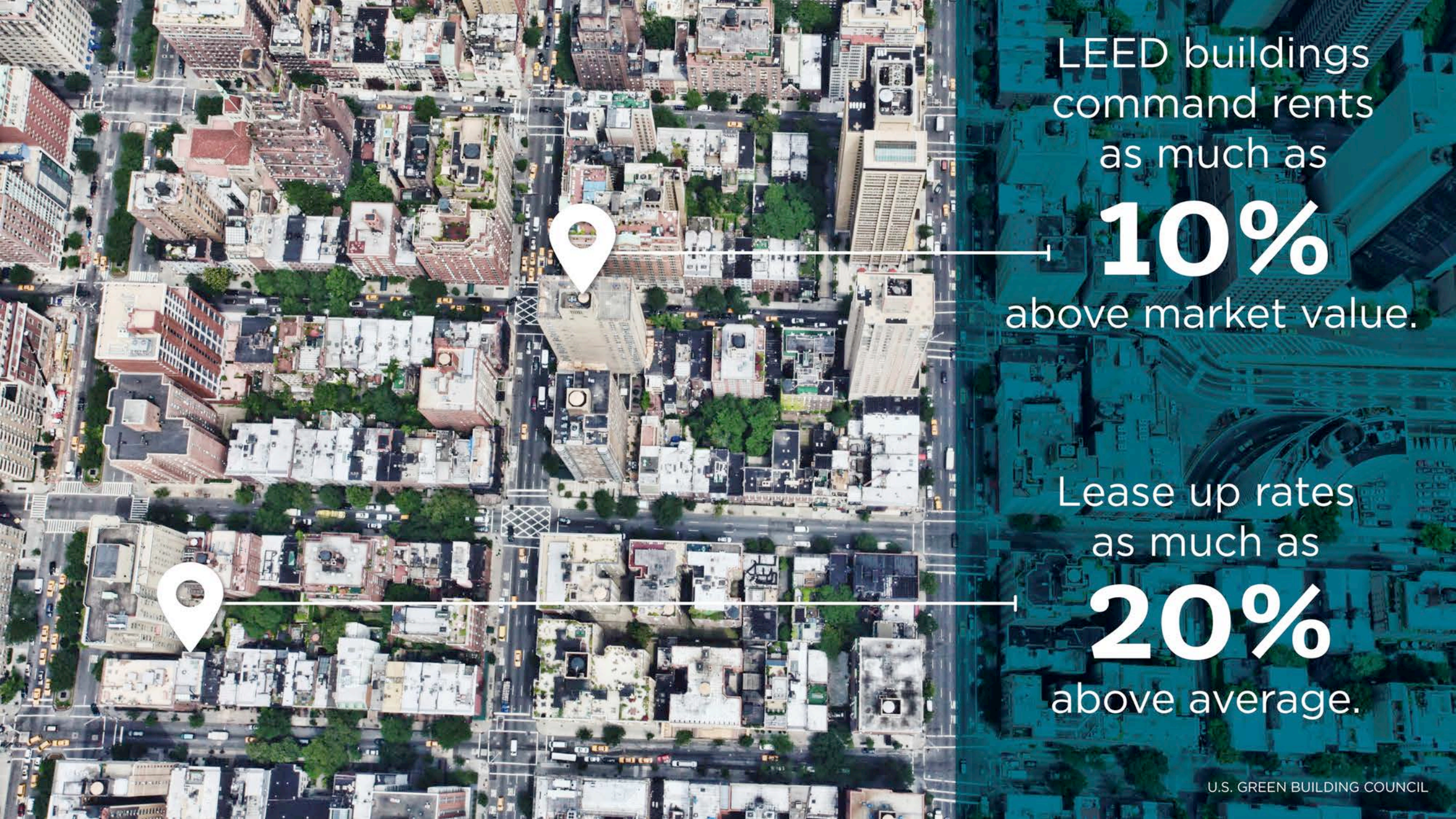
Green Building Occupants Are Healthier & More Productive

- In the U.S., people spend, on average, 90% or more of their time indoors*
- Green buildings typically have better indoor air quality and lighting

* Source: The Total Exposure Assessment Methodology (TEAM) Study. EPA 600/S6-87/002. U.S. Environmental Protection Agency. 1987.

Slide from www.usgbc.org

Studies have found a positive correlation between **improved indoor environmental quality** and **human health**, **productivity and attendance**.


LEED buildings
command rents
as much as
10%
above market value.
Lease up rates
as much as
20%
above average.
U.S. GREEN BUILDING COUNCIL

Every **$1*** saved in operating expenses

increases property value by **$10***

*per square foot

U.S. GREEN BUILDING COUNCIL

Our Mission

To transform the way buildings and communities are designed, built and operated, enabling an environmentally and socially responsible, healthy and prosperous environment that improves the quality of life.

Slide from www.usgbc.org

Leadership in Energy & Environmental Design


LEED is the most widely used green building rating system in the world. It works for all buildings at all phases of development, from new construction to existing buildings, and all building sectors, from homes to hospitals to corporate headquarters.

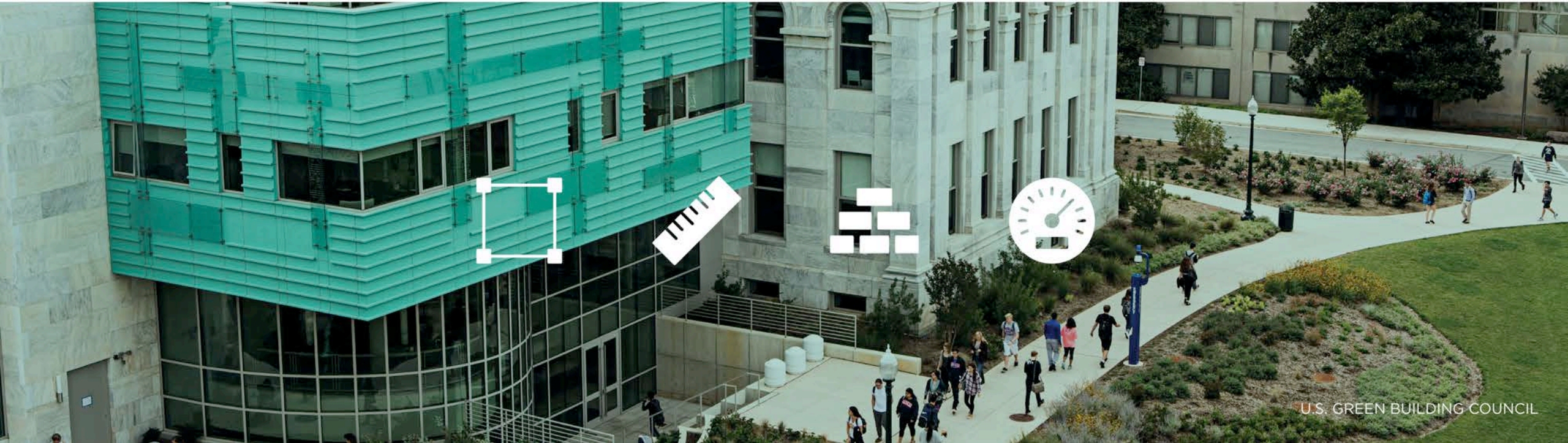

Every day,
1.8 million
square feet
of building space
is LEED certified.
U.S. GREEN BUILDING COUNCIL

750+ policies that incentivize LEED across federal, state and local governments

Leadership in **Energy** and **Environmental Design**

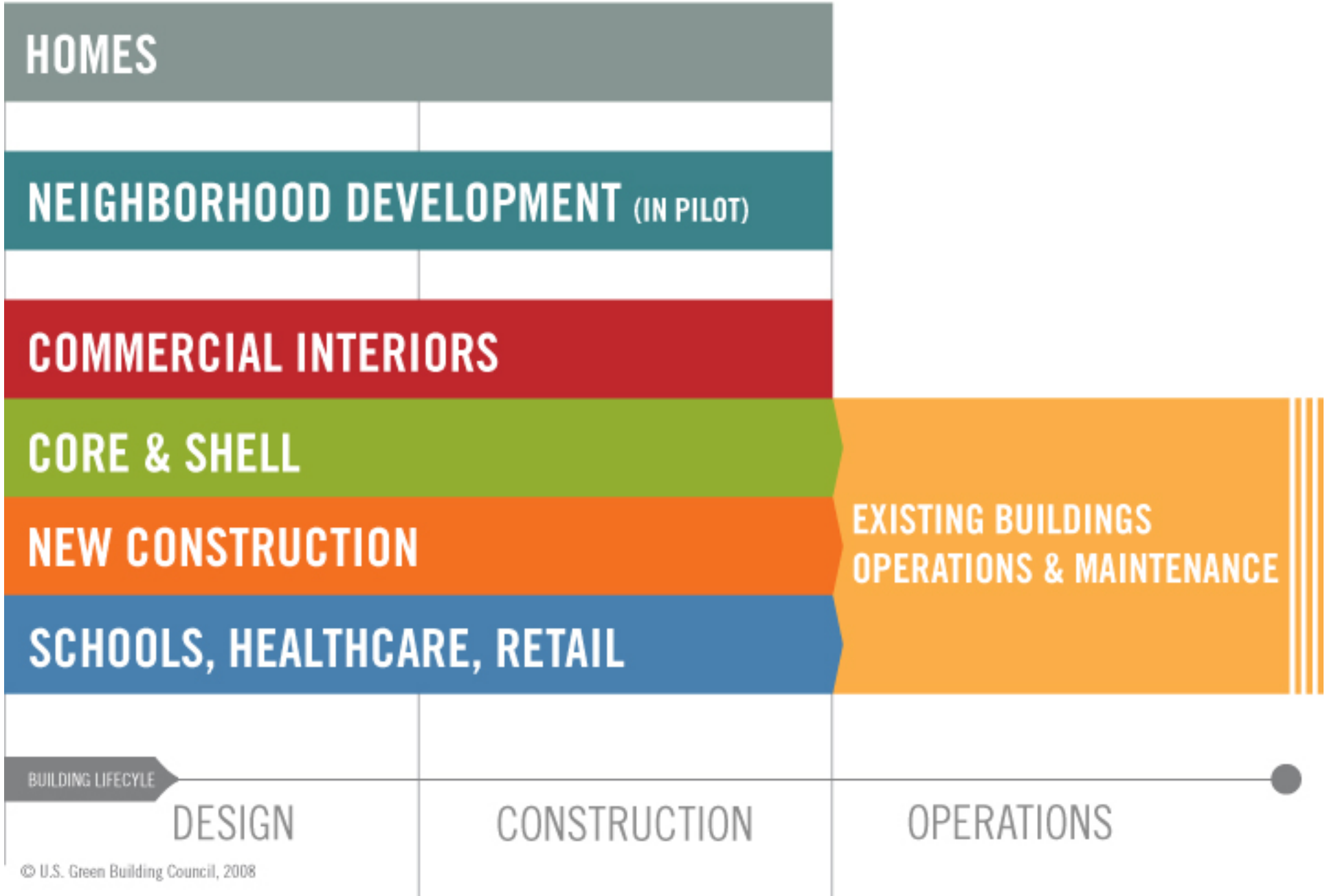
A leading-edge system for certifying the greenest performing buildings in the world

A concise framework for identifying & implementing **practical & measurable** green building design, construction, operations & maintenance strategies and solutions.



What Is Green Building?

LEED address the complete lifecycle of buildings:



Cross-Functional Team

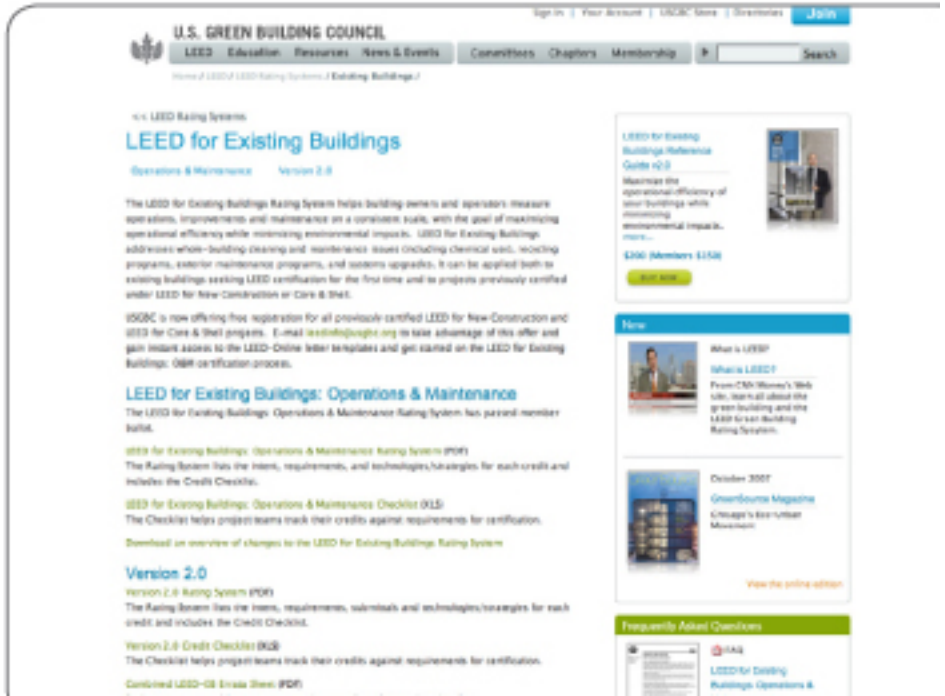
LEED Is Consensus-Based

USGBC has four levels of LEED:

Steps to LEED Certification

Getting Started: Tools

- Rating systems
- Reference guide
- Project checklist
- Credit Interpretation Requests (CIRs)
- LEED Online
- Educational workshops
- Project case studies
- www.usgbc.org



LEED v4 for BD+C: New Construction and Major Renovation

Project Checklist

Project Name

Date

Y	?	N			
			Credit 1	Integrative Process	1
			Location and Transportation	**Possible Points:**	**16**
			Credit 1	LEED for Neighborhood Development Location	16
			Credit 2	Sensitive Land Protection	1
			Credit 3	High Priority Site	2
			Credit 4	Surrounding Density and Diverse Uses	5
			Credit 5	Access to Quality Transit	5
			Credit 6	Bicycle Facilities	1
			Credit 7	Reduced Parking Footprint	1
			Credit 8	Green Vehicles	1
			Sustainable Sites	**Possible Points:**	**10**
Y			Prereq 1	Construction Activity Pollution Prevention	Required
			Credit 1	Site Assessment	1
			Credit 2	Site Development--Protect or Restore Habitat	2
			Credit 3	Open Space	1
			Credit 4	Rainwater Management	3
			Credit 5	Heat Island Reduction	2
			Credit 6	Light Pollution Reduction	1
			Water Efficiency	**Possible Points:**	**11**
Y			Prereq 1	Outdoor Water Use Reduction	Required
Y			Prereq 2	Indoor Water Use Reduction	Required
Y			Prereq 3	Building-Level Water Metering	Required
			Credit 1	Outdoor Water Use Reduction	2
			Credit 2	Indoor Water Use Reduction	6
			Credit 3	Cooling Tower Water Use	2
			Credit 4	Water Metering	1
			Energy and Atmosphere	**Possible Points:**	**33**
Y			Prereq 1	Fundamental Commissioning and Verification	Required
Y			Prereq 2	Minimum Energy Performance	Required
Y			Prereq 3	Building-Level Energy Metering	Required
Y			Prereq 4	Fundamental Refrigerant Management	Required
			Credit 1	Enhanced Commissioning	6
			Credit 2	Optimize Energy Performance	18
			Credit 3	Advanced Energy Metering	1
			Credit 4	Demand Response	2
			Credit 5	Renewable Energy Production	3
			Credit 6	Enhanced Refrigerant Management	1
			Credit 7	Green Power and Carbon Offsets	2

			Materials and Resources	**Possible Points:**	**13**
Y			Prereq 1	Storage and Collection of Recyclables	Required
Y			Prereq 2	Construction and Demolition Waste Management Planning	Required
			Credit 1	Building Life-Cycle Impact Reduction	5
			Credit 2	Building Product Disclosure and Optimization - Environmental Product Declarations	2
			Credit 3	Building Product Disclosure and Optimization - Sourcing of Raw Materials	2
			Credit 4	Building Product Disclosure and Optimization - Material Ingredients	2
			Credit 5	Construction and Demolition Waste Management	2

			Indoor Environmental Quality	**Possible Points:**	**16**
Y			Prereq 1	Minimum Indoor Air Quality Performance	Required
Y			Prereq 2	Environmental Tobacco Smoke Control	Required
			Credit 1	Enhanced Indoor Air Quality Strategies	2
			Credit 2	Low-Emitting Materials	3
			Credit 3	Construction Indoor Air Quality Management Plan	1
			Credit 4	Indoor Air Quality Assessment	2
			Credit 5	Thermal Comfort	1
			Credit 6	Interior Lighting	2
			Credit 7	Daylight	3
			Credit 8	Quality Views	1
			Credit 9	Acoustic Performance	1

			Innovation	**Possible Points:**	**6**
			Credit 1	Innovation	5
			Credit 2	LEED Accredited Professional	1

			Regional Priority	**Possible Points:**	**4**
			Credit 1	Regional Priority: Specific Credit	1
			Credit 2	Regional Priority: Specific Credit	1
			Credit 3	Regional Priority: Specific Credit	1
			Credit 4	Regional Priority: Specific Credit	1

			Total	**Possible Points:**	**110**

Certified 40 to 49 points Silver 50 to 59 points Gold 60 to 79 points Platinum 80 to 110


U.S. GREEN BUILDING COUNCIL
LEED PLATINUM
2009

USGBC overview

- More than 12,000 national members
- More than 18,000 Greenbuild attendees (Los Angeles)
- 167 countries and territories with LEED projects

LEED credentials

- More than 202,600 total LEED credentials held
- More than 201,000 total LEED professionals

LEED projects

- 2.2 million certified square feet per day
- More than 205,830 certified gross square meters per day
- More than 92,200 total commercial + LEED ND projects
- More than 92,000 total commercial projects
- More than 19.3 billion total commercial square feet (excludes ND)
- More than 1.8 billion total commercial square meters (excludes ND)
- More than 39,000 certified commercial projects
- More than 6.2 billion certified commercial square feet
- More than 577 million certified commercial square meters
- More than 1.6 million residential units registered or certified with LEED
- 2,000 K-12 projects certified
- More than 2,100 K-12 projects registered
- More than 4,200 higher education projects certified
- Nearly 3,900 higher education projects registered
- 961 state government projects certified
- More than 2,900 local government projects certified

https://www.usgbc.org/articles/usgbc-statistics

The Tower at PNC Plaza

https://www.nextpittsburgh.com/city-design/frick-environmental-center-open-public/

http://www.sustainablesites.org/phipps-center-sustainable-landscapes

http://www.ppgpaintsarena.com/plan_your_visit

https://pittsburghkids.org/visit

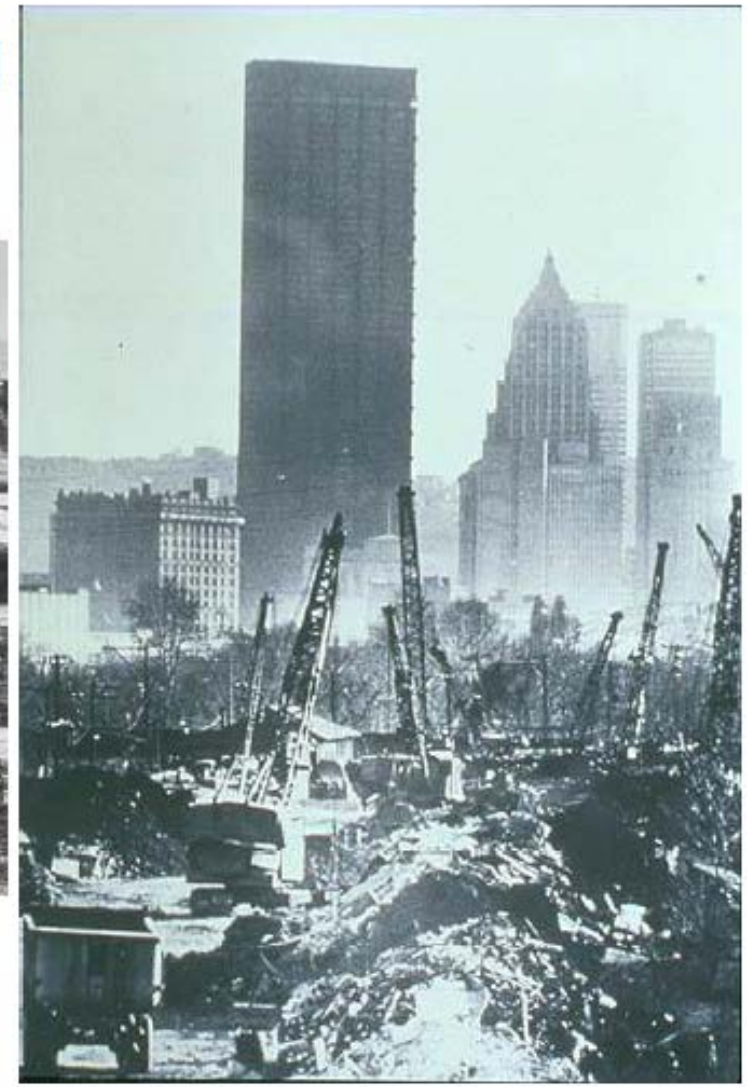
What Is Green Building?

What Is Green Building?

Sustainable Sites

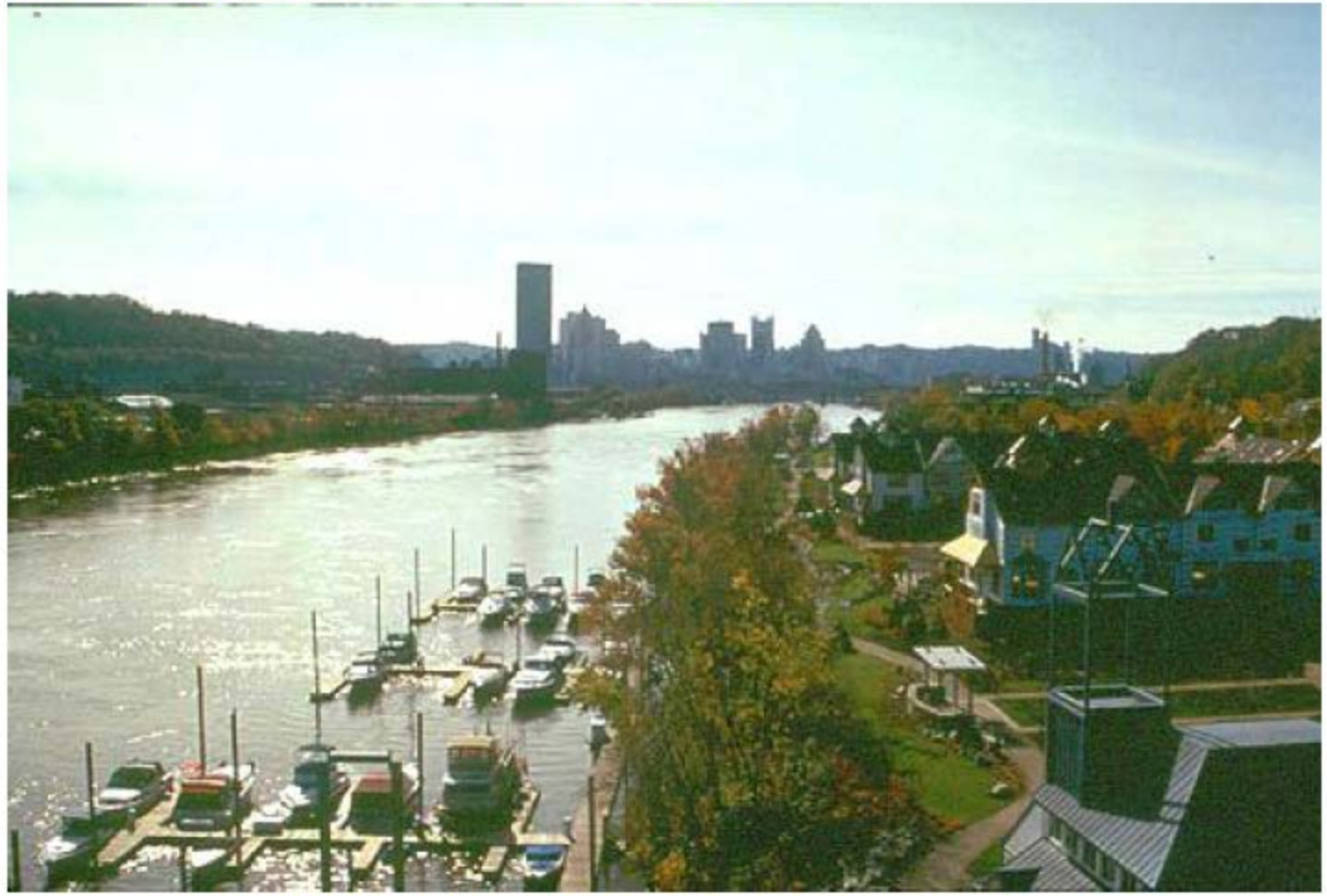
- Based on the principle that land is a precious finite resource
- Effective planning
  - Minimize urban sprawl
    - Overdependence on automobiles
    - Excessive fossil fuel consumption
    - Higher pollution level
- Land is recyclable
  - Pittsburgh is known for its brownfields

Washington's Landing



Strengthening our neighborhoods - Revitalizing our downtown
Reclaiming our rivers

Washington's Landing



Strengthening our neighborhoods - Revitalizing our downtown
Reclaiming our rivers

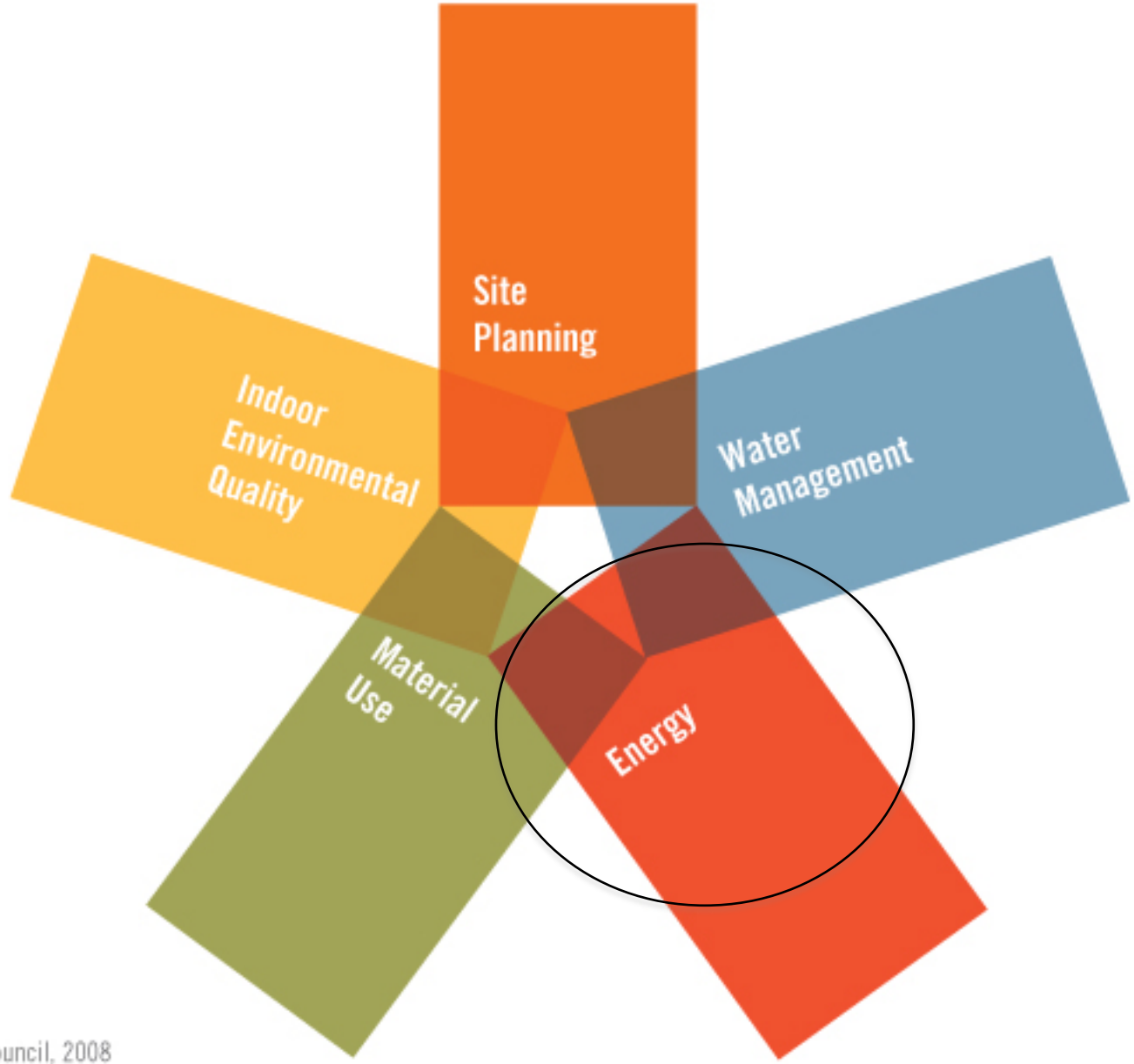
Washington's Landing

Strengthening our neighborhoods - Revitalizing our downtown
Reclaiming our rivers

Summerset at Frick Park

SouthSide Works

What Is Green Building?



Energy and Atmosphere

- Energy conservation is best addressed through effective building design
  - Designing a building envelope that is highly resistant to conductive, convective, and radiative heat transfer
  - Employing renewable energy resources
  - Fully implement *passive design*

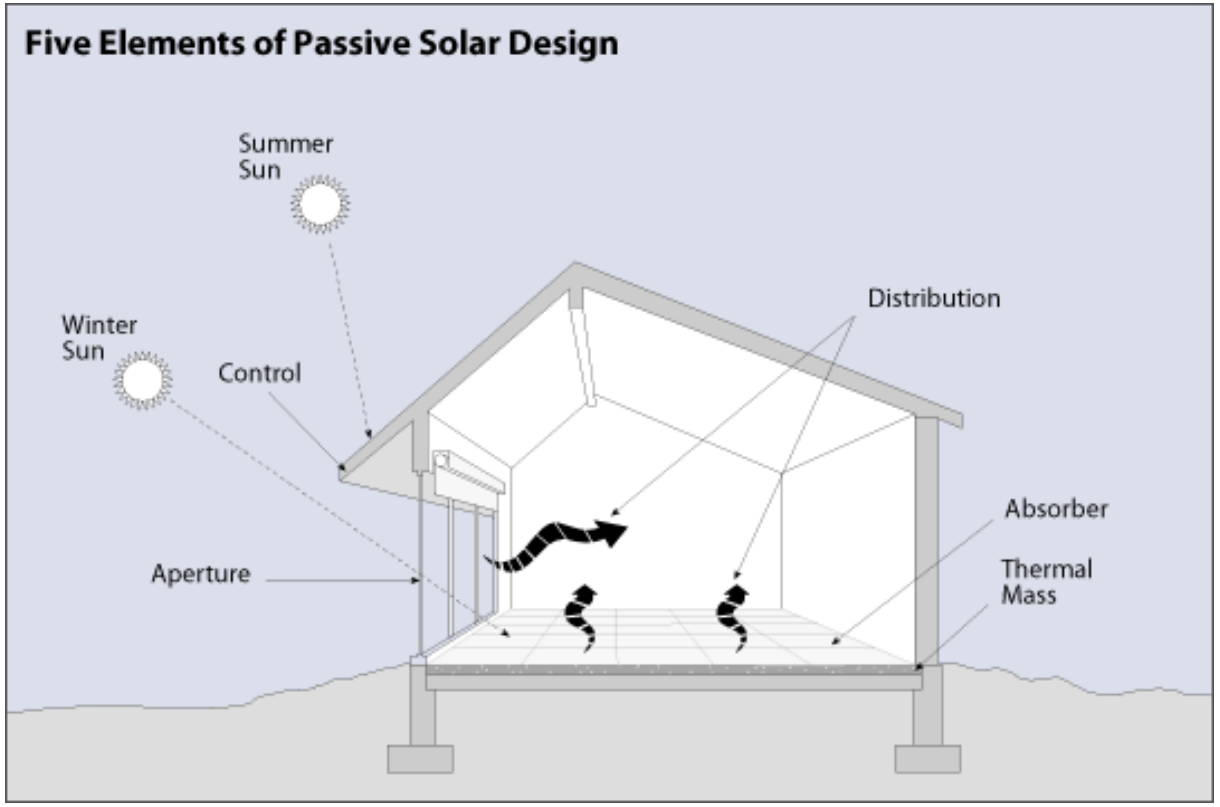
  - *https://sustainabilityworkshop.autodesk.com/buildings/building-energy-fundamentals*

Energy and Atmosphere

•Building's geometry
•Orientation
•Mass

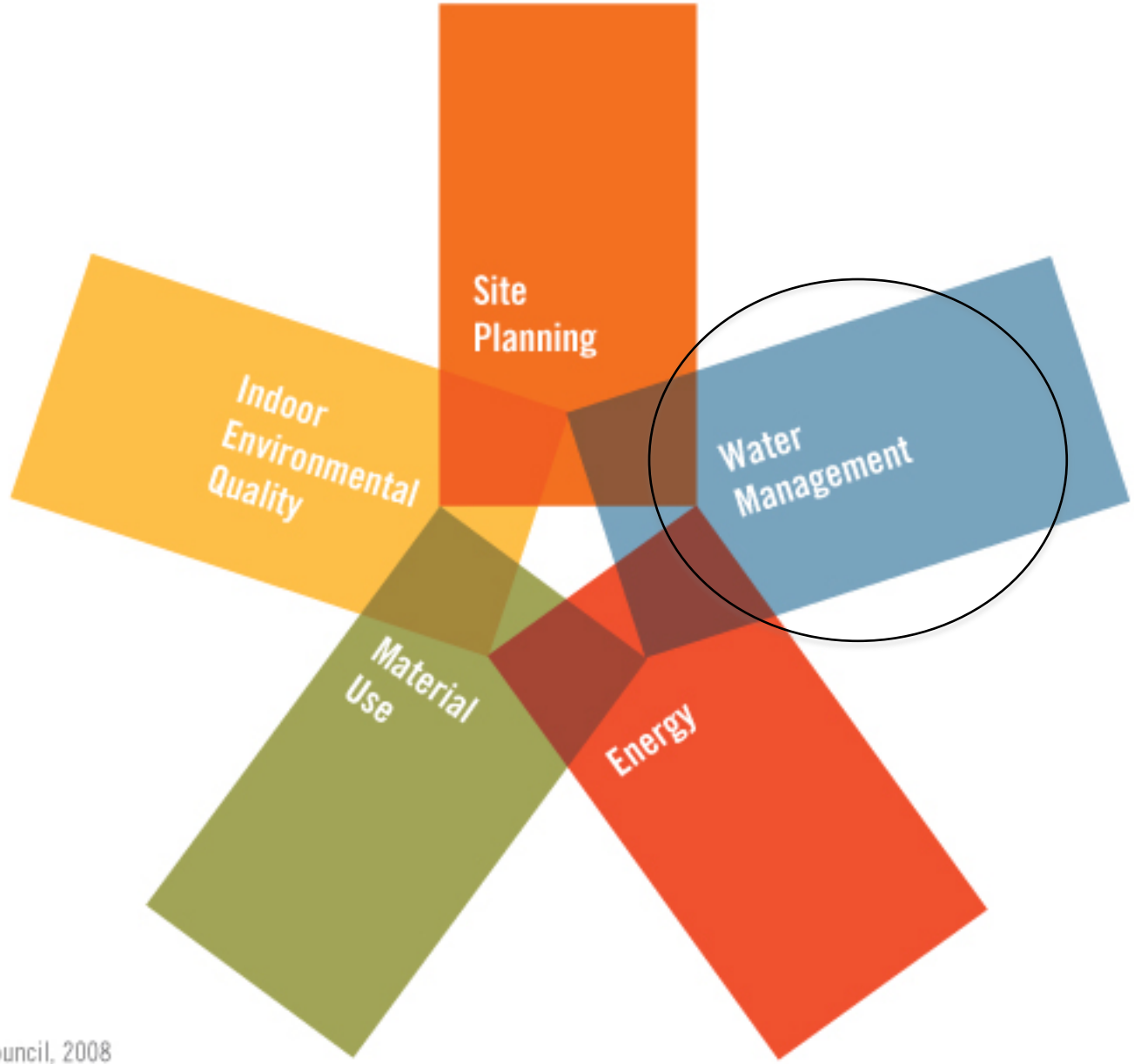
to condition the structure using natural and climatological features such as

•Site's solar insulation
•Thermal chimney effect
•Prevailing winds
•Local topography
•Microclimate
•Landscaping.



From Kibert

What Is Green Building?



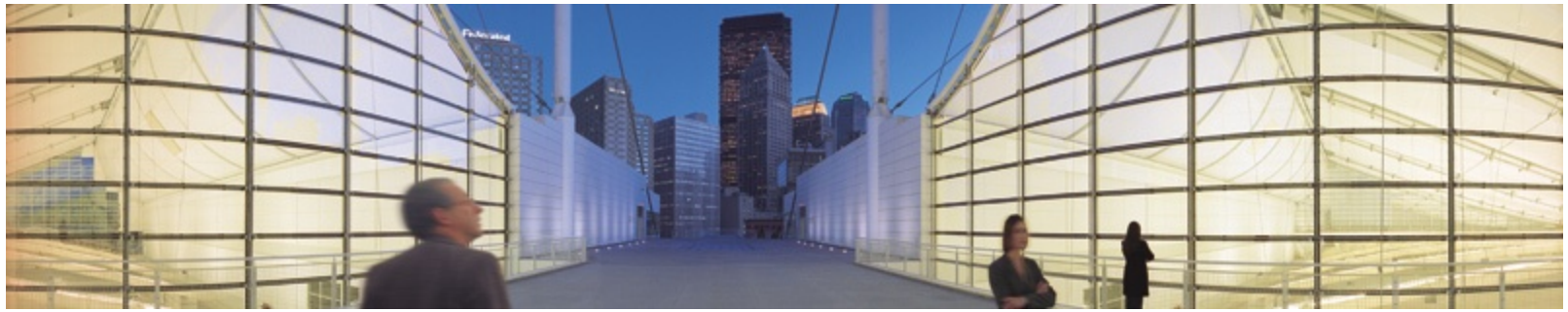
Water Issues

- Availability of potable water is the limiting factor for development and construction in many areas of the world
  - In the US – western regions
- Climate changes are exacerbating the problems
- Extremely difficulty to reverse contaminated water

Water Issues

- Water conservation techniques
  - Low-flow plumbing fixtures
  - Water recycling
  - Rainwater harvesting

Convention center: water reclamation system that reduces potable water use by nearly 60 percent



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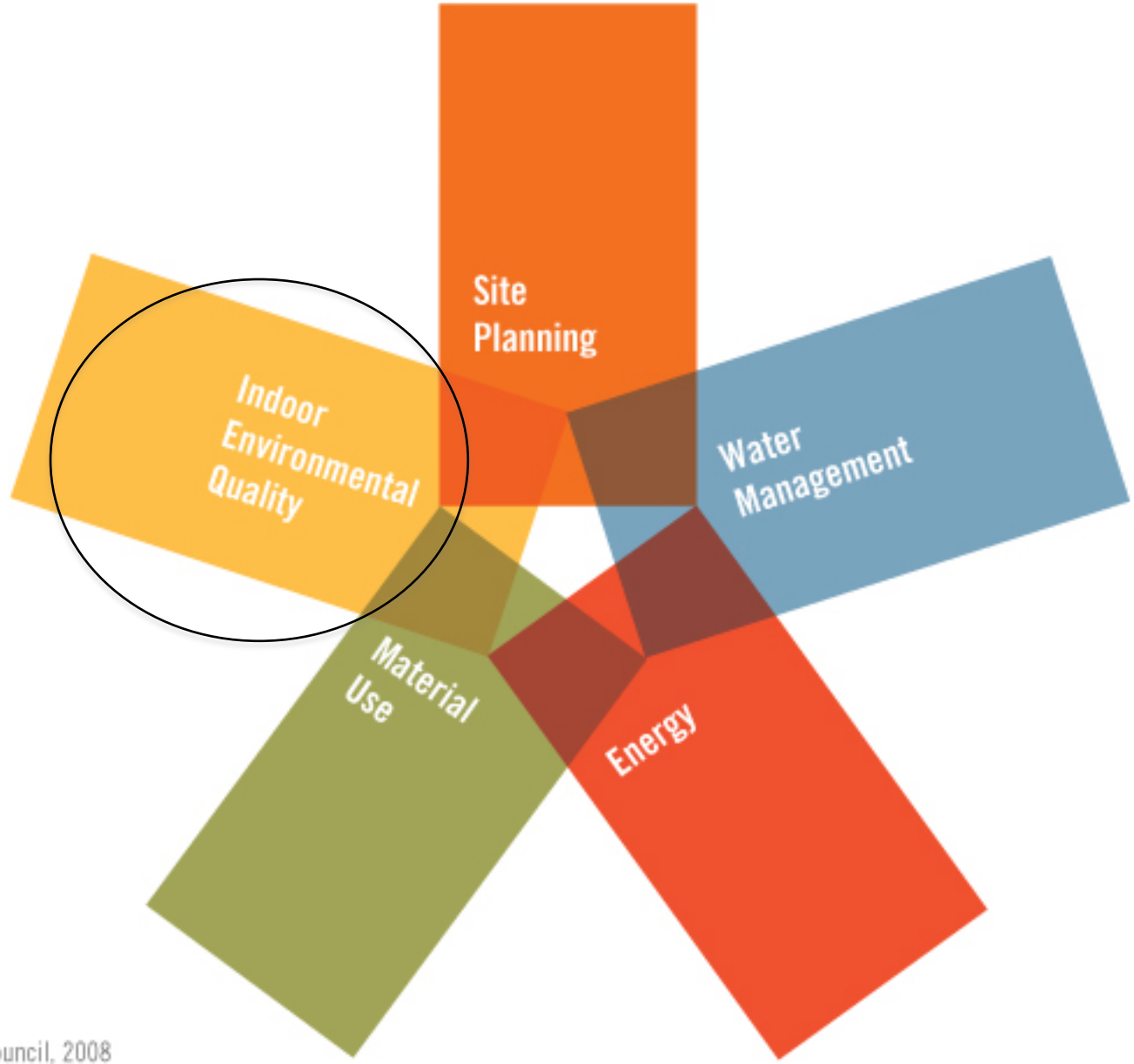

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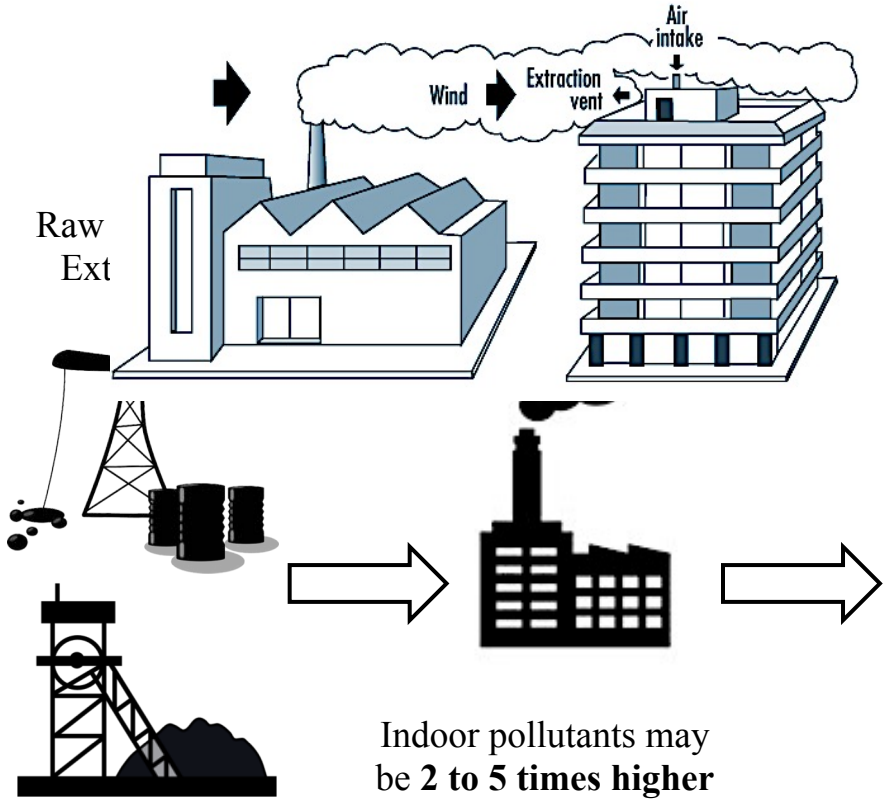
Ambient and Indoor Air Quality

- 3.5 million deaths a year are caused by indoor air pollution while another 3.3 million are caused by outdoor air pollution (WHO 2016)

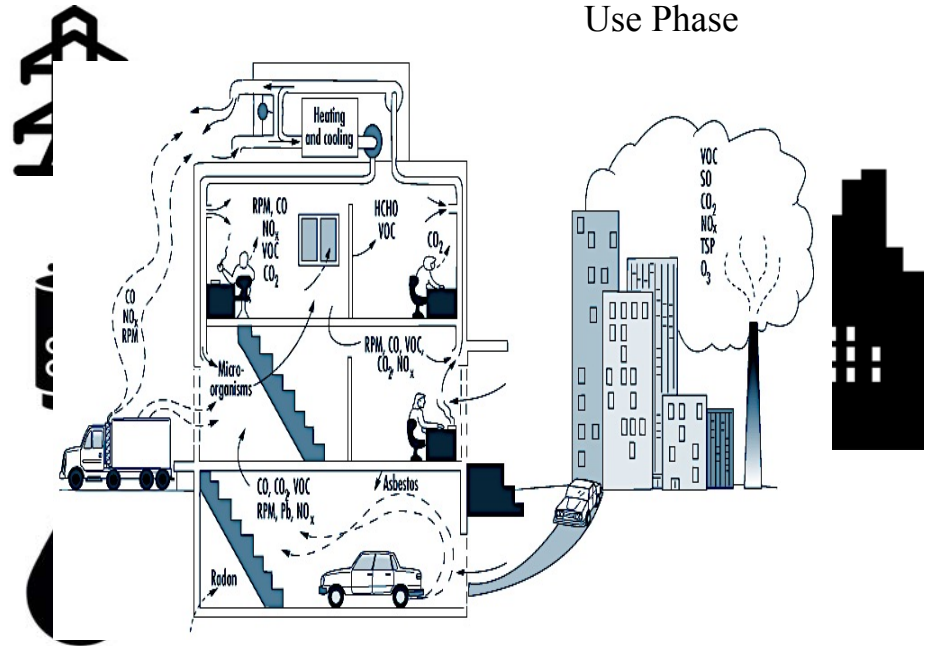


Indoor pollutants may be **2 to 5 times higher** than outdoor pollutant levels (EPA 2015).

Americans, on average, spend approximately **90 percent** of their time indoors (EPA 2015).

Distribution

Use Phase



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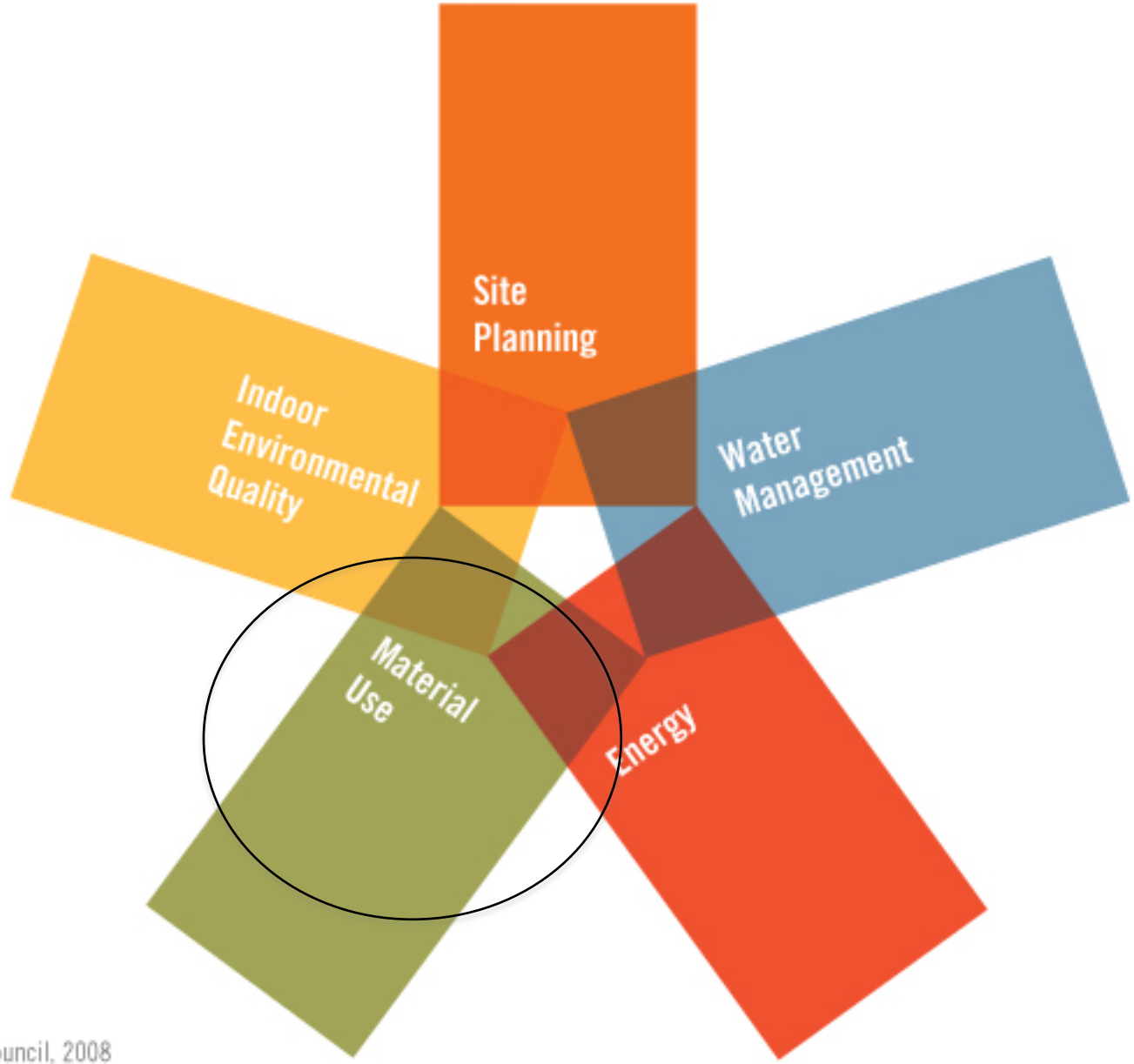

Context

- Materials flows between all economic sectors, construction uses about 40% in U.S.

- Materials as a problem to address in sustaining the built environment
  - What are ‘green materials’?
  - How do we evaluate them?
  - What is the best we can do?
  - What are the limitations?
  - How do we implement change on an industrial scale?

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Issues in Selecting Green Building Materials and products

- example….rapidly renewable resources
  - WOOD
    - Old-growth versus plantation forests
    - USGBC “rapidly renewable resources”
      - Growth and harvest cycle of 10 years or less
    - More sustainable?
      - Water, fertilizer, pesticides…

How to select?

- Natural Step
- Life cycle assessment
- CAL
- Material specific
- Databases

GBA

- Show example.

Building products – Databases/how to rate products

MATERIALS

RED LIST

IMPERATIVE 10

There are temporary exceptions for numerous Red List items due to current limitations in the materials economy. Refer to the Materials Petal Handbook for complete and up-to-date listings.

The project cannot contain any of the following Red List materials or chemicals:[21]

- Alkylphenols
- Asbestos
- Bisphenol A (BPA)
- Cadmium
- Chlorinated Polyethylene and Chlorosulfonated Polyethlene
- Chlorobenzenes
- Chlorofluorocarbons (CFCs) and Hydrochlorofluorocarbons (HCFCs)
- Chloroprene (Neoprene)
- Chromium VI
- Chlorinated Polyvinyl Chloride (CPVC)
- Formaldehyde (added)
- Halogenated Flame Retardants (HFRs)
- Lead (added)
- Mercury
- Polychlorinated Biphenyls (PCBs)
- Perfluorinated Compounds (PFCs)
- Phthalates
- Polyvinyl Chloride (PVC)
- Polyvinylidene Chloride (PVDC)
- Short Chain Chlorinated Paraffins
- Wood treatments containing Creosote, Arsenic or Pentachlorophenol
- Volatile Organic Compounds (VOCs) in wet applied products[23]

21 A link to the list of CAS Registry Numbers that correspond with each Red List item is available in the Materials Petal Handbook.

22 Wet applied products (coatings, adhesives and sealants) must have VOC levels below the South Coast Air Quality Management District (SCAQMD) Rule 1168 for Adhesives and Sealants or the CARB 2007 Suggested Control Measure (SCM) for Architectural Coatings as applicable. Containers of sealants and adhesives with capacity of 16 ounces or less must comply with applicable category limits in the California Air Resources Board (CARB) Regulation for Reducing Emissions from Consumer Products.

Conclusion
LEED is not perfect.

- Number of points available in each category indicated the weight they place on the major issues
  - "Weighting" is based solelåy on judgment
  - Is this good or bad?
    - Not scientific
    - Based on professionals…slow process
      - Still logical and rational?
- Model based.
- Other systems

International