


THE COSTS OF SUSTAINABILITY

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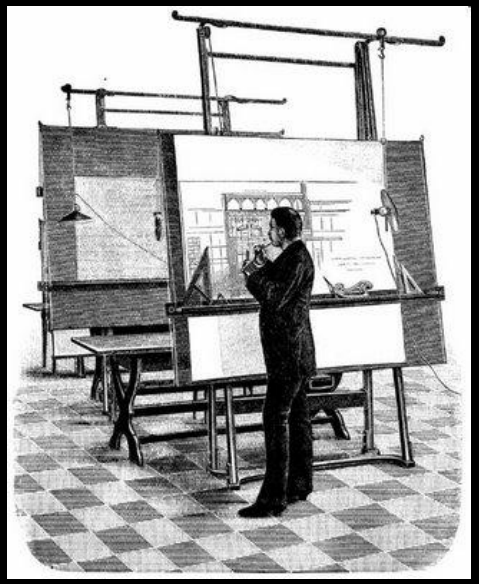
KENT STATE UNIVERSITY
EXCELLENCE *in Sweet Action*

TWO WAYS TO ASSESS COSTS: First Way.

Initial Costs Method

DESIGN -
The costs to develop
Good Ideas.



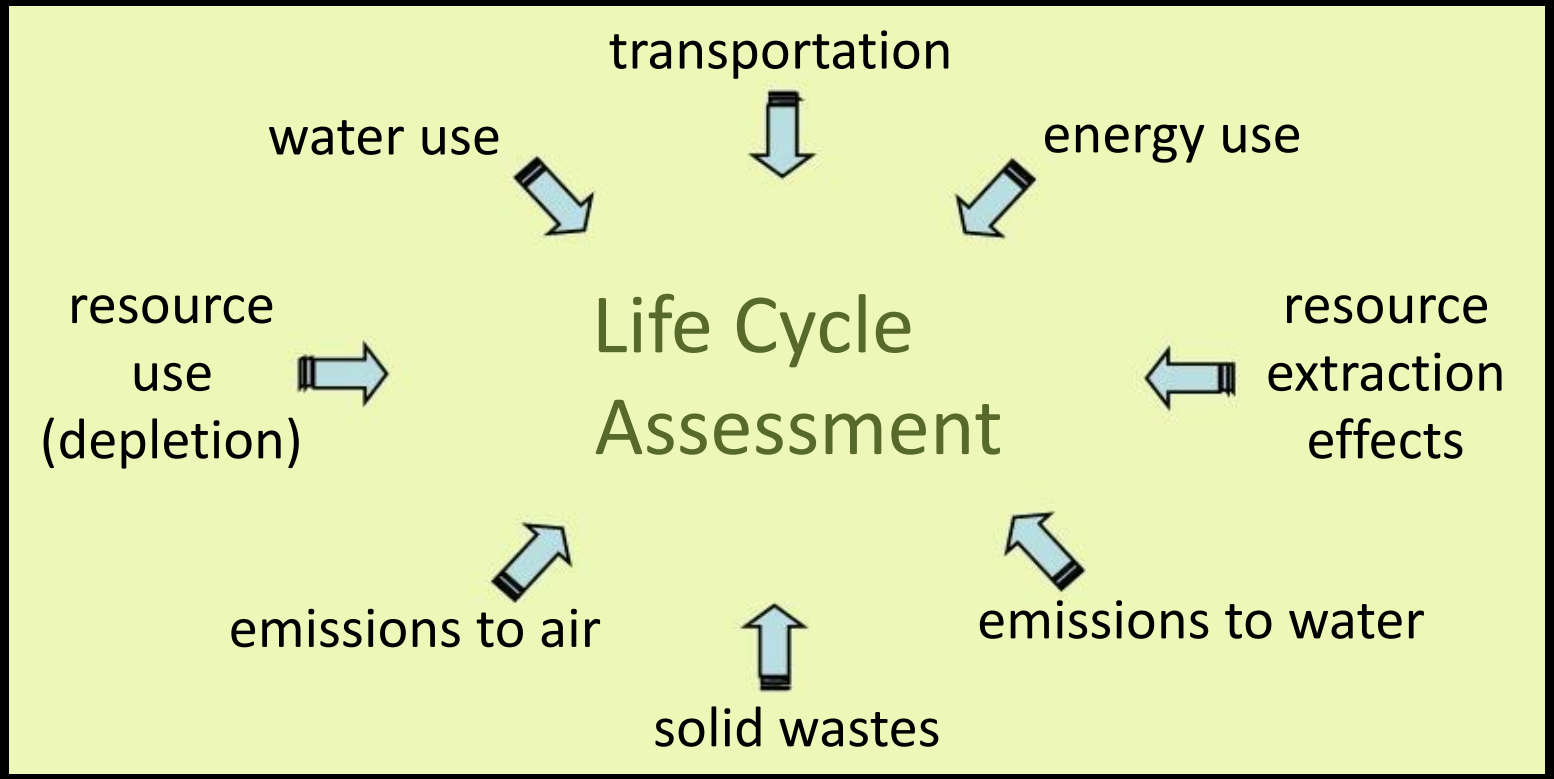
BRICKS & MORTAR -
Hard costs of
Materials and Labor.

TWO WAYS TO ASSESS COSTS: Second Way.

Life-Cycle Cost Method - Assesses Total Cost over Time

Initial costs	(Design and construction)	ONCE
Operating costs	(Energy, water/sewage, waste, recycling, utilities)	ONGOING
Maintenance costs	(Replacement, repair)	ONGOING
Refurbishment	("New life")	PERIODIC
Environmental	(Pollution, resource use)	CONTINUOUS
Disposal costs	(Tear that ugly thing down!)	ONCE, at end

Life Cycle ASSESSMENT (very different… about performance, not just cost)



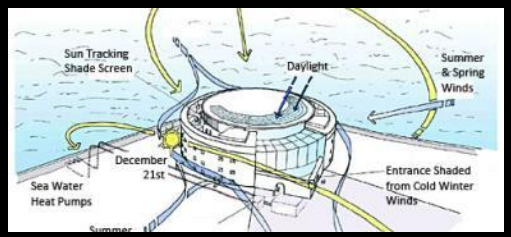
A methodology for assessing the environmental performance of a product over its full life cycle

What is the LEED anyway?

LEADERSHIP in **ENERGY** and **ENVIRONMENTAL DESIGN**

A voluntary, consensus- based national standard for developing high-performance, sustainable buildings and interiors

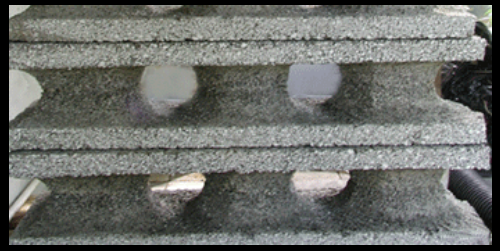
Design and construction practices that significantly reduce or eliminate negative impacts of buildings on the environment and occupants in five broad areas:



*Sustainable site planning

* Safeguarding water and water efficiency

* Energy efficiency



* Conservation of materials and resources

* Indoor environmental quality

How did I pass LEED?

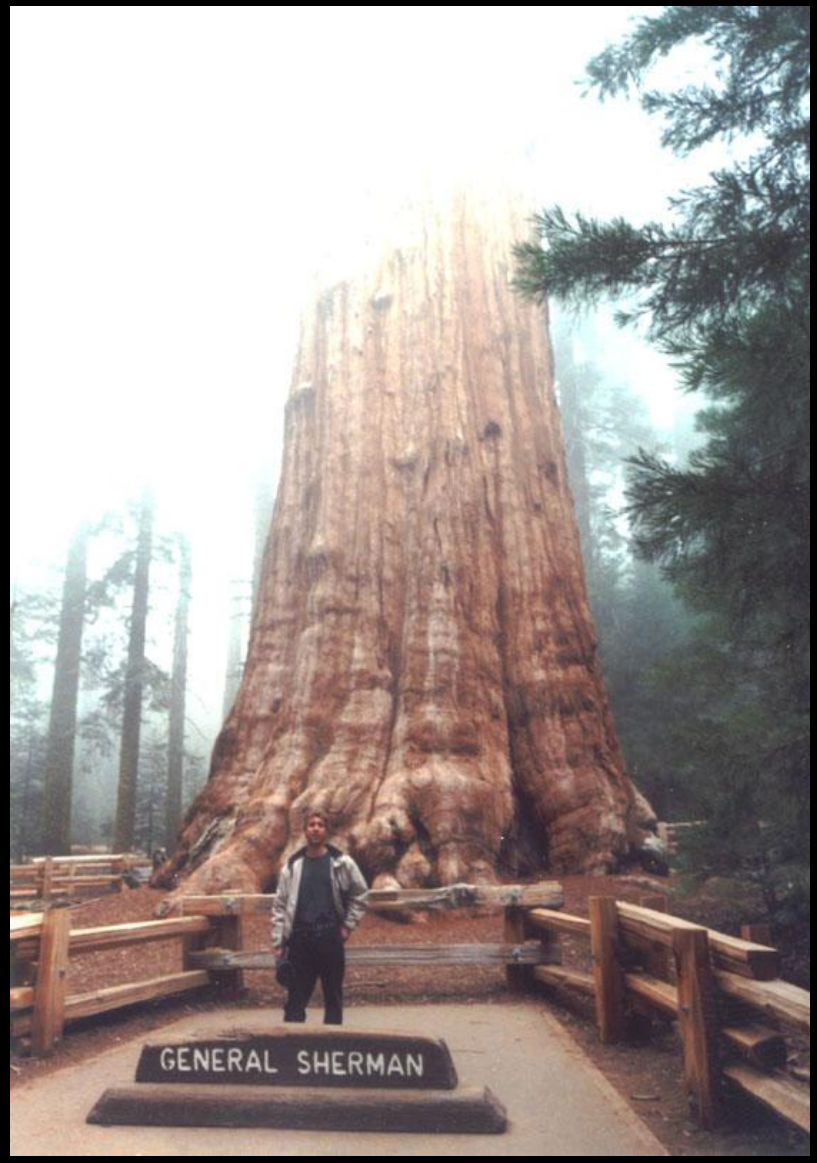
- Read LEED Prep and drew a few pictures for each credit.
- Printed out pictures from www. LEEDVisual. com

- Took practice test. • Failed.

- Read entire riveting 422 page handbook from USGBC.
- Read materials from roughly eleven thousand websites.

- Took another practice test.
- Failed that , too.

- Took five more practice tests.
- Finally passed one. BOOM.



Largest living organism; 52,500 cu. Ft.

SUSTAINABLE SITES (SS)

Sites: An Object Lesson

(What not to do)

(What to do)

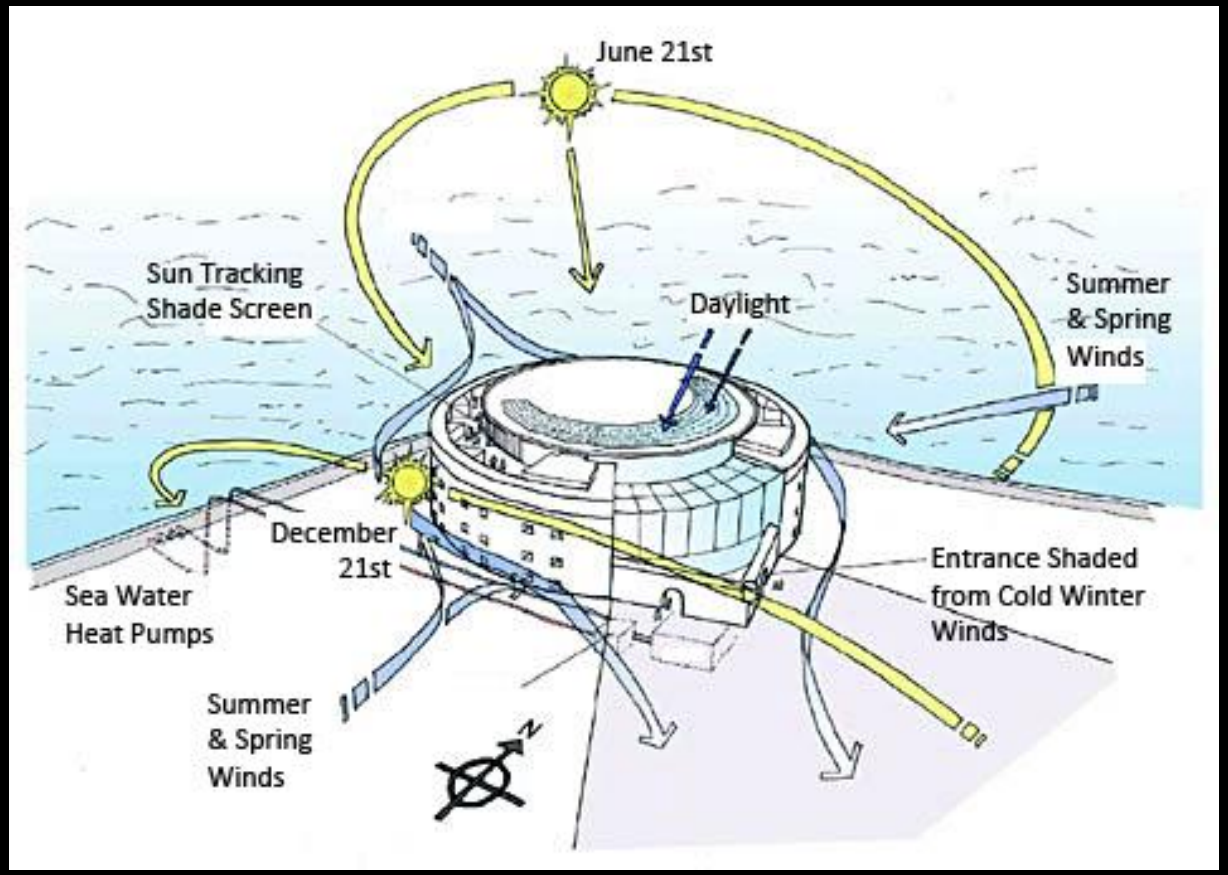
Efficient Use of Infrastructure & Resources

Lincoln Institute:
Public sector in the Northeast says we could save $40 billion over 25 years with more compact development.

Fix-it-First and other smart growth initiatives focus on saving space and public sector money.

Building Orientation

Existing Building on Governor's Island



Building Orientation

Climatic concerns – Wind and Light

WATER EFFICIENCY (WE)

Water Efficiency

- Water savings from:
  - Water-efficient fixtures and appliances
  - Water-efficient landscaping
  - Rainwater collection systems
- Benefits include:
  - ↓ water bills
  - ↓ volumes of wastewater
  - ↓ energy costs for hot water

Water Efficiency

Example: Water Efficient Landscaping

- **Denver, CO**
  - Low water landscaping cost = 1/2 of standard irrigation
  - Almost eliminates water use in lawns
  - Also saves labor, fertilizer, herbicides & fuel
- **Palm Desert, CA Water-Efficient Median Strips**
  - Well-received by the public
  - 85% ↓ in water & maintenance costs

Water Efficiency

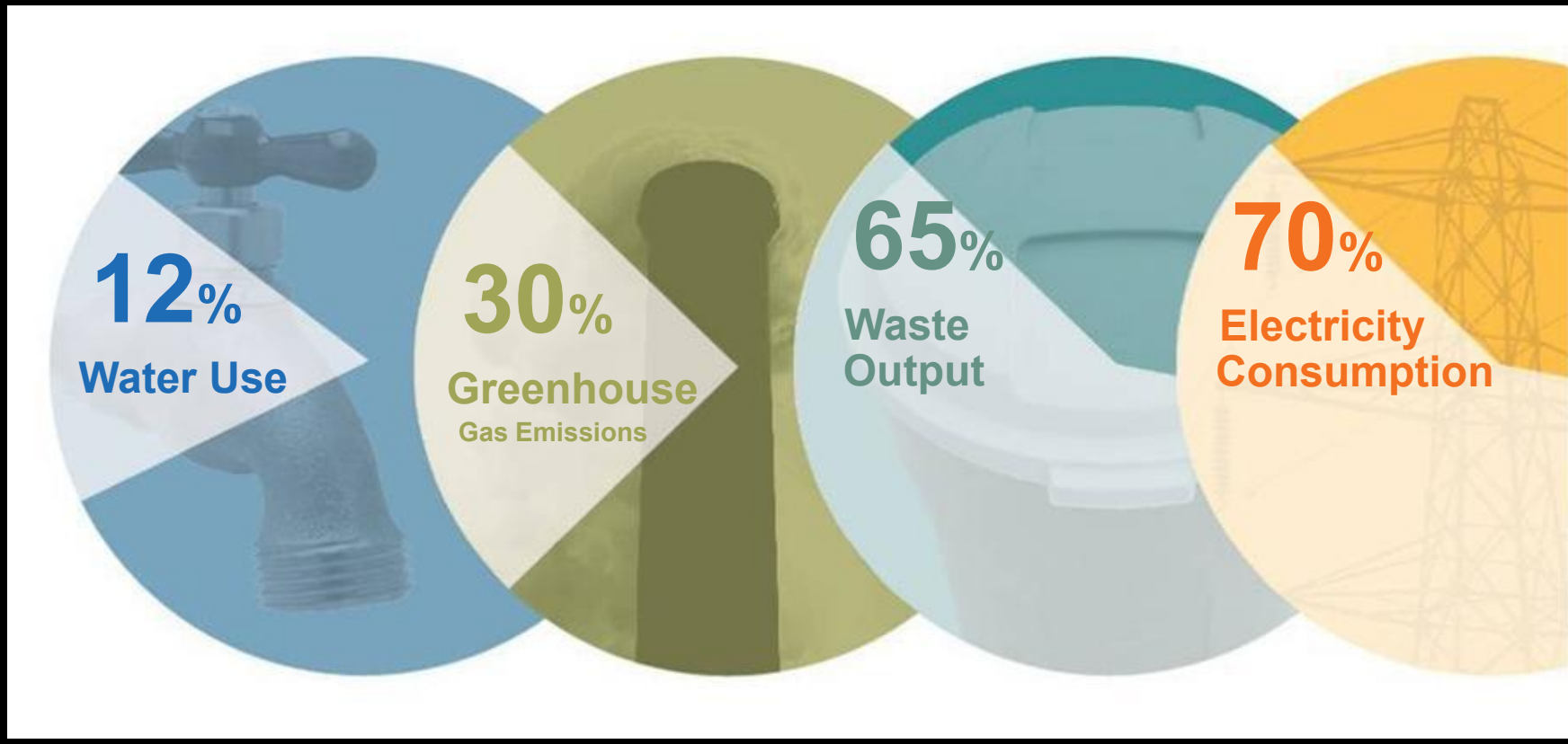
Example: Rainwater Collection System

Austin, TX Residence

- Rainfall collected from roof
- 84,000 tank can provide 100 gallons/day
- Met all 2-person household needs since 1988
- Worked well during 3-year drought
- Cost of system < drilling well or connecting to water district
- Can ↓ fire insurance premiums

ENERGY & ATMOSPHERE (EA)

Buildings Use Lots of Energy




Coors

MATERIALS & RESOURCES (MR)

KNOW YOUR EMBODIED ENERGY !

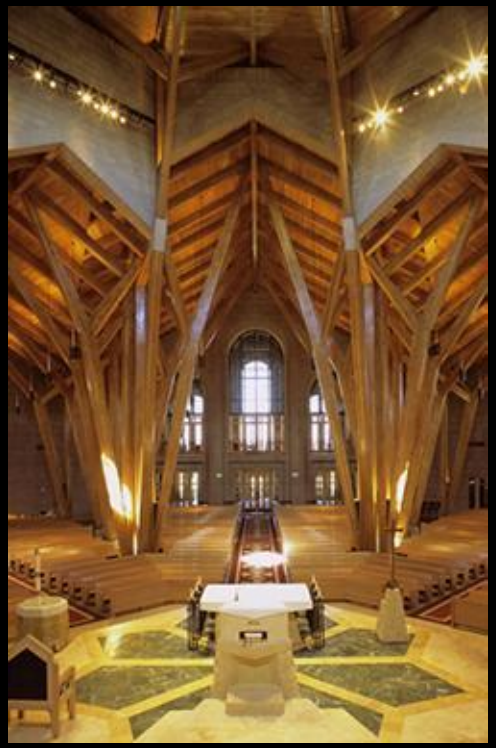
Embodied energy is defined as all the energy that was used in the work of making (and using) a product. Embodied energy is the sum total of the energy necessary for that product in its entire lifespan.

The product lifecycle includes:
A) Extraction of raw material
B) Transportation to the plant
C) Refining / Milling the product
D) Manufacturing process
E) Transportation to the site
F) Construction / Assembly of final product
G) Disassembly or Demolition

	EMBODIED ENERGY	
MATERIAL	MJ/kg	MJ/m3
Aggregate	0.10	150
Straw bale	0.24	31
Soil-cement	0.42	819
Stone (local)	0.79	2030
Concrete block	0.94	2350
Concrete (30 Mpa)	1.3	3180
Concrete precast	2.0	2780
Lumber	2.5	1380
Brick	2.5	5170
Cellulose insulation	3.3	112
Gypsum wallboard	6.1	5890
Particle board	8.0	4400
Aluminum (recycled)	8.1	21870
Steel (recycled)	8.9	37210
Shingles (asphalt)	9.0	4930
Plywood	10.4	5720
Mineral wool insulation	14.6	139
Glass	15.9	37550
Fiberglass insulation	30.3	970
Steel	32.0	251200
Zinc	51.0	371280
Brass	62.0	519560
PVC	70.0	93620
Copper	70.6	631164
Paint	93.3	117500
Linoleum	116	150930
Polystyrene Insulation	117	3770
Carpet (synthetic)	148	84900
Aluminum	227	515700

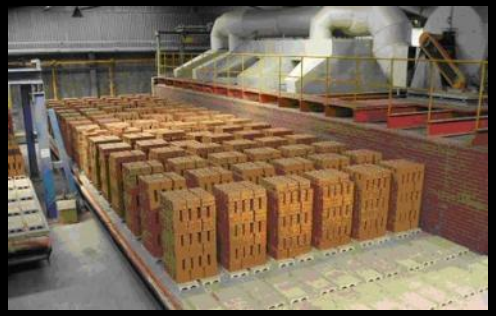
NOTE: Embodied energy values based on several international sources - local values may vary.





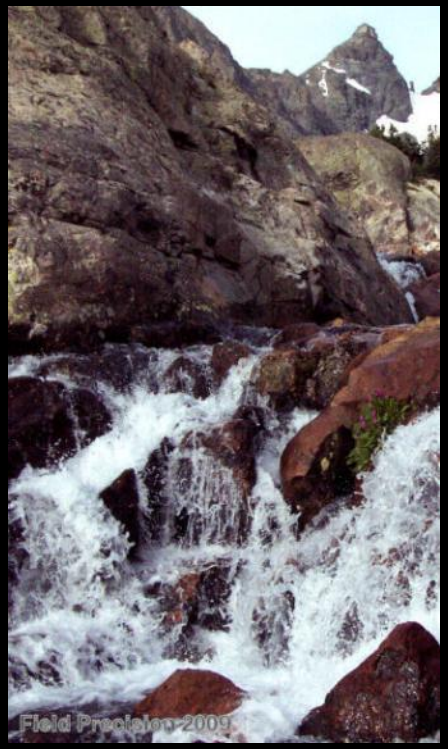

A25D


210
210

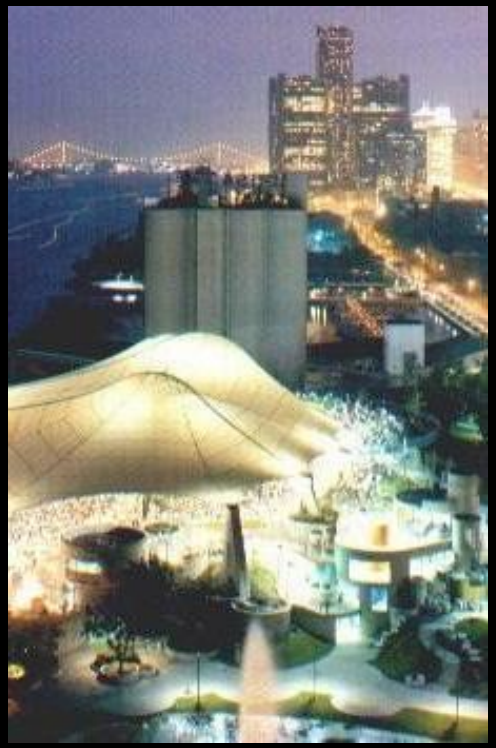



1889

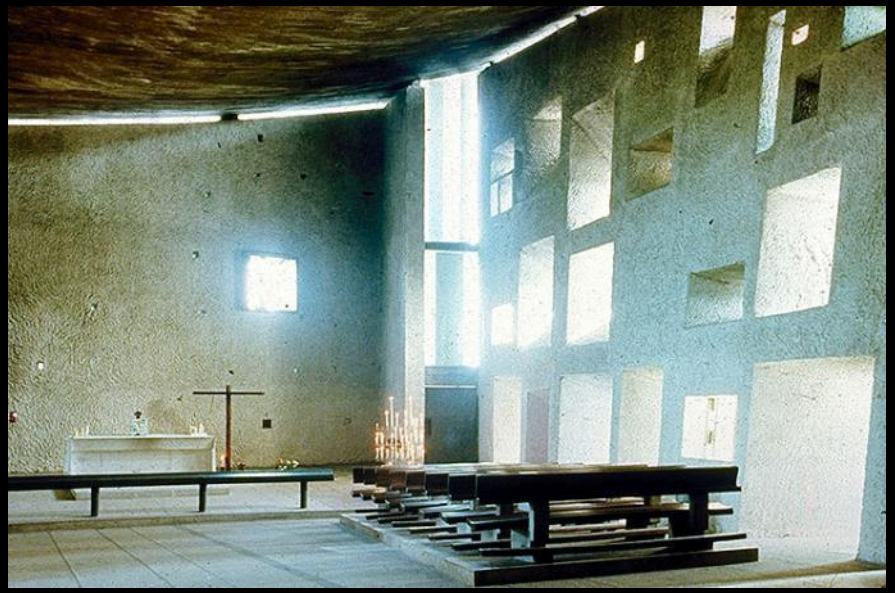


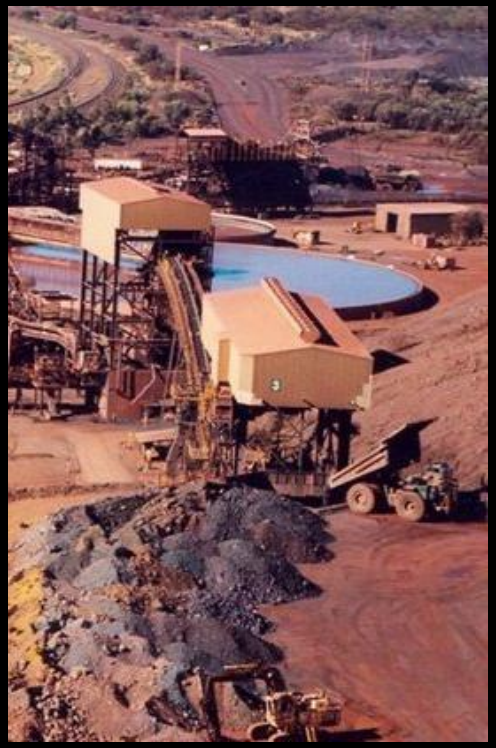



$$C_3S + H_2O \rightarrow CSH(gel) + CaOH$$




MEDUSA





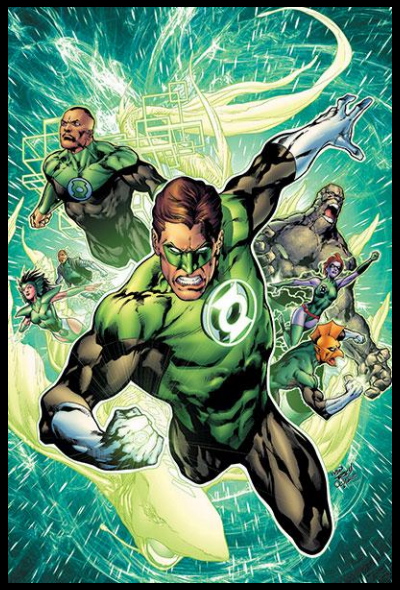



The Importance of Embodied Energy (for Historic Projects)

The embodied energy of a typical historic building is equal to 5 - 1 5 gallons of gasoline per square foot

INDOOR ENVIRONMENTAL QUALITY (EQ)

1) Make sure the spaces are well ventilated.
2) No polluting products (off-gassing or otherwise)
3) Make sure the occupants are comfortable thermally
4) Make sure the occupants have plenty of good light, both natural daylighting and artificial.



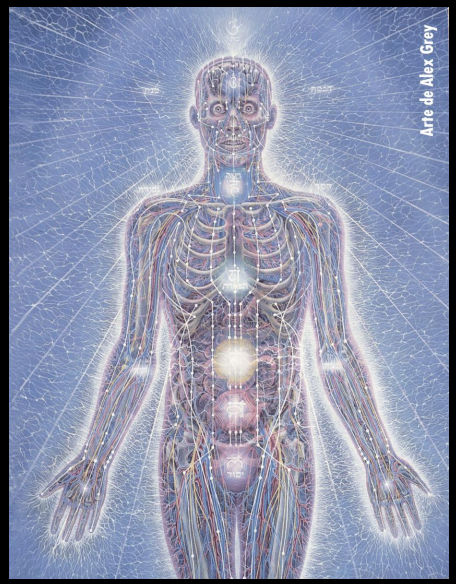
INNOVATION IN DESIGN (ID)

1) Have a LEED Accredited Professional person on board for the duration of the project.
2) Try a green method that is untested, difficult to categorize, but still viable.

1980

2003

3 B L



SOCIAL

People

ENVIRONMENTAL

Planet

ECONOMIC

Profits

COSTS OF SUSTAINABILITY:

Empirical Data

Davis Langdon

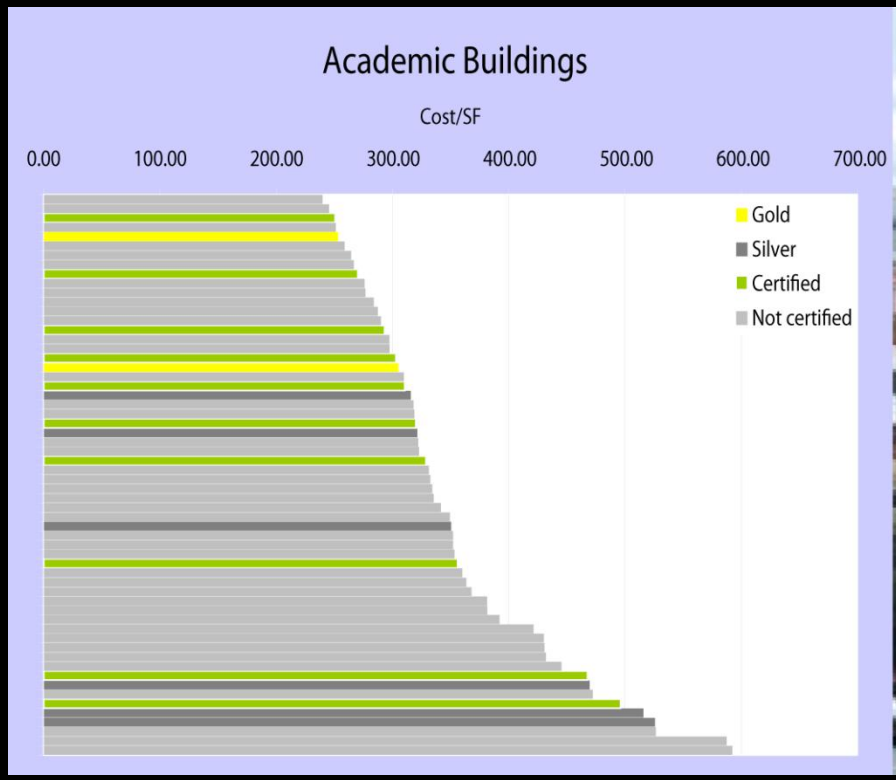
Construction cost manager since 1974

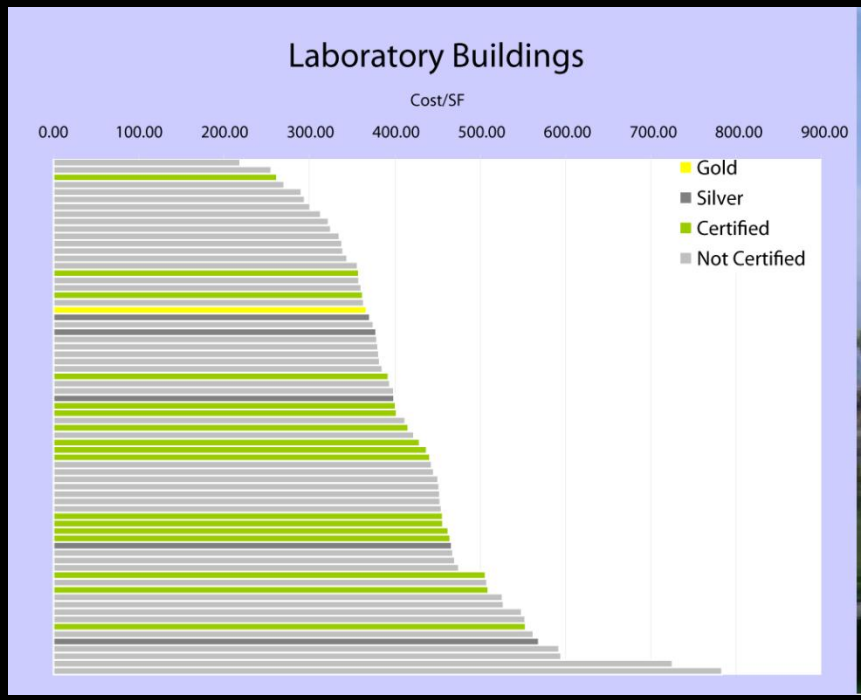
2800 employees, 69 offices worldwide; 2000 more in 32 offices in Asia.
High profile projects, 880 million dollar turnover annually.

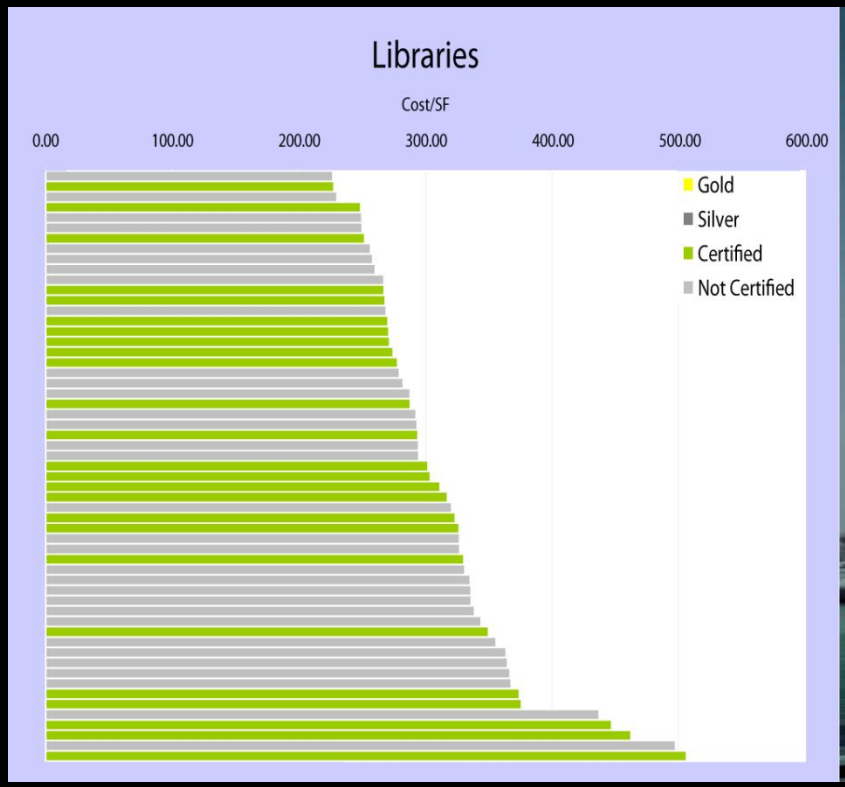
* Project Management
* Sustainability Consulting
* Specification Consulting
* Cost Management
* Research and Publications

"It is clear from the substantial weight of evidence in the marketplace that reasonable levels of sustainable design can be incorporated into most building types at little or no additional cost."

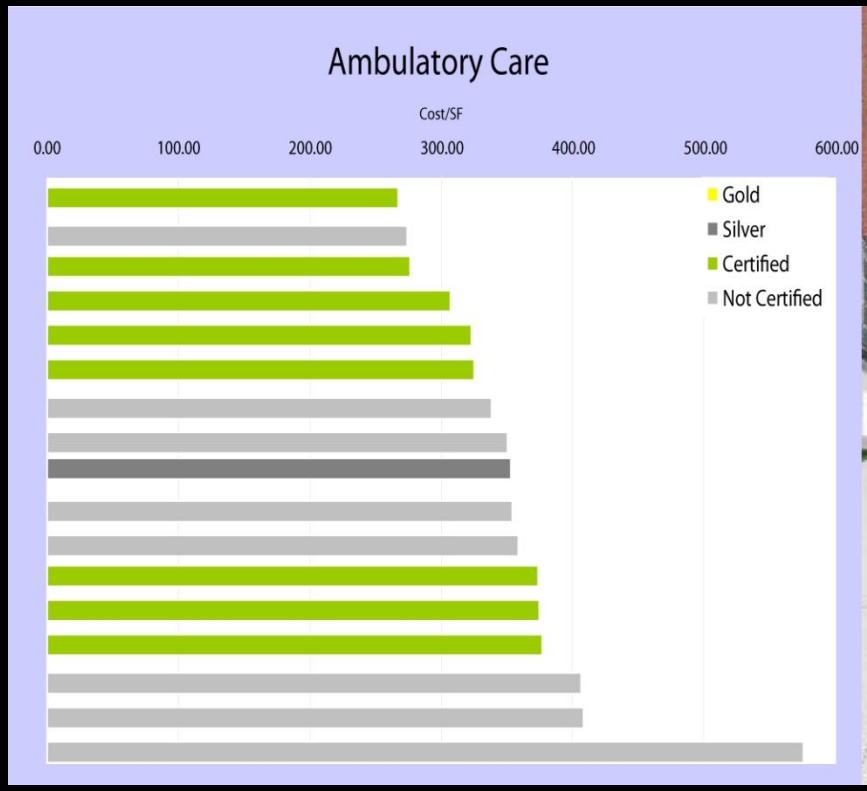
- *What Does Green Really Cost?* by Peter Morris


Academic Buildings
Cost/SF
0.00
100.00
200.00
300.00
400.00
500.00
600.00
700.00
Gold
Silver
Certified
Not certified


Laboratory Buildings
Cost/SF
0.00
100.00
200.00
300.00
400.00
500.00
600.00
700.00
800.00
900.00
Gold
Silver
Certified
Not Certified


Libraries
Cost/SF
0.00
100.00
200.00
300.00
400.00
500.00
600.00
Gold
Silver
Certified
Not Certified


Community Centers
Cost/SF
0.00
50.00
100.00
150.00
200.00
250.00
300.00
350.00
400.00
450.00
500.00
Gold
Silver
Certified
Not Certified


Ambulatory Care
Cost/SF
0.00
100.00
200.00
300.00
400.00
500.00
600.00
Gold
Silver
Certified
Not Certified

FDA FEDERAL OFFICE BUILDINGS

WASHINGTON, D.C. BALFOUR BEATTY

SLIDE SHOW CREDITS:

Several leaders in industry were kind enough to offer their expertise.

Wood: Mr. Phil Bibeau, Wood Products Manufacturing Association
Brick: Mr. Keith Lashway, P.E., International Masonry Institute
Concrete: Mr. Terry Collins, P.E., Portland Cement Association
Steel: Mr. Martin Anderson, American Institute of Steel Construction
Mr. John Cross, same

Construction Project in D.C.: Mr. James Briggs,
Balfour Beatty Construction

Water: California Integrated Waste Mgmt. Board

Green and LEED Expertise: Mr. Ralph DiNola,
Green Building Services