Green Building:
Today’s Practices
Tomorrow’s Challenges

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Principal
Director of Sustainable Design
QUINN EVANS | ARCHITECTS
Outline

• Who I am
  • Today’s Green Building Marketplace
  • Current Green Building Practice
  • Emerging Green Technologies
  • Facing the Carbon Challenge
The *Greenest* Building is ...
... One That is *Already* Built.
Outline

• Who I am

• **Today’s Green Building “Marketplace”**

• Current Green Building Practice

• Emerging Green Technologies

• Facing the Carbon Challenge
Green Building Rating Systems

LEED

USGBC

United States Green Building Council

LEED

Leadership in Energy and Environmental Design
Green Building Rating Systems

**LEED**

**SS** Sustainable Sites

**WE** Water Efficiency

**EA** Energy & Atmosphere

**MR** Materials & Resources

**EQ** Environmental Quality

**ID** Innovation & Design
Green Building Rating Systems

LEED NC v2.2 Scoring

69 total points

Platinum
52 + points

Gold
39 – 51 points

Silver
33 – 38 points

Certified
26 – 32 points
# Green Building Rating Systems

## LEED

### Sustainability Matrix

#### Building Form

<table>
<thead>
<tr>
<th>Living Building</th>
<th>Plan (x)</th>
<th>Wall</th>
<th>Energy to Operate Building</th>
<th>Grid Reliance</th>
<th>Pollution from Building Operations (tpy)</th>
<th>External Cost to Society (tpy)</th>
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<tr>
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#### Energy, Pollution and External Cost to Society

- **LEED Platinum**
  - Construction Cost: $12.9 m
  - Furniture, Fixtures and Equipment: $1.7 m
  - Design and Management Fees: $2.0 m
  - Net Present Value: $18.7 m

- **LEED Gold**
  - Construction Cost: $12.1 m
  - Furniture, Fixtures and Equipment: $1.6 m
  - Design and Management Fees: $1.7 m
  - Net Present Value: $18.3 m

- **LEED Silver**
  - Construction Cost: $11.5 m
  - Furniture, Fixtures and Equipment: $1.6 m
  - Design and Management Fees: $1.3 m
  - Net Present Value: $18.5 m

- **LEED Certified**
  - Construction Cost: $11.3 m
  - Furniture, Fixtures and Equipment: $1.5 m
  - Design and Management Fees: $1.3 m
  - Net Present Value: $19.7 m

### Schedules

- Project Design: 18 months
- Construction: 24 months
- Operations: 5 years

### Short and Long Term Costs

- LEED Platinum: $18.7 m
- LEED Gold: $18.3 m
- LEED Silver: $18.5 m
- LEED Certified: $19.7 m
Green Building Regulation

Maryland

High-Performance Buildings Act
LEED Silver Rating / Green Globes 2 Globes
7,500 SF

Green Buildings Tax Credits
8% Construction, 30% Fuel Cells,
25% PV’s, 20% BIPV’s, 25% Wind

Energy Administration Incentives
Bio-Fuel Tax Credits, Renewable Energy Grants,
Geothermal Grants, Wind Power Grants
Green Building Regulation
Montgomery County

Green Buildings Law
LEED Certification over 10,000 SF
LEED Silver Rating for Public Buildings

Clean Energy Rewards
Clean Energy Purchase Tax Credits

Solar Tax Credits
50% Tax Credits on Solar Technologies
Green Building Standards
Federal

ASHRAE
Advanced Energy Design Guides
90.1-2004 30% better than 90.1-1999
Net-Zero Goal

US DOE
Energy Efficiency & Renewable Energy
Building Energy Codes

US EPA
Energy Star
Outline

• Who I am
• Today’s Green Building “Marketplace”

• **Current Green Building Practice**
• Emerging Green Technologies
• Facing the Carbon Challenge
Current Green Building Practice

No-Cost Green

Best-Practice Green

Maximum Benefit Green
No-Cost Green

Shielded Lighting Fixtures
Water-efficient Plumbing Fixtures
Occupancy & Proximity Sensors
Green Materials
Green Cleaning
No-Cost Green

Transit-oriented Development
Compact Mixed-use Development
Climate-responsive Design
Daylighting
Operable Windows
Best-Practice Green

LID Stormwater Management
Rainwater Harvesting
High-performance HVAC Systems
Energy-efficient Lighting Technologies
High-performance Building Envelopes
Commissioning
Greening Case Study

HD Cooke
Greening Case Study

HD Cooke
Greening Case Study
HD Cooke
Greening Case Study

HD Cooke
Sustainable Sites

- Dense urban site
- Access to transit
- Alternative transportation
- Contamination-Free site
- Storm water quantity and quality
- New roofs limit heat-island effect
- Joint use of facilities
# Greening Case Study

**HD Cooke**

## Sustainable Sites

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Greening Case Study
HD Cooke

Water Efficiency

- Water efficient landscaping w/o irrigation
- Water use 30% below the baseline
### Greening Case Study

**HD Cooke**

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Energy & Atmosphere

- Fundamental & enhanced commissioning
- Energy use 17.5% below baseline
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Greening Case Study
HD Cooke

Materials & Resources
- Storage and collection of recyclables
- 75% retention of the existing structure
- 50% construction waste diverted
- 10% new recycled materials
- 10% new regional materials
# Greening Case Study

**HD Cooke**

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<th>Materials &amp; Resources</th>
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Environmental Quality

- Outdoor air monitoring & increased ventilation
- Construction IAQ
- Low-emitting materials & pollutant source control
- Advanced lighting control
- Advanced thermal control
- Daylight & views
- Acoustic performance
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Innovation & Design

- Green Cleaning
- Green Arts and Crafts
- School as teaching tool
- Exceptional performance: regional materials
- Exceptional performance: green power
### Greening Case Study

**HD Cooke**

<table>
<thead>
<tr>
<th>Credit</th>
<th>Description</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Innovation in Design: Green Cleaning</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>Innovation in Design: 40% Regional Materials</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>Innovation in Design: Green Arts &amp; Crafts</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>Innovation in Design: 70% Green Power</td>
<td>1</td>
</tr>
</tbody>
</table>
Outline

• Who I am
• Today’s Green Building “Marketplace”
• Current Green Building Practice
• Emerging Green Technologies
• Facing the Carbon Challenge
Maximum Benefit Green

Green Roofs
Maximum Benefit Green
Green Roofs

Costs

• Extensive (shallow) Vegetated Roofs
  • 30 $/SF
  • 30 #/SF

• Intensive (deep) Vegetated Roofs
  • 100 $/SF
  • 100 #/SF

• 60-70% reduced run-off
• +/- R10 insulation
Maximum Benefit Green

Geothermal
Maximum Benefit Green

Geothermal

Costs

• save 40% energy over conventional heat pump systems
• save 70% energy over electric heating and cooling systems
• 1/2 ton heating/cooling per 250 ft well
• 2,500 $/ton heating/cooling (about 2x conventional heat pump system)
Maximum Benefit Green Solar
Costs – HD Cooke Array

- 100+ panels on Gym Roof
- 20+ kW maximum output
- $200,000 estimated installed cost
- $3,500 estimated annual energy cost savings
• Who I am
• Today’s Green Building “Marketplace”
• Current Green Building Practice
• Emerging Green Technologies
• Facing the Carbon Challenge
The Climate Change Imperative
Building Impacts

Ah, Pogo, the beauty of the forest primeval gets me in the heart.

It gets me in the feet, Porkypine.

It’s hard walkin’ on this stuff.

Yep, Son, we have met the enemy and he is us.

Pogo
Earth Day 1971
Walt Kelly
"Our home planet is dangerously near a tipping point at which human-made greenhouse gases reach a level where major climate changes can proceed mostly under their own momentum."

James Hansen
<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-industrial level</td>
<td>280 ppm</td>
</tr>
<tr>
<td>2007 measured level</td>
<td>383 ppm</td>
</tr>
<tr>
<td>Tipping point</td>
<td>450 ppm</td>
</tr>
<tr>
<td>Delta</td>
<td>067 ppm</td>
</tr>
<tr>
<td>Current annual increase</td>
<td>002 ppm</td>
</tr>
<tr>
<td>Years to tipping point</td>
<td>67/2 = 34</td>
</tr>
</tbody>
</table>
Climate Change Response Policy

IPCC / ICLEI / US Conference of Mayors

Architecture 2030 Challenge

Montgomery County Sustainability Working Group (SWG)
Building Stock Statistics
Existing Stock by Decade Constructed

AREA: Non-Residential Buildings

2003 Commercial Building Energy Consumption Survey
U.S. Department of Energy

64,783 Million SF
Building Stock Statistics
Traditional & Historic Buildings

Area in Millions SF

10,640 Million SF
16%

Construction Decade

2003 Commercial Building Energy Consumption Survey
U.S. Department of Energy
36,250 Million SF

55%

2003 Commercial Building Energy Consumption Survey
U.S. Department of Energy
Building Stock Statistics
LEED Buildings

AREA: Non-Residential Buildings

3,200 Million SF
5%
1,283 Certified / 9,867 Registered

2003 Commercial Building Energy Consumption Survey
U.S. Department of Energy

Construction Decade

2003 or Before
1920 to 1945
1946 to 1959
1960 to 1969
1970 to 1979
1980 to 1989
1990 to 1999
2000 to 2003
Montgomery County

Existing Stock by Period Constructed

Montgomery County, Maryland, Non-Residential Buildings

<table>
<thead>
<tr>
<th>Period of Construction</th>
<th>Total Area (SF)</th>
</tr>
</thead>
<tbody>
<tr>
<td>pre-1900</td>
<td>0</td>
</tr>
<tr>
<td>1900-1919</td>
<td>0</td>
</tr>
<tr>
<td>1920-1939</td>
<td>1,000,000</td>
</tr>
<tr>
<td>1940-1959</td>
<td>5,000,000</td>
</tr>
<tr>
<td>1960-1979</td>
<td>60,000,000</td>
</tr>
<tr>
<td>1980-1999</td>
<td>65,000,000</td>
</tr>
<tr>
<td>2000-2008</td>
<td>20,000,000</td>
</tr>
<tr>
<td>Unknown</td>
<td>35,000,000</td>
</tr>
</tbody>
</table>
Montgomery County
Existing Stock by Type

Montgomery County, Maryland, Non-Residential Buildings by Type

- Office: 80,000,000 SF
- Retail: 30,000,000 SF
- Research & Development: 20,000,000 SF
- Religious activities: 10,000,000 SF
- Schools/daycare: 10,000,000 SF
- Warehouse/Mini-Storage: 10,000,000 SF
- Unknown: 0 SF
- Hospitals/Motels: 0 SF
- Industrial: 0 SF
Montgomery County
Public Stock by Decade Constructed

Montgomery County, Maryland, Public Buildings

Total Area (SF)

0 5,000,000 10,000,000 15,000,000 20,000,000 25,000,000 30,000,000

Period of Construction

Unknown category dominates the graph with the largest total area.
Montgomery County
Public Stock by Type

Montgomery County, Maryland, Public Buildings by Type

<table>
<thead>
<tr>
<th>Type of Buildings</th>
<th>Total Area (SF)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industrial</td>
<td>0</td>
</tr>
<tr>
<td>Office</td>
<td>2,000,000</td>
</tr>
<tr>
<td>Other</td>
<td>18,000,000</td>
</tr>
<tr>
<td>Parking Structure</td>
<td>3,000,000</td>
</tr>
<tr>
<td>Schools</td>
<td>12,000,000</td>
</tr>
<tr>
<td>Unknown</td>
<td>0</td>
</tr>
<tr>
<td>Warehouse</td>
<td>0</td>
</tr>
</tbody>
</table>
Projected Growth to 2030
New Building Construction

AREA: Non-Residential Buildings

28,000 Million SF
43%

Construction Decade

1919 or before
1920 to 1945
1946 to 1959
1960 to 1969
1970 to 1979
1980 to 1989
1990 to 1999
2000 to 2003

The Boom To Come – America Circa 2030
Architect Magazine, October 2006
Projected Growth to 2030
Renovation

AREA: Non-Residential Buildings

54,000 Million SF
84%

The Boom To Come – America Circa 2030
Architect Magazine, October 2006
Life Cycle Analysis

Environmental Impacts of Wall Assemblies

- Brick & Block
- Precast
- Brick & Steel
- Metal Siding
- EIFS
- Brick & Wood
- Wood Siding
- PVC Siding

- Water Pollution
- Air Pollution
- Resources
- Climate
- Energy
- R Value
Life Cycle Analysis

Environmental Impacts of Wall Assemblies

Brick & Block
Precast
Brick & Steel
Metal Siding
EIFS
Brick & Wood
Wood Siding
PVC Siding

Water Pollution
Air Pollution
Resources
Climate
Energy
R Value
Life Cycle Analysis
U.S. EPA & NIST BEES

Building for Economic and Environmental Sustainability

BEFORE USE
Extraction
Manufacture
Fabrication
Transportation
Construction

- Carbon Dioxide
- Global Warming
- Methane
- Acidification
- Nitrous Oxide
- Eutrophication
- Fossil Fuel Depletion
- Indoor Air Quality
- Habitual Alteration
- Water Intake
- Criteria Air Pollutants
- Human Health
- Smog
- Ozone Depletion
- Ecological Toxicity
- First Cost
- Economic Performance Score
- Future Costs
- Overall Score
- Environmental Performance Score
Life Cycle Analysis
U.S. EPA & NIST BEES

Building for Economic and Environmental Sustainability

AFTER USE
Renewal
Removal
Re-use
Disposal
Life Cycle Impacts
Recapturing Environmental Impacts Through Improved Performance
Life Cycle Impacts

Recapturing Environmental Impacts Through Improved Performance

Recaptures Energy in

3.5 years
Life Cycle Impacts

Recapturing Environmental Impacts Through Improved Performance

Recaptures Toxic Emissions in

22 years
E-Valuating Existing Buildings
E-Valuating Existing Buildings
Preservation Economics

Re-investment Driven
over $1 trillion annually
over $100 trillion inventory

The Restoration Economy
The Greatest New Growth Frontier
Storm Cunningham
www.restorationeconomy.com
E-Valuating Existing Buildings

Preservation Economics

Minimal Material Expenditure
Minimal Energy Expenditure
Skill and Craft Intensive
Creates Good Jobs
Cycles Money Through Local Economy

The Economics of Historic Preservation
A Community Leaders Guide
Donovan Rypkema
www.preservationbooks.org
The *Greenest* Building is ...
... One That is *Already* Built.