

# Does it cost more to build green?

Tri-Service Cost Engineering Workshop and  
Conference, 3-5 June, 2003

NAVFAC Engineering Innovation and Criteria Office

# Green Buildings

- Green buildings embody a design intent on balancing environmental responsiveness, resource efficiency, and cultural and community sensitivity.
- The goal of this process is to create buildings that meet the needs of current building occupants while being mindful of the needs of future generations.

# Drivers for sustainable development

- Environmental Stewardship
- Reducing Total Cost of Ownership
- Executive Orders
- Energy Security: Reduce dependence on foreign oil and other scarce resources
- Marketing – our clients desire and expect it

# LEED

- Leadership in Energy & Environmental Design
- A system to define and measure “green buildings”
- LEED Green Building Rating System has possible 69 points
- LEED Certification Levels
  - Certified 26 to 32 points
  - Silver 33 to 38 points
  - Gold 39 to 51 points
  - Platinum 52 or more points

# Service Policies for SD

- Air Force – use LEED\* / target = Certified level
- Army – use SPiRiT (Sustainable Project Rating Tool) / current target = Silver, **FY06 target = Gold**
- Navy – use LEED / target = Certified level

# Upfront costs to build green

- Design costs
- Construction costs

# Design costs 1

- Integrated design coaching: \$10-15K
- Energy modeling: \$15-30K
- Daylight modeling: \$6-20K
- Moisture flow analysis: \$1-3K
- Spec editing – green issues: \$1-4K
- Commissioning: .3%-1% construction cost
- Construction partnering: \$25-30K
- LEED project registration: \$750-3,750
- LEED project certification: \$1,500-7,500
- LEED project documentation: \$8-20K

*Bill Reed, AIA, LEED, VP Integrative Design, Natural Logic*

# Design costs 2

- Additional 3%-5% of construction costs for design and building commissioning services – *LEED Silver rating, state of Maryland's target for its buildings*
- If the design and construction team will be required to submit paperwork for LEED certification by the USGBC, budget of additional fees to cover this cost. Cost will vary based on the size and complexity of the project, however generally costs will range between \$10K and \$30K for this task. – *Air Force Sustainable Facilities Guide, 1391 Checklist*

# Construction costs 1

- 3%-10% - *LEED Silver rating, state of Maryland's target for its buildings*
- 0%-2.5% - *LEED Silver or Gold, Bill Reed, AIA, LEED, VP Integrative Design, Natural Logic*
- 1% Certified, 2% Silver, 5% Gold, 8-10% Platinum – *George Kats, Capital E, USGBC Federal Summit, April 2003*
- 2%-5% - *Air Force Sustainable Facilities Guide, 1391 Checklist*

# Construction costs 2

• In order to meet the requirements of the Executive Order 13123, OPNAV, and NAVFAC policy, additional costs may be included under a line item titled “Sustainability Features” in the Primary Facility and/or Supporting Facilities sections of MCON form DD1391 Block 9, as appropriate, where justified by life cycle cost analysis. **As a guide, the total of these added costs should not exceed 5% of the total facility cost** (first line Cost of Block 9). However, if fully justified, this figure may be exceeded.

*NAVFAC Technical Guidance for FY2006 MCON Program Development*

LEED™ Unit Cost Summary		First Costs				Operating	Productivity
		Design		Construction		Costs	Benefits
		Unit	Low	High	Low	High	Avg. Annual
<b>Sustainable Sites</b>							
SS Prereq.: Erosion & Sedimentation Control	sq. ft.	\$0.00	\$0.03	\$0.10	\$0.25	NA	NA
SS Credit 1: Site Selection		\$0.00	\$1,200.00	NA	NA	NA	NA
SS Credit 2: Urban Redevelopment		\$0.00	NA	NA	NA	NA	NA
SS Credit 3: Brownfield Development	acre	\$5,000.00	\$40,000.00	\$10,000.00	\$10,000,000.00	NA	NA
SS Credit 4: Alternative Transportation							
4 .1 Access to Public Transportation		NA	NA	NA	NA	NA	NA
4 .2 Bicycle Parking/Shower Facilities	project	\$0.00	\$3,500.00	\$0.00	\$40,000.00	\$500.00	potential
4 .3 Alternative-Fuel Vehicle Refueling							
Electric Vehicle Charging Stations	each	\$0.00	\$1,200.00	\$1,500.00	\$6,500.00	\$300.00	NA
Comp. Natural Gas Fueling Station	each	\$0.00	\$5,000.00	\$5,000.00	\$10,000.00	\$700.00	NA
Hybrid Vehicles	each	NA	NA	NA	NA	\$4,000.00	NA
4 .4 Reduced Parking/Carpool Parking	ea. space	\$0.00	\$0.00	(\$1,000.00)	(\$10,000.00)	(\$25.00)	NA
SS Credit 5: Reduced Site Disturbance							
5 .1 Limit Disturbance/Restore Site	sq. ft.	\$0.00	\$0.01	\$0.20	\$4.50	\$0.00	potential
5 .2 Reduce Development Footprint	sq. ft.	NA	NA	\$0.00	\$1.00	\$0.00	potential
SS Credit 6: Stormwater Management							
6 .1 Stormwater Runoff	project					(\$1,500.00)	
Green Roofs	sq. ft.	\$0.05	\$0.20	\$5.00	\$15.00	see above	potential
Rainwater Harvesting	gallon	\$0.01	\$0.03	\$1.00	\$2.00	see above	NA
Porous Pavment	sq. ft.	\$0.00	\$0.02	\$2.00	\$4.00	see above	NA
Drywells	each	\$200.00	\$500.00	\$2,000.00	\$10,000.00	see above	NA
6 .2 Water Quality Treatment							
Bioretention Ponds	sq. ft.	\$0.00	\$0.02	\$1.00	\$2.00	\$0.30	NA
Infiltration Basins	cu. ft. cap.	\$0.00	\$0.02	\$4.00	\$6.00	\$0.10	NA
Bioswales	sq. ft.	\$0.00	\$0.02	\$2.00	\$4.00	\$0.30	NA
Stormwater Filters	each	\$600.00	\$4,500.00	\$8,000.00	\$35,000.00	\$2,000.00	NA
6 .2 Water Quality Treatment							
SS Credit 7: Site Design to Reduce Heat Islands							
7 .1 Shade/Reflectance of Imperv. Surface	sq. ft.	\$0.00	\$0.03	\$2.00	\$4.00	NA	NA
7 .2 Roof Reflectance							
Green Roofs	sq. ft.	\$0.05	\$0.20	\$5.00	\$15.00	(\$0.10)	potential
Energy Star Roofs	sq. ft.	\$0.00	\$0.00	\$0.00	\$1.00	(\$0.10)	NA
SS Credit 8: Light Pollution Reduction	project	\$0.00	\$5,000.00	\$0.00	\$10,000.00	NA	NA
						Date:	



LEED™ Unit Cost Summary		Unit	First Costs				Operating	Productivity
			Design		Construction		Costs	Benefits
			Low	High	Low	High	Avg. Annual	Avg. Annual
<b>Sustainable Sites</b>								
SS	Prereq.: Erosion & Sedimentation Control	sq. ft.	\$0.00	\$0.03	\$0.10	\$0.25	NA	NA
SS	Credit 1: Site Selection		\$0.00	\$1,200.00	NA	NA	NA	NA
SS	Credit 2: Urban Redevelopment		\$0.00	NA	NA	NA	NA	NA
SS	Credit 3: Brownfield Development	acre	\$5,000.00	\$40,000.00	\$10,000.00	\$10,000,000.00	NA	NA
SS	Credit 4: Alternative Transportation							
	4 .1 Access to Public Transportation		NA	NA	NA	NA	NA	NA
	4 .2 Bicycle Parking/Shower Facilities	project	\$0.00	\$3,500.00	\$0.00	\$40,000.00	\$500.00	potential
	4 .3 Alternative-Fuel Vehicle Refueling							
	Electric Vehicle Charging Stations	each	\$0.00	\$1,200.00	\$1,500.00	\$6,500.00	\$300.00	NA
	Comp. Natural Gas Fueling Station	each	\$0.00	\$5,000.00	\$5,000.00	\$10,000.00	\$700.00	NA
	Hybrid Vehicles	each	NA	NA	NA	NA	\$4,000.00	NA
	4 .4 Reduced Parking/Carpool Parking	ea. space	\$0.00	\$0.00	(\$1,000.00)	(\$10,000.00)	(\$25.00)	NA
SS	Credit 5: Reduced Site Disturbance							
	5 .1 Limit Disturbance/Restore Site	sq. ft.	\$0.00	\$0.01	\$0.20	\$4.50	\$0.00	potential
	5 .2 Reduce Development Footprint	sq. ft.	NA	NA	\$0.00	\$1.00	\$0.00	potential
SS	Credit 6: Stormwater Management							
	6 .1 Stormwater Runoff	project					(\$1,500.00)	
	Green Roofs	sq. ft.	\$0.05	\$0.20	\$5.00	\$15.00	see above	potential
	Rainwater Harvesting	gallon	\$0.01	\$0.03	\$1.00	\$2.00	see above	NA
	Porous Pavment	sq. ft.	\$0.00	\$0.02	\$2.00	\$4.00	see above	NA
	Drywells	each	\$200.00	\$500.00	\$2,000.00	\$10,000.00	see above	NA
	6 .2 Water Quality Treatment							
	Bioretention Ponds	sq. ft.	\$0.00	\$0.02	\$1.00	\$2.00	\$0.30	NA
	Infiltration Basins	cu. ft. cap.	\$0.00	\$0.02	\$4.00	\$6.00	\$0.10	NA
	Bioswales	sq. ft.	\$0.00	\$0.02	\$2.00	\$4.00	\$0.30	NA
	Stormwater Filters	each	\$600.00	\$4,500.00	\$8,000.00	\$35,000.00	\$2,000.00	NA
	6 .2 Water Quality Treatment							
SS	Credit 7: Site Design to Reduce Heat Islands							
	7 .1 Shade/Reflectance of Imperv. Surface	sq. ft.	\$0.00	\$0.03	\$2.00	\$4.00	NA	NA
	7 .2 Roof Reflectance							
	Green Roofs	sq. ft.	\$0.05	\$0.20	\$5.00	\$15.00	(\$0.10)	potential
	Energy Star Roofs	sq. ft.	\$0.00	\$0.00	\$0.00	\$1.00	(\$0.10)	NA
SS	Credit 8: Light Pollution Reduction	project	\$0.00	\$5,000.00	\$0.00	\$10,000.00	NA	NA
							Date:	

LEED™ Unit Cost Summary		First Costs				Operating	Productivity
		Design		Construction		Costs	Benefits
		Unit	Low	High	Low	High	Avg. Annual
<b>Materials and Resources</b>							
MR Prereq. 1: Stor. & Collection of Recyclables	sq. ft.	\$0.00	\$0.00	\$0.02	\$0.04	(\$0.24)	NA
<b>MR Credit 1: Building Reuse</b>							
1.1 Maintain 75% of Structure & Shell	sq. ft.	\$0.00	\$0.50	(\$5.00)	\$10.00	\$0.00	NA
1.2 Maintain Additional 25% (100% Total)	sq. ft.	\$0.00	\$0.75	(\$8.00)	\$8.00	\$0.00	NA
1.3 Maintain 100% Shell & 50% Non-Shell	sq. ft.	\$0.00	\$1.00	(\$10.00)	\$0.00	\$0.00	NA
<b>MR Credit 2: Construction Waste Management</b>							
2.1 Recycle/Salvage 50% of Const. Waste	sq. ft.	\$0.00	\$0.00	(\$0.40)	\$0.00	NA	NA
2.2 Recycle/Salvage Add. 25% (75% Total)	sq. ft.	\$0.00	\$0.00	(\$0.90)	\$0.20	NA	NA
<b>MR Credit 3: Resource Reuse</b>							
3.1 Specify 5% Materials as Salvaged	sq. ft.	\$0.00	\$0.02	(\$1.75)	\$0.50	NA	NA
3.2 Specify Additional 25% (10% Total)	sq. ft.	\$0.02	\$0.03	(\$3.50)	\$1.00	NA	NA
<b>MR Credit 4: Recycled Content</b>							
4.1 Specify 25% of Materials as Recycled	sq. ft.	\$0.00	\$0.00	\$0.00	\$0.50	NA	NA
4.2 Specify Additional 25% (50% Total)	sq. ft.	\$0.00	\$0.02	\$0.00	\$0.80	NA	NA
<b>MR Credit 5: Local/Regional Materials</b>							
5.1 Specify 20% of Materials Manuf. Locally	sq. ft.	\$0.00	\$0.02	\$0.00	\$0.10	NA	NA
5.2 Of Those, Specify 50% Extracted Locally	sq. ft.	\$0.00	\$0.04	\$0.00	\$0.10	NA	NA
MR Credit 6: Rapidly Renewable Materials	sq. ft.	\$0.00	\$0.02	\$0.15	\$0.40	NA	NA
MR Credit 7: Certified Wood (50%)	sq. ft.	\$0.01	\$0.04	\$0.10	\$0.60	NA	NA
						Date:	

LEED™ Unit Cost Summary		First Costs				Operating	Productivity
		Design		Construction		Costs	Benefits
		Unit	Low	High	Low	High	Avg. Annual
<b>Indoor Environmental Quality</b>							
EQ Prereq. 1: Minimum IAQ Standards		\$0.00	\$0.00	\$0.00	\$0.00	\$0.00	Potential
EQ Prereq. 2: Environ. Tobacco Smoke Control	project	\$0.00	\$5,000.00	\$0.00	\$25,000.00	\$0.00	"
EQ Credit 1: Carbon Dioxide Monitoring	sq. ft.	\$0.00	\$0.02	\$0.03	\$0.03	(\$0.05)	"
EQ Credit 2: Increase Ventilation Effectiveness	sq. ft.	\$0.00	\$0.30	\$0.50	\$5.00	(\$0.03)	"
EQ Credit 3: Construction IAQ Management							
3.1 Management During Construction	sq. ft.	\$0.00	\$0.00	\$0.11	\$0.15	NA	Potential
3.2 Pre-Occupancy Flush-Out or Testing	sq. ft.	\$0.00	\$0.00	\$0.00	\$0.10	NA	"
EQ Credit 4: Low-Emitting Materials							
4.1 Adhesives and Sealant	sq. ft.	\$0.00	\$0.01	\$0.00	\$0.01	NA	Potential
4.2 Paints and Coatings	sq. ft.	\$0.00	\$0.01	\$0.00	\$0.02	NA	"
4.3 CRI Green Label Carpet	sq. ft.	\$0.00	\$0.01	\$0.00	\$0.00	NA	"
4.4 Composite Wood	sq. ft.	\$0.00	\$0.01	\$0.00	\$0.03	NA	"
EQ Credit 5: Indoor Chem/Pollut. Source Ctrl.	sq. ft.	\$0.00	\$0.01	\$0.00	\$0.04	NA	"
EQ Credit 6: Controlability of Systems							
6.1 Perimeter Light/Ventilation Control	sq. ft.	\$0.00	\$0.01	\$0.30	\$0.70	\$0.00	\$1.00
6.2 Non-Perimeter Light/Ventilation Control	sq. ft.	\$0.00	\$0.00	\$5.00	\$6.00	(\$0.03)	\$1.00
EQ Credit 7: Thermal Comfort							
7.1 Temp. & Humidity Control	sq. ft.	\$0.00	\$0.01	\$0.00	\$1.00	\$0.02	\$1.00
7.2 Temperature/Humidity Monitoring	sq. ft.	\$0.00	\$0.00	\$0.10	\$0.20	(\$0.02)	NA
EQ Credit 8: Daylight and Views							
8.1 Access to Daylight	sq. ft.	\$0.02	\$0.15	see EAc1	see EAc1	see EAc1	\$3.00
8.2 Access to Views	sq. ft.	\$0.00	\$0.05	\$0.00	\$0.00	NA	see above
Indoor Environmental Quality Control						Date:	

LEED™ Unit Cost Summary	Unit	First Costs				Operating	Productivity
		Design		Construction		Costs	Benefits
		Low	High	Low	High	Avg. Annual	Avg.
Innovation and Design							
ID Innovation 1.1:							
ID Innovation 1.2:							
ID Innovation 1.3:							
ID Innovation 1.4:							
ID Credit 2: LEED Accredited Professional							
Innovation and Design						Date:	

# Air Force Sustainable Facilities Guide

<http://www.afcee.brooks.af.mil/dc/dcd/arch/rfg/index.html>



## PM's Project Checklist

key:

Critical decision point

Documentation point

Guidance available

No guidance available



This tool serves as a roadmap throughout the design process. In the left column are the LEED credits and prerequisites. The next column marked "AF Policy", prioritizes the credits. The criteria identified as "highly recommended" are generally accepted good practice that either do not add cost, or have strong life cycle cost justification. The criteria identified as "recommended" provide benefits that can generally be easily justified, however must be tested in the context of the specific design solution. The criteria identified as "conditionally recommended" will be beneficial in some applications, however may be inappropriate in others.





# Energy and Atmosphere

<b>EA Prereq 1:</b> Fundamental Building Systems Commissioning	HR	<input type="checkbox"/>	/	/	/	/	/	/	<input type="checkbox"/>	/	/
<b>EA Prereq 2:</b> Minimum Energy Performance	req	/	<input type="checkbox"/>	/	/	/	<input type="checkbox"/>	/	/	/	/
<b>EA Prereq 3:</b> CFC Reduction in HVAC&R Equipment	HR	<input type="checkbox"/>	/	/	/	/	<input type="checkbox"/>	/	/	/	/
<b>EA Prereq 4 (AF Amendment):</b> Air Quality Protection	HR	/	<input type="checkbox"/>	/	/	/	<input type="checkbox"/>	/	/	/	/
<b>EA Credit 1:</b> Optimize Energy Performance	HR	/	/	/	/	/	<input type="checkbox"/>	/	/	/	/
<b>EA Credit 2:</b> Renewable Energy	CR	<input type="checkbox"/>	/	/	/	<input type="checkbox"/>	<input type="checkbox"/>	/	/	/	/
<b>EA Credit 3:</b> Additional Commissioning	HR	<input type="checkbox"/>	/	/	/	/	/	/	<input type="checkbox"/>	/	/
<b>EA Credit 4:</b> Elimination of HCFC's and Halons	CR	/	/	/	/	<input type="checkbox"/>	/	/	<input type="checkbox"/>	/	/
<b>EA Credit 5:</b> Measurement and Verification	HR	<input type="checkbox"/>	/	/	/	/	/	/	<input type="checkbox"/>	/	/
<b>EA Credit 6:</b> Green Power	CR	/	<input type="checkbox"/>	/	/	/	/	/	<input type="checkbox"/>	/	/

# Indoor Environmental Quality (IEQ)

<b>IEQ Prereq 1:</b> Minimum IAQ Performance	HR	/	□	/	/	/	/	○	/	/	/	/
<b>IEQ Prereq 2:</b> Environmental Tobacco Smoke (ETS) Control	HR	/	□	/	/	/	/	○	/	/	/	/
<b>IEQ Prereq 3                  (AF Amendment):</b> Acoustics and Noise Control	HR	/	□	/	/	/	/	○	/	/	/	/
<b>IEQ Credit 1:</b> Carbon Dioxide (CO2) Monitoring	CR	/	□	/	/	/	/	○	/	/	/	/
<b>IEQ Credit 2:</b> Increase Ventilation Effectiveness	CR	/	/	/	/	□	/	○	/	/	/	/
<b>IEQ Credit 3.1:</b> Construction IAQ Management Plan	HR	/	□	/	/	/	/	/	○	/	/	/
<b>3.2</b>	HR	/	□	/	/	/	/	/	○	/	/	/

# Innovation & Design Process

<b>ID Credit 1:</b> Design Innovation	CR	/	/	/	/	/	/	/	/	/	/	/
<b>ID Credit 2:</b> LEED Accredited Professional	HR	/	/	/	/	/	/	/	/	/	/	/
<b>ID Credit 3</b> (AF Amendment): Integrated Landscape Management	R	/	/	/	/	/	/	/	/	/	/	/
<b>ID Credit 4</b> (AF Amendment): Deconstruction	R	/	/	/	/	/	/	/	/	/	/	/
<b>ID Credit 5</b> (AF Amendment): Advanced Resource Efficiency	R	/	/	/	/	/	/	/	/	/	/	/

## 1391 CHECKLIST

During the Planning phase, the base project manager should work together with the Engineering and Environmental flights, and future Facility Managers, to develop a set of sustainable design goals as applicable to the individual project. The project budgeting is developed using DD Form 1391, a parametric cost estimate, site plans, project requirements and sustainable goals and strategies. This tool should be used to estimate the additional costs that may be associated with some of the sustainable design strategies. Not all sustainable design goals will result in added cost, however this tool can be used to identify those that may have an impact on first cost or design fees.

LEED credit	Planning
<b>General</b>	
<input type="checkbox"/> <b>General:</b> LEED Rating (for <i>USGBC certification,</i> <i>as opposed to self</i> <i>certification)</i>	AF Sustainable Design Policy states that by 2004 at least 20% of new MILCON projects should be selected as LEED pilot projects. Some innovative design strategies will require additional design fees (these are detailed below), however in general the cost of designing a LEED certifiable project should be considered part of basic services. If the design and construction team will be required to submit paperwork for LEED certification by the USGBC, budget for additional fees to cover this cost. Cost will vary based on the size and complexity of the project, however generally costs will range between \$10k and \$30k for this task.
<input type="checkbox"/> <b>General:</b> Life Cycle Value	If possible, allocate an additional 2% to 5% of total construction cost as a fund for life cycle cost justified improvements to the project. This contingency budget could be spent on improvements in energy efficiency, renewable energy, xeriscape plantings, bioretention, etc. Investments from this budget would be justified based on MILCON approved return on investment analysis. (see life cycle cost analysis links on this website).

## Sustaining Sites

- |  |   |
|--|---|
| <input type="checkbox"/> <b>SS Credit 3:</b><br>Brownfield<br>Redevelopment                                  | If a brownfield site is selected, budget for site remediation expenses.   |
| <input type="checkbox"/> <b>SS Credit 6:</b><br>Stormwater<br>Management                                     | Explore potential Pollution Prevention (P2) funds that may be available for low-impact stormwater initiatives which contribute to P2 goals.   |
| <input type="checkbox"/> <b>SS Credit 7.2:</b><br>Landscape and<br>Exterior Design to<br>Reduce Heat Islands | Consider budgeting for a vegetated roof where this multi-functional solution may be beneficial. Vegetated roofs may contribute to Force Protection goals (less visible from the air when landscaped to blend with surroundings), while mitigating stormwater retention requirements and improving energy performance. Additional cost for system is approx. \$10/SF for roof areas. |

## Water Efficiency

- |   |  |
|---|--|
| <input type="checkbox"/> <b>WE Credit 2:</b><br>Innovative Wastewater<br>Technologies | If no municipal sewage treatment system exists, or if existing system is at capacity, budget funds to study biological on-site wastewater treatment as a cost-effective and environmentally preferable alternative to septic or expanded sewage treatment during the design phase. |
| <input type="checkbox"/> <b>WE Credit 3.1:</b><br>Water Use Reduction                 | If water use in the facility is high (e.g. multi-family residential, gym, laundry facility, etc.), consider budgeting funds to study the feasibility of an on-site greywater treatment and reuse system.   |

## Energy and Atmosphere

- |  |  |
|--|--|
| <input type="checkbox"/> <b>EA Prerequisite 1:</b><br>Fundamental Building Systems Commissioning | Fundamental Building Systems Commissioning should be adopted at a minimum. Scope should be determined at the planning phase. Cost for fundamental commissioning should be included in basic services.  |
| <input type="checkbox"/> <b>EA Prerequisite 3:</b><br>CFC Reduction in HVAC&R Equipments         | If renovating or re-using an existing facility, evaluate existing HVAC&R equipment to determine if CFC-based refrigerants are used. If equipment uses CFC-based refrigerants, plan for a comprehensive CFC phaseout conversion that will capture CFC's and either convert or replace equipment. Budget for CFC phaseout conversion.  |
| <input type="checkbox"/> <b>EA Credit 1:</b><br>Optimize Energy Performance                      | Budget for energy analysis in 1391. Cost varies depending on size and complexity of project, however in general energy analysis adds \$0.15 to \$0.30 per SF to the design fee.  |
| <input type="checkbox"/> <b>EA Credit 2:</b><br>Renewable Energy                                 | Budget for renewable energy systems where appropriate: Study potential for cost-effective use of renewable energy systems, using the FRESA (Federal Renewable Energy Screening Assistant) software or FEMP (Federal Energy Management Program) design assistance. Identify applicable federal, state, or utility-based incentive programs that will buy down the cost of renewable systems. Where analysis indicates that use of renewable technology will produce a simple payback of less than 10 years, plan for additional design fees for further evaluation. |
| <input type="checkbox"/> <b>EA Credit 3:</b><br>Additional Commissioning                         | Commissioning scope should be defined to meet the LEED requirement for additional commissioning during the planning phase because it has significant budget impact. The additional fee required for commissioning should be included in 1391 budget request. Per the WBDG, full systems commissioning will cost between \$0.50 to \$1.50 per SF; costs tend to be higher for buildings with complex systems, and lower for smaller buildings with less complex systems.  |
| <input type="checkbox"/> <b>EA Credit 5:</b><br>Measurement and Verification                     | It is highly recommended that all building projects over 50,000 SF in size develop a Measurement and Verification (M&V) plan. M&V is not included in basic services. Budget for M&V services.  |

## Materials and Resources

- MR Prerequisite 2 (AF Amendment):** Hazardous Materials and Waste Mgmt. Budget for proper removal of hazardous materials such as asbestos, lead, and other hazardous constituents listed in TSCA, RCRA, and OSHA.

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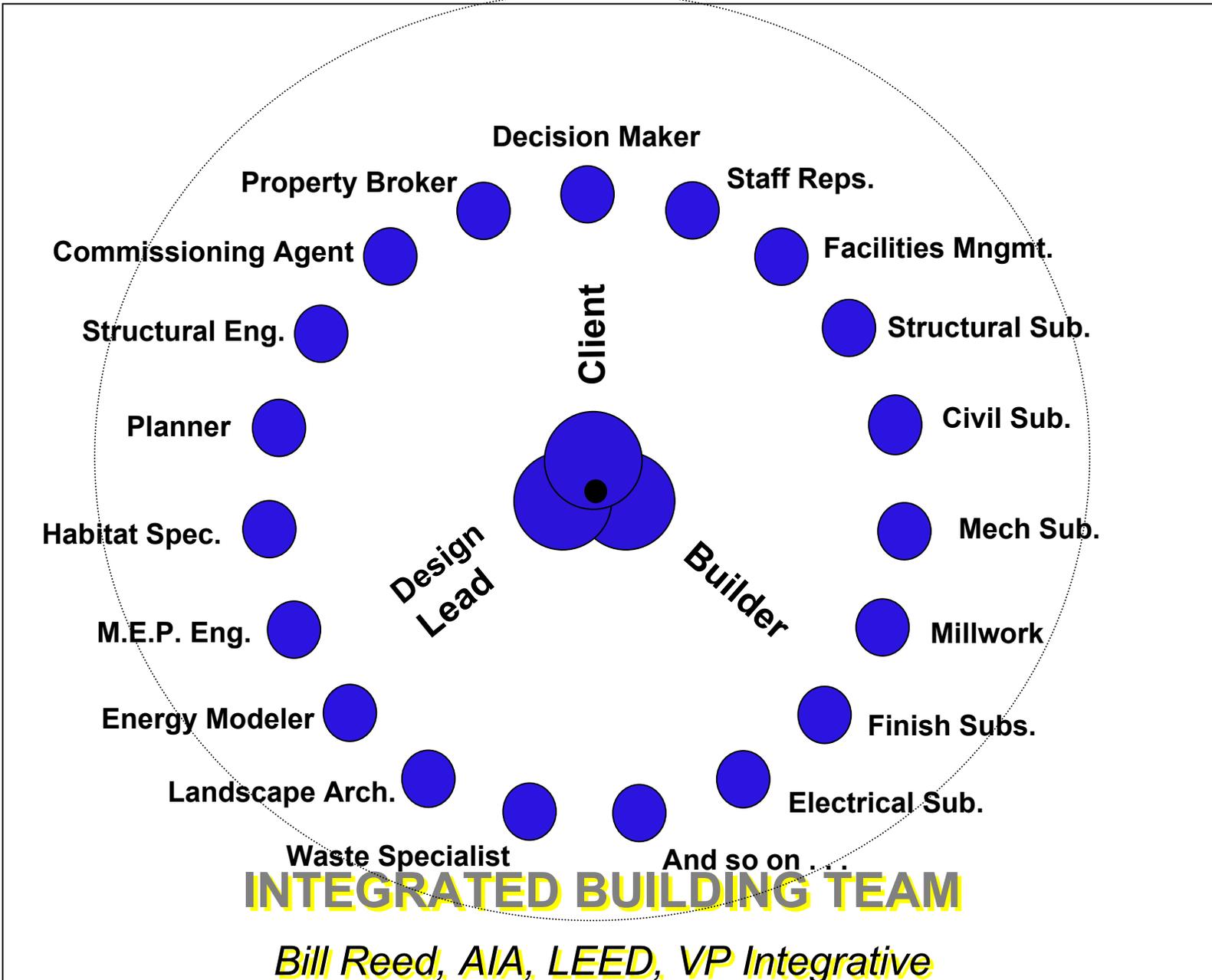
- MR Credit 1:** Building Reuse When comparing cost of building new vs. renovating, include cost to demolish existing facility in the "new construction" cost estimate.

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- MR Credit 3.1:** Resource Reuse Determine whether facility will re-use furniture from other facilities, purchase refurbished furniture, or purchase new furniture. Document budget impact of decision regarding furniture.

## Indoor Environmental Quality (IEQ)

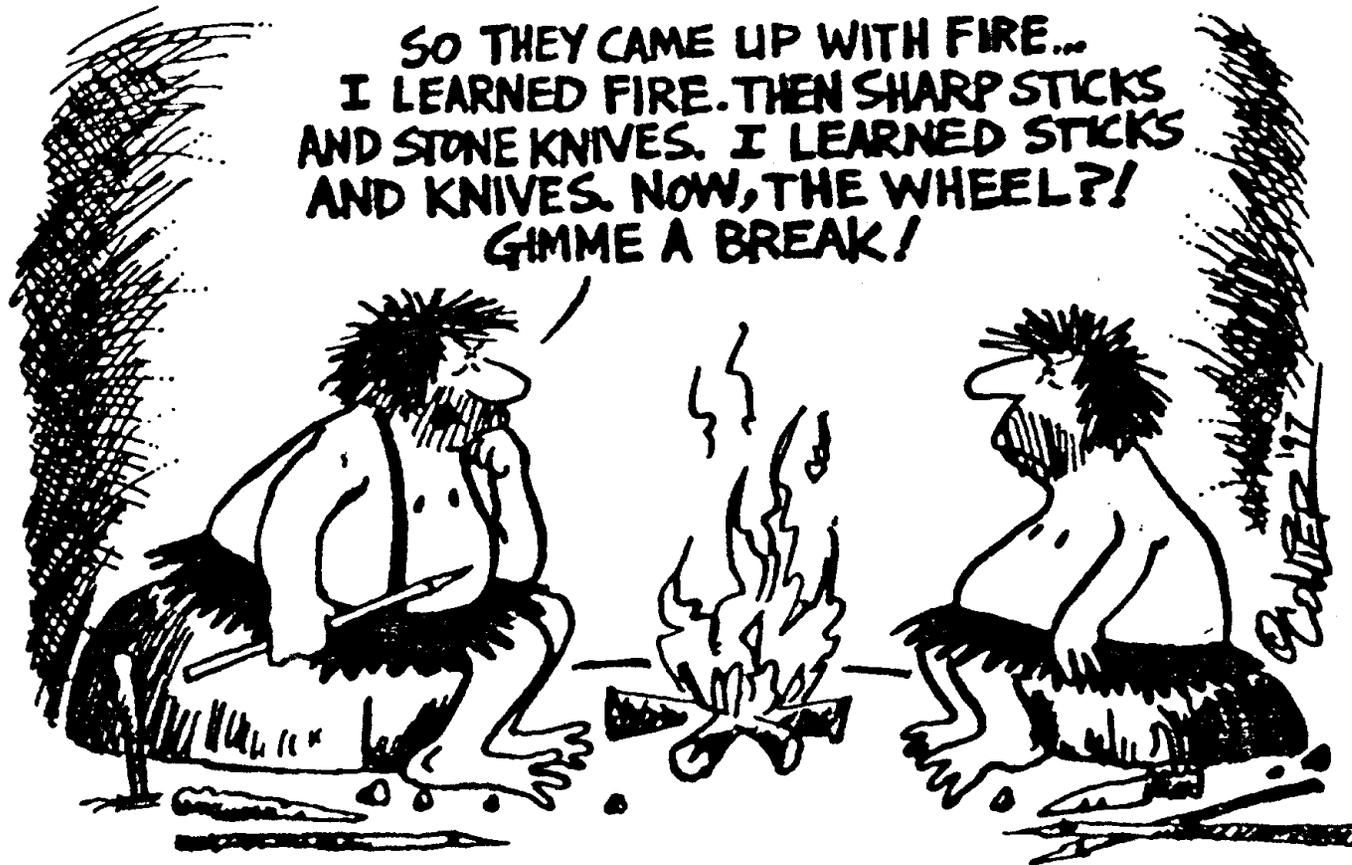
- IEQ Credit 8.1:** Daylight and Views Budget for daylighting analysis for all office buildings greater than 50,000 SF. Cost will vary based on size and complexity of project, however in general daylighting analysis adds between \$0.10 to \$0.20 per SF to the fee.



# The Building Process

AVOIDING RECIPROCAL IGNORANCE

# Challenges



CAREER CHALLENGES FACING EARLY ENGINEERS