

Sustainability in Building Design, Construction, and Occupancy

Olympic College
June 20-24



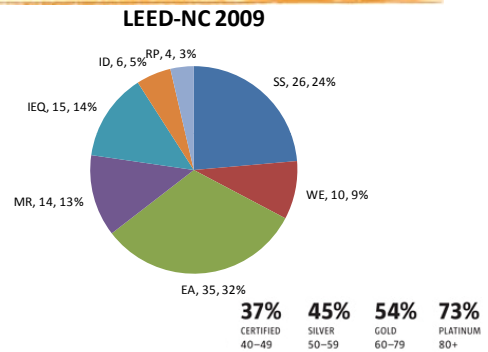
Today's Overview

- Integrative Process
- Sustainable Jobsite Best Practices
- Innovative Construction Techniques
- Prioritizing Green Options – Decision Matrix
- LEED-EB 101
- Green Job Pathways



Typical LEED Categories (varies slightly per Rating System)	Sustainable Sites
	Water Efficiency
	Energy & Atmosphere
	Materials & Resources
	Indoor Environmental Quality
	Innovation / Regional Priority Credits

Point Distribution



Key Term: Commissioning (Cx)

Cx is a systematic process of inspecting and documenting a building to make sure all the systems:

- have been designed and installed properly
- are properly functioning
- can be maintained



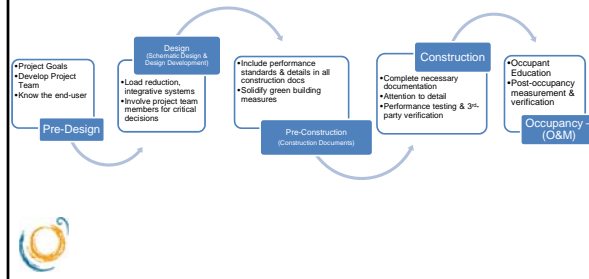
Integrative Process

- What are the phases?
- Who is involved?
- What is a charrette?

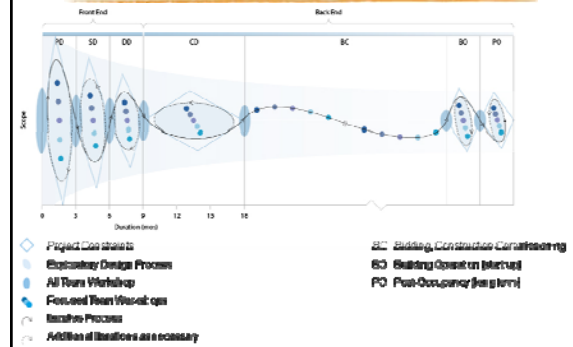
Activities
 – Mini-Eco-Charrette
 – Name the Phase



Development Phases



Integrative Process



Pre-Design

- Includes a goal-setting meeting
- Involvement of the design team upfront:
 - Interdisciplinary teamwork is critical for maximum success
 - The end user should be represented on the design team

More about Sustainability Goals...

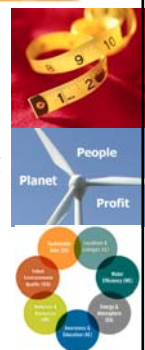
Integrative Process: GOALS

Sustainability Goals

Are they Measureable?

Do they meet the 3 P's?

Have you covered all the categories you wish to cover?



Schematic Design

- Requests for Qualifications (RFQs) should include the "green" element.
- Once the team is in place, conduct an **eco-charrette** (strategic brainstorming session)
- Generate a list of green options for the project. If the project is pursuing LEED certification, the LEED rating system can provide a framework for this session.

Design Development

- Analysis of Strategies:
 - Applicability and cost-effectiveness
 - Do they align with client priorities?
 - Project's potential for LEED or other certification
- The process of "Enhanced" Commissioning (Cx) begins in this phase, with "focused design reviews" that pick up inconsistencies between design elements and intent.

Design Development (cont'd)

- Integrative design is not just a one time, charrette activity
- The project team needs to periodically reconsider and reinforce the sustainable building goals that were agreed on earlier



Construction Documents

- Written specifications (**SPECS**) need to incorporate green products and practices
- Specs should reference a standards when applicable, e.g., CRI, Green Seal, ASTM, ANSI, FSC, etc. (see MR credits)
- Define terms unique to green products, e.g., recycled content, low-VOC, and non-toxic.



Construction Documents (cont'd)

- TESC Plan
- Tree Preservation Plan
- LEED elements should be clearly indicated
 - Recycling area
 - Bicycle storage / showers
 - Preferred Parking
 - Landscaping Details



Construction

- The bulk of Cx takes place during this phase
 - An independent Cx agent, or someone not on the design team itself, can be used to conduct the Cx process.
- Waste Management
- IAQ During Construction
- Materials Handling



Occupancy

- Many green building features require the “cooperation” of occupants, either in operation or in maintenance, to be really effective over the long term
 - training, handbooks, and signage
- Final commissioning and post-occupancy evaluations



Pre-Construction Considerations and Sustainable Jobsite Operations

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Sustainable Jobsites

Erosion & Sedimentation Control
Construction Waste Management
Indoor Air Quality Management
General Jobsite Best Practices



Learning Objectives

- Define terms related to erosion control
- Identify key components of TESC Plan
- Define terms related to waste management
- Define terms related to IAQ during construction
- Identify at least five strategies for optimizing job site practices



LEED is a Team Process

- All trades must work together
- Champions are important
- The contractors' contractual role and responsibilities vary
- Contractor's Team
 - Preconstruction
 - Project Manager/Engineer
 - Site Super
 - Subcontractors



EROSION AND SEDIMENTATION CONTROL



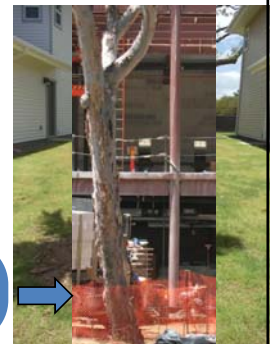
Protecting the Site

Prevent impact

Reduce impact

Repair impact

Example:
Fencing for
Tree
Protection



Erosion & Sedimentation Control

Erosion & Sedimentation Control Plan

Project: Rehabilitation and Site
 Disposed Recycling Center, Oahu, Hawaii

1.

Communications Plan

- 1. Erosion prevention and recycling activities will be discussed at the beginning of each utility meeting.
- 2. An approved sedimentation control plan, the recycling coordinator and permittee will work with a copy of the Erosion Prevention Plan and provide a copy of the recycling plan.
- 3. The sedimentation control plan will be updated to include any of their trees located with the plan.
- 4. All recycling activities will be clearly marked.
- 5. Site of any sedimentation control measures will be posted throughout the site.

Approved Project Plans, Reports, and Findings

The following items identify waste materials generated on the project, their disposal method, and handling procedures.

2.

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- 1. Minimize
- 2. Control
- 3. Clean up



Issues

- o On-Site Resource Degradation
- o Off-Site Issues
 - o Water & Soil
 - o Wind & Soil



Objectives

- o To prevent loss of soil during construction
 - o Stormwater runoff
 - o Wind
- o To prevent sedimentation of storm sewers or receiving waters
- o To prevent pollution of the air with dust and particulate matter

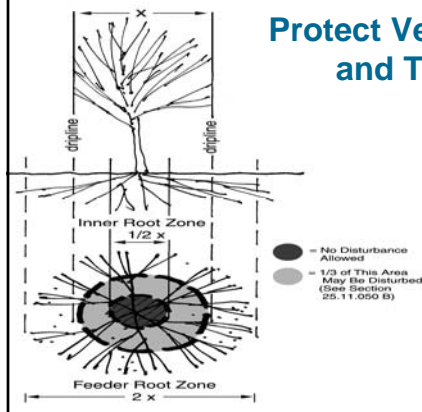


On-Site Resources

- o On-site Protection
 - o Existing native vegetation (natural erosion control)
 - o Existing top soil (stockpile with cover)



Protect Vegetation and Trees



Protect Vegetation and Trees



all non-paved surfaces under the trees are protected with construction fencing



Off-site Issues

- Water & Soil Issues
 - Surface water flow interruption
 - Surface water pollution
 - Toxins
 - Nutrient loading
 - Sedimentation
 - Habitat loss



Erosion Control

- Keep it on site!
- Limit grading
- Mulch or cover soil piles
- Establish a single site entry

Post the Erosion Control Plan in a visible location on your job site



Erosion Control

- Redundant Erosion Control Devices



Erosion Control

- Install and Maintain Sediment Traps



Dust Control

- Limit disturbance
 - Minimize equipment use
 - Drive slowly
 - Use designated roads
- Use the best control technique for your site
 - Chain link w/ screen
 - Custom high screen
- Use non-potable water



How does LEED address it?

Sustainable Sites

- **Prerequisite**– Erosion Controls During Construction

SEE example in plan set



CONSTRUCTION WASTE MANAGEMENT



Objectives

- Optimize the use of framing materials (and other materials) through waste minimization
- Minimize the amount of construction waste that is sent to a landfill or incinerator



Construction Materials Use

- BUILDINGS
 - Use about 40% of the world's raw materials

Source: Rocky Mountain Institute



Construction Waste

- Buildings:
 - Produce about 40% of landfill waste
 - Only ~ 20-30% of building related construction waste is diverted
 - Almost all construction waste can be diverted from landfills to be reused or recycled.



Source: Rocky Mountain Institute



Construction Waste

- First Rule of Construction Waste: produce less waste
- REDUCE #1
- REUSE
- RECYCLE



Minimizing Waste

- Proper ordering = waste minimization!
- Using detailed drawings and cut lists = waste minimization!



Waste Management Issues

- Packaging!
- Co-mingled recycling: Calculating the % recycled
- Track all wastes taken off-site
- Contamination and Pollution



Construction Waste Management

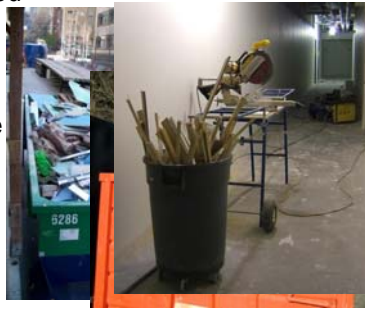
- Need a Detailed Plan – check the job shack!
- Enforce with subs through good communication

WASTE TYPE	Est. Quantity	Reuse/Recycle/Recovery	On-Site Material Production	On-Site Material Reuse	Off-Site Material Reuse	Recycling/Sorting	Incineration/Composting	Landfill	Other
Asbestos									
Lead									
Mercury									
Polychlorinated Biphenyls (PCBs)									
Flammable Liquids									
Flammable Solids									
Flammable Gases									
Flammable Aerosols									
Compressed Gases									
Refrigerants									
Acids									
Alkalies									
Flammable Powders									
Explosives									
Other									



Reduce, Reuse, Recycle!

1. Know what you need!
2. Support re-use on site
3. Optimize recycling



Key Term: Waste Diversion

- Construction waste that otherwise would be destined for a landfill, but instead is processed for recycling or reuse.
- Per LEED for Homes, the following are **NOT** considered waste diversion:
 - Grinding treated or finished wood as soil amendment
 - Industrial Waste Stabilizer (IWS) – material that is mixed with industrial ash to stabilize it & prevent erosion



Key Terms: ADC & WDF

Alternative Daily Cover (ADC)

- Non-earthen material that is placed on the surface of a landfill at the end of each day to control odors, fire, litter, etc.

Wood Derived Fuel (WDF), aka “hog fuel”

- Specific grade of wood/bark typically used to fuel boilers for wood / pulp mills and the paper-making industry



Construction Waste Management

Source Separation



Comingled



INDOOR AIR QUALITY MANAGEMENT



Issues

- o Job site – worker exposure to pollutants
- o Durability of materials
- o Health of future occupants



Objectives

- o Ensure worker health.
- o Protect materials from damage during storage and prior to building close up.
- o Install materials and products with future occupants in mind.
- o Use source control, HVAC protection, scheduling, housekeeping, and pathway interruption measures to attain great IAQ.



Construction IAQ Management Plan

- o **First, minimize introduction**
- o **Next, reduce impact**
- o **Then, clean up problems**



What does LEED say?

LEED IEQ Credit 3.1 – Construction IAQ Mgt Plan – During Construction

- o Meet or Exceed SMACNA Guidelines
- o Protect stored materials
- o Use MERV 8 filters on return air grilles

LEED IEQ Credit 3.2 – Construction IAQ Mgt Plan – Before Occupancy

- o Option 1: FLUSH OUT
- o Option 2: TESTING (using protocols consistent with EPA – see Rating System)



Protect the Indoor Environment



HVAC Protection

- Dry, protected storage for components
- Seal all openings
- Don't or minimize use of system (filter if used)



HVAC Protection

- Temporary filters MERV 8 or better
- Clean underfloor plenums prior to occupancy



Source Control

- Do not install moisture damaged materials
- Protect materials from moisture/dust
- Install Low-emitting materials (low-VOC paint, urea-formaldehyde-free composites, GreenGuard Insulation)
- Allow high-VOC materials to off-gas prior to installation



Storing Materials

Keep them dry!



Source Control – Construction Process

- No gasoline powered equipment
- Cover containers with VOC liquids (even outside the building envelope)
- Use only low-toxic cleaners
- No smoking within building structure
- Utilize and protect walk off mats



Source Control

- Suppress Dust
 - Wet or vacuum sand
 - Wet drop cloths



Pathway Interruption

- o Double air barriers
- o Negative pressure
- o Exhaust fans



Housekeeping

- o Housekeeping and Scheduling
 - o Daily and Weekly Cleaning
- o Scheduling
 - o Installing Absorptive Materials List



Health Protection: Your Health + VIP's

Worker Protection

- o Right gear for the right application



Future Residents

- o Protect all supply / return registers
- o Protect absorptive materials



Ventilation

- o Flush during construction
- o Flush out at the end



SUSTAINABLE JOBSITE BEST PRACTICES



Clean and Green Jobsite Best Practices

Messy work area
– unsafe
pathways

No designated
cutting/work area

Materials left
unprotected

No designated
recycling bins

Would you rather work here...



Clean and Green Jobsite Best Practices



Completely clean wall cavities, no dust/debris



Safe & Healthy

Durable & Long Lasting



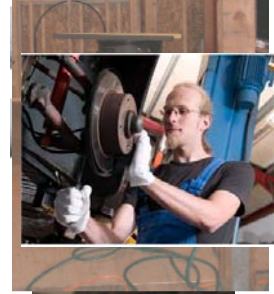
= SUSTAINABLE!

...or here?!



Equipment

- Save energy
- Avoid combustion equipment
- Use rechargeable batteries
- Maintain!
- Invest in durable equipment



Green Cleaning Products

- Concentrated
- Biodegradable
- Low- or no-VOC
- Fragrance-free
- Recycled content
- Simple ingredient list



Energy Conservation: Transportation



Vehicles & Equipment Efficiency

- Efficient equipment
- Electric over gas
- Renewable fuels
- Don't idle!



Innovative Construction

- Design for Disassembly

Materials

- Considerations for the Lifecycle Impacts of Materials/Equipment

Embodied Energy

“Cradle to Cradle” Opportunities?

Materials Sourcing

- What does ‘locally sourced’ mean?
Consider *The Living Building Challenge* definitions....

MATERIAL OR SERVICE	MAXIMUM DISTANCE
Ideas	12,429.91 miles
Renewable Energy Technologies ²⁷	7000 miles
Consultant Travel ²⁸	1500 miles
Lightweight Materials ²⁹	1000 miles
Medium Weight Materials	500 miles
Heavy Materials	250 miles

Water-Saving Systems

- Design for Greywater
 - The BRAC System

THE BRAC SYSTEM PLUMBING NETWORK
 *1/2 All equipment, piping and components connected to the flow system and must be installed by a professional plumber and are not supplied by the system. System representation or distribution which are a violation of any applicable code must be removed.
 **1/2 Inquire with your local plumbing authority for permitted attached devices.

Water

- Design for Water Collection and Reuse

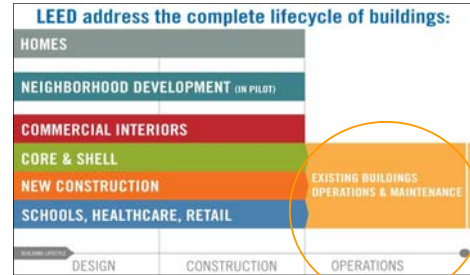
Innovative Water Strategies

- Products: Looking to the Future
 - Urine Diversion Toilets

- Urine and feces separated at source before mixing
- Urine and feces can be handled separately and specifically
- Excellent nutrient recovery and recycling potential
- System configurations with or without flushing water
- Reduced nutrient pollution of aquatic environment

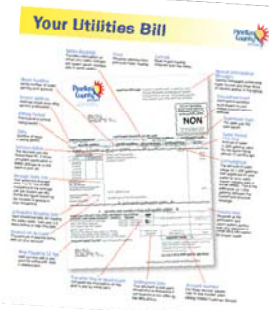
LEED-EB O&M 101

LEED Family of Rating Systems



Eligibility

- o Compliance with environmental laws
- o 12 months of energy use data (electricity, gas, oil, etc.)
- o Typical physical occupancy (minimum of 50%)



Categories and Credits

Category	Prereq.	Credits	Points
Sustainable Sites	0	8	26
Water Efficiency	1	4	14
Energy & Atmosphere	3	6	33
Materials & Resources	2	9	12
Indoor Environmental Quality	3	3	15
Innovation in Operations / Regional Priority Credits	0	3	10
TOTAL 9 prerequisites – 33 credits – 110 points			

Prerequisites

Getting on the Board

WE P1: Minimum Indoor Plumbing Fixture and Fitting Efficiency

- o Based on the date of installation of your water fixtures, beat the custom LEED baseline for your building.



EA P1: Energy Efficiency Best Management Practices

- o Develop/Update the following documents:
 - o Sequence of Operations
 - o Building Operating Plan
 - o Systems Narrative
 - o Preventative Maintenance Plan
- o Conduct an ASHRAE Level 1 Energy Audit.



EA P2: Minimum Energy Efficiency Performance

- o Earn a minimum score of 69 in Energy Star Portfolio Manager.

Other compliance pathways are available, but are more difficult to document.



ENERGY STAR Portfolio Manager

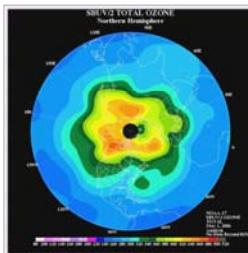


ENERGY STAR Portfolio Manager



EA P3: Fundamental Refrigerant Management

- o Do not use CFC-based refrigerants in HVAC&R base building systems (unless it is not economically feasible)
- OR
- o Demonstrate that a phase-out plan is in place



MR P1: Sustainable Purchasing Policy

- o Develop a policy that addresses, at minimum, purchases of ongoing consumables



MR P2: Solid Waste Management Policy

- o Develop a solid waste management policy that addresses:
 - o ongoing consumables,
 - o durable goods,
 - o facility alterations and additions and
 - o recycling of all mercury-containing lamps.



EQ P1: Outdoor Air Introduction and Exhaust Systems

- o Supply air ventilation rate to meet ASHRAE 62.1-2007
- OR
- o At least 10 cubic feet per minute (cfm) of outdoor air per person.



EQ P2: Environmental Tobacco Smoke (ETS) Control

- o Prohibit smoking in the building and designate smoking areas at least 25 feet from building entries
- OR
- o Designate smoking rooms in the building and design to effectively contain, capture, and remove ETS from the building.



EQ P3: Green Cleaning Policy

- o Develop a Green Cleaning Policy which addresses:
 - o Purchase of sustainable cleaning equipment and products
 - o Standard operating procedures for methods of cleaning different building surfaces



Credits



LEED Credit Format & Structure

Goal	Additional Indoor Plumbing Fixture and Fitting Efficiency	1-3 points Credits 2.1 - 2.3
Target or Task	<p>Intent</p> <p>To reduce the use of potable water and consequent burden on municipal water supply and wastewater systems.</p> <p>Requirements</p> <p>During the performance period, have in place strategies and systems that in aggregate produce a reduction in indoor plumbing fixture and fitting potable water use from the calculated LEED for Existing Buildings O&M baseline established in WE Passports 1.</p> <p>WE Credit 2.1 (1 point): 10% reduction in indoor plumbing fixture and fitting potable water use from the LEED for Existing Buildings O&M baseline.</p> <p>WE Credit 2.2 (2 points): 20% reduction in indoor plumbing fixture and fitting potable water use from the LEED for Existing Buildings O&M baseline.</p> <p>WE Credit 2.3 (3 points): 30% reduction in indoor plumbing fixture and fitting potable water use from the LEED for Existing Buildings O&M baseline.</p> <p>Drinking water is more suitable for drinking than meets or exceeds EPA drinking water standards. It is supplied from wells or municipal water systems.</p>	EXEMPLARY PERFORMANCE AVAILABLE
Tips		Bonus points are available for going above-and-beyond
Reference Standards	<p>Potential Technologies & Strategies</p> <p>Reduce indoor plumbing fixture and fitting water usage through automatic controls and other water saving technologies for indoor plumbing fixtures and fittings that meet Uniform Plumbing Code 2004 International Plumbing Code</p>	



Plans & Policy Credits



Tracking Credits



Calculation Credits



Retrofit Credits



Audit & Survey Credits



Regional Priority Credits (Seattle)

- o 25% of site area in open space
- o Stormwater quantity control
- o Sustainable purchasing of food
- o Waste stream audit
- o Energy Star Score of 95+
- o Renewable energy (12% on-site, 100% off-site)



Key Considerations



Major Players

Have Substantial Responsibility for Prerequisites and Credits

- o Facility Manager
- o Building Engineer

Additional Participants

- o Owner
- o Tenants
- o Custodial staff
- o Groundskeeper
- o AEC Team (for renovations and additions)



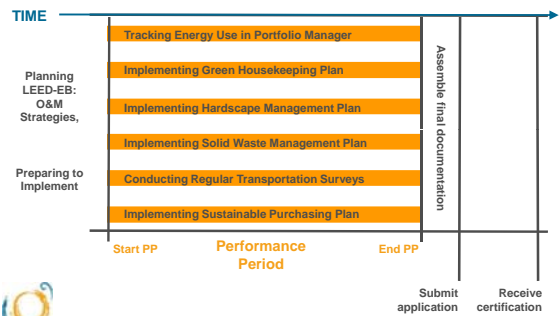
Timeline

- o If the project team decides to pursue LEED-EB, what are the other major milestones that effect the certification and performance periods?

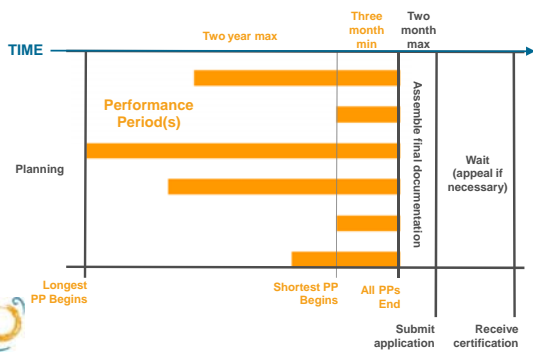
January	February	March
April	May	June
July	August	September
October	November	December



Certification Timeline - Ideal



Certification Timeline - Reality



Building Type

- o Specifically applicable to commercial, institutional, and multi-family residential



Occupant Involvement

- Prerequisites are all within the control of the building owners and operators – but the actions of **building users** are critical to earning some points



Individual Building Requirement

- EB is designed to certify individually-metered, **single buildings**



Alterations and Additions

- Maximum limit for renovations is 50% of floor space/occupants relocated
- Maximum limit for additions is no more than 50% increase in floor area



Recertification

- Recertification is available every 1-5 years



Benefits



Certification Benefits

- **Third party validation** of achievement
- LEED certification **plaque** to mount on building



Certification Benefits

- o Qualify for growing array of state and local government **incentives**



Certification Benefits

- o Assist with meeting mandates

SB 5854 - 2009-10

... Beginning in 2010, **eligible privately-owned commercial buildings are required to be benchmarked using Portfolio Manager** and resulting metrics will be disclosed to a prospective buyer, lessee, or lender.



Certification Benefits

- o Be recognized as a **regional leader**
 - o There are only 8 LEED-EB certified buildings in WA(all old versions)

Project Name	Owner	City
King Street Center	King County	Seattle
Microsoft Buildings 30, 31, & 32	Microsoft	Redmond
DEPARTMENT OF ECOLOGY - HEADQUARTERS FAC	Washington Department of Ecology	Olympia
Starbucks Center	NITZE-STAGEN & CO., INC.	Seattle
901 5TH AVENUE	BEACON CAPITAL PARTNERS	Seattle
ROSETTA INPHARMATICS	ROSETTA INPHARMATICS	Seattle
Whatcom County Courthouse	Whatcom County	Bellingham
18W Harrison		Seattle



Certification Benefits

- o **Marketing exposure** through USGBC web site, case studies and media announcements



Resources

- o **USGBC**
<http://www.usgbc.org/LEED/eb>
Download the LEED-EB "Rating System"
- o **Portfolio Manager**
<https://www.energystar.gov/istar/pmpam/>
Create a free account, enter data for your building
- o **BOMA Killowatt Crackdown**
<http://betterbricks.com/DetailPage.aspx?ID=1116>
Stories about local buildings' success in reducing energy use, using Energy Star Portfolio Manager



Thank You!

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