



SEBESTA BLOMBERG
Providing Technical & Business Solutions



LEED Commissioning of Innovative Systems

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Popularity of LEED

USGBC - Leadership in Energy & Environmental Design

LEED Metrics	LEED NC	LEED EB	LEED CI	LEED CS
registered	3,034	163	276	165
certified	340	27	47	11
registered sq. ft.	>380 million	>62 million	>16 million	>46 million
certified sq. ft.	>39 million	>11 million	>3 million	>5 million

www.usgbc.org

Popularity of LEED

Fundamental Commissioning (Prerequisite)

1. Designate a commissioning authority.
2. Owner documents owner project requirements (OPR). A/E develops basis of design (BOD). CxA reviews.
3. Develop and use commissioning requirements in construction documents.
4. Develop and use a commissioning plan.
5. Verify installation and performance of systems.
6. Complete a summary commissioning report.

Additional Cx (Optional Credit)

1. Prior to construction documents phase designate an independent commissioning authority to oversee "all commissioning activities."
2. CxA to perform review of OPR, BOD and design documents prior to mid-construction documents phase and perform a back-check.
3. CxA to review contractor submittals.
4. Develop a systems manual.
5. Verify operator and occupant training.
6. CxA to perform a post-occupancy review.

LEED Impacts

- Promotes integrated design
- Promotes thinking outside the box
- "New" systems in buildings
- Promotes commissioning
- Point chasing

"Happiness is when what you think, what you say, and what you do is all in harmony."

Commissioning Philosophy

"A happy building is when an owner's needs, design, construction, and operation are all in harmony."

Case Studies

- Standing column well, ground-coupled heat pump system
- Graywater System – RO/DI wastewater for toilet flushing
- Composting Toilet System

Case 1: Ground-coupled Heat Pump

Project Overview

- Non-profit Organization
- Office and Conference Space
- New Construction
- Three-story, 14,000 square feet
- Involvement of Commissioning Provider started in Construction



Case 1: Ground-coupled Heat Pump

Owner's Requirements

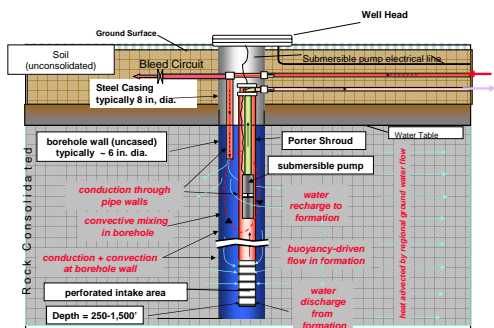
- Demonstration project of sustainable design & technologies
- Minimizing energy consumption & life cycle costs
- Operable windows for natural ventilation & connection to outdoors
- Local controls
- LEED NC – Gold Level

Case 1: Ground-coupled Heat Pump

Design Analysis

- Distributed water-to-air heat pump system
- Ground-coupling method - Standing column well
- Hybrid ventilation
 - Mechanical ventilation - Central energy recovery unit
 - Natural ventilation – operable windows
- Central Building Management System

ANATOMY of STANDING COLUMN WELL



Case 1: Ground-coupled Heat Pump

Design Considerations

- Distributed heat pumps – maintenance access
- Integrated with architecture – natural ventilation
- Seasonal groundwater temperature fluctuations
- Local & state groundwater permits / regulations
- Number of wells (500-1,500 ft; 30-40 tons max.)
- Final well pump sizing after well drilled
- Geologic conditions / other experience in area

Case 1: Ground-coupled Heat Pump

Design Considerations (cont.)

- Auxiliary Heat
- Control system & interaction with local controls
- Filtration & air separation
- Water treatment
- Groundwater loop pipe insulation
- Sequences of Operation / System Narratives
- Complete information on equipment schedules

Case 1: Ground-coupled Heat Pump

Well - Pre-functional Checks

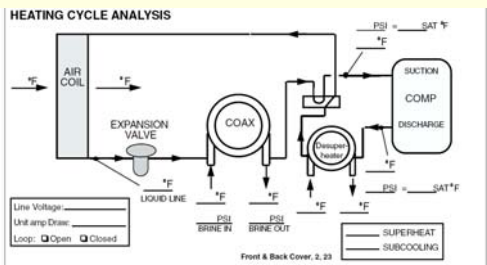
- Water quality tests
- Flow tests with check of static water level; developing the well
- Leak tests for buried piping
- Disinfecting piping loop
- Filling system – watch drawdown
- Controls

Case 1: Ground-coupled Heat Pump

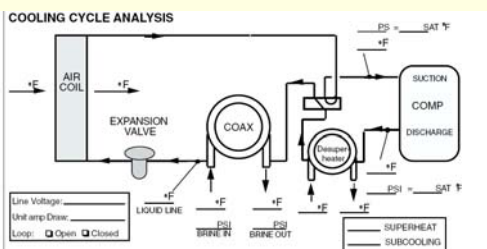
Heat Pumps - Pre-functional Checks

- Start-up & performance check
 - Manufacturer's documentation
 - Confirm piping connections
- Internal controls
- Condensate pumps
- Testing, Adjusting and Balancing

Case 1: Ground-coupled Heat Pump



Case 1: Ground-coupled Heat Pump



Project Overview

- University Teaching Laboratory Building
- New Construction
- Six-story, 60,000 square feet

Design Considerations

- Central Circulating RO/DI System
- LEED Credit Review – Water Efficiency
- Water Consuming Systems – RO/DI , Toilets

Owner's Requirements

- Modular lab layout for flexibility
- Pure water for labs
- LEED NC – Certified Level

Case 2: Graywater Reuse

Design Considerations

- Central Circulating RO/DI System
- LEED Credit Review – Water Efficiency
- Water Consuming Systems – RO/DI , Toilets

Case 2: Graywater Reuse

Water System Synergies

- RO/DI "Wastewater"
 - 72,000 gallons per year
- Toilet Flushwater
 - 70,000 gallons per year
- Overall offset 87% of potable water usage

Case 2: Graywater Reuse

Graywater Description

- RO/DI wastewater and backflush is collected in storage tank
- Separate booster pump and piping system feeds toilets
- Back-up connection to city water
- Tank overflow connected to drain

Case 2: Graywater Reuse

Graywater Design Considerations

- Matching sources and consumers
- Storage capacity
- Filtration & sterilization
- Separation from potable sources
- Signage and notification

Case 2: Graywater Reuse

Graywater Testing Concepts

- Equipment Start-up & Checks
 - RO/DI discharge
 - Booster pumps
 - Tank controls
- System Functional Test
 - Create load on system – confirm response
- Power Outage Test

Final Thoughts

- Commissioning as a service is a market response to building owners who are unsatisfied with the results of the design and construction process
- Independent third-party commissioning provides an unbiased technical resource to assist the owner resolve disagreements between designers and contractors
- LEED projects increase the likelihood that systems are included in the building that the design, construction, and operation teams are not familiar with, which increases the importance of the commissioning provider's role
- Don't underestimate the power of a question
- The LEED programs promote sustainability, but, if misapplied, an untrained operating staff attempting to operate a poorly designed, untested, and undocumented building is not sustainable, no matter what "green" technologies were included.

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Questions?

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