



# Agenda and Objectives



## Trane Engineers Newsletter Live Series LEED 2009 Modeling and Energy Savings

Trane applications engineering discuss the major changes in LEED 2009 and how they impact the HVAC practitioner. The LEED 2009 green building certification program was introduced in March of 2009 after eight years of user feedback. It incorporates highly anticipated regional credits, extra points that have been identified as priorities within a project's given environmental zone. LEED has also undergone re-weighting of credits, changing allocation of points among LEED credits to reflect climate change and energy efficiency as urgent priorities.

By attending this event you will learn:

1. Understand LEED 2009 as it pertains to HVAC Systems
2. Identify system options for meeting WE, EA and IEQ prerequisites and achieving credits in these sections
3. Understand the importance of integrated building design
4. Compare modeling and energy savings comparisons in various location

Agenda:

- 1) Overview
  - b) Recent activity
    - i) Rising energy costs
    - ii) Change to LEED (mandatory two Optimize Energy Performance points)
    - iii) Energy Policy Act
- 2) Energy-saving strategies to achieve two points (ECM discussion)
  - a) Rooftop VAV systems
  - b) Self-contained VAV systems
  - c) Chilled-water VAV systems
  - d) Chilled-water fan-coil systems
  - e) Water-source heat pump systems
- 3) The "big picture" of building energy use
  - a) Examples from Neil's team
- 4) Top ten energy modeling mistakes
  - a) Share experience
- 6) Summary



## Presenters



Trane Engineers Newsletter Live Series  
LEED 2009 Modeling and Energy Savings  
(2009)

### **Chris Hsieh | systems engineer | Trane**

Chris Hsieh specializes in all HVAC industry-related green and environmental initiatives locally and globally, including programs such as Energy Star®, LEED®, the Collaborative for High-Performance Schools. He holds bachelor and master's degrees in electrical engineering from National Kaohsiung Institute of Technology in Taiwan and Southern Methodist University, respectively. Chris is currently a member of the TFM Green Building Advisory Board, a member of the CSI's GreenFormat™ task team and the membership chair of ASHRAE La Crosse chapter. Chris is also a LEED Accredited Professional.

### **Mick Schwedler | manager, applications engineering | Trane**

Mick joined Trane in 1982. With expertise in system optimization and control, and in chilled-water system design, Mick's primary responsibility is to help designers properly apply Trane products and systems through one-on-one support, technical publications, and seminars. Mick is a past Chair of SSPC 90.1 and holds a B.S. and M.S. degree in mechanical engineering. Mick is a registered professional engineer in the State of Wisconsin.

### **Scott Hintz | marketing engineer | Trane**

Scott joined Trane in July 2007 after spending more than eight years with Siemens Building Technologies. He earned his B.S. in Industrial Engineering from the Milwaukee School of Engineering. At Siemens, Scott held various positions including Applications Engineer and Project Manager for Room Level Automation Controls. In addition to his support role as a C.D.S. Marketing Engineer, Scott is responsible for customer training of C.D.S. software and project management of the new Trane Option Analyzer software. Scott is currently a consultant to the Energy Cost Budget Subcommittee of SSPC 90.1 and is a LEED Accredited Professional.

## LEED 2009 Modeling and Energy Savings



**Engineers  
Newsletter Live**

- "Trane" is a Registered Provider with The American Institute of Architects Continuing Education Systems. Credit earned on completion of this program will be reported to CES Records for AIA members. Certificates of Completion for non-AIA members available on request.
- This program is registered with the AIA/CES for continuing professional education. As such, it does not include content that may be deemed or construed to be an approval or endorsement by the AIA of any material of construction or any method or manner of handling, using, distributing, or dealing in any material or product. Questions related to specific materials, methods, and services will be addressed at the conclusion of this presentation.



## LEED 2009 Update Agenda

- Major changes
- Impact for HVAC practitioners
- EAc1 modeling
- Summary

3 | © 2009 Trane

## Today's Presenters



**Scott Hintz**  
C.D.S. marketing  
engineer



**Mick Schwedler**  
manager,  
applications  
engineering



**Chris Hsieh**  
systems engineer

4 | © 2009 Trane

## LEED 2009 Update



### Major Changes

### Building Facts

- 39% U.S. primary energy use
- 72% U.S. electricity consumption
- 14% U.S. potable water (15 trillion gallons)
- Million tons of construction waste
- 15% of Gross Domestic Product
- 40% of raw materials globally

## **USGBC**

- LEED Green Building rating systems
- LEED building certification
- LEED AP
- Greenbuild conference

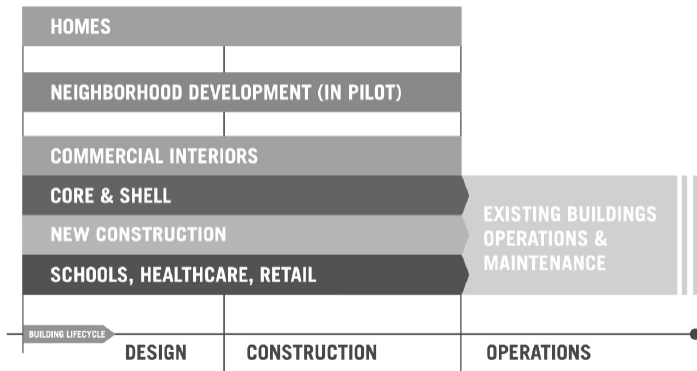
7 | © 2009 Trane

## **LEED® Green Building Rating System**

- LEED: Leadership in Energy and Environmental Design
- Consensus-based, national standard for developing high-performance, sustainable buildings
  - Introduced and administered by U.S. Green Building Council
  - Voluntary, point-based rating system
  - Measures: Sustainable sites development  
Water savings  
Energy efficiency  
Materials selection  
Indoor environmental quality

8 | © 2009 Trane

## LEED Addresses entire Building Lifecycle



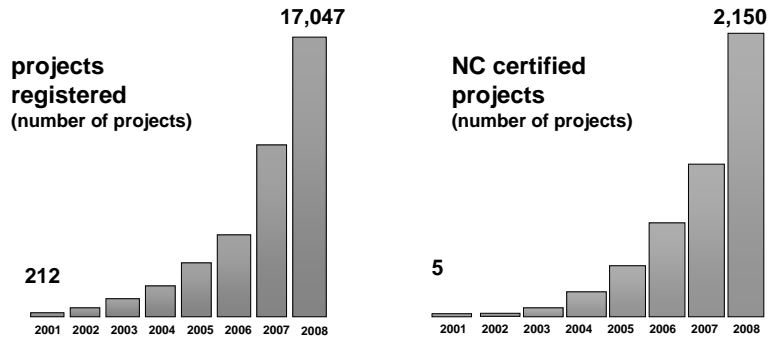
Source: U.S. Green Building Council

## Four Levels of LEED



Source: U.S. Green Building Council

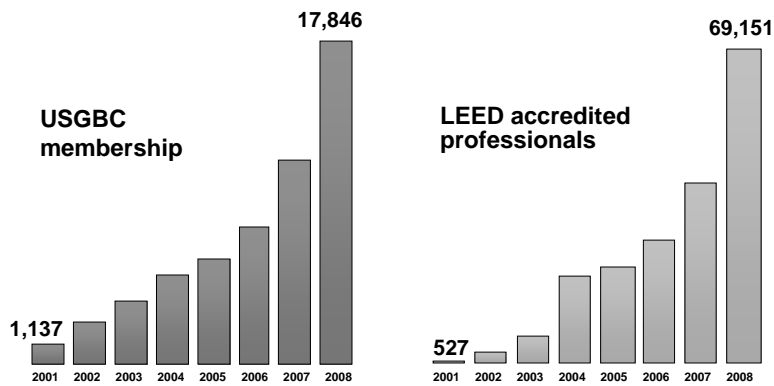
## Progress of LEED



Source: U.S. Green Building Council, Dec. 2008

11 | © 2009 Trane

## Progress of USGBC



Source: U.S. Green Building Council, Dec. 2008

12 | © 2009 Trane



## Greenbuild

- 2008 (28,000 attendees)
  - Green Revolution
  - Look beyond first cost to total triple line ROI
  - Pennies upfront, payback in dollars
  - Green economy, jobs, and innovations

[Greenbuild365.org](http://Greenbuild365.org) Web site

13 | © 2009 Trane

## LEED V3

- LEED 2009
  - Advancements to the rating system
- LEED certification process
  - Speed, capacity, performance
- LEED Online v3
  - Faster, smarter and better user experience

14 | © 2009 Trane

## Comparison

- NC 2.2
- NC 2009

## For LEED NC Prerequisites

	2.2	2009
▪ Sustainable Sites	1	1
▪ Water Efficiency	0	1
▪ Energy & Atmosphere	3	3
▪ Material & Resources	1	1
▪ Indoor Environmental Quality	2	2
▪ Innovation & Design Process		
▪ Regional Bonus		

New

### For LEED NC Points distribution

	2.2	2009
▪ Sustainable Sites	14	26
▪ Water Efficiency	5	10
▪ Energy & Atmosphere	17	35
▪ Material & Resources	13	14
▪ Indoor Environmental Quality	15	15
▪ Innovation & Design Process	5	6
▪ Regional Bonus		4

25% (points to Energy & Atmosphere)
 35% (points to Energy & Atmosphere)
 22% (points to Indoor Environmental Quality)
 15% (points to Indoor Environmental Quality)
 10 pt extra (points to Innovation & Design Process and Regional Bonus)

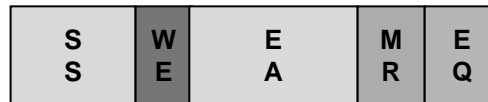
17 | © 2009 Trane

### Point distribution

- NC 2.2



- NC 2009



ID and regional 10%

18 | © 2009 Trane

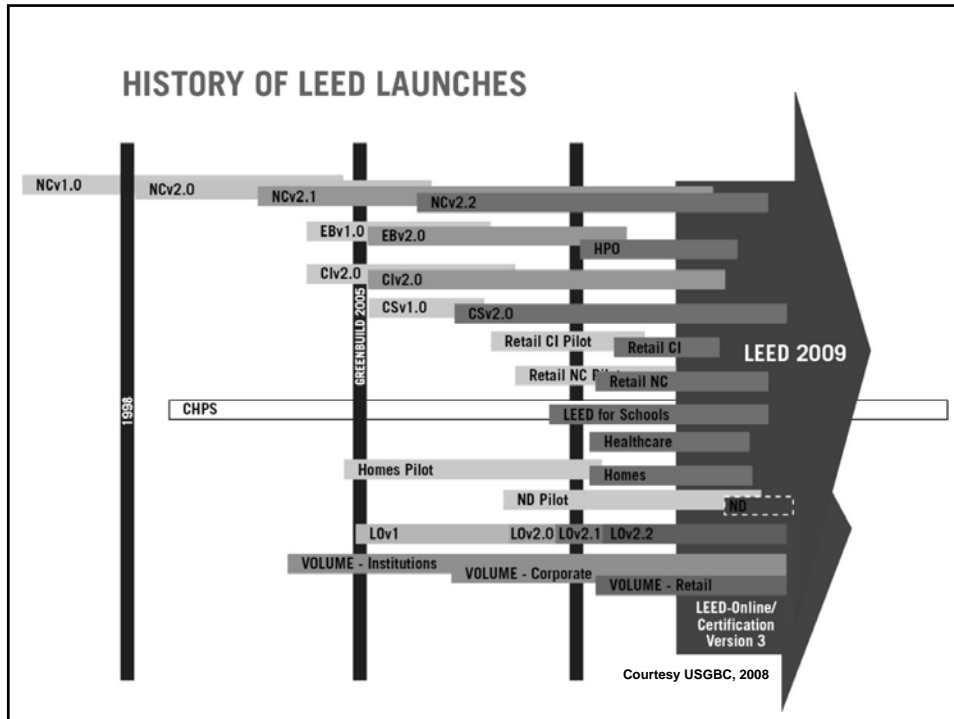
## LEED 2009 Modeling and Energy Savings



Harmonization

### Why Change?

- LEED use increasing
- LEED acceptance increasing
- LEED Accredited Professionals increasing in number
- High momentum



## Why Change?

- LEED use increasing
- LEED acceptance increasing
- LEED Accredited Professionals increasing in number
- High momentum
- Products are becoming dissimilar
- LEED AP a bit nebulous
- Time for re-focus of LEED
- Need for future growth

## **LEED 2009**

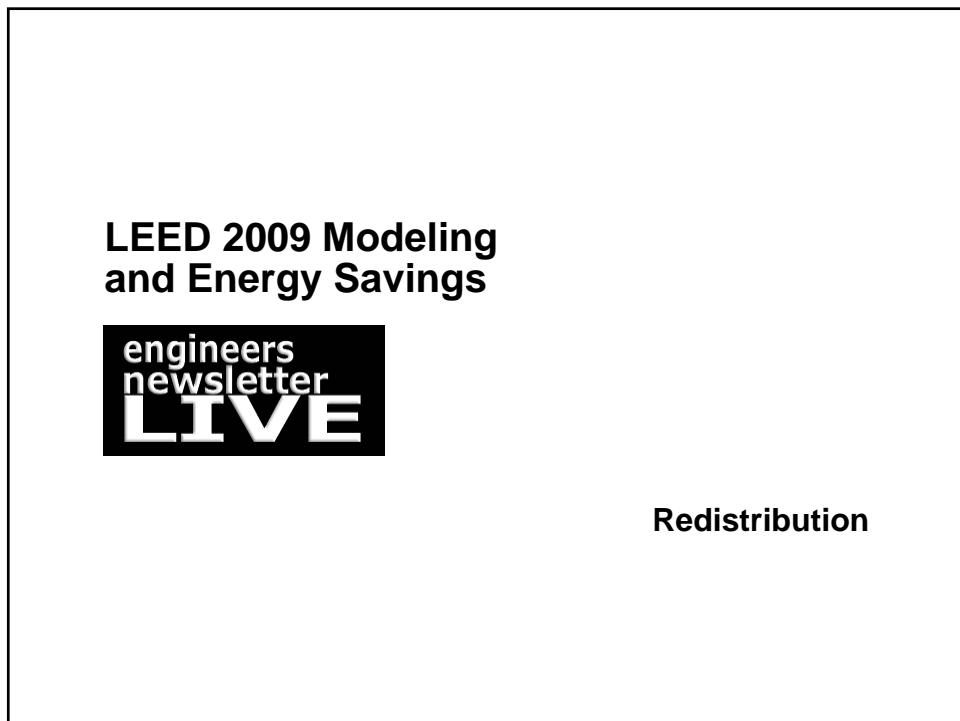
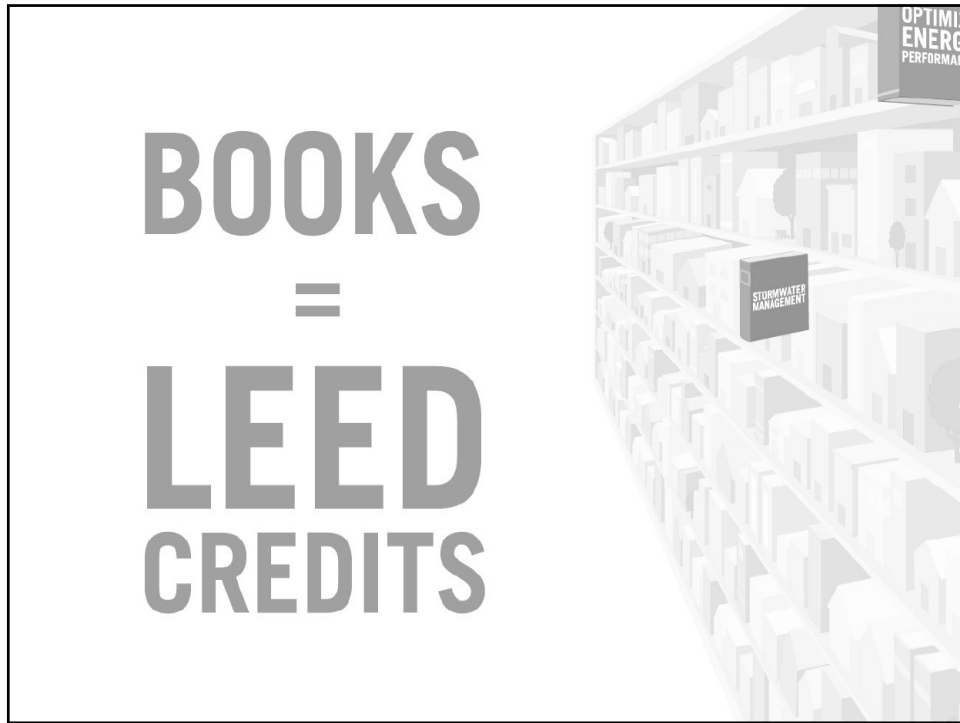
- LEED Prerequisite/Credit alignment and harmonization
- Predictable development (2 year)
- Transparent environmental/human impact credit rating
- Regionalization

23 | © 2009 Trane

## **Harmonization**

- Make things that can be the same, the same
  - New Construction
    - Including retail, small schools
  - Schools
  - Healthcare (future)
  - Core & Shell
  - Commercial Interiors
  - Existing Buildings: Operation and Maintenance (EBOM)

24 | © 2009 Trane



## LEED 2009 Credit Weighting

- 13 Impact Categories  
(top 6 by weighting)
  - Greenhouse gas emissions
  - Fossil fuel depletion
  - Water use
  - Indoor environmental quality
  - Particulates
  - Human health - cancer

27 | © 2009 Trane

## LEED 2009 Credit Weighting

- Total 100 points
  - excluding innovation and regional credits
- Credits are positive integers
  - with a minimum value of 1
- Credits are static, independent values

28 | © 2009 Trane



## LEED 2009 Credit Weighting Activity Groups

- Building systems  
(specifically fuel and electricity consumption)
- Transportation (commuting and services)
- Water consumption (domestic and landscaping-related)
- Materials (core, shell, and finishings)
- Indoor environmental quality

29 | © 2009 Trane

## LEED 2009 Credit Weighting LEED Credit Weighting Tool

**Impact Category x Activity Group x Association = Credit Weight**

*Sample scorecard comparing credit weightings for LEED-NC v2.2 with LEED v3*

		LEED-NC		Existing Credit Point Allocation In LEED 2.2		Credit's Allocated Points Based on Environmental Impact	
				Points			
				LEED 2.2	LEED 2.2 (%)	LEED 3.0	LEED 3.0 (%)
<input type="checkbox"/>	<input type="checkbox"/>	<b>Transportation</b>		5	7%	8.3	8.3%
	<input type="checkbox"/>	Credit 2	Development Density & Community Connectivity	1	1.4%	1.66	1.7%
<input type="checkbox"/>	<input type="checkbox"/>	Credit 4.1	Alternative Transportation, Public Transportation Access	1	1.4%	1.66	1.7%
<input type="checkbox"/>	<input type="checkbox"/>	Credit 4.2	Alternative Transportation, Bicycle Storage & Changing Rooms	1	1.4%	1.66	1.7%
<input type="checkbox"/>	<input type="checkbox"/>	Credit 4.3	Alternative Transportation, Low-Emitting and Fuel-Efficient Vehicles	1	1.4%	1.66	1.7%
<input type="checkbox"/>	<input type="checkbox"/>	Credit 4.4	Alternative Transportation, Parking Capacity	1	1.4%	1.66	1.7%
<input type="checkbox"/>	<input type="checkbox"/>	<b>Sustainable Sites</b>		9	13%	9.0	9.0%
<input type="checkbox"/>	<input type="checkbox"/>	Prereq 1	Construction Activity Pollution Prevention	Required			
<input type="checkbox"/>	<input type="checkbox"/>	Credit 1	Site Selection	1	1.4%	1.74	1.7%

30 | © 2009 Trane

## LEED 2009 Certification Thresholds

- Certified: 40–49 points
- Silver: 50–59 points
- Gold: 60–79 points
- Platinum: 80+ points

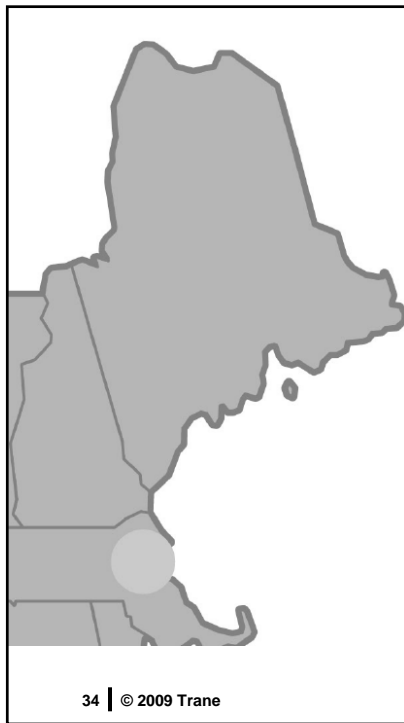


31 | © 2009 Trane

## LEED 2009 NC Scorecard

	2.2	2009
▪ Sustainable Sites	14	26
▪ Water Efficiency	5	10
▪ Energy & Atmosphere	17	35
▪ Material & Resources	13	14
▪ Indoor Environmental Quality	15	15
▪ Innovation & Design Process	5	6
▪ Regional Bonus		4
▪ Total points available	69	110

32 | © 2009 Trane

# BOSTON-CI

**SUSTAINABLE SITES**  
**CREDIT 3.2 ALTERNATIVE TRANSPORTATION, BICYCLE STORAGE & CHANGING ROOMS**

**WATER EFFICIENCY**  
**CREDIT 1 WATER USE REDUCTION**

**ENERGY AND ATMOSPHERE**  
**CREDIT 1.1 OPTIMIZE ENERGY PERFORMANCE: LIGHTING POWER**  
**CREDIT 1.3 OPTIMIZE ENERGY PERFORMANCE: HVAC**

**MATERIALS AND RESOURCES**  
**CREDIT 3.1 MATERIAL REUSE, 5%**  
**CREDIT 5.1 REGIONAL MATERIALS, 20% MANUFACTURED REGIONALLY**

**34 | © 2009 Trane**

## LEED 2009 Modeling and Energy Savings



### Certification Changes

### Certification Changes

- Being performed by the Green Building Certification Institute (GBCI)
- Responsible for
  - Project certification
  - Accreditation

[www.gbci.org](http://www.gbci.org)

## **“Legacy” LEED Accredited Professionals**

- Become “Legacy LEED AP”
- Do not have to retake the exam
- Must agree to the Code of Ethics
- To remain active as of June 2011:
  - Fee waived if you “opt in”
  - Biennial training requirements:  
30 hours (minimum 6 LEED specific)
  - Inactive can still use LEED AP title, but will not be in active directory

37 | © 2009 Trane

## **Credentials**

- Three Tiers
- All required to agree to disciplinary policy and credentialing maintenance guidelines
- Maintenance
  - May use same credentialing hours as for (e.g.) PE, AIA
  - Credit for speaking and conferences

38 | © 2009 Trane

**Tier 1:**  
**LEED Green Associate**

- Demonstrate involvement in support of LEED projects
- Be employed in sustainable field or engaged in green education
- Submit to application audit
- Examination of basic information across all LEED products
- Biennial maintenance:
  - 15 hours
  - Minimum 3 LEED specific

39 | © 2009 Trane

**Tier 2:**  
**LEED Accredited Professional**

- In-depth knowledge in a particular field

40 | © 2009 Trane

## Particular Rating Systems for LEED AP

- Commercial
  - Design & Construction
  - Operations & Maintenance
  - Interiors
- Residential Design & Construction
- Neighborhood Development

41 | © 2009 Trane

## Tier 2: LEED Accredited Professional

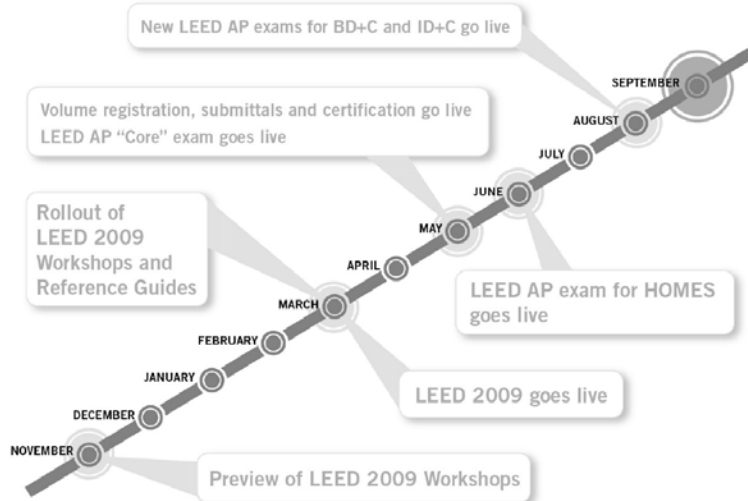
- In-depth knowledge in a particular field
- Demonstrate professional experience on at least one LEED project
- Document work on a LEED project within the last 3 years
- Examination of specific LEED product
- Biennial maintenance:
  - 30 hours
  - Minimum 6 LEED specific

42 | © 2009 Trane

### Tier 3: LEED AP Fellow

- Major contribution to the standards of practice and body of knowledge for achieving continuous improvement in the green building field
- Peer review of project portfolio

### Rollout will be completed by September 1





## **Project Certification**

- Announced July 29, 2008
- 10 certification bodies
- GBCI
  - Developed ISO compliant certification process
  - Began administering January 2009
- Allows USGBC to focus on LEED

45 | © 2009 Trane

## **LEED 2009 Modeling and Energy Savings**



**Prerequisite  
Update**

## Prerequisite

- Energy and Atmosphere (EA)
  - 1: Fundamental commissioning of building energy systems
  - 2: Minimum energy performance
  - 3: Fundamental refrigerant management
- Indoor Environmental Quality (EQ)
  - 1: Minimum IAQ performance
  - 2: Environmental Tobacco Smoke control
- Water Efficiency (WE)
  - 1: Water Use Reduction
- Sustainable Sites (SS)
  - 1: Construction Activity Pollution Prevention
- Materials & Resources (MR)
  - 1: Storage & Collection of Recyclables

47 | © 2009 Trane

## LEED NC 2009 : EAp2 Minimum Energy Performance

- Option 1: performance compliance path
  - Mandatory provision (5.4, 6.4, 7.4, 8.4, 9.4, and 10.4)
  - Baseline building complies with Appendix G Building PRM
  - 10% better than 90.1-2007 for new construction, 5% better for existing building
- Option 2: prescriptive compliance path
  - ASHRAE AEDG for small office buildings 2004
  - ASHRAE AEDG for small retail buildings 2006
  - ASHRAE AEDG for small warehouses and self-storage buildings 2008
- Option 3: prescriptive compliance path
  - Advanced Buildings Core Performance Guide

48 | © 2009 Trane

## Major Changes : EAp2 Minimum Energy Performance

### NC 2.2

#### Option 1: 90.1-2004

- Mandatory provision (5.4, 6.4, 7.4, 8.4, 9.4, and 10.4)
- Prescriptive requirement (5.5, 6.5, 7.5, and 9.5)
- Baseline building complies with Appendix G Building Performance Rating Method (PRM)
- 14% better than 90.1-2004 for new construction, 7% better for existing building

### NC 2009

#### Option 1: 90.1-2007

- Mandatory provision (5.4, 6.4, 7.4, 8.4, 9.4, and 10.4)
- Baseline building complies with Appendix G Building PRM
- 10% better than 90.1-2007 for new construction, 5% better for existing building

## Major Changes : EAp2 Minimum Energy Performance

### NC 2.2

#### Option 2: prescriptive compliance path

- ASHRAE Advanced Energy Design Guide (AEDG) for small office buildings 2004

### NC 2009

#### Option 2: prescriptive compliance path

- ASHRAE AEDG for small office buildings 2004
- ASHRAE AEDG for small retail buildings 2006
- ASHRAE AEDG for small warehouses and self-storage buildings 2008

## Major Changes : EAp2 Minimum Energy Performance

### NC 2.2

No option 3

### NC 2009

**Option 3: prescriptive compliance path**

- Advanced Buildings Core Performance Guide

## Major Changes: EQp1 Minimum IAQ Performance

### NC 2.2

62.1-2004

- Sections 4 through 7
- Mechanical ventilation systems design using ventilation rate procedure or the applicable local code, whichever is more stringent
- Nature ventilated buildings shall comply with ASHRAE 62.1-2004, paragraph 5.1

### NC 2009

62.1-2007

- Sections 4 through 7
- Mechanical ventilation systems design using ventilation rate procedure or the applicable local code, whichever is more stringent
- Nature ventilated buildings shall comply with ASHRAE 62.1-2007, paragraph 5.1

## Major Changes: WEp1 Water Use Reduction

**NC 2.2**  
none

**NC 2009**  
20% water use reduction

- Energy Policy Act 1992
- Energy Policy Act 1995
- Uniform Plumbing Code or International Plumbing Code of 2006

## Credits

Sustainable Sites (SS)	2.2	2009
▪ 1: Site Selection	1	1
▪ 2: Development Density & Community Connectivity	1	5
▪ 3: Brownfield Redevelopment	1	1
▪ 4.1: Alternative Transportation: Public Transportation Access	1	6
▪ 4.2: Alternative Transportation: Bicycle Storage & Changing Rooms	1	1
▪ 4.3: Alternative Transportation: Low Emitting & Fuel Efficient Vehicles	1	3
▪ 4.4: Alternative Transportation: Parking Capacity	1	2

## Credits

Sustainable Sites (SS)	2.2	2009
▪ 5.1: Site Development: Protect or Restore Habitat	1	1
▪ 5.2: Site Development: Maximize Open Space	1	1
▪ 6.1: Stormwater Design: Quantity Control	1	1
▪ 6.2: Stormwater Design: Quality Control	1	1
▪ 7.1: Heat Island Effect: Non-Roof	1	1
▪ 7.2: Heat Island Effect: Roof	1	1
▪ 8: Light Pollution Reduction	1	1

55 | © 2009 Trane

## Credits

Materials & Resources (MR)	2.2	2009
• 1.1: Building Reuse: Maintain Existing Walls, Floors & Roof	2	3
• 1.2: Building Reuse: Maintain 50% of Interior Non-Structural Elements	1	1
• 2.1: Construction Waste Management: Divert 50% From Disposal	1	1
• 2.2: Construction Waste Management: Divert 75% From Disposal	1	1
• 3.1: Materials Reuse: 5%	1	1
• 3.2: Materials Reuse: 10%	1	1

56 | © 2009 Trane

## Credits

	2.2	2009
▪ Materials & Resources (MR)	2.2	2009
• 4.1: Recycled Content: 10% (post-consumer + ½ pre-consumer)	1	1
• 4.2: Recycled Content: 20% (post-consumer + ½ pre-consumer)	1	1
• 5.1: Regional Materials: 10% Extracted, Processed & Manufactured Regionally	1	1
• 5.2: Regional Materials: 20% Extracted, Processed & Manufactured Regionally	1	1
• 6: Rapidly Renewable Materials	1	1
• 7: Certified Wood	1	1

57 | © 2009 Trane

## LEED 2009 Modeling and Energy Savings



ASHRAE Standard  
90.1-2007  
Major Addenda

ASHRAE Standard 90.1-2007 Change  
**Envelope Addenda**

- as: Modifies opaque envelope requirements
- at: Modifies fenestration (glass) requirements

59 | © 2009 Trane

ASHRAE Standard 90.1-2007 Change  
Section 6: HVAC  
**Equipment Efficiencies Raised**

- an: Boiler efficiencies  
18 trillion Btu of gas or oil annually as stock turns
- F: Three-phase air-cooled AC and heat pumps  
2.3 quads by 2035
- g: Air-cooled AC and heat pumps  
1.05 quads by 2035

60 | © 2009 Trane



ASHRAE Standard 90.1-2007 change  
**ASHRAE 62.1 Reference**

- Changed from 62.1-1999 to 62.1-2004
  - Ventilation rates changed
  - Now based on summation of rates per person and per area

61 | © 2009 Trane

ASHRAE Standard 90.1-2007 Change  
Mandatory HVAC Provisions  
**Ventilation: High Occupancy**

- Demand Control Ventilation (DCV) required for Spaces > 500 ft<sup>2</sup> and design occupancy > 40 people/1000 ft<sup>2</sup>:  
*(was 3000 cfm and 100 people/1000 ft<sup>2</sup>)*

62 | © 2009 Trane

ASHRAE Standard 90.1-2007 Change  
**Off-Hour Controls**

- Exception was deleted for HVAC systems serving hotel/motel guest rooms

63 | © 2009 Trane

ASHRAE Standard 90.1-2007 Change  
 Prescriptive HVAC Requirements  
**Air System Design & Control**

- Fan system power limitation:
  - Applies to systems > 5 hp

Option	Constant volume	Variable volume
1) Nameplate hp	$hp \leq CFMs \times 0.0011$	$hp \leq CFMs \times 0.0015$
2) System bhp	$bhp \leq CFMs \times 0.00094 + A$	$bhp \leq CFMs \times 0.0013 + A$

64 | © 2009 Trane

**ASHRAE Standard 90.1-2007 Change  
Fan Power Limitation Pressure Drop Adjustment**

- $A = \sum (PD \times CFM_{\text{design}} / 4131)$
- PD specified for
  - Ducts
  - Filters
  - Gas-phase air cleaners
  - Heat recovery devices
  - Sound attenuation sections
  - Other devices

65 | © 2009 Trane

**ASHRAE Standard 90.1-2007 Change  
Prescriptive HVAC Requirements  
Air System Design & Control**

- VAV fan control
  - Motors  $\geq 10$  hp require one of the following: (*was 15 hp*)
    - Variable-speed drive
    - Vane axial fan with variable-pitch blades
    - Design wattage  $\leq 30\%$  at 50% air volume
  - DDC systems must include setpoint reset (fan-pressure optimization)

66 | © 2009 Trane

ASHRAE Standard 90.1-2007 change  
**Lighting Addenda**

- ai: retail display lighting  
 Gives lighting designers flexibility

**EA Credit Redistribution**

Credit	Description	LEED NC		LEED 2009	
		Maximum points	Max %	Maximum points	Max %
1	Optimize Energy Performance	10	14.5%	19	19.0%
2	On-site renewable energy	3	4.3%	7	7.0%
3	Enhanced Commissioning	1	1.4%	2	2.0%
4	Enhanced Refrigerant Management	1	1.4%	2	2.0%
5	Measurement and verification	1	1.4%	3	3.0%
6	Green Power	1	1.4%	2	2.0%
	<b>EA Section</b>	<b>17</b>	<b>24.6%</b>	<b>35</b>	<b>35.0%</b>
	<b>Rating system total</b>	<b>69</b>		<b>100</b>	

## **Minor Changes, EAc3, 4, 6**

(with the exception of credit points available)

<b>Enhanced Commissioning</b>	<b>No changes</b>
<b>Enhanced Refrigerant Management</b>	<b>No changes</b>
<b>Green Power</b>	<b>All purchases of green power shall be based on the quantity of energy consumed, not the cost</b>

69 | © 2009 Trane

## **Significant EA Changes**

- EAc1 – Optimize Energy Performance
- EAc2 – On-Site Renewable Energy
- EAc5 – Measurement and Verification

70 | © 2009 Trane

EAc1 – Prescriptive Option 1

ASHRAE

## Advanced Energy Design Guides

- (1 point)
  - Offices < 20,000 ft<sup>2</sup>
  - Retail < 20,000 ft<sup>2</sup>
  - Small Warehouses < 50,000 ft<sup>2</sup>
  - K-12 Schools < 200,000 ft<sup>2</sup>

Available at no charge

[www.ashrae.org/technology/page/938#completed](http://www.ashrae.org/technology/page/938#completed)

71 | © 2009 Trane

EAc1 – Prescriptive Option 1

ASHRAE

## Advanced Energy Design Guides

- Recommendations by Climate Zone  
(Must follow all for LEED EAc1)
  - Envelope
  - Lighting
  - HVAC
  - Service Water Heating

72 | © 2009 Trane

Another Option  
ASHRAE

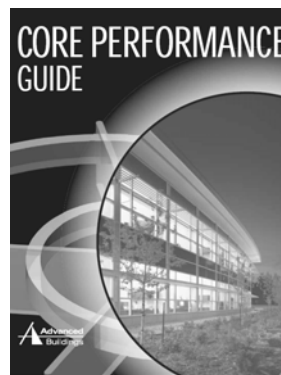
## Advanced Energy Design Guides

- K-12 AEDG: Savings compared to 90.1-2004
  - At least 30%
  - Daylighting, but not high efficiency lighting, 30%–45%
  - High efficiency lighting but not daylighting, 24%–41%
- Follow the recommendations, but model the project
- May achieve significantly more than 1 credit point

73 | © 2009 Trane

## EAc1 – Prescriptive Option 2 Core Performance Guide

- Offices, school, public assembly, retail under 100,000 ft<sup>2</sup>
  - NOT health care, warehouses or laboratory projects



[www.advancedbuildings.net/publications.htm](http://www.advancedbuildings.net/publications.htm)

74 | © 2009 Trane

## EAc1 – Prescriptive Option 2 Core Performance Guide

- Section 1
  - Design Intent
  - Communicating Design Intent
  - Building Configuration
  - Mechanical System Design
  - Acceptance Testing
  - Operating Training and Documentation
  - Performance Data Review
- Section 2
  - IAQ
  - Below Grade Insulation
  - Envelope
  - Lighting
  - Mechanical System Design, Control, and Mechanical Performance
  - Domestic Hot Water

75 | © 2009 Trane

## Operator Training and Documentation

- Documentation – Similar to 90.1-2007 Completion Requirement
- Operator Training

76 | © 2009 Trane



### Core Performance Guide Lighting

- Whole building lighting power densities the same as 90.1-2007...but
  - *“The lighting power densities contained in this table include allowances for video-display terminals, decorative lighting, and display lighting. Additional lighting power is not allowed for these uses. Task lighting is not included in these connected LPD limits.”*

77 | © 2009 Trane

### Lighting Power Density Comparison

Building Type	90.1-2007 (W/ft <sup>2</sup> )	Core Performance Guide (W/ft <sup>2</sup> )
Family Dining	1.6 Up to 1.0 additional decorative	1.6 Including decorative lighting
Retail	1.5 Plus display lighting	1.3 Including display lighting

78 | © 2009 Trane

### Examples Core Performance Guide Mechanical Efficiency

Category	Size	90.1-2007	CPG
Rooftop	20 tons	10.0 EER 9.7 IPLV	10.5 EER 10.9 IPLV
Air-cooled chiller	All	1.26 kW/ton 1.15 IPLV	1.2 kW/ton 1.0 IPLV
Constant Speed centrifugal chiller	>600 tons	0.576 kW/ton 0.549 IPLV (as of 1/1/2010) 0.570 kW/ton 0.539 IPLV	0.550 kW/ton 0.510 IPLV
Variable Speed centrifugal chiller	>600 tons	0.576 kW/ton 0.549 IPLV (as of 1/1/2010) 0.590 kW/ton 0.400 IPLV	0.55 kW/ton 0.400 IPLV

79 | © 2009 Trane

### Core Performance Guide EAC1 – Prescriptive

- One point for each three additional strategies (maximum of 2 additional pts)
  - Except: Cool roofs, Night Venting, Additional Commissioning
- Enhanced Performance Strategies
  - Daylighting and control
  - Additional lighting power reduction
  - Plug loads/appliance efficiency
  - 14 available strategies

[www.advancedbuildings.net/publications.htm](http://www.advancedbuildings.net/publications.htm)

80 | © 2009 Trane

### EAC1 – Modeling Up to 19 points

New Buildings	Existing Building Renovations	Points
12%	8%	1
14%	10%	2
16%	12%	3
18%	14%	4
20%	16%	5
22%	18%	6
24%	20%	7
26%	22%	8
28%	24%	9
30%	26%	10
32%	28%	11
34%	30%	12
36%	32%	13
38%	34%	14
40%	36%	15
42%	38%	16
44%	40%	17
46%	42%	18
48%	44%	19

81 | © 2009 Trane

### EAC2 – On-Site Renewable Energy

% Renewable Energy*	Points	
1%	1	<ul style="list-style-type: none"> <li>▪ Reduce building energy use first</li> <li>▪ Same size renewable system becomes more cost effective</li> </ul>
3%	2	
5%	3	
7%	4	
9%	5	
11%	6	
13%	7	

82 | © 2009 Trane

## EAc5 – Measurement and Verification

- Same requirements as NC v2.2 with one addition...
- *“Provide a process for corrective action to ensure energy savings are realized if the results of the M&V plan indicate that energy savings are not being achieved.”*

83 | © 2009 Trane

## EA Section Summary

- 35% of possible 100 points
- Increased focus on energy
  - Project
  - Renewables
  - Measurement and verification
- Significant rewards for exemplary buildings

84 | © 2009 Trane

## LEED 2009 Modeling and Energy Savings



ASHRAE Standard  
62.1-2007  
Major Addenda

## ASHRAE Standard 62.1-2007

Incorporates addenda a, b, c, d, e, f, g,  
and h to 62.1-2004



ASHRAE 62.1 -2007 Change

Addendum b:

### **Airstream & Space Type Revisions**

- Employee Locker Rooms, Kitchenettes, and Private toilet/bath now have minimum exhaust rates (Table 6-4)
- New occupancy categories with minimum exhaust rates (Table 6-4)
- Science Laboratories – new class. for min breathing zone rate (Table 6-1)
- “Other Space Types” now have min breathing zone rates (Table 6-1)

87 | © 2009 Trane

ASHRAE 62.1 -2007 Change

Addendum g:

### **ETS Areas & ETS-Free Areas**

- Separation of ETS and ETS-free areas
- Separation via pressurization and air-tightness
- Limiting air transfer and recirculation of ETS areas
- ETS are signage requirements

88 | © 2009 Trane

**ASHRAE 62.1 -2007 Change**
**Addendum h:**
**Residential Space Requirements**

- Deleted tables E-2 & E-3 from Normative Appendix E
- Residential spaces added to Table 6-1
- ASHRAE Standard 62.2-2004 residential ventilation rates differ from those in addendum h

**Significant EQ Changes**

Credit	Description	LEED NC 2.2		LEED 2009	
		Maximum credits	Max %	Maximum credits	Max %
1	Outdoor Air Delivery Monitor.	1	1.45%	1	1.0%
2	Increased Ventilation	1	1.45%	1	1.0%
3.1-3.2	Construction IAQ Manage. Plan	2	2.9%	2	2.0%
4.1-4.4	Low-Emitting Materials	4	5.8%	4	4.0%
5	Indoor Chemical & Pollutant Source Control	1	1.45%	1	1.0%
6.1-6.2	Controllability of Systems	2	2.9%	2	2.0%
7.1-7.2	Thermal Comfort	2	2.9%	2	2.0%
8.1-8.2	Daylight & Views	2	2.9%	2	2.0%
	<b>EQ Section</b>	<b>15</b>	<b>21.7%</b>	<b>15</b>	<b>15.0%</b>
	<b>Rating System Total</b>	<b>69</b>		<b>100</b>	

## EQ Changes – Credits 1 & 2

- No changes to credit points
- Credit requirements referencing 62.1-2004 now reference 62.1-2007
  - Credit 1 – Outdoor Air Delivery Monitoring
  - Credit 2 – Increased Ventilation

91 | © 2009 Trane

## Significant WE Changes

Credit	Description	LEED NC 2.2		LEED 2009	
		Maximum credits	Max %	Maximum credits	Max %
1.1	Water Efficient Landscaping, Reduce by 50%	1	1.45%	2	2.0%
1.2	Water Efficient Landscaping, No Potable Use or No Irrigation	1	1.45%	2	2.0%
2	Innovative Wastewater Technologies	1	1.45%	2	2.0%
3	Water Use Reduction	1 to 2		2 to 4	
3.1	20% now 30% Reduction	1	1.45%	2	2.0%
3.2	30% now 35% Reduction	2	2.9%	3	3.0%
3.3	40% Reduction	N/A		4	4.0%
	<b>WE Section</b>	<b>5</b>	<b>7.2%</b>	<b>10</b>	<b>10.0%</b>
	<b>Rating System Total</b>	<b>69</b>		<b>100</b>	

92 | © 2009 Trane



## Possible Responses to LEED 2009 Changes

- Energy has become more important
  - Focus on efficient system design, control and operation
- Condensate reclamation
- Your LEED tools may need to change

93 | © 2009 Trane

## LEED 2009 Modeling and Energy Savings



**EAc1 Modeling:  
Option 1 – Whole Building  
Energy Simulation**

## Whole Building Simulation

- Section G2.2.1 of Standard 90.1-2007 lists eight (8) criteria as requirements for an acceptable modeling tool
- Section G2.2.4 of Standard 90.1-2007 states that a simulation program shall be tested per ASHRAE Standard 140



95 | © 2009 Trane

## LEED Sections and Points (NC 2009)

Design Category	Possible Points	
Sustainable Sites	26	
Water Efficiency	10	<b>8</b>
Energy and Atmosphere	35	<b>31</b>
Materials and Resources	14	
Indoor Environ. Quality	15	<b>1</b>
Innovation & Design	6	
Regional Priority	4	
<b>Total Available Points</b>	<b>110</b>	<b>40</b>

**Blue indicates categories TRACE can be used with and the total possible points that can be obtained**

96 | © 2009 Trane

## Full Year, 8,760 Hour Analysis

DOE2.COM your home for DOE-2 based software

home

### Weather Data & Weather Data Processing Utility Programs

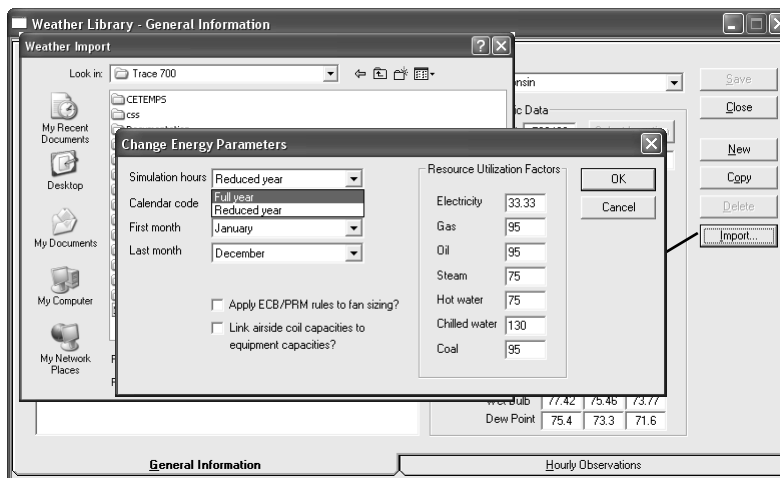


This download area also provides access to a wide variety of weather data that is compatible with eQUEST, DOE-2.x, PowerDOE and COMcheck-Plus. eQUEST will automatically download data from this area, except the non-us directory, when available. The pre-processed weather data available includes:

- [CTMY](#) (Canadian TMY, 12 locations, derived from Canadian Government data)
  - [CTMY2](#) (CTMY, updated 40 location version, derived from Canadian Government data)
  - [CZ2](#) (California Climate Zones Revision 2, 16 zones, 1992 supplied by the California Energy Commission)
  - [TMY](#) (Typical Meteorological Year, 238 locations, derived from US NOAA's NCDC TMY datasets)
  - [TMY2](#) (Typical Meteorological Year version 2, 238 locations, derived from USDOE's NREL datasets)
  - [TMY3](#) (NEW - Typical Meteorological Year version 3, 1020 locations, derived from USDOE's NREL datasets. Thanks to Joe Huang at [White Box Technologies](#) for these files processed for use with DOE-2)
  - [TRY](#) (Test Reference Year, 60 locations, derived from US NOAA's NCDC datasets)
  - [WYEC](#) (Weather Year For Energy Calculations, 51 ASHRAE locations, derived from US NOAA's NCDC data)
  - [WYEC2](#) (WYEC version 2, 51 ASHRAE locations, derived from US NOAA's NCDC datasets)
- Note on WYEC and WYEC2: these are **not** the ASHRAE files - get those from [ASHRAE](#)
- [NON-US](#) (various ZIP archives containing undocumented data for locations outside North America)

97 | © 2009 Trane

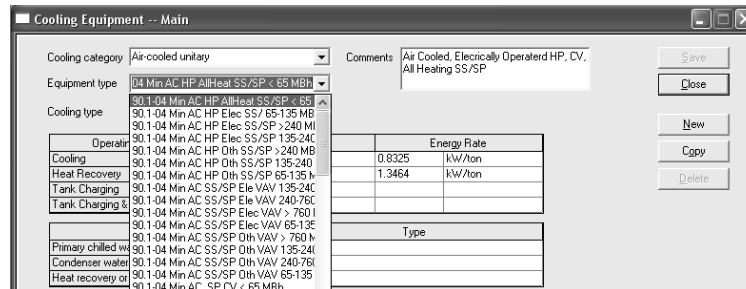
## Full Year, 8,760 Hour Analysis



98 | © 2009 Trane

## 90.1 Minimally Compliant Equipment Library

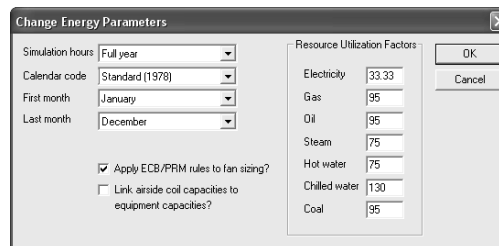
- Over 160 library members including fans, heating equipment, cooling equipment, and heat rejection equipment



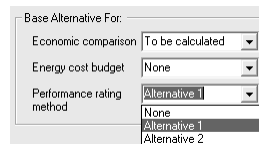
99 | © 2009 Trane

## Automatic Features for LEED

- G3.1.2.9 - System Fan Power Calculation



- Baseline Building Rotation



100 | © 2009 Trane

**Performance Rating Details**

**Energy Cost Budget / PRM Summary**  
By Trane

Project Name: \_\_\_\_\_ Date: February 02, 2009  
City: \_\_\_\_\_ Weather Data: 0760 Columbus OH

Note: The percentage displayed for the "Proposed Base 1" column of the table is actually the percentage of the total energy consumption.  
\* Denotes the base alternative for the EGB study.

		* All-2 Baseline EGB		All-1 Proposed Office Building	
		Energy /10% Btu/yr	Proposed /Base % Peak kWh	Energy /10% Btu/yr	Proposed /Base % Peak kWh
Lighting - Conditioned	Electricity	619.7	28	267	795.4
Space Heating	Electricity	40.8	1	11	31.0
Space Heating	Gas	1,074.0	33	1,239	790.2
Space Cooling	Electricity	472.5	14	445	304.2
Pumps	Electricity	110.4	4	32	114.8
Heat Rejection	Electricity	33.1	1	35	45.3
Fans - Conditioned	Electricity	234.9	7	137	73.4
Receptacles - Conditioned	Electricity	302.5	12	114	302.5
<b>Total Building Consumption</b>		<b>3,205.2</b>			<b>2,536.7</b>

		* All-2 Baseline EGB		All-1 Proposed Office Building	
		Energy /10% Btu/yr	Cooling /Btu	Energy /10% Btu/yr	Cooling /Btu
Total	Number of hours heating load met	43		75	
	Number of hours cooling load met	0		0	

		* All-2 Baseline EGB		All-1 Proposed Office Building	
		Energy /10% Btu/yr	Cooling /Btu	Energy /10% Btu/yr	Cooling /Btu
Electricity		2,211.1	61,408	1,746.5	67,648
Gas		1,074.0	5,139	790.2	5,140
<b>Total</b>		<b>3,285</b>	<b>66,548</b>	<b>2,537</b>	<b>72,788</b>

Project Name: C:\DOCUMENTS AND SETTINGS\SLAD\PIDEK\TOP\CDS SUPPORTS\UPPORT SAMPLE01 LE  
Database Name: C:\DOCUMENTS AND SETTINGS\SLAD\PIDEK\TOP\CDS SUPPORTS\UPPORT SAMPLE01 LE  
TRACER 9.0701 v8.2 calculated at 08:13 AM on 02/02/09  
Energy Cost Budget Report Page 1 of 1

101 | © 2009 Trane

## Daylighting

**Daylighting Parameters**

General | Daylighting Controls | Room Parameters | Glass Parameters | Construction Parameters | Internal Shade Parameters

Template Name: Std Continuous Dimmer Copy Delete Import Rename Apply

**Controls**

Percent of Space Affected: 0.0 %

Lighting Setpoint: 0.0 fc

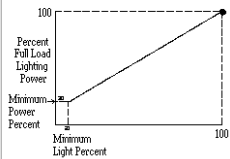
Lighting Control Type: Continuous

Minimum Power Percent: 0.0 %

Minimum Light Percent: 0.0 %

Light Control Steps: 1

Light Control Probability: 0.0 %



**Geometry**

Reference Height (A): 0.0 R

Distance from Glass (B): 0.0 R

Window Sill Height (C): 0.0 R

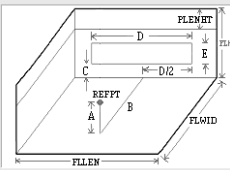
Glass Length/Distance From (D/B): 0.0

Glass Height/Distance From (E/B): 0.0

Horizontal Offset: 0.0 R

Skylight Length/Distance: 0.0

Skylight Width/Distance: 0.0



102 | © 2009 Trane

## Daylighting, cont.

### EQc 8.1 - Daylight 75% of Spaces

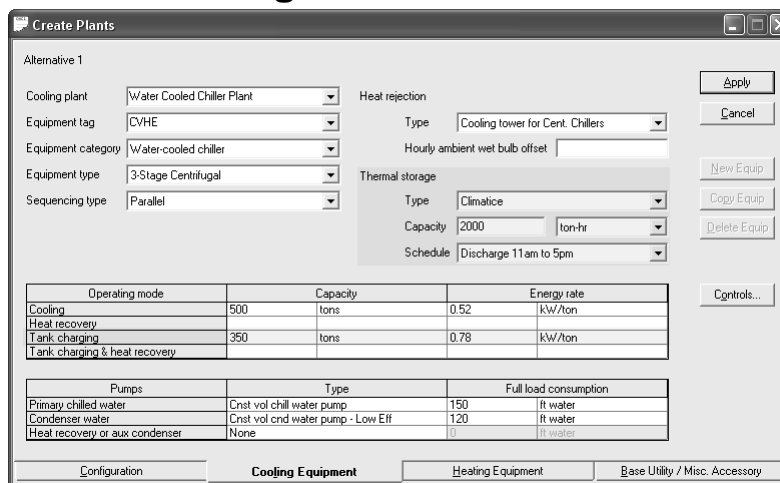
#### Option 2 – Daylight Simulation Model

- Minimum of 25 footcandles achieved in at least 75% of occupied spaces
- Under clear sky, at noon on the equinox and at 30” above the floor

System Desc	Room Desc	Dayl Sched	Glass		Month	Day	Hour	GlassSolar ToSpace	Pct Ext Btuh	Pct Lites Shad %	Pct Lites MetByDayl%	Ref#1 Dayl Illum ft-cand
			Area ft2	Floor Area ft2								
2- AHU 1-2 (bldg:3-110_A Sci Available (100			99.6	1376	Mar	21	12	5396.7	0	0	70	25.3
					Sep	21	12	5294.2	0	0	70	25
2- AHU 1-2 (bldg:3-107 Readin Available (100			111	821	Mar	21	12	5533	0	0	70	37.6
					Sep	21	12	5231.8	0	0	70	36.5
2- AHU 1-2 (bldg:3-106 Lang A Available (100			66.6	820	Mar	21	12	4058	0	0	70	29.9
					Sep	21	12	3994.4	0	0	70	29.6

103 | © 2009 Trane

## Thermal Storage



Alternative 1

Cooling plant: Water Cooled Chiller Plant

Equipment tag: CVHE

Equipment category: Water-cooled chiller

Equipment type: 3-Stage Centrifugal

Sequencing type: Parallel

Heat rejection Type: Cooling tower for Cent. Chillers

Thermal storage Type: Climatic

Capacity: 2000 ton-hr

Schedule: Discharge 11 am to 5 pm

Operating mode	Capacity	Energy rate
Cooling	500 tons	0.52 kW/ton
Heat recovery		
Tank charging	350 tons	0.78 kW/ton
Tank charging & heat recovery		

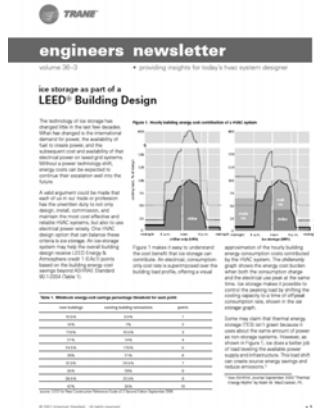
Pumps	Type	Full load consumption
Primary chilled water	Crst vol chill water pump	150 ft water
Condenser water	Crst vol cond water pump - Low Eff	120 ft water
Heat recovery or aux condenser	None	0 ft water

Configuration | Cooling Equipment | Heating Equipment | Base Utility / Misc. Accessory

104 | © 2009 Trane

## Thermal Storage, cont.

- Engineers Newsletter: Ice storage as part of a LEED® building design, volume 36-3, 2007.



**engineers newsletter**  
volume 36-3 • providing insights for today's best system designers

**Ice storage as part of a LEED® Building Design**

The technology of ice storage has changed little in the last few decades. What has changed is the environmental demands for green, the availability of high-performance air conditioning and the electrical power or load profiles. Building owners are increasingly aware of the environmental benefits that ice storage can provide. A good engineer could find that what is not a new topic or profession has the potential to be a hot one. Designing that ice storage system and related HVAC systems, that also fit an electrical power profile, can be a challenge. This article will discuss how to design that ice storage system that fits the overall building design. LEED Green Building Accredited (LEED GB) Accredited Design Professionals (LEED AP) will be discussing the design of ice storage systems for LEED Green Building Accredited (LEED GB) Accredited Design Professionals (LEED AP).

**Table 1: Monthly energy and cooling load profiles for each peak**

Month	Peak 1 (kW)	Peak 2 (kW)	Peak 3 (kW)
Jan	100	100	100
Feb	100	100	100
Mar	100	100	100
Apr	100	100	100
May	100	100	100
Jun	100	100	100
Jul	100	100	100
Aug	100	100	100
Sep	100	100	100
Oct	100	100	100
Nov	100	100	100
Dec	100	100	100

© 2007 Trane Inc. All rights reserved.

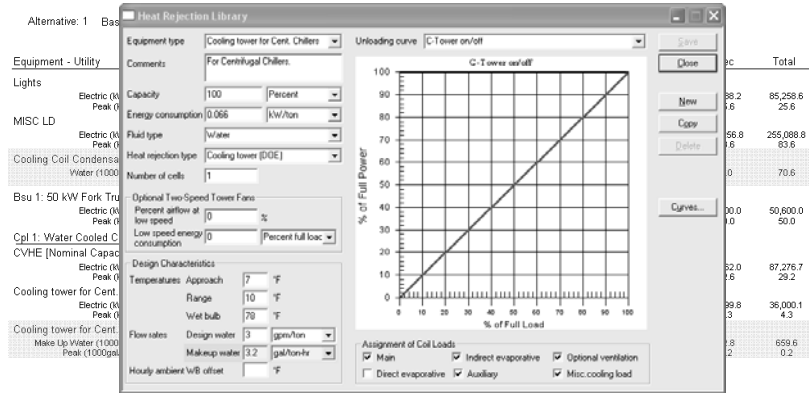
## LEED 2009 Modeling and Energy Savings



Segue

## Water Consumption

- Cooling Tower water usage and Cooling Coil Condensate recovery



107 | © 2009 Trane

## Water Consumption

- Marley cooling tower make-up usage calculation

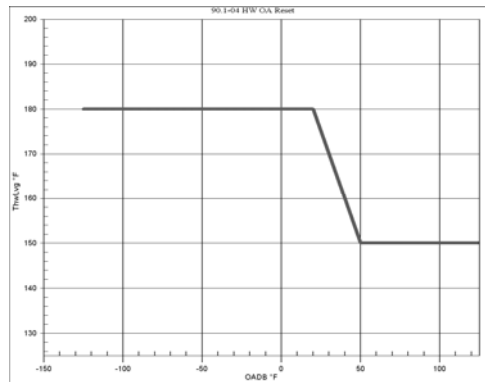
<u>Number of concentrations</u>	<u>Blowdown</u> (% of cooling tower gpm)
3	0.4
4	0.25
5	0.18
6	0.13
8	0.08
10	0.06
12	0.04

108 | © 2009 Trane



## Enhanced Capabilities

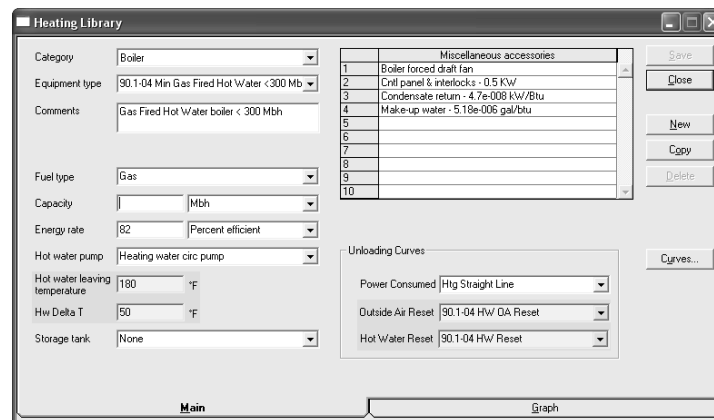
- Hot-Water Supply Temperature Reset



109 | © 2009 Trane

## Enhanced Capabilities

- Hot-Water Supply Temperature Reset



**Heating Library**

Category: Boiler

Equipment type: 90.1-04 Min Gas Fired Hot Water <300 Mb

Comments: Gas Fired Hot Water boiler < 300 Mbh

Fuel type: Gas

Capacity: | Mbh

Energy rate: 82 Percent efficient

Hot water pump: Heating water circ pump

Hot water leaving temperature: 180 °F

Hw Delta T: 50 °F

Storage tank: None

Miscellaneous accessories:

1	Boiler forced draft fan
2	Ctrl panel & interlocks - 0.5 KW
3	Condensate return - 4.7e-008 kW/Btu
4	Make-up water - 5.18e-006 gal/btu
5	
6	
7	
8	
9	
10	

Unloading Curves:

Power Consumed: Htg Straight Line

Outside Air Reset: 90.1-04 HW OA Reset

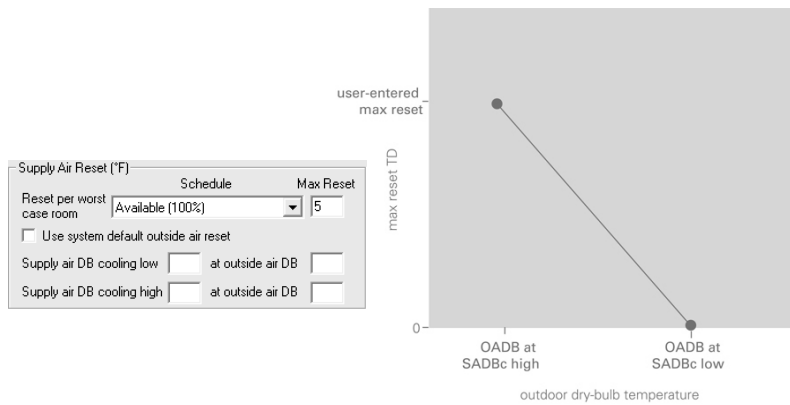
Hot Water Reset: 90.1-04 HW Reset

Main | Graph

110 | © 2009 Trane

## Enhanced Capabilities, cont.

- Supply Air Temperature Reset



111 | © 2009 Trane

## Enhanced Capabilities, cont.

- Hot gas reheat for dehumidification



The 'Cooling Equipment Controls' dialog box is shown with the following settings:

- Plant description: Water Cooled Chiller Plant
- Equipment tag: CVHE
- Free Cooling: Type (None), Fluid cooler type (None), Pump (None), Pump full load energy (0 kW)
- Max chilled water reset: 0 °F
- Load shedding economizer: No
- Evaporative precooling: No
- Energy source: (empty)
- Reject condenser heat: Heating plant
- Reject heat to plant: Heating Plant 1
- Equipment schedule: Available (100%)
- Demand limiting priority: (empty)
- Hot gas reheat for dehumidification: Yes

112 | © 2009 Trane

## Enhanced Capabilities, cont.

- ASHRAE Standard 62.1 report

**ASHRAE Standard 62.1-2004/2007**  
By Trane

**System Ventilation Requirements**

AHU Location	Description		$\sum Vpz$ cfm	$Pp$ People	$\sum Pz$ People	$D$ $Pz / \sum Pz$	$Vou$ cfm	$Vps$ cfm	$Xs$	$Ev$	$Vot$ cfm	%OA $Vot / Vps$
<b>Alternative 1</b>												
System	Lab & Corridor	Cooling	17,294	21	21	1.00	0	6,295	0.000	1.000	0	0.0
		Heating	5,176	21	21	1.00	0	5,176	0.000	1.000	0	0.0
Zone	Office	Cooling	4,192	50	50	1.00	684	4,192	0.193	0.911	751	17.9
		Heating	4,192	50	50	1.00	684	4,192	0.193	0.848	807	19.2
System	Warehouse	Cooling	118,000	7	7	1.00	216	118,000	0.002	1.000	216	0.2
		Heating	35,664	7	7	1.00	216	35,664	0.006	1.000	270	0.8

**Ventilation Parameters**

System Zone Room	$Rp$ cfm/p	$Pz$ People	$Ra$ cfm/ft <sup>3</sup>	$Az$ ft <sup>3</sup>	$Vbz$ cfm	---Cooling---		---Heating---	
						$Ez$	$Voz$ cfm	$Ez$	$Voz$ cfm
<b>Alternative 1</b>									
Lab Corridor	0.00	1.00	0.00	800	0	1.00	0	1.00	0
Lab 1	0.00	5.00	0.00	1,800	0	1.00	0	1.00	0

113 | © 2009 Trane

## New System Categories & Types

**System category**

- All
- Variable Volume
- Constant Volume - Non-mixing
- Constant Volume - Mixing
- Heating Only
- Induction
- Underfloor Air Distribution
- Displacement Ventilation
- Chilled Beams

**System type**

- UFAD VAV w/ Baseboard Heating
- UFAD VAV w/ Fan-Assisted Reheat
- Underfloor Air Distribution CV
- Underfloor Air Distribution FFP/VAV
- Underfloor Air Distribution SFP/VAV

**System category**

- All
- Variable Volume
- Constant Volume - Non-mixing
- Constant Volume - Mixing
- Heating Only
- Induction
- Underfloor Air Distribution
- Displacement Ventilation
- Chilled Beams

**System type**

- Displacement Ventilation CV
- Displacement Ventilation VAV
- Displacement Ventilation w/ Chilled Ceilings
- Passive Chilled Beams
- Room Induction

**System category**

- All
- Variable Volume
- Constant Volume - Non-mixing
- Constant Volume - Mixing
- Heating Only
- Induction
- Underfloor Air Distribution
- Displacement Ventilation
- Chilled Beams

**System type**

- Active Chilled Beams
- Passive Chilled Beams

114 | © 2009 Trane

# Humidity Control? UFAD, Chilled Beams, DV...

**engineers newsletter**  
Volume 34-4 • providing insights for today's hvac system designer

**advances in Desiccant-Based D...**

Using "indirect" dehumidification, which removes moisture from the air by cooling it to its dew point, allows for more efficient humidity control in buildings. This is especially true in buildings with high humidity loads, such as data centers and pharmaceutical manufacturing.

**An Introduction to desiccants**

Desiccants are substances that absorb moisture from the air as part of an air conditioning process. They are used in a variety of applications, including air conditioning, industrial processes, and food processing.

**engineers newsletter**  
Volume 33-2 • providing insights for today's hvac system designer

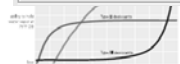
**Stage 1 Air-to-Air Energy Recovery/Transfer**

Type:

Sup-side deck:

Exh-side deck:

Schedule:



# Energy Saving Strategies for LEED - ENL

**engineers newsletter**  
Volume 34-4 • providing insights for today's hvac system designer

**Top ten frequently asked questions (FAQs) about LEED and HVAC**

As the LEED certification process continues to gain momentum, many building owners and designers are asking questions about how to integrate LEED requirements with HVAC systems. This document addresses the top ten most common questions.

**LEED v2 LEED programs**

LEED v2 programs are designed to provide a more comprehensive and consistent approach to green building certification. They include LEED v2-1 for new buildings, LEED v2-2 for existing buildings, and LEED v2-3 for homes.

**engineers newsletter**  
Volume 37-2 • providing insights for today's hvac system designer

**energy-saving strategies for LEED® Energy and Atmosphere Credit 1 (EAc1)**

Energy and Atmosphere Credit 1 (EAc1) is a key LEED certification requirement. It focuses on reducing energy consumption in buildings. This document provides strategies for achieving EAc1, including energy audits, commissioning, and energy modeling.

**Energy-saving strategies for LEED® Energy and Atmosphere Credit 1 (EAc1)**

Energy audits, commissioning, and energy modeling are key strategies for achieving EAc1. Energy audits help identify energy waste and opportunities for improvement. Commissioning ensures that the building systems are installed and operating correctly. Energy modeling predicts energy consumption and helps optimize building design and operation.

## Canada Green Building Council Ballots Passed Late 2008 or Early 2009

- LEED Canada for Homes  
[http://www.cagbc.org/uploads/Homes\\_ENG.pdf](http://www.cagbc.org/uploads/Homes_ENG.pdf)  
March release of the Reference Guide
- LEED Canada for Existing Buildings  
[http://www.cagbc.org/uploads/EBOM\\_formatted\\_ENG.pdf](http://www.cagbc.org/uploads/EBOM_formatted_ENG.pdf)
- LEED Canada for New Construction v 2.0  
[http://www.cagbc.org/uploads/LEED\\_NC\\_English\\_FINAL.pdf](http://www.cagbc.org/uploads/LEED_NC_English_FINAL.pdf)

117 | © 2009 Trane

## LEED Canada Updates Enhanced Refrigerant Management

- Now use the same method as USGBC
  - Homes – EA 11
  - EBOM – EA Credit 5
  - NC Version 2.0 – EA Credit 4

118 | © 2009 Trane

## LEED Canada Updates Enhanced Refrigerant Management

- Summary
  - Credit is achieved if no refrigerant is used
  - If refrigerant is used the method:
    - Balances refrigerant global warming and ozone depletion potentials
    - Requires calculation for all refrigerants (R-22, R134a, R-123, R-410a, R407c)
    - If project calculation is  $\leq 100$  the credit is earned
    - *“Select HVAC&R equipment with reduced refrigerant charge and increased equipment life.”*

[http://www.trane.com/Commercial/Uploads/XLS/891/EAc4Calculator\\_LEEDV2-2.xls](http://www.trane.com/Commercial/Uploads/XLS/891/EAc4Calculator_LEEDV2-2.xls)

119 | © 2009 Trane

## LEED 2009 Modeling and Energy Savings



Summary



## **USGBC's Momentum Continues...**

*"The Obama Administration's economic recovery plan includes many important provisions for green building, green schools, and energy efficiency for existing buildings that will be of great importance to our community. This investment in our nation's built environment will not only stimulate renewed activity, it will bear further fruit measured in energy savings, cost savings, and new green jobs."*

**Michelle Moore**

Senior Vice President, Policy & Public Affairs

121 | © 2009 Trane

## **LEED 2009**

- LEED is gaining momentum
- More harmonization and easier to understand
- Higher performance buildings

122 | © 2009 Trane

## References for This Broadcast Where to Learn More



123 | © 2009 Trane

## Watch Past Broadcasts ENL Archives



[www.trane.com/bookstore](http://www.trane.com/bookstore)

- Insightful topics on HVAC system design:
  - Chilled-water plants
  - Air distribution
  - Refrigerant-to-air systems
  - Control strategies
  - Industry standards and LEED
  - Energy and the environment
  - Acoustics
  - Ventilation
  - Dehumidification

124 | © 2009 Trane





## **2009 ENL Broadcasts**

- **April 22**  
ASHRAE Clean, Lean and Green  
IAQ for Sustainable Buildings
- **May 13**  
Ice Storage System Design and Application
- **November 4**  
Air-Handling Systems, Energy, and IAQ

125 | © 2009 Trane