



Trane Engineers Newsletter Live

LEED v4

Presenters: Chris Hsieh, Charlie Jelen, Mick Schwedler and John Murphy





Presenter biographies

John Murphy | applications engineer | Trane

John has been with Trane since 1993. His primary responsibility as an applications engineer is to aid design engineers and Trane sales personnel in the proper design and application of HVAC systems. As a LEED Accredited Professional, he has helped our customers and local offices on a wide range of LEED projects. His main areas of expertise include energy efficiency, dehumidification, dedicated outdoor-air systems, air-to-air energy recovery, psychrometry, and ventilation.

John is the author of numerous Trane application manuals and Engineers Newsletters, and is a frequent presenter on Trane's Engineers Newsletter Live series. He also is a member of ASHRAE, has authored several articles for the ASHRAE Journal, and has been a member of ASHRAE's "Moisture Management in Buildings" and "Mechanical Dehumidifiers" technical committees. He was a contributing author of the *Advanced Energy Design Guide for K-12 Schools* and the *Advanced Energy Design Guide for Small Hospitals and Health Care Facilities*, a technical reviewer for the *ASHRAE Guide for Buildings in Hot and Humid Climates*, and a presenter on the 2012 ASHRAE "Dedicated Outdoor Air Systems" webcast.

Mick Schwedler | manager, applications engineering | Trane

Mick has been involved in the development, training, and support of mechanical systems for Trane since 1982. With expertise in system optimization and control (in which he holds patents), and in chilled-water system design, Mick's primary responsibility is to help designers properly apply Trane products and systems. To do so, he provides one-on-one support, writes technical publications, and presents seminars.

A recipient of ASHRAE's Distinguished Service and Standards Achievement Awards, Mick Chairs ASHRAE's Advanced Energy Design Guide (AEDG) Steering Committee and is past Chair of SSPC 90.1. He also contributed to the ASHRAE GreenGuide and is a member of the USGBC Pilot Credits Working Group. Mick earned his mechanical engineering degree from Northwestern University and holds a master's degree from the University of Wisconsin Solar Energy Laboratory.

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.

Charlie Jelen | C.D.S. marketing engineer | Trane

Charlie Jelen is a Trane C.D.S. Marketing Engineering. His primary role as the TRACE 700 product manager is to maintain and develop all aspects of TRACE 700. Outside of development he also provides technical support for all C.D.S. customers and field offices. As a LEED Green Associate he has helped develop functionality in TRACE 700 to aid users in the LEED modeling process. He is a member of ASHRAE and serves as the La Crosse Area chapter technology transfer committee chair.

He earned a degree in Mechanical Engineering from the University of Minnesota. Before coming to Trane in 2011, he worked as a sales engineering for a power transmission company in Minneapolis, MN.



Trane Engineers Newsletter Live Series

LEED v4

Abstract

LEED v4 officially launched at Greenbuild 2013. In order to smoothly transition to LEED v4 USGBC has extended the usage of LEED 2009 to June 1, 2015. This ENL will provide an overview and comparison of what has changed from the 2009 version of LEED section by section. We'll identify areas related to HVAC in LEED v4 and provide insight in meeting the prerequisites and credit requirements.

Presenters: Trane applications engineers John Murphy, Chris Hsieh, Mick Schwedler and Charlie Jelen.

Learning Objectives: After attending you will be able to:

1. Introduce the LEED v4
2. Summarize the differences between LEED v4 and LEED 2009
3. Identify the areas related to HVAC in LEED v4 and provide insight in meeting the prerequisites and credit requirements
4. Summarize timeline for LEED v4 implementation in future projects
5. Identify available resources to support your next LEED v4 project

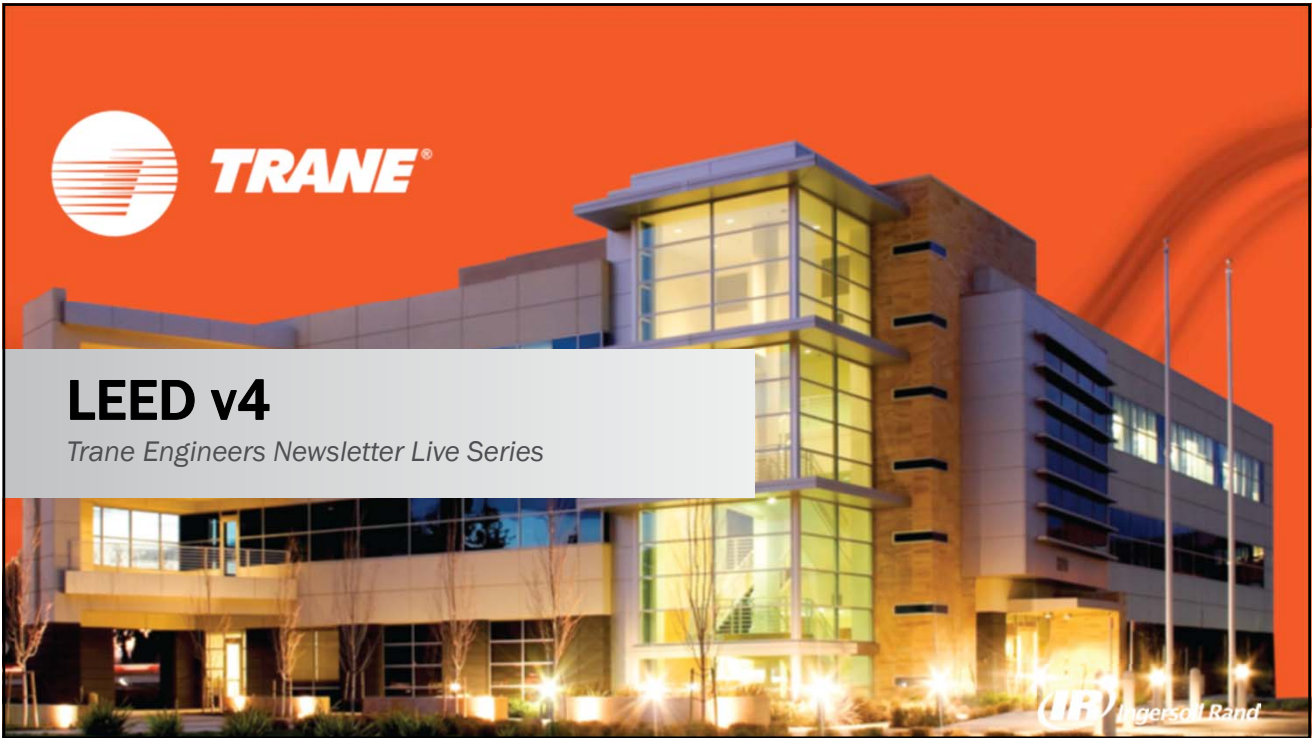
Agenda

- Introduction
 - Green Building / LEED Background
 - LEED v4 Overview
- Integrative Process
- Location and Transportation
- Sustainable Site
- Water Efficiency
- Energy and Atmosphere
- Materials and Resources
- Indoor Environmental Quality
- Innovation (Pilot Credits)
- Regional Priority
- Modeling Tools
- Summary



LEED v4

Trane Engineers Newsletter Live Series



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Ingersoll Rand

is a USGBC Education Provider committed to enhancing the professional development of the building industry and LEED Professionals through high-quality continuing education programs.

As a USGBC Education Provider, we have agreed to abide by USGBC-established operational and educational criteria, and are subject to course reviews and audits for quality assurance.



LEED® v4 (Course ID: 0090010909)

Approved for 1.5 GBCI LEED-specific hours for LEED professionals



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learning objectives

After today's program you will be able to:

- Introduce LEED v4
- Summarize the differences between LEED v4 and LEED 2009
- Identify the areas related to HVAC in LEED v4 and provide insight in meeting the prerequisites and credit requirements
- Summarize timeline for LEED v4 implementation in future projects
- Identify available resources to support your next LEED v4 project

Today's Presenters



Chris Hsieh
Applications
Engineer



Mick Schwedler
Applications
Engineer



Charlie Jelen
C.D.S. Marketing
Engineer



John Murphy
Applications
Engineer

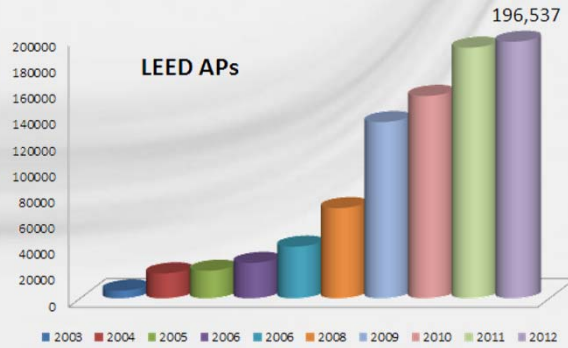
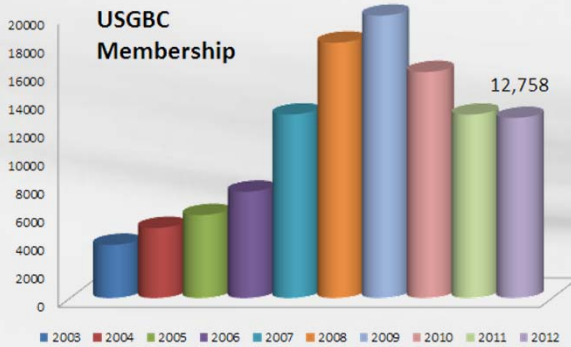
AGENDA

- Overview
- Integrative Process
- Location & Transportation (LT)
- Sustainable Sites (SS)
- Water Efficiency (WE)
- Energy & Atmosphere (EA)
- Materials & Resources (MR)
- Indoor Environmental Quality (IEQ)
- Innovation (IN)
- Regional Priority (RP)



USGBC STATISTICS

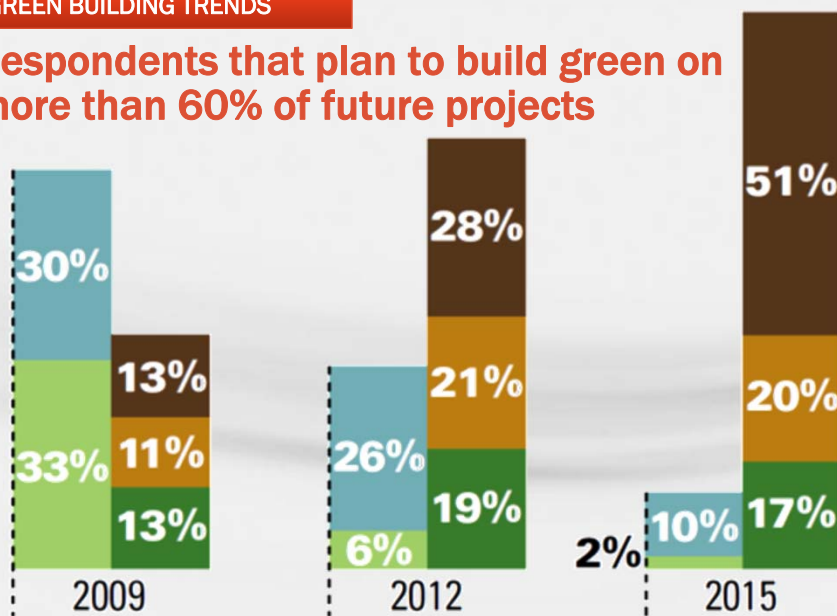
- 20 years
- 77 chapters
- 5,670 volunteers
- 268,254 volunteer hours



Source: USGBC 2012 annual report

GREEN BUILDING TRENDS

Respondents that plan to build green on more than 60% of future projects



More than 60%

31% to 60%

16% to 30%

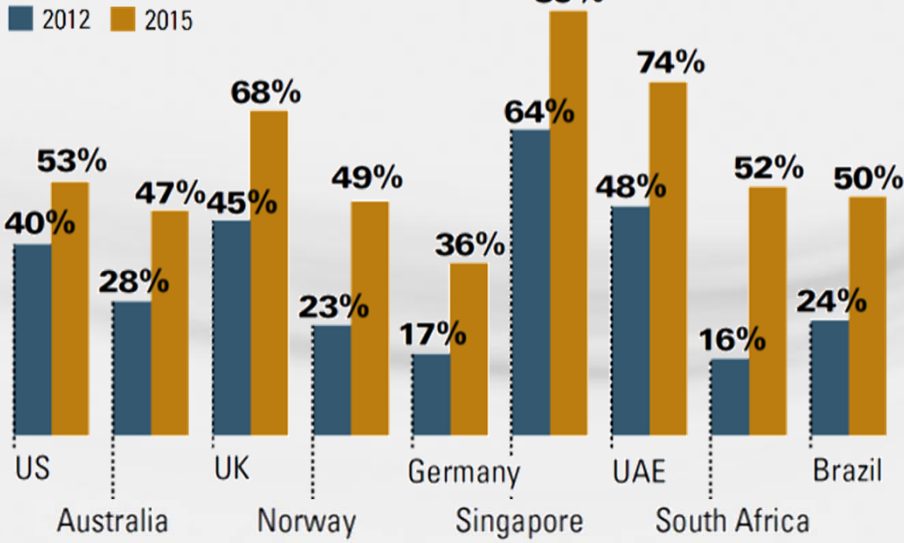
1% to 15%

Exploring

Source: USGBC 2012 annual report

GREEN BUILDING TRENDS

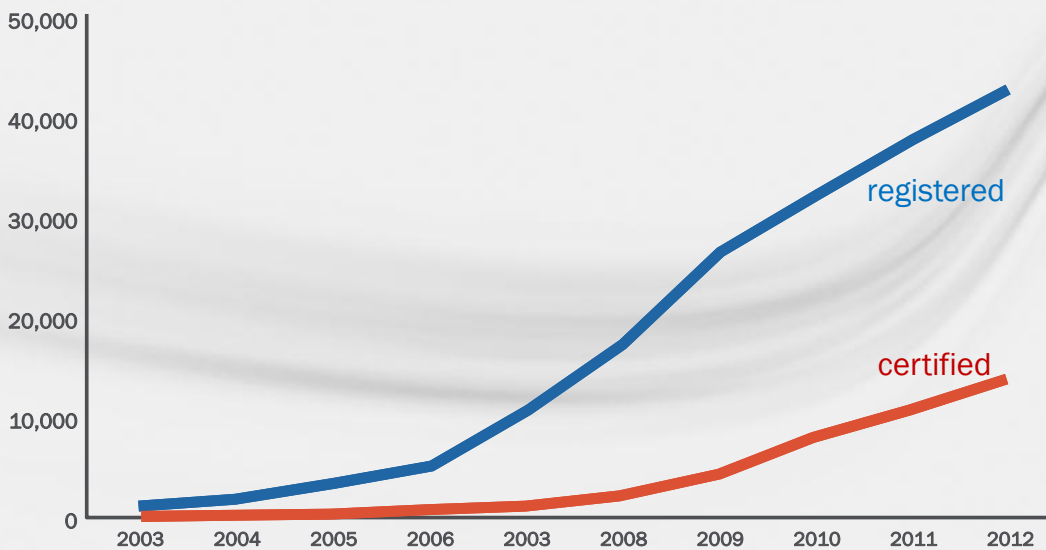
Firms with more than 60% of work green



Source: USGBC 2012 annual report

GREEN BUILDING TRENDS

Growth of LEED®



Agenda



- Overview
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LEED v4

- Global focus
 - SI units
 - Alternative Compliance Paths
- New and more stringent prerequisites and credits
- Online credit library
- Market sector language

The screenshot shows the LEED v4 online credit library interface. The top navigation bar includes 'COMMUNITY', 'LEED', 'EDUCATION', 'ADVOCACY', and 'INITIATIVES'. Below this is the 'LEED' logo and a search bar. The main content area is titled 'FILTER CREDITS' and shows a filter for 'New Construction' (callout 1) and a 'v4' filter (callout 2). A search bar is present below the filters. The left sidebar lists various credit categories such as 'Integrative process credits', 'Location & transportation', 'Sustainable sites', 'Water efficiency', 'Energy & atmosphere', 'Material & resources', 'Indoor environmental quality', 'Innovation', 'Regional priority', 'Appendices', and 'Minimum program requirements'. The main content area displays a list of credits, with 'Integrative process' (P1c1 | 1 point) highlighted (callout 3). At the bottom left, there is a 'DOWNLOAD SCORECARD' button (callout 4).

BD+C BUILDING DESIGN AND CONSTRUCTION RATING SYSTEMS	ID+C INTERIOR DESIGN AND CONSTRUCTION RATING SYSTEMS	EB:O+M EXISTING BUILDINGS: OPERATIONS AND MAINTENANCE RATING SYSTEMS	ND NEIGHBORHOOD DEVELOPMENT RATING SYSTEMS
New Construction	Commercial Interiors	Existing Buildings: Operations & Maintenance	Neighborhood Development Plan
Core & Shell	Retail	Schools	Neighborhood Development
Schools	Hospitality	Retail	
Retail		Hospitality	
Hospitality		Data Centers	
Data Centers		Warehouses & Distribution Centers	
Warehouses & Distribution Centers			
Healthcare			
Homes			
Mid-Rise			

www.usgbc.org/leed/v4

Y	?	N			
			Credit 1	Integrative Process	1
			Location and Transportation		Possible Points: 16
			Credit 1	LEED for Neighborhood Development Location	16
			Credit 2	Sensitive Land Protection	1
			Credit 3	High Priority Site	2
			Credit 4	Surrounding Density and Diverse Uses	5
			Credit 5	Access to Quality Transit	5
			Credit 6	Bicycle Facilities	1
			Credit 7	Reduced Parking Footprint	1
			Credit 8	Green Vehicles	1
			Sustainable Sites		Possible Points: 10
Y			Prereq 1	Construction Activity Pollution Prevention	Required
			Credit 1	Site Assessment	1
			Credit 2	Site Development--Protect or Restore Habitat	2
			Credit 3	Open Space	1
			Credit 4	Rainwater Management	3
			Credit 5	Heat Island Reduction	2
			Credit 6	Light Pollution Reduction	1
			Water Efficiency		Possible Points: 11
Y			Prereq 1	Outdoor Water Use Reduction	Required
Y			Prereq 2	Indoor Water Use Reduction	Required
Y			Prereq 3	Building Level Water Metering	Required
<div style="border: 1px solid black; padding: 2px;"> New Construction / Core and Shell / Schools / Retail / Data Centers / Warehouses & Distribution Cntrs / Hospitality / Healthcare </div>					

Building Design and Construction (BD+C)

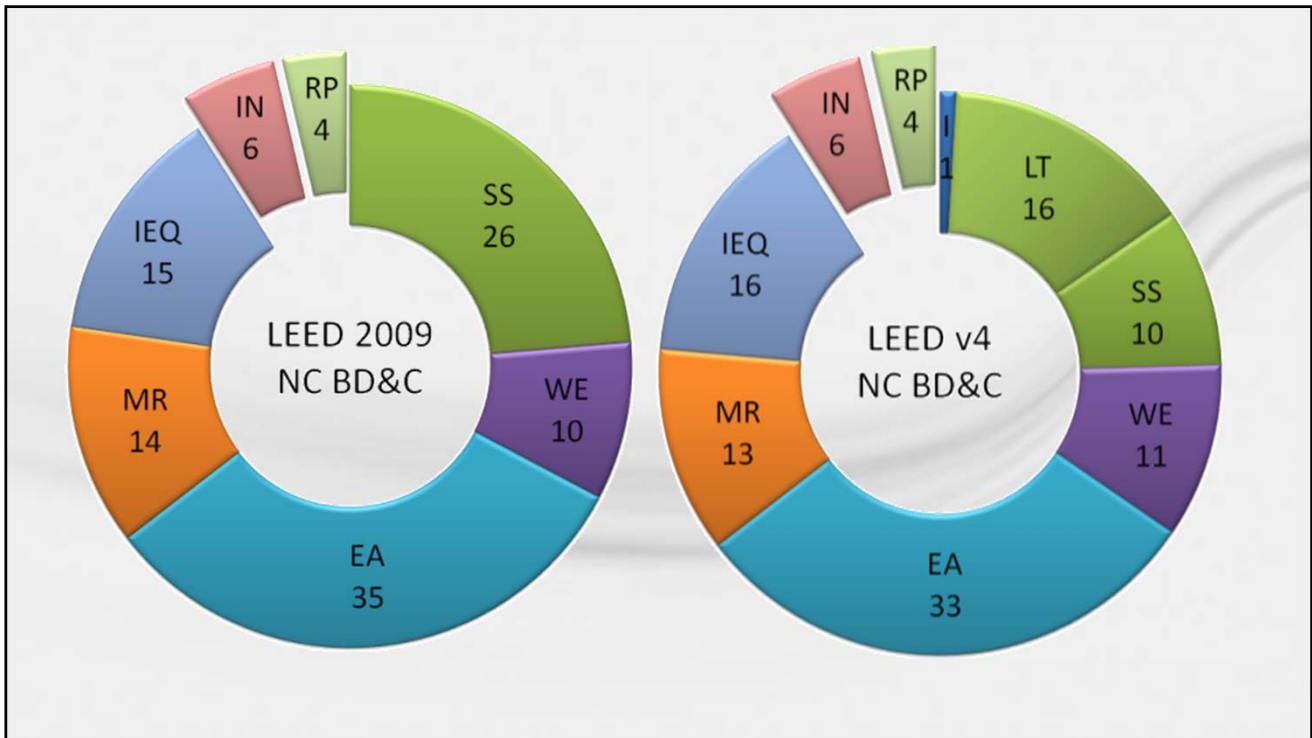
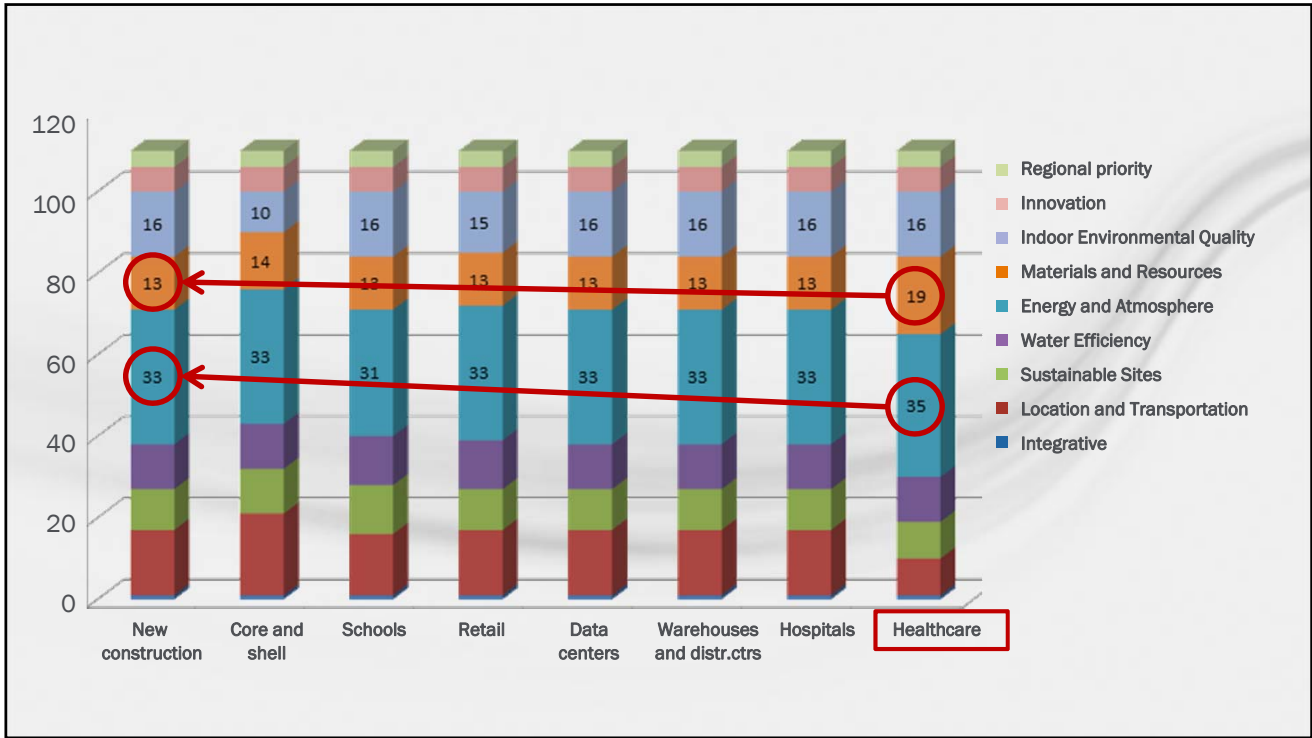
LEED v4

Category	Points (NC)
Integrative Process	1
Location and Transportation	16
Sustainable Sites	10
Water Efficiency	11
Energy and Atmosphere	33
Materials and Resources	13
Indoor Environmental Quality	16
Total Points	100

Building Design and Construction (BD+C)

LEED v4

Category	Points (NC)
Innovation	6
Regional Priority	4
Total Bonus Points	10



Agenda



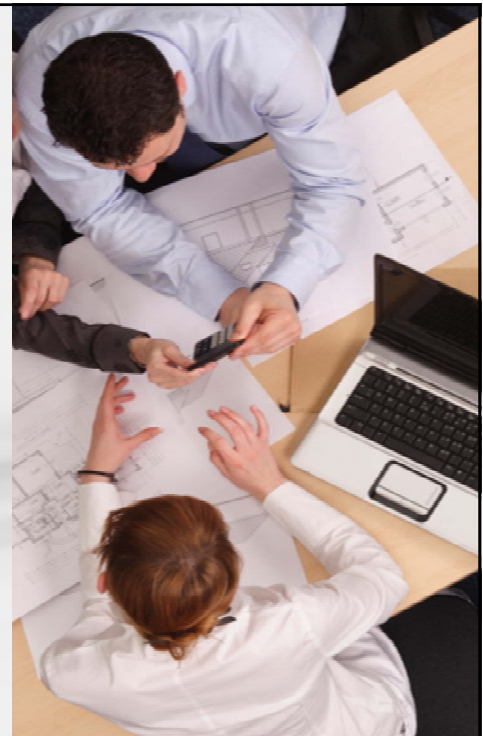
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New Prerequisite

Integrative Project Planning and Design

Required for healthcare facilities

- Owner's project requirements document
- Preliminary rating goals
- Integrated project team
- Design charrette



New Prerequisite

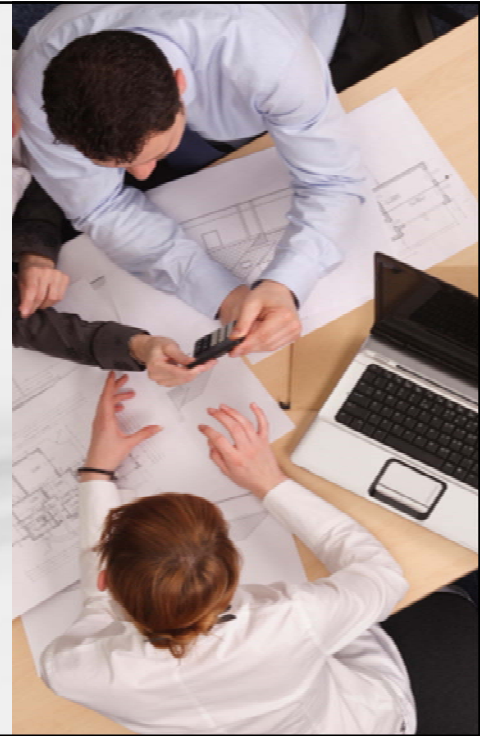
Integrative Process 1 point

Energy-Related Systems

site conditions	thermal comfort
massing and orientation	plug and process loads
Envelope	operational parameters
interior lighting	

Water-Related Systems

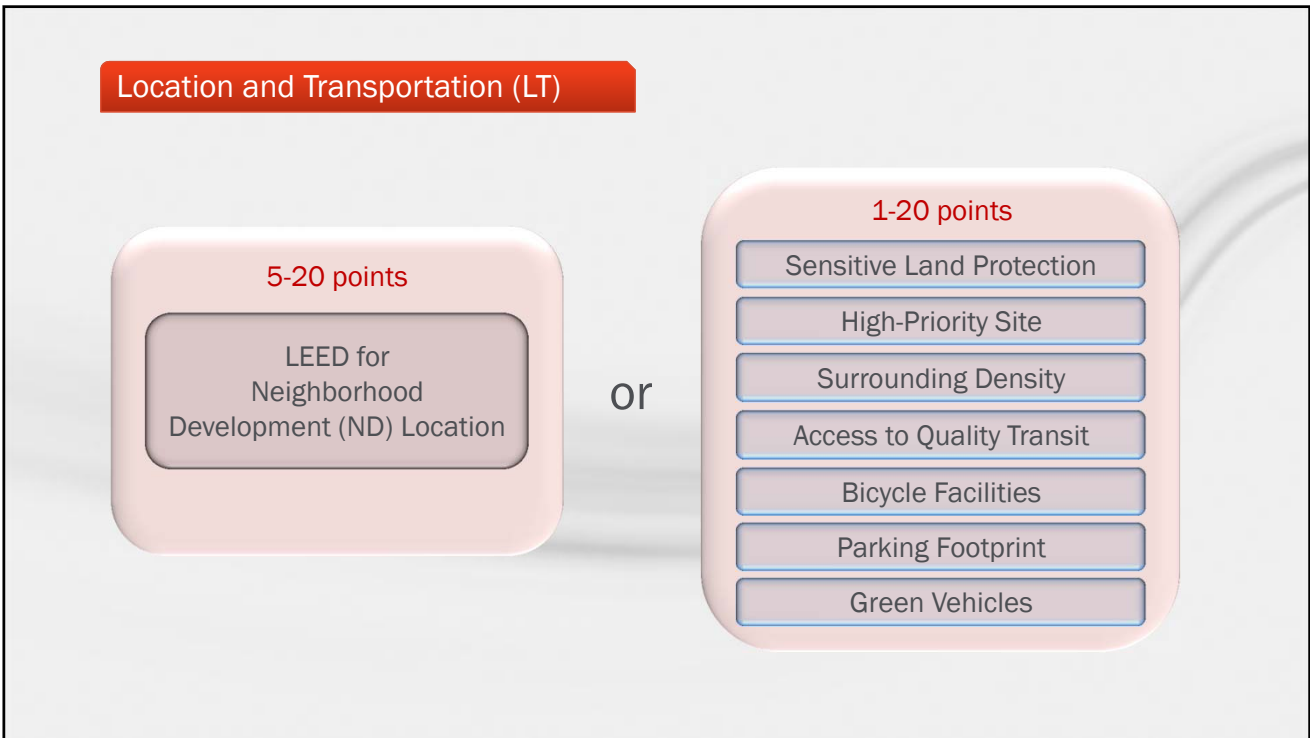
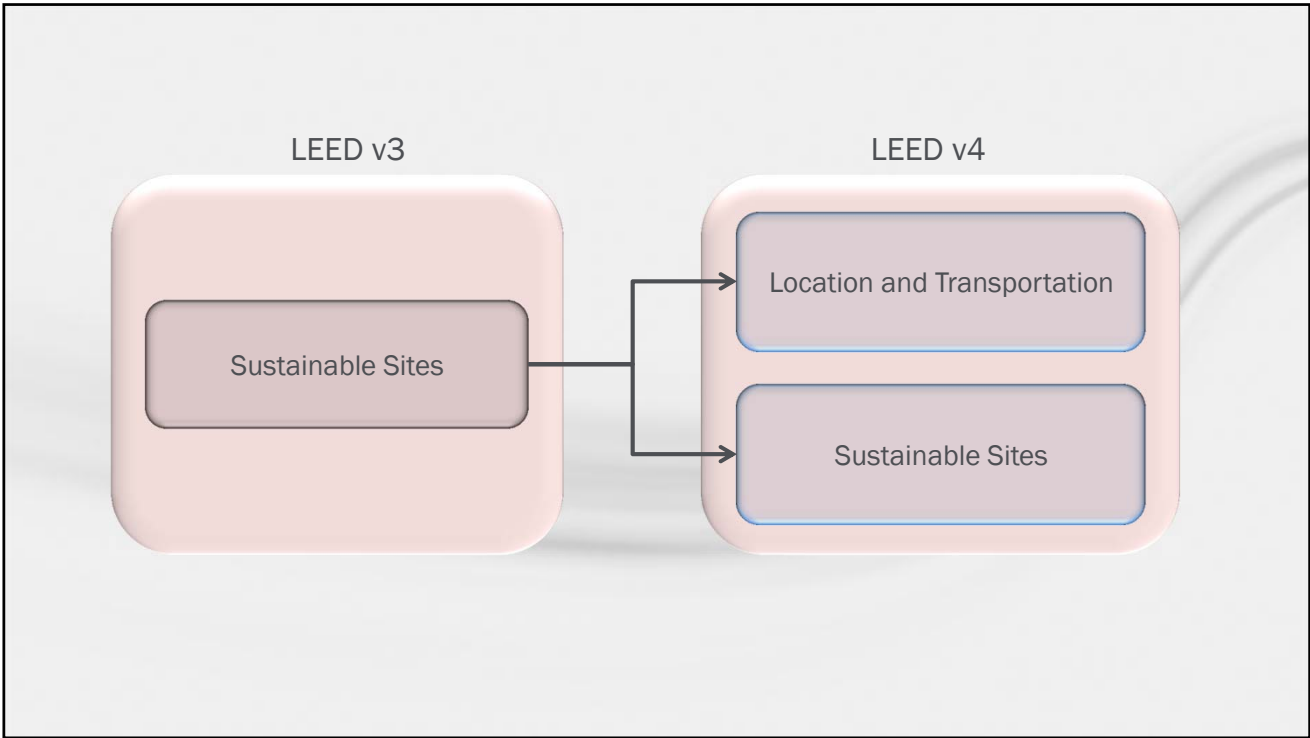
indoor water demand	process water demand
outdoor water demand	supply sources



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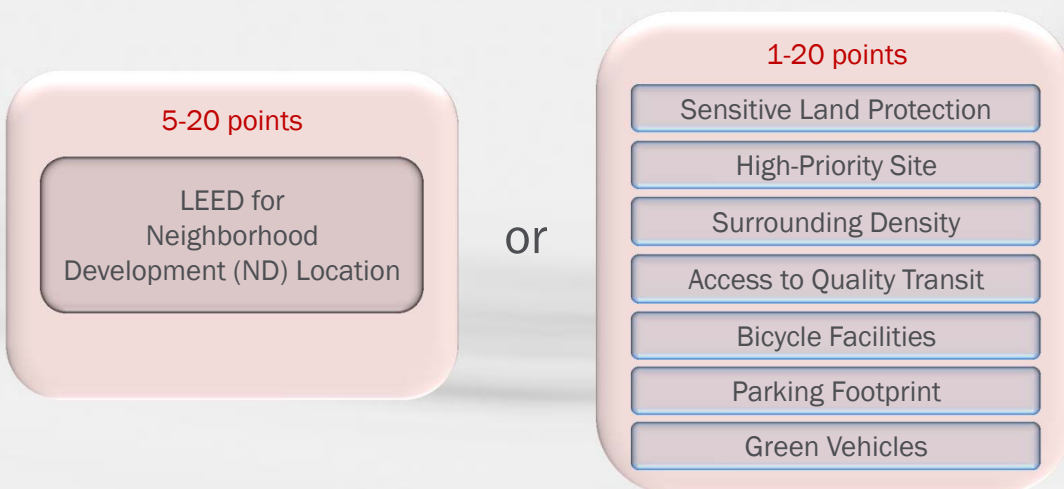


Location and Transportation (LT)

LEED for ND Location

LEED-ND Certification Level	Points (NC)	Points (Core & Shell)	Points (Schools)	Points (Healthcare)
Certified	8	8	8	5
Silver	10	12	10	6
Gold	12	16	12	7
Platinum	16	20	15	9

Location and Transportation (LT)



Location and Transportation (LT)

Credits

LEED v3	pts	LEED v4	pts
Site Selection	1	Sensitive Land Protection	1-2
Brownfield Redevelopment	1	High-Priority Site	1-3
Development Density and Community Connectivity	5	Surrounding Density and Diverse Uses	1-6
Public Transportation Access	6	Access to Quality Transit	1-6
Bicycle Storage & Changing Rooms	1	Bicycle Facilities	1
Parking Capacity	2	Reduced Parking Footprint	1
Low-Emitting, Fuel-Efficient Vehicles	3	Green Vehicles	1

Location and Transportation (LT)

Bicycle Facilities

LEED v3

- Commercial or Institutional
- Racks/storage within 200 yards of entrance, for 5% of building users
- Showers/changing rooms within 200 yards of entrance, for 0.5% of occupants
- Residential
- Storage for 15% of occupants

LEED v4

Building \leq 200 yards from bicycle network connected to services

Commercial or Institutional

- Short-term and long-term storage
- Showers/changing rooms (removed minimum distances)

Residential

- Short-term and long-term storage

Specific requirements for schools, retail, healthcare, or mixed-use

Location and Transportation (LT)

Green Vehicles

LEED v3

Low-Emitting Vehicles (3 pts)

1. Preferred parking spaces, *or*
2. Install fueling stations, *or*
3. Provide low-emitting, fuel-efficient vehicles for 3% of occupants, *or*
4. Provide a low-emitting or fuel-efficient vehicle sharing program

LEED v4

Green Vehicles 1 pt

- Preferred or discounted parking for green vehicles

And one of the following for at least 2% of total parking spaces:

1. Electric vehicle charging, *or*
2. Liquid or gas fueling facilities or battery switching stations

Other options specific to schools and warehouses

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Sustainable Sites (SS)

Prerequisites

LEED v3		LEED v4	
Construction Activity Pollution Prevention	X	Construction Activity Pollution Prevention	X
Environmental Site Assessment	Schools, Healthcare	Environmental Site Assessment	Schools, Healthcare

Sustainable Sites (SS)

Credits

LEED v3	pts	LEED v4	pts
		Site Assessment	1
Protect or Restore Habitat	1	Protect or Restore Habitat	1-2
Maximize Open Space	1	Open Space	1
Stormwater – Quantity Control	1	Rainwater Management	1-3
Stormwater – Quality Control	1		
Heat Island Effect – Nonroof	1	Heat Island Reduction	1-2
Heat Island Effect – Roof	1		
Light Pollution Reduction	1	Light Pollution Reduction	1

Sustainable Sites (SS) - CHANGES

Heat Island Reduction

LEED v3

Heat Island Effect – Roof (1 pt)

Heat Island Effect – Nonroof (1 pt)

1. 50% of site hardscape, *choose:*

- Shaded, *or*
- Materials with SRI ≥ 29 , *or*
- Open-grid pavement

or

2. 50% of parking covered

LEED v4

Option 1 (2 pts), *choose:*

- Nonroof measures (SR ≥ 0.28), *or*
- High-reflectance roof, *or*
- Vegetated roof

or

Option 2 (1 pt)

- 75% of parking covered



Sustainable Sites (SS) - CHANGES

Light Pollution Reduction

LEED v3

Interior lighting with line of sight to building envelope openings, *choose*:

1. Automatic power reduction of all nonemergency luminaires, *or*
2. Automatic shielding for nonemergency luminaires

Exterior lighting shall comply with ASHRAE 90.1-2007 (lighting power density and controls)

LEED v4

Uplight, *choose*:

- Option 1: BUG rating method, *or*
- Option 2: Calculation method

Light Trespass, *choose*:

- Option 1: BUG rating method, *or*
- Option 2: Calculation method

Internally-illuminated signage:

- $\leq 200 \text{ cd/m}^2$ (night)
- $\leq 2000 \text{ cd/m}^2$ (day)

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Water Efficiency (WE)

Prerequisites

LEED v3		LEED v4	
Water Use Reduction	X	Indoor Water Use Reduction	X
		Outdoor Water Use Reduction	X
		Building-Level Water Metering	X



Water Efficiency (WE) - CHANGES

Indoor Water Use Reduction

- Reduce water consumption by 20% from baseline
- Specific appliances require performance or certification
- New requirements for cooling towers
- No once-through cooling with potable water
- Makeup water meters
- Conductivity and overflow monitoring
- Drift eliminators

Water Efficiency (WE)

**New Prerequisite:
Outdoor Water Use Reduction**

Option 1: No irrigation

or

Option 2: Reduce irrigation by
30% below baseline



Water Efficiency (WE)

Prerequisites

LEED v3		LEED v4	
Water Use Reduction	X	Indoor Water Use Reduction	X
		Outdoor Water Use Reduction	X
		Building-Level Water Metering	X

Water Efficiency (WE)

Credits

LEED v3	pts	LEED v4	pts
Water Efficient Landscaping	2-4	Outdoor Water Use Reduction	1-2
Innovative Wastewater Technologies	2		
Water Use Reduction	2-4	Indoor Water Use Reduction	1-7
Process Water Use Reduction	1		
		Cooling Tower Water Use	1-2
		Water Metering	1

Water Efficiency (WE) - CHANGES

Outdoor Water Use Reduction

Percent Reduction from Baseline	Points (except Healthcare)	Points (Healthcare)
30%	Prerequisite	Prerequisite
50%	1	1
100%	2	---
no irrigation	2	1

Water Efficiency (WE)

Credits

LEED v3	pts	LEED v4	pts
Water Efficient Landscaping	2-4	Outdoor Water Use Reduction	1-2
Innovative Wastewater Technologies	2		
Water Use Reduction	2-4	Indoor Water Use Reduction	1-7
Process Water Use Reduction	1		
		Cooling Tower Water Use	1-2
		Water Metering	1

Water Efficiency (WE) - CHANGES

Indoor Water Use Reduction

Percent Reduction	Points (BD&C)	Points (Schools, Retail, Hospitality, Healthcare)
20%	Prerequisite	Prerequisite
25%	1	1
30%	2	2
35%	3	3
40%	4	4
45%	5	5
50%	6	---

Water Efficiency (WE)

Credits

LEED v3	pts	LEED v4	pts
Water Efficient Landscaping	2-4	Outdoor Water Use Reduction	1-2
Innovative Wastewater Technologies	2		
Water Use Reduction	2-4	Indoor Water Use Reduction	1-7
Process Water Use Reduction	1		
		Cooling Tower Water Use	1-2
		Water Metering	1

Water Efficiency (WE) – NEW

Cooling Tower Water Use

Parameter	Maximum Concentration
Ca (as CaCO ₃)	1000 ppm
Total Alkalinity	1000 ppm
SiO ₂	100 ppm
Cl ⁻	250 ppm
Conductivity	2000 μS/cm



Water Efficiency (WE)

Credits

LEED v3	pts	LEED v4	pts
Water Efficient Landscaping	2-4	Outdoor Water Use Reduction	1-2
Innovative Wastewater Technologies	2		
Water Use Reduction	2-4	Indoor Water Use Reduction	1-7
Process Water Use Reduction	1		
		Cooling Tower Water Use	1-2
		Water Metering	1

Water Efficiency (WE) – NEW

Water Metering

Install water meters for at least two subsystems:

Subsystem	Metering Requirement
Irrigation	≥ 80% of irrigated landscape area
Indoor Plumbing	≥ 80% of indoor fixtures and fittings
Domestic Hot Water	≥ 80% of domestic hot water capacity
Boilers	makeup water
Reclaimed Water	reclaimed water
Process Water	≥ 80% of expected daily consumption for end uses (humidification, dishwashers, clothes washers, etc.)

Water Efficiency (WE)

Credits

LEED v3	pts	LEED v4	pts
Water Efficient Landscaping	2-4	Outdoor Water Use Reduction	1-2
Innovative Wastewater Technologies	2		
Water Use Reduction	2-4	Indoor Water Use Reduction	1-7
Process Water Use Reduction	1		
		Cooling Tower Water Use	1-2
		Water Metering	1
Total possible points	10-11		12

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Energy and Atmosphere (EA)

Prerequisites

LEED v3		LEED v4	
Fundamental Commissioning	X	Fundamental Commissioning and Verification	X
Minimum Energy Performance	X	Minimum Energy Performance	X
Fundamental Refrigerant Management	X	Fundamental Refrigerant Management	X
		Building-Level Energy Metering	X

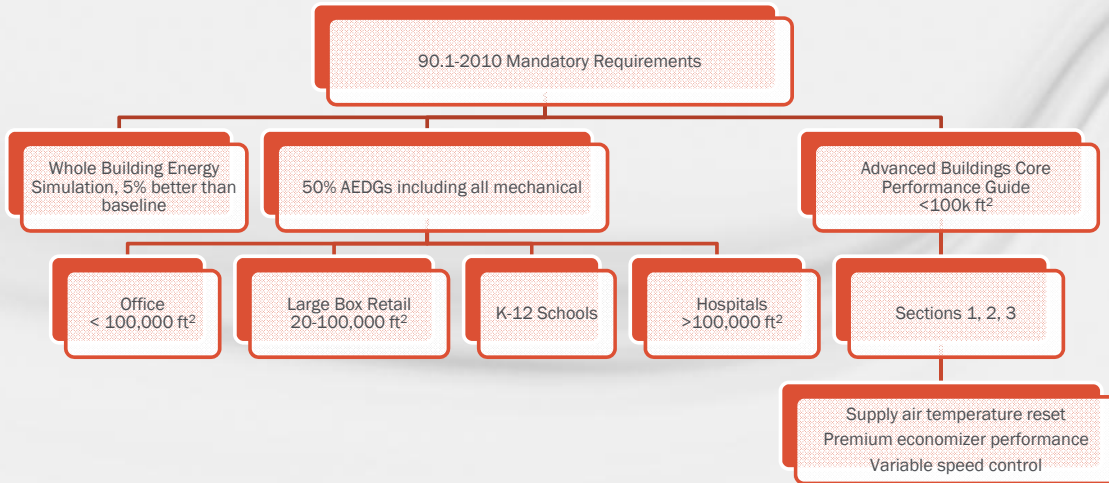
Energy and Atmosphere (EA)

Fundamental Commissioning and Verification (EAp1)

- Mechanical, electrical, plumbing and renewable energy systems
- ASHRAE Guideline 0-2005 and ASHRAE Guideline 1.1-2007 for HVAC&R (energy, water, IAQ, durability)
- Building enclosure must comply with Owner's Project Requirements and Basis of Design
- CxA not on construction team
- Exception: Buildings <20,000 ft² (was 50,000)

Energy and Atmosphere (EA)

Minimum Energy Performance (EAp2)



Energy and Atmosphere (EA)

Minimum Energy Performance (EAp2)

Option 1: Modeling, 5% Better performance than 90.1-2010

- Meet 90.1-2010 Mandatory requirements
- Use 90.1-2010 Appendix G for baseline modeling
- % improvement “proposed building performance rating” when compared with “baseline building performance rating”

Project Type	Percent Improvement
New Construction	5%
Major Renovations	3%
Core and Shell	2%

Energy and Atmosphere (EA)

90.1-2010 Envelope Changes

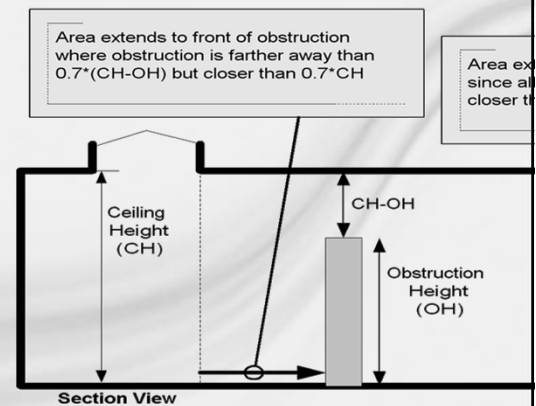
- Fenestration orientation
- Continuous air barrier
- Cool roofs (Zones 1-3)
- Envelope/lighting interactions
 - daylighting control
 - modify the area thresholds for top and side daylighting



Energy and Atmosphere (EA)

90.1-2010 Lighting Changes

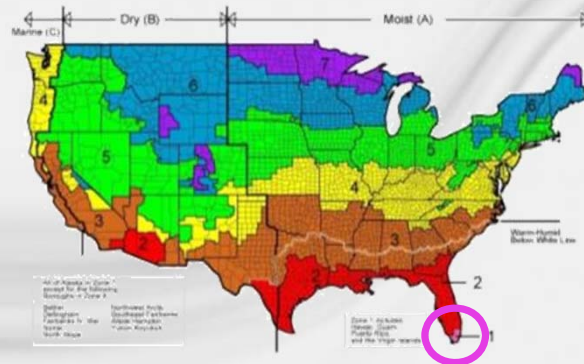
- Lower Lighting Power Density (LPD)
- Lighting controls
 - Manual on or first level of lighting 50%
 - One control step between 30% and 70% of design LPD
 - Parking garage lighting control
 - Control of 50% of receptacles
- Envelope/lighting interaction
- Alteration threshold (10%) at which replacement lighting and controls must comply



Energy and Atmosphere (EA)

90.1-2010 Significant Mechanical Changes

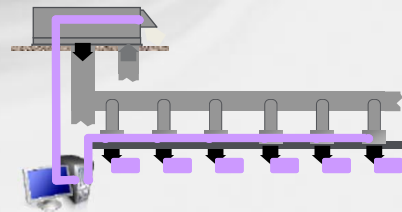
- Equipment efficiencies
- Economizers required in almost all climate zones
- Airside energy recovery required in smaller systems and more climate zones



Energy and Atmosphere (EA)

90.1-2010 Mechanical Controls Changes

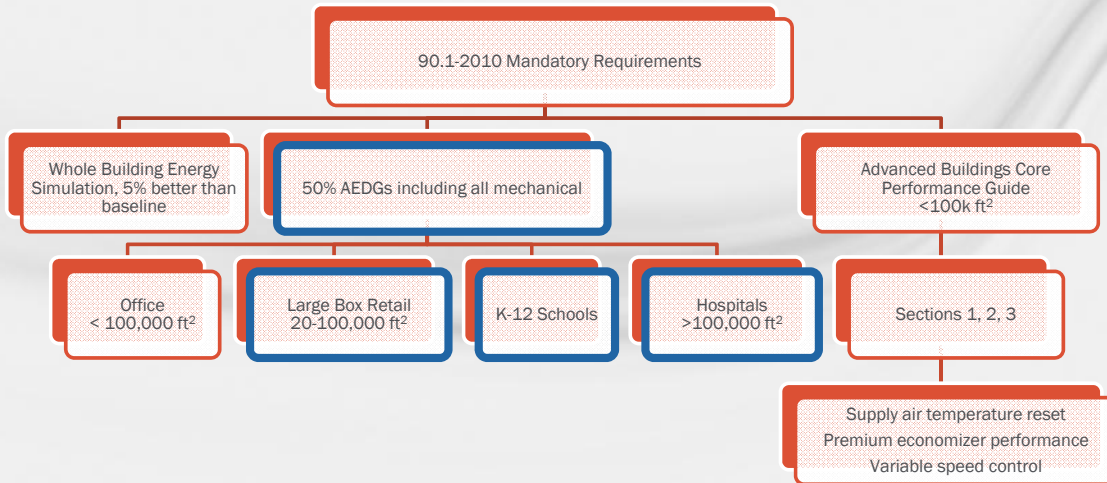
- Existing control requirements (*since 1999*)
 - Fan pressure optimization
 - Demand control ventilation (DCV) in high density zones
- Changes to controls requirements
 - DCV in lower density zones
 - Ventilation reset
 - Supply air temperature reset
 - VAV minimum airflow/reheat minimums
 - Pump pressure optimization



Energy and Atmosphere (EA)

Minimum Energy Performance (EAp2)

Option 2: 50% AEDGs



Energy and Atmosphere (EA)

Minimum Energy Performance (EAp2)

Option 2: 50% AEDGs

- Meet 90.1-2010 mandatory *and* prescriptive requirements
- Comply with AEDG Chapter 4 HVAC and service water heating recommendations
- Vary by climate zone

Energy and Atmosphere (EA) – Option 2: 50% AEDGs
Four 50% Advanced Energy Design Guides



Energy and Atmosphere (EA) – Option 2: 50% AEDGs

AEDG Recommendation Tables

- Categories
- Envelope
- Daylighting/lighting
- Plug loads
- Service water heating
- HVAC
- Quality assurance



Recommendation Table for Table for Large Hospitals (Continued)

Component	Recommendation	How to Type
Cooking equipment	ENERGY STAR or California Title 24 compliant equipment. Insulated hot, L22 lighting. Building level pressure controls. Sign* pressure sensitive, adjustable light. Refrigerant, compressor condenser.	PLB-9, 12
Refrigeration equipment	Use flexible insulation for all condenser and evaporator coils. Refrigerant condenser. High capacity, large condenser, use seal at application, properly trained, VCR demand based control.	PLB, 10, 13
Use flexible insulation for all condenser and evaporator coils. Refrigerant condenser. High capacity, large condenser, use seal at application, properly trained, VCR demand based control.		PL 16
Use flexible insulation for all condenser and evaporator coils. Refrigerant condenser. High capacity, large condenser, use seal at application, properly trained, VCR demand based control.		17, 18
Use flexible insulation for all condenser and evaporator coils. Refrigerant condenser. High capacity, large condenser, use seal at application, properly trained, VCR demand based control.		19, 20, 21, 22, 24
Use flexible insulation for all condenser and evaporator coils. Refrigerant condenser. High capacity, large condenser, use seal at application, properly trained, VCR demand based control.		23, 24
Use flexible insulation for all condenser and evaporator coils. Refrigerant condenser. High capacity, large condenser, use seal at application, properly trained, VCR demand based control.		25, 26
Use flexible insulation for all condenser and evaporator coils. Refrigerant condenser. High capacity, large condenser, use seal at application, properly trained, VCR demand based control.		27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100

Energy and Atmosphere (EA) – Option 2: 50% AEDGs

Large Hospital: HVAC System Recommendations

- Surgical areas: Water-cooled chilled water system
- Non-surgical areas
- Water-source heat pumps with DOAS
- Fan-coils with DOAS
- Mixed-air VAV system with separate OA treatment and heat recovery



HVAC and SWH recommendations must be followed to meet EA_{p2}

Energy and Atmosphere (EA) – Option 2: 50% Large Hospital AEDGs

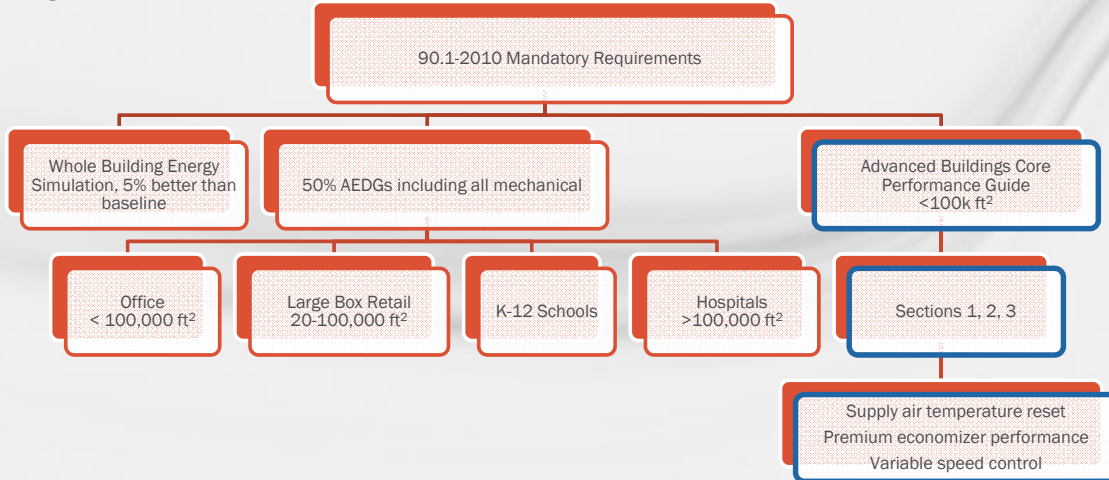
Climate Zone 3: Mixed VAV System Recommendations

Component	Recommendation
Heat recovery water-cooled chiller	4.55 COP (0.77 kW/ton)
Water-cooled chiller (AHRI Standard conditions)	6.5 COP (0.54 kW/ton)
Water-circulation pumps	VFD and NEMA premium
Cooling towers	VFD on tower fans, near- optimal control
Boiler efficiency	90% combustion efficiency
Fan power	$bhp \leq \text{supply cfm} \times 0.0012 + A$
Exhaust air energy recovery	60% effectiveness

Energy and Atmosphere (EA)

Minimum Energy Performance (EAp2)

Option 3: NBI Guide

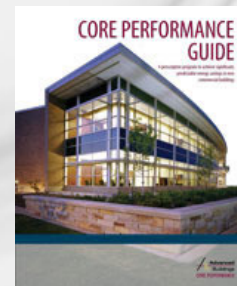


Energy and Atmosphere (EA)

Minimum Energy Performance (EAp2)

Option 3: Advanced Buildings, Core Performance Guide

- Meet 90.1-2010 Mandatory and prescriptive requirements, plus CPG
 - Section 1: Design Process Strategies
 - Section 2: Core Performance Requirements
 - Section 3: Enhanced Performance Strategies
 - 3.5 Supply Air Temperature Reset (VAV)
 - 3.9 Premium Economizer Performance
 - 3.10 Variable Speed Control
- <100,000 square feet
- Healthcare, warehouse, laboratory ineligible for this option



<http://www.advancedbuildings.net/core-performance>

Energy and Atmosphere (EA)

Minimum Energy Performance (EAp2)

Building type specific

- Retail modeling
- Refrigeration, cooking and food preparation, clothes washing, other major support appliances.
- Industry standard performance in Appendix 3
- Data centers
- A minimum of 2% (of the 5%) must come from building power and cooling infrastructure

Energy and Atmosphere (EA)

New Prerequisite (EAp3)

Building-level energy metering

- Building-level meters or submeters that can be aggregated
 - Electricity, natural gas, chilled water, steam, fuel oil, propane, etc.
- Commitment to sharing energy consumption and electric demand with USGBC for five years
 - At least monthly data



Energy and Atmosphere (EA)

Prerequisites

LEED v3		LEED v4	
Fundamental Commissioning	X	Fundamental Commissioning and Verification	X
Minimum Energy Performance	X	Minimum Energy Performance	X
Fundamental Refrigerant Management	X	Fundamental Refrigerant Management	X
		Building-Level Energy Metering	X

Energy and Atmosphere (EA)

Credits

LEED v3	Pts	LEED v4	Pts
Enhanced Commissioning	2	Advanced Commissioning	2-6
Measurement and Verification	3		
Optimize Energy Performance	1-19	Optimize Energy Performance	1-20
		Advanced Energy Metering	1
		Demand Response	1-2
On-site Renewable Energy	1-7	Renewable Energy Production	1-3
Enhanced Refrigerant Management	2	Enhanced Refrigerant Management	1
Green Power	2	Green Power and Carbon Offsets	1-2

Energy and Atmosphere (EA)

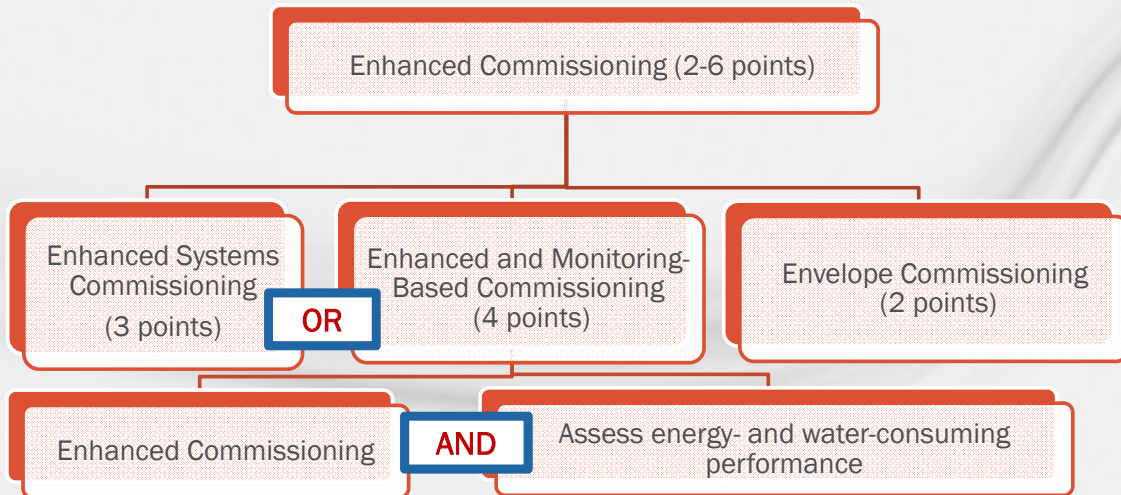
Enhanced Commissioning (EAc1)

2-6 points

- Documented commissioning experience
 - At least two projects with similar scope of work
 - Early design phase through at least 10 months of occupancy
- Employee of owner, independent consultant or “disinterested subcontractor of the design team”



Energy and Atmosphere (EA)



Energy and Atmosphere (EA)

Option 1, Path 1: Enhanced Systems Commissioning 3 points

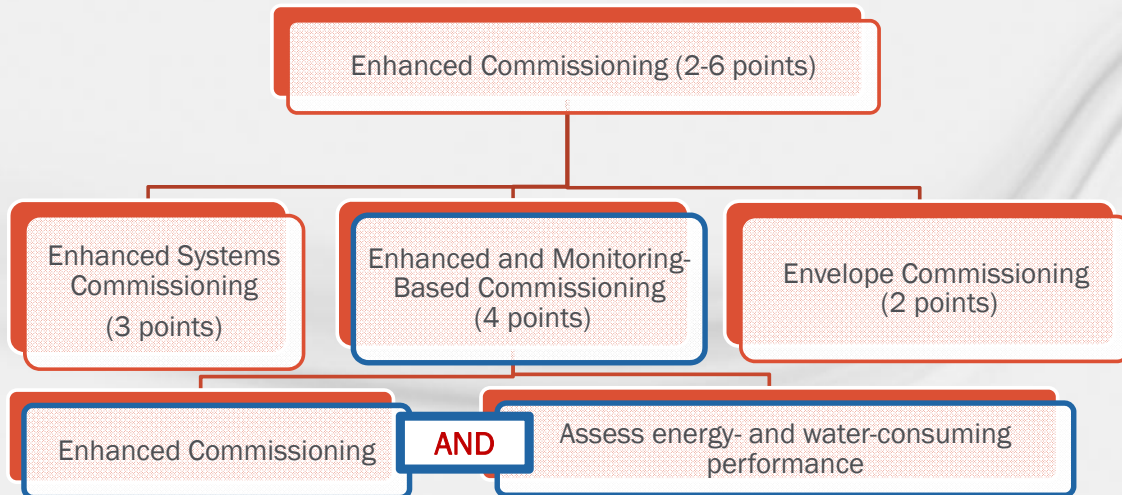
ASHRAE Guidelines

- 0 - 2005
- 1.1-2007

Actions

- Review submittals
- Verify systems manual, operating and occupant training documented and delivered
- Verify seasonal testing
- Review operations 10 months after substantial completion
- Develop on-going commissioning plan

Energy and Atmosphere (EA)

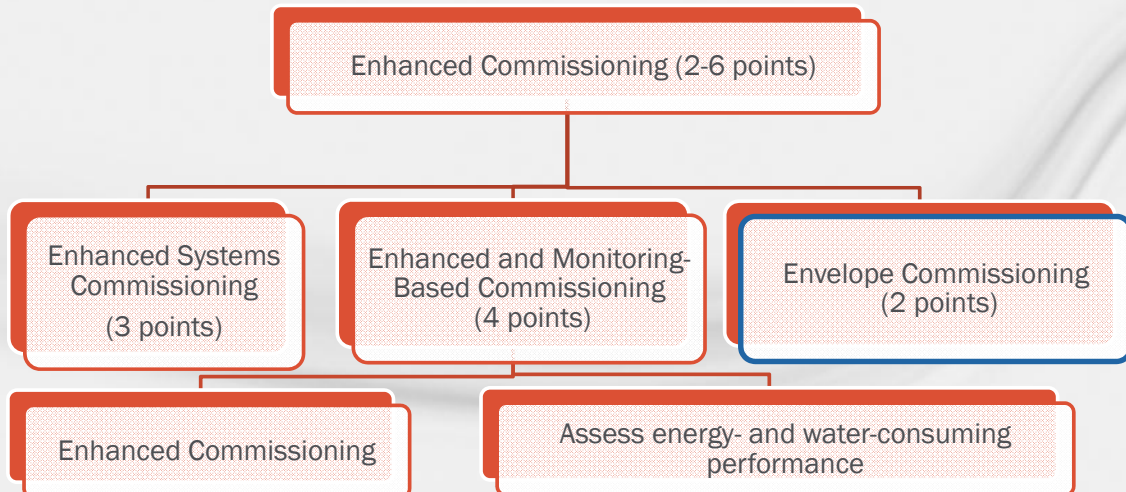


Energy and Atmosphere (EA)

Option 1, Path 2: Enhanced Monitoring-Based Commissioning 4 points

- Path 1 *AND*
- Monitoring-based procedures
 - Identify points to be measured and evaluated
 - Intent is to assess performance of energy- and water-consuming systems
- Measurement, tracking, limits, evaluation, correction, training, repairs and frequency

Energy and Atmosphere (EA)



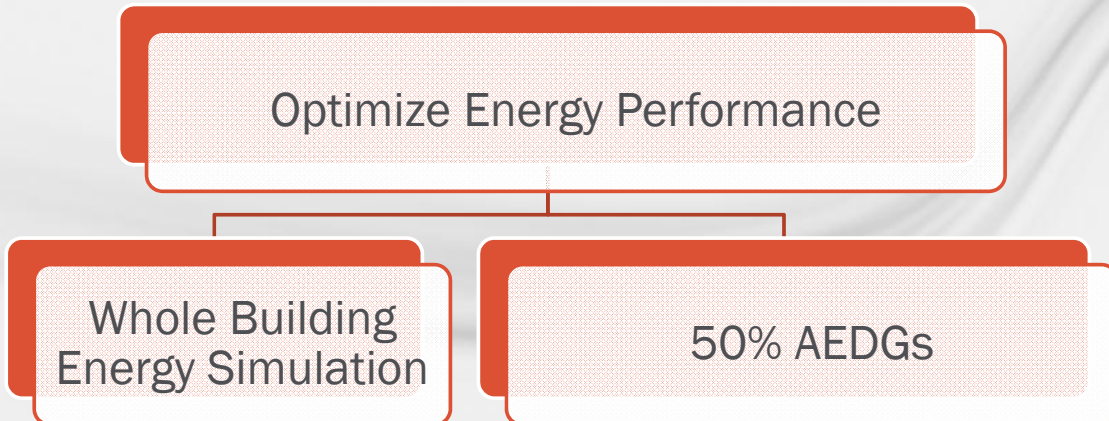
Energy and Atmosphere (EA) - *NEW*

Option 2: Envelope Commissioning
2 points

- Commissioning of the thermal envelope
 - ASHRAE Guideline 0-2005
 - National Institute of Building Standards (NIBS) Guideline 3-2012
- Related to energy, water, indoor environmental quality, durability

Energy and Atmosphere (EA) - *NEW*

Optimize Energy Performance (EAc2)



Energy and Atmosphere (EA)

Optimize Energy Performance (EAc2)

Option 1 - Modeling

Application	Maximum Points
Schools	16
New Construction, Core & Shell, Retail, Data Centers, Warehouses and Distribution Centers, Hospitality	18
Healthcare	20

Compared to baseline defined by 90.1-2010 Appendix G
 More credit for higher % improvement

Energy Cost Savings by Construction Type			EAC2 Points Earned by Building Type		
New Construction	Major Renovation	Core and Shell	All others	Healthcare	Schools
5%	3%	2%	Prerequisite		

Energy Cost Savings by Construction Type			EAC2 Points Earned by Building Type		
New Construction	Major Renovation	Core and Shell	All others	Healthcare	Schools
5%	3%	2%	Prerequisite		
+1% 6%	4%	3%	1	3	1

Energy Cost Savings by Construction Type			EAC2 Points Earned by Building Type		
New Construction	Major Renovation	Core and Shell	All others	Healthcare	Schools
5%	3%	2%	Prerequisite		
6%	4%	3%	1	3	1
8%	6%	5%	2	4	2
...					
20%	18%	17%	8	10	8
...					
42%	40%	39%	16	18	16
46%	44%	43%	17	19	16
50%	48%	47%	18	20	16

Energy and Atmosphere (EA)

Optimize Energy Performance (EAc2)

Modeling example

- Core and Shell project
- 17.5% energy cost savings compared to the baseline building
- How many LEED v4 points?

Core and Shell, 17.5% savings = 8 Points

Energy Cost Savings by Construction Type			EAC2 Points Earned by Building Type		
New Construction	Major Renovation	Core and Shell	All others	Healthcare	Schools
5%	3%	2%		Prerequisite	
6%	4%	3%	1	3	1
8%	6%	5%	2	4	2
...					
20%	18%	17%	8	10	8
...					
42%	40%	39%	16	18	16
46%	44%	43%	17	19	16
50%	48%	47%	18	20	16

Energy and Atmosphere (EA)

Optimize Energy Performance (EA_{c2})

Option 2: 50% Advanced Energy Design Guides

- 1 point each for following recommendations
 - Building envelope (opaque)
 - Building envelope (glazing)
 - Interior lighting
 - Exterior lighting
 - Plug loads
- Sixth point, retail only (medium and big box)
 - Additional interior lighting for sales floor

5 possible points

Energy and Atmosphere (EA) - NEW

Advanced Energy Metering (EA_{c3})

- Submeters for any *individual energy end use* that represents 10% or more of total building annual consumption
- Characteristics
 - Permanently installed, 1 hour interval, transmit data
 - Store all meter data for 36 months
 - Remotely accessible
 - Report hourly, daily, monthly and annual energy use
 - Electric: Consumption and demand

Energy and Atmosphere (EA) - *NEW*

Advanced Energy Metering (EA_{c3})

“Identifying major energy end uses is the first step in choosing what to meter. Often, in large commercial or industrial buildings, end uses are classified as systems composed of discrete pieces of equipment that can be metered together. For example,

- Chilled water system: chillers, chilled water pumps
- Condenser water system: cooling tower, condenser water pumps
- Hot water system (natural gas): boilers
- Hot water system (electricity): hot water pumps
- Air-handling system: supply fan, return fan, damper motors”

Energy and Atmosphere (EA) - *NEW*

Demand Response (EA_{c4})

Case 1:

Participate in utility DR program (2 points)

- Real-time fully automated response
- 10% demand reduction
- Minimum 1 year contract with multiple year intent
- Comprehensive plan to meet DR contract
- Include DR in commissioning

Case 2:

No DR program available (1 point)

- Install recording meters with communications and ability to accept DR signal
- 10% demand reduction
- Include DR in commissioning
- Contact local utility representatives to discuss future DR programs

On-site electricity generation does not meet the intent of this credit

Energy and Atmosphere (EA) - *NEW*

Renewable Energy Production (EAc5)

Available

LEED V3: Up to 7 points

LEED V4: Up to 3 points

Solar gardens or
community renewable
energy systems allowed

% Renewable Energy	Points (NC, Retail, Schools, Healthcare)	Points (CS)
1%	1	1
3%		2
5%	2	3
10%	3	

Energy and Atmosphere (EA) - *CHANGES*

Enhanced Refrigerant Management

- Reduced from 2 points (v3) to 1 point (v4)
 - Credit for refrigerants with ODP = 0 and GWP < 50
 - Calculation for other refrigerants required (no changes)
- Retail commercial refrigeration (freezer cases, etc.)
 - <1.75 lb of refrigerant per 1000 Btu/h
 - Annual leak rates no more than 15% (Leak testing using GreenChill's best practices guidelines)
<http://www2.epa.gov/sites/production/files/documents/leakpreventionrepairguidelines.pdf>

Energy and Atmosphere (EA) - CHANGES

Green Power and Carbon Offsets

LEED v3

35% from renewable sources (2 pts)

At least a two-year contract

LEED v4

50% from renewable sources (1 pt)

100% from renewable sources (2 pts)

At least a **five**-year contract

Resources must have come online since
1 January 2005

Agenda



Overview

Integrative Process

Location & Transportation (LT)

Sustainable Sites (SS)

Water Efficiency (WE)

Energy & Atmosphere (EA)

Materials & Resources (MR)

Indoor Environmental Quality (EQ)

Innovation (IN)

Regional Priority (RP)

Materials and Resources (MR)

Prerequisites

LEED v3		LEED v4	
Storage and Collection of Recyclables	X	Storage and Collection of Recyclables	X
		Construction and Demolition Waste Management Planning	X
PBT Reduction (Mercury)	Healthcare	PBT Reduction (Mercury)	Healthcare

Materials and Resources (MR)

Credits

LEED v3	Pts	LEED v4	Pts
Building Reuse - Walls, Floors, Roof	1-3	Building Life-Cycle Impact Reduction	1-6
Building Reuse - Interior Nonstructural Elements	1		
Materials Reuse	1-2		
Construction Waste Management	1-2	Construction and Demolition Waste Management	1-2

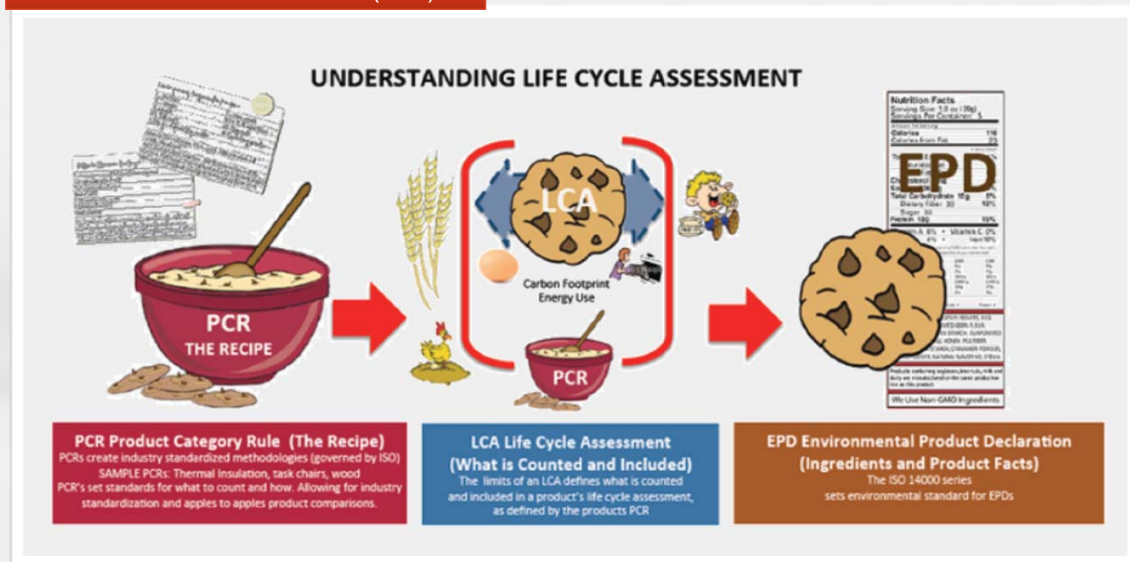
Materials and Resources (MR)

Credits

LEED v3	Pts	LEED v4	Pts
Recycled Content	1-2	Environmental Product Declarations (EPD)	1-2
Regional Materials	1-2	Sourcing of Raw Materials	1-2
Rapidly Renewable Materials	1	Material Ingredients	1-2
Certified Wood	1		



Materials and Resources (MR)



Source: <http://urbanfabrick.com/understanding-life-cycle-assessment-lca/>

Materials and Resources (MR)

Environmental Product Declarations (EPD)

Option 1: EPD (1 pt)

- Use ≥ 20 permanently-installed products (at least 5 manufacturers)
- Product-specific self declaration (valued at $\frac{1}{4}$ product)
- Industry-wide third-party EPD (valued at $\frac{1}{2}$ product)
- Product-specific third-party EPD (valued at 1 product)
- USGBC-approved program

Option 2: Multi-Attribute Optimization (1 pt)

- At least 50% (based on cost) of the permanently-installed products must demonstrate environmental impact reduction (third-party certified)
- Products sourced within 100 miles of site are valued at 2x the cost
- Structure and enclosure materials can contribute no more than 30%

The screenshot displays the website of Institut Bauen und Umwelt e.V. (IBU). The main content area features a large image of a Trane Centrifugal Chiller. Below the image is the title "Environmental Product Declaration According to ISO 14025" and the specific product name "Trane Centrifugal Chiller 2500 Ton". The declaration number is listed as EPD-TBA-201111-E. The website header includes navigation links for Sitemap, Contact, Imprint, Login, and a search bar. A green navigation bar contains links for Members, EPD, SVA, Sustainability, Service, Partners, and Database. The footer includes contact information for Germany and Switzerland, and the website URL construction-environment.com.

Agenda



- Overview
- Integrative Process
- Location & Transportation (LT)
- Sustainable Sites (SS)
- Water Efficiency (WE)
- Energy & Atmosphere (EA)
- Materials & Resources (MR)
- Indoor Environmental Quality (EQ)**
- Innovation (IN)
- Regional Priority (RP)

Indoor Environmental Quality (IEQ)

Prerequisites

LEED v3		LEED v4	
Minimum IAQ Performance	X	Minimum IAQ Performance	X
Environmental Tobacco Smoke (ETS) Control	X	Environmental Tobacco Smoke (ETS) Control	X
Minimum Acoustic Performance	Schools only	Minimum Acoustic Performance	Schools only

Indoor Environmental Quality (IEQ) – Prerequisite CHANGES

Minimum IAQ Performance

LEED v3

ASHRAE 62.1-2007, Sections 4–7
(ASHRAE 170-2008 for healthcare)

Mechanically ventilated spaces:

Must use Ventilation Rate
Procedure or local code

Naturally ventilated spaces:

Must comply with Section 5.1

IAQ Procedure not allowed

Except via pilot credit EQpc68

LEED v4

- ASHRAE 62.1-2010, Sections 4–7
(ASHRAE 170-2008 for healthcare)
- Mechanically ventilated spaces:
 - Use Ventilation Rate Procedure
 - Monitor OA intake flow
- Naturally ventilated spaces:
 - Use Natural Vent. Procedure
 - Monitor NV openings, exhaust airflow, or CO₂ concentrations
- IAQ Procedure not allowed

Indoor Environmental Quality (IEQ)

ASHRAE Standard 62.1-2010

section	change
6.2.1	Added MERV 11 requirement for PM2.5 non-attainment areas, more stringent requirements for ozone air cleaning

<http://www.epa.gov/oar/oaqps/greenbk/rindex.html>
PM2.5 Non-Attainment Areas



<http://www.epa.gov/oar/oaqps/greenbk/hindex.html>
Ozone Non-Attainment Areas



Indoor Environmental Quality (IEQ)

ASHRAE Standard 62.1-2010

section	change
6.2.1	Added MERV 11 requirement for PM2.5 non-attainment areas, more stringent requirements for ozone air cleaning
6.2.7.1	Prescriptive requirements for DCV and other reset strategies
6.4	Prescriptive requirements for natural ventilation (location and size of openings, controls), requires “mixed-mode” systems in most applications

ASHRAE Standard 62.1-2010, Section 6.4

Natural Ventilation Procedure

A “mixed-mode” ventilation system is required:

“Natural ventilation systems shall be designed in accordance with this section and shall include mechanical ventilation systems designed in accordance with Section 6.2 (Ventilation Rate Procedure) and/or Section 6.3 (IAQ Procedure).”

...unless either:

- Openings are permanently open or controls prevent closing during periods of expected occupancy, or
- Zone is not served by heating or cooling equipment

Indoor Environmental Quality (IEQ)

ASHRAE Standard 62.1-2010

Section	Change
6.2.1	Added MERV 11 requirement for PM2.5 non-attainment areas, more stringent requirements for ozone air cleaning
6.2.7.1	Prescriptive requirements for DCV and other reset strategies
6.4	Prescriptive requirements for natural ventilation (location and size of openings, controls), requires “mixed-mode” systems in most applications
6.1, 6.5	Clarified that exhaust airflow requirements are required regardless of which procedure is being used
5.5.1	Simplified intake/exhaust separation requirements (by air class)
6.2	Clarified Ventilation Rate Procedure calculations

Indoor Environmental Quality (IEQ)

Credits

LEED v3	Pts	LEED v4	Pts
Outdoor Air Delivery Monitoring	1	Enhanced IAQ Strategies	1-2
Increased Ventilation	1		
Indoor Source Control	1		
Low-Emitting Materials	1-4	Low-Emitting Materials	1-3
Construction IAQ Management Plan – During Construction	1	Construction IAQ Management Plan	1
Construction IAQ Management Plan – Before Occupancy	1	IAQ Assessment	1-2

Indoor Environmental Quality (IEQ) – Credit CHANGES

Enhanced IAQ Strategies

LEED v3

Outdoor Air Delivery Monitoring (1 pt)
 Increased Ventilation (1 pt)
 Indoor Source Control (1 pt)

LEED v4

Option 1 (1 pt), *implement all:*

- Entryway systems, *and*
- Local exhausts, *and*
- MERV 13 filtration of outdoor air

Option 2 (1 pt), *choose:*

- Prevent pollutants from outside, *or*
- Increased ventilation (↑30%), *or*
- CO₂ monitoring (≥ 25p/1000ft²), *or*
- Monitor other contaminants

Indoor Environmental Quality (IEQ)

Credits

LEED v3	Pts	LEED v4	Pts
Outdoor Air Delivery Monitoring	1	Enhanced IAQ Strategies	1-2
Increased Ventilation	1		
Indoor Source Control	1		
Low-Emitting Materials	1-4	Low-Emitting Materials	1-3
Construction IAQ Management Plan – During Construction	1	Construction IAQ Management Plan	1
Construction IAQ Management Plan – Before Occupancy	1	IAQ Assessment	1-2

Indoor Environmental Quality (IEQ) – Credit CHANGES

Construction IAQ Management Plan

LEED v3

IAQ Plan – During Construction (1 pt)

- SMACNA control measures
- Protect materials from moisture
- MERV 8 filters if HVAC equipment is used during construction

IAQ Plan – Before Occupancy (1 pt)

- Option 1: Building flush-out
- Option 2: Air testing

LEED v4

Construction IAQ Plan (1 pt)

- SMACNA control measures
- Protect materials from moisture
- MERV 8 filters if HVAC equipment is used during construction

IAQ Assessment, *choose*:

- Option 1: Flush-out (1 pt), *or*
- Option 2: Air testing (2 pts)
(more contaminants to test for)

Indoor Environmental Quality (IEQ)

Credits

LEED v3	Pts	LEED v4	Pts
Controllability of Systems – Lighting	1	Interior Lighting	1-2
Controllability of Systems – Comfort	1	Thermal Comfort	1
Thermal Comfort – Design	1		
Thermal Comfort – Verification	1		
Daylight and Views – Daylight	1-3	Daylight	1-3
Daylight and Views – Views	1-3	Quality Views	1-2
Acoustic Performance (Schools and Healthcare only)	1-2	Acoustic Performance (all buildings, except Retail)	1-2

Indoor Environmental Quality (IEQ) – Credit CHANGES

Thermal Comfort

LEED v3

Thermal Comfort – Design (1 pt)

- Design per ASHRAE 55-2007

Thermal Comfort – Verification (1 pt)

- Permanent monitoring system
- Conduct occupant survey

Controllability – Comfort (1 pt)

- Individual controls for at least 50% of building occupants, controls for all shared multi-occupant spaces

LEED v4

Thermal Comfort (1 pt)

- Design per ASHRAE 55-2010
- Requirements for permanent monitoring and occupant survey have been removed
- Individual controls for at least 50% of individual occupant spaces, controls for all shared multi-occupant spaces

Indoor Environmental Quality (IEQ)

Credits

LEED v3	Pts	LEED v4	Pts
Controllability of Systems – Lighting	1	Interior Lighting	1-2
Controllability of Systems – Comfort	1	Thermal Comfort	1
Thermal Comfort – Design	1		
Thermal Comfort – Verification	1		
Daylight and Views – Daylight	1-3	Daylight	1-3
Daylight and Views – Views	1-3	Quality Views	1-2
Acoustic Performance (Schools and Healthcare only)	1-2	Acoustic Performance (all buildings, except Retail)	1-2

Indoor Environmental Quality (IEQ) – CHANGES

Acoustic Performance

LEED v3

Schools (prerequisite)

- Background sound level ≤ 45 dBA
- ANSI S12.60-2002 reverberation time requirements

Schools (credit, 1 pt)

- Background sound level ≤ 40 dBA
- ANSI S12.60-2002 STC reqs
- Window STC rating ≥ 35

LEED v4

Schools (prerequisite)

- Background sound level ≤ 40 dBA
- ANSI S12.60-2010 reverberation time requirements
- Limit noise from exterior sources

Schools (credit, 1 pt)

- Background sound level ≤ 35 dBA
- ANSI S12.60-2010 STC reqs
- Window STC rating ≥ 35

Indoor Environmental Quality (IEQ) – Credit CHANGES

Acoustic Performance

LEED v3

Healthcare (1-2 pts)

- Meet 2010 FGI Guidelines for speech privacy, background sound, acoustical finishes, and site noise

LEED v4

Healthcare (1-2 pts)

- Meet 2010 FGI Guidelines for speech privacy, background sound, acoustical finishes, and site noise

NC, Hospitality, Warehouses (1 pt)

- Maximum background sound levels per ASHRAE Handbook
- STC requirements (table)
- Reverberation time reqs (table)
- Reinforcement or masking systems

Agenda



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- Innovation (IN)**
- Regional Priority (RP)

Innovation (IN)

Credits

LEED v3	Pts	LEED v4	pts
Innovation in Design	1-5	Innovation	1-5
LEED Accredited Professional	1	LEED Accredited Professional	1

Regional Priority (RP)

Credits

LEED v3	pts	LEED v4	pts
Regional Priority	1-4	Regional Priority	1-4

LEED Pilot Credits

Intent is to “test” ...

- Revised LEED credit language
- Alternative compliance paths
- New or innovative green building technologies and concepts
- Any Pilot Credit may be used to earn an available Innovation point

<http://www.usgbc.org/leed/tools/pilot-credits>

LEED Pilot Credits

Proposals

- Can be submitted by members
- One proposal per member
- Reviewed by USGBC staff and appropriate committees
- May be included in LEED Pilot Credits Library

LEED Pilot Credits

Use

- Can be used for up to four of the innovation credits
- A number of v3 Pilot Credits became “full” credits in v4
- Product materials transparency
- Demand Response
- Cooling Tower Water Use

Agenda



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Regional Priority

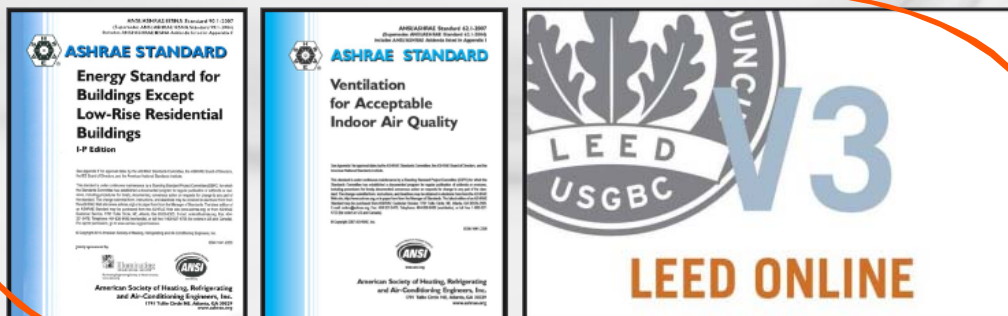
Credits

- Preselected credits by the USGBC Regional Council
- May earn 4 possible points out of 6 pre-selected credits
- If your project earns one of the RP credits, it receives an additional credit
- In the U.S, the library is referenced by ZIP code
- For international projects refer to your location

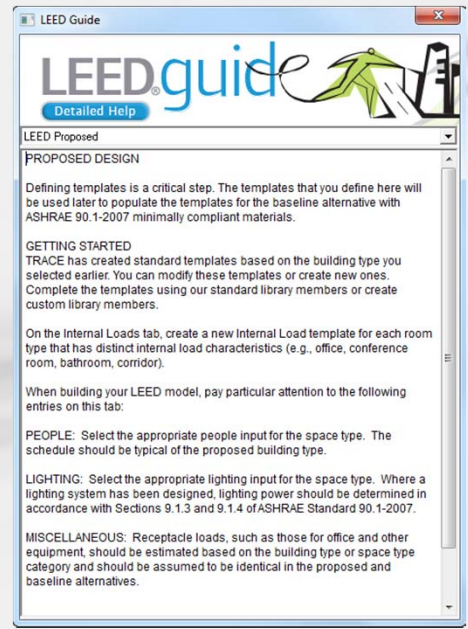
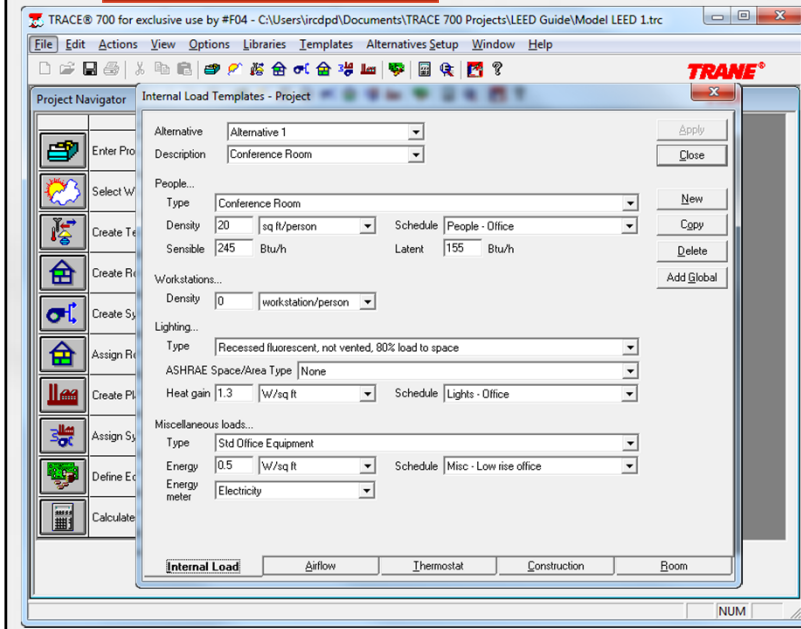
<http://www.usgbc.org/rpc>

Modeling for LEED

- Tedious and time consuming
- Requires multiple resources to complete a project
- Users need extensive knowledge on multiple platforms

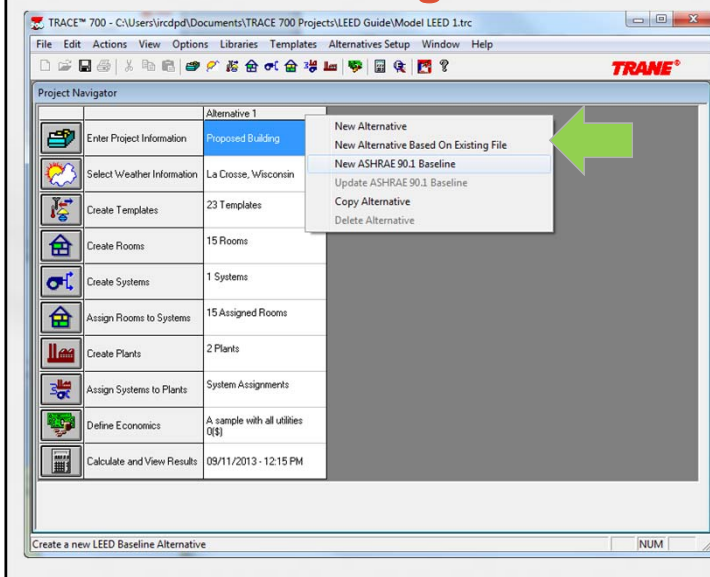


Modeling for LEED



Modeling for LEED

Baseline Building Creator



- ASHRAE Std 90.1 minimally compliant constructions
 - Windows
 - Walls
 - Roofs
 - Slabs
 - Doors
- ASHRAE Std 62.1 design ventilation matching
- Reduced window-to-wall ratios > 40%
- Reduced skylight-to-roof ratios > 5%
- Predefined max allowable lighting powers

LEED v4

Key Dates

LEED v4

- Launched in November 2013 ... available to use now
- 100+ “beta” projects already using

LEED 2009 (v3)

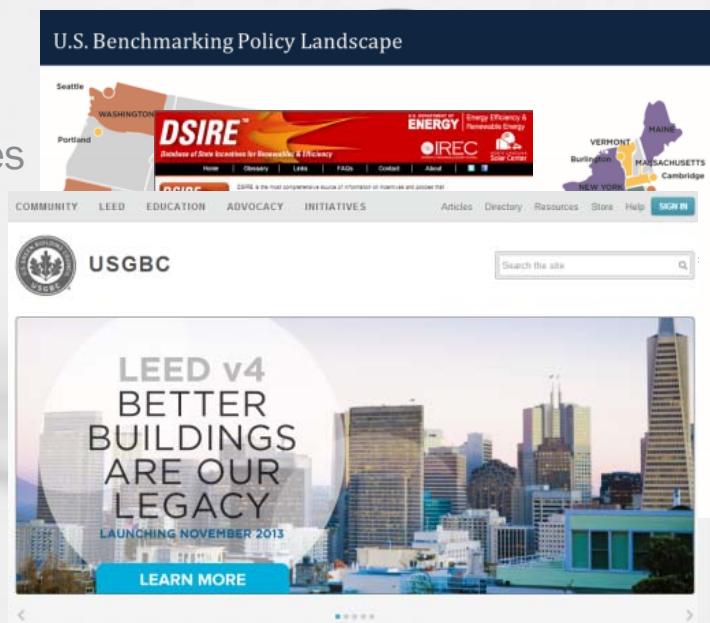
- Continues to be available
- Can register projects up until 1 June 2015

www.usgbc.org/help/how-long-will-leed-2009-be-open-registration

LEED v4

Be Adaptive

- Find reputable resources
- Mandates & incentives
- Standards – ASHRAE 189.1, 90.1, 62.1, 55
- Rating systems
- Learn and apply



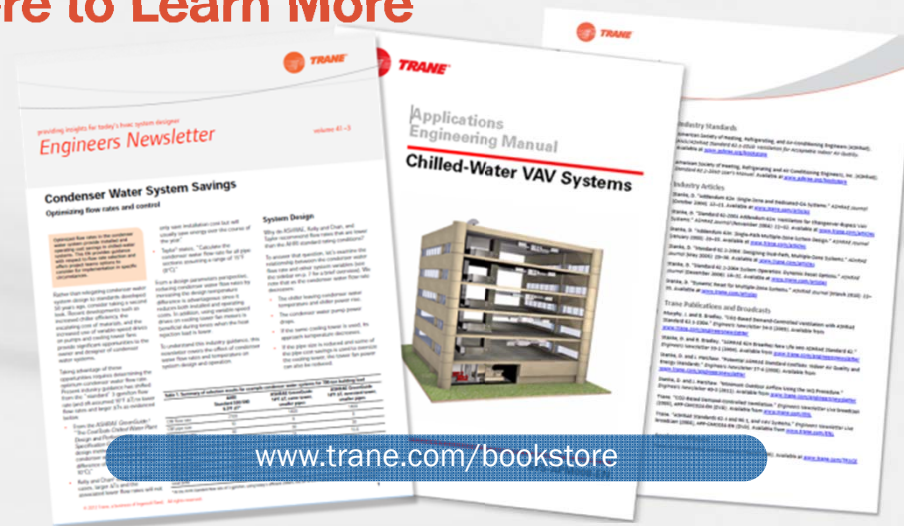
LEED v4

Summary

- Energy and IEQ continue to play a large role
- Water conservation will continue to increase in importance

LEED v4 references

Where to Learn More



LEED v4 references

www.trane.com/ENL



EDUCATION PROVIDER



Past programs include:

- Air-to-Air Energy Recovery
- ASHRAE Standards 189.1, 90.1, 62.1
- High-performance VAV Systems
- Chilled-water plants
- WSHP/GSHP systems
- Control strategies
- USGBC LEED®
- Energy and the environment
- Acoustics
- Ventilation
- Dehumidification
- Ice storage
- Central geothermal systems

LEED v4 references

LEED Continuing Education Courses

on-demand, no charge, 1.5 CE credits

ASHRAE Standards 62.1 and 90.1 and VAV Systems

ASHRAE Standard 62.1: Ventilation Rate Procedure

ASHRAE Standard 90.1-2010

ASHRAE Standard 189.1-2011

High-Performance VAV Systems

Single-Zone VAV Systems

Ice Storage Design and Control

All Variable-Speed Chiller Plant Operation

www.trane.com/ContinuingEducation

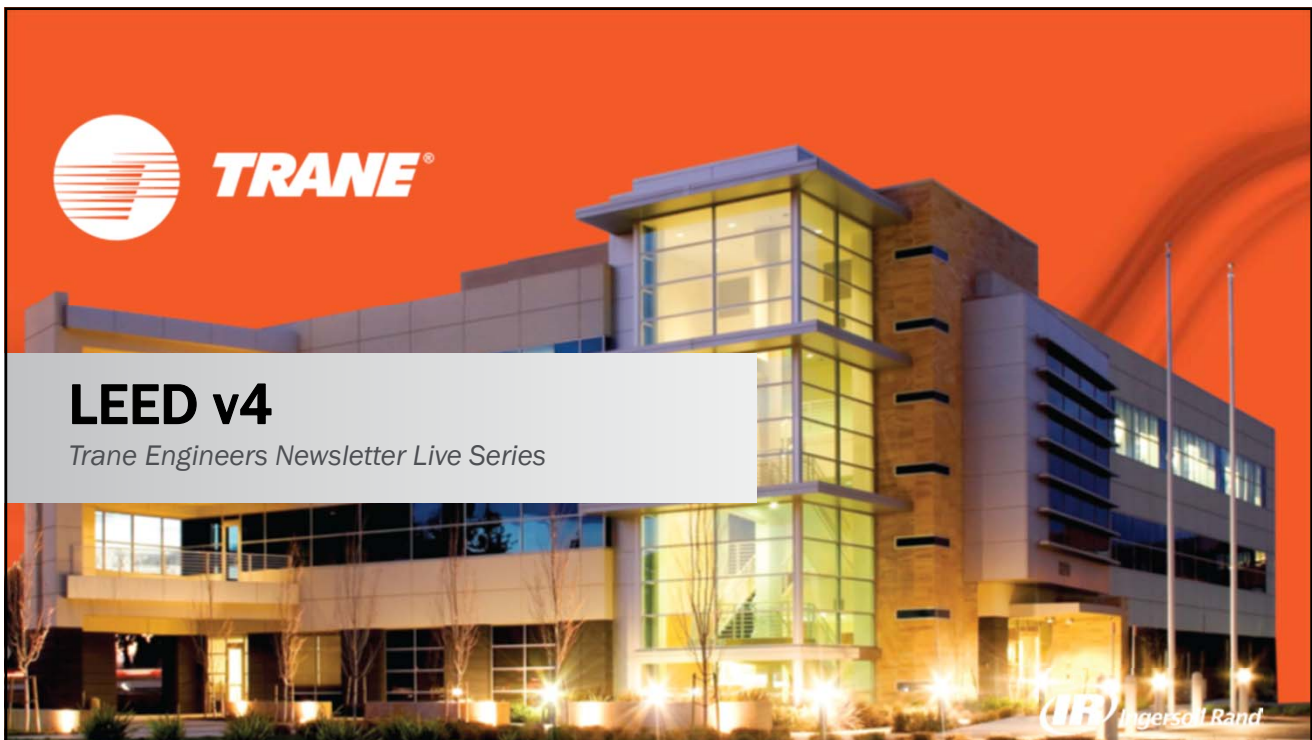


EDUCATION PROVIDER



Join Us in 2014

- Applying Variable Refrigerant Flow (VRF)
- Energy-saving Strategies for Chilled-water Terminal Systems





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March 2014

LEED v4

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Stanke, S. "Potential ASHRAE Standard Conflicts - Indoor Air Quality and Energy Standards." *Engineers Newsletter* 37-4 (2008).

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Murphy, J., Harshaw, J., Solberg, P., and Stanke, D., "ASHRAE Standard 62.1-2010," *Engineers Newsletter Live* program (2013) APP-CMC047-EN.

Analysis Software

Trane Air-Conditioning and Economics (TRACE™ 700). Available at www.trane.com/TRACE

Quiz Trane Engineers Newsletter LIVE: LEED® v4

1. What is true about all of the LEED v4 Minimum Energy Performance (EAp2) prerequisite requirements?
 - a. They must all meet the mandatory and prescriptive requirements of ASHRAE/IES 90.1-2010
 - b. They must all meet the mandatory requirements of ASHRAE/IES 90.1-2010*
 - c. They must all meet the mandatory and prescriptive requirements of ASHRAE/IES 90.1-2013
 - d. They must all meet the mandatory requirements of ASHRAE/IES 90.1-2013

* Note: The AEDG and NBI Core Performance Guides options must meet both the mandatory and prescription requirements of 90.1-2010. The Modeling method must meet the mandatory requirements – but can “trade-off” prescriptive requirements.

2. Which LEED v4 Energy and Atmosphere Credit was originally a credit in the LEED v3 Pilot Credits Library?
 - a. Advanced Energy Metering
 - b. Demand Response
 - c. Green Power and Carbon Offsets
 - d. None of the above
 - e. All of the above
3. Which ASHRAE 50% Advanced Energy Design Guides are available?
 - a. Small to Medium Office Buildings
 - b. Medium to Large Box Retail Buildings
 - c. K-12 School Buildings
 - d. Large Hospitals
 - e. All of the above
4. What rating system requires the Integrative Process as a prerequisite?
 - a. New Construction
 - b. Core and Shell
 - c. Healthcare
 - d. Schools
 - e. All of the Above
5. Which of the following is not a credit category under Water Efficiency in LEED version 4?
 - a. Indoor Water Use Reduction
 - b. Water Metering
 - c. Waste Water Techniques
 - d. Cooling Tower Water
 - e. Outdoor Water Use Reduction
6. When does submission for LEED certification become mandatory for LEED version 4?
 - a. June, 2013
 - b. June, 2014
 - c. June, 2015
 - d. June, 2016
7. True or False: In LEED v4, the Minimum IAQ Performance prerequisite has been updated to require compliance with the 2010 edition of ASHRAE Standard 62.1.
8. True or False: When natural ventilation is used, ASHRAE Standard 62.1-2010 requires that the building also include a mechanical system in many cases to ensure proper ventilation whenever the natural ventilation openings are closed.
9. Which of the following was added as a requirement in the Minimum IAQ Performance prerequisite of LEED v4?
 - a. Movable furnishings must be in place before the building flush-out begins
 - b. A permanent monitoring system for thermal comfort must be installed
 - c. A direct outdoor airflow measurement device must be installed in a variable-airflow system
 - d. Simultaneous reduction of condenser and evaporator water flow

10. True or False: In LEED v4, the Acoustic Performance credit is only available to use for schools or healthcare facilities.



Engineers Newsletter Live - Audience Evaluation

LEED v4

Return via fax immediately following program to your host

Your Name _____

Company name: _____

Business address: _____

Business Phone: _____

Email address: _____

Event location: _____

AIA member Number: _____

PE license No.: _____

How did you hear about this program? (Check all that apply)

- Flyers, email invitations
- Trane Web site
- Sales Representative
- Other. Please describe _____

What is your **preferred** method of receiving notification for training opportunities (check one)?

- Email
- fax
- US mail
- Trane Website

Was the topic appropriate for the event? Yes No

Rate the content of the program. Excellent Good Needs Improvement

Rate the length of the program. Appropriate Too long Too short

Rate the pace of the program. Appropriate Too fast Too slow

What was most interesting to you?

What was least interesting to you?

Are there any other events/topics you would like Trane to offer to provide additional knowledge of their products and services?

Additional questions or comments: