

Using Building Automation Systems in Attaining LEED Certification

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ASHRAE Member

USGBC Member

LEED AP

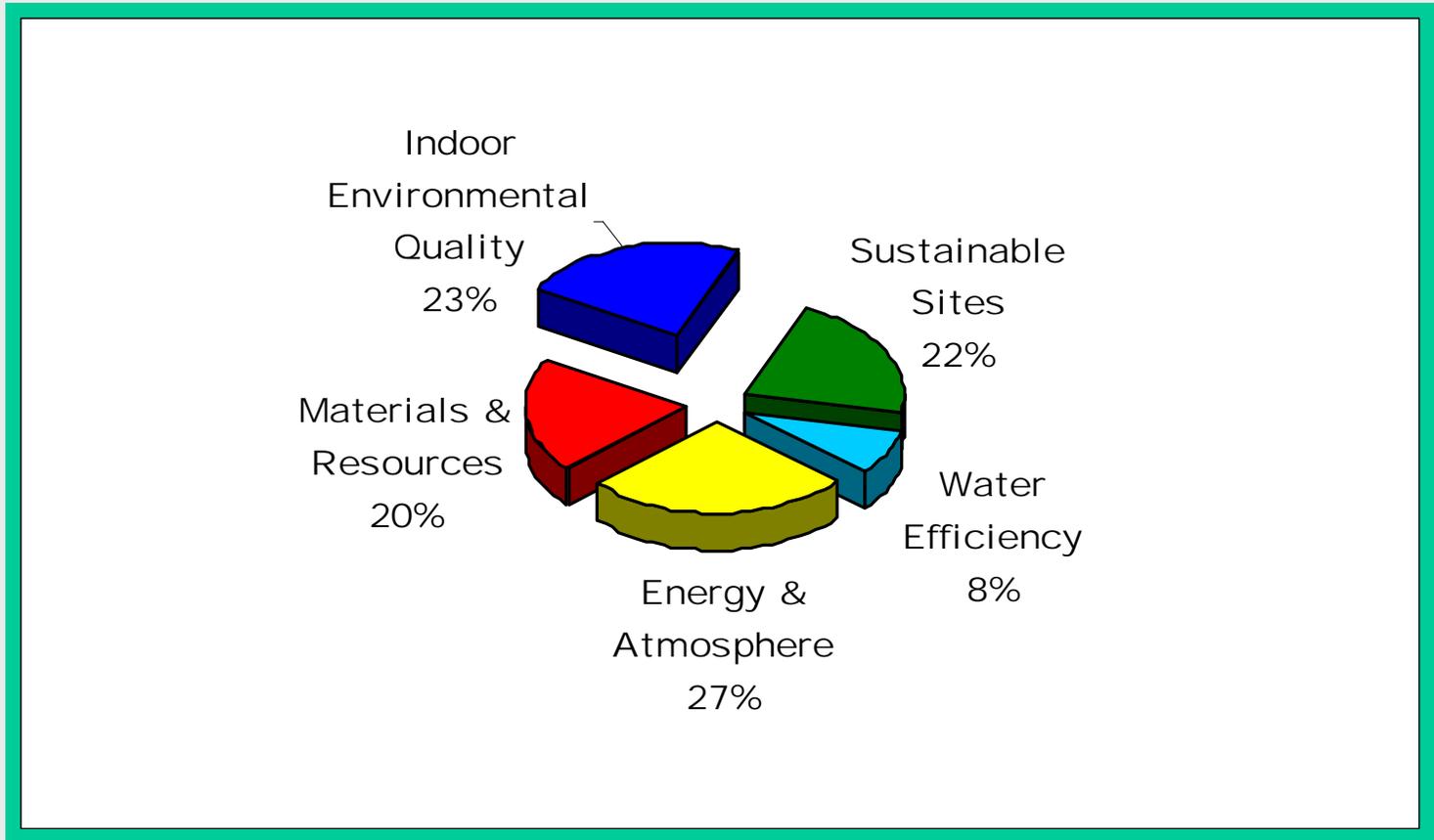
LEED Certification Process for Commercial Buildings

- Credits are broken down by categories
 - Sustainable sites
 - Water Efficiency
 - Energy & Atmosphere
 - Materials & Resources
 - Indoor Environmental Quality
 - Innovation in Design

BAS and the LEED Certification Process

- Of these categories, building automation systems can typically help to enable LEED points:
 - Water efficiency
 - Energy & Atmosphere
 - Indoor Environmental Quality
 - Innovation in Design

LEED-NC[®] Point Distribution



Five LEED credit categories

Yes ? No

Water Efficiency

5 Points

Credit 1.1	Water Efficient Landscaping , Reduce by 50%	1
Credit 1.2	Water Efficient Landscaping , No Potable Use or No Irrigation	1
Credit 2	Innovative Wastewater Technologies	1
Credit 3.1	Water Use Reduction , 20% Reduction	1
Credit 3.2	Water Use Reduction , 30% Reduction	1

Yes ? No

Energy & Atmosphere

17 Points

Y		
Y		
Y		

Prereq 1	Fundamental Building Systems Commissioning	Required
Prereq 2	Minimum Energy Performance	Required
Prereq 3	CFC Reduction in HVAC&R Equipment	Required
Credit 1	Optimize Energy Performance	1 to 10
Credit 2.1	Renewable Energy , 5%	1
Credit 2.2	Renewable Energy , 10%	1
Credit 2.3	Renewable Energy , 20%	1
Credit 3	Additional Commissioning	1
Credit 4	Ozone Depletion	1
Credit 5	Measurement & Verification	1
Credit 6	Green Power	1

Y			Required
		Prereq 1 Storage & Collection of Recyclables	Required
		Credit 1.1 Building Reuse , Maintain 75% of Existing Shell	1
		Credit 1.2 Building Reuse , Maintain 100% of Shell	1
		Credit 1.3 Building Reuse , Maintain 100% Shell & 50% Non-Shell	1
		Credit 2.1 Construction Waste Management , Divert 50%	1
		Credit 2.2 Construction Waste Management , Divert 75%	1
		Credit 3.1 Resource Reuse , Specify 5%	1
		Credit 3.2 Resource Reuse , Specify 10%	1
		Credit 4.1 Recycled Content , Specify 5% (post-consumer + ½ post-industrial)	1
		Credit 4.2 Recycled Content , Specify 10% (post-consumer + ½ post-industrial)	1
		Credit 5.1 Local/Regional Materials , 20% Manufactured Locally	1
		Credit 5.2 Local/Regional Materials , of 20% Above, 50% Harvested Locally	1
		Credit 6 Rapidly Renewable Materials	1
		Credit 7 Certified Wood	1

Indoor Environmental Quality

15 Points

Y	Prereq 1	Minimum IAQ Performance	Required
Y	Prereq 2	Environmental Tobacco Smoke (ETS) Control	Required
	Credit 1	Carbon Dioxide (CO₂) Monitoring	1
	Credit 2	Ventilation Effectiveness	1
	Credit 3.1	Construction IAQ Management Plan, During Construction	1
	Credit 3.2	Construction IAQ Management Plan, Before Occupancy	1
	Credit 4.1	Low-Emitting Materials, Adhesives & Sealants	1
	Credit 4.2	Low-Emitting Materials, Paints	1
	Credit 4.3	Low-Emitting Materials, Carpet	1
	Credit 4.4	Low-Emitting Materials, Composite Wood & Agrifiber	1
	Credit 5	Indoor Chemical & Pollutant Source Control	1
	Credit 6.1	Controllability of Systems, Perimeter	1
	Credit 6.2	Controllability of Systems, Non-Perimeter	1
	Credit 7.1	Thermal Comfort, Comply with ASHRAE 55-1992	1
	Credit 7.2	Thermal Comfort, Permanent Monitoring System	1
	Credit 8.1	Daylight & Views, Daylight 75% of Spaces	1
	Credit 8.2	Daylight & Views, Views for 90% of Spaces	1

			Innovation & Design Process
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5 Points

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Credit 1.1 Innovation in Design: Provide Specific Title	1
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Credit 1.2 Innovation in Design: Provide Specific Title	1
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Credit 1.3 Innovation in Design: Provide Specific Title	1
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Credit 1.4 Innovation in Design: Provide Specific Title	1
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Credit 2 LEED™ Accredited Professional	1

Yes ? No

			Project Totals (pre-certification estimates)
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69 Points

Certified 26-32 points **Silver** 33-38 points **Gold** 39-51 points **Platinum** 52-69 points

BAS and LEED-NC Credits

- Great impact on amount of LEED points:
 - Water Efficient Landscaping – 1pt
 - Energy and Atmosphere points – Up to 12 pts
 - Optimize Energy Performance (1-10 pts)
 - Best Practice Commissioning (1 pt)
 - Measurement & Verification (1 pt)

**Building Automation System – Can impact
up to 40% of LEED points**

BAS and LEED -NC Credits

- Indoor Environmental Quality – 6 pts
 - Carbon Dioxide Monitoring (1 pt)
 - Increase Ventilation Effectiveness (1 pt)
 - Controllability of Systems (2 pts)
 - Thermal Comfort (2 pts)
- Innovation and Design Credits – Up to 5 pts

**Building Automation System – Can impact
up to 40% of LEED points**

Water Efficiency

Water Efficient Landscaping

1-2 Points

SS	WE	EA	MR	EQ	ID
Credit 1					

Intent

Limit or eliminate the use of potable water for landscape irrigation.

Requirements & Submittals

Credit 1.1 (1 point) Use high efficiency irrigation technology, OR, use captured rain or recycled site water, to reduce potable water consumption for irrigation by 50% over conventional means.

- Provide cut sheets for high efficiency irrigation equipment. Include calculations demonstrating that potable water consumption for irrigation is reduced by 50%.

OR,

- Provide drawings and a narrative describing the captured rain system or recycled site water system. Highlight portions of the system highlighted. Include calculations demonstrating potable water consumption for irrigation is reduced by 50%.

Credit 1.2 (1 point) Use only captured rain or recycled site water for irrigation to reduce potable water consumption for irrigation by 50% reduction (100% total reduction) for site irrigation needs, OR, do not use any irrigation systems.

- Provide drawings and a narrative describing the captured rain system or recycled site water system. Highlight portions of the system highlighted. Include calculations demonstrating that potable water used for irrigation is reduced by 100%.

OR,

Use BAS here- Monitor and control irrigation system

Energy & Atmosphere

SS	WE	EA	MR	EQ	ID
Prerequisite 1					

Prerequisite 1 Fundamental Building Systems Commissioning

Required

Intent

Verify and ensure that fundamental building elements and systems are designed, installed and calibrated to operate as intended.

Requirement

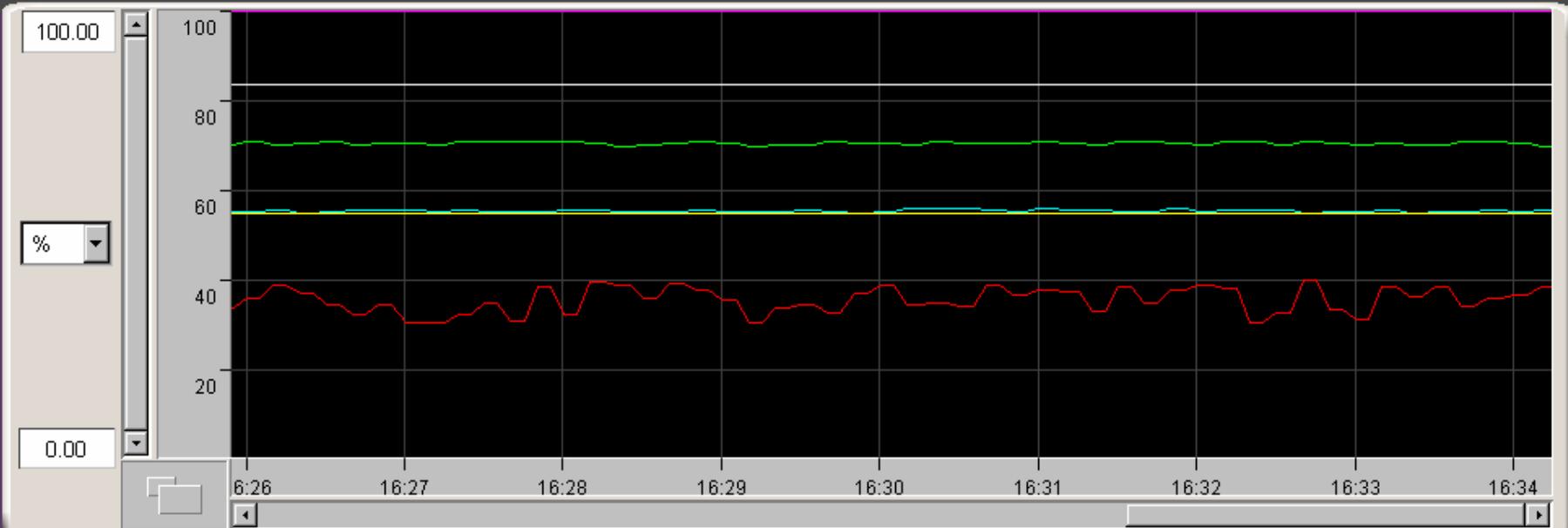
- Prerequisite 1.0 Implement the following fundamental best practice commissioning procedures:
- Engage a commissioning authority
 - Review design intent and basis of design documents
 - Include commissioning requirements in bid documents
 - Develop and utilize a commissioning plan
 - Verify installation, functional performance and operation
 - Complete a commissioning report

Use BAS here-Trends, reports

Technologies & Strategies

Engage a commissioning authority and adopt a commissioning plan. Include commissioning requirements in bid documents and task the commissioning agent to produce a commissioning report once commissioning activities are completed.

Trend 6 Zeus Air Handler 1 Type Multiplot Samples 100 Interval 5 sec



Pen on/off	Point ID	Parameter	Description	value at: 16:34:10
<input checked="" type="checkbox"/>	zhAhu1DaTemp	PV	Ahu-1 Discharge Air Temperature	55.5832 °F
<input checked="" type="checkbox"/>	zhAhu1RaTemp	PV	Ahu-1 Return Air Temperature	83.7083 °F
<input checked="" type="checkbox"/>	zhAhu1MaTemp	PV	Ahu-1 Mixed Air Temperature	70.0588 °F
<input checked="" type="checkbox"/>	zhAhu1MaDamper	PV	Ahu-1 Mixed Air Dampers	55 %
<input checked="" type="checkbox"/>	zhAhu1SaFan	PV	Ahu-1 Supply Air Fan	ON
<input checked="" type="checkbox"/>	zhAhu1ChwValve	PV	Ahu-1 Chilled Water Valve	38.4022 %
<input checked="" type="checkbox"/>				
<input checked="" type="checkbox"/>				

History offset: 00:00:00

Energy and Atmosphere

SS	WE	EA	MR	EQ	ID
Prerequisite 2					

Requirements

Prerequisite 2 **Minimum Energy Performance**

Intent

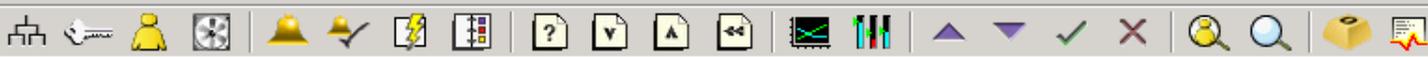
Establish the minimum level of energy efficiency for the base building and systems.

Requirement

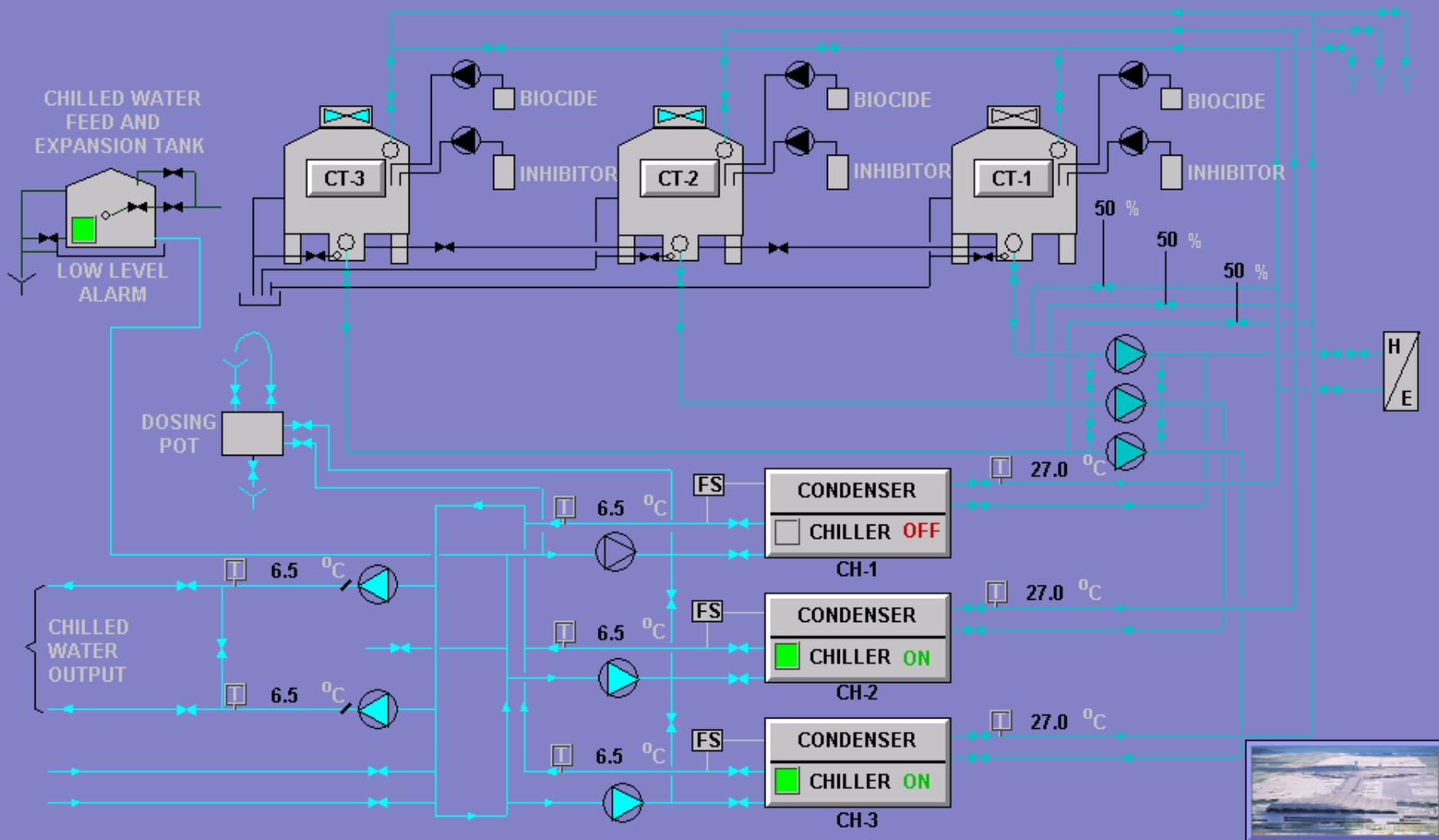
Design to meet building energy efficiency and performance as required by ASHRAE/IESNA 90.1-1999 or the local energy code, whichever is the more stringent.

Use BAS here-Monitor minimum energy efficiency requirements

Use BAS to monitor building systems to maximize energy performance. Monitor the energy performance and identify the measures. Quantify energy performance as com-



CHILLED WATER OVERVIEW



Energy and Atmosphere

SS	WE	EA	MR	EQ	ID
Credit 1					

2-10 Points

Credit 1 Optimize Energy Performance

Intent

Achieve increasing levels of energy performance above the prerequisite standard to reduce environmental impacts associated with excessive energy use.

Requirements

Reduce design energy cost compared to the energy cost budget for regulated energy components described in the requirements of ASHRAE/IESNA Standard 90.1-1999, as demonstrated by a whole building simulation using the Energy Cost Budget Method described in Section 11:

New Buildings	Existing Buildings	Points
20%	10%	2
30%	20%	4
		6
		8
		10

Use BAS here-Use system to integrate more energy efficient sequences. Integrate systems to gain efficiencies

systems, building envelope, service hot
ns as defined by ASHRAE.

cost by 20% / 10%.

cost by 30% / 20%.

energy cost by 40% / 30%.

design energy cost by 50% / 40%.

Credit 1.5 (10 points) Reduce design energy cost by 60% / 50%.

Technologies & Strategies

Design the building envelope and building systems to maximize energy performance. Use a computer simulation model to assess the energy performance and identify the most cost effective energy efficiency measures. Quantify energy performance as compared to a baseline building.

What are Intelligent, Integrated Buildings?

CABA's
Intelligent & Integrated
Buildings Conference



FIRE

Functionality checks
Detector service
Fire, Life, Safety



SECURITY

Doors
PIR
Integration
Asset Location



ACCESS

Doors
Buildings
Occupancy
Feed Forward



ENERGY

Utility Monitoring
(Elect/Water/Gas/Oil)
Tenant Billing
Air/Water
Heat
Lighting
Back-up Generation



LIGHTING

Schedules
Occupancy Sensing



LIFTS

Breakdown
Maintenance
Traffic Performance



COMMUNICATIONS

Voice/Video/Data



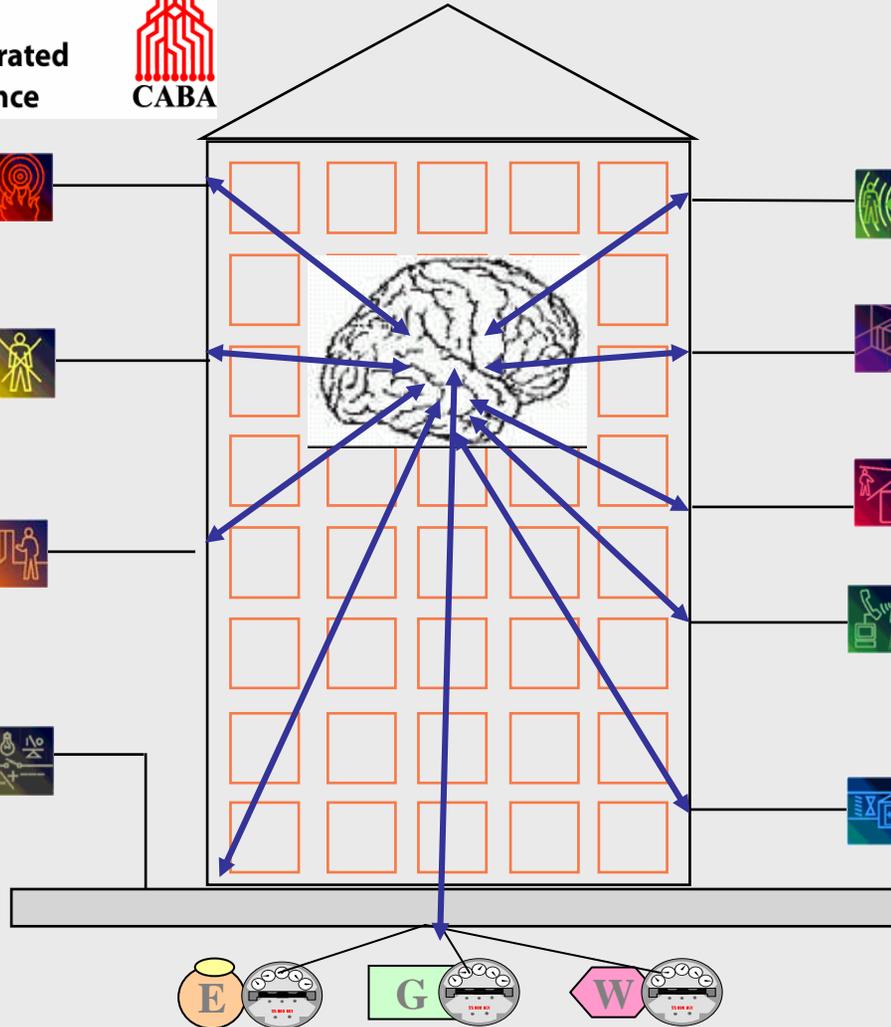
24/7 Monitoring

Breakdown
Plant Tuning
Conditioned Monitoring
Car Park Utilization

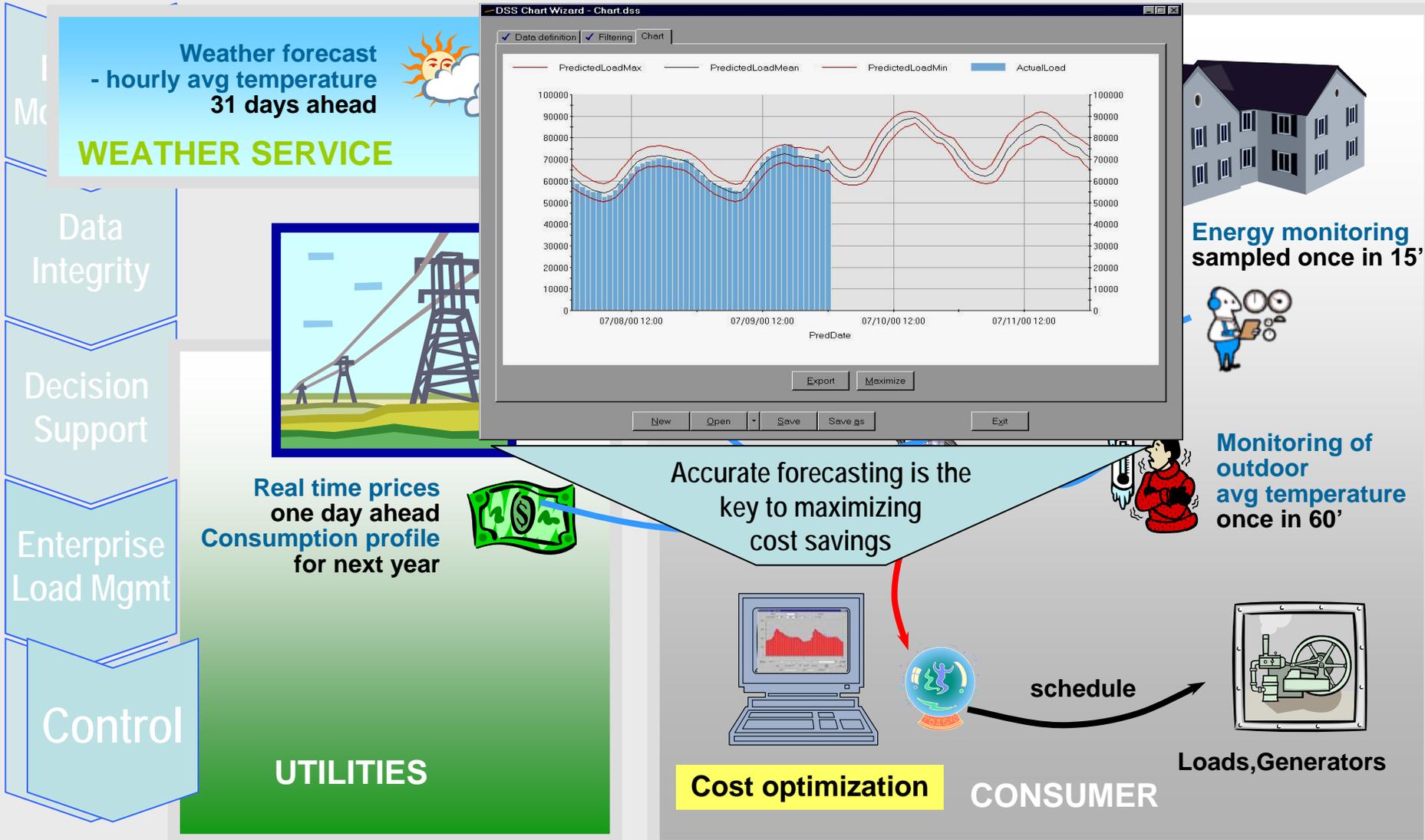


HVAC

Air-Handling Unit
Boilers
Pumps
Fans
Energy Control
Variable Air Volume
Air Quality



Enterprise Load Management: Bringing the data together



Automation Sequences enabling LEED-NC Credits

- Integration has increased value when “knowledge” is built-in
 - A cardholder automatically turns on lights and triggers temperature control upon entering area of the building
 - Integrates Security and HVAC to reduce energy costs
 - Window contacts shut off/minimize mechanical cooling to a zone when a window is open.

**Building Automation System – Can impact
up to 40% of LEED points**

Automation Sequences enabling LEED-NC Credits

- Motorized blinds sequenced with lighting and HVAC controls to optimize indoor environment conditions
 - Integrates HVAC, lighting, occupancy and window status sensing to optimize energy use and provide ultimate working conditions
- System analyzes landscaping moisture conditions and weather data from web-based provider to determine need for watering landscape
 - Takes advantage of Internet link set up to optimize building performance for improving water usage efficiency also

**Building Automation System – Can impact
up to 40% of LEED points**

Energy and Atmosphere

SS	WE	EA	MR	EQ	ID
Credit 3					

1 Point

Credit 3 Additional Commissioning

Intent

Verify and ensure that the entire building is designed, constructed, and calibrated to operate as intended.

Requirement

Credit 3.0 (1 point)

In addition to the Fundamental Building Commissioning prerequisite, implement the following additional commissioning tasks:

1. Conduct a focused review of the design prior to the construction documents phase.

2. Conduct a focused review of the Construction Documents prior to completion.

3. Conduct a review of contractor submittals of construction documents. (The above three reviews must be conducted by the designer.)

4. Develop a commissioning management manual.

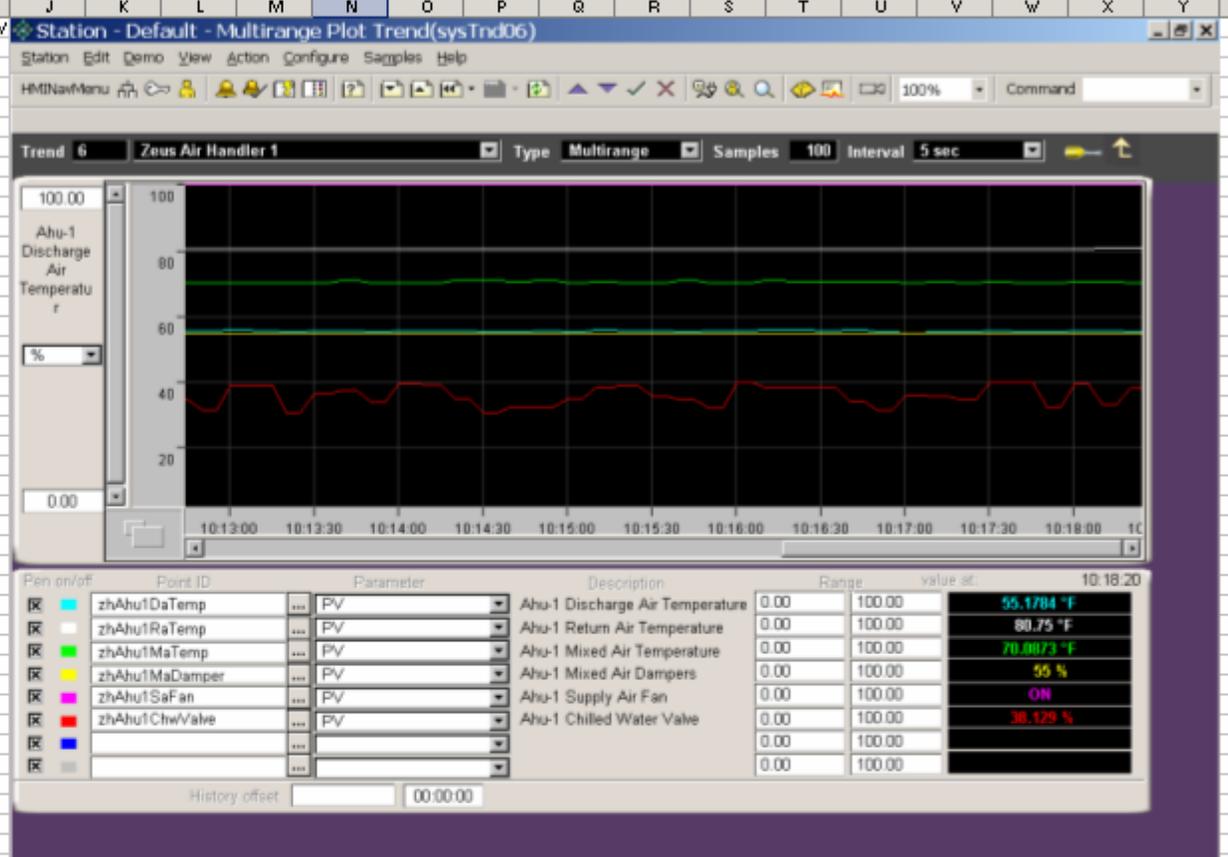
5. Conduct a near-warranty end or post-warranty end review of the project.

6. Conduct a project design phases. Task the commissioning agent before and after construction documents completion. The agent must also create a recommissioning manual.

7. Review the project at near-warranty end.

Use BAS here- comprehensive trending and reporting to determine systems current state and compare to recommissioning for future

time	zhAhu1Da	zhAhu1Ra	zhAhu1Ma	zhAhu1Ms	zhAhu1Sa	zhAhu1Chw	Valve.PV
10:13:40 AM	55.37	80.54	70.34	55	1	37.33	
10:13:35 AM	55.45	80.54	70.33	55	1	36.21	
10:13:30 AM	55.45	80.54	70.33	55	1	36.21	
10:13:25 AM	55.21	80.54	70.31	55	1	30.47	
10:13:20 AM	55.21	80.54	70.31	55	1	30.47	
10:13:15 AM	55.58	80.54	70.2	55	1	38.66	
10:13:10 AM	55.58	80.54	70.2	55	1	38.66	
10:13:05 AM	55.95	80.5	70.25	55	1	38.78	
10:13:00 AM	55.95	80.5	70.25	55	1	38.78	
10:12:55 AM	55.59	80.5	70.07	55	1	31.17	
10:12:50 AM	55.59	80.5	70.07	55	1	31.17	
10:12:45 AM	55.66	80.5	70.27	55	1	34.52	
10:12:40 AM	55.66	80.5	70.27	55	1	34.52	
10:12:35 AM	55.72	80.5	70.87	55	1	38.19	
10:12:30 AM	55.72	80.5	70.87	55	1	38.19	
10:12:25 AM	55.63	80.5	70.14	55	1	37.39	
10:12:20 AM	55.63	80.5	70.14	55	1	37.39	
10:12:15 AM	55.55	80.5	70.37	55	1	33.74	
10:12:10 AM	55.55	80.5	70.37	55	1	33.74	
10:12:05 AM	55.21	80.46	70.59	55	1	38.52	
10:12:00 AM	55.21	80.46	70.59	55	1	38.52	
10:11:55 AM	55.57	80.46	70.16	55	1	36.63	
10:11:50 AM	55.57	80.46	70.16	55	1	36.63	
10:11:45 AM	55.62	80.46	70.75	55	1	33.89	
10:11:40 AM	55.62	80.46	70.75	55	1	33.89	
10:11:35 AM	55.39	80.46	70.57	55	1	30.05	
10:11:30 AM	55.39	80.46	70.57	55	1	30.05	
10:11:25 AM	55.36	80.46	70.05	55	1	39.63	
10:11:20 AM	55.36	80.46	70.05	55	1	39.63	
10:11:15 AM	55.47	80.46	70.11	55	1	30.39	
10:11:10 AM	55.47	80.46	70.11	55	1	30.39	
10:11:05 AM	55.88	80.42	70.05	55	1	34.86	
10:11:00 AM	55.88	80.42	70.05	55	1	34.86	
10:10:55 AM	55.18	80.42	70.65	55	1	30.5	
10:10:50 AM	55.18	80.42	70.65	55	1	30.5	
10:10:45 AM	55.69	80.42	70.28	55	1	39.65	
10:10:40 AM	55.69	80.42	70.28	55	1	39.65	
10:10:35 AM	55.29	80.42	70.21	55	1	34.43	
10:10:30 AM	55.29	80.42	70.21	55	1	34.43	
10:10:25 AM	55.03	80.42	70.97	55	1	38.49	
10:10:20 AM	55.03	80.42	70.97	55	1	38.49	
10:10:15 AM	55.89	80.42	70.49	55	1	39.84	
10:10:10 AM	55.89	80.42	70.49	55	1	39.84	
10:10:05 AM	55.86	80.38	70.51	55	1	32.1	
10:10:00 AM	55.86	80.38	70.51	55	1	32.1	
10:09:55 AM	55.9	80.38	70.85	55	1	33.25	
10:09:50 AM	55.9	80.38	70.85	55	1	33.25	
10:09:45 AM	55.6	80.38	70.75	55	1	32.86	
10:09:40 AM	55.6	80.38	70.75	55	1	32.86	
10:09:35 AM	55.49	80.38	70.45	55	1	39.9	
10:09:30 AM	55.49	80.38	70.45	55	1	39.9	
10:09:25 AM	55.05	80.38	70.61	55	1	31.7	
10:09:20 AM	55.05	80.38	70.61	55	1	31.7	
10:09:15 AM	56	80.38	70.04	55	1	35.5	
10:09:10 AM	56	80.38	70.04	55	1	35.5	
10:09:05 AM	55.45	80.33	70.62	55	1	36.72	
10:09:00 AM	55.45	80.33	70.62	55	1	36.72	
10:08:55 AM	55.43	80.33	70.84	55	1	34.66	
10:08:50 AM	55.43	80.33	70.84	55	1	34.66	
10:08:45 AM	55.44	80.33	70.33	55	1	36.42	
10:08:40 AM	55.44	80.33	70.33	55	1	36.42	



05-Jan-06 10:00:00 System Testing license H 00 License for internal testing

Date	Time	Alarm	Observer	Str	Mngr
05-Jan-06	10:18:25	Alarm	ebserver	Str04	Mngr

Energy and Atmosphere

SS	WE	EA	MR	EQ	ID
Credit 5					

1 Point

Credit 5 Measurement & Verification

Intent

Provide for the ongoing accountability and optimization of building energy and water consumption performance over time.

Requirement

Credit 5.0 (1 point) Comply with the long term continuous measurement of performance as stated in Option B: Methods by Technology of the US DOE's International Performance Measurement and Verification Protocol (IPMVP) for the following:

- Lighting systems and controls
- Fan and variable motor loads
- Variable frequency drive (VFD) operation
- Cooling plant variable loads (kW/ton)
- Chiller compressor and heat recovery cycles
- Supply and return static pressures and ventilation air volumes
- Energy efficiencies
- Including specific process energy efficiency systems and equipment
- Indoor water risers and outdoor irrigation systems

Technologies & Strategies

Model the energy and water systems to predict savings. Design the building with equipment to measure energy and water performance. Draft a Measurement & Verification Plan to apply during building operation that compares predicted savings to those actually achieved in the field.

Use BAS here-Use system to integrate systems for metering and sub metering purposes. Verification is automated

SS	WE	EA	MR	EQ	ID
Prerequisite 1					

Indoor Environmental Quality

Required

Prerequisite 1 **Minimum IAQ Performance**

Intent

Establish minimum indoor air quality (IAQ) performance to prevent the development of indoor air quality problems in buildings, maintaining the health and well being of the occupants.

Requirement



Prerequisite 1.0

Meet the minimum requirements of voluntary consensus standard ASHRAE 62-1999, Ventilation for Acceptable Indoor Air Quality and approved Addenda.

Use BAS here-Use system to determine that proper minimum outdoor air control is implemented according to ASHRAE standards

...tilation requirements of the reference station on the site and locate air intakes away from

Indoor Environmental Quality

SS	WE	EA	MR	EQ	ID
Credit 1					

1 Point

Credit 1 Carbon Dioxide (CO₂) Monitoring

Intent

Provide capacity for indoor air quality (IAQ) monitoring to sustain long-term occupant health and comfort.

Requirement

Credit 1.0 (1 point) Install a permanent carbon dioxide (CO₂) monitoring system that provides feedback on space ventilation performance in a form that affords operational adjustments, AND specify initial operational set point parameters that maintain indoor carbon dioxide levels no higher than outdoor levels by more than 100 ppm at any time.

Use BAS here-Use system to monitor and control (as required per code) the CO2 levels in densely occupied spaces and outdoor air flows

Provide monitoring sensors and integrate these sensors with the building management system (BAS).

Indoor Environmental Quality

SS	WE	EA	MR	EQ	ID
Credit 2					

Credit 2 Increase Ventilation Effectiveness

1 Point

Intent

Provide for the effective delivery and mixing of fresh air to support the health, safety, and comfort of building occupants.

Requirement

Credit 2.0 (1 point) For mechanically ventilated buildings, design ventilation systems that result in an air change effectiveness (E) greater than or equal to 0.9 as determined by ASHRAE 129-1997. For naturally ventilated spaces demonstrate a distribution and laminar flow pattern that involves not less than 90% of the room or zone area in the direction of air flow for at least 95% of

Use BAS here-Use system to determine that proper minimum outdoor air control is implemented according to ASHRAE standards

air change effectiveness.
ventilation strategies
low ventilation such
Test the air change

Indoor Environmental Quality

SS	WE	EA	MR	EQ	ID
Credit 6					

Credit 6 **Controllability of Systems**

1-2 Points

Intent

Provide a high level of individual occupant control of thermal, ventilation, and lighting systems to support optimum health, productivity, and comfort conditions.

Requirements

- Credit 6.1** (1 point) Provide a minimum of one operable window and one lighting control zone per 200 SF for all occupied areas within 15 feet of the perimeter wall.
- Credit 6.2** (1 point) Provide controls for each individual for airflow, temperature, and lighting for 50% of the non-perimeter, regularly occupied

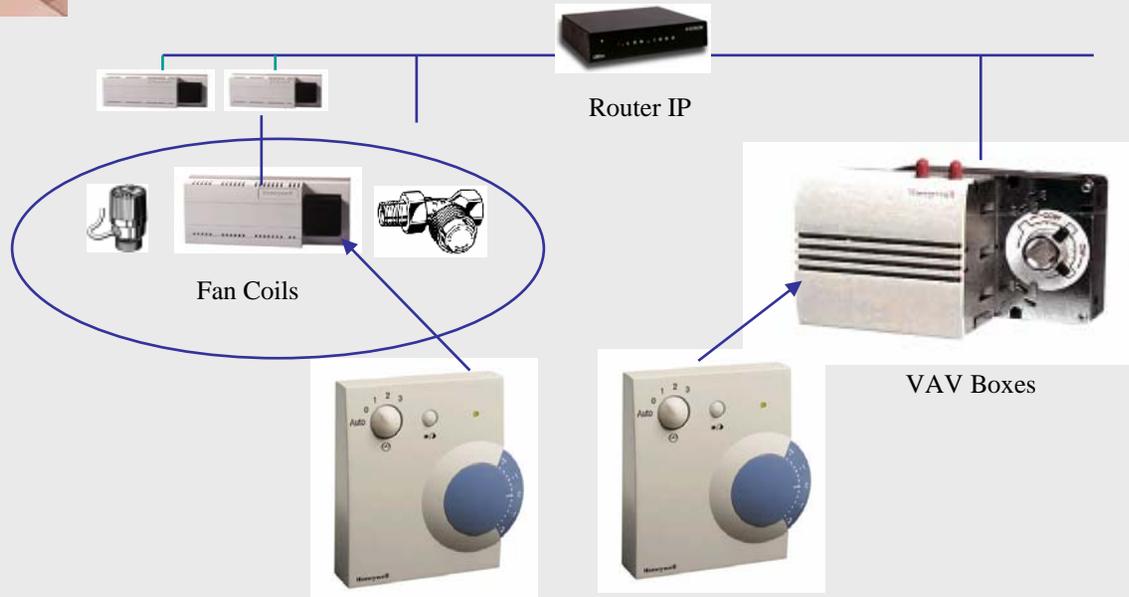
Use BAS here-Use system to determine that proper temperature and humidity control is provided to occupants

temperature, and lighting.
and underfloor HVAC

Green Credit Example: Controllability



**HVAC, Lighting, Motorized shades,
Window Status/Control**



Indoor Environmental Quality

SS	WE	EA	MR	EQ	ID
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Credit 7

1-2 Points

Credit 7 Thermal Comfort

Intent

Provide for a thermally comfortable environment that supports the productive and healthy performance of the building occupants.

Requirements

Credit 7.1 (1 point) Comply with ASHRAE Standard 55-1992, Addenda 1995 for thermal comfort standards including humidity control within established ranges per climate zone.

Credit 7.2 (1 point) Install a permanent temperature and humidity monitoring system configured to provide operators control over thermal comfort performance and effectiveness of humidification and/dehumidification systems in the building.

Use BAS here-Use system to determine that parameters are met and allow control of comfort by operators

comfort ranges and design the building envelope comfort ranges. Install and maintain a temperature and humidity monitoring system that allows the building to automatically adjust building

SS	WE	EA	MR	EQ	ID
Credit 1					

Innovation & Design Process

1-4 Points

Credit 1 Innovation in Design

Intent

To provide design teams and projects the opportunity to be awarded points for exceptional performance above requirements set by the LEED Green Building Rating System™ and/or innovative performance in Green Building categories not specifically addressed by the LEED Green Building Rating System™.

Requirements

- Credit 1.1 (1 point)** In writing, using the LEED™ Credit Equivalence process, identify the intent of the proposed innovation credit, the proposed requirement for compliance, the proposed submittals to demonstrate compliance, and the design approach used to meet the required elements.
- Credit 1.2 (1 point)** Same as Credit 1.1.
- Credit 1.3 (1 point)** Same as Credit 1.1.
- Credit 1.4 (1 point)** Same as Credit 1.1.

Technologies & Strategies

Substantially exceed a LEED™ performance credit such as energy performance or water efficiency. Apply strategies or measures that are not covered by LEED™ such as acoustic performance, education of occupants, community development, or life-cycle analysis of material choices.



Innovation and Design

As stated in the LEED Rating Systems, the intent of Innovation in Design Credit 1 is to provide design teams and projects the opportunity to be awarded points for *exceptional* performance above the requirements set by the LEED Green Building Rating System and/or *innovative* performance in green building categories not specifically addressed by LEED.

As a general rule of thumb, ID credits for *exceptional* performance are awarded for doubling the credit requirements and/or achieving the next incremental percentage threshold. For instance, an ID credit for exemplary performance in water use reduction (WE Credit 3) would require a minimum of 40% savings (20%=WE Credit 3.1; 30%=WE Credit 3.2, etc.).

ID credits for *innovative* performance are awarded for comprehensive strategies which demonstrate quantifiable environmental benefits. A representative list of innovative performance ID credits awarded to LEED certified projects is outlined below.

Educational Outreach Program	(IDc1.1 inquiry 9-24-01)
Green Housekeeping	(IDc1.1 inquiry 4-8-04)
High Volume Fly Ash	(IDc1.1 inquiry 12-6-02)
Low-Emitting Furniture & Furnishings	(AD inquiry 1-6-03; IDc1.1 inquiry 10-21-03)
Organic Landscaping / Integrated Pest Management Program	(via certification submittal)

On-going Benefits of BAS for Green Buildings

- Building Automation Systems can help maintain LEED intent through a building's life cycle
 - Weather-factored energy usage data and graphs pinpoint building performance difference over time
 - Recommissioning capabilities
 - Remote diagnostics, etc.
- BAS will help set the stage for LEED-EB Certification
 - Trending and reporting capabilities to tie into maintenance and operation of a building

Summary

- Commissioning
 - Use BAS
- Water Efficiency
 - Use BAS
- Energy system performance
 - Use BAS
- Enhance Energy strategies
 - Use BAS
- Measurement and verification
 - Use BAS
- Innovation
 - Use BAS

Use the BRAIN-BAS

CABA's
Intelligent & Integrated
Buildings Conference



FIRE

Functionality checks
Detector service
Fire, Life, Safety

SECURITY

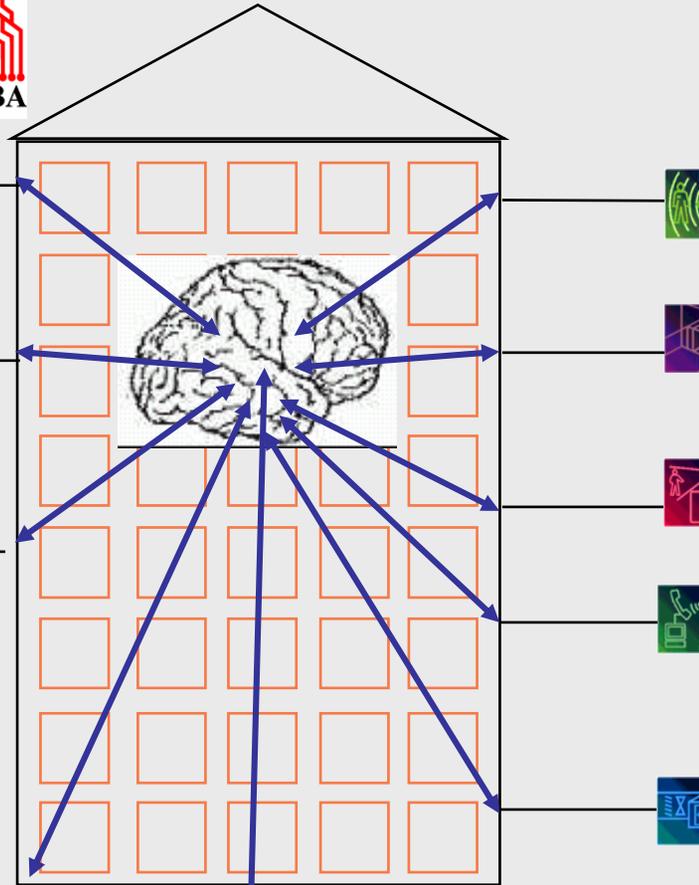
Doors
PIR
Integration
Asset Location

ACCESS

Doors
Buildings
Occupancy
Feed Forward

ENERGY

Utility Monitoring
(Elect/Water/Gas/Oil)
Tenant Billing
Air/Water
Heat
Lighting
Back-up Generation



LIGHTING

Schedules
Occupancy Sensing

LIFTS

Breakdown
Maintenance
Traffic Performance

COMMUNICATIONS

Voice/Video/Data

24/7 Monitoring

Breakdown
Plant Tuning
Conditioned Monitoring
Car Park Utilization

HVAC

Air-Handling Unit
Boilers
Pumps
Fans
Energy Control
Variable Air Volume
Air Quality

