



INTERNATIONAL AIR-CONDITIONING • HEATING • REFRIGERATING EXPOSITION

AHR EXPO[®]

January 31-February 2, 2011

Las Vegas Convention Center
Las Vegas, Nevada

Co-sponsors:



Key Technologies for our Connected Future

9:30 am Tuesday, February 1st

Jim Sinopoli PE, RCDD, LEED AP

Managing Principal,

[Smart Buildings LLC](#)

- **Ken Sinclair Publisher/Owner**

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Energy and Facility Management

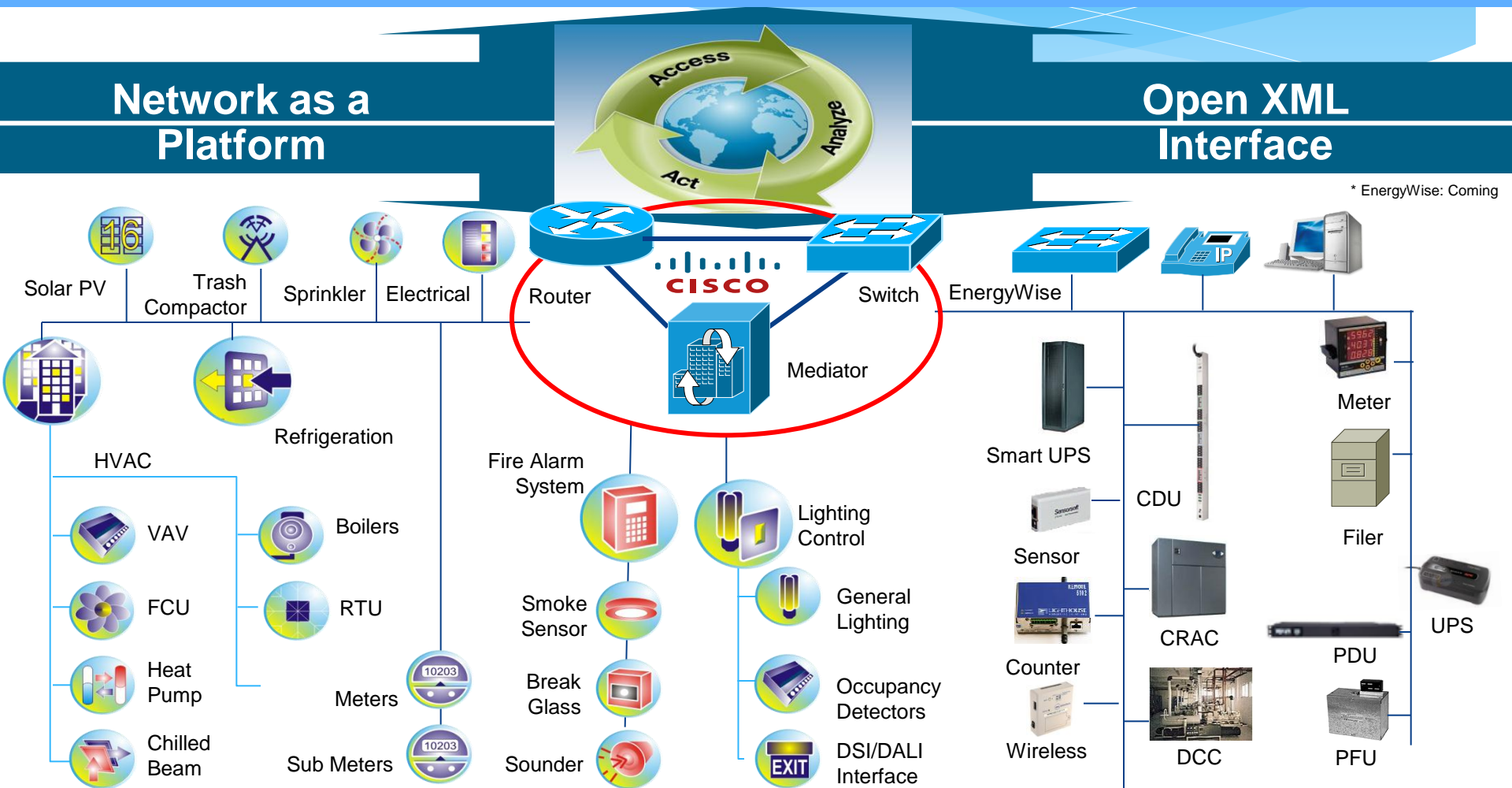
Today's Disparate Building Systems



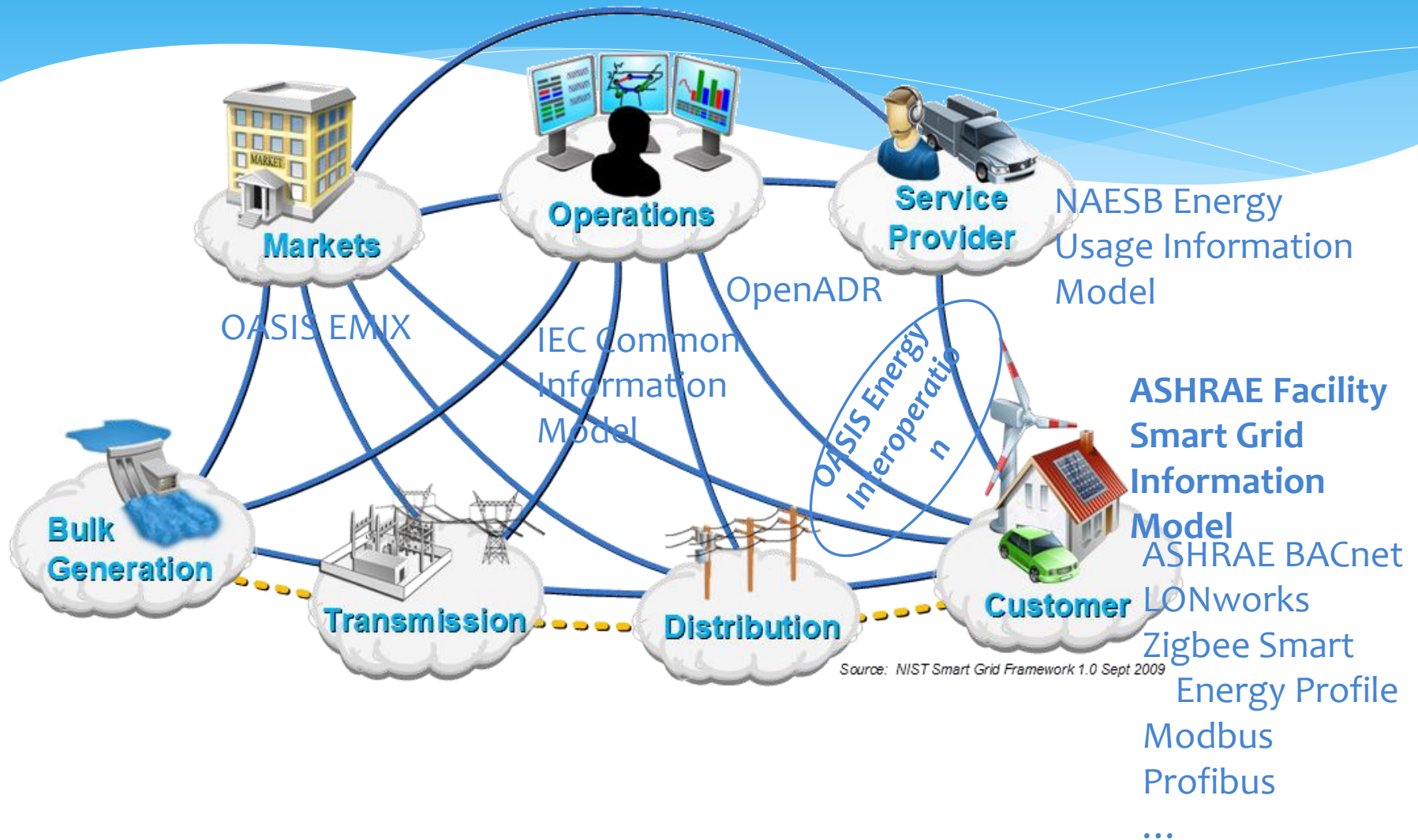
System Architecture

Enterprise or Cloud Applications:

Energy Dashboards, EEM, Demand Response, Fault Detection, Event Reporting, SmartGrid, etc.



Conceptual Model of the Smart Grid



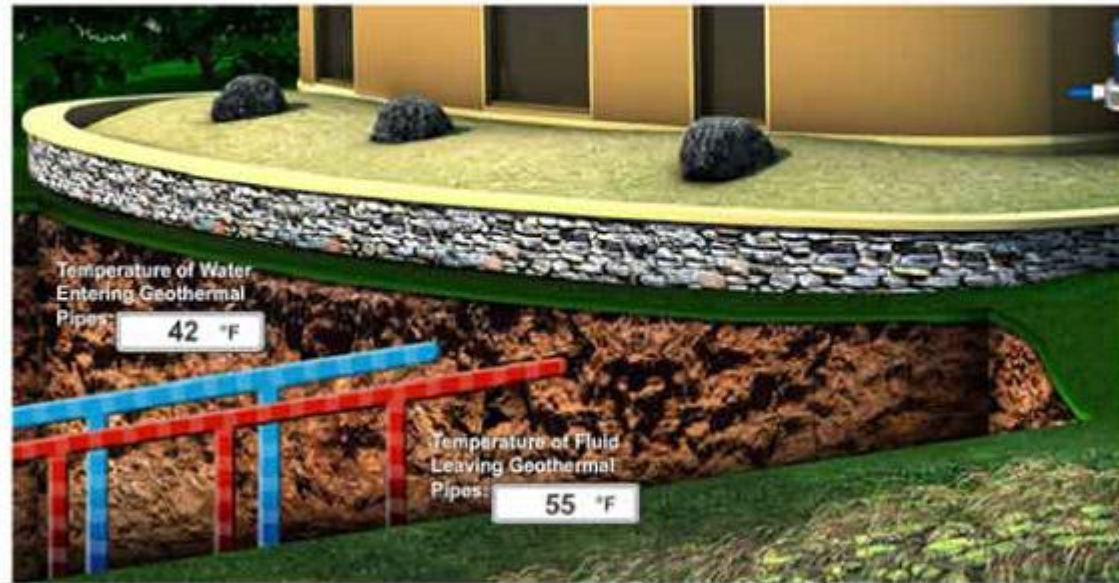
Anywhereness & Visible



GEOHERMAL SYSTEM

Touch each label below to learn more about the geothermal system in the building.

Geothermal Well Network



Temperature of Water Entering Geothermal Pipes:

42 °F

Temperature of Fluid Leaving Geothermal Pipes:

55 °F

Well Pump Speed:

36 %

Geothermal wells run underground, where the earth's temperature remains constant throughout the year. A solution circulates through the wells: before being pumped back into the building to help heat or cool, depending on the season.



Home



Green Features



Water Use



Energy

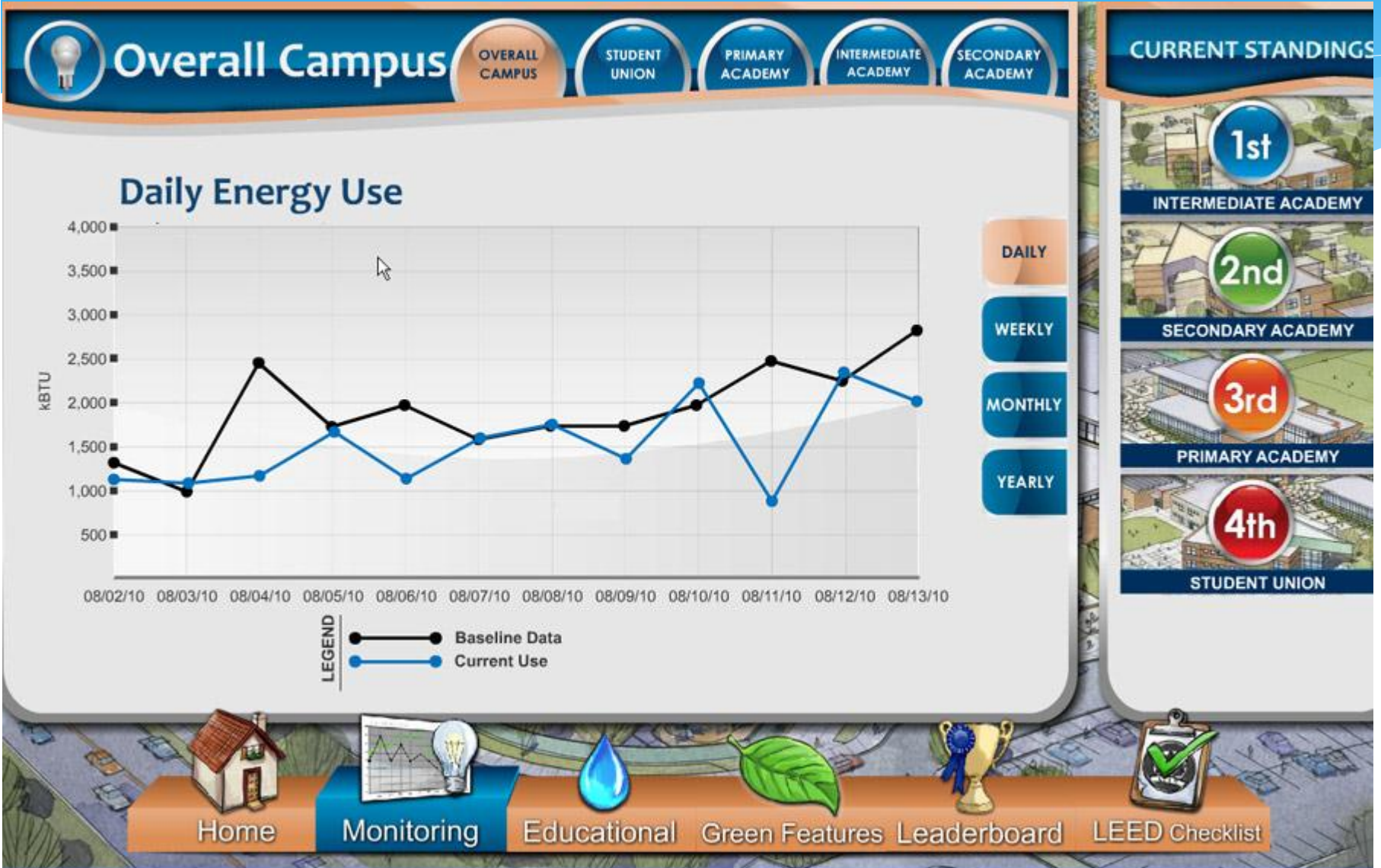


Geothermal



Weather

Invisible made visible exposes all



Continuous Connected Commissioning

- * Persistent monitoring and diagnostics of system operations directly impacts sustainable energy efficiency in commercial buildings.
- * CCC uses access to the existing Building Automation System (BAS) for this new class of analysis. The data is then used to create performance models of each piece of equipment to track actual (vs. design) operation.
- * New modeling techniques have emerged to create models that persistently **predict** actual performance
- * By leveraging these models, building operators and facility managers have a powerful means to diagnose and control component and system faults and anomalies.

Reasons Commissioning is Important

- * Energy usage. Less than optimum performance translates into inefficient energy usage, increased energy costs and higher maintenance costs.
- * Range of building technology systems. Each sub-system plus the complexities of system integration and their interdependence.
- * Operations. Small improvements in the efficiencies and effectiveness of operations, the result will be significant lifecycle cost savings.

Definitions

- * Commissioning addresses if the equipment was properly installed and whether the equipment and systems are functionally operating according to the intent of the design.
- * Continuous commissioning. Software tools (A&M, over-designed and often rather different from actual use)
- * M&V is the process of accurately measuring and verifying energy and water savings.

Value of Commissioning

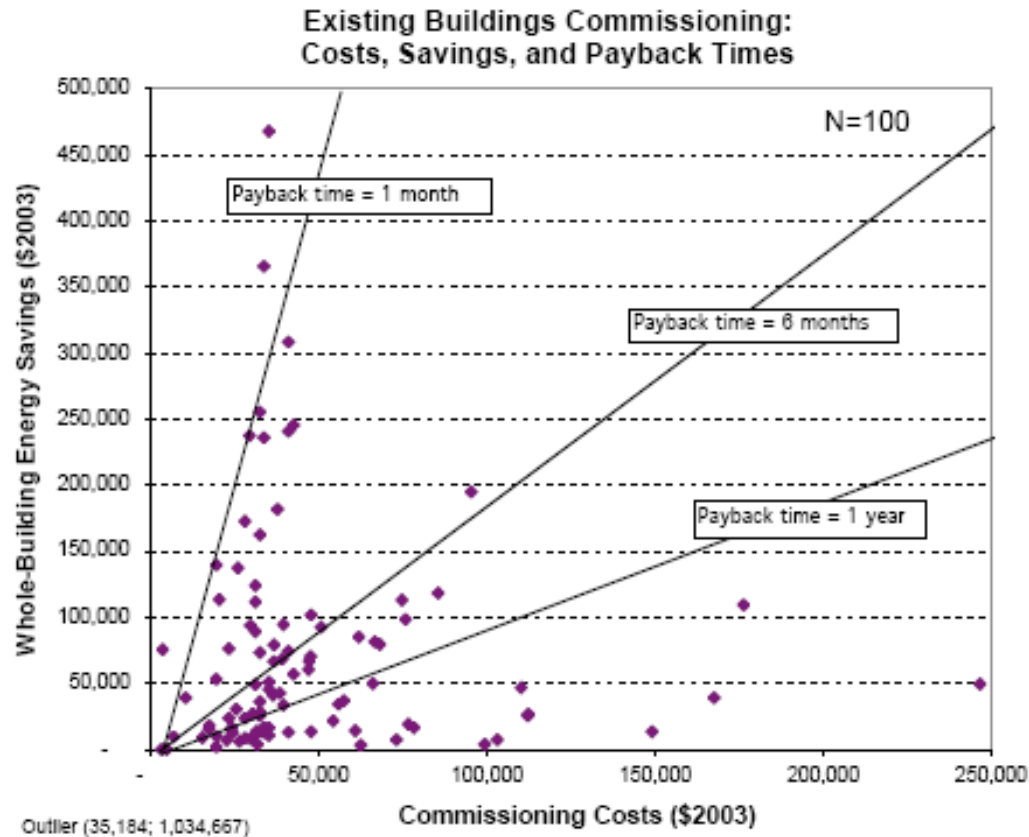
DOE Study

- * “The need for commissioning in new construction is indicated by our observation that the number of deficiencies identified in new-construction exceeds that for existing buildings by a factor of three.”

Existing Buildings – Value of Commissioning

- * Energy Savings
- * Improved O&M
- * Non Energy Benefits
- * Risk Management

Return on Investment of Commissioning

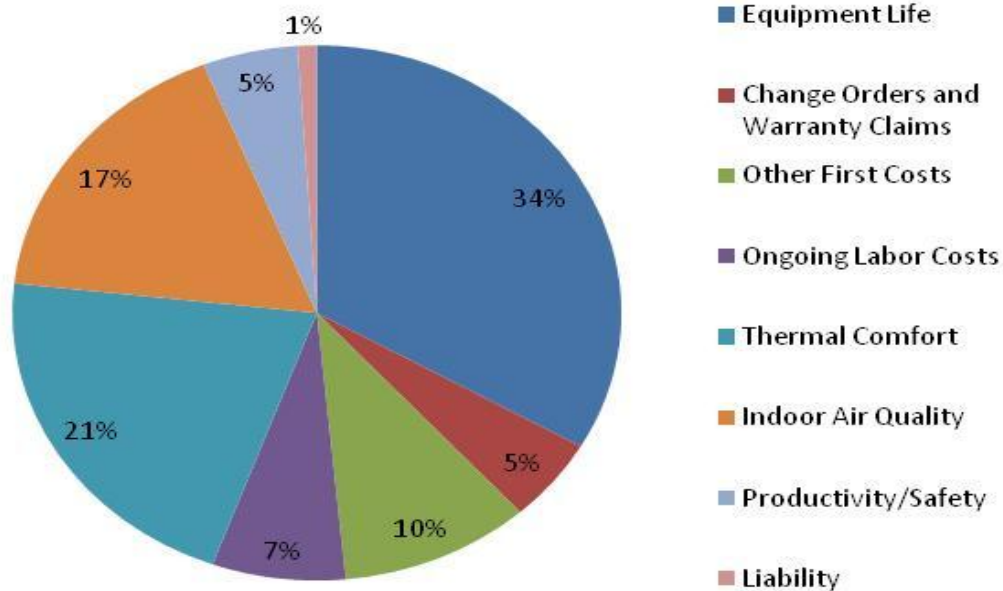


Findings from LBNL Study

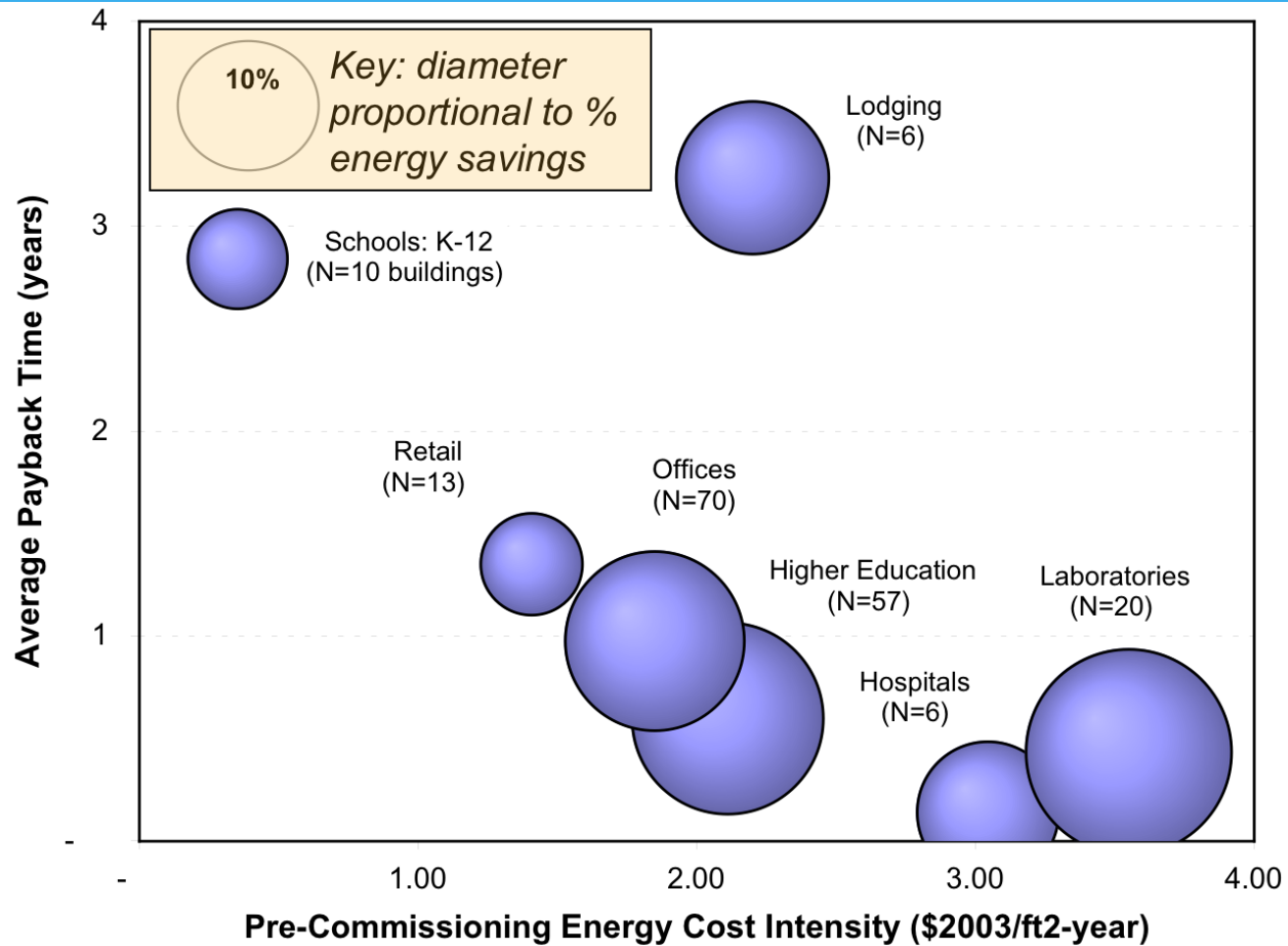
- * Existing Buildings
 - * Cx cost: \$0.27/ft² • Median NEBs: \$0.18/ft²
 - * Deficiencies: 11 per building
 - * Energy Savings: 15%
 - * Payback time: 8.5 months
- * New Construction
 - * Cx cost: \$1.00/ft² • Median NEBs: \$1.24/ft²
 - * Deficiencies: 28 per building
 - * Payback time: 4.8 years
- * Cost-effective over range of energy intensities, building types, sizes, locations
- * Most successful: energy-intensive buildings
- * Cost-effective outcomes harder in small buildings
- * Energy savings rise with more thorough commissioning

Non-Energy Impacts

Reported Non-Energy Impacts for Existing Buildings



Existing Buildings Type



Excluding non-energy impacts

LEED Considerations

APPLICABLE AREAS OF LEED NC CREDITS

* Water Efficiency

- * Irrigation Systems
- * Water Use Reduction (OC)
- * Smart meters, valves and fixtures

* Energy and Atmosphere

- * **Commissioning**
- * Energy Performance
- * Metering
- * Measurement and Verification

* Indoor Environmental Quality

- * Monitor Outdoor Air Quality
- * Controllability of Lighting, Thermal Comfort
- * Verification

* Innovation and Design Process

APPLICABLE AREAS OF LEED EB CREDITS

* Water Efficiency

- * Irrigation Systems
- * Water Performance Management
- * Smart meters, valves and fixtures
- * Cooling Tower Water Management

* Energy and Atmosphere

- * Energy Performance
- * **Commissioning**
- * Building Automation System
- * System Level Metering
- * Emissions Reduction Reporting

* Indoor Environmental Quality

- * Monitor Outdoor Air Quality
- * Controllability of Lighting, Thermal Comfort
- * Verification

* Innovation and Design Process

- * Document Sustainable Building Cost Impacts

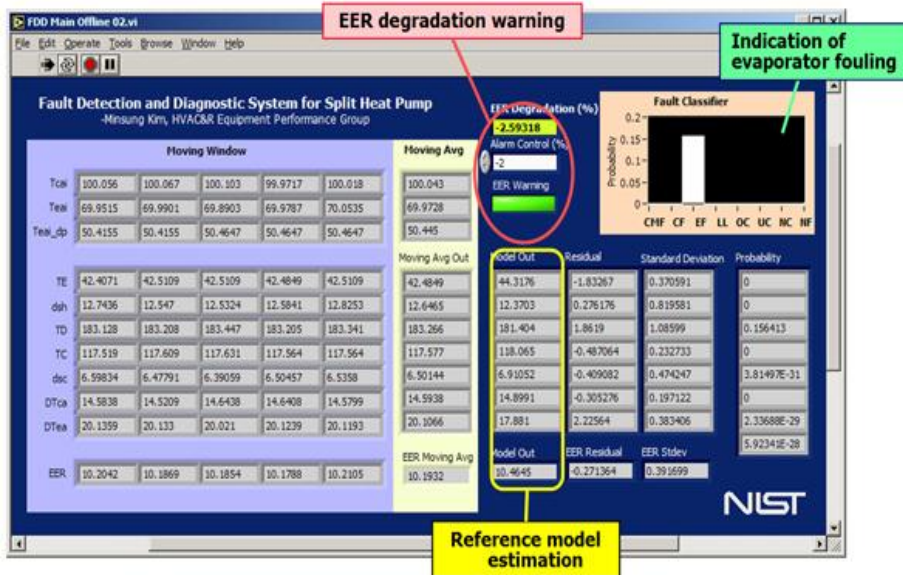
Fault Detection and Diagnostics

- * Software tools based on fault detection and diagnostics (FDD).
- * FDD focuses on HVAC systems.
- * FDD is based on research of faults in HVAC systems
- * National Institute of Standards and Technology

FDD Rules

- * Uses relationships and rules between the different equipment and processes that make up the HVAC system.
 - * A chilled water plant supplying chilled water to air handling units is a relationship
 - * Air handling units delivering supply air to terminal units are a relationship
 - * Via air or water
- * Relationships are used to collect fault reports and raw data, and then apply a set of rules.
- * Rules for the same equipment based on the state of the equipment

NIST – FDD Residential Heat Pumps



- * Residential split-system heat pumps
- * Faults
 - * Improper refrigerant charge
 - * Improper indoor airflow
 - * Incorrect outdoor airflow
 - * Flow restriction in the refrigerant liquid line
 - * Non-condensable gases in the refrigerant
 - * Reversing valve or compressor valve refrigerant leakage/bypassing
- * Fault-free and faulty performance characteristics for both heating and cooling modes.

Potential Issues

- * Lack of Data- FDD needs data from the BAS systems
- * Rules Specific To Building Systems
- * How to Handle the FDD Information
- * Using the Diagnostic Data/Work Order Systems
- * Lack Of Applications For Emerging Systems
- * Alternative Ways to Deploy FDD
- * SaaS

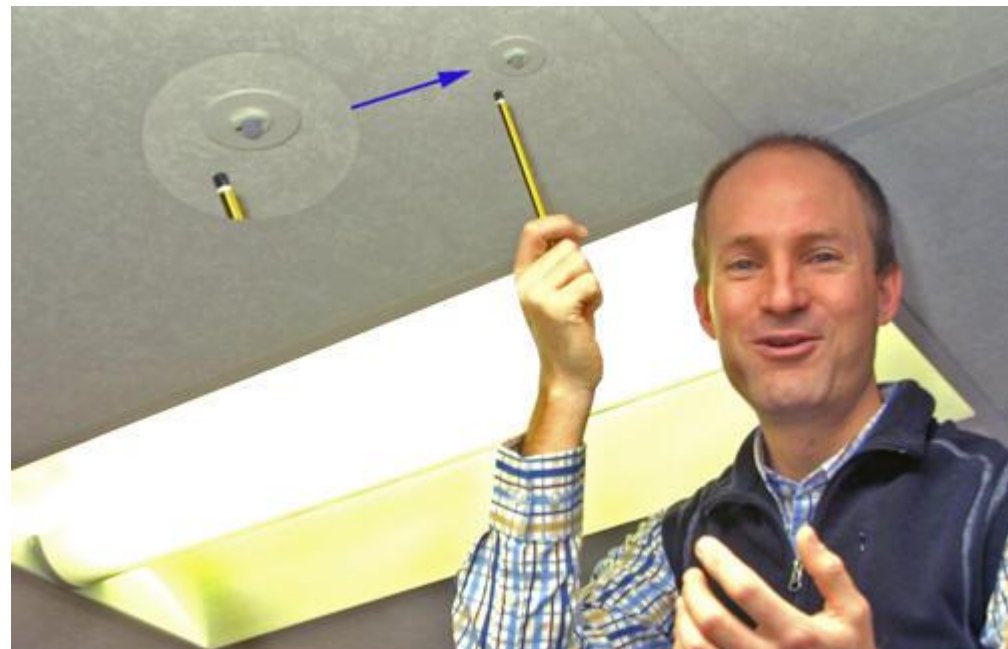
Please Enlighten your Client

- * For over two decades lighting control has typically been implemented as a stand-alone system because integration through a fragmented approach predictably fails.
- * This is in spite of the fact that; building owners want an integrated system, open protocols have been widely available for over a decade, and lighting is the single largest electrical load in most commercial buildings.
- * An industry survey of large and small BAS companies revealed that less than 6% of all BAS installations control any lighting. The primary reason for these meager results is the fragmentation of accountability.
- * You can fix this and add the necessary accountability for your client.

Energy-efficiency & Flexibility Enabled by Open Standards Addressable Ballast

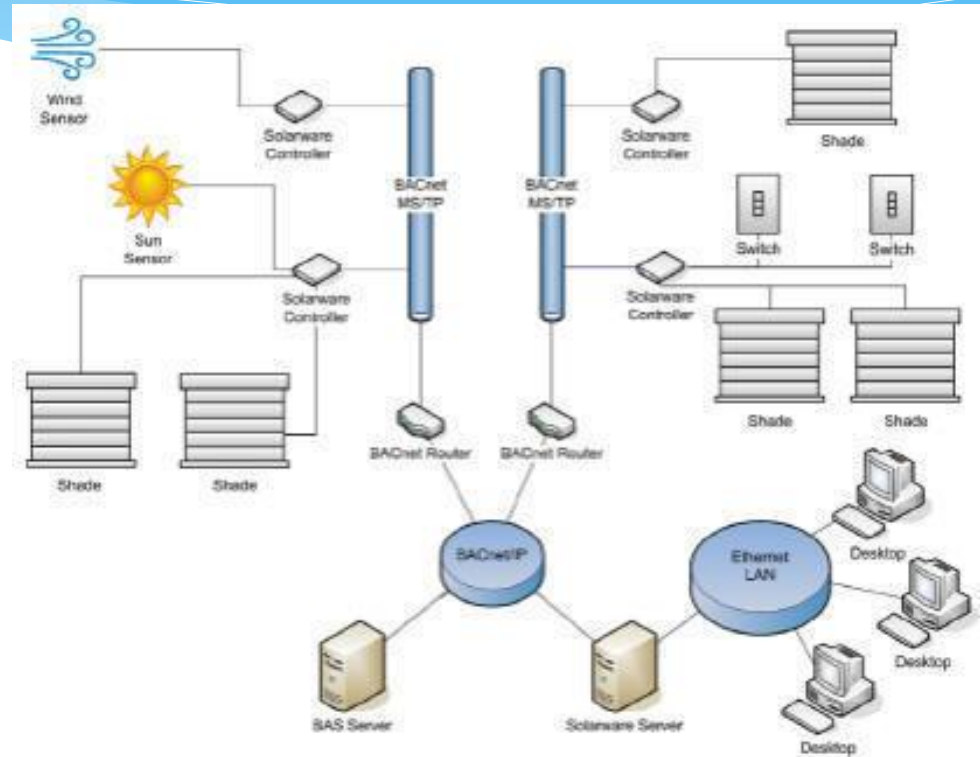
- * Open Standards greatly increase flexibility.
- * Wireless is a good solution to achieve lighting control in existing buildings.

pointing out a sensor that detects ambient light and movement enabling the light's output to be regulated.



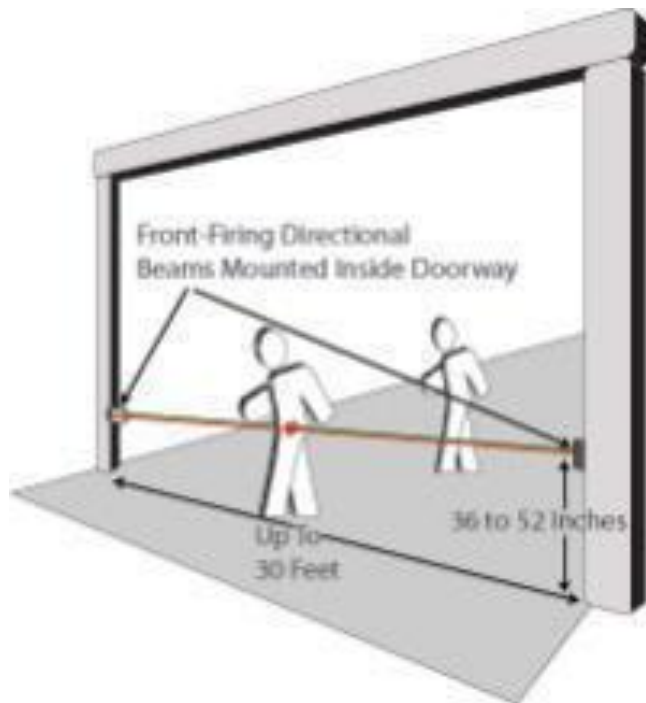
Yes we do windows as well

The comfort and productivity of the occupants is very important; not only thermal comfort but also “visual comfort” such as brightness, glare and shadows.



Gathering Occupancy Data

- * The most popular technology for counting people at the doorway appears to be thermal sensors or imaging, infrared and video analytics.



Open Information Connections

- * Does Owning the Meters Make You Smarter?
- * Only if you do smart things with them.
- * If we own the smart meter or the collection of sub-meters we no longer need to deal with other people politics.
- * We need to prove our value continuously to our client and sharing instant meter information is our vehicle.

What does this mean to me?

- * Past focus has been the network; we now must refocus on the power and reach of cloud web services.
- * More of your work will be virtual, prepare to manage this.
- * Clients are now organized vertically national and internationally, not geographically.
- * You will be part of teams not directly under your control.
- * Ease of collaboration and playing well with others will be mandatory.
- * The integrator is the cloud connector who maintains physical connections to these new areas of building analytics and advanced services.

Building Operations get Sassy in the Cloud

- * SaaS is short for Software as a Service.
- * SaaS went beyond ASP to leverage the new approaches we learned as applications moved to the web. Applications were re-crafted to expose web services to remote applications.
- * As seamless interactions with other systems became paramount, these new services co-evolved the practices now known as Service Oriented Architecture (SOA) and the Service rather than the Application became paramount.
- * SaaS was not only big in traditional applications such as Building Monitoring and Energy Management, but opened up whole new areas of building analytics and advanced services.

Energy Efficient Education Dashboard



Main Page of the ASU Campus Metabolism Showing Overall Energy Use

Focus on education about a building's efficiency.



Green Features

PREV



Carroll County Public Library
A great place to learn

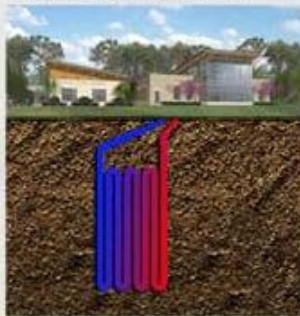
Solar Hot Water

- 20 sq foot collector plate on the roof



Geothermal Heat Pump

- 30 wells, 375 feet deep into rock and water at a constant 55 degrees
- Closed system with water
- 6 year payback (or less)



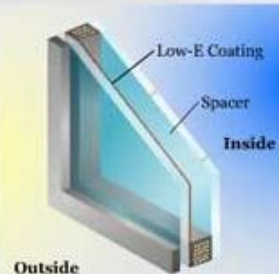
Stormwater Management

- Underground stormwater collection system
(Volume = 112,200 gallons)



Sustainable Practices

- Natural Daylight - Passive solar
- Low-E Glass - Block heat and UV rays



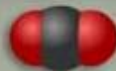
Recyclable/ Renewable Materials

- Carpet - InterfaceFLOR
- Recyclable Materials - Interior and exterior finishes and furnishes whenever possible - recycled steel
- Regionally manufactured materials - all masonry is from Maryland
- Renewable woods



Home

Green
Features



CO₂



Electricity



Solar Hot
Water



Geothermal
Heat Pump



Stormwater
Management



Weather
Monitor

What does this all mean? Show them your stuff!

We have always done great stuff but we have never had a powerful media that reaches outside of the building to the world and into the cloud... Use it the best way you can.

You must master this new art that is a “mashup” of web presentations and interactive digital signage because it carries your company’s message to a larger than ever audience.

As the messenger you will gain deeper insight into the project and the project will better understand your value.

New connections grow our existing business

- * New building construction market is at a low point.
- * Investing in existing building operations and energy efficiency of existing buildings is the new market.
- * Retrofitting our existing buildings in North America is our new market.
- * New connections to building systems previously not included in integration is job number 1.



"Smart Grid, beyond the grid"

meaning that there is a lot of opportunities outside of the traditional utility

With buildings accounting for up to 70% of electricity consumption, the reality of directly connecting building automation with the Smart Grid has tremendous value for building owners, energy suppliers and society at large. A key objective of the B2G Summit is to outline the value proposition of this opportunity to building automation and controls industry.

If you are a player in building automation and control systems, from manufacturers, integrators, contractors and consulting engineers, it is critical that you attend this Summit and hear first hand from key Smart Grid experts on business, technology and policy perspectives.

Our Education sessions; Continuously Connected Open Information for BAS - 5 AHR Expo Education sessions Las Vegas

- 1. Connecting Building Automation to Everything**
9:00 am Monday, January 31st
- 2. Continuous Commissioning and Today's Aggressive Energy Standards** - 1:30 pm Monday, January 31st
- 3. Key Technologies for our Connected Future**
9:30 am Tuesday
- 4. A Panel discussion – Incentives to Motivate and Connect our Industry**
1:30 pm Tuesday
- 5. A Panel discussion Creating Budget for Implementing Information Management** 3:00 pm Tuesday

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Gridwise Education Sessions at AHR Expo

- * **Green Buildings meet the Green Grid** 10:30-11:30am on Monday, Jan.31
- * **Building Automation, Demand Response and Next Frontier for Energy** 11:00 - 12 on Tuesday, Feb.1