Leveraging Building Automation Systems to support ongoing commissioning
Building Automation Systems

- Introduction
- Show me the money
- Critical components
- Building Automation System Architectures
- Protocols
- Data Harmonization
- Fault Detection and Diagnostics: Applying Algorithms
- I.T. Matters and The Cloud
A global multi-industrial company focused on building and enterprise systems and energy storage technologies

**Fire and Security**
Global leaders in fire safety and security products and services

**Building Efficiency**
Delivering technologies and services that increase efficiency and lower operational and energy costs in buildings.

**Power Solutions**
The world’s largest manufacturer of automotive batteries, powering nearly every type of vehicle.
Modern BAS provide critical value to building owners

Manage Occupant Comfort
- Automating controls & equipment (e.g. HVAC, lighting, chillers, roof tops, air handlers, vav boxes, etc.)
- Integration & control of other systems

Energy Management
- Intelligent sequences and routines to manage building and system energy consumption

Alert operators of facility problems
- Detect problems prior to becoming an issue.
- Alarm notification and management

Protect facility assets
- Chiller plants, HVAC and mechanical equipment, people, Fire & Security systems
- Increase facility value!

Benefits
- Automate tasks for facility managers & staff
- Optimize resources; increase effectiveness
- Lower energy and operational costs
Control Core Mechanical Systems

- Air Handlers
- Chillers
- Cooling Towers
- Boilers
- Command Central
- Rooftop Equipment
- Fan Coils
- Unit Ventilators
- VAV Boxes
Key Sub-Systems Integrations

- Data Centers
- Command Central
- Fire
- Security / Access Control
- UPS / Generators
- Lighting / Blinds
The realities for Building Operators

- Energy costs continue to increase
- Budgets continue to decrease
- Funding for staff and training continues to dry up
- Buildings are often “value engineered” for low first cost, not ongoing operating cost
- 80% of buildings are never fully commissioned
- Too much data; not enough time to evaluate it
- Building operators often have conflicting priorities.
Money left on the table

The total operating cost for a typical building can range from $5/ft² to $12/ft² depending on the size, hours of operation, facility usage.

Cost reduction potentials¹ from a proactive and continuous Analysis and Optimization solution are not limited to energy:

- Energy 8 - 20%
- O & M 5 - 10%
- Repair and Replacement 10%
- Occupant Productivity 3 - 15%

Where can you get the information to save money?

¹ National Institutes of Science and Technology
Continuous Commissioning

- What if you had an engineer who specialized in analyzing Energy, HVAC and Building Automation Systems?

- What if he was there everyday, 24/7, looking at all the data, comparing it to the HVAC manufacturers’ specification, NIST and ASHRAE standards for HVAC systems and energy usage?

- What if he reviewed the data against the original facility design documents and compared those to the current building occupancy and usage?

- And, you didn’t have to set aside leave time, sick time, retirement pay...???
Continuous Commissioning
Continuous Commissioning

- Continuous Commissioning is a comprehensive, ongoing process to identify and resolve operating problems, improve comfort, and optimize energy use.

- It is a “service marked” term that was developed out of Texas A&M and adopted by FEMP.

- The process focuses on improving overall system control and operations for the building as it is currently used, not simply to original design parameters.
Industry Facts - Continuous Commissioning

*Continuous Commissioning is built on a foundation of ongoing monitoring, expert analysis, and optimization.*

**Key elements include:**

- Developing monitoring and measurement methodologies
- Getting meaningful system data
- Evaluating and improving operational and control schedules, set points and optimization strategies to meet user needs
- Continuously analyzing potential performance changes and energy saving opportunities
- Performing engineering analyses of the system changes
- Reporting and tracking results from actions taken
Critical components and enablers

- Documented systems, sequence of operations, building current use
- IP / IT connectivity, knowledge, and support
- Open protocols, point naming conventions, and data definitions
- Data sufficiency; co-temporal data harmonization and analysis
- HVAC/BAS Intelligent algorithms and filters
- Monetization of findings
- Organizations with the resources to develop/deploy/implement
- Organizations with the resources to address findings
System Architecture

**Browsers**
- User interface
  - View / interact with system from tablet, computer, or smartphone via web browser

**Field Controllers**
- Intelligent, stand-alone devices
- Execute control algorithms and routines
- Report current values, receive supervisory commands to/from Network Controllers
- Connect to & control mechanical & electrical systems (HVAC, lighting, power, etc.)

**Network Controllers**
- Supervisory control & coordinate field controllers
- Scheduling, Alarming, Trending
- Global management strategies
- User interface via web browser

**BAS Servers**
- UI Servers
- For storing data (schedules, alarms)
- Provide reporting features

**Servers**
- UI Servers
  - For storing data (schedules, alarms)
  - Provide reporting features

**Proprietary**, **LonTalk**, **BACnet MS/TP**

**Building LAN/WAN (Ethernet)**
Network Controllers

Supervisory Functions
- Integrate field controllers
- Alarm detection
- Scheduling
- Trends (short-term storage)
- Global control strategies
- Optimal stop/start
- BACnet IP integration
- BACnet MS/TP integration
- Modbus integration

On Board User Interface

On Board Tools

Provide supervisory control and monitoring of field controllers, and bring information to BAS server
I.T. Integration

Maintenance Center

Internet / VPN

TCP/IP BAS Ethernet VLAN

Building I.T. IP SWITCH / ROUTER

Site IT/ PC Equipment

BAS Server

Browser Interface

Control, Status, Schedules Trends, and Alarm Data from HVAC, meters, and other equipment
BAS sharing IT Infrastructure

Building with BAS

IT Router and Firewall

Buildings with BAS

Buildings with other BAS

BMS VLAN

IT network and PC's

IT Infrastructure

IT network and PC's

BMS VLAN

Operator Interface

Central Utilities

BAS Servers

Other BAS Sites

HVAC equipment Energy Management, Monitoring and Control

Air Conditioning and Ventilation Control.

Interior and Exterior Lighting Control

IT infrastructure and PC's

Buildings without BAS

IT Infrastructure

IT network and PC's

Other BAS
graphics dashboards and navigation
Management information

Enterprise Applications present a **bridge** between the data available in energy management and control systems and corporate management objectives.

- Shareholders
- Corporate Mgmt
- Plant Mgmt
- Production Mgrs
- Plant Engineers
- Supervisors
- Operators
Enterprise Optimization Applications

Dashboards
- Enterprise Dashboard
- Green Kiosk Dashboard
- Operations Dashboard
- Tenant Energy Dashboard

Portal
- Enterprise Portal

Analysis Tools
- Meter Analysis Tool
- Fault Analysis Tool
- Work Order Analysis Tool
- LEAN Analysis Tool
- Workplace Analysis Tool
- Connected Services
- Connected Services Mobile
- Reporting Tool
Open IT architecture

Metasys Enterprise Optimization Applications

- Green Kiosk Dashboard
- Meter Analysis Tool
- Fault Analysis Tool
- Operations Dashboard
- Work Order Management

Business Applications
- Project Management Systems
- Sustainability Reporting
- Real Estate Management
- Work Order / Work Ticket Systems
- Financial Systems
- ERP Systems
- IBM Cognos
- Tivoli Software
- Hitachi Consulting
- Oracle
- Business Objects

Data Management
- Facility-related data from the network
- Weather
- Utilities
- Work Order
- Client-specific
- Data Analytics
- Data Warehouse
- Processed facility data available through standard queries and API's
- Aggregation • Normalization • Classification

Meters & HVAC Equipment

[+other monitored assets]
- e.g. Data Center: PDU, UPS, Generator, Tank, inlet/outlet, temperature, CPU utilization, etc.

Building Data Integration

Building Automation

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Meter Analysis Tool – What is my overall energy performance?
Identifying issues

Excessive outside air

![Graph showing actual and design minimum outside air fraction for different air handling units.](image-url)
Fault Analysis Tool – Where should I focus my team’s attention?
Fault Analysis Tool – Select additional rules, or write your own rules
Operations Dashboard – Convert faults to work orders

Claimed events are automatically searched for open work orders at that site if the Operations Dashboard has been integrated with a Work Order system. Remote operators review the information and make decisions on resolution – with the option to queue up a new work order.
Operations Dashboard – Convert faults to work orders

Scrolling the down in the claimed event window exposes the history and conditions leading the the event in order to aid in the analysis by the operator.
Converting Data to Insights

Enterprise Dashboard Application

**Reporting**

**Analysis**

**Optimization**

Utility spend – roll up by meter, building, tenant, and portfolio.

“What are my energy costs and how do they compare?”
Converting Data to Insights

Facility Performance Dashboard

Reporting

Analysis

Optimization

HVAC Systems Performance
Performance tracking of HVAC equipment and systems with generated alerts for persistent issues.

“How are my HVAC systems performing in the central plant and in individual buildings?”
Benefits to Building Operators

- Lower Energy Costs
- Increase Occupant Comfort
- Support Business Decisions
- Support Regulatory Programs
- Optimize Service Consolidation
- Lower Operating and Maintenance Costs
- Lower Repair/Replacement Costs.
Big Data from BAS. Anyone interested?

Google to Acquire Nest

MOUNTAIN VIEW, CA – JANUARY 13, 2014 — Google Inc. (NASDAQ: GOOG) announced today that it has entered into an agreement to buy Nest Labs, Inc. for $3.2 billion in cash.

This is a momentous day for me, for Matt and for all of the Nest family. This afternoon, we announced that we will be acquired by Google.
“The future has already happened - it’s just not evenly distributed yet “

William Gibson
Questions

Thank You