Automated Facility Energy Management

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STRATEGY

Fully Integrated,
Multiple Facility,
Building Automation System

- **Personal Comfort**
- **Energy Efficiency**
- **Reduced Expenses**

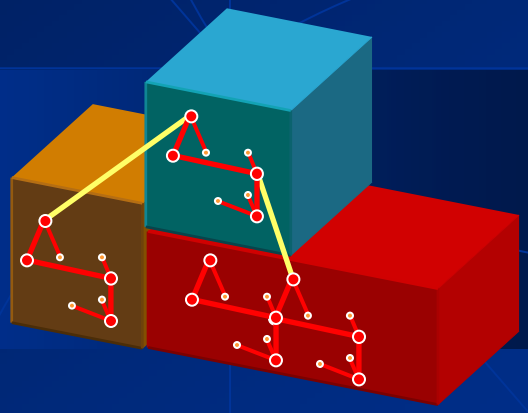
VISION

Clusters of buildings aggregated and managed as a *Single Facility*,

by an intelligent computer network that optimizes comfort and energy costs in response to occupant needs, equipment performance, and energy price signals;

and alerts and debriefs O&M personnel whenever intervention would be beneficial.

BENEFITS



- Extended energy manager reach and influence
- Reduced energy consumption and costs
- Lower power demand and charges
- Aggregated energy purchasing power
- Minimally invasive emergency response
- Improved indoor environmental quality
- Increased productivity of facilities staff

Today's Situation

- Commissioning rarely happens
- Building design doesn't match actual usage
- Run-to-failure prevails
- Service life is severely compromised
- Energy is wasted throughout the reduced system life

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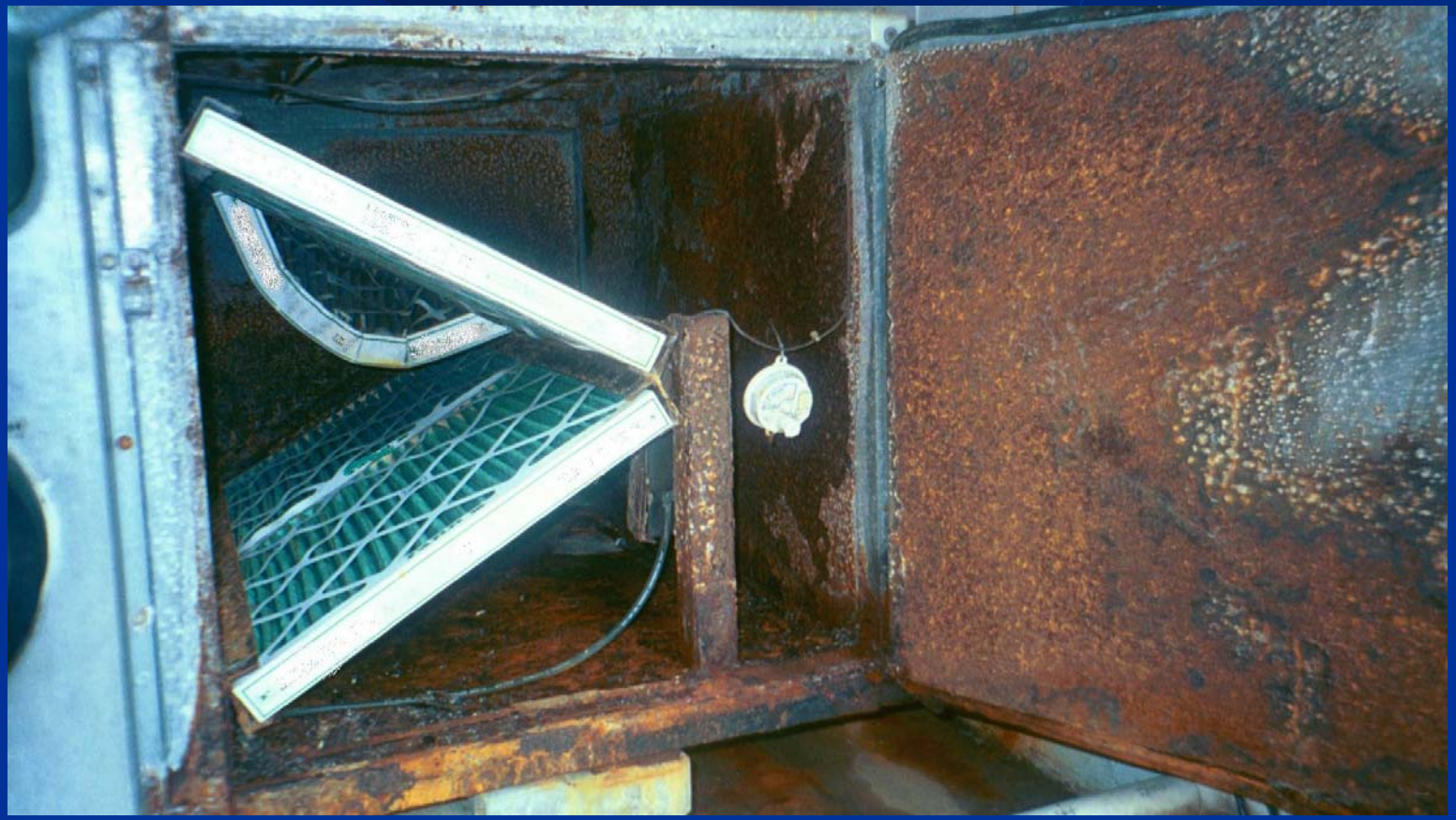
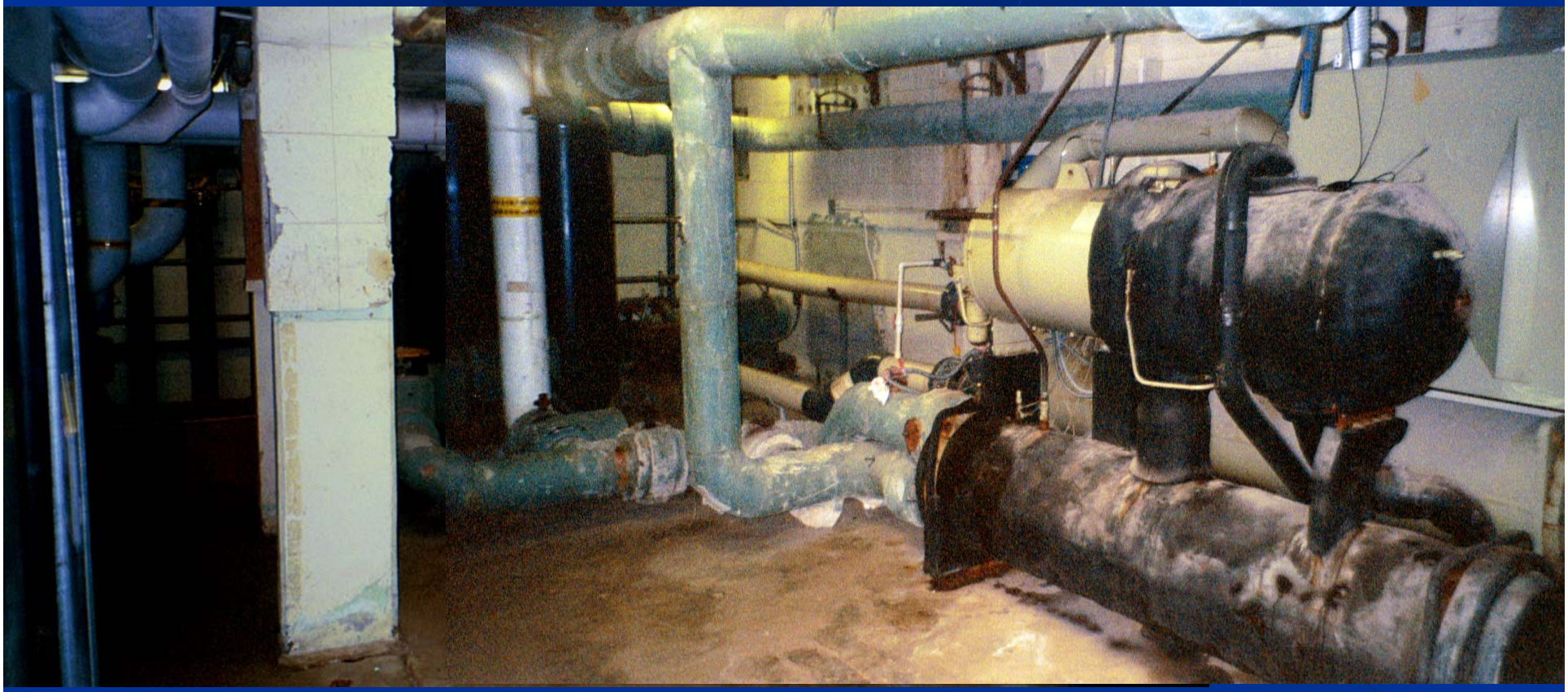


Today's Situation



Today's Situation

Most buildings are essentially unsupervised

- Energy Management functions are limited by distances
- Problems go undetected until failure occurs
  - "Emergency" O&M is the normal modus operandi
  - Cannot curtail loads or defuse power emergencies
  - Power quality is not monitored or managed
- Incompatible proprietary systems from many vendors
  - No capability to track energy efficiency (other than bills)
  - Little or no interconnection between buildings
  - No capability to optimize comfort and energy use

How Did We Get Here?

- Numerous designers and design approaches
- Primary system / equipment selection criteria is usually *low first-cost*
- O&M staff concentrated at large buildings and HQ
- Controls typically not upgraded to keep pace with technology, vendors don't support legacy systems, many are non-functional, operate in manual override
- Energy O&M is only a fraction of facility manager's responsibility
  - Usually lower priority than mission-oriented tasks

How Did We Get Here?

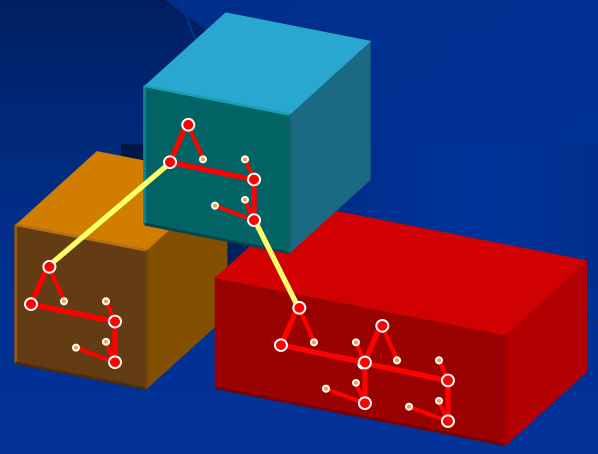
- Most energy audits biased towards replacement: it is easier to simply replace one with another one, not people-dependent
- Optimal O&M requires a more intense approach, is harder to implement, and needs lots of data.
- About half of Federal O&M at is contracted out
  - No performance-based incentives
  - Typical contract term is 3 to 5+ years

Where can Automation take us?

- Enable one person to monitor and manage virtually every system in many buildings from his/her desk
  - Simplified non-technical graphical user interface
  - Software learns and automates repetitive actions
  - Required staff time is minimized
- **Automatically take action** without involving facilities staff whenever possible
- **Automatically reach the best compromise** between environmental conditions and energy use

When can we go?

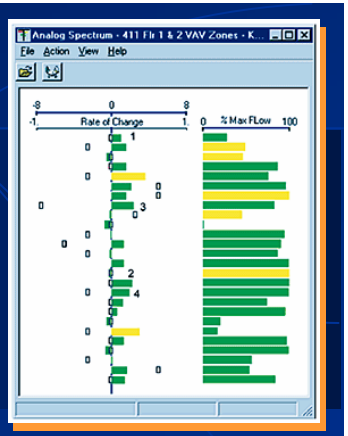
- Feasible *now* by integrating current EMCS products
  - Web server based system with TCP/IP and XML
  - Utilization of web browser allows local control via PLC
  - Use existing facility Ethernet LAN, VPN, and/or Internet
  - EMCS bandwidth usage is extremely small
  - LonWorks, BACnet, and/or MODBus components



Integrated BAS Functionality

- Monitoring HVAC Equipment
- Facility Operations
- Enterprise Energy Management

Monitoring HVAC Equipment

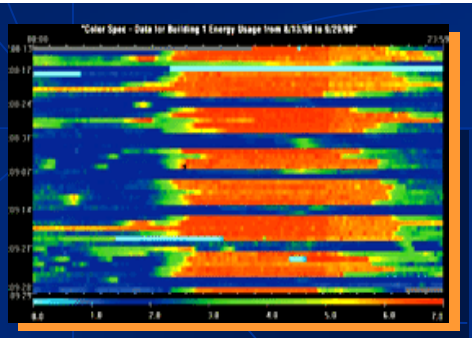


- Monitoring typically means manual sensor readings and looking for abnormal conditions.
- *Checking HVAC equipment operation should be done routinely.* In reality, such tasks are left for mythical slow times, and are usually skipped for weeks or months. Degrading performance is the result.
- An automated BAS condenses and prioritizes data, highlights conditions that need attention from an operator, makes contact via e-mail or cell phone, and provides a debrief on the condition and corrections.

Facility Operations

- Operation and service are typically done in a reactive manner in response to comfort complaints.
- Response involves diagnosing the problem and making manual adjustments and/or repairs.
- An automated BAS anticipates equipment failure from trends and historical data. A consolidated report of relevant values expedites troubleshooting decisions.

Enterprise Energy Management



- Support of Energy Purchasing
  - An aggregate load is presented to utility company as one meter to qualify for lower rates and leverage negotiations
  - Needs forecasting allows buyers to take advantage of lower day-ahead and hour-ahead energy rates
- Benchmarking and Monitoring Energy Usage
  - Automated verification of utility bill's complex rate tiers
  - Ranking and comparison of buildings by type, usage, etc.
  - Easy identification of potential savings opportunities
- Demand Limiting and Load Shedding
  - Load curtailment spread over many buildings so that any changes go unnoticed by occupants

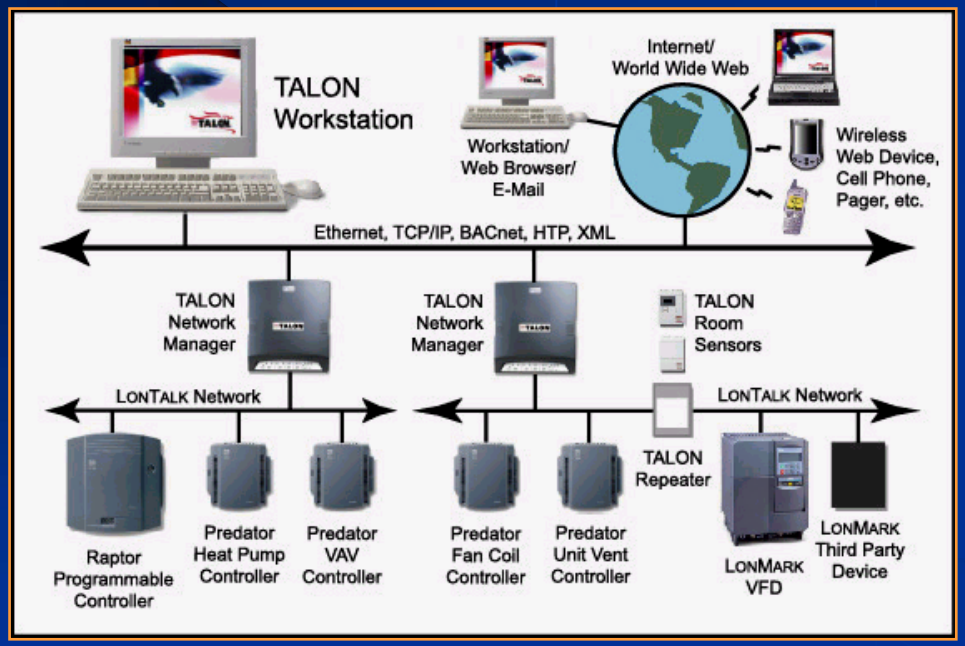
The Energy Industry is Changing

- Trading and hedging energy, power, and transmission is becoming increasingly common
  - 34% of wholesale power was traded in 2002. This figure will reach 90% by 2008.
- More differential between off-peak and on-peak rates
  - For example, PEPCO (MD) off-peak rates averaged $0.02/kWh while on-peak rates reached $0.19/kWh.
- Distributed power generation is becoming a reality
  - Facilities are being paid premium rates to generate and/or curtail load during on-peak times.

Taking advantage of the new energy market requires sophisticated BAS capabilities.

Hardware Basis

INTERFACES TO EXISTING CONTROL SYSTEMS



KEY POINTS

Integrated Building Automation System

- Links Systems and Buildings
  - Thermal Comfort, Energy Efficiency, Reduced Expenses
- Applies Computer Power to O&M
- Cross-Functional
  - HVAC Equipment Monitoring
  - Facility Operations
  - Enterprise Energy Management

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Thank you!

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