Evolution Of Facility Management Systems

Stephen Mitchell King Kullen
John Wallace Retail Solutions
Discussion Topics

• Introduction & History Of Facility Management Systems
• Control Strategies By Geographic Locations
• Supermarket End User Experience
• Key Elements Of Next Generation Facility Management Systems
Early Refrigeration & HVAC Systems
Essence Of Simplicity

Refrigeration System

HVAC System

Things Were Simple Then!

1900’s  1940’s-1970’s  1970’s-1990’s  1990’s-2010’s
Systems Evolved With Emphasis On Mechanical Controls

- Early Refrigeration Systems Transitioned From “Refrigerators” To Rack Based Systems
- Typically Mechanical Control Systems Operating Independently
  - Defrost Time Clocks
  - Thermostats
- No “Cross System” Integration Or Optimization
- No Temperature Monitoring
Technology & Regulatory Concerns Drive Improvements in Systems and Better Control

- Advances in sensing technology & electronics enable cost-effective electronic controls
- Electronics platforms enable improved control & optimizations for energy and maintenance
- Regulatory drivers force energy & refrigerant considerations
- Case temperature monitoring for food safety considerations

1900’s 1950’s 2000’s
“Islands Of Control” Integrated To Complete Facility Management

- Individual Systems Tied Together
- Information Sharing Across Systems
- Emergence of “Supervisory Functions” (Data Logging, Alarms, etc.)
- Unified Remote Access Provides Facility Visibility And Enterprise Data Feed
- System & Point Alarming

Connecting The “Islands”

1900’s 1950’s 2000’s
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Centralized Control Concentrates Controls Functions

- Control Elements At Refrigeration Rack Or Electrical Panel
- "Home Runs" For Sensors
- Separate Electrical Circuits For Loads
Distributed Control Places Control Close To Loads Being Controlled

- Control Elements At Case
- Communication “Daisy Chain” To Supervisory System
- Load Control At Refrigeration Case
Predominant Control Architecture Varies By Region: CO2 Impacting Future
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King Kullen Grocery Co.

Headquarters: Bethpage, N.Y.

Top Executives: Bernard D. Kennedy and Ronald Conklin, co-chairs

Privately Held By The Cullen Family

Number of Stores: 46

Founded: 1930
“America’s First Supermarket”
Website: www.kingkullen.com

Supermarket News Top 50 Small Chains & Independents- #9

Note: King Kullen operates 42 stores under the King Kullen banner and four as Wild by Nature
Control History

• Suction Control
  – The Installation Of Electronic Pressure Controls
  – The Ability To Raise Suction Pressure Closer To The Needs Of The Fixtures.

• Back to Basics
  – Instituted A Comprehensive Case Cleaning
  – Restarted And Tuned Each Case
  – Secure Expansion Valves, Leak Checking, And Adjust Super Heat

• Training
  – Seminars & Broad Knowledge Of Control Strategy Key
  – Need To Ensure Technicians Maximize Value Of Investment

• Point The Blame
  – Avoid Tendency To Assume “New” Responsible For All Issues
  – Requires Buy In From Technicians
Control History

• Conclusion
  – Energy Savings
  – Less Wear And Tear On The Compressors
  – Less Iced Up Cases
  – Less Oil Failures And Less Flooding.
  – The Need And Importance Of Superheat
Case Control: A Great Solution To Maintain Superheat

- Superheat Maintained By Electronic Expansion Valve (EEV) Control In Each Case Has Many Benefits
  - Constant Super Heat Control (Real Time)
  - Lowering Discharge Pressures.
  - Ability To Control Fixtures, Temperature, And Outputs.
  - Enables Loop Piping, Control Wiring, Line Voltage Wiring, And Low Voltage Wiring At Fixture Level

- Outputs For Medium Temperature Controls
  - Temperature
  - Defrost
  - Superheat
  - Lights

Case Control With EEV
Case Control

- Low Temperature Fixtures Controls
  - Temperature
  - Superheat
  - Lights
  - Fans
  - Anti-sweats
  - Defrost (Electric)

- Integrated Temperature Alarming

- Case Control Alarming
  - Temperature Display (The Controller Sees The Same Temperature As Store Level)
Designing Case Control

• Refrigeration Design
  – Know What You Want
  – Build A Team With The Case Manufacturer, The Control Manufacturer, Your Refrigeration Engineer, And Your Electrical Engineer.
  – Don’t Just Tell Your Team You Want Case Control, Show Them. Discuss Every Aspect.
  – Make Sure All Plans Show:
    • Network Looping
    • Controller Addresses
    • Transducer Locations
  – Hold All Contractors To A Rigid Disciplinary Action To Follow These Plans With Absolutely NO Deviation.
  – When The Store Is Still In The Planning Stages, Start Designing Your Training Program For The Mechanics That Have To Work On It (Make Sure Everyone On This Team Knows How And What You Would Like To Control.
Case Control Value Story

Savings
- Electrical Installation
- Piping & Refrigerant
- Maintenance & Leak Reduction
- Energy

Cost
- Increased Equipment Cost

First Cost Savings 10-15%; Ongoing Energy & Maintenance Savings
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1. Building Energy Management Hits The Cloud
2. Co-opetition Is On The Rise In The Building Industry
3. Targeted Acquisitions Help Key Players Deliver Energy Services
4. Demand For Smart Building Products Will Soar (China)
5. US Energy Companies (ESCOs) Turn To Federal Sector
6. Building Communications Protocols Are Converging
7. Demand Response Is Shifting Into Automatic Submeters Find New Opportunities In Smarter Buildings
8. Building Information Modeling (BIM) Is Transforming The Design Process
9. The Interface Between Smart Building And The Smart Grid Is Blurring

From Pike Research Report published 2012
Trends Drive 4 Key Areas

1. User Interface & Usability
2. Communication & Integration
3. Cloud Connectivity
4. Extensibility And Applications
Web Expectations Drive User Experience

- Web Technologies Drive Standards For All UI’s
  - Web & Mobile Expectations

- Importance Of “View Anywhere” Capabilities

- Personalized UI - Role Based Reduces Information Overload

- Increasing Use Of Charts And Graphics To Simplify Information

- Enterprise User Management Simplifies Administration

- Single View Across All Areas Of Facility

Site Information Portal
“IT Friendly” Will Be The Rule
- Internet, M2M and Other Technologies Drive Best Practices

Top Level Sub-System Integration Will Drive Interoperability
- Not A Single Protocol (i.e. BACNet, Echelon, etc.)

Wireless Technology Will Drive Installation Costs Down
- Additional Sensors & Data
- Flexibility In Installation
The Blurry Line Between A Site And The Cloud

• Advanced Network Capabilities Create Seamless Cloud/Site Interface
• “Cloud” Applications Extend Capability In Seamless Manner
  – Data Storage, Enterprise Management
  – Building/Enterprise Analytics
• Provisioning & Controller Management Automates:
  – Firmware Updates
  – User Management
  – License Management
• Enterprise Analytics
  – Enable “Big Data” Analysis & Actions
Extensibility: “Value Add” Capabilities Build Onto Base Functionality

- Modular Architecture Enables Flexibility
- Allows Systems To Be Adapted To Specific Requirements
- Automated Provisioning Manages Complexity
- Local Algorithms Manage Complex Data Analysis
- Enterprise “Roll Ups”
Extensibility: Managing The Changing Energy Landscape

• Smart Grid Beginning To Drive Automated Demand Response
  – Automatic DR Provides Direct Connection From Utility To Loads
  – CA OpenADR Protocol Standard Gaining Acceptance

• Automated Energy Analysis With Normalization To Key Drivers

• Supporting LEED Accreditation
  – Submeters On Key Loads
Extensibility: Diagnostics & Health Metrics

Aggregation Across Systems Creates Site Metric That Can Be Compared Across Sites

Aggregation Across Components To Form System Health

Algorithms Analyze Performance And Create “Health” Indicator
Questions?
Definitions

- **Facility Management Systems (AKA Building Management System (BMS), Energy Management System (EMS), Building Automation System (BAS))**
  - Combination Of Hardware & Software For Control Of All Major Subsystems (i.e. HVAC, Refr, Lighting, etc.) At A Site

- **Supervisory System**
  - Hardware/Software With Capabilities For Communication To Other Systems To Perform Data Logging, Alarm Management, Remote Access Functions For All Systems

- **Control Systems**
  - Hardware/Software For Controlling A System; Part Of A Facility Management System

- **Distributed Control**
  - Elements Of Control Pushed To Dedicated Hardware; Typically Single Purpose (or single subsystem)

- **Central Control**
  - Control Elements Concentrated With Other Functions

- **Case Control**
  - Dedicated Hardware With Sensors/Outputs To Control A Refrigeration Case