BACnet and Total Environmental Control
Fulfilling the Promise of Building Automation Systems

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Introductions

• VP of Sales & Marketing
  – Over 20 Years in Controls Industry
  – Started with Company in 1999
  – Based in Northern California

• Volunteer for over 10 Years
  – Board of Directors Since 2015
  – Marketing Committee Member
  – Former Marketing Committee Chair
Session Objectives

• Discuss how BACnet is changing the BAS landscape
  – Open Source vs. Proprietary

• Review Total Environmental Control Concept
  – Occupant vs. Scheduled Based Strategies
  – Comfort & Coolness

• Energy Code Update & Additional Motivations
  – Why?
Fulfilling The Promise of BAS

• BACnet Unifies Discrete Building Systems
  – Temperature Controls
  – Lighting Controls
  – Access Control/Fire/Security/Elevators/Irrigation...

• Environmental Control
  – Increased Comfort
  – Increased Productivity
  – Increased Energy Savings
Total Environmental Control

• TEC Means Moving Beyond Traditional Approach
  – Temperature
  – Humidity
  – Indoor Air Quality

Due to the inverse relationship between costs and comfort in HVAC systems, occupant input (choice) is limited.
Total Environmental Control

• Expanding TEC to Include Lighting Environment
  – Light Intensity (Task Oriented Lighting Level)
  – Light Color (Circadian Rhythm, Comfort)
  – Light Usage (Daylight Harvesting)

Light level is directly correlated with energy savings, allowing for more occupant input.
Circadian Rhythm Cycle

- Highest alertness: 10:00
- Highest testosterone secretion: 10:00
- Bowel movement likely: 09:00
- Melatonin secretion stops: 07:30
- Sharpest rise in blood pressure: 06:45
- Lowest body temperature: 04:30
- Deepest sleep: 02:00
- Noontime: 12:00
- Best coordination: 14:30
- Fastest reaction time: 15:30
- Greatest cardiovascular efficiency and muscle strength: 17:00
- 18:00: Highest blood pressure
- 19:00: Highest body temperature
- Melatonin secretion starts: 21:00
- Bowel movements suppressed: 22:30
Natural Circadian Support

• **Day Time - Cool, Blue Light**
  – Shorter Wavelength (Reduces Melatonin, Increases Alertness)

• **Late Afternoon - Warm, Reddish Light**
  – Longer Wavelength (Calming Effect, Begins Night Cycle)

2,000 K - Campfire (Really Warm Color)
3,200 K – Sunrise (Warm Color)
5,000 K – Sunny Day/Noon (Cool Color)
7,000 K – Overcast Day (Very Cool Color)
3,200 K – Sunset (Warm Color)
Researching Effects of Color Tuning

• **K-12 and Higher Education**
  – Special Education (Calming Effect of Warmer Colors)
  – Maximizing Learning Environment (Color Tuning)

• **Health Care**
  – Increasing Recovery Rates (Patient Turnover)
  – Improving Mental Health

• **Correctional Industry**
  – Circadian Rhythm (Minimal Natural Light Exposure)
  – Lowering Instances of Violence
Light Color and Office Productivity

How Lighting Affects Productivity

One of the most striking factors influencing how we work is the color temperature — measured in Kelvin (K) — of the light sources we’re exposed to on a regular basis.

![Color Temperature Chart]

- **Warm (2,000 K - 4,000 K)**
  - Use in: Intimate settings, break rooms
  - Creates a sense of comfort and relaxation.

- **Midday (4,000 K - 5,000 K)**
  - Use in: Conference rooms
  - Welcoming but still cool enough to promote alertness.

- **Cold (5,000 K - 7,000 K)**
  - Use in: Brainstorming rooms
  - Improves alertness, mood, and productivity. Lowers melatonin, which reduces fatigue.

Sources:
Where Are Lighting Codes Today?

• Manual On With Dimming Control In Each Zone
  – Occupant Chooses Light Level to Match Current Task

• Automatic Off Via Vacancy Sensor
  – Lights
  – 50% of Plug Loads

• Daylight Harvesting
  – Multiple Independent Automatic Day Light Zones
  – Dim to Off Requirements

• Automated Demand Response Capability (ADR)

• Lumen Maintenance/Light Level Tuning
  – Setting High and Low Trim Levels
Where Are Lighting Codes Going?

• **Color Tunable Lighting**
  – DMX (Multi Channel Red, Green, Blue)
  – 0-10v (Additional Analog Output for color)

• **Additional Daylight Harvesting**
  – Increase the Size and Number of Mandatory Daylight Zones

• **Decreased Vacancy Timing**
  – LEDs Provide Instant On
  – Increased Detection Capabilities (High Frequency Doppler Sensors)

• **True ADR**
  – Peak Demand Management (Growth of Smart Grid)
Additional TEC Motivations

• **Energy Costs**
  – Prices Moving Forward (Supply, Demand, Geopolitical Risks)
  – Effects of Reduced Demand (Infrastructure Cost)

• **Occupant Comfort**
  – Quality of Work Place
    • $/Sq. Ft.
    • Desirability
  – Productivity

• **Unified Control Benefits**
  – One BACnet Front End
  – One Point of Accountability

• **Cost of Inaction**
  – $/Day
Questions To Leave You With

• **Unified Approach or Discrete Building Systems?**
  – BACnet brings systems together (BTL Proves It)
  – Eliminate Duplicates (Networks, Infrastructure, Devices, GUIs)
  – Allows for Total Environmental Control

• **Open Standards or Proprietary Systems?**
  – Cost of Proprietary Systems (Life Span, Replacements)
  – Cost for Servicing each type of system

• **Am I Adding to Occupant Comfort?**
  – Ease of Use (Programmability, Local Service)
  – Occupant Centric Design
References

The BACnet Institute  www.BACnetInstitute.org

BACnet International www.BACnetInternational.org (Booth 3852)

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Questions?