Energy Efficient Design
Lessons Learned & Best Practices

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Better Performing Buildings™

Outline

- Owner Involvement
- Design Phase Comparative Analysis
- Integrated Energy Design
- Right-Sizing System Solutions
- Long Term Operations Outlook for Persistent Energy Conservation

Owner Involvement

- Understand the Energy Efficient Design Process
- Know the Questions to Ask & Deliverables to Expect
- Appreciate the Design Team Effort
- Document Objective Owner's Project Requirements
- Commit Facilities Operations Time to Participate on the Design Team
- Contribute to Design Discussions & Debates
- Be Pragmatic about All Project Priorities

Owner Involvement

- Understand the Energy Efficient Design Process
- Know the Questions to Ask & Deliverables to Expect
- Appreciate the Design Team Effort
  - Design phase scope definition
  - Reasonable design phase schedule milestones
  - Direct contact with all design team members
  - Increased design professional fees

Owner Involvement

- Document Objective Owner's Project Requirements
  - Energy use intensity (EUI)
  - Space temperatures
  - Space relative humidities
  - Indoor air quality
  - Occupancy schedules
  - Etc.
  - Emergency power coverage
  - Redundancy/reliability
  - Lighting levels
  - Domestic water temperatures
  - Renewable energy targets

Owner Involvement

- Commit Facilities Operations Time to Participate on the Design Team
  - Speak now or forever hold your peace
  - Command/demand respect
  - Be open to new ideas
  - Do not accept solutions which you do not understand
  - Contribute to cost/benefit/risk assessment of various options

- No Full Time Operations Team?
  - Engage a third party owner's technical representative

Design Phase Comparative Analysis

- Select Design Engineers with Energy Systems Comparison Experience (or Demonstrated Passion)
- Select Architect with an Understanding of and Enthusiasm for the Process
- Design Team needs to be Believers
- High Level Evaluation of all Potential Options
- Deep Dive into a Manageable Number of Options & Sub-Options
- Quantitative Assessment of Life Cycle Costs

Integrated Energy Design

- Consideration of all Building Elements
  - Architecture
  - Orientation
  - Occupancy
  - Operations Staffing
  - Mechanical
  - Electrical
  - Life Safety

Integrated Energy Design

- Detailed Equipment and Systems Integration
  - Central building automation system
  - Self-contained equipment controllers
  - Life safety systems
  - Lighting controls
  - Security
  - Building envelope

Integrated Energy Design

- Longer Design Schedule, Higher Design Fees
  - Experienced design team will understand more time is required
  - More time = more design $$
  - More time = longer design phase schedule
  - Design team needs to be serious about meeting their deadlines

Right-Sizing System Solutions

- Maintainable?
  - Quantity of equipment vs. staff availability
  - Availability of local outside expertise
- Sustainable?
  - What does it take to keep the system operating as intended?
  - Life expectancy of technology
  - Operations staff analytical skill set

Right-Sizing System Solutions

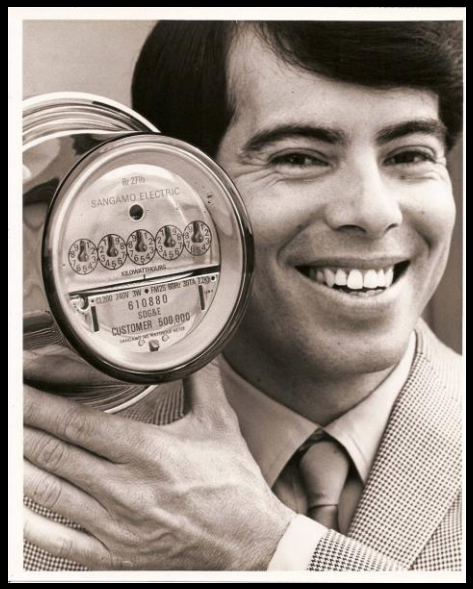
- Operations & Maintenance Budget Requirements
  - Sensor calibration
  - Building automation system "analyst"
  - Proactive instead of reactive maintenance

Long Term Operations Outlook for Persistent Energy Conservation

- Respectfully Listen to Building Operators
- O&M Documentation Specification
  - Equipment manuals
  - Systems manual
- O&M Equipment Training Planning & Specification
  - Equipment training
  - Systems training
- As-Built Documentation

Long Term Operations Outlook

- On-Going Commissioning Planning
  - Preventive maintenance schedule
  - Sensor calibration schedule
  - Performance tracking and analysis
    - Building automation system trends
    - Utility energy usage
  - System performance testing schedule
  - Smart alarms



Costs

- Increased Design Fees
- ?? Procurement & Installation Costs
- Decreased Troubleshooting Costs
- Decreased Remediation Costs
- Decreased Energy Costs

Energy Efficient Design Summary

- Owner-Driven, Designer-Delivered Process
- Increased Design Phase Effort to:
  - Improve Energy Performance
  - Reduce Overall Owner Costs
- Great Opportunity for Energy-Passionate Innovative Engineers

Discussion