An Energy Efficiency Workshop & Exposition

Palm Springs, California

Energy vs. Customer Service

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Agenda

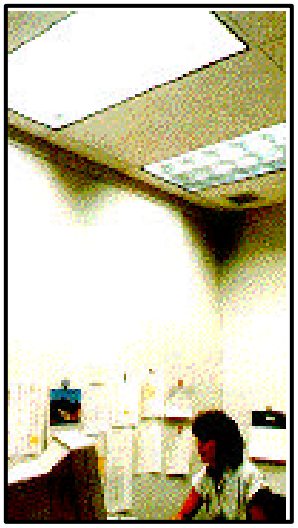
- Background
- Lighting
- Outdoor Air
- Temperature
- Systems
- Controls
- Responsiveness

Background

- How Many Engineers Were Fired for Over Designing?
  - Too much light
  - Too large boiler
  - Too large chillers
- Which way do you Err toward?

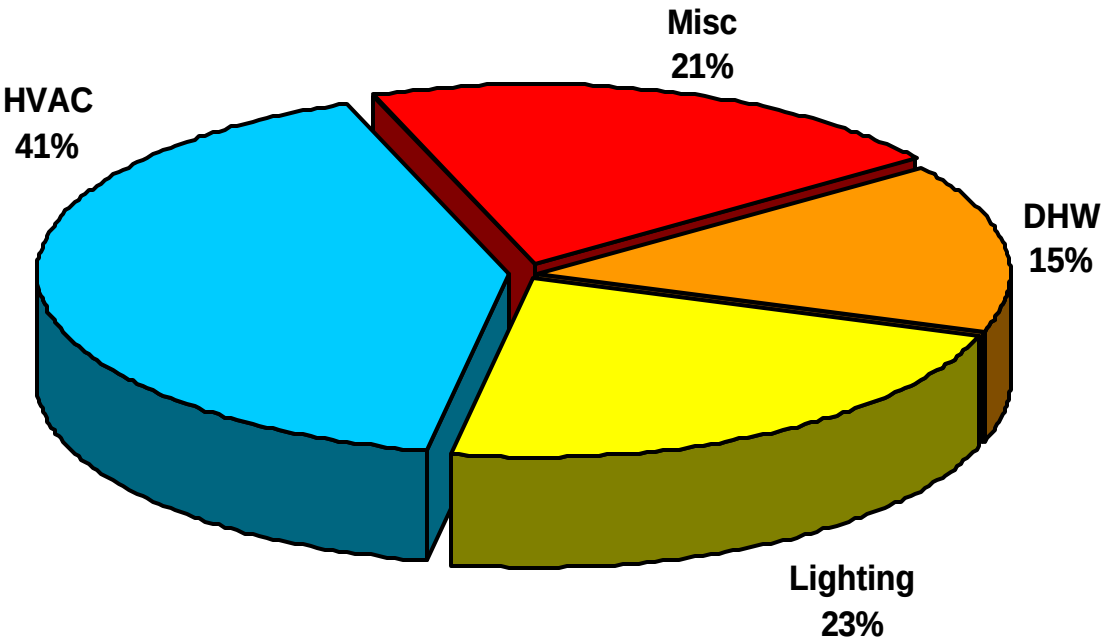
The Dilemma - Balance

Overlit

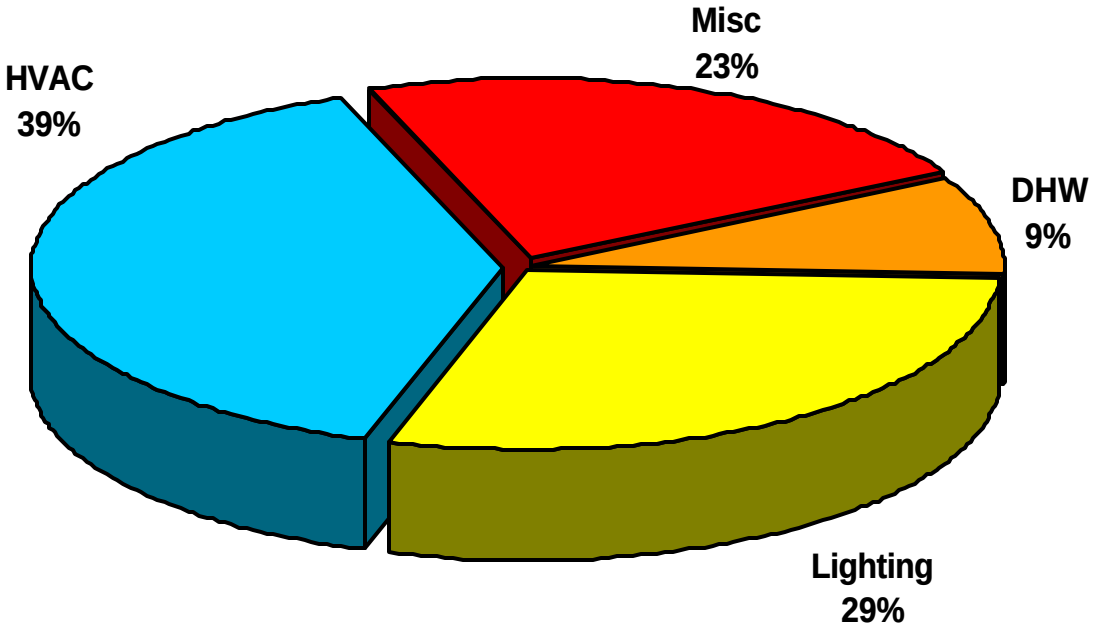


Underlit

Background
Total Facility Energy



Background
Office Space Facility Energy

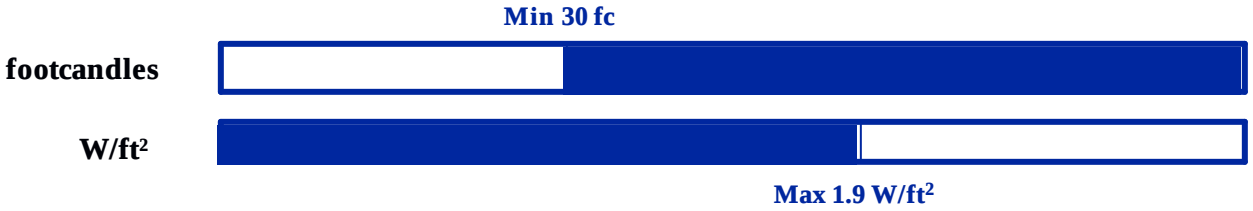


Energy Savings
vs
Lighting Quality

Too little lighting

- IESNA recommended lighting levels
  - Minimum footcandles
- ASHRAE 90.1 energy limits
  - Maximum W / ft^2

Example



Too much lighting

- Excess Energy
- Glare
- Reflections
- Headaches
- Overheating

Right approach for lighting

- Evaluate
- Limit Lighting to Tasks vs Area
- Day Lighting
- Control
  - Dimmers
  - Day lighting stats
  - Occupant sensors

Energy
vs
Outdoor Air

Outdoor Air History

- 1865 – 1905 – Only for Infection Control
  - 25 – 30 cfm per person
- 1936 – Odor Control
  - 10 - 15 cfm per person
- ASHRAE 62-1981 – to curb over ventilation
  - Minimum 5 cfm per person
- ASHRAE 62-1989 – in response to sick building syndrome
  - Minimum 15 cfm per person
- ASHRAE 62-1999 increased OA more
  - 15 – 20 cfm per person (based on building type)

Outdoor Air Why is it Important?

- Health
  - Millions affected annually
  - Billions in insurance and compensation
- Productivity
  - 1.2 to 1.9 days more sick leave with lower ventilation rates
- Perception- Stuffy or Stale Air

Outdoor Air

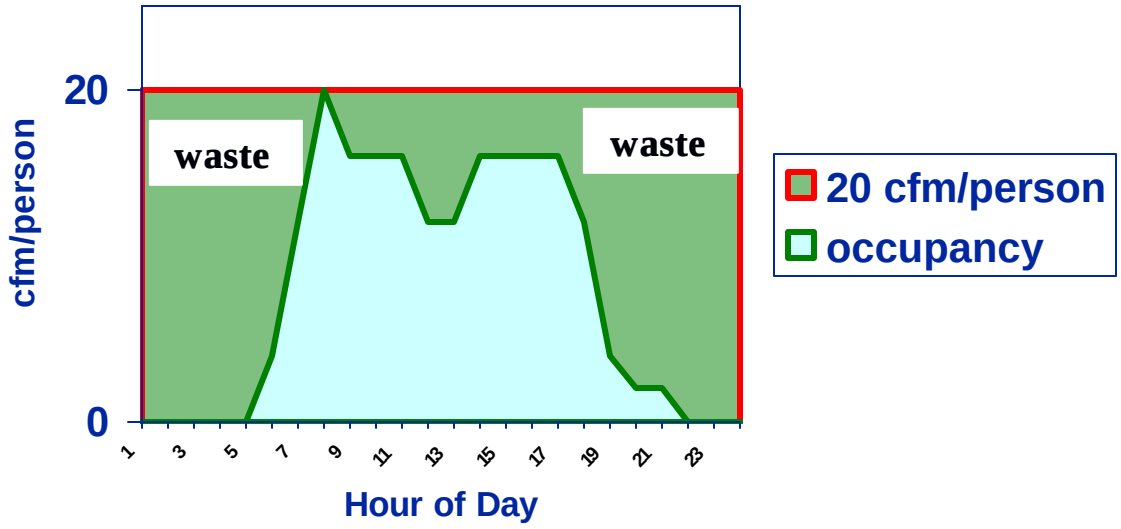
- ASHRAE 62- 1981-1999 increased OA cfm from 5 cfm / person – 20 cfm / person
- Jan 2000 EPA study "Energy Cost and IAQ Performance of Ventilation System and Controls" (EPA 402-S-01-001D)
  - 1% to 4% increase in total energy consumption for 20 cfm / person vs. 5 cfm / person
  - Up to 8% increase for very high density buildings

Outdoor Air

- Conditioning air – approximately 50% of a buildings energy consumption
- Most Space is Still Over-ventilated
- How do you use CO2 monitors to maximize the savings?

Energy vs OA requirements

- Constant OA volume - minimum 20 cfm per person



Energy Savings

vs

Space Temperature

Temperature

- Originally 68 and 75 degrees
  - Mostly never followed or enforced
- Set Point 72 degrees Year-round
- Balance system vs response and change
  - Placebo thermostats
  - Overriding systems
  - Space Heaters

Energy Savings

vs

Systems Employed

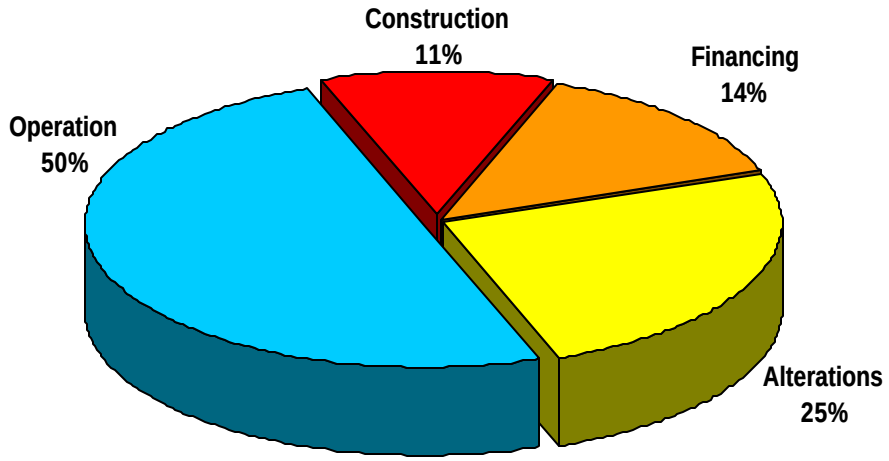
Systems

- 2 pipe
- Floor Plenum
- 4 pipe
- VAV
- Geothermal

Life Cycle vs First Cost

- Beyond Basic Prescriptive
  - Less Lights – Smaller Chiller
  - Higher Gas Rates – More Insulation
- Design for Life Cycle Costing – Cost More
- Justify Life Cycle over First Cost for OMB
- Find the Additional Funding if Required

Life Cycle Costs



Energy Savings
vs
Control Systems

Controls

- Majority of Energy Usage Problems Centers on Information and Control
- Direct Digital Control (DDC)
  - Include in all new and retrofit buildings
- Energy Management System (EMS)
  - Put in with new groupings or tie to existing
- Enterprise Management Software
  - Tie DDC, meters and EMS together

Controls Applications

- Demand Limiting
- Night Setback
- Night Shutdown
- Hot/Cold Deck Resets
- Outdoor Air Temperature Resets
- Minimize Outdoor Air - Unoccupied
- Customer Involvement

Controls Applications

- Demand Control Ventilation (DCV)
- Heat Recovery
- Economizer Control
- Bundling ECMs with increased OA

Energy Savings

vs

Customer Responsiveness

Eliminate Temporary Fixes

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Poor Management and Control

- Complaints
  - Management Involvement
  - Supervisor Involvement
- Responses to Calls
  - Travel Time
  - Evaluation Time
  - Return and Recovery Time
- Customer Interference
- Customer Perception

Good Management and Control

- Proactive control and enterprise management
- Good commissioning and recommissioning
- Aggressive PM Program

Summary

Standard	Optimal
No Energy Manager	Qualified Energy Manager
Decisions based on First Cost	Decisions based on lowest Life Cycle Costs
Attention solely on Safety and Health	Balanced Approach
No integrated Controls	Practice Control System
Least Effort to accomplish design	Additional effort (cost) up front

Results

- **Most Cost-effective design**
- **Maximum comfort for occupants**
- **Increased Productivity**