# Energy Best Practices

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# Topics

- Getting started
- What did we do?
- Goals
- Internal customer involvement
- What else can we do?
- How did we do?
- Questions

# Getting Started

- Question: Do you have an energy management program at your place of business?

- Assign an energy coordinator
  - Multi-site companies may need separate assignee per location
  - We have had an Energy Coordinator assigned for many years

- Establish a goal
  - How much do I want to reduce energy consumption (%)?
  - How much money do I want to save?

- Now what do I do?

# Here is what we did

- As energy prices continued to increase we knew additional focus was required
- Early in 2007 we commissioned a study via NYSERDA's Flextech Program to review energy performance on a sample size of our air handlers
- As a result of that study we learned two things:
- *1) All air handlers were maintaining required space conditions*
- *2) All air handlers were wasting energy!*

# Here is what we did

- Used that study as a basis for what we would go after first (low hanging fruit)
- Created Site Operations Energy Team
- Assigned two maintenance technicians to begin the process of reviewing all site AHUs
- Within a few days it was obvious we were moving in the right direction
    - “Hey Frank, you wouldn’t believe what we just found!”
    - Simultaneous heating/cooling
    - Valves leaking by
    - Sensors out of calibration
    - On/off schedules disabled

# Here is what we did

- We established a PM to look at all site air handlers on a scheduled basis:

1) Check/Verify outside air sensor (Temperature & Humidity)
2) Check/Verify Preheat Temperature sensor
3) Check/verify Repair Preheat valve operation
3a) Check temperature stratification across all preheat coils
4) Check/Verify Chill Water Temperature sensor
5) Check/verify / Repair Chill Water valve operation
6) Check/Verify LTCHW Temperature sensor
7) Check/verify/Repair LTCHW valve operation
8) Check/Verify ReheatTemperature sensor
9) Check/verify/Repair Reheat valve operation
9a) Check temperature stratification across all reheat coils
10) Check/Verify Unit Discharge Temperature and Humidity sensor
11) Check/Verify Dewpoint Sensor(s)
12) Check/Verify Humidity control valve
13) Check/verify Freezstat all controls
14) Check/verify static pressure transmitter
15) Verify / check / that all control valves (preheat, chilled water, brine, runaround, reheat) close 100% and do not leak by
16) Check to determine if strainers require cleaning (e.g. bypass open, etc)

# Here is what we did

- Over time the team & role expanded
  - Two additional technicians added 1H08
    - Additional support for AHU PMs
  - One additional technician added 2H08
    - Focus on site lighting
      - Delamping to meet (but not exceed) standard lighting levels
      - Relamping to convert from 32W T8 to 25W T8
      - Upgrading from T12 to T8 lighting
- Additional tasks
  - Compressed air leak checks
  - Weekly BMS (building management system) audit
  - Energy surveys & project support
- Long term
  - Integrated energy team into maintenance departments

# So how about the goal?

- Is it fair that Site Operations be responsible for all energy conservation?
- NO
- The internal customers drive energy consumption, it's only fair that they help!
  - Manufacturing
  - Labs
  - Data Centers

# So how about the goal?

- How do we fairly distribute the goal?

- Site Operations should take a portion
  - 30% – 45% is suggested
  - Vary YTY based on energy projects going forward

- Remainder to be shared by internal customers
  - Balance is distributed based on the prior 12 months energy consumption
  - Use meters if available
  - Engineering estimates

# So how about the goal?

- Your distribution might look something like this

2013 x% Energy Conservation

| AREA | 2013 Percent | GOAL ($K) | YE EST ($K) | % of Goal |
|---|---|---|---|---|
| MANUFACTURING | 40.0% | 80.0 | 27.0 | 34% |
| LABS | 10.0% | 20.0 | 8.0 | 40% |
| DATA CENTERS | 20.0% | 40.0 | 32.0 | 80% |
| SITE OPERATIONS | 30.0% | 60.0 | 45.0 | 75% |
| TOTAL CONSERVATION | 100.0% | 200.0 | 112.0 | 56% |

- You'll need to track every measure
  - Title
  - Date implemented (most measures count for 12 months)
  - Who's responsible
  - Energy saved (kWh & MMBtu)
  - Calculated savings

- Remember everything counts no matter how large or small
  - "A whole lot of little things add up to one big thing"

# How do we get the internal customers involved?

- Focal point
  - One from each internal customer
    - Familiar with operation
  - Requires commitment from management
    - Internal customer
    - Executive management

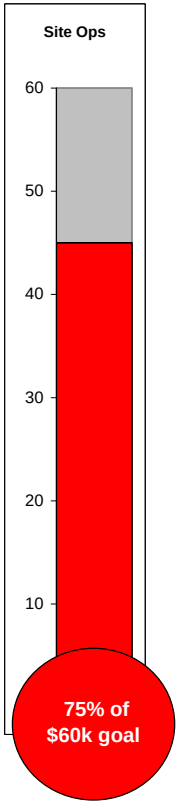
- Structured meetings (grass roots teams)
  - 2x/month
  - Attendees
    - Energy Program Manager
    - Customer Focal Point
    - Engineers
    - Managers
    - Equipment Operators
    - Process Engineers

# How do we get the internal customers involved?

- Schedule walkthroughs
  - Gemba walk is an activity that takes the team to the front lines to look for waste
  - In lean manufacturing, the idea of gemba is that the problems are visible
- You'll find out a number of things
  - People have really good ideas, you just have to ask
  - Some ideas have already been implemented and are eligible for energy conservation
- What type of ideas work?
  - Consolidate tools & support equipment
  - Reduce equipment operating hours
  - Relax T&H specifications
  - Reduce exhaust

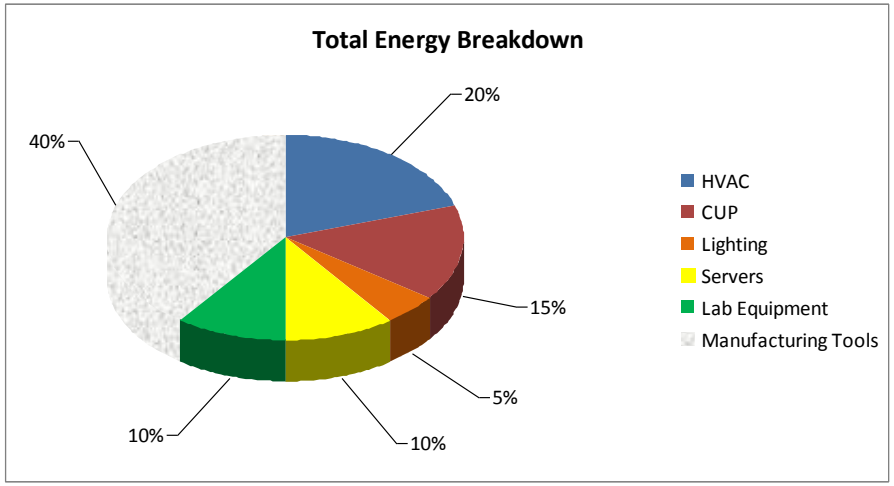
# How do we get the internal customers involved?

- Communicate
  - Periodic letters to all employees
  - Monthly wiki updates (progress/status)
  - Energy program overview
    - New employee orientation
    - Department meetings
    - Functional meetings
    - Post progress where everyone can see



# How do we get the internal customers involved?

- Show them how they contribute to energy consumption




- Internal customers meet monthly
  - Review progress
  - Share ideas

# What else can we do?

- Use available resources
  - NYSERDA (we use the IPE program)
    - Rebates can help offset project costs
  - Local Utility

- A couple of examples
  - Project to improve chilled water energy consumption
    - ROI w/o NYSERDA rebate = 3.1 yr
    - ROI w/ NYSERDA rebate = 2 yr
  - Project to utilize heat recovery to warm process water
    - ROI w/o NYSERDA rebate = 3 yr
    - ROI w/ NYSERDA rebate = 1.2 yr

# What else can we do?

- Multi-site locations should share data & success stories
  - Monthly meetings with site Energy Managers
  - Brief status on progress
  - Success story presentations (usually 1/month)

- Create an Energy Master Plan
  - Historical data (usage, spend & conservation)
  - Energy Plan (usage & spend)
  - Possible Future Energy Projects
  - General Information (energy suppliers, system capacities, etc)

# What else can we do?

- Use your available data to benchmark & identify problem areas
  - Electric meters
  - Natural gas meters
  - Building management system
    - Building Utilities
    - Air Handlers
    - Trends
- If you have sub-level metering compare utility usage across similar buildings
  - Multi-site companies can compare site to site

# What else can we do?

- If all you have is 1 electric meter you can still benchmark
  - Utilize EUI (Energy Use Intensity) tables

| Building Type Name | Thousands of Square Feet (KSF) | Thousands of Square Meters (KSM) | Number of Floors |
|---|---|---|---|
| Large Office | 101 & greater | 9.4 & greater | 12 & greater |
| Medium Office | 11 to 100 | 1.0 to 9.3 | 2 to 11 |
| Small Office | 1 to 10 | 0.1 to 0.9 | 1 |
| Warehouse | 1 to 100 | 0.1 to 9.3 | 1 |
| Strip Mall | 1 to 50 | 0.1 to 4.6 | 1 |
| Small Hotel | 1 to 80 | 0.1 to 7.4 | 1 to 5 |
| Large Hotel | 81 & greater | 7.5 & greater | 6 & greater |
| Mid-rise Apartment | 1 to 70 | 0.1 to 6.5 | 2 to 4 |

# What else can we do?

Table #C2. New Construction (2000 to the present)

| New Construction | kBtu per Square Foot (kBtu / SF) | | | kBtu per Square Meter (kBtu / SM) | | |
|---|---|---|---|---|---|---|
| Building Type Name | Coastal | Inland | Sub Arctic | Coastal | Inland | Sub Arctic |
| Large Office | 44 | 46 | 59 | 474 | 495 | 635 |
| Medium Office | 47 | 51 | 66 | 506 | 549 | 710 |
| Small Office | 47 | 53 | 72 | 506 | 570 | 775 |
| Warehouse | 26 | 35 | 63 | 280 | 377 | 678 |
| Strip Mall | 63 | 82 | 135 | 678 | 883 | 1,453 |
| Small Hotel | 65 | 70 | 86 | 700 | 753 | 926 |
| Large Hotel | 121 | 141 | 191 | 1,302 | 1,518 | 2,056 |
| Mid-rise Apartment | 36 | 44 | 66 | 388 | 474 | 710 |

Table #C3. Recent Construction (1980 to 1999)

| Recent Construction | kBtu per Square Foot (kBtu / SF) | | | kBtu per Square Meter (kBtu / SM) | | |
|---|---|---|---|---|---|---|
| Building Type Name | Coastal | Inland | Sub Arctic | Coastal | Inland | Sub Arctic |
| Large Office | 53 | 57 | 76 | 570 | 614 | 818 |
| Medium Office | 59 | 65 | 86 | 635 | 700 | 926 |
| Small Office | 63 | 71 | 96 | 678 | 764 | 1,033 |
| Warehouse | 27 | 52 | 117 | 291 | 560 | 1,259 |
| Strip Mall | 103 | 132 | 213 | 1,109 | 1,421 | 2,293 |
| Small Hotel | 80 | 85 | 102 | 861 | 915 | 1,098 |
| Large Hotel | 144 | 165 | 221 | 1,550 | 1,776 | 2,379 |
| Mid-rise Apartment | 54 | 71 | 116 | 581 | 764 | 1,249 |

Table #C4. Old Construction (prior to 1980)

| Old Construction | kBtu per Square Foot (kBtu / SF) | | | kBtu per Square Meter (kBtu / SM) | | |
|---|---|---|---|---|---|---|
| Building Type Name | Coastal | Inland | Sub Arctic | Coastal | Inland | Sub Arctic |
| Large Office | 56 | 59 | 77 | 603 | 635 | 829 |
| Medium Office | 64 | 74 | 97 | 689 | 797 | 1,044 |
| Small Office | 77 | 97 | 151 | 829 | 1,044 | 1,625 |
| Warehouse | 29 | 56 | 129 | 312 | 603 | 1,389 |
| Strip Mall | 106 | 140 | 229 | 1,141 | 1,507 | 2,465 |
| Small Hotel | 72 | 74 | 86 | 775 | 797 | 926 |
| Large Hotel | 130 | 137 | 156 | 1,399 | 1,475 | 1,679 |
| Mid-rise Apartment | 57 | 78 | 132 | 614 | 840 | 1,421 |

- Coastal is within 200 miles of a shoreline
- Other resources can be found on the internet
  - http://www.energystar.gov/buildings/facility-owners-and-managers/existing-buildings/use-portfolio-manager/understand-metrics/what-energy

# What else can we do?

- Survey systems during off hours
  - Lighting
  - Equipment schedules
  - Look at air handlers
    - Is the system using energy when off line?

- We created checklists
  - Reviewed every 2 – 3 years
  - Engineering & maintenance work together to complete
  - Honest assessment of current conditions
  - Used to assist in obtaining project funding

# Lighting Checklist Example

- Checklist types:
  - Cafeteria Equipment
  - Compressed Air
  - Cooling Systems
  - Data Centers
  - Heating Systems
  - HVAC
  - Labs & Manufacturing
  - Lighting (example included)
  - Office Equipment
- Acceptable Answers:
  - Yes
  - No (in progress)
  - No (not started)
  - No (not feasible)
  - Not applicable
- All “NO” answers require comments

| Interior Lighting | * Answer |
|---|---|
| 1. Have all corridors/aisles, offices, common areas and lobbies been delamped as much as possible? | |
| 2. Has a process been implemented to prevent installation of lamps in light fixtures that have been delamped for conservation? | |
| 3. Have all incandescent bulbs/lamps been replaced? | |
| 4. Have lighting fixture lenses been cleaned (during bulb replacement) to provide maximum illumination? | |
| 5. Are exterior window aisle fixtures off during the day to take maximum advantage of daylight harvesting? | |
| 6. Do all maintenance areas have lighting timers or sensors installed? | |
| 7. Have all lighted Exit signs been changed to light emitting diode (LED) type? | |
| 8. Is the emergency lighting systems for the site designed and operating with the minimum number of fixtures on the emergency system? | |
| 9. Do all raised floor and/or lab spaces have lighting control systems or occupancy sensors? | |
| 10. Are lights on to the minimum degree during “after hours cleaning”? | |

# Lighting Checklist Example

| Exterior Lighting | * Answer |
|---|---|
| 13. Are exterior/parking lot lights scheduled for the minimum hours? List the current hours of operation. | |
| 14. Have parking lot lighting levels been reviewed recently? | |
| 15. Are photocells and/or modern astronomical timers installed and working correctly on all exterior parking lot lighting? | |
| 16. Have parking lots been consolidated and closed when possible? | |

| Vacant/Warehouse Space | * Answer |
|---|---|
| 17. Is lighting turned off at the electrical panels in vacant space? | |
| 18. Do all warehouse areas have occupancy sensors or lighting controls? | |

| Building Management System | * Answer |
|---|---|
| 19. Are all lighting panels controlled by the site Building Management System (BMS)? | |
| 20. Do lighting controls have the necessary zoning so entire buildings do not have to be "on" to meet non standard occupancy? | |
| 21. Has the schedule for automatic lighting controls been set to the minimum amount? | |
| 22. Has an after hours review been conducted to ensure controls are working as programmed and the lights go off as scheduled? | |
| 23. Has the manual override for the lights been set not to exceed two hour intervals? | |
| 24. Have Maintenance Work Orders been processed to repair any lighting controls that aren't working correctly? | |
| 25. Are lighting controls, relays, low voltage (LV) switches and other devices working correctly? | |

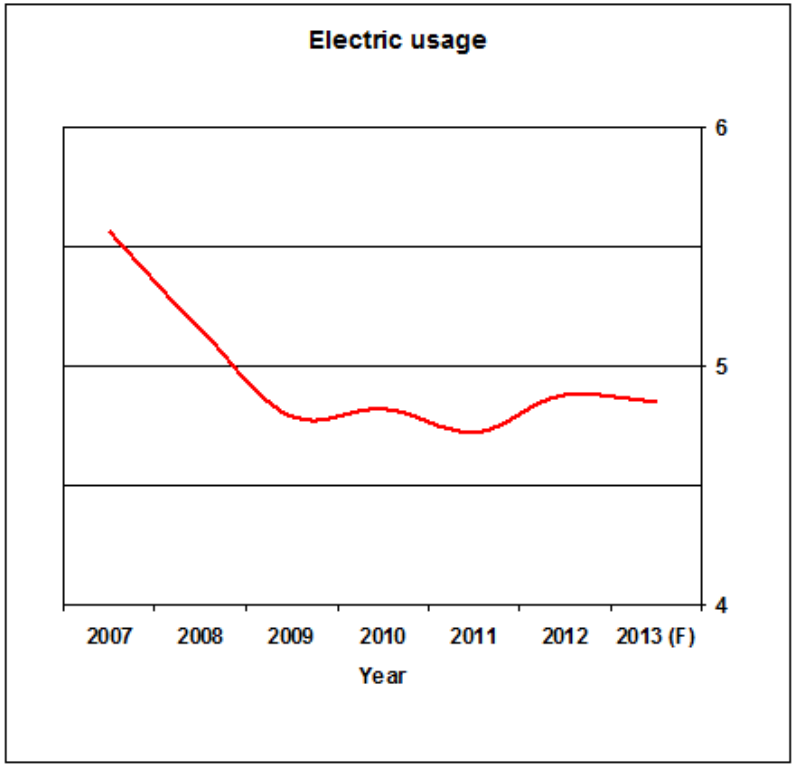
**Commitment to Action and Work Plan**

| Nr | Project, Action or Activity (Current Year plus one) * | Estimated Cost ($K) | Estimated MWH Savings | Estimated Completion * | Owner * |
|---|---|---|---|---|---|
| * 1 | | | | 16 | |
| 2 | | | | 16 | |
| 3 | | | | 16 | |

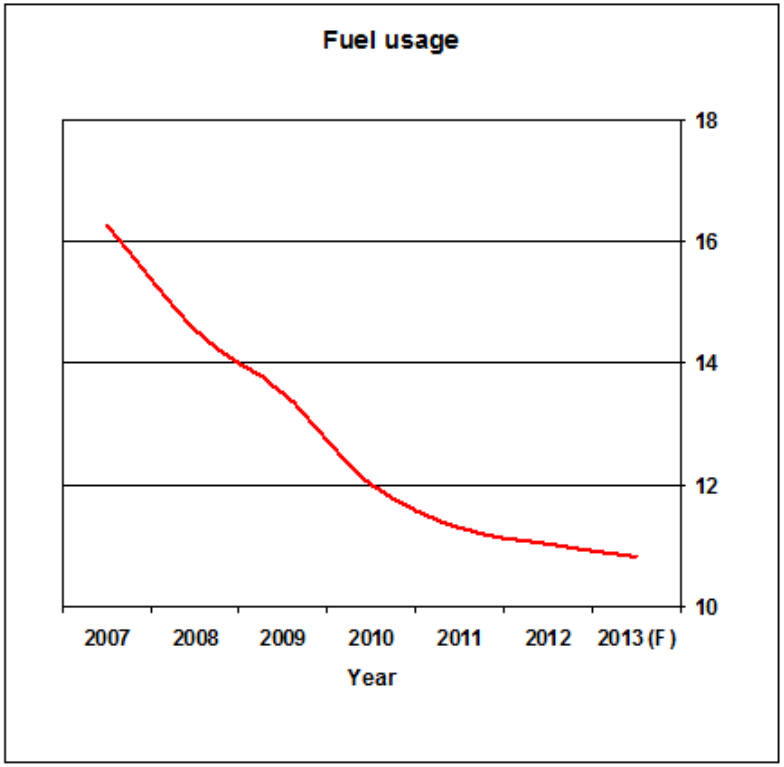
☐ I/We certify that no actions can be taken at this time.
Justification:

# How did we do?

**Since 2007 we have reduced our overall electric consumption by 13%**




**Since 2007 we have reduced our overall fuel consumption by 33%**




- Charts above include growth
- Reducing energy consumption is key to being cost competitive

# Questions?

- Anything you would like to ask?
- Contact information
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