Uncover Energy Savings:

Energy Efficiency Best Practices

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Meet Your Presenter:

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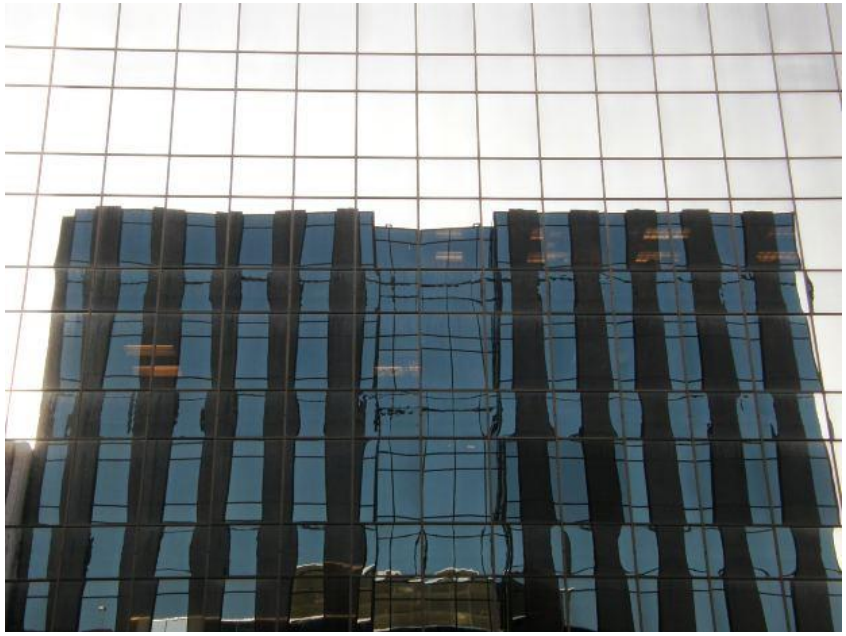
Benchmarking

to

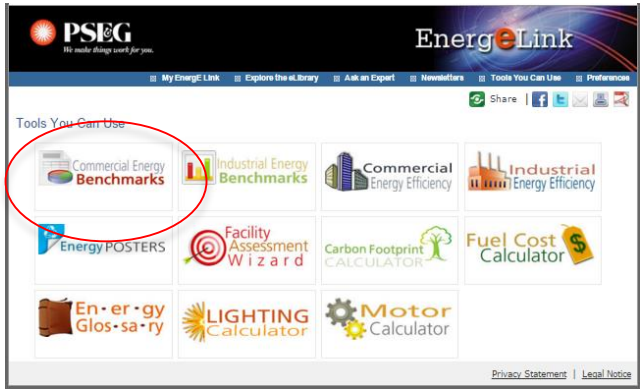
Identify Waste

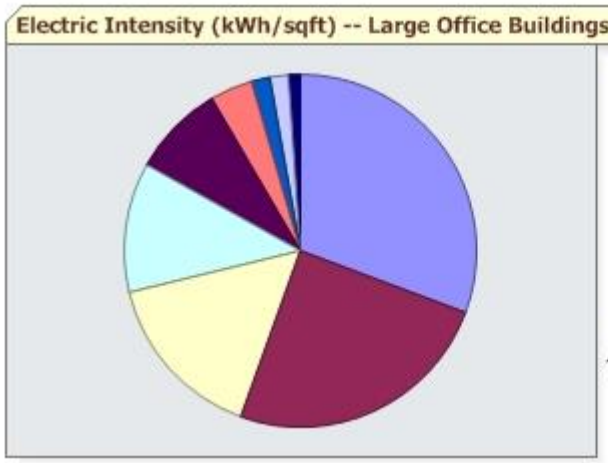
Office Buildings



Average Office Consumption Patterns

- Cooling/ventilation and lighting accounts for approximately 75% of electricity consumption
  - Cooling/ventilation is about 6.6 kWh/ft^2
- Space heating represents the largest gas consumption

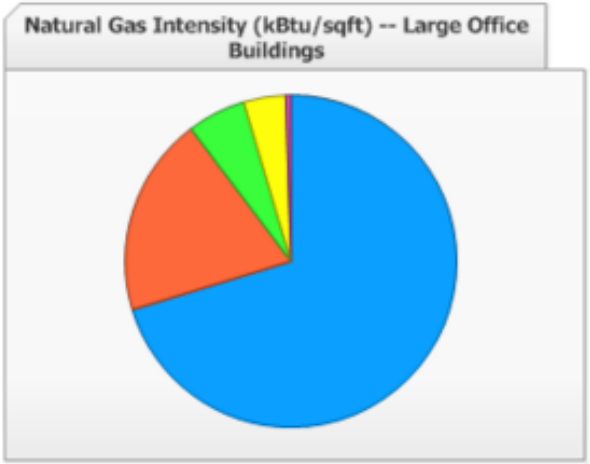




Climate Zone #3

5.03	Lighting	30.70%
4.07	Cooling	24.80%
2.57	Ventilation	15.70%
1.95	Office Equip.	11.90%
1.39	Other	8.50%
0.64	Heating	3.90%
0.28	Refrigeration	1.70%
0.28	Cooking	1.70%
0.18	Water Heating	1.10%

16.40 total



Climate Zone #2

26.22	Heating	70.30%
7.24	Water Heating	19.40%
2.13	Cooling	5.70%
1.53	Cooking	4.10%
0.19	Other	0.50%

37.30 total

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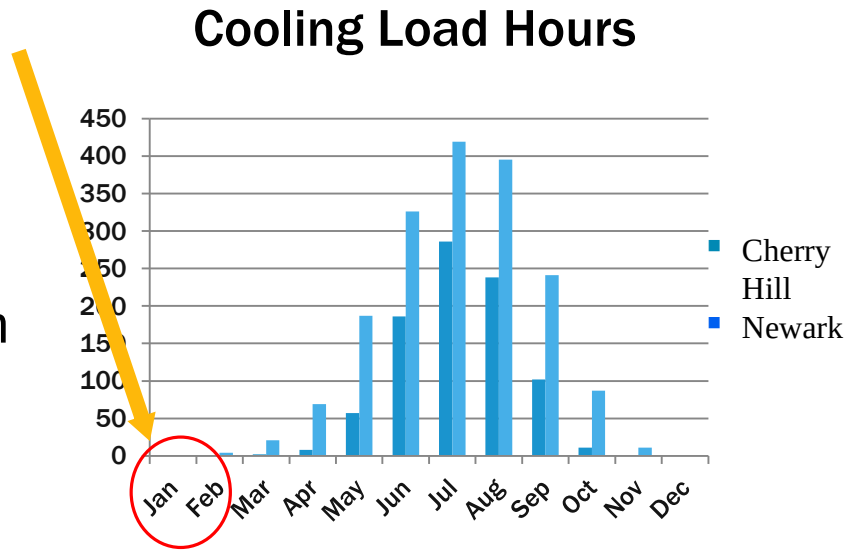
Average Office Consumption Patterns

- How to calculate your usage for comparison
  - $\frac{1{,}500{,}000 \text{ kWh}}{80{,}000 \text{ ft}^2} = 18.75 \text{ kWh/ft}^2$
  - $18.75 \text{ kWh/ft}^2 > 16.40 \text{ kWh/ft}^2$
    - Possible improvement opportunities

Source: ENERGY STAR

Estimating HVAC Billing

- HVAC costs, typically the largest portion of your bill, can be estimated by using cooling load hours
- When heating with natural gas, establish lowest cooling load hour month electrical consumption as a baseline to estimate the air conditioning portion of your bill
  - Most other end uses such as lighting and office equipment are fairly constant over the year
  - Almost all of the month-to-month increases in energy consumption are due to air conditioning



HVAC Monthly Billing

- Use baseline consumption in winter months to estimate cooling portion of bill
- Subtracting winter months baseline from actual will give a good estimate of cooling energy consumption
  - Use 80% of January/February energy consumption as a baseline

Monthly Electricity Consumption, kWh (1,000s)													
	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Actual	78	80	88	102	138	175	196	190	167	116	90	80	1,500
Base	62.5	62.5	62.5	62.5	62.5	62.5	62.5	62.5	62.5	62.5	62.5	62.5	
Δ	15.5	17.5	25.5	39.5	75.5	112.5	133.5	127.5	104.5	53.5	27.5	17.5	750

Example: $\frac{750{,}000\ \text{kWh}}{80{,}000\ \text{ft}^2} = 9.4\ \text{kWh/ft}^2\text{/yr}$ **(vs. 6.6 to 7.0 cooling + ventilation)**

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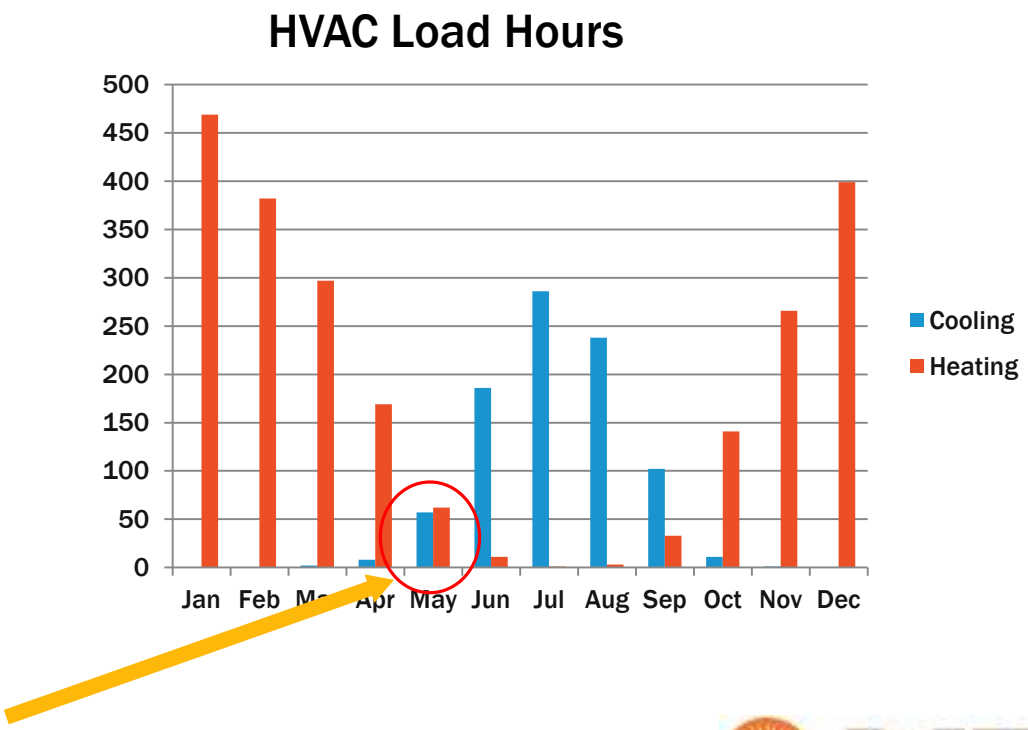
HVAC Monthly Billing

- When heating with electricity, establish lowest HVAC load hour month electrical consumption as a baseline to estimate the HVAC (cooling plus heating) portion of your bill
  - Typically spring or fall month



HVAC Monthly Billing

- For all-electric HVAC, use baseline consumption in spring/fall months to estimate HVAC portion of bill
- Subtracting baseline from actual will give a good estimate of HVAC energy consumption
  - Use 80% of May (or September) energy consumption as a baseline

All-Electric Monthly Electricity Consumption, kWh (1,000s)													
	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
Actual	245	210	190	110	78	90	138	102	80	80	175	210	1,500
Base	62	62	62	62	62	62	62	62	62	62	62	62	
Δ	183	158	128	48	16	28	76	40	18	18	113	158	984

Example: $\frac{984{,}000\ \text{kWh}}{80{,}000\ \text{ft}^2} = 12.3\ \text{kWh/ft}^2\text{/yr}$ (vs. 12.2 to 12.6 cool/heat/vent)

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HVAC Equipment Capacity

- An alternative to baselining energy consumption is using nameplate capacity, efficiency, and weather data to estimate HVAC energy consumption
  - Annual Cooling Load Hours (CLH)
    - Cherry Hill 943 CLH
    - Newark 1,091 CLH
  - Typical equipment efficiency
    - Rooftop unit 1.3 kW/ton FLV
    - Chiller 0.8 kW/ton FLV

FLV (kW/ton)	COP	EER
0.6	5.9	20
0.75	4.7	16
1.0	3.5	12
1.5	2.3	8

Example: HVAC consumption = Load (tons) x FLV x CLH
= 300 tons x 1.3 kW/ton x 1,091 hours
= 425,500 kWh (vs. 261,800 @0.8 kW/ton)

- Intensity = $\frac{\textbf{425,500 kWh}}{\textbf{50,000 ft}^2}$ = 8.5 kWh/ft^2/yr (vs 6.6 for cooling + ventilation)

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HVAC Savings Estimate

- Use Full Load Value (kw/ton) efficiency ratings to estimate energy savings from upgrading to new HVAC equipment
  - A 10% to 20% energy savings from a new rooftop unit is a reasonable assumption

    Existing: Rooftop unit 1.3 kW/ton FLV (9.0 EER)

    Proposed: Rooftop unit 1.1 kW/ton FLV (10.9 EER)

Example: HVAC consumption = Load (tons) x FLV x CLH

Existing = 300 tons x 1.3 kW/ton x 1,091 hours = 425,500 kWh

Proposed = 300 tons x 1.1 kW/ton x 1,091 hours = 360,000 kWh

Annual energy savings = 65,500 kWh

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HVAC Savings Estimate

- There may be demand savings as well as energy savings from upgrading to new HVAC equipment

Existing: Rooftop unit 1.3 kW/ton FLV (9.0 EER)

Proposed: Rooftop unit 1.1 kW/ton FLV (10.9 EER)

Demand savings = 0.2 kW/ton

Energy savings ($) = 65,500 kWh x $0.07/kWh
= $4,585 per year

Demand savings ($) = (0.2 kW/ton) x 300 tons x $8/kW x 8
= $3,840 per year

Total savings ($) = $8,425 per year

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Determining Energy-Saving Lighting Opportunities

- Average large office lighting electricity intensity is about 5.0 kWh/ft^2/yr
- A walk-through lighting inventory can be used to estimate lighting intensity
- A four-step procedure is used to estimate actual lighting intensity
  1. Identify # lamps/lamp type
  2. Use wattage table
  3. Estimate annual burn time
  4. Measure floor area

F34T12 Wattage		
# Lamps	4 ft	8 ft
1	38	75
2	74	126
4	144	--

F32T8 or LED Wattage		
# Lamps	4 ft	8 ft
1	26	53
2	51	100
4	98	--

Energy consumption (kWh) = Power (kW) x Time (hrs)

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Determining Energy-Saving Lighting Opportunities

Example: 40 4-lamp 4-foot F34T12 fixtures
12 hours/day, 5 day/week burn time
(3,120 hrs annually)
3,520 sqft floor area

Energy consumption = 40 x 144 watts x 3120 hrs ÷ 1,000W/kW
= 18,000 kWh

Electricity intensity (T12) = 18,000 kWh/3,520 sqft
= 5.11 kWh/sqft (>5.0)

Electricity intensity (T8) = 3.47 kWh/sqft (<<5.0)

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Lighting Controls

- Lighting occupancy sensors
  - Turn off lights based on foot traffic

Example: Meeting room with
six 4-lamp F34T12 fixtures

Savings = 6 x 144w x 3120 hour x 0.5
= 1350 kWh
= $135 @ $0.10/kWh

- Lighting bi-level switching
  - Allows you to reduce light output in one step when full illumination is not required
- Dimmers
  - Reduces light output for setting mood or for multimedia events
- Daylight sensors (Photocells)
  - Dims or turns off lighting when free daylight is available

Energy-Savings Potential With Occupancy Sensors

Application	Energy Savings
Offices (private)	25–50%
Offices (open spaces)	20–25%
Rest rooms	30–75%
Corridors	30–40%
Storage areas	45–65%
Meeting rooms	45–65%
Conference rooms	45–65%
Warehouses	50–75%

Note: Figures listed represent maximum energy-savings potential under optimum circumstances. Figures are based on manufacturer estimates. Actual savings may vary.

Source: California Energy Commission/U.S. Department of Energy/ Electric Power Research Institute

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Personal Appliances

- Another focus for best-in-class office operations is employee personal appliances that circumvent energy-efficiency efforts
  - Employee personal appliances can cost up to $135 annually per office!
- To limit expenses related to personal appliances, offices…
  - Require formal request for personal appliances
  - Charge for privilege of using personal appliances

Appliance	Average Power (watts)	Annual Operating Hours	Annual Energy (kWh)
Space Heater	1,500	500	750
Mini-fridge, 3ft^3	150	Year-round	320
Microwave	1,000	125	125
Portable Fan	180	500	90
Coffee Pot/Warmer	300	250	75
		Total	1360

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Sample Savings From Equipment Settings

- Office equipment with idle and sleep mode features are energy-saving replacements when it is time to upgrade

Device	Typical Operating Power (Watts)	Typical *Idle* Power (Watts)	Typical *Sleep* Power (Watts)	Annual Energy Cost		
				8 Hours/Day, 5 Days/Week, Sleep Mode*	24 Hours/Day, 7 Days/Week, Sleep Mode**	24 Hours/Day, 7 Days/Week, No Sleep Mode**
Desktop Computer	100	60	6	$12	$16	$56
CRT Monitor (15")	60	40	4	$7.70	$10	$37
LCD Monitor (17")	35	8	2	$2.50	$3.90	$9.20
Laptop	65	15	1	$4.60	$5.30	$15
Laser Printer	350	85	20	$26	$29	$96
Fax Machine	300	75	10	$12	$19	$69
Copier (small)	300	75	20	$13	$26	$76
Copier (large)	1,400	350	40	$55	$82	$315

**Assumes $0.10/kWh, 2085 operating hours per year, 20% full power, 60% overall idle mode, 20% sleep mode for computers and monitors, 50% idle mode and 45% sleep mode for printers, faxes, and copiers. Equipment is turned off for 6675 hours.*
***Assumes $0.10/kWh, 8760 operating hours per year, same 8-hour/5-day mode, and either sleep or idle for non-work hours (work day nights and weekends). Equipment is never turned off.*
Sources: Manufacturers' specifications, Energy Star (DOE), and Office Equipment Energy Savings Calculator (LBL)

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Use Efficient Settings and Equipment

- Offices can save approximately $70 per year per computer just by using sleep mode

Annual Energy Cost (24 Hours/Day, 7 Days/Week)		
	No Sleep Mode	Sleep Mode
Desktop computer	$56	$16
CRT monitor (15”)	$37	$10
Total	$93	$26

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Use Efficient Settings and Equipment

- Replacing CRT monitors with LCD saves up to $20 per year

Annual Energy Cost (24 Hours/Day, 7 Days/Week)		
	No Sleep Mode	Sleep Mode
CRT monitor (15”)	$37	$10
LCD monitor (17”)	$ 9	$ 4
Total	$28	$6

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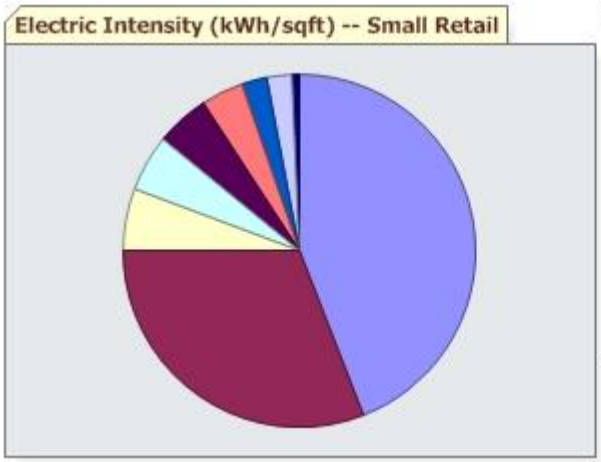
Poll Question

- When did you last benchmark your facility energy use or perform an energy audit?
  a) Less than 6 months ago
  b) In 2015
  c) In the last 5 years
  d) Never

Retail Outlets

Retail Consumption Patterns

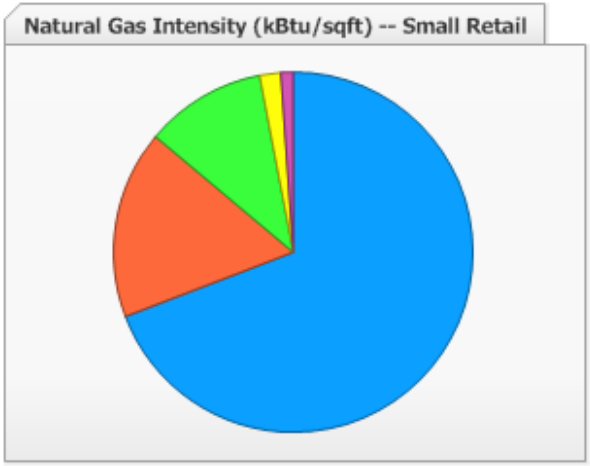
- Like offices, HVAC and lighting offer the best savings opportunities to retailers
  - Lighting represents about 45% of total electric end-use consumption.
- Space heating represents 70% of gas consumption.



Climate Zone #3

6.79	Lighting	44.10%
4.76	Cooling	30.90%
0.88	Heating	5.70%
0.80	Ventilation	5.20%
0.75	Refrigeration	4.90%
0.60	Other	3.90%
0.35	Office Equip.	2.30%
0.35	Water Heating	2.30%
0.11	Cooking	0.70%

15.40 total



Climate Zone #2

36.88	Heating	69.20%
9.01	Water Heating	16.90%
5.81	Cooking	10.90%
1.01	Other	1.90%
0.59	Cooling	1.10%

53.30 total

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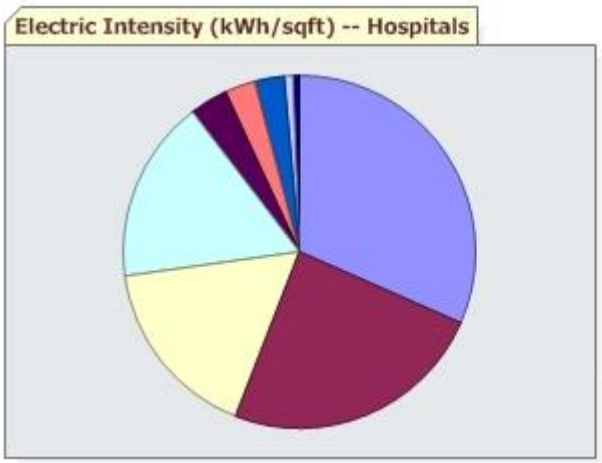
Hospitals


Emergency
University Hospital
Taubman Center
Women's Hospital
Mott Children's Hospital
Cancer Center
Geriatrics Center
Parking B
Parking A

Hospital Consumption Patterns

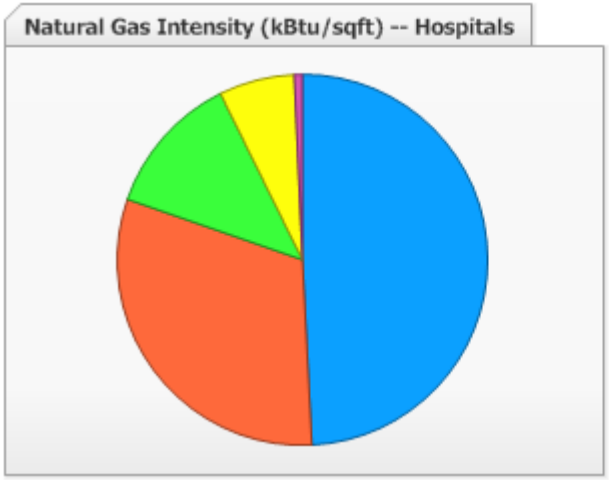
- Hospital equipment running 24/7 leads to consistently high energy usage
- Average hospital annual electricity intensity is about 30 kWh/ft^2/yr
  - Electricity intensity is more than twice that of offices and retail
- Water heating is a significant amount of gas consumption at over 30%.



Climate Zone #3

9.73	Cooling	31.60%
7.48	Lighting	24.30%
5.21	Other	16.90%
5.17	Ventilation	16.80%
1.08	Cooking	3.50%
0.86	Office Equip.	2.80%
0.83	Refrigeration	2.70%
0.25	Water Heating	0.80%
0.18	Heating	0.60%

30.80 total



Climate Zone #2

60.22	Heating	49.20%
38.07	Water Heating	31.10%
15.18	Cooking	12.40%
8.08	Cooling	6.60%
0.86	Other	0.70%

122.40 total

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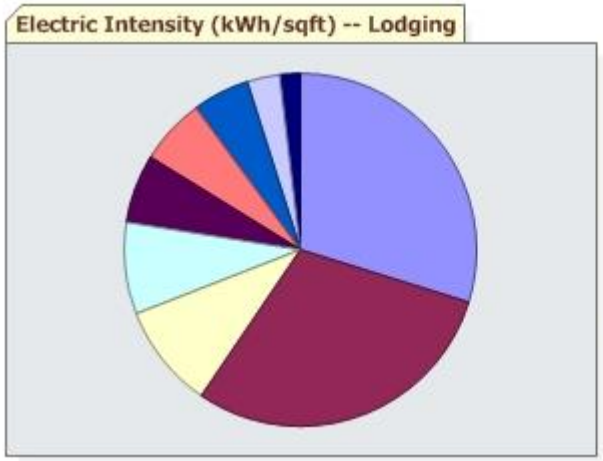
Hotels & Motels

Hotel and Motel Consumption Patterns

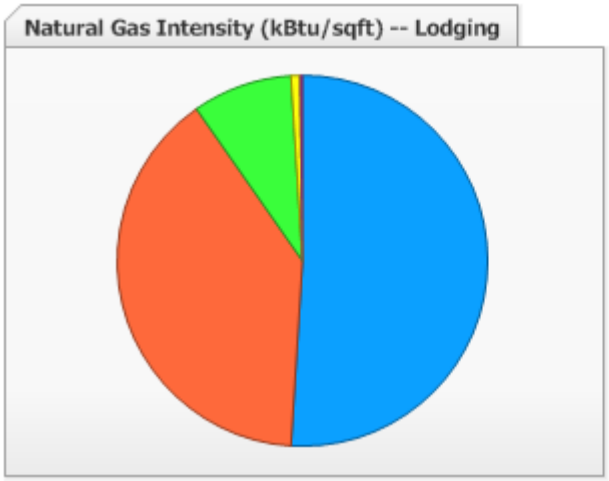
- Hotel/motel share of consumption is similar to that of hospitals but is half of the intensity
- Average hotel/motel annual electricity intensity is about 16 kWh/ft^2/yr
  - Great opportunity for occupancy sensors and CFL/LEDs
- Water heating is a significant amount of gas consumption at around 40%.



Climate Zone #3

4.74	Lighting	29.80%
4.72	Cooling	29.70%
1.53	Other	9.60%
1.34	Ventilation	8.40%
1.00	Heating	6.30%
0.97	Water Heating	6.10%
0.83	Refrigeration	5.20%
0.48	Cooking	3.00%
0.30	Office Equip.	1.90%

15.90 total



Climate Zone #2

27.95	Water Heating	51.00%
21.54	Heating	39.30%
4.77	Cooking	8.70%
0.44	Other	0.80%
0.11	Cooling	0.20%

54.80 total

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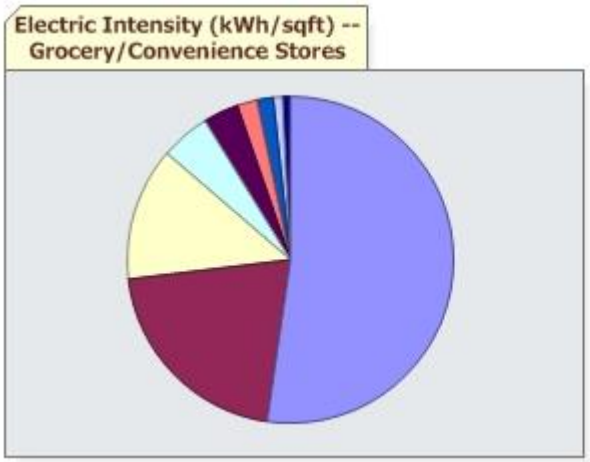
Food Stores

Grocery Store Consumption Patterns

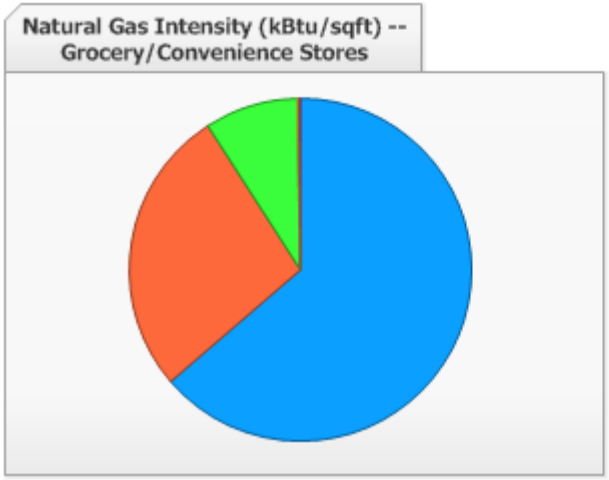
- Grocery stores' electric intensity is 4X higher than that of large office buildings due to refrigeration requirements
- Average food store annual electricity intensity is about 53 kWh/ft^2/yr
  - Refrigeration represents half of total end-use intensity
  - Highest lighting intensity at 11 kWh/ft^2/yr
- Space heating represents almost two-thirds of gas consumption.



Climate Zone #3

27.77	Refrigeration	52.30%
11.04	Lighting	20.80%
7.01	Cooling	13.20%
2.60	Ventilation	4.90%
1.86	Cooking	3.50%
1.06	Other	2.00%
0.85	Heating	1.60%
0.48	Water Heating	0.90%
0.42	Office Equip.	0.80%

53.10 total



Climate Zone #2

32.55	Heating	63.70%
13.90	Water Heating	27.20%
4.50	Cooking	8.80%
0.10	Other	0.20%
0.05	Cooling	0.10%

51.10 total

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Walk-In Cooler/Freezer Energy Consumption

- Freezer energy consumption is three times that of a cooler

Cooler Avg. kWh/Month	
Size	kWh
6x6, 6x8	660
8x8, 8x10, 8x12	1120
10x10, 10x12	1410

Freezer Avg. kWh/Month	
Size	kWh
6x6, 6x8, 8x8	2280
8x10, 8x12, 10x10	3480
10x12	4100

Source: U.S. Cooler

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Nameplate Data Energy Consumption

- Knowing amps and volts allows you to estimate kWh

Energy consumption (1Ø) = Amps x Volts x PF x Hours/1000
= 75A x 240V x 0.8 x 480 Hours/1000
= 6910 kWh/Month

Energy consumption (3Ø) = Amps x 1.73 x Volts x PF x Hours/1000

Component (240V)	Rated Amps	Total Amps
3 Compressors	15A	45A
9 Condenser Fans	2A	18A
6 Evaporator Fans	2A	12A
	Total	75A

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Refrigerator/Cooler Best Applications

- Best energy-saving options for refrigeration offer less than two-year payback

Reach-In Refrigerator Energy Savings (Relative to Base Model)				
Technology	**Electricity Savings (%)**	**Cost Premium ($)**	**Annual Savings ($) (at $.0782/kWh)**	**Payback (years)**
High-Efficiency Compressors	12%	$16	$40	0.4
Non-Electric Anti-sweat	20%	$93	$67	1.4
Condenser Fan ECM Motor	3.3%	$22	$11	2.0
Evaporator Fan ECM Motor	7%	$48	$23	2.1
ECM/Variable Speed Compressor	16%	$150	$54	2.8
Thicker Insulation	2%	$100	$8	13
Note: Savings not additive due to interactions between measures, ECM = electrically commutated motor. *Source: ADL 1996*				

Source: DOE, Energy Savings Potential for Commercial Refrigeration Equipment

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Freezer Best Applications

- Best energy-saving options for freezers offer less than two-year payback

Reach-In Freezer Energy Savings (Relative to Base Model)				
Technology	**Electricity Savings (%)**	**Cost Premium ($)**	**Annual Savings ($) (at $.0782/kWh)**	**Payback (years)**
High-Efficiency Compressors	16%	$24	$65	0.4
Non-Electric Anti-sweat	14%	$67	$58	1.2
ECM/Variable Speed Compressor	19%	$160	$77	2.1
Condenser Fan ECM Motor	2.7%	$24	$11	2.2
Evaporator Fan ECM Motor	2.3%	$24	$9	2.6
Hot Gas Defrost	6.3 %	$83	$26	3.2
Thicker Insulation	3.8%	$84	$15	5.5
Liquid-Suction Heat Exchanger	3.4%	$75	$14	5.5
Note: Savings not additive due to interactions between measures, ECM = electrically commutated motor. *Source: ADL 1996*				

Source: DOE, Energy Savings Potential for Commercial Refrigeration Equipment

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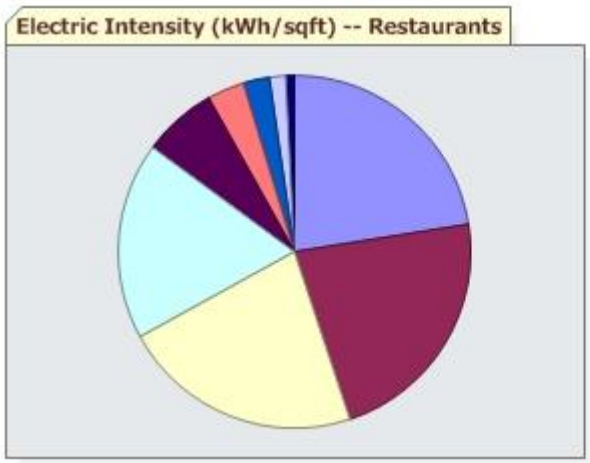
Restaurants

Restaurant Consumption Patterns

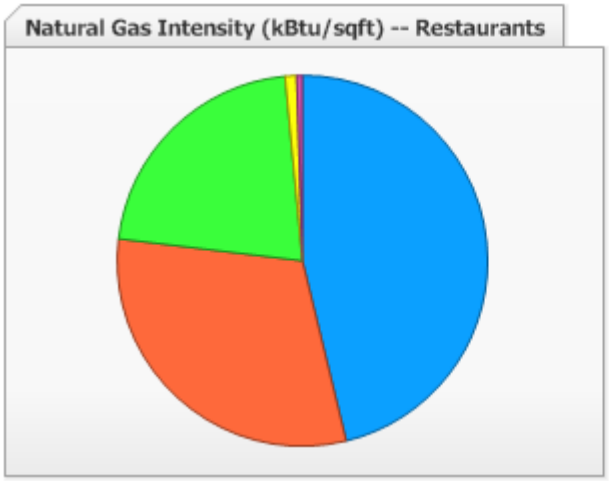
- Cooling, lighting, and cooking/refrigeration are typically responsible for the majority of restaurant energy usage
- Average restaurant annual electricity intensity is about 44 kWh/ft^2/yr
  - End-use intensity is four times higher than large office building
  - Cooking and refrigeration each represent 20% of total electric end-use intensity
- Cooking represents almost 50% of gas consumption



Climate Zone #3

10.06	Refrigeration	22.50%
10.01	Cooking	22.40%
9.88	Lighting	22.10%
8.09	Cooling	18.10%
3.04	Ventilation	6.80%
1.52	Water Heating	3.40%
1.07	Other	2.40%
0.67	Heating	1.50%
0.36	Office Equip.	0.80%

44.70 total



Climate Zone #2

79.14	Cooking	46.20%
52.59	Water Heating	30.70%
37.00	Heating	21.60%
1.71	Cooling	1.00%
0.86	Other	0.50%

171.30 total

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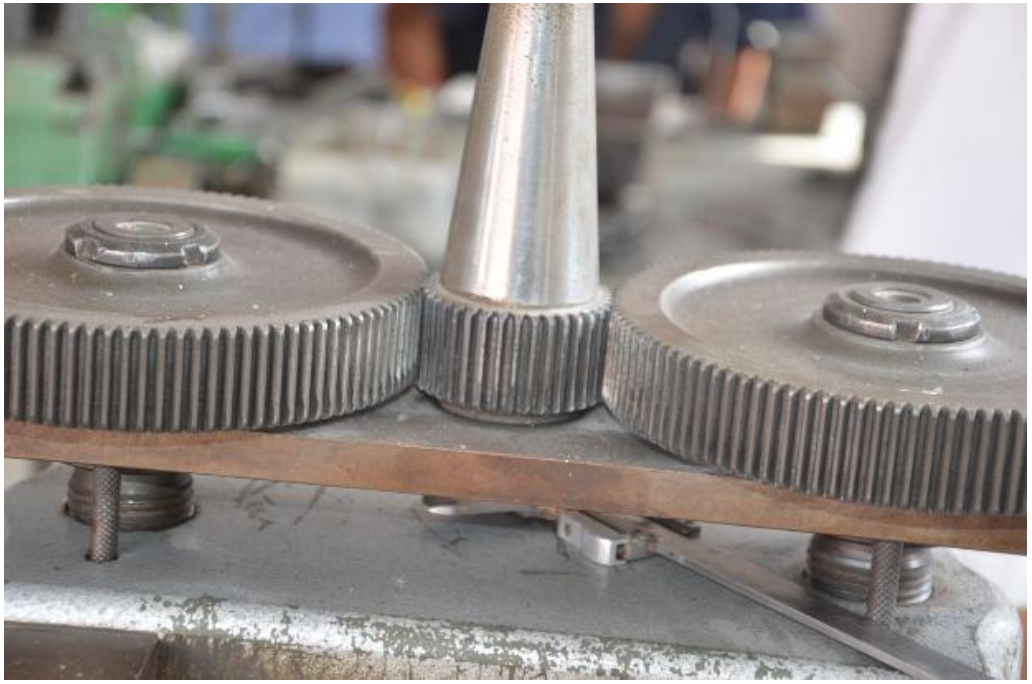
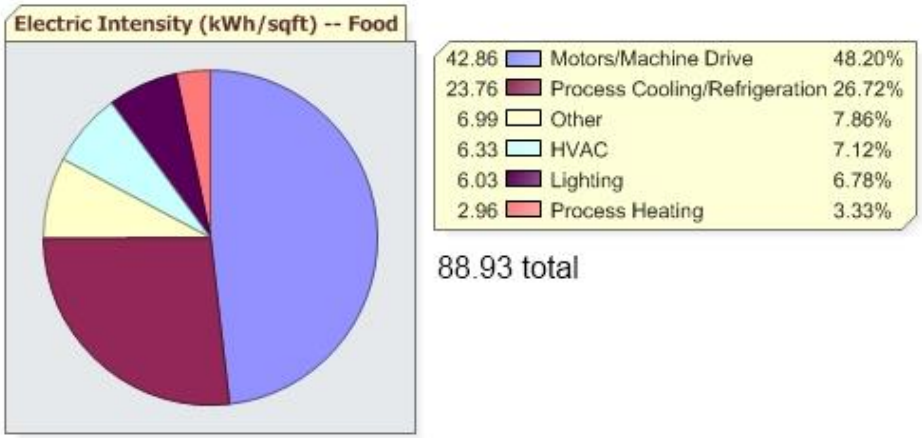
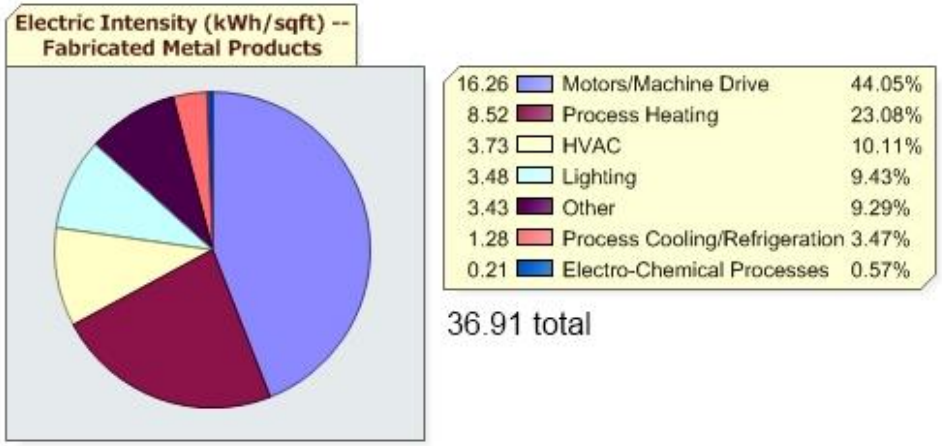
Manufacturing



Manufacturing Consumption Patterns

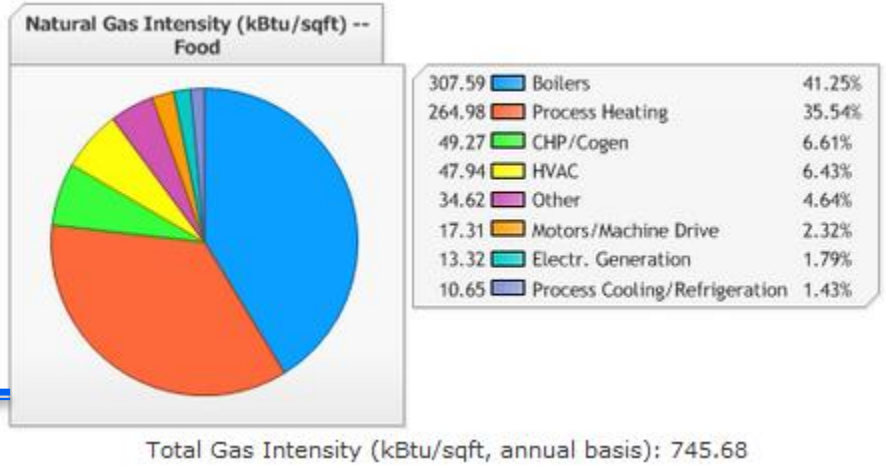
- Motors represent largest end use
  - Chemicals (228 kWh/sqft)
  - Paper Mills (113)
  - Food Processing (88.93)
  - Plastic Products (69.15)
  - Pharmaceutical (63.40)
  - Computer & Electronics (57.67)
  - Wood Products (47.16)
  - Transportation Equipment (45.46)
  - Beverage (42.20)
  - Fabricated Metal Products (36.91)
  - Apparel (32.28)
  - Machinery Manufacturing (29.77)

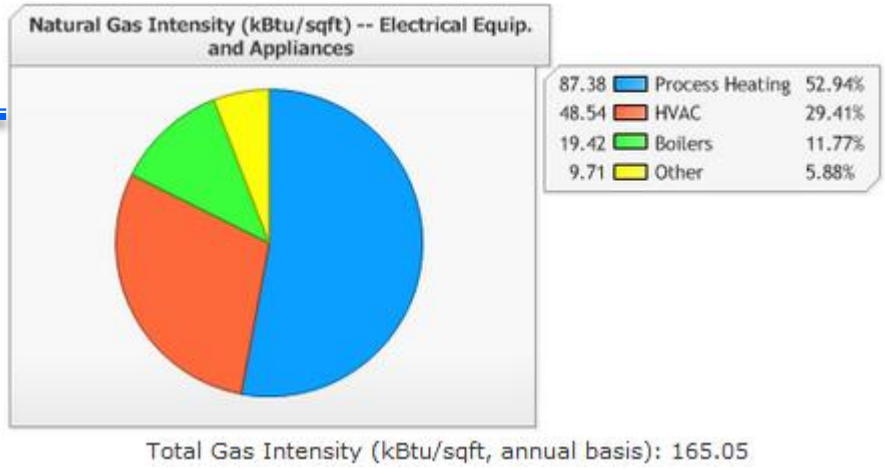




Manufacturing Consumption Patterns

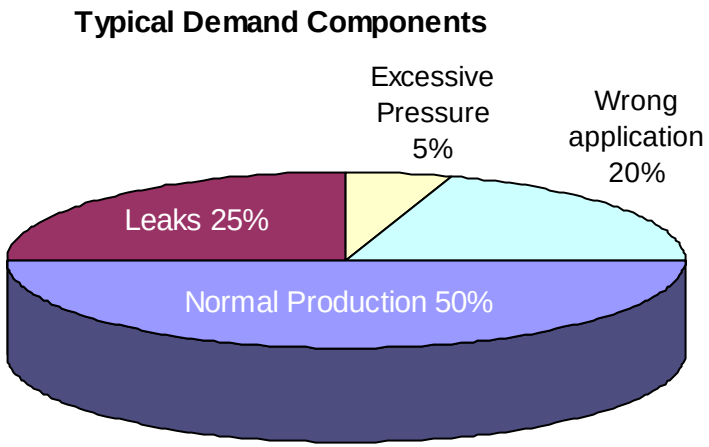
- Process heating represents largest gas end use
  - Petroleum (10,950 kBtu/sqft)
  - Chemicals (2,432)
  - Primary Metals (1,184)
  - Paper Mills (845)
  - Food Processing (745)
  - Pharmaceutical (355)
  - Beverage (250)
  - Transportation Equipment (177)
  - Electrical Equipment (165)
  - Plastic Products (164)
  - Fabricated Metal Products (160)
  - Apparel (144)
  - Wood Products (125)
  - Machinery Manufacturing (97)





Compressed Air Energy Management

- Bottom line cost savings today!
  - Compressed air is the most expensive utility.
  - Compare annual energy cost for 1 hp air motor at $1,358 versus 1 hp electric motor at $194.
  - Easily averages $100 per cfm per year (3-shifts)!



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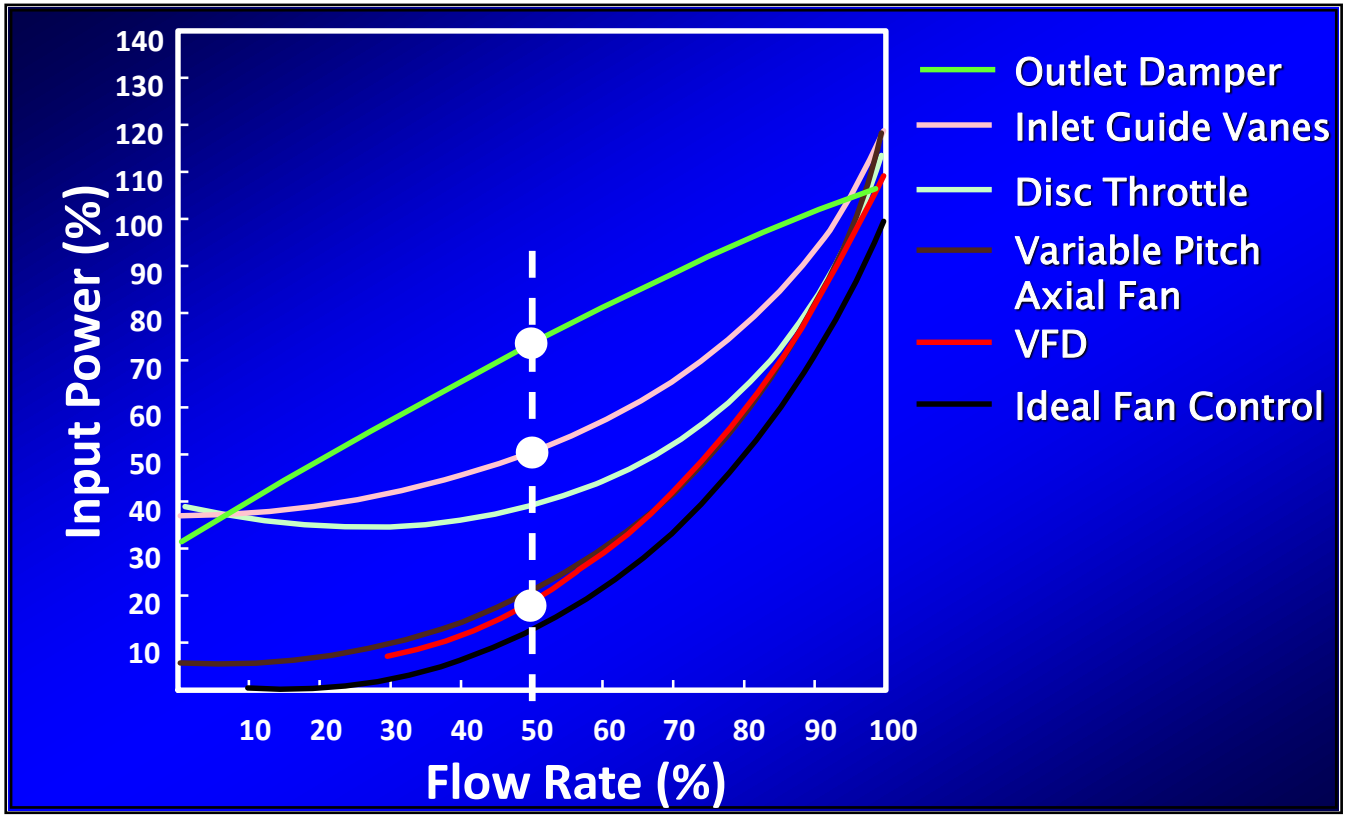
VFD Motors

- With a VFD, decreasing speed (rpm) by 50% decreases power (HP) by 87%!



Source: Emerson Industrial Automation

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Sample Savings from VFD Motors

- Estimating VFD energy savings
  - Assume a 50 HP (41.4 kW) motor operating at reduced speeds (but equivalent flow)

Full load energy consumption = 41.4 kW x 16 hr
= 662 kWh

VFD energy consumption = 352 kWh

Savings = 310 kWh

VT/VH Power vs Speed	
Speed	Power
100%	100%
90%	73%
80%	51%
70%	34%
60%	22%
50%	13%
40%	6%
30%	3%
20%	1%
10%	0.1%

50 HP VFD Pwr vs Speed @Hrs				
Speed	Power	kW	Hours	kWh
100%	105%	43.5	2	87
75%	42%	17.4	8	139
67%	30%	12.4	8	99
50%	13%	5.4	5	27
		Totals	23	352

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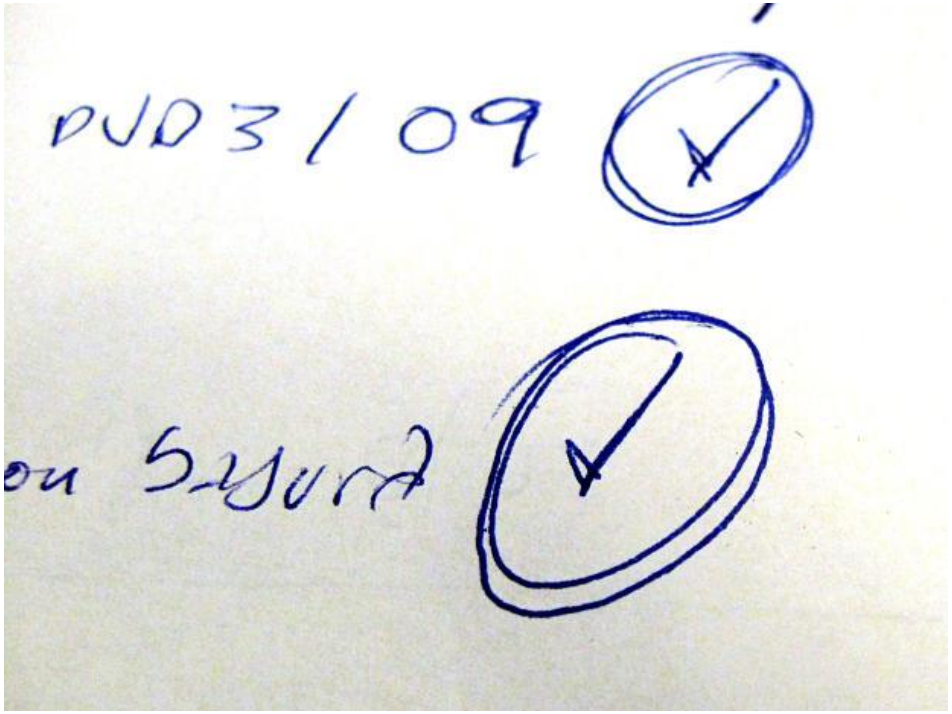
Poll Question

- What energy efficiency incentives programs have you participated in at your facility?
  a) PSE&G incentives
  b) New Jersey state incentives
  c) Federal tax incentives
  d) None
- If you answered, "None", what has kept you from applying?

Audit Checklists



All Customers

- Building Envelope
  - Check and verify insulation levels
  - Fill in outside air leaks with a low expanding foam
  - Replace cracked or missing window and door caulking
  - Install solar film or blinds for windows with south exposure
  - Replace cracked or missing weather-stripping
  - Air doors/curtains used for loading docks

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All Customers

- HVAC Operation
  - The recommended winter temperature is 68°F (50°F setback)
  - The recommended summer temperature setting is 78°F with 55% relative humidity (84°F setforward)
  - Programmable thermostats are used
  - Economizers are used for >4.5 tons (ASHRAE 90.1-2010)
  - Chilled water temperature raised 5°F to 10°F during spring and fall
  - Check air handler damper actuators for movement and sealing

All Customers

- HVAC Maintenance
  - ❑ Furnace filters are replaced on a monthly or bi-monthly schedule
  - ❑ Registers have free airflow
  - ❑ Thermostats and ventilation controls are covered and locked
  - ❑ Check for unusual noise, vibration, decrease in performance, or compressors/motors
  - ❑ Seal ductwork leaks
  - ❑ Inspect/clean condenser tubes and coils
  - ❑ Clean and disinfect condensate drain pans

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All Customers

- Lighting Operations
  - Occupancy/vacancy sensors for low foot-traffic areas
  - Photocells for all-night outdoor lighting
  - Timers in parking lots and restricted-access areas
  - Dimming controls take advantage of daylighting
  - Illumination levels are verified
  - No more than one lamp per ballast is removed in delamping

All Customers

- Lighting Operations
  - T12 fixtures replaced with T8/T5/LED
  - Probe-start metal halides replaced with fluorescent/LED
  - Halogen spots replaced with metal halide/LED
  - Incandescent A-bulbs replaced with CFL/LED
  - Exit signs use LED lamps
  - Illumination levels are verified
  - Lights turned off in unoccupied areas or during non-working hours

All Customers

- Lighting Maintenance
  - A lamp upgrade program is in place
  - Ballasts that are not in use are de-energized
  - Lamps and fixtures are cleaned for maximum illumination
  - Broken fixtures are repaired/replaced
  - Reflectors are added to existing lighting
  - Lighting panels and switches are labeled

Commercial Customers

- Hot Water Operations
  - Hot water heater(s) and pipes are insulated
  - Thermostat temperature set to 120ºF
  - Low-flow pre-rinse spray valves are used
  - Water leaks are fixed
  - Microwave ovens are used for thawing, partial cooking, and reheating (instead of hot water)
  - Dishwashers are fully loaded before washing

Commercial Customers

- Refrigeration Operation
  - Ambient air relative humidity levels are between 40% to 55%
  - VFD/ECM evaporator fan controllers used for refrigerators
  - Floating head pressure controls are used with compressors
  - Heat recovery systems used with condensers
  - Air doors/strip curtains used on freezer doors
  - Condensation sensor used with anti-sweat heater

Commercial Customers

- Refrigeration Maintenance
  - Evaporator and condenser coils are clean
  - Refrigerant charge is adequate
  - Check for unusual noise, vibration, and performance reductions of the compressors/motors
  - Worn and/or leaky door seals are replaced
  - Verify operation and efficiency of defrost timers and moisture sensors to ensure optimal performance
  - Clean and disinfect condensate drain pans

Commercial Customers

- Kitchen Operations
  - New equipment is ENERGY STAR rated
  - Plug loads are identified and controlled
  - Preheat is only done before actual cooking
  - Pots are all covered
  - Potatoes and chicken are pre-cooked in a steamer before frying

Commercial Customers

- Kitchen Operations (continued)
  - Sensors are used to turn down heat when food is not present
  - Flat-ribbon, low-watt-density heating elements replace calrods
  - Contact between the thermostat tip and griddle plate is solid
  - TRIAC solid-state relays replace thermo-mechanical thermostat controls

Commercial Customers

- Kitchen Ventilation
  - Temperature and optical sensors used with VFD motors to control hood exhaust
  - Makeup air velocity near the canopy or hood is limited to 75 fpm
  - Partial or full side panels/skirts added to hoods
  - Hoods pull the air (not push)

Manufacturing Customers

- Motor Operation
  - Motors are sized to run near rated load
  - Replaced motors meet NEMA premium efficiency
  - Voltage unbalance <3%
  - Reduced voltage starter or VFD is used to reduce starting current
  - VFD used for variable torque loads
  - Power factor is corrected if justifiable

Manufacturing Customers

- Pump Operation
  - Pumps are sized to run near rated load
  - Pump demand reduction
  - Impeller trimming for constant loads
  - Use of VFD control for variable loads

Manufacturing Customers

- Boilers/Steam Systems
  - Jack-shaft controls are inspected and calibrated
  - Excess air not over 15%
  - Steam trap leaks detected and repaired
  - Heat recovered from steam condensate during blowdown
  - Boiler tube heat transfer surfaces are clean
  - Inspect boiler access openings for leaks
  - Improve water quality to reduce deaerator vent rate
  - Insulate steam pipes and other hot surfaces

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Manufacturing Customers

- Process Operation
  - Remove power from unused transformers
  - Industrial heat pumps considered
    - <250ºF final temperature
    - <100ºF total lift
    - >0.5 MMBtuh waste heat source
  - Radio Frequency/Microwave heating/drying
    - <750ºF final temperature
    - Thickness <6” food; <18” wood
  - Induction process heating considered
    - Simple geometries

Manufacturing Customers

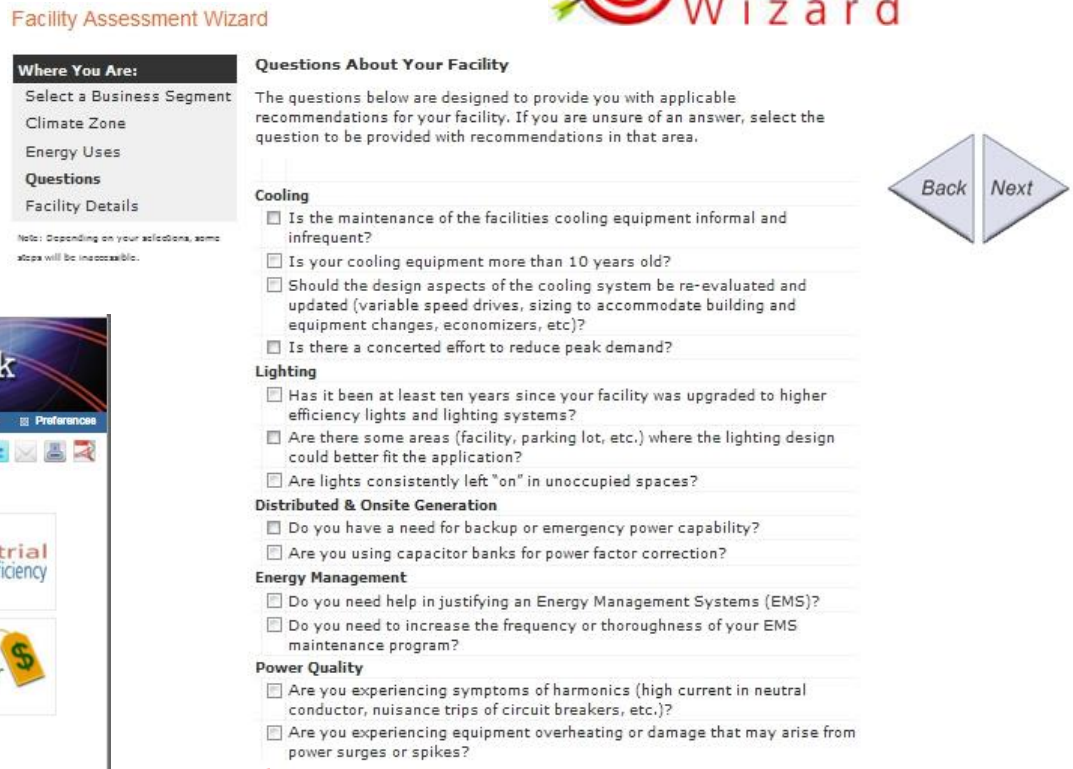
- Compressed Air Operation
  - Two-stage preferred to single-stage
  - Bad applications replaced with actuators/fans
  - Leaks are fixed
  - Variable speed controls used for trim units
  - Reduce blow off set-point (typically below 75%)
  - System pressure reduced to minimum required
  - Use ¾" diameter hose for >3 HP tools or >50' lengths
  - Heat recovery integrated with air-cooled compressors

Poll Questions

- I would like someone from PSE&G to contact me about the Commercial Efficiency program.
  a) Yes
  b) No
- How valuable has this Webinar been to you?
  a) Not valuable at all
  b) Slightly valuable
  c) Moderately valuable
  d) Very valuable
  e) Extremely valuable

Helpful Resources

- Facility Assessment Wizard



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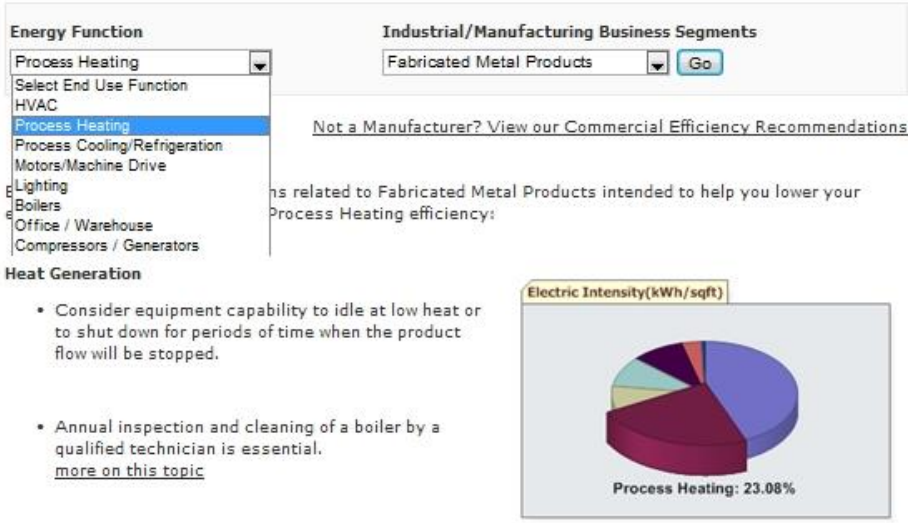
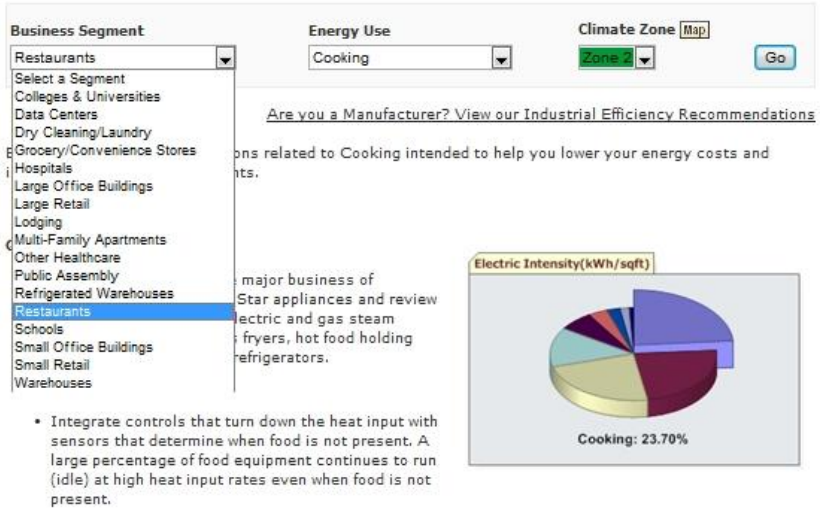
Helpful Resources

- Energy Efficiency Recommendations

Industrial Energy Efficiency



Commercial Energy Efficiency



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Helpful Resources

- Air-Conditioning, Heating, and Refrigeration Institute (AHRI)
  - http://www.ahrinet.org/
- DOE commercial lighting solutions tool
  - https://www.lightingsolutions.energy.gov
- Food service technology center
  - http://www.fishnick.com/
- Improving Compressed Air System Performance sourcebook
  - http://www.compressedairchallenge.org

Helpful Resources

- Energy Auditing Software
  - EnerSys Analytics - Energy Profile Tool
  - InterEnergy Software - Building Energy Analyzer Pro
  - DOE Industrial Facilities Scorecard
  - DOE Integrated Tool Suite/Plant Energy Profiler
  - ENERGY STAR - Portfolio Manager

Questions?

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  - Websites:
    - http://www.pseg.com/business
    - http://www.njcleanenergy.com/
    - http://members.questline.com/Default.aspx?accountID=197

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