

Energy Auditing

Presented by:



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Introduction to Energy Audit

- ▶ **What?** – detailed examination of how a facility uses energy, what the facility pays for that energy and finally recommendation of cost effective energy conservation opportunities (ECOs).
- ▶ **Why?** – saves energy, money, and the environment (recognition for being green).
- ▶ **How?** – recommends to retrofit inefficient old equipments, implement advance technologies and control measures, and change operational practices.



Basic Components of Energy Audit

- ▶ **Step 1:** Obtain facility's general information
- ▶ **Step 2:** Conduct site visit
- ▶ **Step 3:** Prepare the energy audit report



Basic Components ... continued Step 1

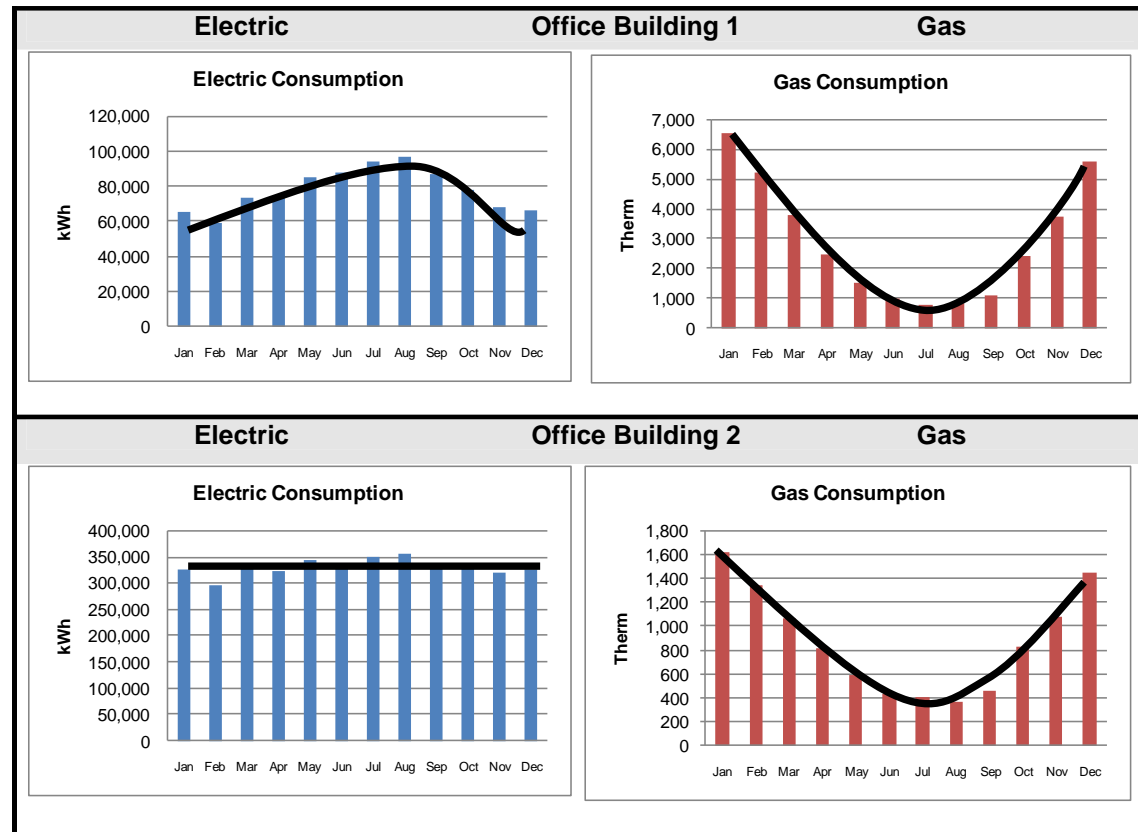
- ▶ Step 1: Obtain facility's general information
 - past utility data (12–24 months).
 - equipment list.
 - facility's physical and operation data (location, weather, operating hours).
 - analyze data to get a picture of how the facility uses and learn what areas to examine to reduce energy use.



Basic Components ... continued Step 1

- ▶ **Exercise:** What is the difference between these two buildings located in DC?

Office Building 1



Office Building 2



Basic Components ... continued Step 2

▶ Step 2: Conduct site visit to get detailed data.

- Basic tools needed: Tape measure, thermometer, lightmeter, flashlight and camera.
- Set up introductory meeting with the facility manager to briefly discuss the purpose of the audit.



Basic Components ... continued Step 2

- Interview the facility or plant manager to get operational data on the facility and equipments.
- Interview the maintenance supervisor for types of lighting and lamps, sizes of motors and equipments.
(write down these people's name, job functions and telephone to get additional information after the initial audit visit if needed.)
- Acquire detailed data on lighting, HVAC equipment, motors, HVAC, Boilers, chillers, DHW, etc.



Basic Components ... continued Step 3

- ▶ Step 3: Prepare the energy audit report which details the final results and recommendations.
 - ▶ Energy Audit Report Format
 - ▶ Executive Summary
 - ▶ Table of Contents
 - ▶ Introduction
 - ▶ Facility Description
 - ▶ Energy Bill Analysis
 - ▶ Energy Conservation Opportunities (ECOs)
 - ▶ Conclusion



Sample report

Facility Description

Example 1

- ▶ XYZ Memorial Medical Center is a multifunction hospital located in Baltimore, MD. The facility is comprised of three different buildings: St. John Building, Administration Building, and Nursing Home Building. The facility is operational 24 hours/day, 365 days/year. It was constructed in 1958. The gross building area is 464,842 ft².

Example 2

- ▶ The ABC Building is a 68,900 square-foot office building located at 200 main street, Alexandria, VA. The building, constructed in 1960, provides office space for 228 employees. At the time of site visit, the basement was unoccupied due to renovation. Approximately 44% of facility's occupied area consists of private office space, 32% is occupied by open office, 8% by files and 16% by other amenities such as conference rooms, cafeteria, copy rooms etc.

Example 3

- ▶ The Ashland building was constructed in 1930 and renovated in 1966 as an office, classroom, and laboratory building. The gross building area is 156,883 ft², including four floors. The building is fully occupied by undergraduate students and faculty during the academic year, which lasts from the last week of August through the second week in May. During the summer, approximately half of the rooms are occupied by summer students and attendees of conferences which occur at the University throughout the summer.



Sample report

HVAC Description

Example 1

- ▶ The building cooling system consists of three McQuay water-cooled chillers. Two of the chillers are original and were installed in approximately 1988. The chillers are used to generate chilled water, which is distributed to the buildings Air Handling systems. Heat rejection for the system is accommodated through a cooling tower, which was replaced in 1995. Primary building cooling is accomplished using Variable Volume Air Handlers, which are located in the basement Mechanical Equipment Room. Building Heating is accomplished using 2 - Cleaver Brookes gas fired Boilers located in the basement. Boilers are in good condition and should have substantial remaining useful life. Heating water is distributed to the building Air Handlers and system VAV Terminal boxes to provide required space heating.

Example 2

- ▶ A central mechanical room consisting of a Carrier air handling unit and a Weil-McLain- LGB gas fired boiler (Johnson controls) regulates the HVAC for the office. A Carrier Air cooled Reciprocating Chiller is installed outside. The building was constructed in 1992 and there have been no substantial modifications. All individual offices and rooms have Carrier fan-coil air conditioners in each room which take heated or cooled water from the boiler room and using thermostats in each unit control the temperature in the room. Central on open areas are controlled from the main air handling unit, the temperature is set in the mechanical room and a return duct temperature reading is used to control. Computer room (in office area) supplemental AC: there is a split type cooling unit/condensing unit installed. It was replaced in 2008



What to look for during site visit

- ▶ Lighting
- ▶ Motors
- ▶ HVAC, boiler, refrigeration equipments



What to look for... continued Lighting

- ▶ **Lighting:** Building, floor, location name, space description, each type of light fixture and lamps, quantity and control system.

CF23/1-L =
1 lamp, **Compact Fluorescent** , 4 ft

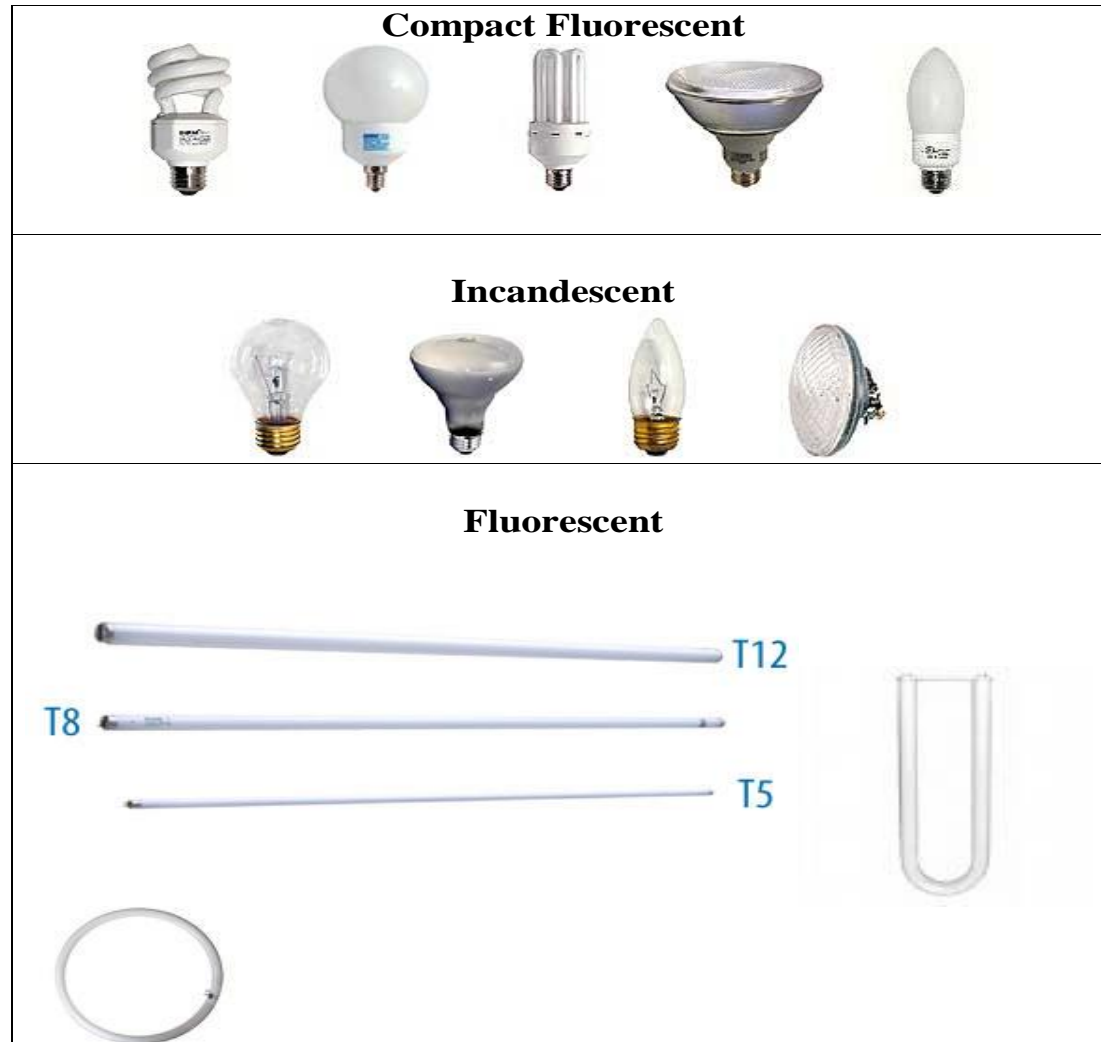
2LT12-4 =
2 lamps, T12, 4 ft

Line #	Building	Floor	Area Description	Usage Code	Pre-Fixture No.	Pre Fixt. Code	Existing Control
1	ABC	1	Office A	Office	20	2LT12-4	
2	ABC	1	Marketing Office B	Office	12	CF23/1-L	yes
3	ABC	2	Men	Restroom	4	4LT8	
4	ABC	2	Hallway next to men	Hall	4	I100/1	
5	ABC	2	Office C	Office	18	2LT12-4	
'	'	'	'	'	'	'	'
'	'	'	'	'	'	'	'
100	ABC	5	Accounting	Office	21	I150/4	
Total							




I150/4L =
4 lamps, **Incandescent 150Watt**



What to look for... continued Lighting



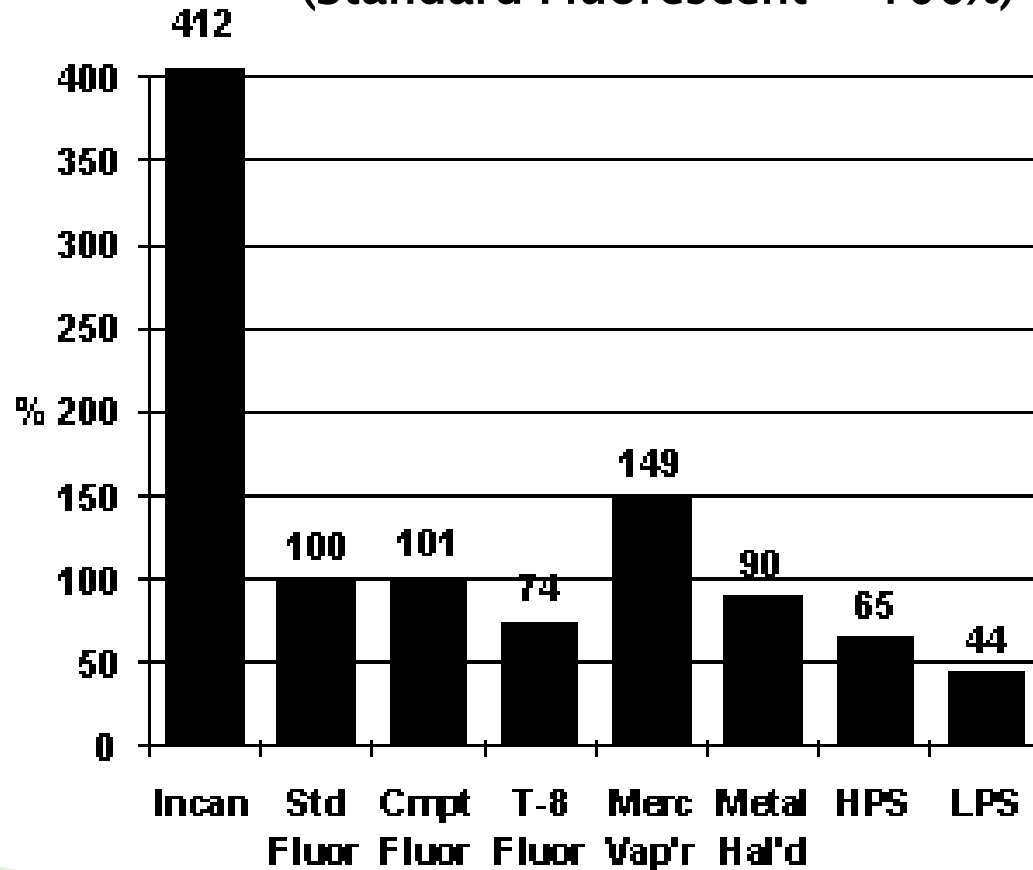
What to look for... continued Lighting

High-intensity discharge (HID)	
Metal Halide	
	
High Pressure Sodium (H.P.S.)	
	
Mercury Vapor	
	



What to look for... continued Lighting

Relative Energy Cost for Equal Light*
(Standard Fluorescent = 100%)



What to look for... continued Motors

- ▶ **Motors:** Building, motor size(HP), motor use, model number, efficiency and electrical data from nameplate.

Building	Floor	Motors Description	Type	# of Motors	HP	Efficiency	RPM	Nameplate Volts	Nameplate Current	Power Factor
ABC	5	AHU-3 SF	Supply fan	1	15	86.5	1750			0.8
ABC	2	CW Pump	Condensor pump	1	15	86.5		208		0.8
ABC	3	CHW pump-1	Chilled water pump	1	5	83.1				0.8
ABC	B	HW pump	Hot water pump	2	15	86.5	1725	208		0.8

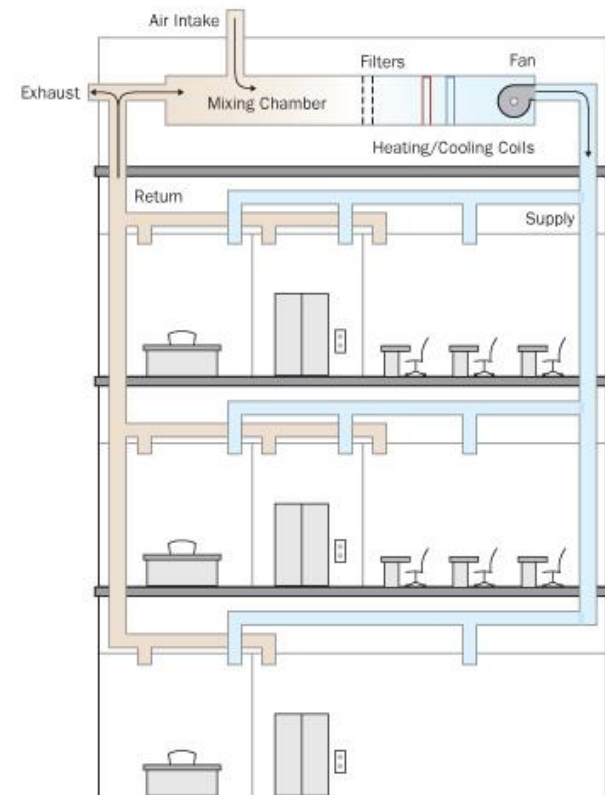
- ▶ An inventory of all electric motors over 1 horsepower should be taken.

Nameplate data



What to look for ... continued HVAC

- ▶ HVAC, boiler, refrigeration equipments: all heating, air conditioning and ventilating equipment should be inventoried.



What to look for ... continued HVAC

- ▶ Data such as building, equipment size or capacity, model number, efficiency, age, electrical specifications or fuel use should be collected.

Pumps



Chiller



What to look for ... continued HVAC

- ▶ Condition of equipment should also be noted.

- ▶ AHU & VSD



Boilers



Energy conservation Measures

- | | |
|--|--|
| <ul style="list-style-type: none">➤ Lighting Retrofit➤ Lighting Controls➤ Premium Efficiency Motors➤ Energy Management System (EMS)➤ Variable Speed Drives➤ Temperature reset➤ Economizer (Free Cooling)➤ Heat Recovery | <ul style="list-style-type: none">➤ Boiler replacement➤ Chiller replacement➤ Ventilation System (OA)➤ Infiltration➤ Building Envelop (usually not cost effective)➤ Laundry processes➤ Vending Machine Control➤ Other (Kitchen equipment, Exhaust Hood, CO2 sensor, etc) |
|--|--|



Questions?

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