

## **ENRG 57 - Miscellaneous Building Systems**

**COURSE DESCRIPTION:** Overview of types of facilities with high-energy use equipment, descriptions of equipment, plug load, vampire loads. Common energy efficiency opportunities.

**18 Lecture Hours**

### **LEARNING OUTCOMES:**

- Describe the types of facilities that contain high energy-use equipment, and evaluate why these are of interest to commercial building auditors
- Summarize the types of equipment in commercial kitchens, describe energy efficiency opportunities within commercial kitchens, and assess the challenges to implementing many of them
- Summarize the types of equipment in grocery stores, describe the energy efficiency opportunities within grocery stores, and assess the challenges to implementing many of them
- Summarize the types of equipment in offices, describe the energy efficiency opportunities within offices, and assess the challenges to implementing many of them
- Categorize equipment that contributes to vampire loads, and assess energy efficiency opportunities

### **COURSE TOPICS:**

- I. Introduction
  - A. Types of commercial facilities with high-intensity energy use due to process equipment requirements
    1. Food service (commercial kitchens)
    2. Grocery stores
    3. Laundries
    4. Data Centers
    5. Hotels (contain kitchens and laundries)
    6. Laboratories
    7. Hospitals (contain kitchens, laundries, computers, diagnostic and monitoring equipment)
  - B. Other energy-consuming equipment
    1. Computers, printers, and copiers
    2. Signage
    3. Conveyance systems
    4. Office plug loads represent 13% of commercial electric energy
    5. Vampire loads from stand-by features of “off” equipment
  - C. Focusing on the areas where energy consumption can be reduced in energy intensive facilities
  - D. Rebates and incentives for energy reductions
- II. Commercial kitchens
  - A. Why auditors need to focus on commercial kitchens
    1. Energy intensive (use 5X more energy per square foot than the rest of the building)
    2. Long operating hours
    3. Low equipment turnover
    4. There’s a kitchen in almost every building
  - B. Types of equipment in commercial kitchens
    1. Cooking
      - a. Electric or gas oven
      - b. Electric or gas steamer
      - c. Griddle equipment
      - d. Hot food holding cabinets
    2. Common energy efficiency measures
      - a. Routine maintenance and cleaning (O&M)
      - b. Focus on ventilation
        - 1.) Position appliances against walls and fully under exhaust hoods

- 2.) Install side panels on exhaust hoods
- 3.) Rebalance ventilation systems
- 4.) Turn off hoods when cooking appliances are off
- 5.) Set make-up air duct stat to 55°
- 6.) Variable speed exhaust fan controls ("demand ventilation")
- 7.) Change exhaust hood lights with CFLs
- c. Replace un-insulated hot food holding cabinets with insulated equipment
- d. Challenges to implementing changes
  - 1.) Long equipment life and low equipment turnover
  - 2.) Long operational hours
  - 3.) Safety of workers and work "traffic" flow
- 3. Refrigeration
  - a. Glass or solid door refrigerators
  - b. Glass or solid door freezers
  - c. Ice machines
  - d. Walk-in coolers or freezers
  - e. Common energy efficiency measures
    - 1.) Routine maintenance and cleaning (O&M)
    - 2.) Condenser coils
    - 3.) Thermostat
    - 4.) Automatic door closers
    - 5.) Leak repairs
    - 6.) Add strip curtains to walk-in coolers
    - 7.) Replace ice machines with energy efficient models
  - f. Challenges to implementing changes
    - 1.) Long equipment life and low equipment turnover
    - 2.) Long operational hours
- 4. Dishwashing
  - a. Water use, sewer costs, water heating costs
  - b. Common energy efficiency measures
    - 1.) Low flow pre-rinse spray valves
    - 2.) Hand sink aerators
    - 3.) Fix leaks

### III. Grocery store cooling/refrigeration equipment and energy consumption

- A. High-intensity facilities: up to 50% of energy use attributable to refrigeration
- B. High air heating costs to compensate for open refrigerated cases
- C. Facilities contain freezers and refrigerated cases
  - 1. Low/Anti-sweat heat refrigeration
  - 2. Open fronted cooling cases
  - 3. Strip curtain freezers
- D. Inspect existing equipment
  - 1. Compressors, condensers, evaporators, cases
  - 2. Refrigerant sight glass
  - 3. Gaskets, automatic door closers, insulation
  - 4. Case lighting controls
  - 5. Anti-sweat controls
- E. Consider store opening schedule (24-hour or more limited hours)
- F. Common energy efficiency measures
  - 1. Routine maintenance and cleaning (O&M)
    - a. Clean condenser coils
    - b. De-ice and clean evaporator coils
    - c. Replace door gaskets
    - d. Repair or replace automatic door closers

2. Repair leaks
3. Correctly size equipment to needs
4. Change defrost schedule
5. Correctly load open cases within cooling area and not blocking air returns
6. Do not block airflow to evaporator in freezers
7. Add doors or covers to open cases
8. Add night covers to open cases
9. Replace freezer lighting with low-temp CFLs
10. Motion sensor case lighting controls
11. Add strip curtains to walk-in freezers and coolers
12. Insulate bare pipes
13. Install efficient evaporator fan motors
14. Replace appliances with new Energy Star rated appliances

G. Challenges to implementing changes

1. Long equipment life and low equipment turnover
2. Long operational hours
3. Employee training and behavior

IV. Hot water equipment and energy consumption (sanitation, laundry, dishwashing, cooking)

A. Process heating boiler

1. Direct contact water boiler
2. Indirect water boiler
3. Large domestic hot water boiler
4. Space heating boiler
5. Steam traps

B. Hot water heater

1. Electric or gas storage water heater
2. Ozone laundry heating systems
3. Commercial pool and spa heaters

C. Common energy efficiency measures

1. Insulate bare pipes
2. Regulate tank temperature
3. Allocate the recirculating pump operation by using a timer to turn it off during closed hours
4. Activate the automatic flue damper operation
5. Fix leaks

V. Codes and standards for appliance and equipment efficiencies

A. Manufacturer specifications

B. Energy Star

C. California Title 20

D. Rebates and incentives

VI. Plug-load of common tenant office equipment

A. Why plug load is important

1. Most office equipment left on 24 hrs/day
2. Plug load equipment totals 13% of electrical use in commercial buildings
3. Heats air in room, which then needs to be cooled
4. Most plug load equipment has minimal control strategies available

B. Equipment contributing to plug load

1. Computers
2. Monitors
3. Printers
4. Scanners
5. Copiers
6. Fax machines
7. Audio/visual equipment

|                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                                                                                                                                                                                 | <ul style="list-style-type: none"> <li>8. Task lighting</li> <li>9. Space heaters</li> <li>10. Ceiling fans</li> <li>11. Home appliances in employee break rooms</li> <li>12. Others</li> <li>C. Common energy efficiency measures               <ul style="list-style-type: none"> <li>1. Routine maintenance and cleaning (O&amp;M)</li> <li>2. Replace appliances with new Energy Star rated appliances</li> <li>3. Turn off equipment when not in use</li> <li>4. Manual controls: tenant education and behavior change</li> </ul> </li> <li>D. Challenges to implementing energy efficiency measures               <ul style="list-style-type: none"> <li>1. Difficult to change behavior</li> <li>2. Few automatic control options</li> </ul> </li> </ul> <p>VII. Vampire loads</p> <ul style="list-style-type: none"> <li>A. Equipment with standby feature draws 1-15 W in off mode</li> <li>B. Control devices such as remote controls</li> <li>C. Video cassette recorder</li> <li>D. Computer monitors</li> <li>E. Television cable box</li> <li>F. Phone charger</li> </ul> <p>VIII. Signage</p> <ul style="list-style-type: none"> <li>A. Exit and other safety signs must remain on</li> <li>B. LED signs</li> </ul> <p>IX. Building conveyance systems</p> <ul style="list-style-type: none"> <li>A. Elevators</li> <li>B. Escalators</li> </ul> |
| <b>TYPES OF ASSIGNMENTS:</b>                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|                                                                                                                                                                                                                                                 | <ul style="list-style-type: none"> <li>I. In-class               <ul style="list-style-type: none"> <li>A. Class discussions</li> <li>B. Small group projects such as on-line research of manufacturer information to determine energy use of specific equipment</li> <li>C. Possible field trips such as to the Pacific Energy Center, or campus or non-campus facilities such as commercial kitchens or grocery stores</li> <li>D. Field simulation exercises such as cataloging equipment during a Field trip or site visit</li> </ul> </li> <li>II. Out-of-class               <ul style="list-style-type: none"> <li>A. Readings from textbooks, instructor handouts or websites</li> <li>B. Research and prepare a brief (1 page) report of energy efficient equipment and rebates in response to specific scenarios</li> <li>C. Field work simulations such as visiting a grocery store and preparing a list of observed energy efficiency opportunities</li> </ul> </li> </ul>                                                                                                                                                                                                                                                                                                                                                                          |
| <b>TEXTBOOKS &amp; RESOURCES:</b>                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <ul style="list-style-type: none"> <li>• Websites such as <a href="http://www.fishnick.com">www.fishnick.com</a>, <a href="http://www.pge.com/ftsc">www.pge.com/ftsc</a>, <a href="http://www.energystar.gov">www.energystar.gov</a></li> </ul> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |

# BEST Center Curricula, Resources & Recordings

## Academic Programs

Georgia Piedmont Technical College - Building Automation Systems

Milwaukee Area Technical College - Sustainable Facilities Operations

Laney College - Commercial HVAC Systems

City College San Francisco - Commercial Building Energy Analysis & Audits

## Professional Development Materials, Presentations & Videos

National Institutes

Building Automation Systems Instructor Workshops

Webinars (e.g., BEST Talks)

## Faculty Profile Videos

## Reports & Case Studies

## Marketing Resources

© 2013-2025 by BEST Center: NSF National Center for Building Technician Education is licensed under Creative Commons Attribution-Non Commercial (CC BY-NC) 4.0 International.

To view a copy of this license, visit <https://creativecommons.org/licenses/by-nc/4.0/>

 CC BY-NC 4.0

# Attribution-NonCommercial 4.0

