

Washington State University Energy Program Energy Audit Workbook

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Please Print or Type
1. Building Information

Name of Institution		Address	
Owner, if other than Institution		Address	
Name of Building		Building #	
Address (Street or P.O. Box)		City, State, Zip	
Date of Audit	Type of Institution Public___ Private Non-Profit ___ Other ___		
Building Manager (administrator responsible for bldg.)			Bldg. Mgr.'s Phone
Energy Management Coordinator (EMC) or Monitor			EMC's Phone
Person Completing this Audit (include Cert. #)			Phone
Building Type and Category <div style="display: flex; justify-content: space-between;"> <div style="width: 20%;"> <u>School</u> ___Element. ___Second. ___Comm.Coll. ___Coll./Univ. ___Voc. Tech. Ctr. ___Other, Specify _____ </div> <div style="width: 20%;"> <u>Hospital</u> ___General ___Psychiatric ___Other, Specify _____ </div> <div style="width: 20%;"> <u>Government</u> ___Federal ___State ___City/County ___Special Dist. ___Indian Tribe </div> <div style="width: 20%;"> <u>Public Care</u> ___Nurs. Home ___Long-term care ___Rehab. Center ___Orphanage ___Public Health ___Res. Child Care ___Other, Specify _____ </div> </div> Date of construction, If known _____			<u>Building Use</u> <div style="display: flex; flex-direction: column; gap: 5px;"> ___Office ___Storage ___Library ___Services ___Police Station ___Fire Station ___Dormitory ___Prisoner Detention ___Other, Specify _____ </div>
Original Architects (if known)		Original Engineers (if known)	
Building Modifications or Changes In Use Anticipated in the next 15 yrs:			Remaining Useful life of the building: _____ Years
Does the Institution Have an ongoing energy management program?			___Yes ___No
Previous Energy Audits Completed? (if yes, give dates) ___Yes ___No Dates _____			
Previous Architectural/Engineering Studies Undertaken? (if Yes, Specify) ___Yes ___No			
Name of Electric Utility		Is this building on the National Historic Preservation Register? ___Yes ___No	

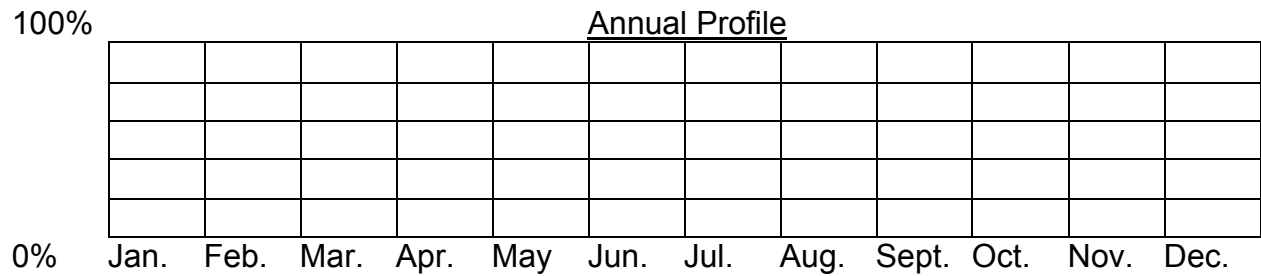
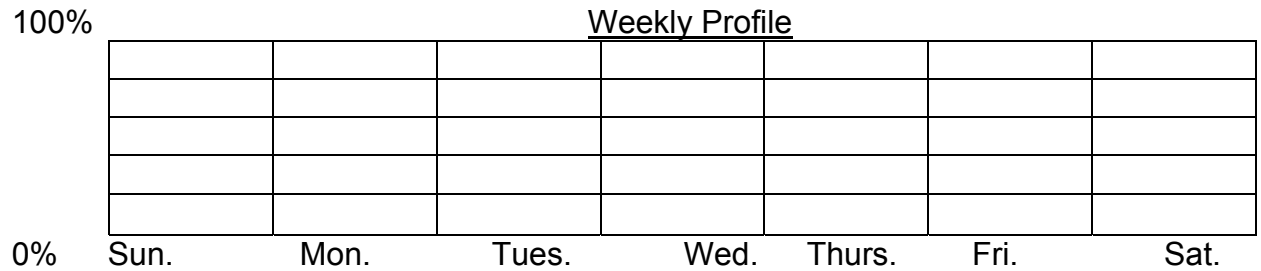
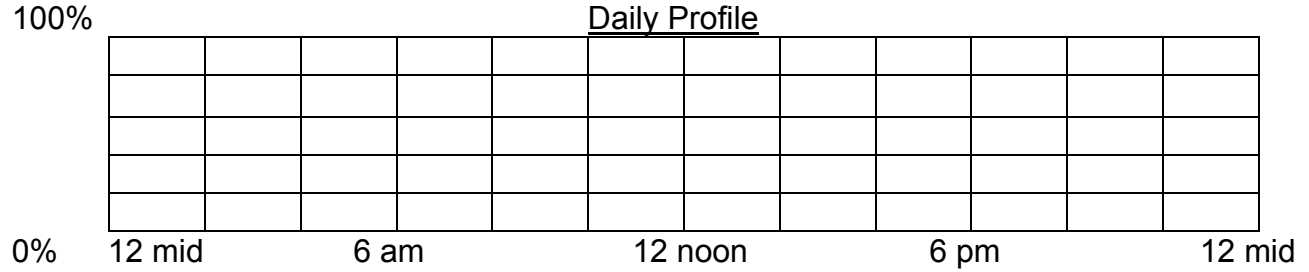
1. Building Information

Energy Saving Operation and Maintenance Procedures Implemented or Under Consideration Prior to this Audit (specify which). Please include an estimate of implementation cost and energy savings in kWh/yr and Btu/yr.

Conservation Measures (retrofit) Already Implemented or Under Consideration Prior to this Audit (specify which). Please Include Estimate of Cost and Savings if Available.

1. BUILDING INFORMATION

Building Occupancy Profile



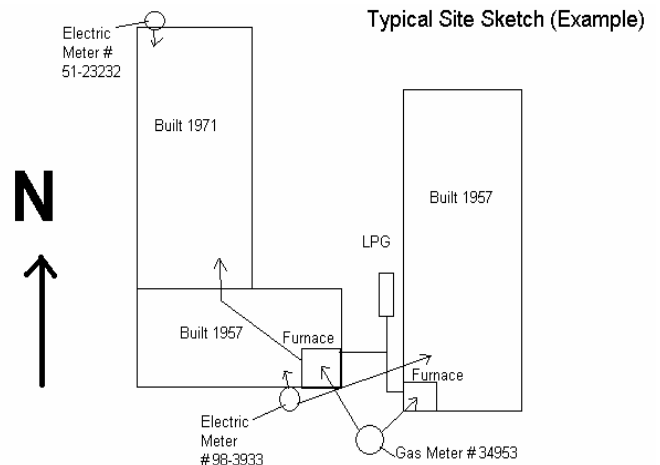
Building Occupancy Schedule

[illegible]

BUILDING INFORMATION

On the following page, prepare a site sketch of your building or building complex which shows the following information:

1. Relative location and outline of the building(s).
2. Building Age
3. Building Number (Assign numbers if buildings are not already numbered.)
4. Building Size
5. Fuel Type
6. Location of heating and cooling units
7. Heating plants
8. Central cooling system, etc.
9. North orientation arrow



2. BUILDING CHARACTERISTICS

- a. **Gross Floor Area:** _____ Gross Sq.Ft. x Ceiling Height _____ Ft. = volume _____ Cu.Ft.
- b. **Conditioned Floor Area:** _____ (if different than gross floor area)
- c. **Total door Area:** _____ Sq.Ft. Glass doors _____ sq.ft. Wood doors _____ sq.ft. Metal doors _____ sq.ft. Garage doors _____ sq.ft.
- d. **Total Exterior Glass Area:** _____ sq.ft. Single Panes _____ sq.ft. Double panes _____ sq.ft.

	North	South	East	West
Total Area _____ sqft	_____ sqft	_____ sqft	_____ sqft	_____ sqft
Single Pane _____ sqft	_____ sqft	_____ sqft	_____ sqft	_____ sqft
Double Pane _____ sqft	_____ sqft	_____ sqft	_____ sqft	_____ sqft

- e. **Total Exterior Wall Area:** _____ sqft Material: ☐ Masonry ☐ Wood ☐ Concrete ☐ Stucco ☐ Other

- f. **Total Roof Area:** _____ sqft Condition: ☐ Good ☐ Fair ☐ Poor

- g. **Insulation Type:** _____ Roof _____ Wall _____ Floor

- h. **Insulation Thickness:** _____ Roof _____ Wall _____ Floor

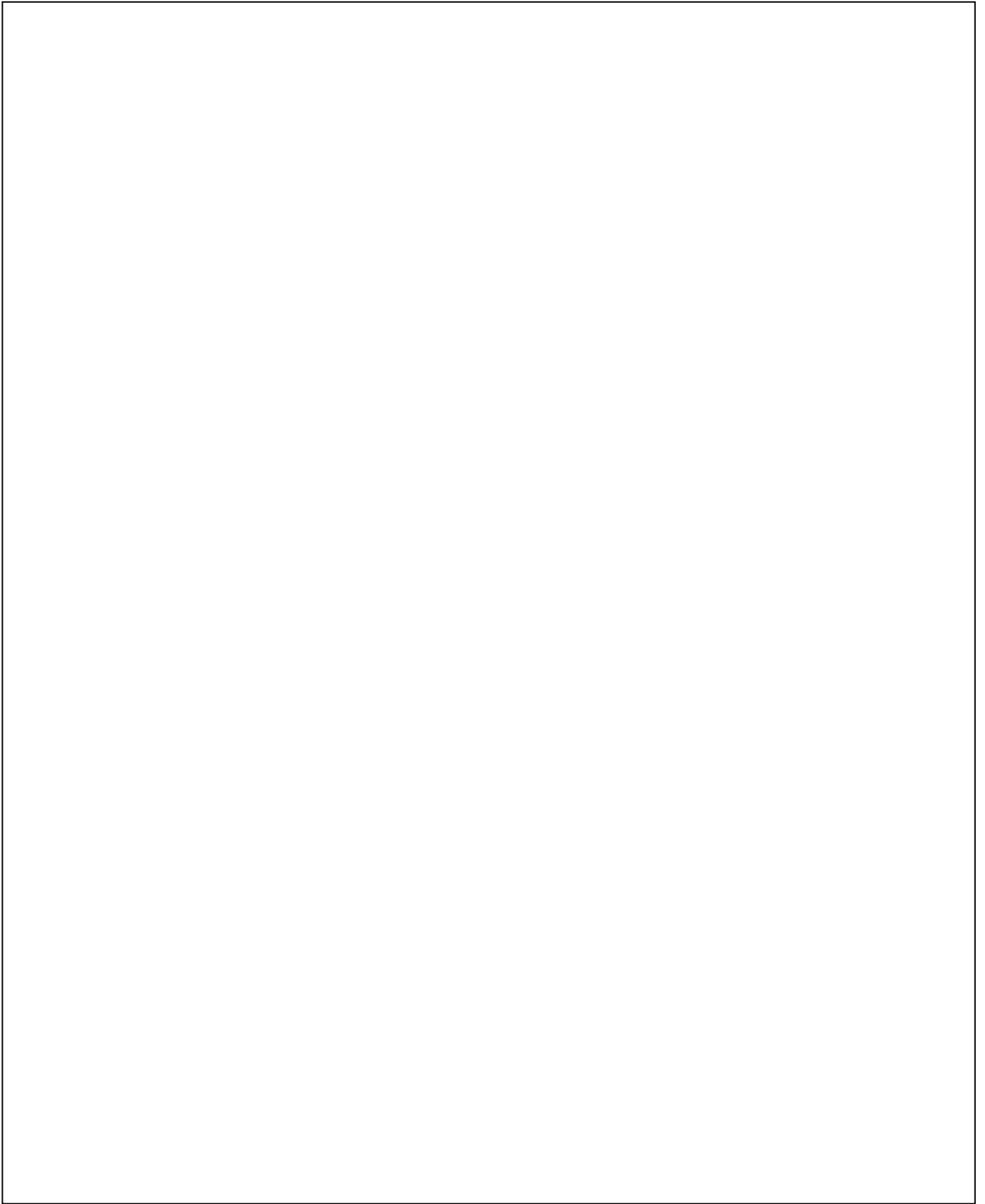
- i. **Metering:** Is this building individually metered for electricity? ☐ Yes ☐ No

Is this building individually metered for natural gas? ☐ Yes ☐ No

Is this building on a control boiler system with other buildings? ☐ Yes ☐ No

- j. **Describe general building condition:**

SITE SKETCH



Indicate compass direction with a north arrow.

2. ANNUAL ELECTRIC USE AND COST									
Include Electrical Demand, if applicable									
Building		Address						Year of Record From / To	
Account Number		Meter Number				Utility			
Maximum kW Demand W/O charge				Minimum Power Factor W/O charge				Building size (sqft)	
1	2	3	4	5	6	7	8	9	10
Meter Read Date From To		KWh* Used	KWh/gross sq.ft. **	Annual (EUI) BTU/sqft (000)	Energy Cost	KW-KVA Demand	Fixed Service Cost	P.F. * and Demand Cost***	Total Cost
TOTAL									

Comments:

Conversion: 3413 BTU/kWh

*KW – Kilowatts, KVA – Kilo-Volt-ampere, KWH – Kilowatt hour, P.F. – Power Factor

**Total annual kWh divided by the building’s gross sq. ft.

***If demand and/or power factor are metered and billed, energy cost here.

3. ANNUAL NON-ELECTRIC ENERGY USE AND COST						
Photo copy this form for additional fuel types						
Building		Address			Year of Record From To	
Account Number		Meter Number		Utility		
Building Size (sq ft)		Fuel Type		Specify Units		
Billing Period From To		Fuel consumption	Conversion Factor	MMBTU	Annual (EUI) Btu/sq.ft.	Cost \$
TOTAL						

*Conversion Factors	
Natural Gas	100,000 Btu/therm
Natural Gas	1,030 Btu/cubic feet
Liquified Petroleum	(LP bottled gas)
	95475 Btu/gallon
Kerosene	134,000 Btu/gallon
Distillate Fuel Oil	138,690 Btu/gallon
Residual Fuel Oil	149,690 Btu/gallon
Coal	24.5 million Btu per
	Standard short ton
Wood	8,680 Btu/pound
Steam	970 Btu/pound
Other	Consult standard Engineering
	Reference Manual

Comments:

4. HEATING PLANT

	PRIMARY	SECONDARY1	SECONDARY2
(A) System Type Code	_____	_____	_____
How many each type?	_____	_____	_____
Rated Input Consumption	_____	_____	_____
Rated Output Capacity	_____	_____	_____
(B) Energy Source Code	_____	_____	_____
(C) Maintenance Code	_____	_____	_____
(D) Control Code	_____	_____	_____

(A) System Type Code	(B) Energy Source	© Maintenance Code	(D) Control Code
1. Fire tube-Steam	1. Natural Gas	1. Good	1. Manual
2. Water tube-steam	2. LP Gas	2. Average	2. Somewhat automated
3. Fire tube-hot water	3. #2 Fuel Oil	3. Fair	3. Highly automated
4. Water tube-hot water	4. #4 Fuel Oil	4. Poor	
5. Electric Resistance	5. #6 Fuel Oil		
6. Heat pump with aux. Elec.heat	6. Electricity		
7. Purchased steam	7. Coal		
8. Other (explain)	8. Wood		
	9. Solar		
	10. Purchased Steam		

Operation Profile:

_____ hrs/weekday _____ hrs/Sat. _____ hrs/Sun. _____ wks/yr

Estimated annual hours of operation _____

From (month) _____ through (month) _____

Thermostat set points:

Day: _____

Night/weekends: _____

Heating Degree Days: _____ (see table on page 15)

Comments:

5. HVAC DISTRIBUTION SYSTEM

Area Served (sq.ft.)	Location of Unit(s)
----------------------	---------------------

	PRIMARY	SECONDARY1	SECONDARY2
A. System Type Code	_____	_____	_____
B. Maintenance Code	_____	_____	_____
C. Control Code	_____	_____	_____

(A) System Type Code

1. Single Zone
2. Multi Zone
3. Dual duct
4. Variable air volume
5. Single duct reheat
6. 2-pipe water
7. 4-pipe water
8. Window unit
9. Unit ventilator
10. Fan Coil
11. Unit heater
12. Other (define)

(B) Maintenance Code

1. Good
2. Average
3. Fair
4. Poor

(C) Control Code

1. Space thermostat
2. Outside temperature sensors
3. Time clocks
4. Energy management system
5. Auto supply temp reset
6. Economy cycle
7. Heat recovery
8. Other (define)

6. COOLING PLANT (continued on next page)

Is building mechanically cooled? ☐ Yes ☐ No

(A) System Type Code _____ (B) Energy Source Code _____ (C) Maintenance Code _____
 D. Control Code _____ (E) Voltage Code _____

(A) System type code	(B) Energy source code	(C) Maintenance Code	(D) Control Code	(E) Voltage Code
1. Reciprocating chiller	1. Electric Motor	1. Good	1. Manual	1. 120/single phase
2. Centrifugal chiller	2. Combustion engine	2. Average	2. Somewhat Automated	2. 208-220/single phase
3. Absorption chiller	3. Steam turbine	3. Fair	3. Highly Automated	3. 208-220/3-phase
4. Solar assisted-absorption chiller	4. Steam boiler	4. Poor		4. 440-480/3-phase
5. Evaporative chiller	5. Purchased steam			
6. Heat pulmp				
7. DX system				
8. Screw compressor				
9. Window or thru-wall unit				
10. Other (define)				

6. COOLING PLANT (continued)

Operation Profile:

_____hrs/weekday _____hrs/Sat _____hrs/Sun _____wks/yr

Estimated Annual hours of Operation _____

From (month) _____through (month) _____

Cooling Degree days _____ (see table on page 15)

Comments:

7. DOMESTIC HOT WATER

Domestic Hot Water Heated by:

☐ Electricity ☐ Natural Gas ☐ Oil ☐ Steam ☐ Heat pump ☐ Other, specify _____

Number of Units	General Location(s) of Unit(s)	Is there a re-circulation loop?
Daily Usage (if known) _____gal/day	Hot Water Temp. At point of Use _____ At heater _____	
Temp. of city water	Is tank wrapped? <input type="checkbox"/> Y <input type="checkbox"/> N	Do obstructions prevent wrapping? <input type="checkbox"/> Y <input type="checkbox"/> N
Distance from Heater to Point of use _____Nearest _____Farthest	Hot Water Uses for Other than Lavatories	

8. FOOD PREPARATION AND STORAGE AREA EQUIPMENT

Item	Exists	Total load (if known) KW	Item	Exists	Total load (if known) KW
Ranges	Yes No	_____	Ovens	Yes No	_____
Steam Tables	Yes No	_____	Frying Tables	Yes No	_____
Freezers	Yes No	_____	Refrigerators	Yes No	_____
Walk-in Refer	Yes No	_____	Walk-in Freezer	Yes No	_____
Infra-red warmer	Yes No	_____	Dishwashers	Yes No	_____
Microwaves	Yes No	_____	Hoods w/Exhaust fans	Yes No	_____
Mixers	Yes No	_____	Other, Define _____	Yes No	_____

9. LIGHTING

Building Area*	Type Code of fixture	Approximate number of fixtures	Average watts per fixture	Operating hours/day	Average footcandles**
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____

Lighting Type Codes

- A. Incandescent
- B. Flourescent
- C. Mercury Vapor
- D. High Pressure Sodium
- E. Low Pressure Sodium
- F. Metal Halide

*Include indoor and outdoor areas.

** Optional

Comments : (e.g., specially installed energy saving fixtures, bulbs, controls such as wall switchers, timeclocks, dimmers, etc.)

10. SOLAR AND RENEWABLE RESOURCE POTENTIAL

Location <input type="checkbox"/> Urban <input type="checkbox"/> Suburban <input type="checkbox"/> Rural															
Building Characteristics # of Stories _____ General shape* _____ <input type="checkbox"/> Roof Unshaded <input type="checkbox"/> Southern Wall Unshaded															
Roof Indicate orientation on pg. 6** <input type="checkbox"/> Flat <input type="checkbox"/> Pitched							Roof's primary structural material**			Type of Roofing**					
Composition of Southern Facing Wall							Southern Facing Wall Glass Area <input type="checkbox"/> Less than 25% <input type="checkbox"/> 25-75% <input type="checkbox"/> Over 75%								
Mean Insolation (Btus/sq.ft.) ***							Mean Wind Speed (miles/hr)***								
Jan _____		Jul _____		Jan _____		Jul _____		Feb _____		Aug _____		Feb _____		Aug _____	
Feb _____		Aug _____		Mar _____		Sep _____		Mar _____		Oct _____		Mar _____		Oct _____	
Mar _____		Sep _____		Apr _____		Nov _____		Apr _____		Dec _____		Apr _____		Dec _____	
Apr _____		Nov _____		May _____		Jun _____		May _____		Jul _____		May _____		Jul _____	
May _____		Jun _____		Jun _____		Jul _____		Jun _____		Aug _____		Jun _____		Aug _____	
Jun _____		Jul _____		Jul _____		Aug _____		Jul _____		Sep _____		Jul _____		Sep _____	
Does the building have adjoining open space along the southern wall? <input type="checkbox"/> Yes <input type="checkbox"/> No															
Monthly Mean Daily Insolation on A Horizontal Surface (Btu/ft2)													Remarks****		
City	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
Seattle															
Tacoma	277	513	978	1487	1856	1886	2089	1668	1196	694	384	236			
Spokane	439	753	1185	1749	2078	2199	2454	2052	1491	830	483	277			
Monthly Mean Wind Speed (miles/hr)															
City	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
Seattle	8	8	9	8	8	8	7	7	7	7	7	8			
Spokane	8	9	9	9	8	8	8	8	8	8	8	8			
Olympia	7	7	8	7	6	6	6	6	5	6	6	8			
Source: Climatic Atlas of the United States															
<p>*Note building characteristics, indicating shape as square, rectangular, E-shaped, H-shaped, L-shaped.</p> <p>**Note roof design. For the orientation of a pitched roof, indicate the compass direction of a line perpendicular to the ridgeline in the direction of the down slope. Note presence of roof obstructions such as chimneys, space conditioning equipment, water towers, mechanical rooms and stairwells. Identify the principal structural material of the roof, e.g., steel concrete, or wood structural components. Also identify the type of roofing such as shingle, slate, or built-up.</p> <p>***Using information from the National Weather Service, the WSU Energy Program, or from charts provided above, enter monthly mean wind speeds and monthly mean daily insolation on a horizontal surface.</p> <p>****Note any special conditions or characteristics related to potential for solar or other renewable resource application.</p>															

11. ENERGY SAVINGS

INSTRUCTIONS: This section is to be completed by the auditor after the walk-through portions of the audit. First, check the boxes which state the range of the percent of energy consumption which would be saved by implementing the operation and maintenance items recommended in section 2 of this book. Second, calculate the range of energy and cost savings by multiplying the estimated percentages by the annual electrical and fuel consumption data on this audit report.

Check two boxes in each category:

Range of Electrical Savings [] 0% [] 5% [] 10% [] 15% [] 20% [] 25% [] Other_____

Range of Fuel Savings [] 10% [] 15% [] 110% [] 115% [] 120% [] 125% [] Other

Calculate ranges of energy and cost savings:

Range of Electrical Savings								
	% Range	Annual Electrical consumption kWh	=	Range of Electrical savings kWh	% Range	Annual Electrical dollars spent	=	Range of Electrical Dollar savings
Lower Bound		X	=			X	=	
	_____	_____		_____	_____	\$ _____		\$ _____
Upper bound		X	=			X	=	
	_____	_____		_____	_____	\$ _____		\$ _____

		Range of Fuel Savings					
	% Range	Annual fuel consumption Btu		Range of fuel savings Btu	% Range	Annual Fuel dollars spent	Range of Fuel Dollar savings
Lower Bound	X	=			X	=	
Upper bound	X	=			X	=	

The auditor is not responsible if actual savings resulting from the implementation of the energy conservation opportunities listed in this section do not fall between the roughly estimated ranges which are specified.

Total Range of operation and maintenance energy savings (total all fuels):

From _____ Btu to _____ Btu.
(lower bound) (upper bound)

Comments:

ANNUAL HEATING DEGREE DAY (HDD) AND COOLING DEGREE DAY (CDD) NORMALS FOR _____ STATE BY COUNTY (19__ - __)

[illegible]

Note: For each site, heating degree day normals are reported in the left column, cooling degree day normals in the right. “Station” refers to the NOAA climatological measuring site from which data are taken to represent the county as a whole. Stations are chosen to be representative of the county according to the location relative to isotherms. Temperature base for heating and cooling degree day is 65° F.

You can find these for your region by contacting local weather service stations or the National Oceanic and Atmospheric Administration.

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WSUCEEP2003-038

Preliminary Site Assessment (Schools)

Energy Partnerships

Date _____

Facility Name _____

Contact Name/ph# _____ / _____

Bldg. A _____

B _____

C _____

Potential EEM

BUILDINGS

I. Building Envelope	A	B	C	Comments
1. Install double glazing				
2. Infill glazing				
3. Solar film for glazing				
4. Weatherstrip/caulk windows				
5. Install insulated doors				
6. Weatherstrip doors				
7. Insulate roof (rigid)				
8. Insulate ceiling (batt/blow)				
9. Insulate wall				
10. Insulate floor				
11. Lower ceiling				
12. Vestibule entry				
13.				
II. HVAC				
A. Boilers				
1. Replace Boilers				
2. Upgrade existing boiler				
3. Replace Burners				
4. Fuel switch				
5. Reduce steam dist. Press.				
6. Tune up boiler				
7. Insulate shell and piping				
8. Replace/repair condensate system				
9. Replace/repair steam traps				
10. Install boiler flue damper				
11. Preheat boiler feed water				
12. Preheat combustion air				
13. Time clock w/low temp. override				
14. Zone controller				
15. Boiler reset control				
16.				

Comments:

	A	B	C	Comments
B. Furnace/U.V./Roof Top				
1. Install high eff. Unit				
2. Recondition units				
3. Replace inefficient burners				
4. Install electronic ignition				
5. Install auto flue damper				
6. Fuel switch				
7.				
C. Heat Pumps				
1. Repair				
2. Install new				
3. Install economizer cycle				
4.				
D. Cooling Systems				
1. Upgrade inefficient chillers				
2. Install var. speed chiller motor				
3. Add head press. Control				
4. Install strainer cycle to chillers				
5. Utilize evap. Cooling				
6. Install cooling tower stage control				
7. Upgrade cooling tower				
8. Install local air conditioners				
9. Install economizer cycles				
10.				
E. Controls				
1. Install an EMCS				
2. Install optimum start/stop				
3. Install night setback				
4. Install load shedding				
5. Install system optim. Cap.				
6. Install warm up cycle				
7. Install deck temp. reset				
8.				
F. Vent/Dist/Term. Equipment				
1. Convert to VAV				
2. Reduce outside air %				
3. Adjust ventilation rates				
4. Install auto. Dampers				
5. Reduce air stratification				
6. Insulate pipes &/or ducts				
7. Modify zoning				

8. Reduce/elim. Heat to h-ways				
9. Reduce/elim. Air to unocc. Areas				
10. T-stat. Rad. Control valves				
11. Rebuild/replace steam traps				
12.				

	A	B	C	Comments
--	---	---	---	----------

G. Domestic Hot Water

1. Install flow restrictors				
2. Install auto-off faucets				
3. Decentralize hot water heating				
4. Insulate HX piping & tank				
5. Install summer heater				
6. Lower temp. & install boosters				
7. Install instant DHW heaters				
8. DHW pump/tank timers				
9.				

III. Lighting

1. Incand. To flour./HID				
2. MV to MH/HPS				
3. Install eff. Ballasts & lamps				
4. Lower fixtures				
5. Delamp & discon. Ballasts				
6. Install occup. Sensors				
7. Install local switches				
8. Exit light replacement				
9. Install photocell exterior				
10. Timer control exterior				
11.				

IV. Electric Equipment

1. De-energize equip. not used				
2. Reduce loads when not req'd				
3. Improve power factor				
4. Convert to eff. Motors				
5. Install var. speed motors				
6. Replace oversized motors				
7.				

V. Meters Numbered

1. Gas				
2. Electric				

VI. Visual Est. of Potential Savings (1=low, 5=high)

VII. Training Needs

--

Comments:

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Guidelines for Public Agencies

Energy-Efficiency Measures List

1.0 Envelope

1.1 Reduce Heat Losses-Ceiling/roof

- 1.11 Additional Ceiling/Roof Insulation
- 1.12 Exhaust Attics
- 1.13 Use Light-Colored Roof Surfaces
- 1.14 Roof Sprinkling/Spray System

1.2 Reduce Heat Losses-Walls/floors

- 1.21 Additional Wall Insulation
- 1.22 Additional Floor/Slab Insulation
- 1.23 Use Light Colored Exterior Surfaces
- 1.24 Thermal Mass/Passive Solar Heating

1.3 Reduce Heat Losses-Windows/Doors

- 1.31 Install Additional Glazing Layer
 - Multilayer reflective roller shade device
 - Operable insulating slats
 - Quilted insulating draperies
- 1.32 Install Movable Insulation
 - Heat mirror
 - Low-e coatings
 - Argon gas window fill
- 1.33 Use Special Coatings or Gases

1.4 Reduce Heat Gain--Windows/Doors

- 1.41 Install Exterior Shading
- 1.42 Install Interior Shading
- 1.43 Use Tinted or Reflective Coatings or Films
- 1.44 Optimize Window Sizing and Orientation

1.5 Reduce Infiltration

- 1.51 Caulk and Weatherstrip Doors and Windows

Dock shelters/seals

Install air curtains

1.52 Install Air-Lock Vestibule System or Revolving Doors

2.0 Lighting

2.1 Reduce Lighting Required

2.11 Utilize Task Lighting

2.12 Lighting Controls

Selective switching

Programmable timing control

Occupancy sensors

Energy management system

2.13 Use Light-Colored Interior Wall Finishes

2.2 Install More Energy-Efficient Lighting System

2.21 Use High-Efficiency Fixtures

HID fixtures in selected locations

Efficient exit signs

Self-ballasted compact fluorescents

2.22 Use Efficient Exterior Fixtures

High-pressure sodium HID fixtures

Metal halide fixtures

2.23 Use High-Efficiency Ballast

Electromagnetic/hybrid.

Electronic

2.3 Use Daylighting

2.31 Install Dimming Controls

2.32 Architectural Modifications

3.0 HVAC Systems

3.1 Air Distribution Systems

3.11 Reduce Energy Losses

Increase duct insulation

Install air-to-air heat recovery

Runaround loop heat recovery

3.12 Reduce System Flow Rates

- Airflow and fan speed reduction

- VAV system to reduce fan energy use

- Variable speed drive motor for VAV

3.13 Reduce System Resistance

- High-efficiency filters

- Improve design and balance of duct system

3.14 Reduce Ventilation Loads

- Reduce ventilation rate to minimum

- Install local ventilation and makeup air hoods

3.15 Air Destratification

- Enclosed high-velocity fan

- Open propeller fans

- Ductwork system with centrifugal or vane axial fans

3.2 Water/Steam Distribution

3.21 Reduce Energy Losses

- Increase pipe insulation

- Steam-trap monitoring system

3.22 Reduce System Flow Rates

- Primary/secondary pumping with variable speed motors

- Isolate off-line equipment in parallel piping circuits

- Time control or interlocks on circulating pumps

3.23 Reduce System Resistance

- Install booster pumps

3.3 Heating Plant

3.31 Improve Boiler or Furnace Efficiency

- Match boiler size to load

- Install multiple boilers

- Condensing hydronic boiler

- Increase heat transfer area

- Preheat combustion air or fuel supply

- Boiler water treatment

3.32 Install High-Efficiency Heat Pump

- Air-to-air heat pump

- Dual-fuel heat pump

- Water-source heat pump

- Ground-source heat pump

3.33 Install Radiant Heating System

3.4 Cooling Plant

3.41 Select More Efficient Cooling System

- Use evaporative cooling

- Use cooling tower instead of air-cooled system

- Use heat recovery chiller

- Direct cooling: well, pond, lake, or river

3.42 Improve Cooling Efficiency

- Optimize chiller efficiency with temperature controls

- Use multiple chillers and optimization controls

- Increase chilled water design temperature

- Optimize cooling tower flow controls

3.43 Increase Condensing Efficiency

- Lower condenser water design temperature

- Reset controls on water temperature

- Tube-brush cleaning system

- Chemical washing system

3.44 Improve Part-Load Performance

- Select chillers based on Integrated Part Load Value (IPLV)

3.5 Control Systems

3.51 Demand Limiting EMCS/DDC

3.52 Optimize Start/Stop

3.53 Duty Cycling Control System (Reduce unoccupied ventilation)

3.54 Supply Temperature Setup/Setback Control System

- Install programmable thermostats

- Install controls and hardware to optimize hot-and-cold deck reset

3.55 Install Economizer Control System

3.56 Boiler Control Strategies

- Draft control modifications

- Barometric or flue shutoff dampers

- Outside air temperature reset or heating lockout

- Boiler optimization controls

- Hi/low, modulating, or reduced excess air burner

Install flu gas analyzer-trim control

3.6 Thermal Storage Systems

3.61 Water Storage Tanks

3.62 Ice Storage Systems

3.63 Rock Bins

4.0 Water Heating

4.1 Reduce Water Heating Loads

4.11 Use Low Water Use Devices

4.12 Use Local Booster or Point-of-Use Heaters

4.13 Preheat Feedwater with Reclaimed Waste Heat

4.14 Timeclock Controls to Reduce Unoccupied Loads

4.2 Reduce System Losses

4.21 Increase Insulation on Hot Water Pipes

4.22 Increase Insulation on Water Storage Tanks

4.3 Install More Energy Efficient Water Heating System

4.31 Use Heat-Pump Water Heaters

4.32 Solar-Assisted Water Heater

5.0 Power Systems

5.1 Reduce Power System Losses

5.11 Correct Power Factors

5.12 Install Energy-Efficient Transformers

5.2 Install Energy-Efficient Motors

5.21 High-Efficiency Motors

5.22 Multispeed. Motors

5.23 Variable-Speed Motors

5.24 Optimize Motor Sizing

5.3 Reduce Peak Power Demand

5.31 Demand Limit Controls (See 3.5 1)

6.0 Refrigeration

6.1 Improve Controls

6.11 Optimize Defrost Cycle Control

6.12 Optimize Condensing Unit Capacity Control

6.13 Install Floating-Head Pressure Control

6.2 Reduce Refrigeration System Losses

6.21 Install Refrigerated Space Doors or Curtains

6.22 Increase Insulation of Refrigerated Area

6.3 Improve Refrigeration System Efficiency

6.31 Multiple Compressors and Controls

6.32 Increase Condensing Unit Efficiency

6.33 Select High-Efficiency Compressor

Reciprocating compressor

Screw compressor

Rotary compressor

Parallel unequal reciprocating compressor

7.0 Miscellaneous

7.1 Heat Recovery

7.11 Install Double-Bundle Chillers

7.12 Reclaim Heat from Combustion System Flue

7.13 Reclaim Heat from Steam Condensate

7.14 Reclaim Heat from Waste Water

7.15 Laundry Process Heat Recovery

7.16 Reclaim Heat from Exhaust Air (See 3.11)

7.17 Pool Dehumidification Heat Recovery System

7.2 Install More Efficient Ancillary Equipment

7.21 Elevator/Escalator Optimization

7.22 Install Pool Cover

Exterior Maintenance Checklist

Provide safe and easy access to areas and equipment to facilitate regular maintenance.

Roof

- ☐ Drain standing water: unplug drainage system, fill low spots
- ☐ Keep gutters and downspouts clear of debris and well attached to building and ground drainage system. Run-off should not drip down walls.
- ☐ Check condition of roofing material, repair cracks, blisters, holes
- ☐ Keep caulking in good condition around planned openings (ducts, pipes, conduit, etc.)
- ☐ Keep skylights clean

Walls

Maintain siding and paint

- ☐ Repair damage
- ☐ Keep caulking in good condition and fill all gaps, replace as needed
- ☐ Keep paint in good condition, find and correct cause of blistered peeling, or cracked paint

Doors and Windows

- ☐ Keep conditioned spaces separated from unconditioned and outdoor spaces
- ☐ Keep them closed with snug fit
- ☐ Keep latches and closing mechanisms in good working order
- ☐ Weather-stripping and thresholds in good condition and draft-free
- ☐ Replace broken glass or multi-paned glass whose seal is broken (evidenced by condensation between panes)
- ☐ Keep awnings in good condition, remove when not needed

Foundation walls

- ☐ Caulk cracks
- ☐ Drain standing water away from building
- ☐ Maintain drainage tiles around footing, keep free of vegetation and damage from crushing
- ☐ Keep buildings drainage connected to storm sewers or appropriate system.

HVAC

- ☐ Keep system operating for comfort so opening of windows or doors is not necessary, (make controls easy to understand and use)
- ☐ Maintain slight positive pressure in building to reduce infiltration of outside air (Building air pressure should not prevent doors from fully closing.)
- ☐ Keep all ducts in good repair with joints sealed and insulated where appropriate.
- ☐ Keep intake and exhaust dampers clear of debris, connected to controllers, and operable

(dirt, corrosion, and rust can impair proper operation).

- ❑ Change filters and clean coils as needed

Miscellaneous

- ❑ Keep insulation on ducts or pipes in good repair and adequate quantity
- ❑ Keep openings screened and / or caulked
- ❑ Correct damage to pipes, conduit, and ducts
- ❑ Check meters for tampering or damage
- ❑ Repair dripping faucets
- ❑ Keep exterior electrical outlets covered when not in use, insulate around them
- ❑ Plan landscape watering for best efficiency, reduce evaporation losses by watering during mornings or evenings
- ❑ Use pool covers
- ❑ Watch for and investigate excessively wet spots on grounds, may be caused by leaking or broken pipes
- ❑ Check exterior lighting for proper operating times, hopefully have photocell or other automatic control system
- ❑ Turn off unnecessary lighting
- ❑ Practice group re-lamping at 70% of rated lamp life,
- ❑ Check that all lamps are operating and providing useful light (mercury vapor lamps put out some light long after they cease providing useful light at the ground level.)
Ballasted lamps continue to use energy as long ballast is connected, even if the lamp is burned out
- ❑ Keep lighting fixtures clean and in good condition

ENERGY AUDITOR CHECKLIST **

A. BUILDING ENVELOPE	Does this problem exist?		Recommended		N/A
	Y []	N []	Y []	N []	
1. Improper alignment and operation of windows and doors allows excessive infiltration. Suggested O & Ms: a. Realign or re-hang windows or doors that do not close properly. In extreme cases, consider permanent sealing of windows. b. Make sure automatic door closing mechanisms work properly. c. Replace or repair faulty gaskets in garage or on other overhead doors. Suggested ECMs: a. Resize exterior doors; i.e., delivery doors, making them smaller to reduce excessive infiltration.* b. Add expandable separate enclosures, where practical. c. Install self-closing doors on openings to unconditioned spaces. d. Install a switch on overhead doors that prevents activation of heating and cooling units when doors are open. e. Install vestibule doors at major entrances.*					
2. Weather-stripping and caulking around windows, doors, conduits, piping, exterior joints, or other areas of infiltration where it is worn, broken or missing. Suggested O&Ms: a. Replace worn and/or broken weather-stripping and caulking. b. Replace broken or cracked windows. (Air leakage is most evident when wind is blowing against the side of the building.) Suggested ECMs: a. Where practical, cover all windows and through the wall cooling units when not in use. Specially designed covers can be obtained at relatively low cost. b. In areas with constant strong winds, install wind screens to protect exterior doors from direct blast of prevailing winds. Screens can be opaque, constructed of metal framing with armored glass. Careful positioning is necessary for infiltration control.	[]	[]			

Measures marked “” may have an adverse affect on indoor air quality. Implementation of these measures is not required.

**All ECMs listed here are potential energy conservation opportunities.

ENERGY AUDITOR CHECKLIST

	Does this problem exist?		Recommended		N/A
A. BUILDING ENVELOPE	Y	N	Y	N	
3. Doors and /or windows separating conditioned from non-conditioned areas (including outdoors) are left open. Suggested O&Ms: a. Post instructions. b. Assure that automatic door closers function properly.	[]	[]	[]	[]	[]
4. Excessive expanses of glass exist on exterior walls. Suggested O&Ms: a. When replacing windows, replace with thermopanes, utilizing the same casings. * b. Keep curtains and drapes closed in unoccupied spaces. Suggested ECMs: a. Totally or partially insulate non-operable windows. Consider replacing non-operable window with walls. b. Install double-pane windows. c. Consider adding reflective or heat absorbing film to minimize solar gain in summer and heat loss in winter. (Note: Any window film reduces natural lighting and winter solar gain.) d. Install adjustable outdoor shading devices. e. Attach storm glazing to moveable sash of operable windows.	[]	[]	[]	[]	[]
5. There is no insulation between conditioned and unconditioned spaces. Suggested ECM: a. Insulate between heated/cooled spaces and unconditioned or outside areas such as parking garages, porticos, storage, basements and attics.	[]	[]	[]	[]	[]
6. Ceiling/roof insulation is inadequate or has been water damaged. Suggested O&Ms: a. Before replacing water damaged insulation, repair roof where required. b. Verify that vapor barrier faces the conditioned space and is intact. Suggested ECM: a. Add new insulation to meet recommended standard. (check the cost effectiveness of this measure particularly if your facility is over there stories.)	[]	[]	[]	[]	[]

ENERGY AUDITOR CHECKLIST

	Does this problem exist?		Recommended		N/A
A. BUILDING ENVELOPE					
7. Blinds and curtains are not used to help insulate the building.	Y []	N []	Y	N	
Suggested O&Ms:					
a. Instruct personnel to close interior shading devices to reduce night heat loss in winter and to reduce solar heat gain during the summer.			[]	[]	[]
b. Repair or replace damaged or missing shading devices.			[]	[]	[]
c. Place reminders where appropriate.			[]	[]	[]
Suggested ECMs:					
a. Add reflective or heat absorbing films to reduce solar heat gain in summer. (Caution: Natural lighting and solar heat gain in winter will be reduced. Also, unless protected by an additional layer of glass, these films are subject to damage.			[]	[]	[]
b. Install outdoor shading devices.			[]	[]	[]

	Does this problem exist?		Recommended		N/A
B. BUILDING OCCUPANCY					
8. Off-hour activities extend operating hours for energy using systems.	Y []	N []	Y	N	
Suggested O&Ms:					
a. Reschedule off-hour activities to accommodate partial shutdown of building systems other than ventilation systems.			[]	[]	[]
b. Reschedule custodial and cleaning activities during working hours whenever possible.			[]	[]	[]
c. Re-examine original assumptions regarding occupancy patterns and building usage. Modify patterns for increased energy efficiency.			[]	[]	[]
Suggested ECM:					
a. Install an automated energy management system that will control all spaces in accordance with usage.			[]	[]	[]
9. Building has extended occupancy areas such as computer rooms.	[]	[]			
Suggested O&Ms:					
a. Isolate these spaces (including related support services such as restrooms and break areas) from the portion of the building having fewer operating hours.			[]	[]	[]

ENERGY AUDITOR CHECKLIST

	Does this problem exist?		Recommended		N/A
C. HVAC -- CONTROLS	Y	N	Y	N	
<p>10. Thermostats on heating/cooling units are vulnerable to occupant adjustment.</p> <p>Suggested O&Ms:</p> <p>a. Reset thermostats to correct settings.</p> <p>b. Install or replace locking screws to prevent tampering.</p> <p>c. Install tamper-proof locking covers on thermostats.</p> <p>Suggested ECMs:</p> <p>a. Install pre-set solid-state electric thermostats if existing controls are electric.</p> <p>b. Relocate thermostats in return air ducts where they will be inaccessible to occupants.</p>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<p>11. Space temperatures are higher or lower than thermostat settings.</p> <p>Suggested O&Ms:</p> <p>a. Recalibrate thermostat.</p> <p>b. Blow out moisture, oil and dirt from pneumatic lines (for pneumatic systems); clean contacts if electrical control system.</p> <p>c. Recalibrate controllers.</p> <p>d. Ensure that control valves and dampers are modulated properly.</p> <p>e. Ensure that heat generating device is producing heat and that heat distribution to the space is unobstructed.</p> <p>f. Make sure that air intake volume is not excessive.</p> <p>Suggested ECM:</p> <p>a. For electric control system, install pre-set solid-state thermostats which do not require calibration.</p>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<p>12. Thermostat settings have not been adjusted for change in seasons.</p> <p>Suggested O&Ms:</p> <p>a. Adjusted thermostats to 68°F in heating season¹ and to 78°F during cooling season.²</p> <p>b. Change the location of thermostats from areas subject to extreme temperature fluctuations, such as next to window, or over a heating or cooling unit.</p> <p>Suggested ECM:</p> <p>a. Replace existing thermostat with a thermostat which has a separate setting for cooling and a separate setting for heating or use one thermostat to control heating and one thermostat to control cooling.</p> <p>¹ except for interior zones requiring cooling</p> <p>² except for reheat systems</p>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

ENERGY AUDITOR CHECKLIST

	Does this problem exist?		Recommended		N/A
C. HVAC -- CONTROLS	Y	N	Y	N	
<p>13. Control devices are not inspected on a regular basis.</p> <p>Suggested O&M:</p> <p>a. Routinely check all time clocks and other control equipment for proper operation, correct time and day and for night and proper programming of on-off set points. Protect from unauthorized adjustment.</p> <p>Suggested ECM:</p> <p>a. Use an automated energy management system.</p>	<p><input type="checkbox"/></p>	<p><input type="checkbox"/></p>	<p><input type="checkbox"/></p> <p><input type="checkbox"/></p> <p><input type="checkbox"/></p>	<p><input type="checkbox"/></p> <p><input type="checkbox"/></p> <p><input type="checkbox"/></p>	<p><input type="checkbox"/></p> <p><input type="checkbox"/></p> <p><input type="checkbox"/></p>
<p>14. Building temperatures are not adjusted for unoccupied periods.</p> <p>Suggested O&Ms:</p> <p>a. Reduce thermostat settings by a minimum of 10°F at nights, for weekends and holidays during heating season, but maintain ventilation..</p> <p>b. Shut down air conditioning units at night, on weekends and holidays.</p> <p>Suggested ECM:</p> <p>a. Install automatic controls such as time clocks or automated management systems.</p>	<p><input type="checkbox"/></p>	<p><input type="checkbox"/></p>	<p><input type="checkbox"/></p> <p><input type="checkbox"/></p> <p><input type="checkbox"/></p>	<p><input type="checkbox"/></p> <p><input type="checkbox"/></p> <p><input type="checkbox"/></p>	<p><input type="checkbox"/></p> <p><input type="checkbox"/></p> <p><input type="checkbox"/></p>
<p>15. Unoccupied or little used areas are heated or cooled unnecessarily.</p> <p>Suggested O&Ms:</p> <p>a. Reduce winter thermostat settings to 55°F in unoccupied areas.</p> <p>b. Where possible, turn off heating systems if nothing ;in space can freeze.</p> <p>c. Use spot heaters/coolers in large spaces with low occupancy.*</p> <p>d. Increase summer thermostat setting, in unoccupied areas, if possible.</p> <p>Suggested ECM:</p> <p>a. Install system controls to reduce heating/cooling of unoccupied spaces.</p>	<p><input type="checkbox"/></p>	<p><input type="checkbox"/></p>	<p><input type="checkbox"/></p> <p><input type="checkbox"/></p> <p><input type="checkbox"/></p> <p><input type="checkbox"/></p>	<p><input type="checkbox"/></p> <p><input type="checkbox"/></p> <p><input type="checkbox"/></p> <p><input type="checkbox"/></p>	<p><input type="checkbox"/></p> <p><input type="checkbox"/></p> <p><input type="checkbox"/></p> <p><input type="checkbox"/></p>
<p>16. Heating/cooling equipment is started before occupants arrive and/or is operating during last hour of occupancy.</p> <p>Suggested O&M:</p> <p>a. Experiment with star-up times and duration of operation to determine satisfactory comfort levels for occupants. Reduce or turn off heating and cooling during the last hour of occupancy, allowing the building to “coast.”</p> <p>Suggested ECM:</p> <p>a. Install a time clock or an automated energy management system that will reduce heating and /or cooling. Maintain ventilation rates.</p>	<p><input type="checkbox"/></p>	<p><input type="checkbox"/></p>	<p><input type="checkbox"/></p> <p><input type="checkbox"/></p>	<p><input type="checkbox"/></p> <p><input type="checkbox"/></p>	<p><input type="checkbox"/></p> <p><input type="checkbox"/></p>

ENERGY AUDITOR CHECKLIST

	Does this problem exist?		Recommended		N/A
C. HVAC – VENTILATION	Y	N	Y	N	
<p>17. Air flow to space feels unusually low or is inconsistent from one space to another.</p> <p>Suggested O&Ms:</p> <ul style="list-style-type: none"> a. Utilize ductwork access openings to check for any obstructions such as loose hanging insulation (in lined ducts), loose turning vanes and accessories, and closed volume and fire dampers. Adjust, repair or replace as necessary. b. Inspect all room air outlets and inlets (diffusers, registers and grilles). They should be kept clean and free of all dirt and obstructions. Clean and remove obstructions as necessary. c. Clean or replace dirty or ineffective filters on a regular basis. d. Post signs instructing occupants not to place objects where they will obstruct air flow. e. Rebalance system. 					
<p>18. Large spaces having low occupancy are maintained at comfort conditions.</p> <p>Suggested O&Ms:</p> <ul style="list-style-type: none"> a. Reduce overall ventilation in space. * b. Consider regrouping activities into smaller areas which can be conditioned separately from remainder of building. 					
<p>19. Heating/cooling equipment is operating in lobbies, corridors, vestibules and /or other public areas.</p> <p>Suggested O&Ms:</p> <ul style="list-style-type: none"> a. Lower heating set points in the above areas if there is no possibility of freeze-up. Disconnect electrical heating units (or switch off at breaker box). Maintain ventilation. b. Close HVAC supply ducts serving the above areas.* <p>Suggested ECM:</p> <ul style="list-style-type: none"> a. Properly adjust and balance air/water systems and controls. 					
<p>20. An excessive quantity of outdoor air is used to ventilate the building.</p> <p>Suggested O&Ms:</p> <ul style="list-style-type: none"> a. Reduce outdoor air quantity to the minimum allowed by codes by adjusting outdoor air dampers during hours of occupancy. b. Repair any malfunctioning ventilation equipment. <p>Suggested ECM:</p> <ul style="list-style-type: none"> a. Replace old style dampers with new high quality opposed-blade models with better close-off ratings. b. Repair leaking or failed dampers. 					

ENERGY AUDITOR CHECKLIST					
	Does this problem exist?		Recom-mended		N/A
C. HVAC – VENTILATION	Y []	N []	Y	N	
21. Outdoor air intake dampers open when building is unoccupied. Suggested O&Ms: a. Close outdoor air dampers when building is unoccupied. Be sure dampers have proper seals and adjust to ensure complete closure. b. Where codes permit, close outdoor air dampers during first and last hours of occupancy to permit fast warm-up and cool-down. Suggested ECM: a. Install controls which will automatically close dampers during unoccupied periods.			[]	[]	[]
22. Return, outdoor air and exhaust dampers are not sequencing properly. Suggested O&Ms: a. Adjust damper linkage. b. Be sure damper motors are operating properly. c. Readjust position indicators to accurately indicate damper positions. d. Reset linkage, repair or replace dampers if blades do not close tightly. e. Close all outdoor air intake dampers when equipment is shut off and when building is unoccupied.* Suggested ECM: a. Replace old style dampers with new high quality opposed-blade models with better close-off ratings.	[]	[]	[]	[]	[]
23. Ventilation systems are not utilized for natural cooling capability. Suggested O&M: a. Whenever possible, use outside air for cooling rather than using refrigeration. (use economizer cycle, if available.) Suggested ECM: a. Install an economizer cycle with enthalpy control to optimize use of outside air for cooling.	[]	[]	[]	[]	[]

ENERGY AUDITOR CHECKLIST

	Does this problem exist?		Recommended		N/A
C. HVAC	Y	N	Y	N	
24. Exhaust system operation is not programmed.	<input type="checkbox"/>	<input type="checkbox"/>			
Suggested O&Ms:					
a. Discontinue use of unnecessary exhaust fans.*			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b. Re-wire restrooms' exhaust fans to operate only when lights are on. (Fans are often wired in reverse. Correct as needed.)*			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c. Establish schedules so that exhaust fans run only when needed.*			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d. Group smoking and other areas with similar exhaust requirements so that they may be served by one exhaust system. Reduce ventilation in remaining non-contaminated areas.*			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Suggested ECMs:					
a. Install time clocks or other controls to shutoff exhaust system when not needed (when permitted by code).*			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b. Install a rheostat in series with exhaust fan to modulate fan speed so that no more than the necessary amount of air will be exhausted.*			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c. Install chemical or electronic odor or particulate remover to reduce the need for using outside air for ventilation.*			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d. Install controlled or gravity dampers on all exhaust ducts to close ducts when fan is not operating.*			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
25. Air filters and heating/cooling coils do not receive scheduled maintenance.	<input type="checkbox"/>	<input type="checkbox"/>			
Suggested O&Ms:					
a. Develop maintenance schedule.			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b. Install filter pressure-drop gauges.			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
26. Duct or pipe insulation is damaged or missing.	<input type="checkbox"/>	<input type="checkbox"/>			
Suggested O&Ms:					
a. Repair.			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b. Replace.			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c. Protect.			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
27. Fan drive belts deflect excessively. (assure fan motor circuit is locked out before testing.)	<input type="checkbox"/>	<input type="checkbox"/>			
Suggested O&M:					
a. adjust fan belt tension.			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
28. Air leaks from ducts and plenums are noticeable.	<input type="checkbox"/>	<input type="checkbox"/>			
Suggested O&M:					
a. Repair leaks.			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

ENERGY AUDITOR CHECKLIST

	Does this problem exist?		Recommended		N/A
C. HVAC -- HEATING	Y	N	Y	N	
29. Air inlets or outlets are dirty or obstructed. Suggested O&Ms: a. Clean b. Remove obstructions. c. Remove access covers and inspect turning vanes, fire dampers, and splitters.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
30. boiler combustion efficiency is not tested on a scheduled basis. Suggested O&Ms: a. Prepare testing schedule and log of test results. b. Conduct combustion efficiency tests.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
31. Boilers are not maintained on a scheduled basis. Suggested O&M: a. Perform maintenance per manufacturer's instructions.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
32. Multiple boilers or heaters fire simultaneously. Suggested O&M: a. Adjust controls so that boiler #2 will not fire until boiler #1 can no longer satisfy the demand. Suggested ECM: a. Purchase and install automatic staging controls, if applicable.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
33. Stack temperature appears excessively high (greater than 400°F plus room temperature). Suggested O&Ms: a. Ensure that proper amount of air for combustion is available in furnace room. b. Examine and clean air intake filters. c. Perform flue gas analysis on a regular basis to ensure proper air to fuel ratio. d. If furnace is over-firing, verify that spuds and nozzles are properly sized. Also check that fuel pressures are not too high. NOTE: Checks and maintenance of boiler operations should be performed by qualified personnel. If there are none on the staff of the institution, consideration should be given to obtaining assistance from a service contractor. Suggested ECM: a. Purchase kit for flue gas analysis if frequent testing is anticipated.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

ENERGY AUDITOR CHECKLIST					
	Does this problem exist?		Recommended		N/A
C. HVAC -- HEATING	Y []	N []	Y []	N []	
34. Water in heating system is heated when there is no need. Suggested O&M: a. Turn off boiler, pumps or heat source. Suggested ECM: a. Install control to automatically shut down heat generating device when outside air temperature reaches 60°F.					
35. Condensate from street stream is being discharged to sewer drain. Suggested ECM: a. Install pump to return condensate to boiler or return condensate by gravity, if possible. Condensate can also be used to heat domestic water or boiler combustion air prior to its return to the boiler feedwater system.					
36. heating pilot lights are on during cooling season. Suggested O&M: a. Turn pilots off. (Enter shut-off and turn-on dates in your log book and post a notice in the boiler/furnace room.) Suggested ECM: a. Replace worn units with new electronic ignition models to avoid unnecessary fuel consumption.					
37. Steam radiators or other steam equipment fails to heat, or is operating erratically. Suggested O&Ms: a. Check the temperature of the pipe on the downstream side of steam traps. If it is excessively hot, the trap probably is passing steam. This can be caused by dirt in the trap, a valve off the stem, excessive steam pressure, or worn trap parts (especially valves and seats). If the pipe is moderately hot (as hot as a hot water pipe), it probably is passing condensate, which it should do. If it's cold, the trap is not working at all, and should be replaced or repaired. Initiate a steam trap maintenance program. b. Clean or replace thermostatic control valves on radiators. c. Check air vent valve. If not operating properly, replace. d. If thermostatic trap is malfunctioning, clean or replace bellows element. e. Water pockets may be obstructing steam flow. Correct by re-pitching or rerouting pipes.					

ENERGY AUDITOR CHECKLIST

	Does this problem exist?		Recommended		N/A
C. HVAC -- HEATING	Y	N	Y	N	
<p>38. Steam, condensate and heating water piping insulation is in disrepair or missing.</p> <p>Suggested O&M:</p> <p>a. Inspect pipes for broken or missing insulation. Repair or replace as needed.</p> <p>Suggested ECM:</p> <p>a. Install additional pipe insulation in accordance with design specifications and energy conservation codes.</p>	<p><input type="checkbox"/></p>	<p><input type="checkbox"/></p>	<p><input type="checkbox"/></p> <p><input type="checkbox"/></p>	<p><input type="checkbox"/></p> <p><input type="checkbox"/></p>	<p><input type="checkbox"/></p> <p><input type="checkbox"/></p>
<p>39. Operation of oil burner is accompanied by excessive smoke and sooting.</p> <p>Suggested O&Ms:</p> <p>a. Inspect burner nozzles for wear, dirt and incorrect spray angles. Clean and adjust as necessary.</p> <p>b. Verify that oil is flowing freely and that oil pressure is correct.</p> <p>c. Perform flue gas analysis to set proper air to fuel ratio.</p> <p>d. If burning heavy oil, check oil temperature.</p> <p>e. If steam atomizing burners, check steam-oil differential pressure.</p> <p>Suggested ECMs:</p> <p>a. Purchase kit for flue gas analysis if frequent testing is anticipated.</p> <p>b. Purchase new burner nozzles or tips.</p>	<p><input type="checkbox"/></p>	<p><input type="checkbox"/></p>	<p><input type="checkbox"/></p> <p><input type="checkbox"/></p> <p><input type="checkbox"/></p> <p><input type="checkbox"/></p> <p><input type="checkbox"/></p>	<p><input type="checkbox"/></p> <p><input type="checkbox"/></p> <p><input type="checkbox"/></p> <p><input type="checkbox"/></p> <p><input type="checkbox"/></p>	<p><input type="checkbox"/></p> <p><input type="checkbox"/></p> <p><input type="checkbox"/></p> <p><input type="checkbox"/></p> <p><input type="checkbox"/></p>
<p>40. Soot and odors are detected in areas where they are not expected.</p> <p>Suggested O&Ms:</p> <p>a. Heat exchanger may have burned out. Replace.</p> <p>b. Stack draft may be inadequate. Clean and correct as necessary.</p> <p>c. Perform flue gas analysis to obtain proper air to fuel ration.</p> <p>d. Check operation of furnace draft controller.</p> <p>e. Check boiler setting for leaks.</p> <p>Suggested ECM:</p> <p>a. Purchase kit for flue gas analysis if frequent testing is anticipated.</p>	<p><input type="checkbox"/></p>	<p><input type="checkbox"/></p>	<p><input type="checkbox"/></p> <p><input type="checkbox"/></p> <p><input type="checkbox"/></p> <p><input type="checkbox"/></p> <p><input type="checkbox"/></p>	<p><input type="checkbox"/></p> <p><input type="checkbox"/></p> <p><input type="checkbox"/></p> <p><input type="checkbox"/></p> <p><input type="checkbox"/></p>	<p><input type="checkbox"/></p> <p><input type="checkbox"/></p> <p><input type="checkbox"/></p> <p><input type="checkbox"/></p> <p><input type="checkbox"/></p>

ENERGY AUDITOR CHECKLIST

	Does this problem exist?		Recommended		N/A
C. HVAC -- HEATING	Y	N	Y	N	
41. Evidence indicated faulty or inefficient boilers or furnaces.	<input type="checkbox"/>	<input type="checkbox"/>			
Suggested O&Ms:					
a. Remove scale deposits, accumulation of sediment and boiler compounds on water side surfaces. Examine and treat rear portion of boiler (the area most susceptible to scale formation).			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b. Remove soot from tubes.			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c. Observe the fire when the unit shuts down. If the fire does not cut off immediately, it could indicate a faulty solenoid valve. Repair or replace as necessary.			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d. Inspect all boiler insulation, refractory, brick work and boiler casing for hot spots and air leaks. Repair and seal as necessary.			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Suggested ECMs:					
a. Replace dangerous or ineffective units with more efficient modular type units. (Note: Do not install oversize unit.)			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b. If applicable, install baffle-type devices in the tubes to improve efficiency.			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
42. Air is humidified.	<input type="checkbox"/>	<input type="checkbox"/>			
Suggested O&M:					
a. Discontinue or reduce humidification where possible.			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
43. Burner short-cycles.	<input type="checkbox"/>	<input type="checkbox"/>			
Suggested O&Ms:					
a. Start-stop limit switches may be set too closely. Reset as required.			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b. Thermostat may be faulty. Replace if necessary.			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Suggested ECM:					
a. Employ control specialist to adjust control.			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
44. Combustion air to boiler/furnace is not preheated.	<input type="checkbox"/>	<input type="checkbox"/>			
Suggested ECMs:					
a. Utilize heat from flue gas to preheat combustion air by means of a heat recovery device.			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b. Consider economizer to transfer heat from flue gas to feed water.			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c. Consider heat recovery from continuous blowdown.			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

ENERGY AUDITOR CHECKLIST

	Does this problem exist?		Recommended		N/A
C. HVAC -- HEATING	Y	N	Y	N	
45. Hot water radiation units fail to operate. Suggested O&Ms: a. Radiators are air-locked. Open air vents and bleed off air until water appears. b. Bleed off water in pneumatic air lines if necessary. (Pneumatic lines may be frozen.) Check for air leaks. c. Repair or replace faulty thermostats. d. Hot water pump or booster pump may not be functioning. Repair or replace as necessary.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
46. Radiators, convectors, baseboards and finned-tube heaters are not providing sufficient heat. Suggested O&Ms: a. Boiler temperature may have dropped. Correct as necessary. b. Bleed air from units. c. Establish a systematic cleaning schedule. d. Remove items obstructing discharge grilles. e. Bleed off water in pneumatic air lines if necessary. (Pneumatic lines may be frozen.) Check for air leaks. f. Repair faulty valves. g. Repair or replace faulty thermostats. h. Hot water pump or booster pump may not be functioning. Repair or replace as necessary.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
47. Condensers and cooling towers are not maintained on a scheduled basis. Suggested O&Ms: a. Prepare maintenance schedule. Perform maintenance per manufacturer's recommendations. b. Maintain cooling tower water.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
48. Circulating pump operation is manually controlled. Suggested O&M: a. Develop operating schedule.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

ENERGY AUDITOR CHECKLIST

	Does this problem exist?		Recommended		N/A
C. HVAC -- COOLING	Y	N	Y	N	
<p>49. Multiple air conditioning compressors start simultaneously.</p> <p>Suggested O&M:</p> <p>a. Adjust controls to stage compressors.</p> <p>Suggested ECM:</p> <p>a. Should automatic controls not exist, purchase and install. This will allow compressor #2 to cut in when compressor #1 can no longer satisfy space conditioning load.</p>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<p>50. Chiller evaporating and condensing temperatures are not optimized.</p> <p>Suggested O&Ms:</p> <p>a. Increase chiller evaporator temperature following manufacturer's recommendations.</p> <p>b. Decrease chiller condensing temperature following manufacturer's recommendations.</p>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<p>51. Chiller is operating during cold weather to provide air conditioning.</p> <p>Suggest ECMs:</p> <p>a. Provide a water temperature system injecting cooling tower condenser water directly into the system's chilled water circuits. Except for pumping and cooling tower fan horsepower, this provides free cooling. Special care must be taken in treating and filtering condenser water.</p> <p>b. If system is forced air, using DX coils and air cooled condenser, install economizer cycle to obtain free cooling.</p>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<p>52. Reheat coils are used to maintain zone temperatures.</p> <p>Suggested ECM:</p> <p>a. Convert to variable air volume system if the reheat coils are not necessary to supply heat during the heating season.*</p>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<p>53. Building utilizes a dual duct or multizone system.</p> <p>Suggested ECMs:</p> <p>a. Convert dual duct or multizone systems to variable air volume, if building has a separate heating season.*</p> <p>b. Install controls to automatically reset hot and cold deck temperatures.</p>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

ENERGY AUDITOR CHECKLIST

	Does this problem exist?		Recommended		N/A
C. HVAC -- COOLING	Y	N	Y	N	
<p>54. Air conditioning load trips circuit breaker on extremely warm days.</p> <p>Suggested O&Ms:</p> <p>a. Tighten wire lugs if loose.</p> <p>b. Replace defective circuit breakers.</p> <p>c. Clean condenser on air cooled systems.</p> <p>d. Clean Scale build-up in condenser on water cooled systems.</p> <p>Suggested ECM:</p> <p>a. Consider installing insulated underground storage tank that would allow night operation of chiller when electrical demand is low. This reservoir tank would be a source of supply of chilled water for daytime operation. Chiller would not be operated during the day.</p>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<p>55. air of inadequate volume or temperature is being discharged through grilles.</p> <p>Suggested O&Ms:</p> <p>a. Defrost evaporator coil if iced. Determine cause of icing and correct.</p> <p>b. Clean evaporator coil, fins and tubes.</p> <p>c. Clean or replace air filters.</p> <p>d. Fire damper may be closed. Open and replace fusible link if necessary.</p> <p>e. Balancing damper may have slipped and closed. Open to correct position and tighten wing nut.</p> <p>f. If fan is rotating backwards, reverse rotation by reversing electrical contacts.</p> <p>g. Clean condenser coil and /or water tower nozzles.</p> <p>Suggested ECM:</p> <p>a. Install differential pressure-sensing switches to alarm when air flow drops significantly.</p>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<p>56. Refrigeration condensers or coils are dirty, clogged and/or not functioning efficiently.</p> <p>Suggested O&Ms:</p> <p>a. Determine if normal operating temperatures and pressures have been identified and if all gauges are checked frequently to ensure design conditions are being met.</p> <p>b. Increased system pressure may be due to dirty condensers which will decrease system efficiency. High discharge temperatures often are caused by defective or broken compressor valves. Repair or adjust as required.</p>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

ENERGY AUDITOR CHECKLIST

	Does this problem exist?		Recommended		N/A
C. HVAC -- COOLING	Y	N	Y	N	
56...					
c. Inspect the liquid line leaving the strainer. If it feels cooler than the liquid line entering the strainer, it is clogged. It is very badly clogged if frost or sweat is visible at the strainer outlet. Clean as required.			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d. Clean coils and /or other elements as needed on a scheduled basis. Include dehumidification coils.			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
57. Chilled water piping, valves and fittings are leaking.	<input type="checkbox"/>	<input type="checkbox"/>			
Suggested O&Ms:					
a. Repair joint or piping leaks.			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b. Repair or replace valves.			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
58. chiller operation is not optimized. (Listen for short-cycling.)	<input type="checkbox"/>	<input type="checkbox"/>			
suggested O&Ms:					
a. Raise chilled water supply temperature. (NOTE: This is especially important if system was designed for a 75°F space temperature and the space setting has been raised to 78°F for energy conservation purposes.)			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b. Remove scale deposits from condensers.			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c. Check refrigerant charge.			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Suggested ECM:					
a. Reduce peak loads with electric load limiters. (this option saves money but not energy.)			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
59. Refrigeration compressor short-cycles.	<input type="checkbox"/>	<input type="checkbox"/>			
Suggested O&Ms:					
a. Refrigerant charge is low or refrigerant is leaking. Find and repair leak. Recharge system.			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b. Repair electrical control circuit if required.			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c. Reset high/low pressure control differential settings if needed.			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d. Evaporation coil may be iced up or dirty. Defrost and clean.			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
e. Liquid line solenoid valve may be leaking. Repair or replace.			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
f. If frost is detected on the liquid line strainer, it is clogged. Clean strainer.			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
g. Clean condenser coil.			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
h. If condenser is a cooling tower, ascertain if spray nozzles are plugged. Make sure water flow is unobstructed. Clean towers of leaves and debris.			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
i. Remove scale deposits form shell/tubes on water condensers.			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
j. Repair suction valves in compressor, if needed.			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

ENERGY AUDITOR CHECKLIST

	Does this problem exist?		Recommended		N/A
C. HVAC -- COOLING					
60. Multiple parallel chillers have no isolation schedule for extended light-load operation. Suggested O&Ms: a. Develop load vs. capacity matrix. b. Isolate unneeded chillers.	Y []	N []	Y []	N []	[] []
61. Steam, hot or chilled water leaks are evident. Suggested O&M: a. Repair leaks	[]	[]	[]	[]	[]
62. Steam, hot or chilled water valves do not shut off tight. Suggested O&M: a. Repair or replace valve.	[]	[]	[]	[]	[]
63. Conditioned air or heated water is discarded. Suggested ECM: a. It is important for building owner to be aware of heat recovery; measures. However, it is not wise to install such equipment without first analyzing the energy characteristics of the building, performance of the hardware, and how it fits into the overall energy plan.	[]	[]	[]	[]	[]
D. DOMESTIC HOT WATER					
64. Hot water temperature is excessive. Suggested O&M: a. Lower thermostat or controller set point to 105°F to 115°F for general purposes. Consult appropriate codes and regulations for permissible water temperatures for sanitation, health and medical purposes.	[]	[]	[]	[]	[]
65. System insulation is damaged or missing. Suggested O&M: a. Repair, replace. Protect as necessary to prevent recurrence of damage.	[]	[]	[]	[]	[]

ENERGY AUDITOR CHECKLIST

	Does this problem exist?		Recommended		N/A
D. DOMESTIC HOT WATER	Y	N	Y	N	
66. Water temperatures are not reduced during unoccupied periods.	<input type="checkbox"/>	<input type="checkbox"/>			
Suggested O&M: a. Schedule setbacks (either manually or with existing time clock). Consider schedule's impact on electrical demand.			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Suggested ECM: a. Install and appropriate automatic control device.			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
67. Water leaks are evident.	<input type="checkbox"/>	<input type="checkbox"/>			
Suggested O&M: a. Repair leaks and defective faucets.			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
68. Heat pump water heater coils are not maintained on scheduled basis.	<input type="checkbox"/>	<input type="checkbox"/>			
Suggested O&M: a. Schedule maintenance following manufacturer's recommendations.			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
69. Hot water recirculating pumps run continuously.	<input type="checkbox"/>	<input type="checkbox"/>			
Suggested O&M: a. Develop operating schedule to match occupancy.			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
70. Drips or leaks are evident in hot water systems.	<input type="checkbox"/>	<input type="checkbox"/>			
Suggested O&M: a. Repair all leaks including those of the faucets and pumps.			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
71. Electric water heater has no time restrictions on heating cycle.	<input type="checkbox"/>	<input type="checkbox"/>			
Suggested O&M: a. Utilize "vacation cycle" on water heater when not needed during extended periods. (Note: Complete deactivation could cause leaks.)			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Suggested ECM: a. Limit the duty cycle with a time clock or other control devices to avoid adding the water heating load to the building during peak electrical demand periods. (additional hot water storage capacity may be required.)			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
72. Devices to conserve heated water have not been utilized where practical.	<input type="checkbox"/>	<input type="checkbox"/>			
Suggested ECMs: a. Install mixing valves.			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b. Replace standard faucets with self-closing, flow restrictor valves. (Note: Highly mineralized water or water containing sediment can cause blockages.)			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c. Install a solar water heater to assist in meeting building hot water demand. This will reduce significantly consumption of traditional energy fuels in facilities which are large users of hot water.			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

ENERGY AUDITOR CHECKLIST

	Does this problem exist?		Recommended		N/A
D. DOMESTIC HOT WATER	Y	N	Y	N	
73. Storage tanks, piping and water heaters are utilized inefficiently.	<input type="checkbox"/>	<input type="checkbox"/>			
Suggested ECMs:					
a. Install a small domestic hot water heater to maintain desired temperature in water storage tank. This could eliminate the need for operating one of the large space heating boilers during summer months.			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b. Install de-centralized water heating.			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
E. LIGHTING					
74. Incandescent lamps are used in offices, workrooms, hallways, and gymnasiums.	<input type="checkbox"/>	<input type="checkbox"/>			
Suggested O&Ms:					
a. Where possible use a single incandescent lamp of high wattage rather than two or more smaller lamps of combined wattage.			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b. Discontinue using extended service lamps except in special cases such as recessed directional lights where short lamp life is a problem.			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c. Discontinue using multi-level lamps. The efficiency of a single wattage lamp is higher per watt than a multi-level lamp.			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Suggested ECM:					
a. Replace non-decorative incandescent lamps with more energy conserving types such as fluorescents in general purpose areas and HIDs in large group areas.			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
75. Lamps and fixtures are not clean.	<input type="checkbox"/>	<input type="checkbox"/>			
Suggested O&Ms:					
a. Establish a regular inspection and cleaning schedule for lamps and luminaires (fixtures). Dust buildup reduces effectiveness.			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b. Replace lens shielding that has turned yellow or hazy with new acrylic lenses which do not discolor.			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c. Replace outdated or damaged luminaires with modern typed that are easy to clean.			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
76. Lamps are replaced individually as they burn out.	<input type="checkbox"/>	<input type="checkbox"/>			
Suggested O&M:					
a. Establish a group relamping schedule. Lamp manufacturer's sales offices can provide a computerized relamping schedule at minimal or no cost.			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
77. Ceilings and other room surfaces have reduced reflectivity due to dirt.	<input type="checkbox"/>	<input type="checkbox"/>			
Suggested O&Ms:					
a. Clean surfaces.			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b. When repainting or recovering, use coatings or coverings with good reflectance.			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

ENERGY AUDITOR CHECKLIST

	Does this problem exist?		Recommended		N/A
E. LIGHTING	Y	N	Y	N	
<p>78. Daylight is not used effectively.</p> <p>Suggested O&Ms:</p> <p>a. Locate work stations requiring high illumination adjacent to windows.</p> <p>b. Switch off lights when daylight is sufficient.</p> <p>c. Clean windows and skylights.</p> <p>Suggested ECM:</p> <p>a. Install light sensors and dimming equipment which automatically compensate for varying natural lighting conditions.</p>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<p>79. Decorative lighting is excessive and/or not controlled optimally.</p> <p>Suggested O&Ms:</p> <p>a. Replace burned out lamp with lower wattage lamps.</p> <p>b. Establish schedule for manual control or control operation with existing photoelectric or time clock controls if practical.</p>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<p>80. In fixtures where fluorescent lamps have been removed, the ballasts have not been disconnected.</p> <p>Suggested O&M:</p> <p>a. Disconnect ballasts, which still use significant amount of energy even though tubes have been removed.</p> <p>Suggested ECM:</p> <p>a. Replace unnecessary tubes with “dummy” types which draw little current and yet provide uniform lighting effect.</p>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<p>81. When burned out fluorescent lamps and/or ballasts have been replaced, more efficiently lights have not been installed.</p> <p>Suggested O&Ms:</p> <p>a. When relamping, replace fluorescent tubes with more efficient and lower wattage types such as 35-watt instead of 40-watt to achieve a reduction in electrical energy consumption. Wherever possible, replace burned out ballasts with more efficient, lower wattage, energy conserving ballasts.</p> <p>b. Consider not replacing burned out bulbs or lamps, and disconnecting ballasts in areas where delamping is possible. For example, in four-lamp fixtures allow two lamps to remain, disconnecting appropriate ballasts.</p> <p>Suggested ECMs:</p> <p>a. Install more efficiently fluorescent tubes and ballasts in all existing luminaires (fixtures). (NOTE: Verify that new lamps will work with existing ballasts.)</p> <p>b. Lowering luminaires (fixtures) will increase illumination levels on the task area, and may permit a reduction in the number of fixtures or the wattage of lamps.</p>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

ENERGY AUDITOR CHECKLIST

	Does this problem exist?		Recommended		N/A
E. LIGHTING	Y	N	Y	N	
<p>82. Lighting is on in unoccupied areas.</p> <p>Suggested O&Ms:</p> <p>a. Post instruction to turn off lights when leaving area.</p> <p>b. Identify areas being controlled by ganged switches.</p> <p>c. Assure wall switch timers function properly.</p> <p>Suggested ECMs:</p> <p>a. Rewire switches so that one switch does not control all fixtures in multiple work spaces.</p> <p>b. Provide timer switches in remote or seldom used areas where there will be brief occupancy periods.</p>	<p><input type="checkbox"/></p>	<p><input type="checkbox"/></p>	<p><input type="checkbox"/></p> <p><input type="checkbox"/></p> <p><input type="checkbox"/></p> <p><input type="checkbox"/></p> <p><input type="checkbox"/></p>	<p><input type="checkbox"/></p> <p><input type="checkbox"/></p> <p><input type="checkbox"/></p> <p><input type="checkbox"/></p> <p><input type="checkbox"/></p>	<p><input type="checkbox"/></p> <p><input type="checkbox"/></p> <p><input type="checkbox"/></p> <p><input type="checkbox"/></p> <p><input type="checkbox"/></p>
<p>83. Security/outdoor lighting is not automatically controlled and /or lighting levels are excessive.</p> <p>Suggested O&Ms:</p> <p>a. Replace burned out lamps with lower wattage lamps.</p> <p>b. Establish manual operation schedule considering change in daylight with season.</p> <p>c. Control lighting with existing photoelectric or time-clock controls if practical.</p> <p>d. Eliminate outdoor lighting where practical.</p> <p>Suggested ECM:</p> <p>a. Replace exterior incandescent lamps with more efficient types such as HPS or MH.</p>	<p><input type="checkbox"/></p>	<p><input type="checkbox"/></p>	<p><input type="checkbox"/></p> <p><input type="checkbox"/></p> <p><input type="checkbox"/></p> <p><input type="checkbox"/></p> <p><input type="checkbox"/></p>	<p><input type="checkbox"/></p> <p><input type="checkbox"/></p> <p><input type="checkbox"/></p> <p><input type="checkbox"/></p> <p><input type="checkbox"/></p>	<p><input type="checkbox"/></p> <p><input type="checkbox"/></p> <p><input type="checkbox"/></p> <p><input type="checkbox"/></p> <p><input type="checkbox"/></p>
<p>84. Deep baffled downlighting fixtures have conventional "R" reflector lamps installed.</p> <p>Suggested O&M:</p> <p>a. Replace burned out "R" lamps with elliptical reflector "ER" lamps which yield approximately the same average light level for half the energy cost.</p>	<p><input type="checkbox"/></p>	<p><input type="checkbox"/></p>	<p><input type="checkbox"/></p>	<p><input type="checkbox"/></p>	<p><input type="checkbox"/></p>
<p>85. Two lamps have not been removed form four-lamp fixtures where possible.</p> <p>Suggested O&M:</p> <p>a. Remove two lamps and disconnect ballasts.</p>	<p><input type="checkbox"/></p>	<p><input type="checkbox"/></p>	<p><input type="checkbox"/></p>	<p><input type="checkbox"/></p>	<p><input type="checkbox"/></p>

ENERGY AUDITOR CHECKLIST

	Does this problem exist?		Recommended		N/A
F. POWER					
86. Transformers remain energized when serving no load for extended periods. Suggested O&M: a. Disconnect transformer.	Y <input type="checkbox"/>	N <input type="checkbox"/>	Y <input type="checkbox"/>	N <input type="checkbox"/>	<input type="checkbox"/>
87. Transformer ambient temperature is high. Suggested O&M: a. Assure that a forced ventilation system serving space is functioning or that natural ventilation system openings are not obstructed.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
88. Vending machines remain energized during unoccupied periods. Suggested O&M: a. Provide manual operation schedule or connect to existing time clock if practical. Consult with vending company prior to implementation.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
89. Refrigerator drinking fountains or recirculating chilled drinking water systems are not controlled for occupancy. Suggested O&M: a. Develop schedule for manual control or connect to existing time clocks or programmable controllers, if practical.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
90. Elevator operation is not optimized for occupancy variations. Suggested O&M: a. Consult with manufacturer for possible operating changes.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
91. Lubricants used on major rotating equipment with high load factors have not been optimized for reduction of friction losses. Suggested O&M: a. consult with equipment manufacturers and lubricant manufacturers to determine if lubricant change is cost-effective.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
92. Substantial electricity demand charges are incurred. Suggested O&M: a. Determine if use of major electrical equipment can be scheduled to reduce demand.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

ENERGY AUDITOR CHECKLIST					
	Does this problem exist?		Recommended		N/A
F. POWER					
93. No records of maintenance for motors and motor driven equipment are available. Suggested O&Ms: a. Using name plate data, prepare an up-to-date list of all motors and pumps used in the facility and list routing maintenance to be performed on each. Check regularly for: 1. Correct motor voltage and amperage. 2. Loose connections and worn contacts. 3. Unbalanced voltages on 3-phase motors. 4. Improper grounding. 5. Packing wear. 6. Wear and binding on bearings and drive belts. 7. Proper sequencing of pumps and motors. Suggested ECM: a. Replace worn equipment with more efficient units, if available.	Y []	N []	Y []	N []	[]
G. REFRIGERATION					
94. Evaporator coils have heavy ice build-up. Suggested O&Ms: a. Defrost coils regularly. b. Determine if automatic defrost system is improperly adjusted or defective. c. Determine if air is leaking into refrigerated area from defective door gaskets or poorly sealed wiring or piping penetrations.	[]	[]	[] [] []	[] [] []	[] [] []
95. Evaporator temperature is lower than required for produce or process. Suggested O&M: a. Increase temperature set-point.	[]	[]	[]	[]	[]
96. System insulation is damaged or missing. Suggested O&M: a. Repair or replace. Protect vulnerable sections form future damage. (Do not insulate hot gas piping unless required for safety.)	[]	[]	[]	[]	[]
97. Condensing temperature is excessive. Suggested O&Ms: a. Reset following manufacturer's recommendations. b. Clean condensing fins or tubes. c. Assure that ventilation for compressor rooms is adequate.	[]	[]	[] [] []	[] [] []	[] [] []
98. Ice-makers are not turned off during extended unoccupied periods. Suggested O&M: a. Develop schedule for manual operation.	[]	[]	[]	[]	[]

F. POWER

93. No records of maintenance for motors and motor driven equipment are available.

Suggested O&Ms:

- a. Using name plate data, prepare an up-to-date list of all motors and pumps used in the facility and list routing maintenance to be performed on each.

Check regularly for:

1. Correct motor voltage and amperage.
2. Loose connections and worn contacts.
3. Unbalanced voltages on 3-phase motors.
4. Improper grounding.
5. Packing wear.
6. Wear and binding on bearings and drive belts.
7. Proper sequencing of pumps and motors.

Suggested ECM:

- a. Replace worn equipment with more efficient units, if available.

G. REFRIGERATION

94. Evaporator coils have heavy ice build-up.

Suggested O&Ms:

- Defrost coils regularly.
- Determine if automatic defrost system is improperly adjusted or defective.
- Determine if air is leaking into refrigerated area from defective door gaskets or poorly sealed wiring or piping penetrations.

95. Evaporator temperature is lower than required for produce or process.

Suggested O&M:

- a. Increase temperature set-point.

96. System insulation is damaged or missing.

Suggested O&M:

- a. Repair or replace. Protect vulnerable sections from future damage. (Do not insulate hot gas piping unless required for safety.)

97. Condensing temperature is excessive.

Suggested O&Ms:

- Reset following manufacturer's recommendations.
- Clean condensing fins or tubes.
- Assure that ventilation for compressor rooms is adequate.

98. Ice-makers are not turned off during extended unoccupied periods.

Suggested O&M:

- a. Develop schedule for manual operation.

ENERGY AUDITOR CHECKLIST

	Does this problem exist?		Recommended		N/A
H. ANCILLARY SYSTEMS	Y	N	Y	N	
99. Kitchen equipment is not used efficiently. Suggested O&Ms: a. Cook with lids in place on pots and kettles. b. Preheat ovens only for baked goods. c. Reduce temperature or turn off frying tables and coffee urns during off peak periods. d. Provide ovens and fryers with loads all of the time they are heated and on. e. Use dishwasher for full loads only. f. Shut down exhaust hood fans when not required. g. Use microwave ovens for small orders.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
100. In-house laundry equipment is not used efficiently. Suggested O&Ms: a. Develop concise operating procedures for each piece of equipment. b. Iron only items which require it. c. Wash and dry full loads only. d. Consider rescheduling laundry work hours to avoid periods when building experiences its peak electrical load if electricity demand charges are significant. e. Consider cold water detergents.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
101. Swimming pool water temperature is too high. Suggested O&Ms: a. Reduce water temperatures to 80°-84°F if users can accept it. b. Indoor pool: turn off heater and circulating pumps during periods of non-use.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
102. Use of equipment associated with laundry and custodial services coincides with heavy electrical demand periods. Suggested O&M: a. Require that major electrical equipment be used in accordance with guidelines that avoid peak electrical demand periods. Suggested ECM: a. Install a demand control system to automatically monitor power demand and to shut off assigned secondary loads to lower demand peaks to pre-established level.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Exterior Maintenance Checklist

Provide safe and easy access to areas and equipment to facilitate regular maintenance.

Roof

- ☐ Drain standing water: unplug drainage system, fill low spots
- ☐ Keep gutters and downspouts clear of debris and well attached to building and ground drainage system. Run-off should not drip down walls.
- ☐ Check condition of roofing material, repair cracks, blisters, holes
- ☐ Keep caulking in good condition around planned openings (ducts, pipes, conduit, etc.)
- ☐ Keep skylights clean

Walls

Maintain siding and paint

- ☐ Repair damage
- ☐ Keep caulking in good condition and fill all gaps, replace as needed
- ☐ Keep paint in good condition, find and correct cause of blistered peeling, or cracked paint

Doors and Windows

- ☐ Keep conditioned spaces separated from unconditioned and outdoor spaces
- ☐ Keep them closed with snug fit
- ☐ Keep latches and closing mechanisms in good working order
- ☐ Weather-stripping and thresholds in good condition and draft-free
- ☐ Replace broken glass or multi-paned glass whose seal is broken (evidenced by condensation between panes)
- ☐ Keep awnings in good condition, remove when not needed

Foundation walls

- ☐ Caulk cracks
- ☐ Drain standing water away from building
- ☐ Maintain drainage tiles around footing, keep free of vegetation and damage from crushing
- ☐ Keep buildings drainage connected to storm sewers or appropriate system.

HVAC

- ☐ Keep system operating for comfort so opening of windows or doors is not necessary, (make controls easy to understand and use)
- ☐ Maintain slight positive pressure in building to reduce infiltration of outside air (Building air pressure should not prevent doors from fully closing.)
- ☐ Keep all ducts in good repair with joints sealed and insulated where appropriate.
- ☐ Keep intake and exhaust dampers clear of debris, connected to controllers, and operable

- (dirt, corrosion, and rust can impair proper operation).
- ❑ Change filters and clean coils as needed

Miscellaneous

- ❑ Keep insulation on ducts or pipes in good repair and. adequate quantity
- ❑ Keep openings screened and / or caulked
- ❑ Correct damage to pipes, conduit, and ducts
- ❑ Check meters for tampering or damage
- ❑ Repair dripping faucets
- ❑ Keep exterior electrical outlets covered when not in use, insulate around them
- ❑ Plan landscape watering for best efficiency, reduce evaporation losses by watering during mornings or evenings
- ❑ Use pool covers
- ❑ Watch for and investigate excessively wet spots on grounds, may be caused by leaking or broken pipes
- ❑ Check exterior lighting for proper operating times, hopefully have photocell or other automatic control system
- ❑ Turn off unnecessary lighting
- ❑ Practice group re-lamping at 70% of rated lamp life,
- ❑ Check that all lamps are operating and providing useful light (mercury vapor lamps put out some light long after they cease providing useful light at the ground level.)
Ballasted lamps continue to use energy as long ballast is connected, even if the lamp is burned out
- ❑ Keep lighting fixtures clean and in good condition