

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				
<u>Building Type and Category</u> <table style="width: 100%; border: none;"> <tr> <td style="width: 25%; vertical-align: top;"> <u>School</u> ___ Element. ___ Second. ___ Comm.Coll. ___ Coll./Univ. ___ Voc. Tech. Ctr. ___ Other, Specify _____ </td> <td style="width: 25%; vertical-align: top;"> <u>Hospital</u> ___ General ___ Psychiatric ___ Other, Specify _____ </td> <td style="width: 25%; vertical-align: top;"> <u>Government</u> ___ Federal ___ State ___ City/County ___ Special Dist. ___ Indian Tribe </td> <td style="width: 25%; vertical-align: top;"> <u>Public Care</u> ___ Nurs. Home ___ Long-term care ___ Rehab. Center ___ Orphanage ___ Public Health ___ Res. Child Care ___ Other, Specify _____ </td> </tr> </table>			<u>School</u> ___ Element. ___ Second. ___ Comm.Coll. ___ Coll./Univ. ___ Voc. Tech. Ctr. ___ Other, Specify _____	<u>Hospital</u> ___ General ___ Psychiatric ___ Other, Specify _____	<u>Government</u> ___ Federal ___ State ___ City/County ___ Special Dist. ___ Indian Tribe	<u>Public Care</u> ___ Nurs. Home ___ Long-term care ___ Rehab. Center ___ Orphanage ___ Public Health ___ Res. Child Care ___ Other, Specify _____	<u>Building Use</u> ___ Office ___ Storage ___ Library ___ Services ___ Police Station ___ Fire Station ___ Dormitory ___ Prisoner Detention ___ Other, Specify _____
<u>School</u> ___ Element. ___ Second. ___ Comm.Coll. ___ Coll./Univ. ___ Voc. Tech. Ctr. ___ Other, Specify _____	<u>Hospital</u> ___ General ___ Psychiatric ___ Other, Specify _____	<u>Government</u> ___ Federal ___ State ___ City/County ___ Special Dist. ___ Indian Tribe	<u>Public Care</u> ___ Nurs. Home ___ Long-term care ___ Rehab. Center ___ Orphanage ___ Public Health ___ Res. Child Care ___ Other, Specify _____				
Date of construction, if known _____							
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

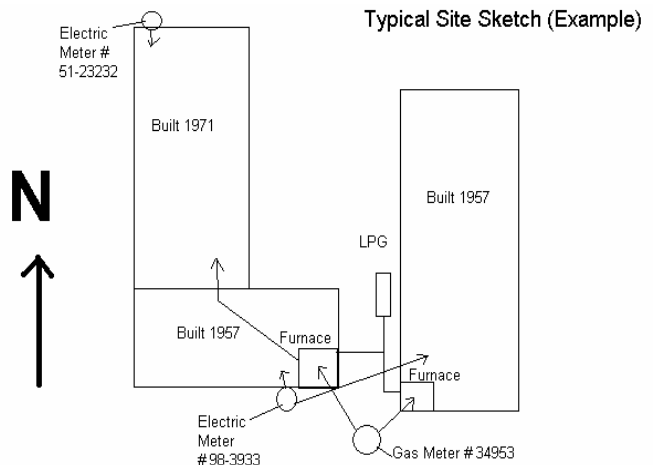
Energy Saving Operation and Maintenance Procedures Implemented or Under Consideration Prior to this Audit (specify which). Please include an estimate of implementation cost and energy savings in kWh/yr and Btu/yr.

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

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

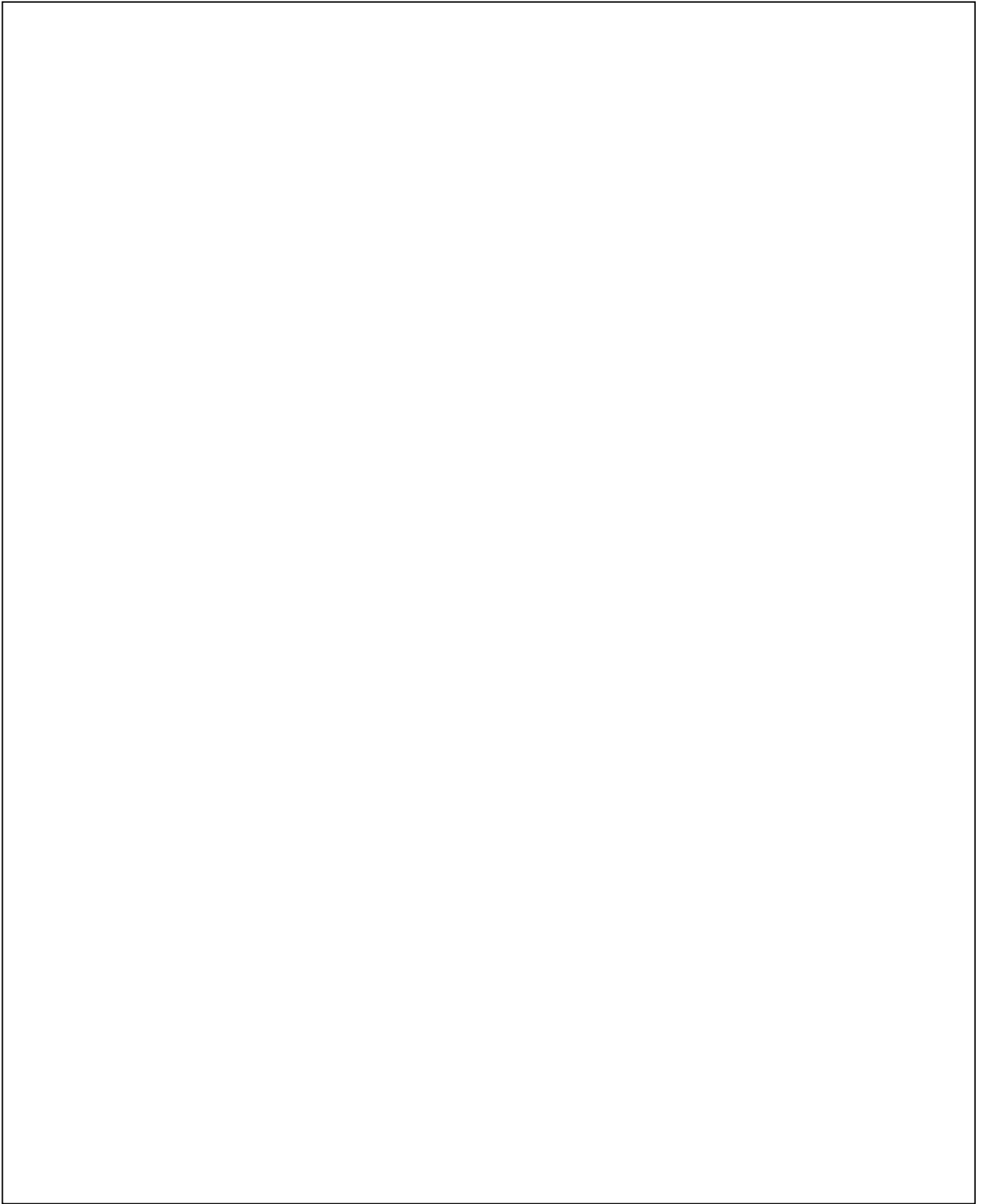
- i. **Metering:** Is this building individually metered for electricity? Yes No

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	Date 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. #6 Fuel Oil | | |
| 5. Electric Resistance | 6. Electricity | | |
| 6. Heat pump with aux. Elec.heat | 7. Coal | | |
| 7. Purchased steam | 8. Wood | | |
| 8. Other (explain) | 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 form Heater to Point of use _____ Nearest _____ Farthest	Hot Water Uses for Other than Laveratories	

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. Fluorescent
- 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 _____		Sep _____		Mar _____			Sep _____		Apr _____		Oct _____			
Apr _____		Oct _____		Apr _____			Oct _____		May _____		Nov _____			
May _____		Nov _____		May _____			Nov _____		Jun _____		Dec _____			
Jun _____		Dec _____		Jun _____			Dec _____							
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 date 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 []0% []5% []10% []15% []20% []25% []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__ - __)**

COUNTY	STATION	ANNUAL	
		HDD	CDD

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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