ENERGY STAR® Action Workbook for Congregations - Appendices

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ENERGY STAR® is a U.S. Environmental Protection Agency program helping organizations and individuals fight climate change through superior energy efficiency. Learn more at energystar.gov/buildings.

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Disclaimer

All energy, water, and monetary savings listed in this document are based upon average savings for end users and are provided for educational purposes only. Actual savings will vary based on energy, water, and facility use, national weather data for your locality, energy prices, and other factors. Greenhouse gas (GHG) emissions are calculated based on emission factors reported to the U.S. EPA by the electric utility provider serving your ZIP Code. Data referenced in this document is provided by the U.S. EPA and the U.S. DOE's NREL.

The *ENERGY STAR Action Workbook for Congregations* and the *ENERGY STAR Action Workbook for Congregations – Appendices* PDF documents can be found online at www.energystar.gov/WhiteHouseEnergyStewardship.

APPENDIX A - Benchmarking your Property with Portfolio Manager®

A.1 Portfolio Manager Data Collection for Houses of Worship

Entering your congregation's energy and water use data into the free online Portfolio Manager software will allow your team to track and measure the property's energy and water use over time—this is especially helpful as new upgrades are implemented.

Worksheet 1 – Portfolio Manager Data Collection

Use Worksheet 1 (Figure A.1-1) to gather your property's energy and water consumption and cost data. Doing this before creating or logging into your Portfolio Manager account will make it easier to enter the information into Portfolio Manager.

Worksheet 1 - Portfolio Manager Data Collection for Congregations

General Property Information

Property Name _____

Year Built_____

Building Address _____

City _____ State _____ZIP _____

*Occupancy _____ (%)

***Note:** Occupancy is defined as the percentage of the space which is occupied and operational. An example of unoccupied space would be dedicated areas used for storage. Most houses of worship have 100% occupancy.*

Contact Information

Collect the following contact information for the person who will be primarily in charge of maintaining your property's Portfolio Manager account. It is very important for your congregation to maintain current contact information for the Portfolio Manager account in order to receive updates and other technical support from ENERGY STAR.

Name (First, Last) _____ Job Title _____

Email _____ Phone _____

Worksheet 1 - Portfolio Manager Data Collection for Congregations

Space Type Use Attributes

As you compile space use data for the property, keep the following points in mind:

- Default values supplied by Portfolio Manager can be used for all space use variables with the exception of gross floor area. Using default values will result in an approximate energy performance score, but for greater accuracy it is recommended that you collect the actual data rather than use the default values, if possible. Your property will not be eligible for certification if you only use default values.
  - Your property may contain multiple space types (parking, K-12 school, etc.). However, use different space types only to define areas that operate differently in terms of energy use and operating hours.
  - Use as few space types as possible. Unnecessarily breaking out the property into multiple space types does not increase the accuracy of the property's score.
- The aggregate area of distinct space types must add up to the total area within the property envelope. Do not double-count space in your property.
- If you would like to add other space types, you can find more information on specific property use details in Portfolio Manager at: http://www.energystar.gov/buildings/sites/default/uploads/tools/PropertyUseDetailsandDefinition.pdf?d6ff-c542

Worship Facility:

_____Gross floor area (ft^2)

Note: *If applicable, the gross floor area of the worship facility should include space used as:* ***1)*** *a social meeting hall/ banquet room;* ***2)*** *classroom space for part time religious education; and* ***3)*** *a preschool/daycare center.*

_____Weekly operating hours

_____Number of weekdays (Monday through Friday) that the property is typically open

_____Seating capacity (number of seats in the main worship area)

_____Number of personal computers (PCs)

_____Presence of cooking facilities (Yes/No)

_____Number of commercial refrigeration/freezer units

Parking:

Include parking only when lighting for the space is included on the property's electric meter. If it is separate, do not include this space.

_____ Completely enclosed gross area (ft^2; enclosed with a roof and walls)

_____ Partially enclosed gross area (ft^2; enclosed with a roof but no walls)

_____ Open parking lot gross area (ft^2; no roof or walls)

_____ Weekly hours of access

Worksheet 1 - Portfolio Manager Data Collection for Congregations
_____ Supplemental heating (Yes/No)
K-12 school, preschools, day cares, or Sunday School areas: _____ Gross floor area (ft^2) _____ Gymnasium floor area (ft^2) _____ High school (Yes/No) _____ Number of workers on main shift (usual number of staff members working at once) _____ Student seating capacity _____ Months in use (annually) _____ Open weekends (Yes/No) _____ Number of PCs _____ On-site cooking facilities (Yes/No) _____ Number of walk-in refrigeration/freezer units _____ Percent of floor area that can be cooled (to the nearest 10 percent) _____ Percent of floor area that can be heated (to the nearest 10 percent) _____ School district
Energy Types Used Before you begin to use Portfolio Manager, identify what types of metered energy your property is using, and how many meters your property has for each energy source. Check the types of energy used in your property on the list below:
☐ Electricity ***Note:*** *Most electricity is purchased from a grid. However, Portfolio Manager also allows you to track electricity generated on-site using either solar panels or wind turbines.* ☐ Natural gas ☐ Fuel oil ☐ District steam ☐ Wood ☐ Propane ☐ Kerosene ☐ Diesel ☐ Coal ☐ District hot water ☐ District chilled water ***Note:*** *Determine whether district chilled water is from an electric-driven chiller, an absorption chiller using natural gas, an engine-driven chiller using natural gas, or another kind of chiller.*

Worksheet 1 - Portfolio Manager Data Collection for Congregations

Energy Meters

To use Portfolio Manager's energy tracking capability, identify what types of metered energy your property is using; how many meters the property has for each energy source; and whether energy from each source is distributed indoors, outdoors, or both. Check the energy sources for your property from the list below; identify all energy meters for your property, and specify the space(s) that each meter serves. Energy meters can include electricity, natural gas, other heating fuels, etc.

Energy Meters		
Meter Name	**Type of Energy**	**Space Served**
Main Utility Meter	Electricity	Full property

Water Sources (optional)

In addition to tracking energy use, Portfolio Manager has the capacity to track water use at your congregation's property. Tracking water use will not affect your ENERGY STAR score, but will allow you to use a single tool to track your property's utility trends. To use Portfolio Manager's water tracking capability, identify what types of metered water your property is using; how many meters the property has for each water source; and whether water from each source is distributed indoors, outdoors, or both. Check the water sources for your property from the list below:

Water Sources Used (Optional)
☐ Municipally supplied potable water
☐ Municipally supplied reclaimed water
☐ Alternative water generated on-site

Water Meters		
Meter Name	**Type of Energy**	**Space Served**
Main Water Meter	Municipal	Full property

Figure A.1-1. Worksheet 1 - Portfolio Manager Data Collection for Houses of Worship

You will need a minimum of 12 consecutive months of utility bill data for each energy type used in the property in order to benchmark. More than 12 months of energy consumption data are not required, but more data (ideally 24 months) will help your team to better understand how the property uses energy.

NOTE: *If you can't locate your property's energy and water use bills, contact the utility and water providers for the monthly use history.*

A.2 Getting Started in Portfolio Manager

Now that you have collected your property's data, you're ready to create the Portfolio Manager account! The following steps will walk you through: 1) signing up for a new account or logging into an existing one; 2) adding account information; 3) benchmarking with Portfolio Manager; and 4) utilizing the information collected on Worksheet 1 - Portfolio Manager Data Collection.

For a quick start guide on Portfolio Manager, please see http://www.energystar.gov/buildings/tools-and-resources/portfolio-manager-quick-start-guide.

Part 1: Sign Up for a New Portfolio Manager Account, or Log into an Existing One

Follow the steps below to sign up for a new Portfolio Manager account for your property, or to log into an existing account.

Step	Action
1.	Go to the Portfolio Manager login page (www.energystar.gov/benchmark).
If you are a New User:	
2.	Click **Sign Up** in the section labeled "Portfolio Manager Login".
3.	Enter the required information in the boxes such as name and address of the property. ***Note:*** *Identify your primary business as "Congregation/Faith-Based Organization".*
4.	Click **Save Profile** to complete your account setup. Continue to **Part 2**, below, and add a property to the account.
If you are already a Registered User:	
5.	Enter your User Name and Password in the section titled "Portfolio Manager Login" on the right-hand side of the page, and click **Login**. Continue to **Part 2**, below, and add a property to the account.

Part 2: Add a Property

Follow the steps below to add a property to the Portfolio Manager account.

Step	Action
6.	From the Welcome page, click **Add a Property**.
7.	In the "Set up Property" section, select the "Worship Facility" space type category.
8.	Enter the number of properties and the construction status.
9.	Click **Get Started**. Continue to **Part 3**, below, and add energy and water data to the account.

Part 3: Add Energy Use-Type Information

Follow the steps below to add energy use type information for the property to the account.

Step	Action
10.	Enter general property information, including the square footage and occupancy and click continue. ***Note:*** *Move your mouse cursor over any* ***blue*** *font to view a pop up window of further details.*
11.	Enter information on how the property is used including operating hours, seating capacity, number of computers, etc. Ensure that the dates in the right hand column are correct.
12.	Click **Add Property**. At this time you have successfully added a new property.

Part 4: Add Energy and Water Data

Follow the steps below to enter energy and water data from your property's utility bills.

Step	Action
13.	Start on the "Summary" tab - observe the basic characteristics of the property.
14.	To enter your property's energy and water data, click the **Meter** tab.
15.	Click **Add Another Meter**.
16.	Select the sources of the property's energy and of its water usage.
17.	Identify the number of meters.
18.	Click **Get Started!**
19.	Click a meter to enter units and first bill date.
	For bulk fuel purchases, check "Enter as Delivery?".
20.	Click **Continue**.
21.	Click the gray arrow next to each meter to expand the section on the Your Meter Entries page.
22.	Click **Add Another Entry** under the meter and enter data.
	Check "Estimation" if you are not including measured data for the entry.
23.	Repeat steps for each energy and water meter until data for all meters has been entered.
24.	Click **Finish Meter Set Up** when you have finished entering information for each meter.
25.	Select the boxes of the meters that total your property's energy and water use on the **Meters to Add to Total Consumption** page.
26.	Click **Apply Selections**.

Congratulations! Now that your account is set up, it will be easy for you to continue tracking your property's performance monthly with Portfolio Manager!

A.3 Portfolio Manager Reports

In addition to displaying your property's performance results online, Portfolio Manager can adapt the data from the account into ready-made reports. These reports will be useful for presenting the results to your congregation, demonstrating your property's history of energy management to congregational lenders, or sharing your success with other interested parties. You can generate reports instantly using your property data, or you can request a Statement of Energy Performance (SEP). For more information on the **Standard Report Templates**, see http://www.energystar.gov/buildings/tools-and-resources/portfolio-manager-standard-reports and see the **Custom Reporting Guide** at http://www.energystar.gov/buildings/tools-and-resources/portfolio-manager-custom-reporting-guide.

To run reports from Portfolio Manager, click the **Reporting** tab to view graphs and reports for a property or account. Click the **Charts & Graphs** options to instantly see colorful graphs of how the property is performing. You can print the graphs or download them to incorporate into a presentation or document. View the **Templates & Reports** section to see a list of available standard reports, including Performance Highlights, Energy Performance, and Water Performance. Select **Generate New Report** from the **Action** drop-down menu to create a spreadsheet.

For more information on applying for ENERGY STAR Certification, see http://www.energystar.gov/buildings/tools-and-resources/how-apply-energy-star.

Appendix B - Savings Assessment Worksheets 2 through 11

The worksheets in this appendix will help your team decide which technologies would be most beneficial to implement for the property as part of your energy efficiency projects. In your decision-making process, consider both the initial cost of installing the efficient technology or product and its expected energy cost savings compared to the technologies and products currently in use. When prioritizing the projects, rank them in terms of energy cost savings relative to initial cost.

The worksheets included in this appendix are:

- #2 – Lighting Savings Assessment
- #3 – Incandescent to compact fluorescent light (CFL) Savings Assessment
- #4 – T12 Fluorescent to T8 Fluorescent Savings Assessment
- #5 – Light Emitting Diode (LED) Exit Sign Savings Assessment
- #6 – Occupancy/Vacancy Savings Assessment
- #7 – Computer Equipment Savings Assessment
- #8 – Office Equipment Savings Assessment
- #9 – Refrigerator Savings Assessment
- #10 – Water Cooler Savings Assessment
- #11 – Vending Machine Savings Assessment.

In addition to these worksheets, see the following free online resources for more information:

- ENERGY STAR Products website: http://www.energystar.gov/index.cfm?fuseaction=find_a_product
  - ✓ Learn more about the ENERGY STAR label
  - ✓ Find ENERGY STAR labeled product lists, cost calculators, and other analysis tools.
- Federal Energy Management Program (FEMP) Energy Efficient Products website: http://www1.eere.energy.gov/femp/technologies/procuring_eeproducts.html
  - ✓ FEMP offers its own recommendations for products not listed under ENERGY STAR
  - ✓ Detailed information about performance requirements for energy-efficient products
  - ✓ Energy cost calculators
  - ✓ Additional resources and analysis tools.
- FEMP Energy Savings Calculators for appliances: http://www1.eere.energy.gov/femp/technologies/eep_eccalculators.html

B.1 Lighting Worksheets

As shown in Figure B.1-1, lowering the amount of energy your property uses for lighting will reduce the cost of your electricity bills. Switching from incandescent lamps to more efficient CFL or LED lighting products will conserve energy. CFLs and LEDs also reduce the energy demanded of the property's cooling system because they produce less heat than incandescent lamps. Occupancy/vacancy sensors and daylight dimmers will also reduce energy consumption by automatically turning lights off when they are not needed.

Bulb Types (all approx. 800 lumens)	Life	Costs	Year 1	Cost Annually	Total Costs over 10 years
Standard Incandescent 60 W	1 yr	Bulb Cost	$0.50	$0.50	$5.00
		Energy Cost	$8.02	$8.02	$80.15
		Total Cost	$8.52	$8.52	$85.15
Halogen Incandescent 43 W	1 yr	Bulb Cost	$1.50	$1.50	$15.00
		Energy Cost	$5.74	$5.74	$57.44
		Total Cost	$7.24	$7.24	$72.44
CFL 13 W	9 yrs	Bulb Cost	$3.00	$0.00	$6.00
		Energy Cost	$1.74	$1.74	$17.37
		Total Cost	$4.74	$1.74	$23.37
LED 10 W	23 yrs	Bulb Cost	$13.00	$0.00	$13.00
		Energy Cost	$1.34	$1.34	$13.40
		Total Cost	$14.34	$1.34	$26.40

Figure B.1-1: The difference between different types of lighting; courtesy of ENERGY STAR

When examining lighting systems, it is important to understand the power input (watts) and light output (lumens). Different lamp technologies produce different amounts of lumens per watt. This ratio of output light (lumens) per input energy (watts) is called lamp efficacy. Incandescent lamps are the least efficacious, whereas fluorescent lamps have greater efficacies. Within the fluorescent lamp group, there is a wide range of efficacies. Older T12 lamps with magnetic ballasts have low efficacies, whereas T5 and T8 lamps with electronic ballasts have very high efficacies - CFLs typically fall somewhere in the middle of this range.

Use worksheets 2 through 6 that follow to estimate the energy cost savings that will occur if your congregation switches to more efficient, energy-saving lighting technologies. To avoid confusion, refer to the key lighting definitions listed in Figure B.1-2.

Key Lighting Definitions	
Item	**Definition**
Ballast	A device that manages the starting and operation of a fluorescent lamp. Ballast provides different levels of power to the lamps depending on whether it is starting or running the lamp. Ballasts are also available to work with a day-lighting control systems. These dimming or stepped ballasts can reduce power (and light output) automatically when a photo-sensor detects sufficient light from daylight alone. Dimming ballasts can also provide occupant control of the luminaires, to allow for different scenes or combinations of light levels for different tasks.
Can Light	Another name for a luminaire recessed into a ceiling in a can shaped housing.
Color Rendering Index (CRI)	A measure of the ability of a light source to render colors accurately compared to an ideal light source. Higher numbers mean better color rendition.
Color Temperature	The color of a light source, as it relates to the temperature of a black-body radiator, expressed in degrees Kelvin (K). Warmer (redder) light sources have low color temperatures, and cooler (bluer) light sources have higher color temperatures.
Directional Lamp	A lamp that emits light in a specific direction. Sometimes called parabolic aluminized reflector (PAR) lamps, reflector lamps or spotlights, these are typically found on track-mounted luminaires and are used for accenting features such as artwork.
Illuminance	The amount of light falling on a surface. This is the traditional way to quantify how well lit a room or a task is. The international standard unit for illuminance is lux, but many codes and standards in the United States use the foot-candle (fc). To convert units, 1 fc = 10.76 lux.
Lamp	A device that uses power (usually expressed in watts) and some technology (incandescent, fluorescent, metal halide, LED, etc.) to produce light.
Light Bulb	See “Lamp”
Light Fixture	See “Lamp”
Light Source	See “Luminaire”
Luminaire	A device that holds one or more lamp(s), provides power to the lamp(s), and may also have reflector(s) and/or lens(es) to direct light to the task surfaces and control glare.
Omnidirectional Lamp	A lamp that emits light (nearly) equally in all directions. This is the typical “light bulb” or “A-lamp” shape, and generally relies on a shade or the luminaire housing to control the light.

Figure B.1-2. Key Lighting Definitions

B.1.1 How’s the Lighting? Conduct a Lighting Assessment

In order to identify lighting energy efficiency measures and to establish a baseline for the property, conduct a lighting assessment. This assessment consists of two main tasks: 1) an evaluation of light levels (illuminance) in the property spaces, and 2) an inventory of the types and quantities of lamps installed. Measure the amount of illuminance (fc) in your property’s spaces throughout the day and compare your findings to industry recommendations. Taking readings during the day and again at night will give you an idea of how much daylight is available in the space. This will help you assess the practicality of installing daylight-responsive lighting controls. Coupling this lighting inventory with an audit of the installed lighting power densities (LPDs) will give your team a clear picture of how efficient the property’s light sources are. To help you complete these two tasks, you will need the following tools:

- Illuminance meter (or commonly called light meter)
- Notebook
- Tape measure
- Camera (optional).

Illuminance meters, like the one shown here at the right, can be found at many online retailers, and can be purchased for less than $50.

It is important to keep a log or a plan of the locations where the lighting measurements are recorded. This will help you replicate the measurements for both the day and the nighttime recordings. A tape measure and some simple drawings can work, but a digital camera allows you to capture more information about the survey and can be useful in reviewing the data afterward.

Conducting a Lighting Assessment

Follow the steps below to conduct a lighting assessment of your property.

Step	Action
1.	Record horizontal illuminance levels (fc) in various spaces within each room using a handheld light meter, and record your results in Worksheet 2 - Lighting Savings Assessment (Figure B.1-3). When measuring illuminance levels, be sure to:
	• Turn on all the electric lights, even for the daytime measurements.
	• Hold the illuminance meter steady, and make sure the sensor is horizontal and at the correct height for the space types listed in the worksheet.
	• Wear dark clothing to minimize the effect of reflected light from your clothes on the sensor.
	• In general, light level measurements should be taken at 30" above any finished floor. This is appropriate for offices, classrooms, pulpit, choir, and nave.
	• Take hallway, lobby, and other general circulation space measurements at the floor level.
	• Take restroom measurements at counter height.
	• Take several readings throughout each space, noting the minimum, maximum, and average light levels for each space.
	• Record nighttime and daytime light levels within each space. Take these measurements at the same location to determine daylight contribution, and note sky conditions (clear, partly cloudy, cloudy, etc.). This can give you an idea of the daylight saturation in the space to see if fixture rezoning or daylight sensors are appropriate.
2.	Record the average daytime and nighttime illuminance levels in Worksheet 2.
3.	Next, gather lighting power density (LPD) data about the property. To calculate the LPD for each room, you will need:
	• The number of lamps in the room
	• The lamp wattage (W)
	• The room area (ft^2).
	Note: *Some light fixtures have multiple lamps, so you need to count the number of lamps per fixture, not just the number of fixtures. Be sure to account for all lamp types in the room; many rooms will have multiple luminaire and lamp types.*
4.	Enter the lamp and wattage totals determined in Step 3 in the Worksheet; there are three fields per space type to accept multiple lamp types.
5.	Calculate the LPD for each space in **Column E** and compare it to the code minimum LPD for each space type.

Step	Action
6.	If your observed LPD is significantly greater than the code minimum LPD, your light sources are likely inefficient. See Section B.1.2 - Efficient Light Sources and Ballasts to estimate lamp energy savings opportunities.
7.	Review the nighttime measured versus recommended illuminance levels for each space. If the measured light levels are significantly higher than industry recommendations, you may be able to reduce the number of luminaires, or reduce the wattage of the lamps in the luminaires.
8.	Compare the average nighttime illuminance to the average daytime illuminance in each space. If the daytime illuminance (WITH electric lights ON) is 50 percent or greater than the nighttime illuminance, there may be sufficient daylight availability to take advantage of daylight-responsive lighting controls.

Worksheet 2 - Lighting Savings Assessment

Worksheet 2 – Lighting Savings Assessment										
Space Type		# of Lamps	Lamp Wattage (W)	Total Wattage (W)	Room Area (ft^2)	LPD (W/ft^2)	Recommended LPD (W/ft^2)	Measured Illuminance (fc)		Recommended Illuminance (fc)
								Day	Night	
		A	B	C = A × B	D	E = ($C_1 + C_2 + C_3$) / D				
Lobby	1						0.90			10
	2									
	3									
Worship Pulpit, Choir, Sacristy							1.53			20-100
Private Office							1.11			30
Classroom							1.24			30
Kitchen							0.99			50
Congregation Seating							1.53			5-30
Corridor, Stair							0.66			5
Restroom							0.98			10
Storage							0.63			5
Electrical/ Mechanical							0.95			20
Parking Areas (uncovered)							0.15			0.2

Notes:

- *Recommended LPDs are from ASHRAE 90.1-2010*
- *Recommended Illuminance levels from the Illuminating Engineering Society of North America (IESNA) Lighting Handbook, Tenth Edition*
- *Illuminance ranges, where given, reflect "dark-horse/meditation" versus "participatory" illuminance targets.*

Figure B.1-3. Worksheet 2 - Lighting Savings Assessment

B.1.2 Efficient Light Sources and Ballasts

For this assessment, in addition to the data you gathered for the Lighting assessment on Worksheet 2, you must determine the information listed in Figure B.1-4, which helps to best determine your property's needs.

Efficient Light Sources and Ballasts	
Item	**Value**
The estimated daily hours of operation for the lamps	_____hours/day
The number of days the property is open per week	_____days/week
The number of weeks the property is open per year	_____weeks/year
The number of lamps in the property, categorized by wattage (use information from the Lighting Assessment Worksheet)	_____number of lamps
The cost of electricity for the property	_____$/kWh
Note: *You can typically find the wattage of a lamp listed on the lamp itself, by the base of a CFL or incandescent lamp, or by one end of a linear fluorescent lamp.*	

Figure B.1-4. Efficient Lighting Sources & Ballasts

When deciding whether to replace incandescent and low efficacy T12 fluorescent lamps with high-efficacy fluorescent lamps, keep in mind that CFLs last 6,000 to 12,000 hours, and linear T8/T5 lamps last 20,000 to 30,000 hours, whereas most incandescent lamps last for only 750 to 2,000 hours. Also, high-efficacy lamps need to be purchased and changed far less frequently than incandescent lamps, saving maintenance costs and energy.

Follow the steps, below, to assess the light sources and ballasts used at the property.

Step	Action
1.	Calculate annual hours of operation for lighting at the property based on current use.
	This answer will be used to complete Worksheet 3 - Incandescent to CFL Savings Assessment (Figure B.1-5) and Worksheet 4 – T12 Fluorescent to T8 Fluorescent Savings Assessment (Figure B.1-6), found on the following pages.
2.	Using the information from Step1 above, calculate the annual energy cost savings that would result from replacing incandescent and low efficacy T12 fluorescent lamps with high efficacy fluorescents on Worksheets 3 and 4.

Worksheet 3 - Incandescent to CFL or LED Savings Assessment

Worksheet 3 – Incandescent to CLF Savings Assessment							
Current Technology: Incandescent Lamp Wattage (W)	Retrofit Technology: CFL/LED Wattage (W)	# of Lamps	Power Reduction (W)	Annual Hours of Operation (hour)	Cost of Electricity ($/kWh)	Annual Energy Savings (kWh)	Annual Cost Savings ($)
A	B	C	D=A - B	E	F	G = C × D × E ÷ 1,000	H = F × G
25	4						
40	9						
60	14						
75	19						
100	23						
120	30						
150	42						
				Annual Savings			

Figure B.1-5. Worksheet 3 - Incandescent to CFL or LED Savings Assessment

YOUR LAMP NOT SHOWN HERE? *CREATE A CUSTOM ENTRY*

The kilowatt-hour savings you determined in Worksheet 3 were derived by comparing the lumen output of each incandescent lamp to that of a comparable CFL/LED replacement. For example, in the form, the 60-watt incandescent lamp is compared to a 14-watt CFL because they produce a similar amount of lumens. Your team can find this information for your specific case in the lamp manufacturer's hard-copy or online catalog. Determine the amount of lumens that your specific lamp produces then look up a CFL replacement that emits the equivalent lumens (note an LED equivalent is 10-watts). The equivalent CFL wattage will be lower, hence the energy savings. Be sure to use the "design lumens" or "maintained lumens," and not the "initial lumens" for the comparison.

In the case of T12 linear fluorescent lamps, the ballasts are often magnetic, as opposed to the much more efficient electronic ballasts that drive the newer high-efficiency T8 lamps. Worksheet 4 that follows (Figure B.1-6) provides energy savings information in a slightly different way to account for the energy savings for both the lamp and ballast.

Identify the number of T12 lamps your property's luminaires have, and fill in the appropriate row on the worksheet using the data for the 32-watt T8 retrofit lamp.

Worksheet 4 - T12 Fluorescent to T8 Fluorescent Savings Assessment

Worksheet 4 – T12 Fluorescent to T8 Fluorescent Savings Assessment								
Lamps per Luminaire	# of Luminaires	Current Technology: 39W T12 Magnetic Ballast Luminaire Power (W)	Retrofit Technology: 32W T8 Electronic Ballast Luminaire Power (W)	Power Reduction (W)	Annual Hours of Operation (hour)	Cost of Electricity ($/kWh)	Annual Energy Savings (kWh)	Annual Cost Savings ($)
A	B	C	D	E = C – D	F	G	H = B × E × F ÷ 1,000	I = G × H
1		44	25					
2		74	48					
3		118	73					
4		148	96					
					Annual Savings			

Note: *For this worksheet, a low ballast factor (0.8) for the electronic replacement is assumed. Despite the reduced light output, the lumen output is still roughly equivalent to the lumen output of the 39-watt T12 with magnetic ballast. Other combinations of T8 lamps and electronic ballasts can be used to arrive at higher or lower light levels.*

Figure B.1-6. Worksheet 4 - T12 Fluorescent to T8 Fluorescent Savings Assessment

B.1.3 LED Exit Signs

Before completing this assessment, you will need to know the: 1) number of incandescent exit signs in your property; 2) wattage of one incandescent exit sign; and 3) the cost of electricity for your property (in $/kWh).

When deciding whether to replace your incandescent exit signs with LEDs, remember that LEDs last for 25,000 hours, whereas incandescent lamps last for only 750 to 2,000 hours. LEDs will also need to be purchased and changed less frequently than incandescent lamps. There is an initial up-front cost increase for LEDs, but once installed and running continuously, they last almost three years before requiring replacement and consume less energy. Use Worksheet 5 (Figure B.1-7) to calculate the annual energy cost savings that would result from replacing incandescent exit signs with LEDs.

Worksheet 5 - LED Exit Sign Savings Assessment

Worksheet 5 – LED Exit Sign Savings Assessment							
Current Technology: Incandescent Exit Sign Lamp Wattage (W)	Retrofit Technology: LED Exit Sign Lamp Wattage (W)	# of Signs	Power Reduction (W)	Annual Hours of Operation (hour)	Cost of Electricity ($/kWh)	Annual Energy Savings (kWh)	Annual Cost Savings ($)
A	B	C	D = A – B	E	F	G = C × D × E ÷ 1,000	H = F × G
	2			8,760			
				Annual Savings			

Figure B.1-7. Worksheet 5 - LED Exit Sign Savings Assessment

B.1.4 Occupancy/Vacancy Sensors

Investing in dual-technology occupancy/vacancy sensors is an excellent way to save money and energy. These room sensors combine passive infrared and ultrasonic technologies to detect occupants in different ways. Having two technologies that must agree on occupancy helps eliminate false positives—where lights turn off when occupants are sitting still or lights turn on when no one is in the space but papers flutter, etc. Even good equipment can be installed in an incorrect location; they should not be installed behind a coat rack, door, bookcase, etc. Likewise, it should be located so that neighboring traffic doesn't inadvertently cause a false trigger. The sensor should be located so that it is only influenced by occupants actually entering the space the sensor is controlling. Sensor vendors generally provide a diagram indicating the sensors' "cones of sensitivity" to assist you with proper positioning.

For this assessment, in addition to the data you gathered for Worksheet 2, you need to determine the information listed in Figure B.1-8.

Occupancy/Vacancy Sensors	
Item	Value
The estimated daily hours of operation for your lamps	_____hours/day (also determined on Worksheet 1)
The number of days your property is open per week	_____days/week
The number of weeks your property is open per year	_____weeks/year
The total wattage of each room in your property (the sum of all lamp wattages in that room)	_____total wattage each room (also determined in Worksheet 2)
The cost of electricity for the property	_____$/kWh

Figure B.1-8. Occupancy/Vacancy Sensors

Follow the steps, below, to assess the property's occupancy/vacancy sensors. Then complete the assessment in Worksheet 6 (Figure B.1-9).

Step	Action
1.	Calculate annual hours of operation for lamps in your property based on current use.
	This answer will be used on Worksheet 6 - Occupancy/Vacancy Sensor Savings Assessment, found on the next page.
2.	Calculate the annual energy consumption in each room.

Worksheet 6 - Occupancy/Vacancy Sensor Savings Assessment

Worksheet 6 – Occupancy/Vacancy Sensor Savings Assessment							
Space Type	Total Wattage (W)	Annual Hours of Operation (Hour)	Annual Energy Consumption (kWh)	Occupancy Sensor Reduction Factors	Cost of Electricity ($/kWh)	Annual Energy Savings from Occupancy Sensors (kWh)	Annual Cost Savings ($)
	A	B	C = A × B ÷ 1,000	D	E	F = C × D	G = E × F
Office				.75			
Sanctuary, Classroom				.70			
Hallways, Restrooms, Storage				.60			
				Annual Savings			

Note: *Reduction factors are based on data from the IESNA Lighting Handbook, Tenth Edition (2011).*

Figure B.1-9. Worksheet 6 - Occupancy/Vacancy Sensor Savings Assessment

B.1.5 Daylight Dimmers/Photo Cell Guidance

Day-lighting, or light from outdoors, can be very difficult to accurately characterize and quantify in terms of energy savings. It can also be difficult to integrate day-lighting into an existing building and control it properly for maximum energy savings. However, many worship facilities have been designed with day-lighting in mind, and your property likely has one or more spaces that can benefit from daylight-responsive lighting controls. If you already have a form of automatic lighting controls, make sure they are properly calibrated (they may not have been calibrated correctly during installation, or occupants may have tampered with them). Adjusting these controls and associated sensors will reduce occupant complaints, maintain safety, and ensure maximum energy savings.

These steps, (along with information from Sections B.1.1 - How's the Lighting? Conduct a Lighting Assessment and B.1.2 - Efficient Light Sources and Ballasts), can help you to get a general sense of the energy savings potential through day-lighting.

Step	Action
1.	Identify all rooms that receive all or some of their light from windows during the day. The best way to do this is to perform a lighting assessment of the property and complete **Worksheet 2**. Be sure to follow the guidance for taking illuminance measurements provided in the steps for "**Conducting a Lighting Assessment**".
2.	Compare the average nighttime illuminance levels to the average daytime illuminance levels (electric lights ON in both cases) for each day-lit space. The difference between the daytime illuminance level and the nighttime illuminance level is the daylight illuminance contribution. If the daylight illuminance contribution is 50 percent or greater than the nighttime illuminance, there may be sufficient daylight availability to take advantage of daylight dimming.
	Note: *If you determine there is day-lighting potential (50 percent of illumination from daylight, as determined above), take additional illuminance measurements to better characterize the daylight availability. Try to take measurements over time to capture both clear and very cloudy conditions. Although this is a very crude way of estimating daylight availability, the more measurements you take, the more accurate the feasibility and savings estimates will be.*

Step	Action
3.	Determine daylight contribution for your additional measurements as you did in Step 2.
	If you have 50 percent of a daylight contribution to the target illuminance, for 50 percent of the times you measured, daylight controls are recommended.
4.	Consider breaking your illuminance measurements into zones; one zone close to the perimeter windows and one further away from the daylight. It may be easier to achieve high daylight contribution and availability if you split the zones this way.
5.	If the savings are significant, hire an electrician to price and install dimming/switching ballasts, photocells, and appropriate zone control wiring. Be sure to have them confirm that the photocell placement is appropriate, and review the cost of controls. If your property is already using highly efficient light sources, implementing this measure may not be cost effective considering the payback.

B.1.6 Additional Online Resources for Lighting Equipment

For more information about efficient lighting equipment, see the following websites:

- ENERGY STAR Products: Lighting: https://www.energystar.gov/index.cfm?c=lighting.pr_lighting_landing
- DOE Commercial Lighting Solutions tool for optimizing your lighting design: https://www.lightingsolutions.energy.gov/comlighting/login.htm
- Lighting Research Center website on controls: http://www.lrc.rpi.edu/researchAreas/controls.asp
  - ✓ Information about lighting controls, including photo-sensors
  - ✓ Information about ongoing lighting control research and product testing.

B.2 Heating, Ventilation, and Air Conditioning (HVAC)

Many of the improvements discussed in other sections of this appendix can also improve the efficiency of your property's HVAC system. For example, efficient lighting has less waste heat and can reduce air conditioning costs; additionally, making sure the property is well insulated will allow the HVAC system to work less to maintain desired indoor temperatures. Since replacing HVAC systems are often larger financial decisions, the information below can help your team consider a replacement plan for your property's system.

B.2.1 Should HVAC Equipment be run to Failure?

All types of equipment have a certain useful lifetime. This lifetime may be extended with regular maintenance, but at some point the equipment will need to be replaced. Replacement offers an opportunity to invest in energy efficiency, and can impact energy consumption and costs for years to come.

Because major HVAC equipment (boilers, air conditioners and air handlers, chillers, etc.) typically has a long useful life and a major impact on energy consumption, special attention should be paid to this equipment. Replacement of major HVAC systems is expensive. In the cases of worship facilities, sometimes a capital campaign must be used to raise money for the new equipment. For these reasons, it is recommended that this equipment be evaluated periodically to estimate how much useful life it has. When the equipment is one to two years from the end of its useful life, plans for a replacement should begin. The difference between running to failure and scheduled replacement are best outlined through the following scenarios.

- **Scenario 1 – Run HVAC system to failure:** A worship facility in Minnesota has a boiler that provides hot water to heat the building. Although the boiler has been well maintained, it is 40 years old. On one particularly cold night, the boiler stops working entirely. The technician comes and says that it can't be fixed. Although the building owners and operators knew that the equipment was old, they'd never really thought about it or planned for this occasion. Now, the congregation is facing a $60,000 dilemma. They must have a new boiler installed right away to keep the worship facility and all its uses functioning for the rest of the winter. They call the local boiler supplier, which carries a few models. The models that it usually stocks are not high-efficiency boilers, but they do have a lower up-front cost, and they're in the warehouse ready for installation. High-efficiency models are available, but they are more expensive, and aren't stocked in the supplier's warehouse at the moment. The building owners choose the regular efficiency unit because it is available right away and is the cheapest. However, the cheapest unit is typically less expensive in terms of upfront costs, but not in lifetime costs in terms of operation, maintenance, and utility costs. As is often the case for any product, higher quality may cost more initially, but will outlast and outperform a cheaper version for life-cycle savings.

- **Scenario 2 – Scheduled HVAC replacement:** This is the same worship facility as described in Scenario 1, but this is two years earlier, before the start of the heating season. The building owners and operators have a boiler technician come every year to tune-up the boiler and let them know

how it's doing. This year, the technician informs them that the boiler will probably last this year and one or two more seasons, but past that point it doesn't look good. With this in mind, the congregation starts a capital campaign to raise money for a new boiler. They start talking to the boiler supplier about the different options available, and find out that the high-efficiency models are 20 percent more expensive up front, but that over their estimated 40-year lifespan, they take only a few years for the energy savings to make up for the extra cost. The people looking into this decision take what they've learned to the other decision makers, and convince them that in the long run, the high-efficiency unit is a better deal, and will actually save the congregation quite a bit on utility bills long after the extra cost has been paid for. The congregation raises the money, and after the end of the second heating season, the staff schedules the replacement with the boiler supplier. The boiler that they want must be shipped in, which will take two weeks, but the weather is warm, so the boiler isn't needed. The boiler is installed, tested, and ready for the next heating season well ahead of time. The congregation is happy that utility bills will be lower for the life of the boiler.

In these two scenarios, the difference is that the second group had the time to sit back, think, and make a decision that made sense in the long run, rather than being limited by the situation at hand. By keeping a close eye on the condition of major HVAC equipment, congregations can plan ahead and make the best decisions possible, which usually mean that equipment is not run to failure.

B.2.2 Applying the Concept

A major piece of equipment is most likely to fail when it is under the most stress or greatest demand. Therefore, it is likely to fail at the "worst possible time." Heating equipment is likely to fail on the "coldest day" and air-conditioning on the "hottest day." Without a planning and replacement strategy in place, a congregation can either "do without" or jump to a major purchase with too little research and too few good choices, and be faced with long-term cost implications. Regularly scheduled maintenance (at least annual or "pre-season") and a replacement plan are the responsible financial stewardship approach for your property and its vital HVAC equipment.

B.3 Building Envelope Assessment Guidance

Having a secured building envelope helps maintain the efficiency of your congregation's HVAC system and the comfort of the property. Recommended building envelope improvements vary based on several factors, including how the property was built, when it was built, and how it is maintained.

B.3.1 Check for Problems with the Building Envelope

This is a time for your team to consider professional assistance. Follow the steps, below, to identify and fix weak points in the overall building envelope of your property. You will also get to know the structure and elements of the building better in the process. Then follow the remaining steps to check for and fix any problems with the buildings': 1) exterior walls; 2) roof and attic spaces; 3) windows and shading; and 4) doors.

You may find it helpful to have the items listed in Figure B.3-1 on hand when completing the building envelope assessments for your property.

Building Envelope Assessment Toolkit	
Tape Measure/Ruler	Incense Stick and Lighter
Flashlight	Digital Camera
Ladder	Thermometer

Figure B.3-1. Building Envelope Assessment Toolkit

Follow the steps, below, to identify and fix problems in the overall building envelope of the property.

Step	Action
1.	**Collect architectural and construction drawings** of the building. Use these resources to determine the layout of internal zones and the construction of exterior surfaces.
	Note: *if you do not have these documents for the property, do your best to sketch the internal layout and building envelope based on your observations. A simple footprint sketch could be adequate for your purposes.*
2.	**Look for noticeable air infiltration** in the property and record your observations. Record temperatures from different points throughout the building to identify less noticeable infiltration points.
3.	**Run either a smoke pencil or a lit incense stick** slowly along door jams, window frames, and vents to determine the level of air flow. This flow is "air infiltration" or the exchange of unconditioned outside air that your congregation paid to heat or cool. Record locations where there are drafts or a lot of air movement on your building sketch. You may need to turn on the air handlers (fans/ventilation) to create air pressure.
4.	**Check the interior walls,** being sure to record:
	• Wall construction and if there is any insulation.
	• Wall condition and noticeable infiltration points.
5.	**Take a digital photo** of all areas of concern.

B.3.2 Check Exterior Walls

Follow the steps, below, to check for problems with the property's exterior walls.

Step	Action
1.	**Check for and fix air leaks:** Unconditioned outside air can add additional heating or cooling loads to the building. Seal areas of infiltration in walls using caulk or weather stripping to prevent unconditioned air from entering your building.
2.	**Check for and fix rainwater leaks:** Wet insulation is not as effective as dry insulation, and excess moisture in wall cavities can create mold, rot, and structural decay. Mold can be a serious health hazard for staff and members of your congregation. Fix rain leaks in exterior walls by repairing poorly installed siding, flashing, weather stripping, or caulking.
3.	**Check the insulation:** Installing additional insulation in exterior walls is a possible way to reduce heat gain or loss through the building envelope. However, depending on the construction of the building, this could be very labor intensive and expensive.
	• Use loose-fill insulation for enclosed existing walls and hard to reach places.
	• Use rigid fibrous insulation for ducts in unconditioned spaces and other places that can withstand high temperatures.
	• Use spray foam or foamed-in-place insulation for enclosed existing walls.

B.3.3 Check Roof and Attic Spaces

Follow the steps, below, to check for problems with the property's roof and attic spaces.

Step	Action
1.	**Check the roof** for the following, being sure to record:
	• Any water intrusion
	• Roof age and warranty.
	Roof condition (including signs of leaks, membrane holes, and damaged insulation)
	• Roof construction and insulation thickness
	• Check attic bypasses.
2.	**Check the insulation:** A professional energy audit will likely recommend the following as applicable. After first sealing attic air infiltration, increase attic and roof insulation to reduce heat transfer through the building envelope; unconditioned outside air can add additional heating or cooling loads to the building. Seal areas of infiltration in walls using caulk or weather stripping to prevent unconditioned air from entering your building.
	• In an unfinished attic, use loose-fill, sprayed foam, or foamed-in-place insulation.
	• In unfinished attic walls and ceilings, use batt or roll insulation.
3.	**Check to see if the roof surface needs replacement:** Research and consider the possibility of retrofitting the existing roof with a "green" roof or a "cool" roof to reduce heat transfer through the building envelope. Make sure to have a structural engineer evaluate the building if the new roof is going to add weight to the building to be sure that its structure is strong enough to carry the additional weight.

B.3.4 Check Windows and Shading

Follow the steps below to check for and fix problems with the property's windows and shading.

Step	Action
1.	**Fix leaks:** Seal areas of air infiltration, starting with the attic and moving to windows using caulk or weather stripping to prevent unconditioned air from entering the building.
2.	**Check the windows**, especially if you are considering replacements, being sure to record:
	• Window condition (cracked or broken glass, dry rot, missing caulk, etc., both inside and outside)
	• The window to wall ratio on each façade (the area of the window: the area of wall)
	• Window size and dimensions
	• Window framing and type of thermal break
	• Window type (double paned, single paned, etc.)
	• Window operation
	• External window shades/overhangs/caulking
	• Interior window blinds.
3.	**Consider installing new windows:** New windows are expensive and may not provide the savings relative to cost of many other upgrades. However, when it is clear that the building needs new windows, replace old or single-pane windows with ENERGY STAR qualified double- or triple-pane glass and an insulating gas. Consider choosing windows with tints, heat reflective coatings, or laminates to further reduce heat gain. Old and metal window frames should also be replaced with non-metal insulating frames.
4.	**Check interior shading:** Venetian blinds and other operable shades are low-cost and effective solutions for keeping out sunlight in summer months.
5.	**Check exterior shading:** Overhangs, awnings, shade screens, roller blinds, and vegetation can provide exterior shading that also reduces the glare from direct sunlight striking glass windows. Overhangs and awnings can be particularly beneficial because they admit light from the low winter sun (when sunlight is beneficial for heating and lighting) and tend to block the higher summer sun (when solar gain is less desirable). Western sun in the summer, especially in hot climates, can increase the cooling load of the building's HVAC system substantially, so it is a good idea to focus shading to the western windows first (in warm climates).
6.	**Consider installing fiberglass or metal shade screens:** These cost-effective applications are capable of reducing solar heat gain up to 80 percent compared to un-shaded clear glass. A shade screen is a specially fabricated screen of sheet material with narrow weave or louvers formed in place to prevent solar radiation from striking a window. The air space between the exterior shade screen and the window helps carry away heat absorbed by the shade before it can be transferred through the window.
7.	**Consider exterior roller blinds:** These are a series of slats, typically horizontally oriented, made of wood, steel, aluminum, or vinyl. Like interior shades, they can be raised or lowered as needed to control the amount of sunlight entering a building space. In warm temperatures during sunny hours, they can be lowered to function as an insulating barrier, limiting incoming sunlight and reducing heat gain. In cold weather they can be raised to allow desirable heat gain. Partially rotating the blinds allows some daylight and air to enter between the slats. However, this shading technique can be expensive, and it alters the exterior appearance of a building.
8.	**Plant a tree:** Deciduous trees are very effective at providing shade. During the winter when they are bare, they allow sunlight to pass through; in summer they leaf out and provide shade. The best location for deciduous trees is due west of west-facing windows. East, southeast, and southwest sides of buildings are also good locations. Plant trees within 20 feet of windows and allow them to grow at least 10 feet higher than the window.

B.3.5 Check Doors

Follow the steps, below, to check for and fix problems with the property's doors.

Step	Action
1.	**Check for and fix air leaks:** Unconditioned air can add additional energy loads to the building's HVAC system. Seal areas of air infiltration around attic access and doors using caulk, weather stripping, and door sweeps to prevent unconditioned air from entering the building.
2.	**Calibrate automatic doors:** If your property has doors that open automatically, set the sensitivity so that the doors only open when people are actually approaching the doors. This is especially important if there is a commonly traveled pathway close to the door.
3.	**Install revolving doors:** One technical option is installing a revolving door to reduce the exchange of unconditioned and conditioned air. However, this could be an expensive option.
4.	**Create an entrance vestibule:** A vestibule is two sets of doors separated by a small enclosed space. The idea of a vestibule is that only one set of doors is open at a time. This reduces the amount of unconditioned air entering the building.

B.3.6 Additional Online Resources for Building Envelope Guidance

For more information about building envelope components, visit the following websites:

- ENERGY STAR Roof Products: http://www.energystar.gov/index.cfm?fuseaction=find_a_product.showProductGroup&pgw_code=RO
- ENERGY STAR Sealing and Insulating Guide: http://www.energystar.gov/index.cfm?c=home_sealing.hm_improvement_sealing
- EPA Indoor Air Quality website: http://www.epa.gov/iaq/
- DOE Cool Roof Calculator: http://www.ornl.gov/sci/roofs+walls/facts/CoolCalcEnergy.htm
  - ✓ This calculator estimates cooling and heating savings for flat roofs with non-black surfaces.
- The Cool Roofs Toolkit: http://www.coolrooftoolkit.org

B.4 Office Equipment Guidance

When you need new office equipment, always buy ENERGY STAR qualified products for savings and high performance.

B.4.1 ENERGY STAR Qualified Office Equipment

ENERGY STAR has qualified a growing list of office equipment that includes the following types of products:

- Desktop and laptop computers
- Cordless phones
- Computer monitors, digital picture frames, and professional signage
- External power adapters (for PDAs, cameras, laptops, etc.)
- Imaging equipment (copiers and fax machines, printers, scanners, etc.)
- Televisions.

The easiest way to measure potential cost savings from investing in ENERGY STAR qualified office equipment is to use one of the free online ENERGY STAR Microsoft (MS) Excel-based calculators found at http://www.energystar.gov/products. Use Figure B.4-1 to determine which data you will need to have ready to use the calculators—an X in the checkbox means you should have this data on hand.

Type of Office Equipment	Quantity	Additional Cost for ENERGY STAR Qualified Model	Percent of Units Turned Off at Night	Percent of Units With Sleep Settings/Low Power Mode Enabled	Imaging Speed
Desktop Computer Laptop Computer Computer Monitor	X	X	X	X	☐
Copier* Multifunction Device Laser Printer*	X	X	☐	☐	X
Scanner FAX Machine Ink Jet Printer	X	☐	☐	☐	☐

*Know whether these products are monochrome (black and white) or color

Figure B.4-1. Data needed to use ENERGY STAR MS Excel-based Calculators

For products not listed under ENERGY STAR, FEMP offers its own recommendations.

B.4.2 Microsoft Windows Power States

Microsoft (MS) Windows computers have a variety of power states and default power plans (modes) that can significantly reduce or optimize a personal computer's (PC's) power use. Creating a custom PC power plan specific to your needs and use will further optimize power use and energy savings.

WINDOWS XP

As shown in Figure B.4-2, Windows XP has two primary low-power modes - Stand By and Shut Down. The advantage of using Stand By as opposed to shutting down the PC is that it very quickly enters the low-power state and resumes equally quickly with all of your programs and documents remaining open, whereas shutting down and later booting takes *several* minutes and does not restore the programs and documents you had open. The only disadvantage to Stand By is that if the PC loses power while it is in Stand By mode, any unsaved work may be lost.

Figure B.4-2. Windows XP Stand By Option

Saving your work before entering Stand By alleviates this concern. Simply locking the computer, logging off, or enabling a screen saver to come on after a period of inactivity will *not* reduce energy use - in fact, the screen saver can even *increase* energy use.

As shown in Figures B.4-3 and B.4-4, Windows XP comes with numerous power schemes for regulating your energy use, or you can create your own. You can find them by clicking the **Start** button, clicking **Control Panel**, clicking **Performance and Maintenance**, and then clicking **Power Options**. Your options may vary depending on whether you are using a desktop or laptop computer.

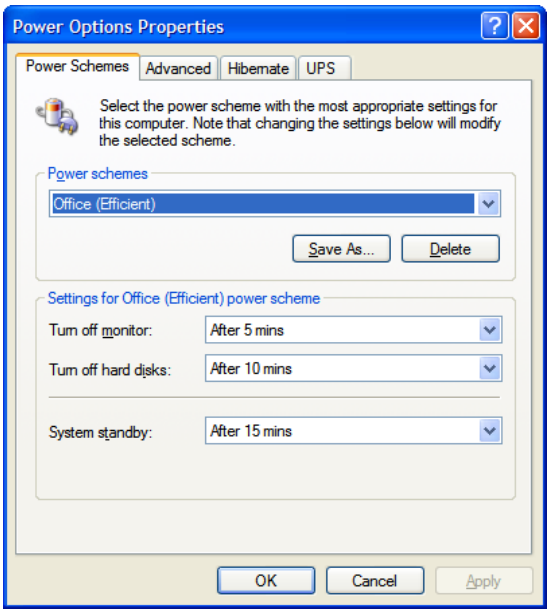

Figure B.4-3. Windows XP Efficient Desktop Power Scheme Settings

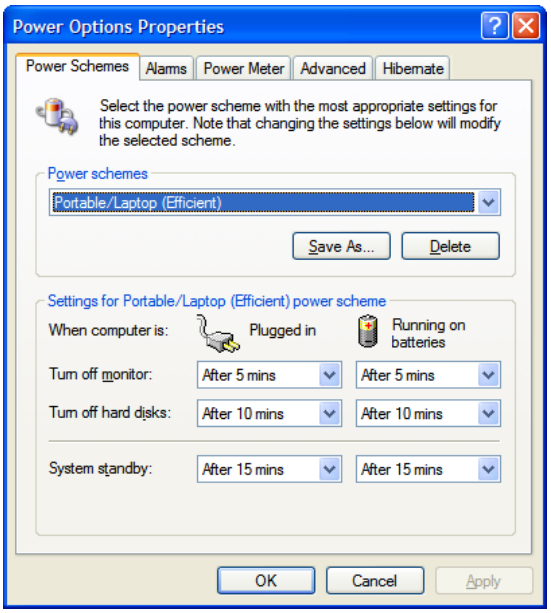

Figure B.4-4. Windows XP Efficient Laptop Power Scheme Settings

The default power schemes for a desktop computer or a laptop running Windows XP are not particularly efficient because they do not go into Stand By mode (except when the laptop is unplugged). An effective and efficient power scheme will turn off the monitor after five minutes, turn off the hard disks after 10 minutes, and put the system into Stand By after 15 minutes of inactivity.

WINDOWS 7

As shown in Figure B.4-5, the two primary low-power options for Windows 7 are Sleep and Shut Down. Sleep mode is very similar to Windows XP's Stand By, with some new improvements. When you use Sleep on a desktop computer, by default it saves all of your running programs and documents to the hard disk so that in the event of a power failure you can still resume from where you left off. You still get the speed benefits and functionality of Stand By mode, with the added benefit of protection from power loss. Using Sleep on a Windows 7 laptop by default does not save your files to the hard disk, performing exactly the same as XP's Stand By (because the laptop has a battery, it is far less likely to completely lose power).

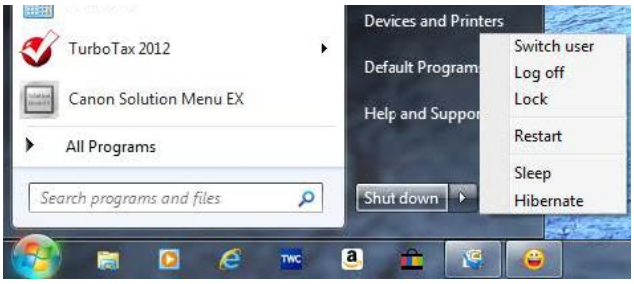

Figure B.4-5. Windows 7 Shut Down Menu Options

To change the current power plan for a desktop or laptop PC running Windows 7 (Figures B.4-6 and B.4-7), click the **Start** button, click **Control Panel**, click **System and Security**, and then click **Power Options**. Following similar guidelines as above, an efficient power plan will turn off the PC's monitor after five minutes and put the system to sleep after 15 minutes (and for laptops, dim the display after two minutes).

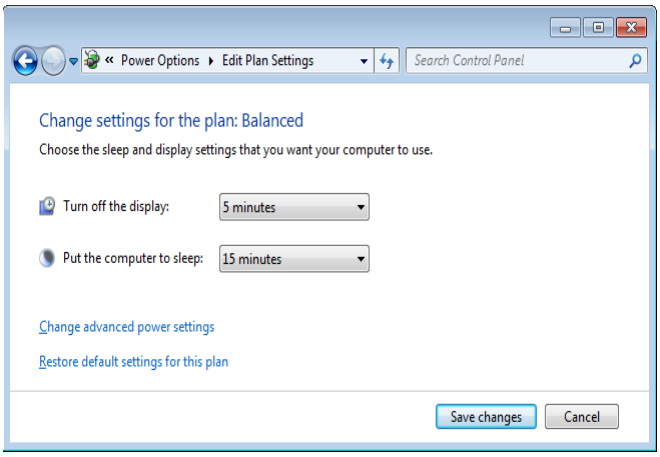

Figure B.4-6. Windows 7 Efficient Laptop Power Options

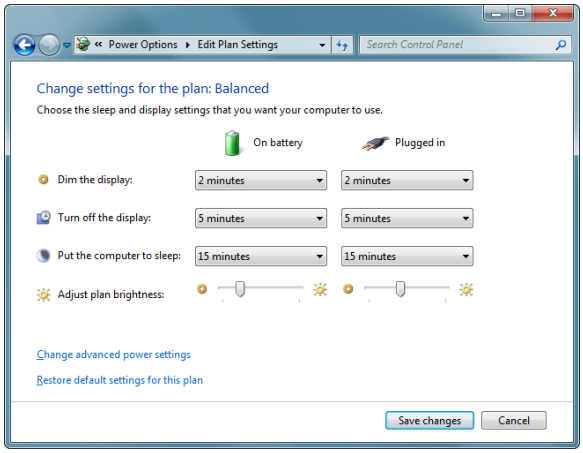

Figure B.4-7. Windows 7 Efficient Desktop Power Options

B.4.3 Apple / Macintosh Computer Power States

As shown in Figure B.4-8, for Apple PCs running **Mac OS X**, you can optimize the power settings similar to Windows. Launch **System Preferences** then click **Energy Saver**. Unlock the settings if necessary using your password, then set the computer sleep time to 15 minutes, and the display sleep time to two minutes.

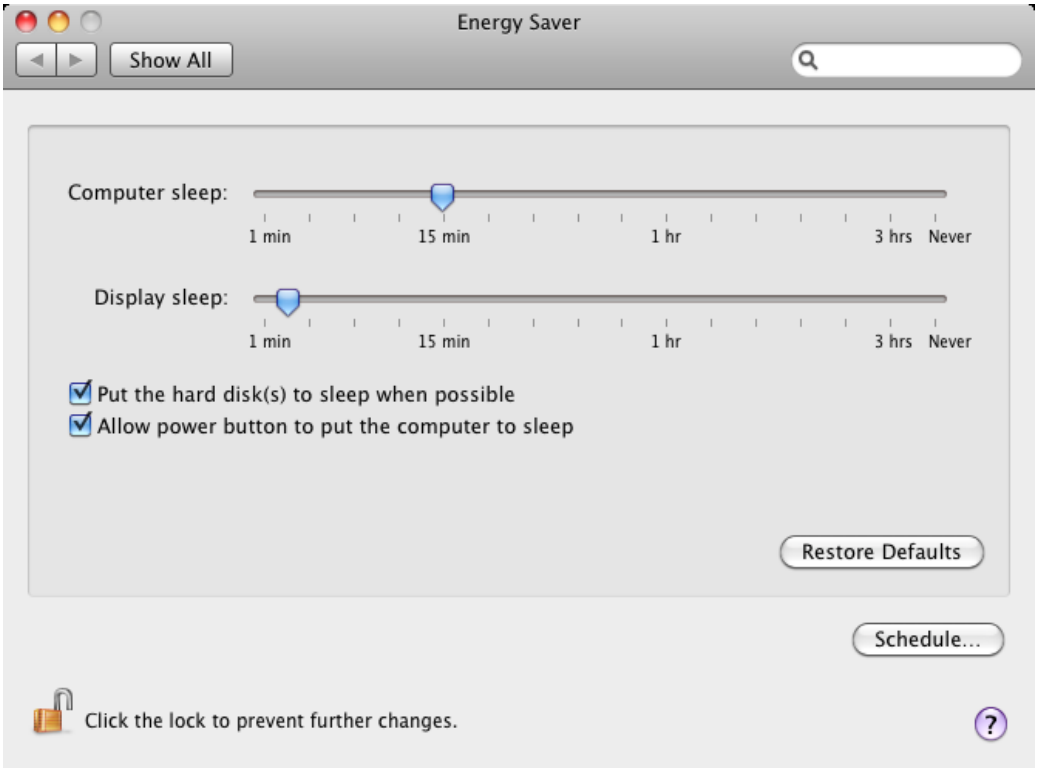

Figure B.4-8. Mac OS X Energy Saver Options

B.4.4 Computer Monitor Power States

When following the desktop computer's recommended energy-efficient power plan above, monitors should enter their sleep state shortly after the PC disables the display because of inactivity (five minutes). Conventional monitors consume an average of 32 watts when active, and less than 1 watt when asleep. ENERGY STAR qualified monitors can consume as little as 25 watts and many models also regulate screen brightness based on ambient light in the vicinity.

B.4.5 Computer Equipment Assessments

Use Worksheet 7 (Figure B.4-9), found on the following page, to determine the savings that can be realized for your property's PC's.

Worksheet 7 - Computer Equipment Savings Assessment

Worksheet 7 – Computer Equipment Savings Assessment					
Strategy	Energy Savings Potential (kWh/year)	Quantity in Your Building	Cost of Electricity ($/kWh)	Annual Energy Savings (kWh)	Annual Cost Savings ($)
	A	B	C	D = A × B	E = C × D
Implement energy-efficient power plans on all computers	**414 kWh/year** for every computer left on 24 hours day				
	40 kWh/year for every computer turned off at night				
Replace CRT monitor with LCD monitors	**53 kWh/year** for every CRT replaced by LCD (assumes both CRT and LCD monitors are power managed)				
Turn off computer speakers when not in use	**8 kWh/year** for each set of computer speakers that are turned off				
Replace desktop computers with a laptop computers	**70 kWh/year** for every desktop computer/LCD monitor replaced with a laptop computer (assumes all components are power managed)				
Enable the power option settings on laser printers and copiers to go into standby after 15 minutes of idle time	**100 kWh/year** for every laser printer set to go to sleep after 15 minutes of idle time				
	230 kWh/year for every copier set to go into standby after 15 minutes of idle time				
		Annual Savings			

Figure B.4-9. Worksheet 7 - Computer Equipment Savings Assessment

B.4.6 Office Equipment and Televisions

Use Worksheet 8 (Figure B.4-10) to determine the savings that can be realized for your property's other office equipment.

Worksheet 8 - Office Equipment and Televisions Savings Assessment

Worksheet 8 – Office Equipment and Televisions Savings Assessment					
Strategy	Energy Savings Potential (kWh/year)	Quantity in your Building	Cost of Electricity ($/kWh)	Annual Energy Savings (kWh)	Annual Cost Savings ($)
	A	B	C	D = A × B	E = C × D
Remove bottle water coolers and provide filtered water at the tap	**550 kWh/year** for every bottle water cooler that is removed				
Purchase new ENERGY STAR qualified televisions	**40 kWh/year** for each ENERGY STAR qualified television				
		Annual Savings			

Note: *This table assumes 10 hours of operation per workday.*

Figure B.4-10. Worksheet 8 - Office Equipment & Televisions Savings Assessment

B.4.7 Additional Online Resources for Computer and Office Equipment

For more information about computer and office equipment, visit the following websites:

- ENERGY STAR Certified Products (including Office Equipment) website: www.energystar.gov/index.cfm?fuseaction=find_a_product.showProductCategory&pcw_code=OEF
  - ✓ Learn about the types of ENERGY STAR qualified office equipment that are available.
- ENERGY STAR Office Equipment Savings Calculator: http://www.energystar.gov/ia/business/bulk_purchasing/bpsavings_calc/Calc_office_eq.xls
  - ✓ Opens an MS Excel spreadsheet from the ENERGY STAR website. It is also available through the Products link from the ENERGY STAR homepage.
- ENERGY STAR Low Carbon IT Campaign website: www.energystar.gov/index.cfm?c=power_mgt.pr_power_mgt_low_carbon
  - ✓ A nationwide effort to assist and recognize organizations for reducing the energy consumed by their information technology equipment.
- FEMP Energy-Efficient Products website: www1.eere.energy.gov/femp/procurement/eep_modellang.html
  - ✓ Helps identify FEMP-recommended energy- and water-efficient products.

B.5 Kitchen and Food Service Equipment Worksheets

Use the worksheets in this section to estimate the energy cost savings that will occur if you switch from conventional kitchen and food service equipment, to ENERGY STAR qualified alternatives. The worksheets in this section include:

- #9 – Refrigerator Savings Assessment
- #10 – Water Cooler Savings Assessment
- #11 – Vending Machine Savings Assessment.

B.5.1 Commercial Food Service Equipment Guidance

When you need new commercial food service equipment, always buy ENERGY STAR qualified products, which use energy more efficiently. Figure B.5-1 lists the types of commercial products covered by the ENERGY STAR Qualified Products program:

ENERGY STAR Qualified Commercial Food Service Products		
Dishwashers	Griddles	Ovens
Freezers	Hot Food Holding Cabinets	Refrigerators
Fryers	Ice Machines	Steam Cookers

Figure B.5-1. ENERGY STAR Qualified Commercial Food Service Products

ENERGY STAR Commercial Kitchen Equipment Calculators

The easiest way to measure potential cost savings from investing in ENERGY STAR qualified commercial food service equipment is to use the free ENERGY STAR MS Excel-based calculators for commercial kitchen equipment. You will need the following data points to use the calculators:

- Number of units in your property
- Type of equipment and equipment specifications (specifications needed vary depending on the type of equipment. Have your user's manual handy.)
- Type(s) of energy used (electric, gas, etc.)
- Rates of utilities used (water, electric, gas, etc.)
- Rate of operation (hours/day, days/year, etc.)
- Difference in cost of a conventional unit versus an ENERGY STAR qualified unit.

Use Worksheet 9 to 11 (Figure B.5-2 to B.5-4) to complete your Refrigerator, Water Cooler, and Vending Machine Savings Assessments.

B.5.2 Refrigerators

Worksheet 9 - Refrigerator Savings Assessment

Worksheet 9 – Refrigerator Savings Assessment

For this assessment you will need to know:

(a) Number of refrigerators in your property _____

(b) Annual energy consumption of one conventional refrigerator (use table below) _____kWh

Conventional Refrigerator Type	Annual Energy Consumption (kWh)
Refrigerator-freezer or refrigerator only (manual or partial-auto defrost)	488
Top-mounted freezer or refrigerator only (automatic defrost)	543
Side-by-side (automatic defrost)	641
Side-by-side with through-the-door ice (automatic defrost)	681
Bottom-mounted freezer (automatic defrost)	584
Bottom-mounted freezer with through-the-door ice (automatic defrost)	675

(c) Annual energy consumption of the same type of ENERGY STAR qualified refrigerator _____kWh

ENERGY STAR Qualified Refrigerator Type	Annual Energy Consumption (kWh)
Refrigerator-freezer or refrigerator only (manual or partial-auto defrost)	381
Top-mounted freezer or refrigerator only (automatic defrost)	423
Side-by-side (automatic defrost)	500
Side-by-side with through-the-door ice (automatic defrost)	531
Bottom-mounted freezer (automatic defrost)	456
Bottom-mounted freezer with through-the-door ice (automatic defrost)	526

(d) Cost of electricity for your property (in $/kWh) $_____

Calculate the **Annual Energy Cost Savings** that would result from replacing a conventional refrigerator with an ENERGY STAR qualified model.

Refrigerator Type	QTY	Annual Energy Consumption	$/kWh	Annual Energy Cost
	(a)	(b) : (c)	(d)	(b) x (d) *or* (c) x (d)
Conventional Refrigerator **(b)**				
ENERGY STAR Qualified Refrigerator **(c)**				
Difference (Savings)				

Figure B.5-2. Worksheet 9 – Refrigerator Savings Assessment

B.5.3 Water Coolers

Worksheet 10 – Water Cooler Savings Assessment

Worksheet 10 - Water Cooler Savings Assessment

For this assessment you will need to know:

(a) Number of water coolers in your property _____

(b) Days per year your water cooler operates _____days/year

(c) Daily energy consumption of one conventional water cooler (use table below) _____kWh

Conventional Water Cooler Type	Daily Energy Consumption (kWh)
ONLY Cold Water	0.29
Both Hot and Cold Water	2.19

(d) Daily energy consumption of one ENERGY STAR qualified water cooler (use table below) _____kWh

ENERGY STAR Qualified Water Cooler Type	Daily Energy Consumption (kWh)
ONLY Cold Water	0.16
Both Hot and Cold Water	1.2

(e) Cost of electricity for your property (in $/kWh) $_____

Calculate the **Annual Energy Cost Savings** that would result from replacing a conventional water cooler with an ENERGY STAR qualified model.

Water Cooler Type	QTY	Days of Operation	Daily Energy Consumption	Annual Energy Consumption	$/kWh	Annual Energy Cost
	(a)	(b)	(c) : (d)	(b) × (c) *or* (b) x (d)	(e)	Annual Energy Consumption x (e)
Conventional Water Cooler **(c)**						
ENERGY STAR Qualified Water Cooler **(d)**						
Difference (Savings)						

Figure B.5-3. Worksheet 10 - Water Cooler Savings Assessment

B.5.4 Vending Machines

Worksheet 11 - Vending Machine Savings Assessment

Worksheet 11 – Vending Machine Savings Assessment					
Strategy	Energy Savings Potential (kWh/year)	Quantity in the Building	Cost of Electricity ($/kWh)	Annual Energy Savings (kWh)	Annual Cost Savings ($)
	A	B	C	D = A × B	E = C ×
Choose an ENERGY STAR qualified 400-can vending machine	**1,700 kWh/year** for every standard vending machine that is replaced with an ENERGY STAR qualified machine with software				
	1,100 kWh/year for every standard vending machine that is replaced with an ENERGY STAR qualified machine				
	600 kWh/year for every ENERGY STAR qualified vending machine that is replaced with an ENERGY STAR qualified machine with software				
Choose an ENERGY STAR qualified 500-can vending machine	**2,200 kWh/year** for every standard vending machine that is replaced with an ENERGY STAR qualified machine with software				
	1,800 kWh/year for every standard vending machine that is replaced with an ENERGY STAR qualified machine				
	400 kWh/year for every ENERGY STAR qualified vending machine that is replaced with an ENERGY STAR qualified machine with software				
Choose an ENERGY STAR qualified 600-can vending machine	**1,800 kWh/year** for every standard vending machine that is replaced with an ENERGY STAR qualified machine with software				
	1,200 kWh/year for every standard vending machine that is replaced with an ENERGY STAR qualified machine				
	600 kWh/year for every ENERGY STAR qualified vending machine that is replaced with an ENERGY STAR qualified machine with software				
Choose an ENERGY STAR qualified 700-can vending machine	**2,300 kWh/year** for every standard vending machine that is replaced with an ENERGY STAR qualified machine with software				
	1,700 kWh/year for every standard vending machine that is replaced with an ENERGY STAR qualified machine				
	600 kWh/year for every ENERGY STAR qualified vending machine that is replaced with an ENERGY STAR qualified machine with software				
Choose an ENERGY STAR qualified 800-can vending machine	**1,300 kWh/year** for every standard vending machine that is replaced with an ENERGY STAR qualified machine with software				
	700 kWh/year for every standard vending machine that is replaced with an ENERGY STAR qualified machine				
	600 kWh/year for every ENERGY STAR qualified vending machine that is replaced with an ENERGY STAR qualified machine with software				

Worksheet 11 – Vending Machine Savings Assessment					
Strategy	Energy Savings Potential (kWh/year)	Quantity in the Building	Cost of Electricity ($/kWh)	Annual Energy Savings (kWh)	Annual Cost Savings ($)
	A	B	C	D = A × B	E = C ×
Remove underused conventional vending machines	**3,600 kWh/year** for every refrigerated vending machine that is removed				
		Annual Savings			

Figure B.5-4. Worksheet 11 - Vending Machine Savings Assessment

B.5.5 Additional Online Resources for Commercial Food Service Equipment

For more information on Commercial Food Service Equipment, please see: https://www.energystar.gov/index.cfm?fuseaction=find_a_product.showProductGroup&pgw_code=CKP

B.5.6 Additional Online Resources for Water Saving Devices

For more information on water-saving devices, please see: http://www.epa.gov/watersense

B.6 Water Heater Guidance

When was the last time your team thought about your worship facility's water heater? If the water heater is outdated or working inefficiently, upgrading to an ENERGY STAR qualified model will reduce water heating costs. All water heaters, especially gas-fired, should be inspected annually for safety as well as efficiency. Keep the immediate area around water heater clean and free of any debris, and allow nothing to be placed on top of the heater.

Figure B.6-1 describes the types of ENERGY STAR qualified water heaters that are available.

ENERGY STAR Qualified Commercial Water Heaters	
Type	**Description**
High Efficiency Gas Storage	High-efficiency gas storage water heaters work the same way conventional gas storage water heaters work: a glass-lined steel tank is heated by a burner beneath the tank. High-efficiency models have better insulation, heat traps, and more efficient burners. These improvements increase energy efficiency by about 7.5 percent. Some models also have a power vent, which also increases efficiency.
Gas Condensing	Gas condensing water heaters operate similarly to conventional gas water heaters, but use less energy. Instead of immediately venting heat and gas produced by combustion, these emissions are vented through a flue that is coiled around the hot water tank. The coiled ventilation system allows more heat to be transferred to the water in the tank from the same quantity of gas, and reduces the amount of gas required by the water heater by approximately 30 percent.
Heat Pump	Heat pump water heaters use electricity to pass vaporized refrigerant through a system containing a compressor, a condenser coil, and an expansion valve. When the refrigerant is forced into the compressor, its temperature rises and it transfers heat by way of a condenser coil in a storage tank; when the refrigerant is released through the expansion valve, the pressure is reduced and the cycle starts over.
Whole-Home Gas Tank-Less	Whole-home gas tank-less water heaters work similarly to conventional gas types by heating cold water with a gas burner. However, instead of constantly maintaining a supply of hot water, tank-less water heaters only operate when hot water is needed. By only heating water on-demand, tank-less water heaters are able to substantially reduce energy consumption in some applications.
Solar Water	Solar water heaters come in a variety of designs, but all include a collector (a device that captures solar thermal energy) and a storage tank for hot water. There are several types of solar hot water systems: • A **direct** system circulates water through the collectors, allowing solar thermal energy to directly heat the water • A **closed-loop** or **indirect** system circulates a nonfreezing liquid through the collector and transfers heat to the hot water storage tank through a series of coils • An **active** or **forced-circulation** system uses an electric system of pumps, valves and controllers to move water from the collectors to the storage tank • A **passive** system requires no pumps, and allows convection to move water from the collectors to the storage tanks as it heats up.

Figure B.6-1. ENERGY STAR Qualified Commercial Water Heaters

Appendix C – Energy Audits and Professional Assistance

C.1 What do I need to do for an Energy Audit?

If your team decides to have an energy audit done, you will need to find which type of audit is right for your property by considering the cost of the audit, your team's project goals and access to funding, and the implementation timeline. For example, a detailed energy audit might not make sense for a worship facility with little access to financing to implement the projects identified. Benchmarking, implementing the Sure Energy Savers described in Section 4.2 Sure Energy Savers of the Workbook, and starting a capital campaign to raise money for the audit and the opportunities it identifies may be a better plan.

C.1.1 Different Types of Energy Audits

Several types of energy audits can survey your property at different levels of detail. Although the accuracy of the audit is directly related to the level of detail, the most extensive and accurate audits may not be necessary or cost effective to accomplish your congregation's energy saving goals within the specified time frame. These types of energy audits, as defined by the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE), are described in Figure C.1-1.

Types of ASHRAE Energy Audits	
ASHRAE Energy Audit	Description
ASHRAE Level I - Walk-Through Analysis	Focuses on low- and no-cost energy conservation measures, and provides a list of higher cost energy conservation measures. Typically, these audits will result in a report about how much energy and money can be saved from specific efficiency opportunities. If you have benchmarked your building and implemented the Sure Energy Savers, you will have already completed most of the analysis that this type of audit provides.
ASHRAE Level II – Energy Survey and Analysis	Expands on the Level I survey by including more detailed energy calculations and financial analysis of proposed energy efficiency measures. The financial analysis used is typically a life cycle analysis, which allows you to better understand the financial benefits of installing energy efficiency measures. You are typically provided with a list of energy conservation/efficiency measures, an estimate of the amount of money and energy that will be saved, and an estimate of the amount each measure will cost. These reports should also include any changes that need to be made to operations and maintenance procedures.
ASHRAE Level III – Detailed Analysis of Capital-Intensive Modifications	Expands on the previous levels of effort and is based on a specific subset of energy conservation/efficiency measures to analyze further. This may include further refinement of an energy model or more extensive data collection. These are often used to provide detailed information to lenders for larger projects.

Figure C.1-1. Types of ASHRAE Energy Audits

C.1.2 How to Find an Energy Auditor

TYPES OF AUDITORS

There are two types of energy auditors: 1) energy consultants, and 2) energy services companies (ESCOs).

Energy consultants evaluate and recommend projects to improve building energy efficiency; they can estimate energy use, energy savings, and project cost. Beyond the initial audit, energy consultants can sometimes prepare project specifications or engineering designs. Energy consultants do not usually provide financial or management services and they are not involved in the actual project implementation process.

ESCOs also identify cost-effective, energy-efficient retrofits in their audits. However, ESCOs have the ultimate goal of being hired by your property to install and manage the projects they recommend. For this reason, ESCOs have a vested interest in the completion, operation, and resulting savings from your projects, and will guarantee positive results as part of a long-term performance contract. Some ESCOs also provide financing and equipment maintenance.

The major difference between ESCOs and energy consultants is the financial arrangement. ESCOs will often pay the up-front costs of implementing the efficiency projects, and will be paid through the savings achieved. This can be a good option for facilities that don't have access to capital to implement the projects on their own.

SELECTION

When hiring an energy consultant/ESCO for an audit, you can either select the consultant/ESCO by sole source or competitive bid. In a sole source selection, you negotiate with a single consultant/ESCO. In a competitive bid, you advertise your team's need for a consultant/ESCO, and receive bids from firms interested in doing business with you.

As a representative of a private property, you are well-suited to negotiate exclusively with a single consultant/ESCO. When hiring via sole source selection, your team can negotiate until a mutually agreeable cost is reached. During these negotiations, be sure to understand the scope of the audit and its minimum reporting and analytical requirements; more specifically, ensure assignments, deliverables, and schedules are clear and understood by all parties.

The major drawback to sole source contracts such as these is that they can be more costly than competitive bid contracts due to a lack of market competition. However, establishing a long-standing working relationship will allow that consultant/ESCO to become intimately familiar with your property's energy equipment, needs, and problems, and will also negate the need for your team to review proposals for each separate project. Understanding the prices of competitive bid contracts in your area prior to negotiating the price of a sole source contract will help you derive the benefits from a sole source contract at a competitive market price.

NEGOTIATE COSTS

Money saved as a result of implementing auditor-recommended energy efficiency improvements may justify the up-front cost of the energy audit. However, your team's budget may limit the types of audit that would make financial sense for your property, because recommended improvements that are not performed shortly after the audit can become outdated. If your congregation has limited property improvement funds, an audit targeting specific types of projects may be the most cost effective as it will recommend projects your congregation will be able to afford to implement in a short time frame with remaining project funds.

Factors that affect the energy audit price include the type of audit, the complexity of the property, and the size of the property.

C.1.3 Identifying Volunteer Resources

Even if your team decides to hire a professional energy consultant, you are still responsible for monitoring the consultant's activities. Your energy stewardship team will need to:

- Prepare a Request for Proposals (RFP) to hire an auditor. ENERGY STAR has a sample RFP to assist you in preparing this document.
- Be familiar with the building in terms of:
  - ✓ Equipment
  - ✓ Energy use
  - ✓ Design (mechanical and electrical).
- Manage the energy auditor:
  - ✓ Maintain communication with decision-making staff
  - ✓ Oversee the auditing work.
- Review the energy audit:
  - ✓ Be aware of the types of improvements the property is interested in and their relative priority
  - ✓ Check to make sure that the assumptions used in the audit calculations make sense with respect to how the building actually operates.

Your team's financial representative is best suited to prepare the RFP. The building operator and technical mind team members should be familiar with the building equipment, design, and operations. The financial representative, building operator, technical mind, and team leader should work together to manage the energy consultant and review the energy audit with regard to their areas of expertise.

C.2 Pre-Audit and Review Checklist

Once your team has chosen an energy auditor, you will need to prepare for their visit. You can help your auditor determine appropriate project recommendations by answering questions about your property's energy use and construction. In particular, providing the consultant with electrical and mechanical drawings of the property will help the auditor perform the job, and will also help control costs; if electrical and mechanical drawings are unavailable for your property, the consultant will need to reconstruct a schematic for equipment operations.

Reviewing a consultant's work can be done internally if your team already has a staff member who is familiar with energy auditing methods and the projects recommended by the auditor. If your property does not have such a person (or group of people) on staff, this may be an opportunity to seek help from a qualified volunteer in your congregation. If neither your staff nor congregation is qualified to review the audit, it may be worthwhile to get an independent review of the recommended projects. Consult your local utility or state energy office for assistance. You can use the following checklist (Figure C.2-1) when monitoring and reviewing your energy audit.

Pre-Audit and Review Checklist			
Item to Review	Description	Answer	✓ when Completed
Property operating hours	*How many hours per week is your property in use?* Operating hours differ from equipment use hours.		
	• Property operating hours can be confirmed by in-house staff		
	• Outside review assistance is not necessary		
Equipment operating hours	*How many hours per week is the equipment in use?* This number will differ from the property operating hours if the property runs equipment when the building is not in use. This is important when assessing the potential benefits of different retrofit investments, because energy savings are calculated using the actual hours when the equipment is on and consuming electricity.		
	• Equipment operating hours can be confirmed by in-house staff		
	• Outside review assistance is not necessary		
Energy and demand rates	*What is the cost of energy charged by your utility company?* Energy and demand rates charged by your utility company may vary by time of year or time of day because of varying peak use rates.		
	• Energy and demand rates can be confirmed by in-house staff with access to the property's billing information		
	• Outside review is recommended if you are unsure about the data		

Pre-Audit and Review Checklist			
Item to Review	Description	Answer	✓ when Completed
Improvements made to the property in the last 12 months	***Have some projects to improve the property's energy efficiency already been implemented?*** If your answer is yes, be sure to tell the auditor. Without this information, they will assume that the property has been using the current equipment for the past 12 months, which may lead to discrepancies between estimated energy consumption and the property's actual energy use.		
	• Property improvements made in the last 12 months can be confirmed by in-house staff		
	• Outside review assistance is not necessary		
Appropriateness of project recommendations	***Is the congregation involved in the decision-making process when selecting energy efficiency projects?*** This is an important part of the audit review. In addition to the energy efficiency gains of the projects, you will need to consider how the projects will affect the aesthetic appeal and comfort of your building.		
	• In-house staff might be able to determine whether a project recommendation is appropriate depending on their level of knowledge		
	• Outside review is recommended if you are unsure about the data		
Accuracy of existing equipment identification	***Did the auditor include all the correct equipment in your audit?***		
	• The accuracy of existing equipment identification can be confirmed by in-house staff		
	• Outside review assistance is not necessary		
Appropriateness of simulation models and assumptions	***Did the auditor estimate the building's energy consumption using appropriate simulation models and accurate assumptions?***		
	• In-house staff might be able to determine whether simulation models are accurate if the staff or congregation contains a person who is an expert on energy auditing		
	• Outside review assistance is recommended		
Project cost estimates	***Are the project cost estimates accurate, and do they make financial sense to your property?*** Ensure the appropriateness of project recommendations for the property by hiring a project manager. The project manager should be able to verify that the equipment's complexity, compatibility, and reliability are suitable for the property, and that your congregation can afford the operational cost of the investment.		
	• In-house staff can verify and assess project cost estimates depending on their level of knowledge and familiarity with the property budget		
	• Outside review is recommended if you are unsure		

Figure C.2-1. Pre-Audit & Review Checklist

C.3 What to Ask the Energy Auditor to Provide

C.3.1 Analysis of Existing Equipment

Depending on the type of energy audit your team chooses, you should expect specific things from the auditor. When negotiating with a sole source, or stating your team's project requirements in a competitive bid RFP, be sure to specifically indicate the requirements of the audit. To get a better idea of what an energy audit will include, see the specific audit types listed in Figure C.3-1. You can also do a search for "sample energy audits" on the internet to see many different examples.

Types of Energy Audits	
Audit Type	**Description**
Targeted Lighting	Targeted lighting audits typically include, at a minimum, a count of the number and types of fixtures in each room and spot checks of light levels.
Targeted HVAC	Targeted HVAC audits include computerized simulations to extrapolate annual operating energy use based on equipment set points and regional weather factors.
Comprehensive	Comprehensive energy audits evaluate the building envelope, lighting, domestic hot water, HVAC, kitchen equipment, and controls in the property. Computer models are used to simulate building and equipment operations, taking account for weather, equipment set points, hours of operation, and other parameters. Estimated energy consumption is compared to the property's utility bill charges to ensure that the consultant is not over- or underestimating energy savings from proposed investments.

Figure C.3-1. Energy Audit Types

C.3.2 Guidance for Project Implementation

Having the consultant who performed the energy audit also prepare a performance specification will help to ensure that your property selects appropriate project types and specifies adequate project quality. Performance specifications will inform equipment contractors and installers about the type of project your team is undertaking. Performance specifications may add up to a few cents per square foot to the cost of a single-purpose or comprehensive energy audit.

C.3.3 Additional Online Resources

Certain faith-based nonprofit groups provide energy services for free or reasonable fees. A few to look into include GreenFaith at http://greenfaith.org; and state affiliates of Interfaith Power and Light such as Georgia IPL, Michigan IPL, Greater Washington IPL and Ohio IPL all linked from Interfaith Power and Light.

Appendix D - Project Financing

D.1 How to Pay for Upgrades

This appendix contains information about the different types of financing options that may be available to your congregation. It also lists factors to consider when deciding which type of financing to use for a project, as well as online resources to find more specific information.

D.1.1 Cash or Savings

A cash purchase is the simplest method for financing energy performance improvements. It is well suited for small or low-risk upgrades and makes sense if your congregation has cash reserves and a strong balance sheet. The advantage of a cash purchase is that all cost savings realized from the upgrade are immediately available to your organization. Generally, relatively inexpensive, simple efficiency measures that are likely to pay for themselves in about a year are purchased with cash (use the worksheets in Appendix B - Savings Assessment Worksheets to determine which investments will pay off in the near term). If your congregation has identified low-cost improvements but does not have the cash for them, your team can consider holding a fundraiser with all proceeds going specifically to the upgrades.

D.1.2 Energy Upgrade Grants

Grants for energy upgrades are usually better suited for larger projects that require extra funding because the process of applying for a grant requires time and resources. Finding and applying for grants can take a large amount of time, so it is recommended that before your team applies for grants, you should implement Sure Energy Savers (Section 4.2 of the workbook) and look for rebates (see Section D.1.3). Energy grants come from many sources—from government (state and federal), from other organizations, and from individuals. Some grants require matching funding from your congregation, some will provide a portion of the funding for a specific type of project, and others will fund a complete upgrade.

Grant opportunities can come up quickly with short deadlines. To keep up with opportunities now and on the horizon, your congregation should have someone from your finance team track grant deadlines and requirements. You should also keep a file of past grant proposals and general information to be able to quickly put together a new proposal. Energy audit reports are often a good source of information when preparing a grant proposal. Consider whether time spent pursuing grants may be better used elsewhere. Figure D.1-1 lists some grant programs that are currently available.

Available Grant Programs	
Grant Program	**Description**
Federal government	For efficiency improvements, the U.S. Department of Agriculture Rural Energy for America Program has grants available for rural organizations.
State programs	Grants for efficiency upgrades vary from state to state. The Database of State Incentives for Renewables and Efficiency (DSIRE) has state-by-state listings for all renewable energy and energy efficiency financing options, including grants, loans and tax incentives.
Religious organizations	If your congregation belongs to a larger religious organization, you should ask if there are any green/efficiency grants available. For example, in 2009, the Christian Reformed Church began funding for a grant called the U.S. Green Congregation Grant. To apply, churches must demonstrate how they can integrate environmental concerns into their teachings. ENERGY STAR has a growing list of links to a number of denominations.
State Interfaith Power and Light (IPL) organizations	IPL has affiliates in most states and can help connect your congregation to larger state-wide energy efficiency initiatives. Some IPLs also have grant programs of their own; for example, Georgia Interfaith Power and Light has a PowerWise grant.

Figure D.1-1. Grant Programs Currently Available to Congregations

D.1.3 Utility Incentives or Rebates

Utilities often provide financial incentives for energy performance upgrades, fuel switching, and even energy audits. They also sometimes provide low-interest loans. Check with your local utility to learn which programs are available. ENERGY STAR has an online Rebate Finder that can help your team find special offers, tax breaks, and rebates from ENERGY STAR partners in your area.

Another good source of rebate information is the Database of State Incentives for Renewables and Efficiency (DSIRE), which contains local, state, federal, and utility rebates. The federal government and many states reward efficient building upgrades with tax incentives. Because congregations do not pay taxes, they are not eligible for these types of incentives. However, a private donor (in consultation with their accountant) might be eligible for tax deductions for energy efficiency capital improvements donated to your worship facility.

D.1.4 Group Purchasing

Another way to fund your congregation's project is through group purchasing. Groups can often negotiate lower prices on efficient equipment with volume purchases. If your team can pool the buying power of more than one organization or group, you can often get lower prices for products and services. Contact local retailers to see if they can set up a program for your congregation members or for a group of congregations to receive bulk discounts. ENERGY STAR has more information on purchasing and procurement and group purchasing.

D.1.5 Loans

If you are not able to fully fund your team's project work through cash, grants, and other avenues, your congregation may want to consider taking a loan for part of the initial investment. Lenders may require a down payment on loans for energy projects. Your congregation's borrowing ability will depend on their current debt load and creditworthiness. Loan payments may be structured to be equal to or slightly

lower than projected energy savings, creating a positive cash flow. In this financing arrangement, your congregation will bear all the risks of the project and receive all the benefits. Contact your congregation's financial institution for more information about its loan products. ENERGY STAR has data indicating that verified energy performance improvements can increase the asset value of your property.

D.1.6 Equipment Leasing

Instead of paying for an entire upgrade in full, your congregation may decide to set up a leasing agreement and make payments over time. Leasing agreements may be with a specific retailer or contractor. Laws and regulations for equipment leasing are complex and change frequently, so be sure to consult your financial team before entering into a lease agreement. Also note that lease terms may charge a higher interest rate than a loan, so be sure your team looks into the total ownership cost of leasing versus taking out a loan before making a decision.

D.1.7 Performance Contracting

Performance contracting (sometimes called "shared savings") is the most complex type of arrangement, but offers your congregation the benefit of risk protection. It is also the most costly financing option because of the amount of monitoring and verification required, and is usually used for larger scale upgrades or for larger facilities. However, even this more expensive alternative can yield a positive cash flow for your congregation immediately upon installation.

In a performance contract, payment for a project is contingent upon its successful operation. For an energy efficiency upgrade, services are rendered in exchange for a share of the future profits from the project. A performance contract can be undertaken with no up-front cost to your congregation (as the building owner) and is paid for out of the resulting energy savings. The service provider, often an ESCO, obtains financing and assumes the performance risks associated with the project. The financing organization owns the upgraded equipment during the term of the contract, and the equipment asset and debt do not appear on your congregation's balance sheet. Financing for performance contracts is based on the cost savings potential of the project. Performance contracting can be applied to purchases or leases. If your team is interested in more details on performance contracting, see the ENERGY STAR Building Upgrade Manual.

D.1.8 Factors to Consider when Choosing how to Finance the Project

Choosing which type of project financing requires a full evaluation of your options. Your team will need to consider the size of the project, and then look at the factors listed in Figure D.1-2.

Factors to Consider when Financing the Project	
Factor	**Description**
Balance Sheet	This is how much money your congregation has on hand versus its debts. Ensure that any investments your team makes do not leave your organization in too much debt.
Initial Payment	A large purchase may be an obstacle for some congregations planning energy efficiency upgrades. If your congregation has large capital reserves or is planning a small project, it makes sense to pay for the project with cash because all the cost savings from the project will be immediately available to offset the original investment. There are financing options that can move a project forward with no initial capital outlay from your congregation. If resources are tight, your congregation may want to consider a performance contract.
Payments	Your team's goal is to obtain financing at a minimum cost to the organization. If your congregation does not have enough cash on hand to make a full purchase, determine the monthly payments (through a loan or leasing) that fit into your congregation's budget.
Ownership	If your congregation owns its energy efficiency upgrade equipment, it will receive all the savings; however, your congregation is also liable for any performance risk associated with the equipment.
Performance Risk	There is risk associated with any investment. Energy efficiency upgrades can be low-risk investments because they apply proven technologies with long records of performance. However, the financing option your team chooses will affect who bears the risk of performance failure. Performance risk of energy upgrades depends on the accuracy of the assumptions about maintenance, cost of energy, occupancy, and other factors. Lighting upgrades are typically considered a lower risk investment than HVAC investments because lighting use is largely consistent and does not vary with the outside temperature. Because it is easier to predict energy savings from lighting upgrades because HVAC performance can be impacted by the property's ventilation system (e.g. clogged ducts, vents stuck open) and other factors that may not be visible. The change in lighting performance from one technology to another is straightforward to calculate since there is only the light source itself which can be swapped out, entirely, and its performance does not depend on other factors/equipment.

Figure D.1-2. Factors to Consider when Financing the Project

D.1.9 Considering a Utility Bill Audit

Have you considered whether your worship facility's utility bills are accurate? You wouldn't pay your restaurant bill without a quick review, so what about you major monthly costs for utilities? Professional consultants who analyze utility bills say that an estimated 85% of congregations are overcharged on utility expenses through calculation errors and other discrepancies billed by utility providers. This may sound self-serving coming from someone who provides such an analysis service for a fee. However, utility bill audits are typically performed on a contingency basis, which means you have no out-of-pocket expenses; you pay only if any refunds are recovered and you pay a percentage of the monies recovered. If no refunds are recovered you pay nothing.

How do you check and verify your utility bills? Do you approve their charges based upon trends, budget, or just pay them because they look right and fit the budget? Do you know that professional analysts say most mistakes are approximately 10% of the bill amount and routinely repeated month after month?

Depending upon the physical property, a congregation's utility expenses can often represent the second or third largest budget expense after personnel costs. Your utility expense is an operational cost that you can reduce, not only with ENERGY STAR strategic energy and water management, but by making sure the cost is correctly calculated at the correct rate classification. Correcting utility billing errors can generate significant savings—some as direct rebates and others as rate corrections that result in long-term savings.

Saving Money with Utility Bill Analysis

One congregation with an estimated annual utility budget of $55,250.00 saw a first year annual savings of $26,000 after utility bill analysis. These savings were a result of a free utility bill analysis of the immediate 36-month worship facility payment history. The analysis reviewed electricity, telecommunications, water, sewer and storm drainage bills, and uncovered simple billing errors, omissions of payments, and improper rate coding over the specified period of time. The cost for this service was paid out of the savings and if no savings had been found, there would have been no fee for the analysis. Going forward, the congregation can expect significantly lower utility bills. Utility bill analysis is not part of the ENERGY STAR program, but EPA recommends it is worth considering, because it could help call attention to costly leaks in water pipes and fixtures, as well as leaky heating/air-conditioning ducts.

More than likely you routinely conduct Financial Audits, General Compliance, Charitable Gift Acknowledgement Receipts, Insurance, and Cash audits. Now you know that you can also undertake a no-risk audit of all your utility expenses. This audits your utility bills; electricity, natural gas, heating oil, telecommunications, water, and sewer. A utility bill audit will refund and remove all erroneous and unnecessary overcharges which results in ensuring that your utility bills are 100% accurate and efficient. This is potentially a great source for raising capital and reducing your operational expenses.

D.2 Online Financing Resources

For more information about resources for financing your property's energy efficiency projects, visit the following websites:

- **ENERGY STAR Directory of Energy Efficiency Programs:** www.energystar.gov/index.cfm?fuseaction=DEEPS.showSponsorSearch
- **ENERGY STAR Buildings Upgrade Manual**—Financing Section: www.energystar.gov/ia/business/EPA_BUM_CH4_Financing.pdf?1305-011d
- **ENERGY STAR rebate finder:** http://www.energystar.gov/index.cfm?fuseaction=rebate.rebate_locator
- **Purchasing and Procurement information on the ENERGY STAR website:** http://www.energystar.gov/index.cfm?c=bulk_purchasing.bus_purchasing
- **ENERGY STAR Group Purchasing Information factsheet:** www.energystar.gov/ia/business/small_business/sb_guidebook/Group_Purchasing_Fact_Sheet.pdf?66af-6be8

- **EPA Green Building Funding Opportunities website**: www.epa.gov/greenbuilding/tools/funding.htm
- **DOE Office of Energy Efficiency and Renewable Energy Financial Opportunities website:** www1.eere.energy.gov/financing
- **Database of State Incentives for Renewables & Efficiency - DSIRE** - is an online database with state-specific/federal information on what types of grants and loans are available for energy efficiency upgrades at www.dsireusa.org
- **Interfaith Power and Light's ShopIPL.org:** an online energy efficiency store that works to achieve competitive pricing and is open to all purchasers at http://www.shopipl.org
- **The Alliance to Save Energy Resources website:** http://ase.org/resources
- **Church Grants website:** all types of grants for churches: www.churchgrants.org

Appendix E - Working with Contractors

Once your team has determined the projects for which your congregation needs to hire a contractor, you will need to find a contractor who will operate within your organization's budget. You may locate a contractor by competitive bid, or based on their qualifications.

Previously this workbook advised taking advance of congregational time and talent. This includes not only congregation members who are in the energy efficiency service and product industry but also any long time contractors who may feel entitled to manage new projects. However, even contractors of long-standing and good service may not have the technology and up to date knowledge on efficiency that you need. This is a business decision regarding your fiduciary responsibility and merits competitive bidding.

However you ultimately select a contractor, make sure to obtain the information listed in Figure E-1, below, when assessing prospective contractors.

Information to Obtain from Prospective Contractors		
Contractor…	Description	✓ when Obtained
References	Ask the contractor to provide multiple current references that your team can contact about the work the contractor has performed.	
Is licensed and insured	Make sure the contractor is licensed and insured. Especially make sure that the contractor carries workers' compensation insurance.	
Follows regulations	Ask the contractor to certify that their work conforms to state and local regulations and codes.	
Has experience	Make sure the contractor has experience with and will use energy-efficient equipment as specified in the project designs.	
Uses Portfolio Manager	Check whether the contractor has involvement with ENERGY STAR, or benchmarking through Portfolio Manager. This will help your property remain consistent in its approach to energy efficiency.	
Availability and communication skills	Check the contractor's availability, and make sure they have good communication skills.	
Provides cost estimates, in writing	Ask the contractor to provide a cost estimate in writing for any work they will do before signing any contract.	

Figure E-1. Information to Obtain from Prospective Contractors

E.1 Selecting a Contractor by Competitive Bid

To select a contractor by competitive bid, issue a Request for Proposal (RFP) to which prospective contractors interested in undertaking your project will bid for the job. When evaluating contractors'

bids, pay attention to the proposed scope of work they describe; not all bidders will offer to undertake all tasks listed in the RFP.

Competitive bids are useful to property managers because they allow the manager to negotiate prices between multiple contractors at once. Think of how you purchase a new car: you don't just go to one dealer, you often go to several. You use the prices given to you by one dealer to talk down the price for the car you want at another dealer. Similarly, your team can negotiate the proposed scope of work and proposed contract cost between contractors, encouraging the contractors to lower their prices and expand their proposed scope of work to remain competitive for your congregation's energy improvement business.

The downside is that competitive bids can take time, and your congregation's project has to be large enough for the contractor to find it profitable. If your congregation wants to invest in a large number of technologies, or to renovate a part of your building's infrastructure, a competitive bid may be the most effective option. However, if your congregation is trying to install a few specific technologies, selecting a contractor by qualification may make more sense for your energy stewardship team.

E.2 Selecting a Contractor by Qualification

When selecting a contractor by qualification, you should identify the contractors your team is interested in considering and assess their qualifications. Specifically, you should ask the questions listed in the introduction to this section, and should interview past clients and references. Based on your team's evaluation of the contractor's responses and those of their past clients and references, you can decide whether to hire him to undertake your project.

Selecting a contractor by qualification may be preferable for some congregations, as it allows your team to work more intimately with the contractor to specify details of the work they will do, and negotiate the extent to which they will assist your team. Unlike a competitive bid, selecting a contractor based on qualification does not allow you to negotiate prices or scope of work with multiple contractors simultaneously. Instead, your team will need to be familiar with the typical costs in your area for the types of projects your congregation is implementing.

E.3 Performance Contract: Using an ESCO

A performance contract is where a congregation hires an ESCO to develop, install, finance, and verify energy efficiency improvements. In return for the ESCO assuming the up-front costs associated with the investments, the congregation agrees to give the ESCO a portion of its energy savings over a period of time specified in the contract. Usually, ESCOs will focus on larger energy use facilities to make it worth their expense. If your congregation has a smaller property, it will most likely use a local contractor rather than an ESCO.

A performance contract may be attractive from an immediate financial standpoint, but the level of control exerted by the contractor may be unfavorable. The contractor will be entitled to a portion of your congregation's energy savings for a contractually specified length of time after the energy project is

completed, limiting the amount of money saved that can be repurposed in your congregation's ministry. However, if your congregation does not have the necessary resources to implement projects or monitor energy management, a performance contract may be a convenient way to overhaul your property's energy-consuming equipment and practices.

E.3.1 Negotiating a Contract

The quality of your contracting experience will be determined in large part by how you negotiate the contract. When drafting the contract, remember that this document will define all interactions between your team and the selected contractor. Therefore, the contract should address all stages of involvement, from planning and decision making, to documentation and monitoring of the investments after installation. If the contractor isn't going to monitor the performance of the equipment after it has been installed, make sure that they agree to provide you with all of the knowledge and resources necessary to allow your team to monitor, maintain, and manage the equipment over time.

Contract Specifics

Before you sign any contract on behalf of your congregation, make sure the contract specifies the items listed in Figure E.3-1, below.

Contract Specifics to Confirm		
Item	Description	✓ when Confirmed
Processes and Procedures	Processes and procedures that the contractor agrees to undertake.	
Activity Schedule	A schedule of activities, including major milestones and due dates.	
Contractor and Customer Roles	The roles of team members, both of contractor personnel and your staff. This is very important in order to ensure that there is no duplication of effort which may result in higher costs for the project.	
Sample Forms, Templates	Sample forms and templates the contractor will use for documentation. Review these documents, and ask for clarification of any parts of the forms that are not clear.	

Figure E.3-1. Contract Specifics to Confirm with the Contractor

E.3.2 Managing a Contractor

When working with a contractor, the extent of your management responsibility will be defined in the contract you have agreed upon. Usually, the day-to-day management of the project is the contractor's responsibility. As the customer, you should facilitate the contractor's work, and make sure that the contractor is adhering to the contract. Schedule regular meetings to check in with the contractor and track their progress. After the project is completed, remember to ask the contractor to provide documentation about how to maintain the performance of the project's installed equipment, and of how frequently maintenance of the equipment is recommended.

Appendix F - More Online Resources from ENERGY STAR

To keep up to date on publications and news from ENERGY STAR, please see the following resources:

- **Join ENERGY STAR**: www.energystar.gov/join
- **Visit ENERGY STAR Qualified Products:** http://www.energystar.gov/index.cfm?fuseaction=find_a_product.
- **Visit ENERGY STAR for Congregations:** http://www.energystar.gov/index.cfm?c=small_business.sb_congregations
- **Download Free ENERGY STAR Publications**: https://www.energystar.gov/index.cfm?fuseaction=publications.showPublications
- **Set up an Account in Portfolio Manager:** www.energystar.gov/benchmark
- **White House Office of Faith-based and Neighborhood Partnerships:** http://www.whitehouse.gov/administration/eop/ofbnp
- **Find Interfaith and Denominational Organizations working on energy stewardship:** http://www.energystar.gov/buildings/tools-and-resources/external-faith-based-environmental-stewardship-organizations
- **EPA's Faith-based and Neighborhood Partnerships:** http://www.epa.gov/fbnpartnerships/index.html

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