



ENERGY STAR® Action Workbook for Small Business - Appendices

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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.

Appendix A - Benchmarking your Property with Portfolio Manager®

A.1 PORTFOLIO MANAGER DATA COLLECTION

Entering your property'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.



Use the worksheet below to gather your property's energy and water consumption and cost data. Doing this before creating or logging into your account will make it easier to enter the information into Portfolio Manager. You can also enter and track your property's waste.

This worksheet was designed to help building owners and managers collect data to benchmark buildings using EPA's ENERGY STAR Portfolio Manager. The information in this worksheet will be used to establish your building's profile in Portfolio Manager, which is critical to calculate benchmarks of key metrics such as energy intensity and costs, water use, and carbon emissions. All building types can be entered into Portfolio Manager and receive energy and water benchmarks, as well as a comparison of performance against a national average for buildings of a similar type.

Some buildings will also receive an ENERGY STAR score. The ENERGY STAR score is a benchmark that indicates how efficiently buildings use energy on a 1-100 scale. A score of 50 indicates that energy performance is average compared to similar buildings, while a score of 75 or better indicates top performance, and means your building may be eligible to earn the ENERGY STAR label. To receive an ENERGY STAR score, the gross floor area of the building must be comprised of more than 50% of one of the following space types: bank/financial institution, courthouse, data center, hospital (general medical and surgical), hotel, house of worship, K-12 school, medical office, office, residence hall/dormitory, retail store, senior care facility, supermarket/grocery store, warehouse (refrigerated and unrefrigerated), and wastewater treatment plant.

Required Data for ENERGY STAR Benchmarking

ENERGY STAR has a data collection worksheet which allows the user to specify a property type and then provides data requirements for that property type at

<https://portfoliomanager.energystar.gov/pm/dataCollectionWorksheet>

Some specific information that will be required for all property types will be:

- Portfolio Manager username and password.
- The building street address, year built, and contact information.

- The building gross floor area and key operating characteristics for each major space type. Use this worksheet to collect this information before logging in to Portfolio Manager.
- 12 consecutive months of utility bills for all fuel types used in the building. If you don't have this information readily available, contact your utility provider(s) as most will be able to easily supply this historical information.

Now that you have collected your property's data, you're ready to create the Portfolio Manager account. For a quick start guide on Portfolio Manager, please see

<http://www.energystar.gov/buildings/tools-and-resources/portfolio-manager-quick-start-guide>.

A.2 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. 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 to determine whether your property type is able to apply for ENERGY STAR Certification, see <http://www.energystar.gov/buildings/tools-and-resources/how-apply-energy-star>.

Appendix B – Areas of Opportunity: Energy and Water

When looking at which products and appliances to purchase, which projects to undertake, and which behavioral changes to implement, the amount of information can be overwhelming. This appendix walks through six project sectors to help your team decide which actions are most beneficial to implement as part of your energy efficiency projects. In your decision-making process, consider both the initial cost of installing the efficient technology/product/practice and its expected energy cost savings compared to the technology/product/practice currently in use. Obviously your business type will determine which information is most relevant; however, all businesses can use the following information and tailor it to their individual needs.

The sections included in this appendix are:

- Lighting
- Windows and Walls (Building Envelope)
- Office Equipment
- Kitchen and Food Service Equipment
- Heating, Ventilation, and Air Conditioning (HVAC)
- Water

In addition to this information, there are free online resources for more information:

- ENERGY STAR Products website: <http://www.energystar.gov/products>
 - ✓ 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://energy.gov/eere/femp/find-product-categories-covered-efficiency-programs>
 - ✓ FEMP offers its own recommendations for products not listed under ENERGY STAR
 - ✓ Detailed information about performance requirements for energy-efficient products, energy cost calculators, and additional resources and analysis tools
 - ✓ Energy Savings Calculators for appliances

B.1 LIGHTING

The lighting systems in any property are integral to a safe, functional, and comfortable environment. For example, spotlighting highlights products in retail facilities, desk and overhead lamps provide a good working environment in offices, and flood lamps create a work space for large areas. Traditionally most, if not all, of these lighting needs were met with incandescent or halogen bulbs because of their low initial cost, warm color, and dimming capabilities. However, both types of bulbs are energy inefficient and radiate significant waste heat. Today, new energy-efficient, long-life bulbs provide features similar to incandescent and halogen bulbs at affordable prices. The result is a tremendous diversity in lighting equipment—all with varying efficiencies that could represent energy saving opportunities. This section discusses the two basic ways to achieve energy savings in your lighting system—installing more efficient equipment, and/or changing the way you operate the lighting. This means turning lights off when unneeded, maintaining the lighting systems (keeping them clean), and illuminating spaces only to the light levels required to suit the task.



Use the following information to consider each lighting suggestion as it may apply to your property, and record progress on the Lighting checklist that follows.

- **Turn off lights (and other equipment) when not in use.** High utility costs often include paying for energy that is completely wasted by equipment left ON for long periods while not in use. You may wish to visit the property at a time when everything is supposed to be turned off and make a list of places where the lights were left ON. Also, ensure that exterior lighting—typically not needed during the day—is turned off in daylight hours. Different types of automatic controls can turn lights ON when needed and off when not.
- **Ensure that appropriate lighting levels are maintained.** Too much light causes glare—and it costs more. Fine-tuning the bulb wattage, type, or layout can improve visual quality and reduce energy use. You may want to consider conducting a lighting assessment by walking through your property both during the day and at night to determine if you are over/under lighting certain areas.

- **Replace incandescent bulbs with ENERGY STAR certified LEDs.**

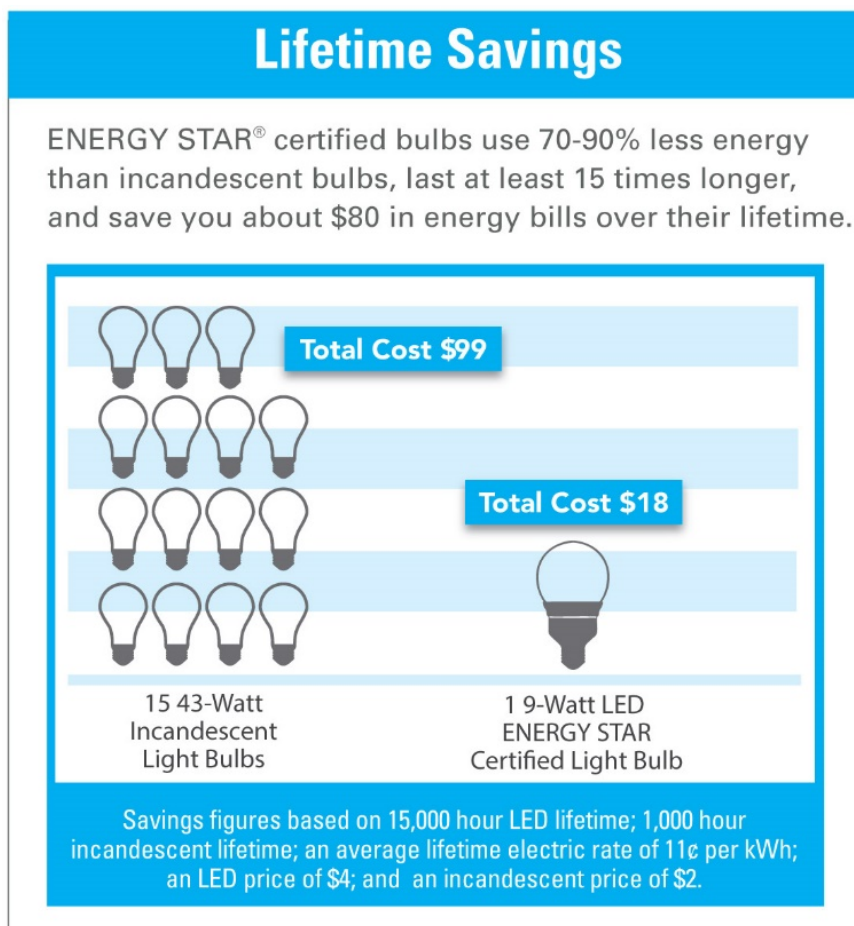
Consider Light Emitting Diode bulbs (LEDs) for your recessed lighting, pendant fixtures, and accent and spot lighting applications. LEDs cost about 75 percent less to operate than incandescent bulbs, and last about six times longer; generating about 75 percent less heat. Until recently, LEDs were more expensive to purchase up front than CFLs; this is no longer the case and LEDs use less energy over the lifetime of the bulb and last longer. New ENERGY

STAR specifications set efficiency levels above today's CFLs, and major manufacturers are not investing in CFL technology improvements. Additional benefits to LEDs include superior dimming ability over CFLs, better color rendering, and they contain no mercury. ENERGY STAR certified LED bulbs are available in a variety of shapes and sizes for any application—including recessed cans, track lighting, table lamps, and more. If you see an incandescent bulb, there is a cost effective replacement option available. In particular look for lights that are ON most often and are easily accessible.

The [ENERGY STAR Lighting Calculator](#) allows you to look at how quickly more efficient bulbs can pay off based on your utility rate, the type of bulb you are replacing, and the replacement type. This can provide a quick estimate on the savings potential of more efficient bulbs.

For more information on ENERGY STAR certified lighting and the energy savings opportunities using LEDs, see: <https://www.energystar.gov/products/ask-the-expert/lighting-made-easy>

- **Upgrade older T12 fluorescent bulbs with magnetic ballasts to more efficient T8 or T5 fluorescent bulbs with solid-state electronic ballasts.** Because T12 bulbs are no longer manufactured, it is timely to upgrade to more efficient T5 or T8 bulbs. T5 (less than 1" diameter) and T8 (1" diameter) fluorescent bulbs with modern electronic ballasts use less energy than older T12 (1.5" diameter) fluorescent bulbs while providing the same amount of light. In areas of the property where T12s are



used for many hours per week, a T12 to T8 or T5 upgrade can pay back the costs quickly, but will require both bulb and ballast changes.

- **Ensure that LED retrofit kits are safe for use.** Underwriters Laboratories (UL), a global safety and science organization, advises that any LED retrofit kits (commonly used to replace recessed ceiling lighting) that are chosen for a project are UL-approved and that proper installation and permitting (if necessary) takes place to ensure they are safe for use.
- **Install LED exit signs.** You may want to consider an LED-illuminated exit sign, which saves about 90 percent over an incandescent fixture's lighting electricity costs. 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. This decreases the need change bulbs as frequently; the lower risk of bulbs burning out can increase property safety. There is an initial up-front cost increase for LEDs, but once installed and running continuously, they last almost three years before requiring replacement.
- **Install occupancy/vacancy sensors.** Install wall-mounted occupancy or vacancy sensors in high-use areas to automatically turn lighting off when no one is present. If occupants forget to turn the lights off when they leave the space, occupancy sensors turn the lights off after a pre-set time, and turn them back on when people re-enter the room. Vacancy sensors automatically turn lights off, but the user must manually turn them back on. Vacancy sensors generally create greater energy savings than occupancy sensors because there are times when occupancy sensors will turn the lights on even when the occupant doesn't necessarily need the lights on. This is particularly true in any space with windows. 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. When installing the sensors, remember that even good equipment can be installed in an incorrect location; they should not be installed behind a coat rack, door, bookcase, etc. Likewise, they should be located so that neighboring traffic doesn't inadvertently cause a false trigger. Sensor vendors generally provide a diagram indicating the sensors' "cones of sensitivity" to assist with proper positioning.
- **Install daylight-responsive lighting controls.** Daylight-responsive lighting controls typically consist of dimmable or switchable ballasts and drivers (installed in the fixtures) and a photocell (typically mounted on the ceiling). These components work together to turn lights on and off (or dim) automatically based on available daylight, thus producing energy savings while maintaining the proper illumination levels for the space. The performance of daylight controls depends on customizing the lighting requirements of each individual space. The sensor's installed position should also be carefully considered to ensure that it is accurately tracking task light levels.



You can use the checklist below to measure your progress towards implementing the lighting suggestions described above.

What can I do?

- ✓ Turn off lights (and other equipment) when not in use
- ✓ Ensure that appropriate lighting levels are maintained
- ✓ Replace incandescent bulbs with ENERGY STAR certified LEDs
- ✓ Upgrade older T12 fluorescent bulbs to more efficient T8 or T5 bulbs by retrofitting fixtures
- ✓ Ensure that LED retrofit kits are safe for use
- ✓ Install LED exit signs
- ✓ Install occupancy/vacancy sensors
- ✓ Install daylight-responsive lighting controls for areas within 15 feet of a window

B.1.1 Additional Online Resources for Lighting Equipment

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

- ENERGY STAR Products - Lighting:
http://www.energystar.gov/products/lighting_fans
- ENERGY STAR Lighting Calculator:
http://www.energystar.gov/buildings/sites/default/uploads/files/light_bulb_calculator.xlsx?0325-e619&0325-e619
- DOE Commercial Lighting Solutions tool for optimizing lighting design:
<https://www.lightingsolutions.energy.gov/comlighting/login.htm>
- Lighting Research Center:
<http://www.lrc.rpi.edu>
- Underwriters Laboratories LED retrofit kit information:
<http://industries.ul.com/lighting/retrofit-kits>

B.2 WINDOWS AND WALLS (BUILDING ENVELOPE)

Your property's "envelope" or "shell" includes windows, walls, roof, and insulation. Addressing leaks that allow unwanted air infiltration into the building envelope can often eliminate a major energy drain. Outside air can enter a building through a variety of places, most commonly the windows, doors, walls, and roof. Outside fresh air can be refreshing, but only as controlled ventilation, not as accidental infiltration. Improvements to the envelope will vary based on several factors, including how the property was built, when it was built, and how it is maintained. The following suggestions provide detailed information on how to check specific areas, address small leaks, and if necessary, suggest greater improvements to the envelope. These include checking: 1) leaks in the overall property; 2) exterior walls; 3) roof and attic spaces; 4) windows and shading; and 5) doors.



B.2.1 Check for Leaks in the Overall Property

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. You may find it helpful to have the items listed below on hand when completing the building envelope assessments for your property.

To complete the task, you should have the following materials on hand: tape measure/ruler; incense stick and lighter; flashlight; digital camera; ladder; and thermometer. Then follow the steps below to identify and fix problems in the property's overall building envelope.

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.
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 business paid to heat or cool. Record locations where there are drafts or a lot of air movement in 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 the wall construction and if there is any insulation/wall condition and noticeable air infiltration
5. Take a digital photo of all areas of concern.

B.2.2 Check Exterior Walls

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

1. Check for and fix air leaks: Unconditioned outside air can add additional heating or cooling requirements. Seal areas of infiltration in walls using caulk or weather stripping to prevent unconditioned air from entering your property.
2. Check for and fix rainwater leaks: Wet insulation is not as effective as dry insulation, and excess moisture can create mold, rot, and structural decay. Mold can be a serious health hazard for staff and customers. 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. However, depending on the construction of the building, this could be very labor intensive and expensive:
 - a. Use loose-fill insulation for enclosed existing walls and hard to reach places
 - b. Use rigid fibrous insulation for ducts in unconditioned spaces and other places that can withstand high temperatures
 - c. Use spray foam or foamed-in-place insulation for enclosed existing walls.

B.2.3 Check Roof and Attic Spaces

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

1. Check the roof for the following and record:
 - Any water intrusion
 - Roof age and warranty.
2. Roof condition (including signs of leaks, membrane holes, and damaged insulation):
 - Roof construction and insulation thickness
 - Check attic bypasses.
3. 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; unconditioned outside air can add additional heating or cooling requirements.
 - 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.
4. 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. Make sure to have a structural engineer evaluate the building if the new roof is going to add weight to be sure that your building is strong enough to carry the additional weight.

B.2.4 Check Windows and Shading

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

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 property 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 requirement of your 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 to limit incoming sunlight and reduce 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.
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.2.5 Check Doors

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

1. Check for and fix air leaks: Seal areas of air infiltration around attic access and doors using caulk, weather stripping, and door sweeps to prevent unconditioned air from entering the property.
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 your property.

As you complete these steps, use the checklist below to keep track of your progress. For more information on the building envelope components (windows, walls, insulation, roofs, etc., see the additional resources at the end of this section).

- ✓ Check for leaks in the overall property.
- ✓ Check the exterior walls and, if needed, fix air and water leaks. Consider adding more insulation if necessary.
- ✓ Check the roof and attic space considering a timeline for roof replacement and additional insulation requirements.
- ✓ Check windows. Fix any leaks and consider installing new ENERGY STAR certified windows.
- ✓ Examine the shading of the building. Look at what you have in place to provide shade in the hot summer months—from interior and exterior blinds, to using exterior overhangs, to planting trees.
- ✓ Check the doors. Fix air leaks; calibrate the automatic doors to decrease air infiltration; consider revolving doors or an entrance vestibule if applicable.

B.2.6 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 Roof Toolkit: <http://www.coolrooftoolkit.org>

B.3 OFFICE EQUIPMENT GUIDANCE

Office equipment used in many small businesses presents an often-overlooked opportunity for significant energy and cost savings. Surveys show a steady increase in the volume of electronic office equipment being used by all types of businesses. This includes computers, printers, copiers, televisions, and small appliances such as coffee makers. Evaluating your office equipment use will help your business realize energy and monetary savings. Review the following information to consider each suggestion as it may apply to your property:



- **Always buy ENERGY STAR certified products when new office equipment is needed.** The ENERGY STAR label indicates highly efficient computers, printers, copiers, televisions and other small appliances and equipment. Equipment that has earned the ENERGY STAR saves energy and money. Many of these products save energy by utilizing auto-power down settings which cause the unit to enter a sleep or off-mode when not used after a certain amount of time. In addition, they also consume less energy when in use. The easiest way to measure potential cost savings from investing in ENERGY STAR certified office equipment is to use one of the free online ENERGY STAR calculators found at <http://www.energystar.gov/products>. Visit the ENERGY STAR website for specific information on: computers; displays; imaging equipment such as copiers, printers, scanners, FAX machines, and all-in-one devices; small network equipment such as routers, modems, etc.; and electronics such as telephones and televisions.
- **Set computer power settings to save energy when not in use.** An average desktop computer consumes 58 watts when powered on and three watts when in a sleep state. Over 60 percent of computers in the United States (U.S.) are left powered on overnight. This wastes significant amounts of money and energy while generating excess heat on site and unnecessary carbon emissions at the power plant. Because the use patterns for many typical businesses are fairly standard, you can program the computers to follow a typical schedule. ENERGY STAR has instructions for setting computer power settings for different operating systems at http://www.energystar.gov/index.cfm?c=power_mgt.pr_power_mgt_users
- **Replace cathode ray tube (CRT) computer monitors.** Older CRT monitors should be replaced by energy-efficient liquid crystal display (LCD) monitors to take advantage of the energy savings LCD monitors provide. It is important to dispose of CRT monitors properly through recycling because they may contain hazardous or toxic components. The average CRT monitor operates at 73 watts while an LCD monitor uses 28 watts. ENERGY STAR has more information on monitor specifications and those that are ENERGY STAR certified at <http://www.energystar.gov/products/certified-products/detail/displays>



- **Utilize Smart Power Strips.** Smart power strips address a key energy-wasting issue: the fact that many appliances and other equipment pull a slight energy load, even when turned off (also called the “vampire effect”). Many devices can be plugged into the same power strip, which can then be turned off to ensure that the appliances are not drawing any power. Power strips are relatively inexpensive and are widely available. They can be used for office and kitchen equipment that “stays on” even when turned off, such as a television, coffee maker, or stereo system.
- **When replacing televisions, buy ones that have earned the ENERGY STAR label.** Non-ENERGY STAR certified televisions should be replaced when financially appropriate with energy-efficient LCD or LED-LCD televisions. You can use a tool such as the ENERGY STAR Certified Television Search to find televisions matching your specifications and sorted by least energy use at <http://www.energystar.gov/products/certified-products/detail/televisions>
- **Develop an education and/or training program to encourage energy conservation.** Educated staff can make significant contributions to load reduction by simply turning off office equipment when it is not in use, and enabling energy-saving settings for computers and monitors.

You can use the checklist below to measure your progress towards implementing the office equipment suggestions described above.

- ✓ Always buy ENERGY STAR certified products when new equipment is needed.
- ✓ Set computer power settings to save energy when not in use.
- ✓ Replace cathode ray tube (CRT) computer monitors.
- ✓ Utilize Smart Power Strips.
- ✓ Buy replacement televisions that have earned the ENERGY STAR.
- ✓ Develop an education and/or training program to encourage energy conservation.

B.3.1 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
- ENERGY STAR Low Carbon IT Campaign website:
www.energystar.gov/index.cfm?c=power_mgt.pr_power_mgt_low_carbon

B.4 KITCHEN AND FOOD SERVICE EQUIPMENT

Many offices have kitchen areas where staff can prepare coffee, lunch, or snacks. Microwave ovens, coffee machines, stoves, and refrigerators are common in these areas. Some appliances like coffee makers may be left on longer than necessary. There are also additional opportunities to improve energy efficiency if your building has a larger commercial kitchen. Obviously, if your business is focused on food service, most of the products and appliances that you use on a daily basis will be food-service related. This section reviews overall kitchen and food service equipment; for more specific facility-type information, see Appendix F - Restaurants, and Appendix J - Grocery and Convenience Stores.

Review the following items to consider each suggestion as it may apply to your property, then check it off when completed on the Kitchen and Food Service Equipment checklist that follows.



- **Purchase ENERGY STAR certified commercial food service equipment.** Certified refrigerators and freezers are, on average, 30 percent more energy efficient than standard models. There are also ENERGY STAR certified dishwashers, fryers, griddles, hot food holding cabinets, ice machines, ovens/stoves, water coolers, and steam cookers.
- **Check current refrigerators.** While your property's old refrigerator may still look good and work well, it could be costing your business over \$300 per year to run, while using a significant amount of energy—in fact, more than twice the energy of a new ENERGY STAR certified model. However, even new refrigerator units can be run inefficiently. To help improve performance, position the refrigerator away from heat sources such as ovens and dishwashers, and leave a space between the wall and the refrigerator to allow air to circulate—this keeps the coils cooler so the refrigerator doesn't have to work as hard. Keeping the coils clean on the outside of the refrigerator is a great way to save energy as well. Also, consider unplugging the refrigerator when it is not in use, especially if it is only used for special events. Be sure to contact the manufacturer or consult the manual of your specific refrigerator model for usage, but it is generally recommended to unplug the refrigerator if it will not be used for a period of four weeks or longer.

By properly recycling a refrigerator manufactured 20 or more years ago and replacing it with a new product that has earned the ENERGY STAR label, your business can save up to \$1,100 and prevent up to 26,000 pounds of GHG emissions. For more information on making sure your old refrigerator is disposed of properly, see the EPA's Responsible Appliance Disposal (RAD) Program at <http://www2.epa.gov/rad>.



- **Have walk-in refrigeration systems serviced at least annually.** This includes cleaning, refrigerant top off, lubrication of moving parts, and adjustment of belts. This will help ensure efficient operation and longer equipment life.

- **Use multiple refrigerators only when necessary:** Work to reduce the use of multiple refrigerators: consider consolidating cooling needs into a single refrigerator and consider turning off an extra unit that is not needed.
- **Check your water cooler.** A typical bottled water cooler can use more energy than a large residential refrigerator. An ENERGY STAR model requires about half as much energy as a standard unit, which reduces your utility bills.
- **Always buy ENERGY STAR certified vending machines.** Improving your property's refrigerated vending machines results in cost savings and reduced building cooling load. Standard refrigerated beverage vending machines use about 50 percent more power than ENERGY STAR certified machines. Talk with your property's vending operator about replacing non-ENERGY STAR vending machines with new or rebuilt models that conform to the latest ENERGY STAR performance standards, and use software or occupancy sensors to further increase their performance.

You can use the checklist below to measure your progress towards implementing the kitchen and food service equipment suggestions described above.

- ✓ Purchase ENERGY STAR qualified commercial food service equipment.
- ✓ Check your refrigerators and freezers.
- ✓ Have walk-in refrigeration systems serviced at least annually.
- ✓ Check your water cooler.
- ✓ Always buy ENERGY STAR qualified vending machines.

B.4.1 Additional Online Resources for Kitchen and Food Service Equipment

For more information about kitchen and food service equipment, visit the following websites:

- ENERGY STAR Commercial Food Service Equipment:
<http://www.energystar.gov/products/certified-products/detail/commercial-food-service-equipment>
- ENERGY STAR Refrigerators and Freezers:
<http://www.energystar.gov/products/certified-products/detail/commercial-refrigerators-freezers>
- ENERGY STAR Water Coolers:
<http://www.energystar.gov/products/certified-products/detail/water-coolers>
- ENERGY STAR Vending Machines:
<http://www.energystar.gov/products/certified-products/detail/vending-machines>
- WaterSense Water Saving Products:
<http://www.epa.gov/watersense/products/index.html>

B.5 HEATING, VENTILATION, AND AIR CONDITIONING (HVAC)

The HVAC systems in many small businesses can be one of the largest energy users. In addition to the recommendations in this section, many of the improvements discussed in other sections of this appendix can improve the efficiency of your property's HVAC system. For example, efficient lighting has less waste heat and can reduce air conditioning costs; 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 maintain your existing system and also create a replacement plan when a new system is required.

- **Keep exterior doors closed while running the HVAC.** This simple action will help avoid wasteful loss of heated or cooled air.
- **Install a programmable thermostat to control the HVAC system.** These thermostats allow you to optimize HVAC operation based on your property's scheduled use, and can be overridden as needed for unscheduled events. To ensure that staff and customers always enter a comfortable facility, a "smart thermostat" can schedule heating/cooling needs for a certain amount of time before arrival.
- **Check the accuracy of the thermostats.** The thermostats at your business can become dirty or damaged over time, causing them to read an incorrect temperature. This can lead to over-heating or over-cooling of the property and to higher utility bills. Your property's thermostats should be checked annually to make sure that they are working properly by comparing them to a thermometer. Ideally, your property's regular professional HVAC tune up should confirm the accuracy of the thermostat.
- **Change the filters.** To ensure maximum efficiency and air quality, HVAC filters should be cleaned and replaced at least quarterly, and even monthly during heating/cooling seasons.
- **Clean heating and cooling coils.** For the highest system efficiency, the place where air/water enters the HVAC system should be kept clean. Whether in an air handler or in a rooftop unit, the methods for cleaning include using compressed air, dust rags or brushes, and power washes. In addition, check baseboard heating systems for dust buildup, and clean them if necessary. This should happen twice a year—in the spring and in the fall.
- **Clear the clutter.** Make sure that fan coil units and baseboards are not blocked or covered by chairs, books, boxes, or file cabinets. Besides creating a fire hazard, blocking these units prevents proper air circulation. Always keep the area around supply and return vents clear.
- **Use fans when a room/area is occupied.** Comfort is a function of temperature, humidity, and air movement. Moving air can make a higher temperature and/or humidity feel more comfortable. Using ceiling fans allows the thermostat to be set as much as three to five degrees higher and the room feels just as comfortable as a lower temperature. Fans are most effective when the air

movement is felt on the skin, and are a good choice for offices and other areas where occupants are in one place.

- **Tune-up the HVAC system with an annual maintenance contract.** Just like a new car, even a new ENERGY STAR qualified HVAC system will decline in performance without regular maintenance. An annual maintenance contract automatically ensures that your HVAC contractor will provide pre-season tune-ups before each cooling and heating season. Use the tune-up appointment to have your contractor check for possible leaks in the property's duct system. You can read more at http://www.energystar.gov/index.cfm?c=heat_cool.pr_hvac.

You can use the checklist below to measure your progress towards implementing the HVAC suggestions described above.

- ✓ Keep exterior doors closed while running the HVAC.
- ✓ Install a programmable thermostat to control the HVAC system.
- ✓ Check the accuracy of the thermostats.
- ✓ Change the filters as needed, checking monthly.
- ✓ Clean heating and cooling coils.
- ✓ Clear the clutter.
- ✓ Use fans when a room/area is occupied.
- ✓ Tune-up the HVAC system with an annual maintenance contract.

B.5.1 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, and for many small businesses, HVAC replacement can have a big impact on finances. For this reason, you should check equipment periodically to estimate its remaining life. When the equipment is one to two years from the end of its remaining life, plans for 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 small business-owned office building 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 business is facing a \$60,000 dilemma. They need a new boiler installed right away to keep the offices

and their 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 property as described in Scenario 1, but this is two years earlier, before the start of the heating season. The 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 business starts to set aside funds 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 team looking into this decision takes what they've learned to the other decision makers at the business, and convinces them that in the long run, the high-efficiency unit is a better deal, and will actually save the business quite a bit on utility bills long after the extra cost has been paid for. The business puts aside 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, 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.

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, businesses can plan ahead and make the best decisions possible, which usually mean that equipment is not run to failure.

B.5.2 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 business 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 approach for your property and its vital HVAC equipment.

B.5.3 Additional Online Resources for HVAC

- ENERGY STAR Heating and Cooling Guide:
http://www.energystar.gov/ia/partners/publications/pubdocs/HeatingCoolingGuide%20FINAL_9-4-09.pdf?75c2-2c21
- Tips for hiring a heating/cooling contractor:
http://www.energystar.gov/index.cfm?c=heat_cool.pr_contractors_10tips
- ENERGY STAR: Heat and Cool Efficiently:
www.energystar.gov/index.cfm?c=heat_cool.pr_hvac
- ENERGY STAR HVAC Maintenance Checklist:
www.energystar.gov/index.cfm?c=heat_cool.pr_maintenance
- ENERGY STAR Duct Sealing brochure:
www.energystar.gov/ia/products/heat_cool/ducts/DuctSealingBrochure04.pdf?0cbe-cc73

B.6 WATER—HOT AND COLD

You may wonder what water use and saving energy have to do with each other. In most cases, electricity or natural gas is used to heat water, and this costs money. The more hot water your business consumes, the more it will benefit from optimizing water use. Additionally, treating and pumping water and wastewater may well be the number one use of electricity by your municipality. You can save water, energy, and money with the EPA's WaterSense program at <http://www.epa.gov/watersense>.



The EPA created WaterSense to help American consumers and businesses use water more efficiently. Reducing water use lowers the costs associated with operating and maintaining equipment, as well as the energy needed to heat, treat, store, and deliver water throughout the property. WaterSense promotes water-efficient products and practices to help commercial and institutional facilities save water, energy, and operating costs. More information on the recommended actions below is available.

Review the following information to consider each suggestion as it may apply to your property, and then check each item off when completed on the Water checklist that follows.

- **Conduct a water assessment to identify major water uses within the property.** Look for opportunities for savings, and track your property's water use in Portfolio Manager.
- **Find and fix leaks.** Small leaks add up to many gallons of water and dollars wasted each month. Water conservation saves energy and money, especially for hot water. Since electricity is also required for purification of drinking water, treatment of waste water, and pumping of water, fixing leaks will save energy.
- **Use water-saving faucets, showerheads, toilets, and urinals to save water.** WaterSense-labeled products can save a great deal of water and therefore energy. For example, WaterSense toilets use 20% less water than those manufactured following the current federal standard. Additionally, replacing just one older inefficient urinal with a WaterSense-labeled model could save your property approximately 4,600 gallons of water per year.
- **Insulate water heaters.** Install an insulation blanket on water heaters that are more than seven years old, and insulate the first three feet of the heated water "out" pipe on both old and new units.
- **Purchase an ENERGY STAR qualified water heater when buying a new water heater.** If your 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. In areas of infrequent water use, consider tank-less water heaters to reduce standby storage costs and waste.

ENERGY STAR Qualified Commercial Water Heaters

- **High Efficiency Gas Storage:** High-efficiency gas storage water heaters work the same way conventional gas storage water heaters work, but high-efficiency models have better insulation, heat traps, and more efficient burners. These improvements increase energy efficiency by about 7.5 percent.
- **Gas Condensing:** Gas condensing water heaters operate similarly to conventional gas water heaters, but reduce 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.
- **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.
- **Set water temperature only as hot as needed.** Typically, hot water should only be heated to 110 to 120 degrees Fahrenheit. This prevents scalding and saves energy. Remember to check local codes for specific temperature requirements.
- **Optimize the amount of water used in heating and cooling systems.** Evaluate cooling towers, chillers, and other large systems to ensure they are running as efficiently as possible. Eliminate single-pass cooling systems wherever possible by re-circulating water or reusing the water for another purpose instead of sending it down the drain.
- **Practice water-efficient landscaping.** Planting native and regionally-appropriate plants on the grounds of your property can reduce the need for extensive outdoor watering in the summer. Reducing the amount of turf grass can also save water—turf grass receives the highest percentage of irrigation water in traditional landscaping, much more than landscapes planted with a mix of trees and shrubs. If an irrigation system is used, be sure it has been installed correctly and have it checked for leaks on a regular basis to avoid wasting water. Native trees and other plants can shade and cool your “micro-climate” by several degrees and are less vulnerable to local insect pests than non-native species.

For more information about water use, visit the WaterSense website at <http://www.epa.gov/watersense/commercial> to learn about *WaterSense at Work*, Best Management practices designed to help properties reduce their water use.

You can use the checklist below to measure your progress towards implementing the water savings suggestions described above.

- ✓ Conduct a water assessment to identify major water uses within the property.
- ✓ Find and fix leaks.
- ✓ Use water-saving faucets, showerheads, toilets, and urinals.
- ✓ Insulate water heaters.
- ✓ Buy the most efficient model possible when purchasing a new water heater.
- ✓ Set water temperature only as hot as needed.
- ✓ Optimize the amount of water used in heating and cooling systems.
- ✓ Practice water-efficient landscaping.

B.6.1 Additional Online Resources for Water

For more information about water saving, visit the following websites:

- EPA WaterSense Program:
<http://www.epa.gov/watersense/>
- WaterSense Water Saving Products:
<http://www.epa.gov/watersense/products/index.html>
- ENERGY STAR Water Savings Tips:
<http://www.energystar.gov/buildings/facility-owners-and-managers/existing-buildings/save-energy/save-water-save-energy>
- ENERGY STAR Certified Hot Water Heaters:
http://www.energystar.gov/index.cfm?c=water_heat.pr_water_heaters_landing

Appendix C – Energy Audits

As the saying goes, “Time is money.” This can be particularly true for small businesses. However, not taking time to save energy can mean big money lost. Reduction in daily energy costs and monthly utility bills for the lifetime of your business can make it well worth the time needed to pursue effective-efficiency upgrades. You may wonder, “Where should I start?” and “Do I replace one piece of equipment or system at a time or should I do a comprehensive



upgrade of my entire facility?” The answers to these questions will vary depending on your business’ situation. The age of your current equipment and facility systems, your type of business, your local utility rates, your hours of operation, and your access to capital are all key factors in what level of upgrade makes business sense. One place to start is with low-cost and no-cost Sure Energy Savers (see Appendix B - Project Sectors-Energy and Water, sections B.1 to B.6). Once these have been implemented, and the property has used Portfolio Manager to benchmark energy use, an energy audit may help your business determine what additional energy efficiency projects make sense. Refer to resources in Appendix D - Project Financing, for ideas on how to pay for your audit.

Did you know that “while many small businesses have invested in energy efficiency, only 16 percent have had an energy audit of their facilities during the past two years?” (per the *National Small Business Association’s 2011 Energy Survey*). This appendix can help your business determine whether or not an audit is appropriate for your small business and—if so—how to choose one. In particular, this appendix tells you:

- What an energy audit is, what types of audits are available, and who can perform them
- How to prepare for an audit
- What you can expect the audit to include
- What energy audit resources are available online.

C.1 WHAT IS AN ENERGY AUDIT?

Energy audits are comprehensive reviews conducted by energy professionals and/or engineers that evaluate the actual performance of your business’ systems and equipment against their designed performance level or against the best available technologies. The difference between the actual performance and designed performance is the potential for energy savings. Whether your business is

home-based, rents space, or owns its own property, you can probably benefit from an energy audit. For home-based businesses, the benefit of an energy audit is two-fold; both you and your business can save money. Be aware—audits alone don't save energy; you need to implement the recommended improvements to reap benefits.

Money saved as a result of implementing auditor-recommended energy efficiency improvements may justify the up-front cost of the energy audit. However, your business' budget may limit the types of audit that would make financial sense, because recommended improvements that are not performed shortly after the audit can become outdated. If your business has limited property improvement funds, an audit targeting specific types of projects may be the most cost effective as it will recommend projects your business will be able to affordably implement in a short time frame with allotted project funds. This section will help your Energy Team review the types of audits and auditors to determine whether or not an audit would benefit your company and which type of audit to select.

C.1.1 Types of Energy Audits

If your business decides to conduct an energy audit, you will need to choose which type of audit is the best fit by considering the property type to be audited, the cost of the audit, your Energy Team's project goals and access to funding, and the implementation timeline. For example, a detailed energy audit might not make sense for a small, home-based business or a business that does not have financing to implement the projects identified by the audit. It is wise to start with benchmarking and implementing the Sure Energy Savers and other steps described in Appendix B - Project Sectors-Energy and Water, to see what you can save prior to getting an audit.

HOME ENERGY AUDITS

For home-based businesses, a home energy audit can be the first step in making both your home and home-based business more efficient. An audit can help you assess how much energy your home uses and evaluate what measures you can take to improve efficiency. You can perform a simple energy audit yourself, or have a professional energy auditor perform a more thorough audit. For more information on home energy audits, visit ENERGY STAR's Home Energy Audits page. You can use ENERGY STAR resources to do-it-yourself using the ENERGY STAR Home Energy Yardstick or find information to hire a professional home energy auditor using the New Homes Partner Locator (all resources with links in Section C.4).

ASHRAE AUDITS

If your company rents or leases office space or owns its own buildings, your Energy Team may consider a professional audit. There are several types of energy audits that survey your property at different levels of detail. The types of audits as defined by American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) standards are:

- ASHRAE Level I – Walk-Through Analysis
- ASHRAE Level II – Energy Survey and Analysis
- ASHRAE Level III – Detailed Analysis of Capital-Intensive Modifications.

These audits are described in detail below. Although the accuracy of the audit is directly related to the level of detail (e.g., a Level III audit is more accurate than a Level II audit), the most extensive and accurate audits may not be necessary or cost effective to accomplish your business' energy saving goals.

Types of ASHRAE Energy Audits

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 audit 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.

C.1.2 Finding an Energy Auditor

Unless you conduct an audit yourself, you can choose from three main types of energy audit providers: 1) utility companies, 2) private sector companies, and 3) state energy offices. The following paragraphs describe these types of auditors in more detail.

Your utility company may offer free or inexpensive energy audits and/or have an energy conservation department.

Private-sector companies include consultants, energy service companies (ESCOs), and ENERGY STAR service and product providers (SPPs). These companies can conduct audits, evaluate and recommend projects to improve building energy efficiency, and can estimate energy use, energy savings, and project cost:

- **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** 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 businesses that don't have access to capital to implement the projects on their own.

- **SPPs** (which can include energy consultants and ESCOs) are companies that assist commercial buildings with running more efficiently by helping clients with benchmarking energy performance, improving efficiency, and earning recognition. ENERGY STAR maintains a list of service and product provider (SPP) partners. To partner with ENERGY STAR, a company must demonstrate a minimum level of past and ongoing experience working with Portfolio Manager and earning ENERGY STAR certification for their client buildings.

Your state energy office may offer free or inexpensive energy audits. Find your state energy office by visiting the National Association of State Energy Officials (NASEO) State and Territory Energy Offices' interactive map at <http://www.naseo.org/members-states>.

C.1.3 Contracting a Private Company to Perform Your Energy Audit

Once your business has reviewed the types of audits and auditors available, you may choose to hire a private sector company for an audit. In this case, you can either select the company 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.

If your business owns its own 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 that 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 costlier 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.

C.1.4 Your Energy Team's Role

If you hire an outside auditor, your Energy Team will be responsible for monitoring the auditor's activities. This section outlines steps and activities your Energy Team should take to ensure the audit's success:

- If your business plans solicit competitive bids for your audit, the Energy Team can prepare a Request for Proposals (RFP) to hire an auditor. ENERGY STAR has a sample RFP (see Section C.4) to assist you in preparing this document.
- Your team should familiarize themselves with the building in terms of equipment, energy use, and design (mechanical and electrical).
- You will need to manage the energy auditor through maintaining communication with decision-making staff and overseeing 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.
 - ✓ Create a final report based on the audit results, and produce a detailed summary of actual steps that can be taken to reduce energy use. The report should recommend actions from simple adjustments in operation to equipment replacement. Estimates of resource requirements for completing actions should be included.

C.2 PRE-AUDIT CHECKLIST

Once your Energy 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, if your business owns its own building(s), 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, it may be worthwhile to get an independent review of the recommended projects. Consult your local utility or state energy office for assistance. You should have an up-to-date Portfolio Manager account for your property(ies) with at least 12 months utility data included. This account will ensure you have the needed data for an audit, such as property use, a list of on-site equipment and associated use profiles, energy costs, and newly implemented projects and upgrades (without knowledge of new project implementation, the audit may assume your property has been using current equipment for the past 12 months).

C.3 WHAT TO EXPECT

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 audit types listed below. You can also do a search for “sample energy audits” on the internet to see many different examples.

Types of Energy Audits

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.

C.3.2 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.4 ONLINE ENERGY AUDIT RESOURCES

This section includes online resources that can help your business learn more about energy audits and auditors as well as potential funding sources. Appendix D - Project Financing, includes a more detailed list of resources for funding your business' audit.

- ENERGY STAR Home Energy Audits:
www.energystar.gov/index.cfm?c=home_improvement.hm_improvement_audits
- ENERGY STAR Home Energy Yardstick:
www.energystar.gov/index.cfm?fuseaction=HOME_ENERGY_YARDSTICK.showGetStarted
- ENERGY STAR New Homes Partner Locator:
www.energystar.gov/index.cfm?fuseaction=new_homes_partners.locator
- List of all ENERGY STAR SPP partners:
www.energystar.gov/buildings/facility-owners-and-managers/existing-buildings/save-energy/expert-help/find-energy-star-service-a-1
- ENERGY STAR sample RFP:
www.energystar.gov/ia/partners/bldrs_lenders_raters/downloads/Enterprise_Rater_RFP_Template.pdf?2a1e-8127
- American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE):
www.ashrae.org
- National Association of State Energy Officials (NASEO) State and Territory Energy Offices:
www.naseo.org/members-states
- Small Business Administration (SBA) State and Local Energy Efficiency Programs:
www.sba.gov/content/state-and-local-energy-efficiency-programs
- SBA Home Energy Saver: hes.lbl.gov/consumer/
- Department of Energy (DOE) Professional Home Energy Audits:
<http://energy.gov/energysaver/articles/professional-home-energy-audits>
- DOE Small Business Energy Audit Program:
energy.gov/savings/small-business-energy-audit-program

Appendix D – Project Financing

One of the challenges a business may face when looking at implementing energy efficiency upgrades is the upfront costs of new equipment and appliances. Usually, these upgrades save you money over time—money that can be used to pay for the cost of future projects. When looking at the project financing this way, your business can plan forward, allowing you to draw on dollars saved from future energy bills to pay for new, energy-efficient equipment and projects today.



Some upgrades require little funding. For those that do require investment, there are many traditional and non-traditional financial resources available which are highlighted in this appendix.

For small, inexpensive projects, you may want to use your own internal funds to pay for the upgrade in order to keep your payback period low and return on investment high. For larger jobs, financing might be the only way to pay for the upgrade. It's your business decision to weigh competing needs for capital versus continuing increases in operating costs for energy. But remember—even a longer return-on-investment energy efficiency upgrade results in affordable comfort, and new, more reliable equipment. Strategic energy efficiency investments are your hedge against the certainty of higher utility bills that you cannot control. This appendix highlights:

- Where to find ENERGY STAR calculators to inform your decision-making process
- How to pay for upgrades
- What factors to consider when choosing financing
- Why you may consider a utility bill audit
- What financing resources are available online.

D.1 ENERGY STAR CALCULATORS

ENERGY STAR offers online calculators to help you determine a best course of action for your business' planned energy efficiency projects. The Cash Flow Opportunity Calculator at <http://www.energystar.gov/buildings/tools-and-resources/cash-flow-opportunity-calculator-excel> can help you answer three critical questions about potential energy efficiency investments:

- How much new energy efficiency equipment can be purchased from anticipated savings?

- Should this equipment purchase be financed now, or is it better to wait and use cash from a future budget?
- Is money being lost by waiting for a lower interest rate?

The Building Upgrade Value Calculator estimates the financial impact of proposed investments in energy efficiency in office properties at

<http://www.energystar.gov/buildings/tools-and-resources/building-upgrade-value-calculator>. The calculations are based on data input by the user, representing scenarios and conditions present at their properties. Required inputs are limited to general characteristics of the building, plus information on the proposed investments in energy efficiency upgrades.

D.2 HOW TO PAY FOR UPGRADES

Today there are many opportunities to finance energy efficiency projects—whether through energy performance contracting, loans, commercial leases, tax-exempt financing, or financial advisory services. This section contains information on the different types of financing options that may be available to your business. It also lists factors to consider when deciding which type of financing to use for a project; additional online resources to find more specific information can be found at the end of this appendix.

Although the right financing option depends on many factors—such as debt capacity, in-house expertise, and risk tolerance—there are viable options for virtually any type of organization to implement a well-designed project. You may choose to fund projects with cash or savings, utility incentives or rebates, grants, loans, or a combination of these. You may also choose to consider equipment leasing or performance contracting. Group purchasing is another way to reduce dollars invested in the initial outlay.

D.2.1 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 business 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. Generally, relatively inexpensive, simple efficiency measures that are likely to pay for themselves in about a year are purchased with cash because the costs of acquiring financing (e.g., the cost to borrow money, the cost of time invested in researching opportunities, etc.) may exceed the projected savings. Most businesses want to keep some liquidity, and cash/savings are things that they would rather not tie it up in larger investments.

D.2.2 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. Your business may also be eligible to receive immediate rebates or tax incentives on purchases of ENERGY STAR qualified equipment. See the ENERGY STAR online Rebate

Finder at <http://www.energystar.gov/rebate-finder> to 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. Additionally, the Chambers for Innovation and Clean Energy (CICE) shares information, tools and resources with chambers and their member companies about the economic benefits and opportunities associated with clean energy and innovation. The federal government and many states reward efficient building upgrades with tax incentives.

D.2.3 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. Because finding and applying for grants can take a large amount of time, you should implement Sure Energy Savers (Appendix B - Project Sectors-Energy and Water) and look for rebates before you apply for grants. Energy grants come from many sources—from state and federal governments and from other organizations. Some grants require matching funding from your business; some will provide a portion of the funding for a specific type of project; others will fund a complete upgrade. Many grants are available to non-profit organizations only, so consider that you will need to perform extra research to find grants applicable to your small business.

Grant opportunities can come up quickly with short deadlines. To keep up with opportunities now and on the horizon, your business could have someone from your Energy 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. Because grants are time-consuming, efforts with a quick turnaround, consider whether time spent pursuing grants may be better used elsewhere. Some current grant programs that are currently available are listed below.

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 at <http://www.dsireusa.org>.

Small Business Administration (SBA): The SBA maintains a listing of state, local and regional grants and loans that offer financial assistance to small businesses making energy efficient upgrades or developing energy efficient technologies at <https://www.sba.gov/content/state-and-local-energy-efficiency-programs>.

Other programs: There may be other programs that offer loans and/or grants for efficiency upgrades. For example, the Office of Energy Efficiency and Renewable Energy's Better Buildings Neighborhood Program helps state and local governments develop sustainable programs to upgrade the energy efficiency of homes and buildings. More information is available at <http://energy.gov/eere/better-buildings-neighborhood-program/better-buildings-neighborhood-program>.

D.2.4 Loans

If you are not able to fully fund your project work through cash, grants, and other avenues, your business 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 borrowing ability will depend on 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 business will bear all the risks of the project and receive all the benefits. Visit the SBA listing of state, local, and regional grants and loans for more information about its loan products at <https://www.sba.gov/content/state-and-local-energy-efficiency-programs>.

D.2.5 Equipment Leasing

Instead of paying for an entire upgrade in full, your business 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 advisor(s) before entering into a lease agreement. Also note that lease terms may charge a higher interest rate than a loan, so be sure your Energy Team looks into the total ownership cost of leasing versus taking out a loan before making a decision. For more details on equipment leasing, see Chapter 4 of the ENERGY STAR Building Upgrade Manual at www.energystar.gov/BldgManual.

D.2.6 Performance Contracting

Performance contracting (sometimes called “shared savings”) is the most complex type of arrangement, but offers your business the benefit of risk protection. It is also the costliest 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 business 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 business (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 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 Chapter 4 of the ENERGY STAR Building Upgrade Manual at www.energystar.gov/BldgManual.

D.2.7 Group Purchasing

Another way to fund your business’ projects is by reducing initial outlay through group purchasing. Why pay more than you must for efficient products and equipment? Perhaps the local Chamber of Commerce or trade/professional business association would sponsor a group purchase in which you and other small

businesses pool your buying power for volume discounts. Contact local retailers to see if they can set up a program for your trade association members to receive bulk discounts.

D.3 CHOOSE HOW TO FINANCE THE PROJECT

Choosing which type of financing you will use requires a full evaluation of your options. Your Energy Team will need to consider the size of the project, and then look at the factors listed below.

Factors to Consider when Financing the Project

Balance Sheet: This is how much money your business has on hand versus its debts. Ensure that any investments your team makes do not leave your business with too much debt.

Initial Payment: A large purchase may be an obstacle for some businesses planning energy efficiency upgrades. If your business 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. If resources are tight, you may want to consider a performance contract.

Payments: Your business' goal is to obtain financing at a minimum cost. If your business 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 budget.

Ownership: If your business owns its energy efficiency upgrade equipment, it will receive all the savings; however, it 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. For example, 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. It can be difficult to predict energy savings from HVAC upgrades because HVAC performance is impacted by the property's ventilation system (e.g. clogged ducts, vents stuck open) and other factors that may not be visible.

D.4 CONSIDER A UTILITY BILL AUDIT

Have you considered whether your utility bills are accurate? You wouldn't pay your restaurant bill without a quick review, so what about major monthly utility bills? Do you know that professional analysts say most mistakes are approximately 10% of the bill amount and are routinely repeated month

after month? Professional consultants who analyze utility bills say that utilities can overcharge through calculation errors and other billing discrepancies.

Your business' utility expenses may represent a large 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.

Your business can undertake a no-risk audit of all your utility expenses. This audit reviews 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. Utility bill audits are typically performed on a contingency basis, which means your business has no out-of-pocket expenses; you pay a percentage of any refunds recovered. If no refunds are recovered, you pay nothing. This is a potentially great source for raising capital and reducing your operational expenses.

D.5 ONLINE FINANCING RESOURCES

Visit the following websites for more information about financing resources for energy efficiency:

- ENERGY STAR Directory to find rebates, incentives, and financing services for energy projects:
<http://www.energystar.gov/findfinancingbuildings>
- ENERGY STAR Building Upgrade Manual—Financing Section:
www.energystar.gov/ia/business/EPA BUM CH4 Financing.pdf?1305-011d
- Special offers and rebates from ENERGY STAR Partners:
www.energystar.gov/index.cfm?fuseaction=rebate.rebate_locator
- ENERGY STAR list of most active service and product providers:
www.energystar.gov/ExpertHelp
- ENERGY STAR Performance Contracting Best Practices:
www.energystar.gov/buildings/tools-and-resources/energy-star%C2%AE-performance-contracting-best-practices
- ENERGY STAR Financial Value Calculator:
www.energystar.gov/buildings/tools-and-resources/financial-value-calculator
- ENERGY STAR Building Upgrade Value Calculator:
www.energystar.gov/buildings/tools-and-resources/building-upgrade-value-calculator
- SBA's Loan and Grant Programs:
www.sba.gov/category/navigation-structure/loans-grants/small-business-loans/sba-loan-programs
- SBA's State and Local Energy Efficiency Programs:
www.sba.gov/content/state-and-local-energy-efficiency-programs
- DOE Industrial Assessment Centers (IACS):
energy.gov/eere/amo/industrial-assessment-centers-iacs
- Database of State Incentives for Renewables & Efficiency (DSIRE): www.dsireusa.org
- Chambers for Innovation and Clean Energy (CICE): www.chambersforinnovation.com/incentives
- National Association of State Energy Officials (NASEO) State and Territory Energy Offices:
<http://www.naseo.org/members-states>
- The Alliance to Save Energy Resources: ase.org/resources
- Local Government Commission funding opportunities:
www.lgc.org/funding?f=resources/energy/funding.html&f=freepub/energy/funding.html

Appendix E – Working with Contractors

Once your team has determined the projects for which your business needs to hire a contractor, you will need to find a contractor who will operate within your budget. You may locate a contractor by competitive bid or based on their qualifications. However, you ultimately select a contractor, so make sure to obtain the information listed below when assessing prospective contractors.

Information to Obtain from Prospective Contractors

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, including 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.

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 go to one dealer; you often go to several in order to compare and then negotiate prices. 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 budget.

The downside is that competitive bids can take time, and your project has to be large enough for the contractor to find it profitable. If your business 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 you are planning to install a few specific technologies, selecting a contractor by qualification may make more sense for your energy 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/her to undertake your project.

Selecting a contractor by qualification may be preferable for some businesses, 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 business is implementing.

E.3 PERFORMANCE CONTRACT - USING AN ESCO

A performance contract is where a business 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 business 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 business 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 business's energy savings for a contractually specified length of time after the energy project is completed, limiting the amount of money saved that you can use elsewhere. However, if your business 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.4 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.

E.4.1 Contract Specifics

Before you sign any contract on behalf of your business, make sure the contract specifies the items listed below.

Contract Specifics to Confirm

- ✓ **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 and 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.

E.5 MANAGING A CONTRACTOR

When working with a contractor, the extent of your management responsibility will be defined in the contract. 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 on how to maintain the installed equipment's performance, and how frequently maintenance of the equipment is recommended.

Appendix F – Restaurants

Restaurants use about five to seven times more energy per square foot than other commercial buildings.

High-volume quick-service restaurants (QSRs) may even use up to 10 times more energy per square foot than other commercial buildings. Restaurants generally use the most electricity for refrigeration, followed by lighting, then cooling. This appendix will help you target energy use in these areas and take your energy program one



step further by providing additional guidance tailored for restaurants including:

- How to profile your restaurant's energy use
- What restaurant-specific tips can help you save energy and money
- Where to find restaurant-specific, online resources.

F.1 PROFILING YOUR ENERGY USE

Restaurants face a number of challenges and opportunities for energy management, so ensuring efficient energy use is a business practice that improves profitability, reduces greenhouse gas emissions, and conserves natural resources. The following ENERGY STAR guides and resources can assist you in streamlining your business' energy needs (see the last section, *Resources and Links*, for website links to all these publications).

The *ENERGY STAR Guide for Cafés, Restaurants, and Institutional Kitchens* helps you identify ways to save energy and water in your restaurant, boost your bottom line, and help protect the environment. This resource also contains tips on how to upgrade your equipment and highlights best practices that can positively impact your business' daily operations. This guide specifically addresses ENERGY STAR for Commercial Food Service and other energy-saving options such as: Lamps and Lighting Fixtures, HVAC, and Water and Waste Management. You can also learn about quick tips, energy-efficient equipment, and resources for saving energy in restaurants in the two-page, quick-reference *Energy Use and Energy Efficiency Opportunities in Restaurants* fact sheet. Restaurants also use a significant amount of water in daily operations so check out EPA's WaterSense resources to identify water-efficient products and programs at <http://www.epa.gov/watersense/index.html>.

Make sure to purchase ENERGY STAR certified Commercial Food Service Equipment for new construction or to replace aging equipment. This can cut kitchen utility costs without sacrificing features,

quality, or style—all while making significant contributions to a cleaner environment. When choosing equipment, take into account the total cost of ownership. The purchase price is often a small portion of the total cost. Certified dishwashers, ice machines, and steam cookers also save water which helps operators lower their water and sewer bills. See how much an upgrade can save using the Commercial Kitchen Equipment Savings Calculator.

In addition to energy waste, another avenue for waste reduction that restaurants can consider is reduction in food waste. The US generates more than 36 million tons of food waste each year. In fact, since 2010, food waste is the single largest component of municipal solid waste reaching landfills and incinerators. Often, simple changes in food purchasing, storage, preparation, and service practices can yield significant reductions in food waste generation. To assist in food recovery, both EPA and the USDA recommend some of the following steps: reduce the amount of food waste being generated, donate excess food to food banks, soup kitchens, and shelters; provide food scraps and fats to farmers for feed and rendering; donate oil for fuel and food discards for animal feed production; recycle food scraps into a nutrient rich soil amendment such as compost. These steps will all significantly improve your waste impact, but you can take it a step further by joining the EPA's Food Recovery Challenge (FRC) at <http://www.epa.gov/foodrecoverychallenge>. By registering with the FRC, you make it easy to set baselines, choose your goals, take specific action to reduce waste, and track your progress with the SMM Data Management System.

F.2 TIPS FOR ENERGY SAVING AT YOUR RESTAURANT

Refer to Appendix B for general information on lighting, HVAC, as well as other equipment, such as kitchen equipment and copy machines. Inefficient equipment/lighting not only draws power, but also emits heat that can contribute to higher cooling bills.

F.2.1 Refrigeration and Other Restaurant Equipment

ENERGY STAR certification currently is available in eight product categories: commercial hot food holding cabinets, solid and glass door refrigerators and freezers, fryers, steam cookers, ice machines, ovens (convection and combination ovens), griddles, and dishwashers. These energy-efficient products offer energy savings of 10 to 70 percent over standard models, depending upon the product category. Here are some specific tips for your restaurant:

- **Maintain and repair.** Leaky walk-in refrigerator gaskets, freezer doors that do not shut, cooking appliances that have lost their knobs—all these “energy leaks” add up to money wasted each month. Don’t let every day wear and tear drive up your energy bills.
- **Cut idle time.** If you leave your equipment ON when it is not performing useful work, it costs you money. Implement a startup/shutdown plan to make sure you are using only the equipment that you need, when you need it.
- **Select ENERGY STAR certified appliances.** If you’re in the market for new equipment, think in terms of life-cycle costs, which include purchase price, annual energy costs, and other long-term costs associated with the equipment. While high-efficiency appliances could cost more up front,

significantly lower utility bills can make up for the price difference. Be sure to ask your dealer or kitchen designer to supply you with ENERGY STAR certified equipment.

- **Recalibrate to stay efficient.** The performance of your kitchen equipment changes over time. Thermostats and control systems can fail, fall out of calibration, or be readjusted. Take the time to do a regular thermostat check on your appliances, refrigeration, dish machines, and hot water heaters and reset them to the correct operating temperature.
- **Cook wisely.** Ovens tend to be more efficient than rotisseries; griddles tend to be more efficient than broilers. Examine your cooking methods and menu; find ways to rely on your more energy-efficient appliances to cook for your customers.

F.2.2 Lighting

Lighting is a significant energy user—averaging 13% of the total energy breakdown of a restaurant—and is a great place to start an efficiency upgrade. Lighting products that have earned the ENERGY STAR deliver exceptional features, while using less energy. ENERGY STAR certified lighting products combine quality and attractive design with the highest levels of energy efficiency available today. ENERGY STAR certified fixtures typically use one-quarter of the energy consumed by traditional lighting, and they distribute light more efficiently and evenly than standard fixtures. Be sure to use *ENERGY STAR Lighting Options for Restaurants and Commercial Kitchens* as a resource. Some specific tips include:

- **Employ bi-level switching.** Bi-level switching allows you to control a lighting system in groups of fixtures or lamps. For example, bi-level switching allows you to turn off half of the lights in a room off when full illumination is not required.
- **Dim the lights.** Dimmers are available for LEDs. Daylight dimmers are special sensors that automatically dim room lights based on the amount of free and natural daylight available.
- **Try daylight sensors (photocells).** A common inefficiency of exterior lighting systems is a tendency to “dayburn,” leaving exterior lights on during the day, wasting energy and money. This problem can be prevented by installing daylight sensors that turn the lights on and off automatically based on daylight.
- **Swap old Open/Closed and EXIT signs with LED lighting for additional energy savings.**
- **Turn off lights in unoccupied areas and where daylight is sufficient.**
- **Install occupancy sensors** in closets, storage rooms, break rooms, and restrooms. Check the manufacturer’s website for compatibility with controls.

F.2.3 Heating and Cooling

ENERGY STAR certified Light Commercial HVAC (LCHVAC) equipment can save a good deal of money for your facility per year—depending on your current use. To save additional energy in your facility, look for ENERGY STAR ventilating fans for bathrooms and ceilings. ENERGY STAR certified ventilating fan models use 70 percent less energy than standard models, and certified ceiling fan/light combination units are over 50 percent more efficient than conventional units. Here are some tips you can employ in your restaurant:

- **Change your air filter regularly.** Check your filter every month, especially during heavy use months (winter and summer). If the filter looks dirty after a month, change it. At a minimum, change the filter every 3 months. A dirty filter will slow down air flow and make the system work harder to keep you warm or cool—wasting energy.
- **Tune up your HVAC equipment yearly.** Just as a tune-up for your car can improve your gas mileage, a yearly tune-up of your heating and cooling system can improve efficiency and comfort. Use the ENERGY STAR Maintenance Checklist as a guide.
- **Install a programmable thermostat.** A programmable thermostat is ideal for spaces that are unoccupied during set periods of time throughout the week.

Although kitchen ventilation is not covered by the ENERGY STAR Program, if you are getting ready to design a new kitchen or renovate an old one, check out “Improving Commercial Kitchen Ventilation System Performance,” a two-part kitchen ventilation design guide written by the experts at PG&E FSTC and available at www.fishnick.com/ventilation/designguides.

You can also cut down on heat and smoke spillage in your kitchen by adding inexpensive side panels to hoods and turning off exhaust hood when appliances aren’t being used. Another option is a demand-based exhaust control system which uses sensors to monitor your cooking and varies the exhaust fan speed to match your ventilation needs.

F.3 RESOURCES AND LINKS

This section includes online resources that can help your restaurant improve its energy use and energy efficiency.

- ENERGY STAR Energy Use and Energy Efficiency Opportunities in Restaurants:
<http://www.energystar.gov/buildings/tools-and-resources/energy-use-and-energy-efficiency-opportunities-restaurants>
- ENERGY STAR Commercial Food Service Equipment:
www.energystar.gov/cfs
- ENERGY STAR for Commercial Kitchens: Helping Customers Manage Costs Through Energy Savings:
www.energystar.gov/ia/products/commercial_food_service/downloads/ES-CFS_Guide_508.pdf
- ENERGY STAR Equipment Savings Fact Sheet:
www.energystar.gov/ia/products/commercial_food_service/downloads/restaurant_equipment_savings_factsheet.pdf
- ENERGY STAR Lighting Options for Restaurants and Commercial Kitchens:
www.energystar.gov/ia/products/commercial_food_service/downloads/Lighting_Fact_Sheet_for_Restaurants_FINAL_for_posting.pdf
- ENERGY STAR Product Finder:
www.energystar.gov/productfinder
- ENERGY STAR Rebate Finder and the CFS Incentive Guide:
www.energystar.gov/rebatefinder
- EPA's WaterSense Partnership Program: www.epa.gov/watersense
- SBA Information for Restaurants:
<http://www.sba.gov/content/energy-efficiency-restaurants>
- The Pacific Gas and Electric Food Service Technology Center: www.fishnick.com
- Green Restaurant Association: www.dinegreen.com
- The National Restaurant Association's Conserve Program: conserve.restaurant.org
- International Council on Hotel, Restaurant, and Institutional Education: www.chrie.org

Appendix G – Auto Dealers

Considering that auto dealerships use, on average, more energy per square foot than a typical office building (110kBTU – 93kBTU respectively), it's important for dealers to explore all their energy efficiency options. Fortunately, there are many cost-effective opportunities that exist for significant reductions in energy usage. These opportunities focus on auto dealership-specific areas of energy use energy such as compressors, paint booths, lighting, HVAC, and certain other services, while still maintaining quality, safety, and customer comfort as top priorities. This appendix is designed to help auto dealers make smart energy decisions that can save time and money. Read more about these potential improvements in the following sections:



- How to profile your dealership's energy use
- What auto dealer-specific tips can help you save energy and money
- Where to find online resources.

G.1 PROFILING YOUR ENERGY USE

The National Automobile Dealers Association (NADA), <https://www.nada.org>, has partnered with the EPA since 2007 to help dealers save energy and money through cost-effective energy efficiency opportunities. With the help of auto dealerships across the country, NADA is gathering data to develop a 1 – 100 ENERGY STAR score for dealerships which will then allow dealers to apply for ENERGY STAR certification. By contributing to this survey, in the future you will be able to receive an “apples to apples” comparison of your energy performance with that of other dealerships nationwide in a simple, easy-to-understand number. A score of 50 represents median energy performance, whereas top-performing dealerships that score a 75 or higher will be eligible to earn ENERGY STAR certification.



G.2 TIPS FOR ENERGY SAVING AT YOUR DEALERSHIP

Be sure to refer to Appendix B which includes additional information on lighting, HVAC, windows and walls, kitchen equipment, as well as office equipment such as computers and copy machines. Inefficient equipment/lighting not only draws power, but also emits heat that can contribute to higher cooling bills. You may also consider referring to the ENERGY STAR Building Upgrade Manual as a resource when looking for more energy savings opportunities at www.energystar.gov/BldgManual.

G.2.1 Compressors

When selecting a compressor, it is important to remember that in addition to your specific performance needs, compressor types consume energy at different rates. Take a look at the following list to see what each compressor type offers:

- **Reciprocating compressors.** This design uses a piston to maintain pressure in a tank. It is prone to heat build-up in the compressor head and condensation build-up. Reciprocating compressors are available in a variety of capacities, require moderate maintenance, and are easy to rebuild.
- **Scroll compressors.** Use a rotating scroll to compress air. They generally are more efficient than reciprocating designs at higher volumes and more frequent use, and deliver greater volume and good pressure.
- **Centrifugal compressors.** Typically used for large shops, they provide large quantities of air at relatively low pressures. They are low-maintenance, and can be energy-efficient when run at 80 percent or greater of peak capacity throughout the day. They are extremely inefficient at lower capacities.

For efficient compressor operation:

- Periodically check belts for wear and tension
- Lubricate moving parts per manufacturer's maintenance recommendations
- Frequently empty water separators
- Change air-filters at manufacturer-recommended intervals. Consult a compressor product and service provider to determine the most appropriate system size and energy efficiency for the facility.

G.2.2 Paint Booths

Paint booths are energy-intensive. Automotive refinishing often involves HVLP (High-volume, Low-pressure) guns that require large volumes of air and ventilation systems necessary to remove vapors and particulates from the booths. However, today's paint booths are much more efficient than those available just five to ten years ago, with manufacturers offering premium motors, improved air-flow and ducting, variable speed drives and controls, and more efficient lighting. When selecting a new paint booth, ask suppliers if they incorporate these features and if they have data comparing the efficiency of their booths to other manufacturers'. For existing booths, consult booth suppliers and/or a qualified electrician to determine if cost-effective energy-efficient features can be retrofitted.

G.2.3 Car Wash and Detailing Facilities

Many dealerships have on-site vehicle washing centers or bays. These range from simple pressure washers to automated car washes with rollers and dryers. These washers can be extremely energy- and water-intensive resulting in significant energy costs.

For any new construction, consider the following:

- At a minimum, HID lighting such as metal halide lamps should be specified and, in many

applications, T8 lamps will provide better energy efficiency.

- Where electricity is the only fuel available, consider heat pumps for water heating. By concentrating existing heat, heat pumps cost much less to operate than electric resistance heating and sometimes even gas heating units.
- Where gas is the primary water heating fuel, carefully evaluate boiler efficiencies, looking for a minimum 8% annual fuel use efficiency (AFUE).
- Maintain boilers regularly, checking for combustion efficiency and sediment.
- Specify NEMA premium motors and consider variable speed drives.
- Evaluate water reclamation systems as they can reduce water use by up to 60 percent.

G.2.4 Bay Doors

Bay doors may open and close dozens of times a day as motor vehicles enter and exit, increasing heating and cooling loads. In some facilities, these doors are left open unnecessarily for long periods of time. To reduce energy losses from bay doors:

- **Check seals to minimize air infiltration.** Replace missing cracked or hardened seals.
- **For new doors,** specify interior and exterior thermal breaks and R-10 or greater.
- **For new installations,** specify automatic sensor-driven bay door actuators to ensure that doors close immediately after vehicles or persons enter or exit. Newer high-speed units safely close doors in a fraction of the time older units take.
- **Educate employees** on the energy efficiency value of keeping doors shut.

G.2.5 Specialty Task Lighting in Shop Areas

Shop areas require a variety of specialty task lighting. These include mobile task lights, such as the work or “drag” lights used to illuminate vehicles during servicing. Older drag lights use incandescent lamps or halogen bulbs, both of which are energy-intensive and inefficient. LED illuminated drag and mobile lights now are available. The advantages of these energy-efficient drag lights include:

- **Reduced energy consumption.** Incandescent drag lights use 60 to 100 watts while LED drag lights use five to eight watts.
- **Increased safety.** Incandescent and halogen drag lights can cause severe burns; LED drag lights will not.
- **Improved Durability.** Incandescent and halogen drag lights are prone to filament and lamp breakage. LED lighting, which is solid state, is very resistant to impacts.

G.3 RESOURCES AND LINKS

This section includes online resources that can help your dealership learn more about energy use and energy efficiency.

- ENERGY STAR materials for Auto Dealers:
<http://www.energystar.gov/buildings/facility-owners-and-managers/small-biz/auto-dealers>
- ENERGY STAR Commercial Light Fixtures:
<http://www.energystar.gov/products/certified-products/detail/7581/partners>
- The SBA Energy Efficiency for Auto Dealers:
www.sba.gov/content/energy-efficiency-auto-dealers

Appendix H – Lodging

The U.S.' 47,000 hotels and motels spend about 6% of their operating costs on energy each year. The varied nature of the physical facilities and activities that they host can make energy management especially challenging. Whether the facility is a large convention hotel, part of a national chain, or a small inn or motel, it is important that you tailor your energy plan for your business' individual needs. The opportunities for enhanced guest comfort, longer equipment life, lower operating costs, and an improved corporate image make pursuing energy efficiency worthwhile.



According to the U.S. Energy Information Administration, hotels and motels generally use the most electricity for lighting, followed by cooling. This appendix will help you target energy use in these areas. However, before you fine-tune your energy program, remember to first use this Small Business Action Workbook as a resource to help you make simple no- and low-cost changes that can affect your bottom line energy consumption. This appendix will help you take your energy program one step further by providing additional guidance tailored for hotels and motels that includes:

- How to profile your energy use
- Tips that can help you save energy and money
- Where to find hotel- and motel-specific, online resources.

H.1 PROFILING YOUR ENERGY USE

If you own or operate a hotel, motel, bed and breakfast, or guesthouse, you face special challenges regarding energy management. Hotels and motels operate 24 hours a day, hosting guests and offering various services and amenities. Guest rooms, public lobbies, banquet facilities and restaurants, lounges, offices, retail outlets, and swimming pools occupy the building or multiple buildings. Ice machines, vending machines, and game rooms are often scattered throughout the facilities. Laundries and kitchens are typically located on-site. The variety of services and amenities provided, and the need to operate around the clock mean that hotels and motels present abundant opportunities for energy savings.

ENERGY STAR partners in the hospitality industry have greatly reduced their expenditures on energy through measures such as lighting upgrades in guest rooms, lobbies, and hallways; occupancy-based

guest-room energy controls; and the installation of energy-efficient water heating equipment, while still providing benefits for hotel guests, owners, operators, and shareholders.

Hotel and motel buildings may use more or less energy for many reasons, including variable equipment efficiency and energy management practices, as well as variations in climate and business activities. Business activity and climate are often correlated with energy consumption. For example, hotels that have more workers per square foot, more commercial refrigeration units per square foot, and/or experience more cooling degree days (CDD) use more energy, on average.

H.2 TIPS FOR ENERGY SAVING AT YOUR HOTEL

Be sure to refer to Appendix B which includes additional information on lighting and HVAC. Another resource you may want to consider is the ENERGY STAR Building Upgrade Manual at www.energystar.gov/BldgManual. This manual is a comprehensive guide to energy efficiency upgrades presented in an easy-to-understand framework. Chapter 12 of that manual provides resources and assistance that can help your hotel or motel achieve exemplary energy-performance goals.

H.2.1 Lighting

Lighting represents almost a quarter of all electricity consumed in a typical hotel, not including its effect on cooling loads. Lighting retrofits can reduce lighting electricity use by 50 percent or more, depending on the starting point, and cut cooling energy requirements by 10 to 20 percent as well. Here are a few basic strategies to make your lodging facilities more energy efficient:

- **Install timers** on bathroom heat lamps and consider connecting bathroom exhaust fans to light switches to reduce excessive operation.
- **Replace light bulbs with more efficient ones.**
- **Use Daylighting.** Natural daylight has been shown to improve a hotel's indoor environment while reducing energy use and peak demand. Whenever possible, any lighting renovation should start by using daylighting as much as possible and reducing electric lighting accordingly.
- **Update lighting with ENERGY STAR certified LED bulbs.** In back-room areas such as kitchens and office space, incandescent and T12 fluorescent lamps can be replaced with LEDs and high-performance T8 lamps and electronic ballasts, a combination that can reduce lighting energy consumption by 35 percent. In guest rooms, LEDs are becoming the standard for table, floor, and reading lamps, and in recessed and vanity lighting in the bathroom.
- **Install occupancy sensors.** Occupancy sensors detect the motion of room occupants, turning off lights in unoccupied areas and turning them back on when movement is detected. Occupancy sensors save energy and also help to reduce maintenance costs. Turning fluorescents off for 12 hours each day can extend their expected calendar life by 75 percent, to nearly seven years. In large restrooms, ceiling-mounted ultrasonic occupancy sensors detect occupants around partitions and corners. For hallways, a recommended strategy is to use a combination of scheduled lighting and dimming plus occupancy-sensor controls after hours. Guests may not like a totally darkened hallway, but dimming lights in unoccupied hallways and stairwells and then turning them up to full brightness

when someone enters is a sensible approach. Occupancy sensors are also appropriate for meeting rooms and back rooms.

H.2.2 Heating and Cooling

Heating and cooling represent almost 40 percent of the electricity and more than half of the natural gas used by hotels and motels. Many hotels heat and cool rooms regardless of whether they are occupied, despite studies having shown that hotel rooms are unoccupied for 12 hours a day on average.

- **Link your energy management system (EMS)**, reservation system, and automated check-out system together to keep an unsold room ventilated but with minimal heating or cooling. A sold room can be heated or cooled to a comfortable temperature an hour before a guest's scheduled arrival. Once the guests arrive in the room, they can then adjust the temperature as they like until they check out, when the HVAC system returns to the unsold mode. An EMS can enhance guest comfort while reducing energy costs by 35 to 45 percent, for a return on investment of 50 to 75 percent.
- **Seal cracks** around windows, doors, and through-the-wall or window type HVAC units with caulk and weather-strip doors and operable windows.
- **Change your air filter regularly.** Check your filter every month, especially during heavy use months (winter and summer). If the filter looks dirty after a month, change it. At a minimum, change the filter every 3 months. A dirty filter will slow down air flow and make the system work harder to keep you warm or cool—wasting energy.
- **Tune up your HVAC equipment yearly.** Just as a tune-up for your car can improve your gas mileage, a yearly tune-up of your heating and cooling system can improve efficiency and comfort.
- **During periods of low occupancy**, close down entire wings or floors and reduce lighting and HVAC systems in these areas.
- **Assign guests to adjoining rooms** to allow the heating and cooling of occupied rooms to act as a buffer or insulator.

H.2.3 Housekeeping, Maintenance, and Management

- **Housekeepers can turn off** guest room lights, televisions, heating or cooling, and radios when rooms are unoccupied.
- **Reduce heat gain in the summer and heat loss in the winter** by closing window draperies and shades when exiting guest rooms.
- **Educate your housekeeping staff to use natural lighting** when making up and cleaning guest rooms, limiting their use of artificial light.
- **Repair leaking water fixtures immediately.**
- **Always buy ENERGY STAR certified products for your business.** The ENERGY STAR mark indicates the most efficient computers, printers, copiers, televisions, windows, thermostats, ceiling fans, and other appliances and equipment.

- **Use power management features:** place computers (CPU, hard drive, etc.) into a low-power "sleep mode" after a designated period of inactivity. You can also purchase a commercial software power management package.

H.3 RESOURCES AND LINKS

This section includes online resources that can help your business learn more about hotel-specific energy use and energy efficiency.

- ENERGY STAR DataTrends: Energy Use in Hotels:
www.energystar.gov/sites/default/files/buildings/tools/DataTrends_Hotel.pdf
- ENERGY STAR Building Upgrade Manual Chapter 12: Hotels and Motels:
www.energystar.gov/buildings/tools-and-resources/energy-star-building-upgrade-manual-chapter-12-hotels-and-motels
- ENERGY STAR Certified Products: <http://www.energystar.gov/products/certified-products>
- ENERGY STAR Computers for Consumers:
www.energystar.gov/products/certified-products/detail/computers
- ENERGY STAR: Activating Power Management Software:
www.energystar.gov/index.cfm?c=power_mgt.pr_power_mgt_comm_packages
- WaterSense Hotel Challenge:
<http://www.epa.gov/watersense/commercial/challenge.html>
- SBA Information on Energy Efficiency and Lodging:
<http://www.sba.gov/content/energy-efficiency-lodging>
- International Council on Hotel, Restaurant, and Institutional Education: chrie.org
- American Hotel & Lodging Association's Green Resource Center: www.ahla.com/green.aspx
- Green Globe: <http://www.greenglobe.com>
- "Green" Hotels Association: <http://www.greenhotels.com>
- Green Restaurant Association: <http://www.dinegreen.com>
- Green Seal: <http://www.greenseal.org>

Appendix I – Commercial and Non-profit Offices: Owners and Tenants

According to the U.S. Energy Information Administration, office spaces generally use the most electricity for lighting, followed by cooling, then computers. This appendix will help you target energy use in these areas. If you rent office space, take an active role in improving the efficiency of your building by contacting your landlord and collectively establishing performance goals. However, before you fine-tune your energy program with office-specific energy upgrades, remember to first refer to the Small Business Action Workbook. This resource will help you



make simple no- and low-cost changes that can affect your bottom line energy consumption; and remember these apply to all businesses! In particular, refer to Step 2, Assess Performance; this step outlines how to create an energy baseline for your office in Portfolio Manager, how to benchmark your office, and how to conduct a technical walkthrough to identify and implement Sure Energy Savers. This appendix will help you take your energy program one step further by providing additional guidance tailored for office space that includes:

- How to profile your office's energy use
- What office-specific tips can help you save energy and money
- Where to find office-specific online resources.

I.1 PROFILING YOUR ENERGY USE

If your business mainly consists of office space, you face specific challenges and opportunities regarding energy management. For example, if your business rents office space, you may need to coordinate energy efficient projects with your landlord and/or co-tenants. Facilities that are not active 24 hours a day can benefit from managing lighting, heating and cooling, and equipment use. Make sure to turn these services down or off when not in use.

If you are a tenant, ENERGY STAR has published *Successes in Sustainability: Landlords and Tenants Team Up to Improve Energy Efficiency*. This 28-page report profiles several commercial real estate owners, managers, and tenants who are tapping into the power of collaboration to overcome barriers to create high-performance, sustainable buildings. These innovative organizations demonstrate the value of retrofitting leased space as green space, measuring and sharing energy data to enable efficiency, and engaging employees. Their stories serve as models for other landlords and tenants who face challenges in coming together for top performance.

EPA's ENERGY STAR DataTrends: Energy Use in Office Buildings examines benchmarking and trends in the energy and water consumption in office spaces. On the whole, office spaces have no "typical operating profile." Energy use intensity (EUI) varies widely, ranging from less than 100 kBtu per square foot to more than 1,000 kBtu per square foot across all office buildings.

I.2 SPECIFIC RESOURCES FOR NON-PROFIT OFFICES

Many non-profit organizations operating in the United States are based in offices and can use the energy saving information included below (for those non-profits with other types of properties, ENERGY STAR most likely has resources for you as well; please see <https://www.energystar.gov/smallbiz>). The majority of non-profit organizations operate with a mission to advance social causes or advocate for specific groups on a limited budget. With this in mind, being able to highlight the organization's role in conserving energy (and money) is likely attractive to donors, members, and employees. Energy efficiency solutions can be fairly simple and low-cost; while having a measurable impact on energy savings for the organization.

Due to the financial structure of many non-profits, paying upfront for efficiency upgrades may not be feasible. Many organizations can qualify for federal, state, and local incentives for energy efficiency upgrades that are specifically targeted toward non-profits. However, since non-profits are tax-exempt organizations, they do not qualify for incentives that are in the form of tax rebates or credits. The Database of State Incentives for Renewables and Efficiency (DSIRE) provides specific information on federal, state, and utility programs to promote renewable energy and energy efficiency (www.dsireusa.org). Non-profit organizations should also consider looking at grant opportunities from foundations and other organizations that support energy efficiency upgrades. Although proposals take time and resources, a successful application can provide funds that the non-profit would not have been easily able to identify otherwise.

I.3 TIPS FOR ENERGY SAVING AT YOUR OFFICE

Be sure to refer to Appendix B which includes additional information on lighting, HVAC, and computers (as well as other office equipment, such as kitchen equipment and copy machines). Inefficient office equipment not only draws power, but also emits heat that can contribute to higher cooling bills. Another resource to consider is the ENERGY STAR Building Upgrade Manual at www.energystar.gov/BldgManual.

I.3.1 Lighting

Lighting products that have earned the ENERGY STAR deliver exceptional features while using less energy. ENERGY STAR certified lighting products combine quality and attractive design with the highest levels of energy efficiency available today. ENERGY STAR certified fixtures typically use one-quarter the energy of traditional lighting and distribute light more efficiently and evenly than standard fixtures. In addition to bulbs and fixtures themselves, your office can employ lighting controls and/or sensors to reduce energy use. Here are some office lighting tips:

- **Employ bi-level switching.** Bi-level switching allows you to control a lighting system in groups of fixtures or lamps. For example, bi-level switching allows you to turn off half of the lights in a room off when full illumination is not required.
- **Dim the lights.** Dimmers are available for LEDs. Daylight dimmers are special sensors that automatically dim room lights based on the amount of free and natural daylight available.
- **Install occupancy sensors.** Occupancy sensors detect the motion of room occupants, turning off lights in unoccupied areas and turning them back on when movement is detected.
- **Try daylight sensors (photocells).** A common inefficiency of exterior lighting systems is a tendency to “dayburn,” leaving exterior lights on during the day, wasting energy and money. This problem can be prevented by installing daylight sensors that turn the lights on and off automatically.

1.3.2 Heating and Cooling

Although heating and cooling systems provide a useful service by keeping employees comfortable, they also account for a significant portion of a building’s energy use—typically about a quarter. However, it is possible to lessen this impact in both central and unitary systems by increasing their efficiency. For more information, see the *ENERGY STAR Guide to Energy-Efficient Heating and Cooling*. Here are some tips you can employ in your office space:

- **Change your air filter regularly.** Check your filter every month, especially during heavy use months (winter and summer). If the filter looks dirty after a month, change it. At a minimum, change the filter every 3 months. A dirty filter will slow down air flow and make the system work harder to keep you warm or cool—wasting energy.
- **Tune up your HVAC equipment yearly.** Just as a tune-up for your car can improve your gas mileage, a yearly tune-up of your heating and cooling system can improve efficiency and comfort. Use the *ENERGY STAR Maintenance Checklist* as a guide.
- **Install a programmable thermostat.** A programmable thermostat is ideal for office spaces that are unoccupied during set periods of time throughout the week. Through proper use of pre-programmed settings, a programmable thermostat can save you about \$180 every year in energy costs.
- **Seal your heating and cooling ducts.** Ducts that move air to-and-from a forced air furnace, central air conditioner, or heat pump are often big energy wasters. Sealing and insulating ducts can improve the efficiency of your heating and cooling system by as much as 20 percent and sometimes much more. See the *ENERGY STAR Duct Sealing brochure* for more information.

1.3.3 Computers and Other Office Equipment

ENERGY STAR qualified computers deliver substantial savings over standard models. In fact, if all computers sold in the U.S. were ENERGY STAR certified products, the U.S. would avoid 15 billion pounds of greenhouse gas emissions annually (more than \$1 billion in energy costs). Desktops, integrated desktops, notebook (laptop) computers, workstations, and small-scale servers are all eligible to earn the ENERGY STAR. Check out ENERGY STAR computers for consumers to find ENERGY STAR certified computer specifications and buying guidance. You can also estimate your office’s savings potential for

computers and laptops using the ENERGY STAR Office Equipment Savings Calculator. Here are some tips to consider for computers and other equipment in your office:

- **Always buy ENERGY STAR certified products for your business.** The ENERGY STAR mark indicates the most efficient computers, printers, copiers, televisions, windows, thermostats, ceiling fans, and other appliances and equipment.
- **Use power management features.** Place computers (CPU, hard drive, etc.) into a low-power "sleep mode" after a designated period of inactivity. You can also purchase a commercial software power management package.
- **Print double sided pages;** much more energy is used in the manufacturing and distributing of paper than the actual printing at your office.
- **Many offices have a variety of kitchen appliances such as refrigerators and dishwashers.** ENERGY STAR certified appliances incorporate advanced technologies that use 10% to 50% less energy and water than standard models.
- **Maintain an air-gap** of at least three inches between the back of refrigerators, water coolers, and freezers and the wall. Also, keep condenser coils clean.
- **Use timers** to ensure that coffee maker heating elements are not operating during off hours.
- **Use dishwashers only when full** to conserve energy, water, and detergent.

I.4 RESOURCES AND LINKS

This section includes online resources that can help your business learn more about office-specific energy use and energy efficiency.

- ENERGY STAR Successes in Sustainability: Landlords and Tenants Team Up to Improve Energy Efficiency:
www.energystar.gov/buildings/tools-and-resources/successes-sustainability-landlords-tenants-team-improve-energy-efficiency
- ENERGY STAR DataTrends: Energy Use in Office Buildings:
www.energystar.gov/buildings/tools-and-resources/datatrends-energy-use-office-buildings
- ENERGY STAR Building Upgrade Manual: www.energystar.gov/BldgManual
- ENERGY STAR Office Equipment Product Finder:
www.energystar.gov/index.cfm?c=ofc equip.pr office equipment
- ENERGY STAR Office Equipment Savings Calculator:
<http://www.energystar.gov/sites/default/files/asset/document/Office%20Equipment%20Calculator.xlsx>
- ENERGY STAR Certified Products: <http://www.energystar.gov/products/certified-products>
- ENERGY STAR Computers for Consumers:
www.energystar.gov/products/certified-products/detail/computers
- ENERGY STAR: Activating Power Management Software:
www.energystar.gov/index.cfm?c=power_mgt.pr power_mgt_comm_packages
- DOE Office of Energy Efficiency and Renewable Energy: Buildings Technology Office:
energy.gov/eere/buildings/building-technologies-office
- DOE Office of Energy Efficiency and Renewable Energy: Take Action to Save Energy in Commercial Buildings: energy.gov/eere/buildings/take-action-save-energy-commercial-buildings

Appendix J – Grocery and Convenience Stores

As a grocery or convenience store owner/operator, you understand that energy management is a top priority in the success and sustainability of your business. Therefore, it's important to seek out new ways to reduce your daily energy usage, whether it's by optimizing current energy use or embedding energy awareness in your company's culture. This section will be a resource to help you build an energy efficiency program that works for your business. This appendix is organized in the following sections:



- How to profile your store's energy use
- Specific tips to save energy and money
- Additional links and resources for your store.

J.1 PROFILING YOUR ENERGY USE

The food-sales industry shares many of the energy-related challenges seen in other business sectors, such as lighting, heating and cooling, appliances, etc., but what sets it apart is its high dependence on refrigeration. For supermarkets, grocery stores, or convenience stores, refrigeration may use up to 40 percent of the property's total energy. That's why it's important to maintain refrigeration systems and to learn about the multitude of energy efficiency options available in today's market. Better technology and improved practices can be applied to all types of refrigeration equipment, such as reach-in, walk-in, and under the counter refrigerators/freezers, as well as a multitude of food/drink storage units and display cases. The following tips are designed to help your business improve the efficiency of its refrigeration, thereby reducing operating costs, saving energy, and preventing pollution.

J.2 TIPS FOR ENERGY SAVING AT YOUR GROCERY/CONVENIENCE STORE

If you'd like to have some general information on how to improve energy use at your place of business, please refer to Appendix B. The following are helpful tips designed specifically for grocery and convenience stores:

J.2.1 Refrigeration

- **Purchase** ENERGY STAR certified refrigerators and freezers which can save you energy and money over time. You may be able to find rebates for your purchase from ENERGY STAR Partners.
- **Keep the doors of all refrigeration and freezer units shut** as much as possible as repeated fluctuations in temperature will damage food quality and cost money.
- **Check the temperature settings of your units.** If the temperature is set lower than necessary, you are probably wasting energy. The most common recommended settings are between -14° and -8° Fahrenheit for freezers and between 35° and 38° Fahrenheit for refrigerators.
- **Clean the cooling coils on the backs of all units.** Over time, dirt accumulation impairs proper heat transfer and lowers the efficiency and capacity of refrigerators. As you clean dirt and dust, watch for ice accumulation on coils and remove that as well.
- **Ensure that the door seals on your units close tightly.** Having tight seals and properly closing doors prevents warm air from entering the unit, reducing energy required for cooling as well as preventing frost build up. Use this rule of thumb: If you can easily slide a dollar bill into the seal, have the seal adjusted.

J.2.2 Lighting

Lighting products that have earned the ENERGY STAR deliver exceptional features, while using less energy. ENERGY STAR certified lighting products combine quality and attractive design with the highest levels of energy efficiency available today. ENERGY STAR certified fixtures typically use one-quarter the energy of traditional lighting and distribute light more efficiently and evenly than standard fixtures. In addition to bulbs and fixtures themselves, your store can employ lighting controls and/or sensors to reduce energy use.

J.2.3 Heating and Cooling

Although heating and cooling systems provide a useful service by keeping customers and employees comfortable, they also can account for a significant portion of a building's energy use. For more information, see the *ENERGY STAR Guide to Energy-Efficient Heating and Cooling*. Here are some tips you can employ in your retail space:

- **Change your air filter regularly.** Check your filter every month, especially during heavy use months (winter and summer). If the filter looks dirty after a month, change it. At a minimum, change the filter every three months. A dirty filter will slow down air flow and make the system work harder to keep you warm or cool—wasting energy.
- **Tune up your HVAC equipment yearly.** Just as a tune-up for your car can improve your gas mileage, a yearly tune-up of your heating and cooling system can improve efficiency and comfort. Use the *ENERGY STAR Maintenance Checklist* as a guide.
- **Install a programmable thermostat.** A programmable thermostat is ideal for areas that are unoccupied during set periods of time throughout the week. Rooms that have minimal traffic (such as stock rooms and warehouses) should be kept cooler in the winter and warmer in the summer.

- **Seal your heating and cooling ducts.** Ducts that move air to-and-from a forced air furnace, central air conditioner, or heat pump are often big energy wasters. Sealing and insulating ducts can improve the efficiency of your heating and cooling system by as much as 20 percent and sometimes much more. See the *ENERGY STAR Duct Sealing brochure* for more information.

J.3 RESOURCES AND LINKS

This section includes online resources that can help you and your employees learn more about energy use and energy efficiency.

- ENERGY STAR Building Upgrade Manual: www.energystar.gov/BldgManual
- ENERGY STAR Commercial Food Service: www.energystar.gov/cfs
- ENERGY STAR Maintenance Checklist:
http://www.energystar.gov/index.cfm?c=heat_cool.pr_maintenance
- ENERGY STAR Refrigeration Factsheet:
[http://www.energystar.gov/ia/products/downloads/Refrigerator and Freezer Fact Sheet.pdf](http://www.energystar.gov/ia/products/downloads/Refrigerator_and_Freezer_Fact_Sheet.pdf)
- ENERGY STAR for Commercial Refrigerators and Freezers:
<https://www.energystar.gov/products/certified-products/detail/7597/partners>
- ENERGY STAR Duct Sealing brochure:
http://www.energystar.gov/ia/products/heat_cool/ducts/DuctSealingBrochure04.pdf?0cbe-cc73
- ENERGY STAR Rebate Finder: <http://www.energystar.gov/rebate-finder>
- SBA Information for Grocery/Convenience Stores:
<http://www.sba.gov/content/energy-efficiency-grocery-and-convenience-stores>
- EnergySmart™ Grocer from the National Grid: <http://www.energysmartgrocer.org/ne/index.html>
- Air Conditioning, Heating, and Refrigeration Institute (AHRI): <http://www.ahrinet.org/site/1/Home>

Appendix K – Small and Medium Manufacturers

In the U.S., industries spend over \$100 billion annually to power their manufacturing plants. As a manufacturer, you understand that energy management is a top priority in the success and sustainability of your business. Therefore, it's important to seek out new ways to reduce energy in your daily usage, whether it's by optimizing current energy use or embedding energy awareness in your company's culture. Energy savings matter. This

section will be a resource to help guide you through additional savings energy-saving strategies that include the following:

- How to profile your plant's energy use
- Manufacturing-specific tips to save energy and money
- Additional links and resources for your plant and business.



K.1 PROFILING YOUR ENERGY USE

Energy is used throughout industrial facilities. Fuels heat materials in furnaces or generate hot water and steam in boilers. Steam dries, heats, or separates product flows. Electricity powers motor systems for air conditioning, lighting, and appliances. Motor systems pump fluids and compress gases or air and move them around. Compressed air drives machinery. ENERGY STAR research has demonstrated that all these systems offer considerable potential for energy-efficiency improvement and energy cost reductions, for nearly all facilities. If you reduce your energy cost per product, then you can use savings to grow market share.

Despite the diversity in energy end uses, in most plants just a few pieces of equipment consume the majority of fuel or electricity. Each plant's energy use distribution is unique, but contains overall patterns. Motor systems use the greatest amount of electricity in most industrial facilities, followed by process heating and cooling, building HVAC, and lighting. Process heating, boiler fuel, and combined heat and power (CHP), and/or cogeneration processes typically dominate fuel use. Energy savings are dollars that you would have to pay your utility. Why not save them for your business priorities?

The ENERGY STAR publication, *Managing Your Energy: An ENERGY STAR Guide for Identifying Energy Savings in Manufacturing Plants* is an excellent resource for energy savings. This guide contains easy-to-use information that identifies multiple opportunities for plants to increase efficiency and cut costs.

If you'd like a resource for instructing employees, tour the *ENERGY STAR animated manufacturing plant*. This interactive tool shows where you can save energy in industrial buildings and manufacturing plants—to raise awareness among staff and workers on the benefits and best-practices of energy use in a manufacturing facility while highlighting the environmental benefits of responsible production.

K.2 TIPS FOR ENERGY SAVING AT YOUR MANUFACTURING PLANT

This section serves as a sample of cost-effective, manufacturing-specific tips and strategies that can help you reduce energy consumption (based on the ENERGY STAR). Strategies in this section address hot water and steam, compressed air, motors, and basic manufacturing practices. The information in this appendix is intended to help energy and plant managers achieve energy reductions while maintaining product quality.

K.2.1 Motor Systems

Manage Motor Systems. Motors are found in your process equipment, HVAC systems, air compressors, and other systems. The following steps are suggested for managing your motor systems:

- Make sure you first locate and identify all motors in the facility
- Document conditions and specifications of each motor to provide a current systems inventory
- Assess the needs and the actual use of the motor systems to determine if motors are properly sized for the equipment being served and how the motor is being operated.
- Collect information on potential repairs and upgrades to the motor systems, including the economic costs and benefits of implementing repairs and upgrades, to enable the energy-efficiency improvement decision-making process
- If upgrades are pursued, monitor the performance of the upgraded motor systems to determine actual costs savings.
- For equipment that runs at different speeds, consider installing Adjustable-Speed Drives (ASD) or Variable-Speed Drives (VSD) to better match speed to load requirements for motor operations, and therefore ensure that motor energy use is optimized to a given application. Energy savings may vary from 7% to as high as 60%.

Create a Motor Management Plan. A motor management plan is another essential part of a plant's energy management strategy. It helps to support long-term motor system energy savings and to ensure that motor failures are handled quickly and cost effectively. The National Electrical Manufacturers Association (NEMA) and other organizations have created the Motor Decisions Matter (MDM) campaign to help industrial and commercial customers evaluate their motor repair and replacement options, promote cost-effective applications of NEMA Premium motors as well as "best practice" repair, and support the development of motor management plans before motors fail. The national campaign suggests the following actions for a sound motor management plan (MDM 2007):

- Prepare for motor failure by creating a spares inventory
- Develop a purchasing specification
- Develop a repair specification
- Develop and implement a predictive and preventive maintenance program
- Develop guidelines for proactive replace/repair decisions.

For more information, download the *Motor Decisions Matter Motor Planning Kit* as a guide to assist in your motor management plan. This planning kit aims to increase productivity and reliability while minimizing motor downtime, reducing operating costs, and conserving energy.

K.2.2 Compressed Air

Compressed air is one of the least energy efficient systems in an industrial plant because of the amount of energy required for compression and distribution. If compressed air is used, it should be at the minimum quantity for the shortest possible time, and it should be constantly monitored and reweighed against alternatives. Inadequate maintenance can lower compression efficiency and increase air leakage or pressure variability, and can lead to increased operating temperatures, poor moisture control, and excessive contamination of compressed air system components. Consider the following maintenance suggestions to reduce these problems and save energy:

- **Blocked pipeline filters increase pressure drop.** Keep the compressor and intercooling surfaces clean and foul-free by inspecting and periodically cleaning filters. Use filters with just a 1 pound per square inch (psi) pressure drop. The payback period for filter cleaning is usually under two years. Fixing improperly operating filters will also prevent contaminants from entering into tools, which causes them to wear out prematurely.
- **Monitor motor cooling.** Poor motor cooling can increase motor temperature and wind resistance, shortening motor life and increasing energy consumption. Keep motors and compressors properly lubricated and cleaned. Sample and analyze compressor lubricant every 1,000 hours and ensure that it is at the proper level. In addition to energy savings, this maintenance can help avoid system corrosion and degradation.
- **Monitor compressed air use.** As with maintenance, proper monitoring of compressed air systems can save energy and money. Proper monitoring includes the following:
 - ✓ Pressure gauges on each receiver or main branch line, and differential gauges across dryers and filters
 - ✓ Temperature gauges across the compressor and its cooling system to detect fouling and blockages
 - ✓ Flow meters to measure the quantity of air used
 - ✓ Dew point temperature gauges to monitor air dryer effectiveness
 - ✓ Kilowatt-hour meters and hours-run meters on the compressor drive.
- **Reduce leaks in pipes and equipment.** Air leaks can be a significant source of wasted energy. A typical plant that has not been well maintained could have a leak rate from 20% to 50% of total

compressed air production capacity. Leak repair and maintenance can reduce this number to less than 10%. Overall, fixing leaks in a compressed air system is projected to reduce annual energy consumption by 20%.

A simple way to detect large leaks is to apply soapy water to suspect areas, or to use a bag to monitor the velocity of the air filling the bag, although this may be time consuming. In the “bag test,” a plastic bag is put up to the leak and used to monitor the velocity of the air filling the bag. The best way to detect leaks is to use an ultrasonic acoustic detector, which can recognize the high-frequency hissing sounds associated with air leaks. After identifying them, leaks should be tracked, repaired, and verified.

- **Turn off unnecessary compressed air.** Equipment that is no longer using compressed air should have the air turned off completely. This can be done using a simple solenoid valve. Check compressed air distribution systems when equipment has been reconfigured to ensure no air is flowing to unused equipment or obsolete parts of the compressed air distribution system.
- **Reduce pressure.** Try to use the lowest possible pressure level to operate the system.

K.2.3 Steam Systems

The most important industrial applications for steam are process heating, drying, concentrating, steam cracking, distillation, and driving machinery such as compressors. Whatever the use or the source of the steam, efficiency improvements in steam generation, distribution, and end use are possible.

BOILER ENERGY EFFICIENCY MEASURES

The boiler energy-efficiency measures presented below focus primarily on improved process control, reduced heat loss, and improved heat recovery. When new boiler systems are needed, they should be designed and installed in a custom configuration that meets that particular plant’s needs. Often, pre-designed boilers cannot be fine-tuned to meet the unique steam generation and distribution system requirements of a specific plant in the most efficient manner:

- **Get a boiler tune-up.** When too much excess air is used to burn fuel, energy is wasted because excessive heat is transferred to the air rather than to the steam. Air slightly in excess of the ideal fuel-to-air ratio will cause the boiler to run inefficiently. A boiler tune-up will help ensure your boiler has the right fuel-to-air ratio.
- **Control boiler processes.** Flue gas monitors maintain optimum flame temperature and monitor carbon monoxide (CO), oxygen, and smoke. A small 1% air infiltration will result in 20% higher oxygen readings. A higher CO or smoke content in the exhaust gas is a sign that there is insufficient air to complete fuel burning. Using a combination of CO and oxygen readings, it is possible to optimize the fuel/air mixture for high flame temperature (and thus the best energy efficiency) and lower air pollutant emissions.
- **Reduce flue gas quantities using visual inspection.** Often excessive flue gas results from leaks in the boiler and/or in the flue. These leaks can reduce the heat transferred to the steam and increase pumping requirements. However, such leaks are often easily repaired, saving 2% to 5% of the energy formerly used by the boiler.

- **Properly size boiler systems.** Designing the boiler system to operate at the proper steam pressure can save energy by reducing stack temperature, piping radiation losses, and leaks in steam traps. Costs and savings will depend heavily on the current boiler system utilization at individual plants.
- **Improve boiler insulation.** It is possible to use new insulation materials, such as ceramic fibers, that both insulate better and have a lower heat capacity (thus allowing for more rapid heating). Savings of 6% to 26% can be achieved if improved insulation is combined with improved heater circuit controls. Due to the lower heat capacity of new insulating materials, the steam output temperature will vary more quickly with variations in the heating element temperature.
- **Implement a boiler maintenance program.** A simple maintenance program to ensure that all boiler components are operating at peak performance can result in substantial savings. In the absence of a good maintenance system, burners and condensate return systems can become worn out.
- **Return condensate to the boiler.** Reusing hot condensate in boilers saves energy, reduces the need for treated boiler feed water, and reclaims water at up to 212F of sensible heat.

STEAM DISTRIBUTION SYSTEM ENERGY EFFICIENCY MEASURES

Steam and hot water distribution systems are often quite extensive and can be major sources of energy loss. Energy efficiency improvements to steam distribution systems primarily focus on reducing heat losses throughout the system and recovering useful heat from the system wherever feasible. The following measures are some of the most significant opportunities for saving energy in industrial steam distribution systems:

- **Improve distribution system insulation.** Using more insulating material or using the best insulation material for the application can save energy in steam systems. Crucial factors in choosing insulating material include low thermal conductivity, dimensional stability under temperature change, resistance to water absorption, and resistance to combustion.
- **Maintain distribution system insulation.** It is often found that after heat distribution systems have undergone some form of repair, the insulation is not replaced. Additionally, some types of insulation can become brittle or rot over time. A regular inspection and maintenance system for insulation can save energy.
- **Improve steam traps.** Modern thermostatic element steam traps can reduce energy use while improving reliability. Their main efficiency advantages are that they open when the temperature is very close to that of saturated steam, purge non-condensable gases after each opening, and are open on startup to allow a fast steam system warm-up. These traps also have the advantage of being highly reliable and useable for a range of steam pressures.
- **Maintain and monitor steam traps.** A simple program of checking steam traps to ensure that they are operating properly can save significant amounts of energy for very little money. In the absence of such a program, it is common to find 15% to 20% of steam traps in a distribution system malfunctioning. Attaching automated monitors to steam traps in conjunction with a maintenance program can save even more energy without significantly adding costs.

- **Repair leaks.** As with steam traps, steam distribution piping networks often have leaks that can go undetected without a regular inspection and maintenance program. The U.S. DOE estimates that repairing leaks in an industrial steam distribution system will lead to energy savings of 5% to 10%.

K.2.4 Manufacturing Processes

Improving operating practices for energy efficiency is an excellent and simple source of no-cost savings opportunities. Try to practice the following as much as possible:

- Turn off idling equipment, machines, and systems
- Reduce startup and shutdown times for equipment, machines, and systems if possible
- Make sure systems are optimized and maintained for maximum productivity.

K.3 RESOURCES AND LINKS

- ENERGY STAR Small & Medium Manufacturer's Guide to Energy Management:
www.energystar.gov/SmallManufacturers
- ENERGY STAR Industrial Energy Management Information Center:
<https://www.energystar.gov/buildings/facility-owners-and-managers/industrial-plants/industrial-energy-management-information-center>
- ENERGY STAR Challenge for Industry: www.energystar.gov/industrychallenge
- ENERGY STAR Energy Treasure Hunt Guide: Simple Steps to Finding Energy Savings:
<http://www.energystar.gov/treasurehunt>
- ENERGY STAR Industrial Plant Employee Awareness Posters:
www.energystar.gov/plantposters
- ENERGY STAR Bring your Green to Work: Interactive Manufacturing Plant:
www.energystar.gov/work
- ENERGY STAR Directory of Industrial Service and Product Providers:
www.energystar.gov/ispp
- DOE Industrial Assessment Centers:
<http://energy.gov/eere/amo/industrial-assessment-centers-iacs>
- SBA Energy Efficiency for Small and Medium-Sized Manufacturers:
<http://www.sba.gov/content/energy-efficiency-small-and-medium-sized-manufacturers>
- Motor Decisions Matter Motor Planning Kit:
<http://www.motorsmatter.org/tools/mpkv21.pdf>

Appendix L – Home-Based Businesses

“What do Apple Computer, Hershey's, Mary Kay Cosmetics, and the Ford Motor Company have in common? These well-known corporations all started out as home-based businesses. More than half of all U.S. businesses are based out of an owner's home” (U.S. Small Business Administration). If your business is home-based, energy efficient projects will affect both your personal and professional bottom line. To get started, consider participating in Home Performance with ENERGY STAR, a program administered by the DOE in conjunction with the EPA. Participants improve their homes' energy efficiency with whole house solutions; typically yielding a utility bill savings of 20% or more. Home improvements fall into six general categories: 1) sealing air ducts and adding insulation; 2) improving heating and cooling systems; 3) sealing ductwork; 4) replacing windows; 5) upgrading lighting, appliances, and water heating equipment; and 6) installing renewable energy systems. You may choose to implement energy projects in one or more of these areas. Further, as your home is also your workplace, consider the top energy consumers in typical office spaces: lighting, cooling, and computers. The first projects you choose to implement may be in areas where home and business uses overlap (e.g. lighting). This appendix will help you take your home energy program one step further by providing additional guidance tailored for you that includes:



- How to profile your home's energy use
- Tips that can help you save energy and money
- Online resources to support your home-based business' energy program.

L.1 PROFILING YOUR ENERGY USE

To profile your energy use, assess the energy efficiency of your home and see how it measures using the ENERGY STAR Home Energy Yardstick. This tool provides a simple assessment of your home's annual energy use compared to similar homes. By answering a few basic questions about your home, you can get:

- Your home's Home Energy Yardstick score (on a scale of 1 to 10)
- Insights into how much of your home's energy use is related to heating and cooling versus other everyday uses like appliances, lighting, and hot water

- Links to guidance from ENERGY STAR on how to increase your home's score, improve comfort, and lower utility bills
- An estimate of your home's annual carbon emissions.

Once you have your Home Energy Yardstick score, you will be able to determine next steps. If you have a very low score, you may consider a home energy audit and/or participation in the Home Performance program. You may also choose to hire a contractor, or implement energy efficient projects yourself.

L.2 TIPS FOR ENERGY SAVING AT HOME

Be sure to refer to Appendix B - Project Sectors-Energy and Water, which includes additional information on lighting, heating and cooling, and computers (as well as other office equipment, such as kitchen equipment and copy machines). Inefficient office equipment not only draws power, but also emits heat that can contribute to higher cooling bills. Find in this section tips for home improvements in the six categories identified by the Home Performance program (with an additional section for computers and other office equipment).

L.2.1 Insulation

Air that leaks through your home's envelope—the outer walls, windows, doors, and other openings—wastes a lot of energy and increases your utility costs. A well-sealed envelope, coupled with the right amount of insulation, can make a real difference on your utility bills. Most homes in the U.S. don't have enough insulation and have significant air leaks. In fact, if you added up all the leaks, holes, and gaps in a typical home's envelope, it would be the equivalent of having a window open every day of the year!

- Seal and insulate your attic. Air sealing in the attic is generally a challenging do-it-yourself project, but the benefits can be substantial.
- Seal and insulate your basement or crawl space. Sealing air leaks and adding insulation in the basement are generally considered moderate to difficult do-it-yourself projects; if you're not comfortable taking on this project yourself, there are many qualified contractors who can help you get the work done.

L.2.2 Ductwork

In houses with forced-air heating and cooling systems, ducts are used to distribute conditioned air throughout the house. In a typical house, about 20 to 30 percent of the air that moves through the duct system is lost due to leaks, holes, and poorly connected ducts. The result is higher utility bills and difficulty keeping the house comfortable, no matter how the thermostat is set.

- **Seal your heating and cooling ducts.** Sealing and insulating ducts can improve the efficiency of your heating and cooling system by as much as 20 percent and sometimes much more. See the *ENERGY STAR Duct Sealing brochure* for more information.

L.2.3 Heating and Cooling Systems

Although heating and cooling systems provide a useful service by keeping you and your employees comfortable, they also account for a significant portion of a home's energy use; as much as half of the energy used in your home goes to heating and cooling. For more information, see how to Heat and Cool Efficiently. Here are some tips you can employ in your home:

- **Change your air filter regularly.** Check your filter every month, especially during heavy use months (winter and summer). If the filter looks dirty after a month, change it. At a minimum, change the filter every three months. A dirty filter will slow down air flow and make the system work harder to keep you warm or cool—wasting energy.
- **Tune up your HVAC equipment yearly.** Just as a tune-up for your car can improve your gas mileage, a yearly tune-up of your heating and cooling system can improve efficiency and comfort. Use the *ENERGY STAR Maintenance Checklist* as a guide.
- **Install a programmable thermostat.** A programmable thermostat is ideal for office spaces that are unoccupied during set periods of time throughout the week. Through proper use of pre-programmed settings, a programmable thermostat can save you about \$180 every year in energy costs.

L.2.4 Windows

Replacing old windows with ENERGY STAR certified windows lowers household energy bills by 7 – 15 percent. Lower energy consumption also reduces greenhouse gas emissions from power plants and shrinks a house's carbon footprint. You may also:

- **Caulk and weather-strip around windows and doors.** Check for signs of air leakage around windows and doors. Then use caulk and weather-stripping to stop the leaks.
- **Use drapes to stay comfortable.** During cold weather, take advantage of the sun's warmth by keeping drapes open on south facing windows during daylight hours. To keep out the heat of the summer sun, close window shades and drapes in warm weather.
- **Make sure your windows and doors are closed** when the air conditioning or heat is on to keep the warmed or cooled air in the house.
- **Replace your screens with storm windows.** During the winter months, replace screens with storm windows to provide an extra barrier to the cold outside air. This will help create a more comfortable living space inside your home.

L.2.5 Lighting, Appliances, and Water Heating Equipment

Lighting products that have earned the ENERGY STAR deliver exceptional features, while using less energy. ENERGY STAR certified lighting products combine quality and attractive design with the highest levels of energy efficiency available today. ENERGY STAR certified fixtures typically use one-quarter the energy of traditional lighting and distribute light more efficiently and evenly than standard fixtures. In addition to bulbs and fixtures themselves, your home office can employ lighting controls and/or sensors to reduce energy use.

Water heaters are the second highest source of energy usage in the home. ENERGY STAR certified water heaters use 14 – 55% less energy than equipment that meets the minimum federal standard. Here are some lighting and water heating tips:

- **Replace incandescent light bulbs with ENERGY STAR certified LEDs bulbs.** The ENERGY STAR label lets you know this bulb is independently certified and has undergone extensive testing to ensure energy savings and performance promises.
- **Choose ENERGY STAR light fixtures.** If every U.S. household replaced the five most frequently used light fixtures with ENERGY STAR certified fixtures, it would prevent greenhouse gas emissions equivalent to those from 10 million cars.
- **Dim the lights.** Dimmers are available for LEDs. Daylight dimmers are special sensors that automatically dim room lights based on the amount of free and natural daylight available.
- **Choose an ENERGY STAR certified Electric Heat Pump** or Gas Storage water heater.
- **Insulate your electric water heater.** Wrap your water heater in an insulating jacket. Increased insulation slows heat loss through the walls of the water heater. Even if your water heater is in a heated part of your home, energy loss through the walls of the water heater can be significant.
- **Lower your water heater temperature.** Set your water heater thermostat at 120 degrees F or lower. This way you'll reduce the amount of energy it takes to produce and maintain your hot water by not overheating it.

L.2.6 Computers and Other Office Equipment

ENERGY STAR certified computers deliver substantial savings over standard models. Desktops, integrated desktops, notebook (laptop) computers, workstations, and small-scale servers are all eligible to earn the ENERGY STAR. Here are some tips to consider for computers and other equipment in your office:

- **Always buy ENERGY STAR certified products.** The ENERGY STAR mark indicates the most efficient computers, printers, copiers, televisions, windows, thermostats, ceiling fans, and other appliances and equipment.
- **Use power management features:** place computers (CPU, hard drive, etc.) into a low-power “sleep mode” after a designated period of inactivity. You can also purchase a commercial software power management package.
- **Print double-sided pages;** much more energy is used in the manufacturing and distributing of paper than the actual printing at your office.

L.2.7 Install renewable energy systems

Once you have made energy efficiency improvements to your home, you may consider additional measures, such as installing solar panels or a solar hot water system. An ENERGY STAR certified solar water heating system can cut your annual hot water costs in half, and is generally designed for use with an electric or gas back-up water heater.

L.3 RESOURCES AND LINKS

This section includes online resources that can help your home-based business:

- Home Performance with ENERGY STAR:
www.energystar.gov/index.cfm?fuseaction=hpwes_profiles.showSplash&s=mega
- ENERGY STAR Energy Savings at Home: www.energystar.gov/campaign/waysToSave
- ENERGY STAR Maintenance Checklist:
http://www.energystar.gov/index.cfm?c=heat_cool.pr_maintenance
- ENERGY STAR Home Energy Audits:
www.energystar.gov/index.cfm?c=home_improvement.hm_improvement_audits
- ENERGY STAR Recommendations for Finding a Contractor:
www.energystar.gov/index.cfm?c=home_improvement.hm_improvement_contractors
- ENERGY STAR Attic Air Sealing Project:
www.energystar.gov/index.cfm?c=home_sealing.hm_improvement_attic
- ENERGY STAR Basement and Crawlspace Air Sealing and Insulating:
www.energystar.gov/index.cfm?c=home_sealing.hm_improvement_basement
- ENERGY STAR Duct Sealing brochure:
http://www.energystar.gov/ia/products/heat_cool/ducts/DuctSealingBrochure04.pdf?0cbe-cc73
- ENERGY STAR Rebate Finder: <http://www.energystar.gov/rebate-finder>
- ENERGY STAR Office Equipment Savings Calculator:
www.energystar.gov/sites/default/files/asset/document/Office%20Equipment%20Calculator.xlsx
- ENERGY STAR: Activating Power Management Software:
www.energystar.gov/index.cfm?c=power_mgt.pr_power_mgt_comm_packages
- ENERGY STAR Qualified Solar Water Heaters:
http://www.energystar.gov/index.cfm?c=solar_wheat.pr_savings_benefits
- Renewable Energy Ready Home Solar Site Assessment Tool:
<https://www.energystar.gov/index.cfm?c=rerh.assessment>
- WaterSense Homes Program: http://www.epa.gov/watersense/new_homes/index.html
- SBA Energy Efficiency for Home Based Businesses:
www.sba.gov/content/energy-efficiency-home-based-businesses
- Lawrence Berkeley National Laboratory's Home Energy Saver: hes.lbl.gov/consumer/

Appendix M –SBA Energy Efficiency Resources

The SBA was created in 1953 as an independent agency of the federal government to aid, counsel, assist, and protect the interests of small business concerns, to preserve free competitive enterprise and to maintain and strengthen the overall economy of our nation.



U.S. Small Business Administration

The SBA recognizes that small business is critical to our economic recovery and strength, to building America's future, and to helping the U.S. compete in today's global marketplace. Although the SBA has grown and evolved in the years since it was established in 1953, the bottom line mission remains the same. The SBA helps Americans start, build, and grow businesses.

Today, there's a new focus on environmental responsibility, and the SBA can help your small businesses make a difference. Help protect our ecosystem and serve your customers who value your environmental efforts. When considering an energy policy and energy efficiency improvements, consult the SBA's Green Business Guide at <https://www.sba.gov/green-business-guide>. This includes information on:

- **Green marketing.** If you are already competitive in terms of price, quality and performance, adding sustainability and green marketing to your business strategy may enhance your brand image.
- **Green business case studies.** Find out about a few of the most well-known green business and their commitments to economic success.
- **Green business practices.** Every business can make simple changes that save energy costs and natural resources.
- **Green certification and eco-labeling.** Eco-labeling is important way to market your product to green consumers and differentiate your product or service as environmentally sound.
- **Environmental grants and loans.** Find financial resources to pay for energy efficient upgrades to your facilities, to finance your business's innovative environmental products and technologies and to support your environmentally friendly business.
- **Green commuting.** Learn more about green alternatives to your daily commute.

In addition to the Green Business Guide, the SBA offers several energy efficiency programs highlighted in the appendix. These include: 1) Certified Development Company (CDC) Energy Efficiency Public Policy Incentives; 2) the Economy, Energy, and the Environment (E3) program; 3) the Small Business Innovation Research (SBIR) Program; and 4) Small Business Investment Company (SBIC) Program. This appendix also contains additional SBA online resources and links.

M.1 CDC ENERGY EFFICIENCY PUBLIC POLICY INCENTIVES

The CDC/504 loan program provides financial assistance to small businesses that design, engineer, manufacture, distribute, market, install, or service energy saving equipment. Loan proceeds can be used for land acquisition, plant construction, equipment, and supplies needed to develop energy conservation devices or techniques.

Within the SBA's 504 loan program, an entrepreneur's project can qualify for a debenture, or long-term fixed-rate financing for major fixed assets (up to \$5 million). Under the Energy/Efficiency Public Policy Goals, the applicant's project can qualify for a larger debenture amount (\$5.5 million) if any of the following goals are met:

- Reduction of energy consumption by at least 10% from an existing business
- Replacing an existing facility by buying/constructing a new one that uses at least 10% less energy (Note: the new facility must be located in same general area)
- Increased use of sustainable designs that reduce the use of greenhouse gas and non-renewable resources and minimize harmful environmental impact
- Installation of equipment and/or upgrades that will process renewable energy sources, including biodiesel and ethanol producers.

There can be more than one project (for small manufacturers and eligible energy projects) for the same applicant or for its affiliates provided the SBA determines that each project meets prudent lending standards. In addition, the applicant must document the project's compliance through an energy audit, engineering report, or other professional evaluation.

M.2 E3 PROGRAM

E3 is a technical assistance framework that advises manufacturers and manufacturing supply chains through community engagement to adapt and thrive in today's green economy. The SBA engages its Small Business Development Center (SBDC) network to provide existing services which may include pre-participation financial stability assessments of prospective E3 companies, and business counseling services to small businesses involved in E3 projects or not yet involved due to financial constraints. The SBA also provides information about lending resources and securing SBA guaranteed loans to implement recommendations from on-site technical reviews. Current partners include a number of federal agencies like the SBA, the DOE, the EPA, the Department of Commerce/ National Institute of Standards and Technology, and the Department of Labor, among others.

M.3 SBIR PROGRAM

The Small Business Innovation Research (SBIR) program is a highly competitive program that encourages domestic small businesses to engage in Federal Research/Research and Development (R/R&D) that has the potential for commercialization.

An SBIR small business is defined as a for-profit organization with no more than 500 employees. The EPA is one of 11 federal agencies that participate in the SBIR program. The EPA issues annual solicitations for Phase I and Phase II research proposals from science and technology-based firms. Under Phase I, the scientific merit and technical feasibility of the proposed concept is investigated. EPA awards firm-fixed-price Phase I contracts of up to \$80,000 for 6 months. Through this phased approach to SBIR funding, EPA can determine whether the research idea, often on high-risk advanced concepts, is technically feasible, whether the firm can do high-quality research, and whether sufficient progress has been made to justify a larger Phase II effort.

Phase II contracts are limited to small businesses that have successfully completed their Phase I contracts. The objective of Phase II is to develop and commercialize the Phase I technology. Competitive awards are based on the results of Phase I and the commercialization potential of the Phase II technology. In Phase II, the EPA awards contracts of up to \$300,000 for two years. EPA also offers a "Commercialization Option" of up to \$70,000 and one additional year for firms with third party financing for accelerating commercialization.

M.4 SMALL BUSINESS INVESTMENT COMPANY (SBIC) PROGRAM

In 2011, the SBA launched an Impact Investment Fund that provides roughly \$200 million a year to Impact SBICs that invest with the goal of maximizing financial returns and generating enhanced social, environmental, or economic impact. Alongside investments in underserved geographies and the education sector, the Impact Fund has designated "clean energy" as a national priority sector. Investment funds that meet the qualifications for an SBIC license and which focus on investments in the clean energy sector are eligible for an Impact SBIC license and an expedited application review process.

In 2012, the SBA introduced its second energy-related change to the SBIC Program with its launch of the Energy-Savings Debenture (ESD). Included as part of the Energy Independent and Security Act of 2007, the ESD is a financing instrument available to all SBICs but which can only be used for investments related to energy-saving activities. Together, these two elements of the SBIC Program are meant to attract fund managers with the expertise needed to identify and finance promising small businesses active in the clean energy economy.

M.5 SBA RESOURCES AND LINKS

- Green Business Guide: www.sba.gov/green-business-guide
- Small Business Loans: www.sba.gov/category/navigation-structure/loans-grants
- CDC/504 Loan Program: www.sba.gov/offices/headquarters/oca/resources/5991
- Small Business Innovative Research (SBIR) / Small Business Technology Transfer (STTR):
www.sbir.gov
- Small Business Investment Company (SBIC) Program:
www.sba.gov/category/lender-navigation/sba-loan-programs/sbic-program-0
- SBIC Impact Investment Fund:
www.sba.gov/category/lender-navigation/sba-loan-programs/sbic-program/general-information/impact-investment-sbic

Appendix N – EPA Green Power Partnership

EPA's Green Power Partnership is a voluntary program helping to increase the use of green power among leading U.S. organizations. Organizations are encouraged to purchase green power as a way to reduce the environmental impacts associated with conventional electricity use.



The Green Power Partnership works with more than a thousand leading organizations, including Fortune 500® companies, local, state, and federal government agencies, manufacturers and retailers, trade associations, and a growing number of colleges and universities. Partners are purchasing billions of kilowatt-hours (KWh) of green power annually, which has the equivalent impact of removing the emissions of hundreds of thousands of passenger cars from the road each year.

An organization can benefit from partnering with EPA's Green Power Partnership by taking advantage of the credibility, expert advice, recognition, and up-to-date market information that EPA provides. Specifically, Green Power Partnership offers the following assistance to organizations that join the Partnership:

- **Why Use Green Power?** EPA's Green Power Partnership will assist in identifying the green power products that best meet an organization's goals.
- **Publicity and Recognition.** The Green Power Partnership actively promotes and recognizes Green Power Partners as environmental leaders.
- **Tools and Resources.** EPA offers organizations a variety of tools and information located on the Partnership website at <http://www.epa.gov/greenpower> to explain and take the guesswork out of green power purchases.
- **Credibility.** Participation in the Green Power Partnership signifies an organization's green power use meets nationally accepted standards in terms of size, content, and resource base.

N.1 Join the Green Power Partnership

EPA invites your organization to join the hundreds of other U.S. organizations that are improving their environmental performance and reducing the risks associated with climate change by switching to green power. To join, organizations must procure green power at a level that meets or exceeds Partnership benchmarks (see below), sign a simple Partnership Agreement, and agree to update EPA on their green power use annually. For more details, please see www.epa.gov/greenpower. Figure N.1-1 describes the Green Power purchase requirements.

Green Power Purchase Requirements

Your Organization's Baseload if your annual electricity use in kilowatt-hours is...	Green Power Partner Requirements You must, at a minimum, use this much green power	Green Power Leadership Club Requirements You must, at a minimum, use this much green power
≥100,000,001 kWh	3% of your use	30% of your use
10,000,001 - 100,000,000 kWh	5% of your use	50% of your use
1,000,001 - 10,000,000 kWh	10% of your use	100% of your use
≤1,000,000 kWh	20% of your use	Not Applicable

In addition, the minimum Partner and Leadership Club purchase requirements must be entirely met with power from "new" renewable facilities (i.e., installed within the last 15 years).

Figure N.1-1. Green Power Purchase Requirements

Appendix 0 – EPA Office of Small Business Programs

Thinking Small Business First:

Professionalism, Innovation, Collaboration, Advocacy

Mission Statement: The mission of the U.S. Environmental Protection Agency's Office of Small Business Programs is to support the protection of human health and the environment by advocating and advancing the business, regulatory, and environmental compliance concerns of small and socio-economically disadvantaged businesses.



The Environmental Protection Agency (EPA) Office of Small Business Programs (OSBP) at <http://www.epa.gov/osbp>, under the Office of the Administrator, advocates and fosters opportunities for direct and indirect partnerships, contracts, and sub-agreements for small businesses and socio-economically disadvantaged businesses. Additionally, OSBP furthers its overall small business advocacy through the Agency's Asbestos and Small Business Ombudsman, where the regulatory and environmental compliance concerns of small businesses are addressed. Below are the key responsibilities for each OSBP component.

Greening Small Business Responsibilities

- Smart Steps to Sustainability- A Greening Guide for Small Business
- Conduit between small business and EPA's voluntary programs
- Advocate for small business greening tools and resources

Direct Procurement Key Responsibilities:

- Acquisition review and approvals
- Procurement data and performance measurement
- Small business consultation, guidance and advocacy

Disadvantage Business Enterprise (Indirect Procurement) Key Responsibilities

- Developing and monitoring EPA's indirect procurement (through grants) policy and procedures
- Providing outreach and training on indirect procurement within the agency and to the public
- Providing technical and programmatic assistance to minority and women-owned businesses

Asbestos Small Business Ombudsman Key Responsibilities

- Small business advocate in regulatory process
- Asbestos and small business assistance hotline
- Compliance assistance for small businesses that are heavily regulated
- State 507 program for small business environmental assistance throughout the country