

### Why should I care about Energy Conservation?

Energy (electricity and fuels) typically makes up 10% to 20% of a small Caribbean hotel’s operating costs, and up to 70% of utility costs (see Figure 1). In this competitive business, costs must be kept as low as possible while still maintaining a desired level of service and comfort. Energy conservation offers virtually all small hotels a quick way to reduce operating costs with relatively little capital investment.

### What are the Benefits of Energy Conservation?

At most small hotels in the Caribbean, there are significant low-cost, high payback opportunities for energy conservation that can lead to a reduction in energy use of 10-25%. At a typical hotel, an investment in energy conservation of approximately US\$ 20-30 per room will yield an annual savings of over US\$ 100 per room,<sup>1</sup> giving a one-year return on investment (ROI) of 300%. For example, an environmental assessment at Blue Waters Inn, a 38-room property on the North End of Tobago, identified low-cost energy conservation opportunities that would reduce their energy consumption and costs by 20% (see Figure 2).

In addition to these significant cost savings, energy conservation can help a property reduce costs in other ways, such as:

1. Reduces equipment operation time and wear & tear
  - reduces maintenance
  - increases equipment lifetime
2. Reduces size and cost of new equipment
  - smaller air-conditioners can be installed in areas that are properly weather stripped, and areas with lower heat gains from efficient lighting, etc.

<sup>1</sup> Source: PA Consulting Group, 2001, includes procedural improvements (not just capital equipment).

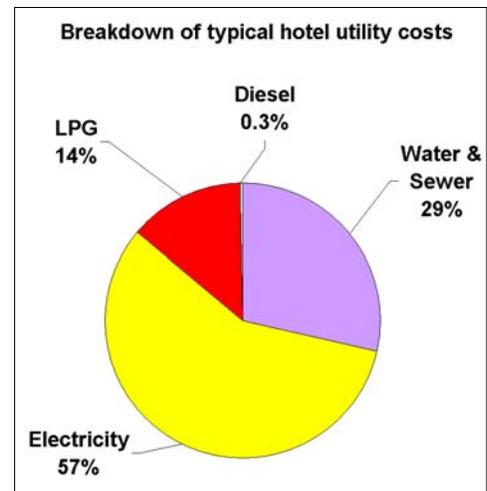


Figure 1. Typical utility cost breakdown for a small hotel (source: PA Consulting Group)

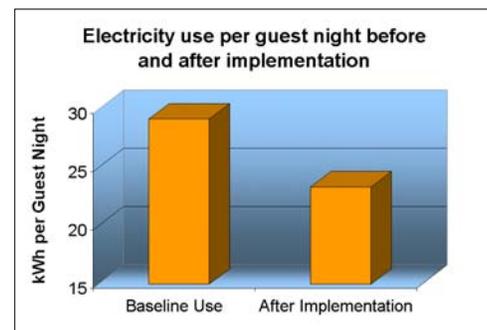


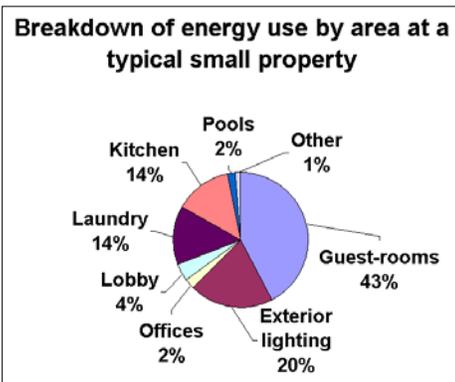
Figure 2. Energy use per guest night before and after implementation of energy conservation measures at Blue Waters Inn.



Figure 3. Energy conservation has environmental benefits that will help the Caribbean over the long term.

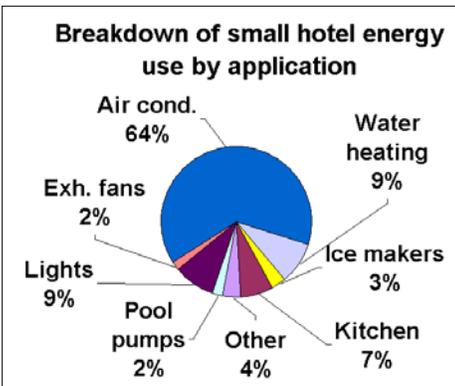
3. Offsets the need for expansion of:
  - air-conditioning capacity,
  - electrical service connections from electricity provider, and
  - transformers, wiring, and distribution panels.

**Environmental Benefits.** While most hotel owners care most about the financial benefits of energy conservation, it also has significant environmental benefits, which are important over the long term. Energy conservation helps reduce the harmful effects of our high use of fossil fuels on air quality, global air and sea temperatures, the protective ozone layer, and sea levels, which could have significant repercussions on the tourism industry in the Caribbean.



### Getting Started

The first step in improving energy efficiency is to figure out how, when, where, and why energy is used on your property. Figures 4 and 5 show how and where typical small hotels use energy. Notice that guestrooms typically account for more than 40% of energy use.



- Begin with an environmental walk-through to identify the best ways to begin to conserve energy.
- Pay attention to your energy bills! Track monthly use and cost, and calculate a monthly energy use index by dividing the total amount consumed by the number of guest nights for that month. (For example, a property that uses 10,000 kWh in a month and had a monthly occupancy of 400 guest nights has an energy use index of  $10000\text{kWh}/400\text{GN} = 25 \text{ kWh/GN}$ ). An index allows you to account for fluctuations in occupancy that affect total energy consumption.
- Compare yourself to appropriate benchmarks for energy-efficient hotels. A small hotel in the Caribbean should use approximately 25 kWh of energy per guest night.<sup>2</sup>
- Identify high-energy use areas.
- Identify and evaluate cost effective energy efficiency opportunities (i.e. those with a rapid payback).<sup>3</sup> See page 7 for an example payback calculation.

Figure 4. Typical breakdown of energy use by area and application at a small hotel (source: PA Consulting Group).

The following pages describe a range of options for small hotels to consider in conserving energy, including the most common “no cost” practices

<sup>2</sup> Represents total energy use (electricity + LPG + diesel). Diesel and LPG consumption figures can be converted from liters to energy (in kWh) by multiplying the volume of each fuel by its energy content (in kWh/liter). The energy content of diesel and LPG is 10.84 kWh/liter and 7.09 kWh/liter, respectively.

<sup>3</sup> A property may decide to conduct an energy audit to establish past and current consumption levels as well as set realistic targets and identify priorities for action,

## The Best “No-Cost” Energy Saving Measures

Environmental audits programs in the Caribbean region revealed a number of no-cost energy saving opportunities that small hotels should adopt. The greatest savings and most successful energy conservation efforts depend more on people, their actions and choices than on technology.

1. Assign one staff member to spearhead the energy conservation program. Responsibilities should include reading of meters (at least on a monthly basis), monitoring progress by developing and reviewing the energy consumption index (kWh/GN).
2. Emphasize staff awareness, training, and checklists or other clear instructions to meet energy conservation targets (see Figure 5, an example housekeeping checklist for energy conservation),
3. Adjust settings and illumination levels to ensure minimum energy used for desired comfort levels.

Hot water: 122 °F

Room air temperature: 72-74 °F

4. Establish a preventative maintenance schedule for all major equipment.
5. Regularly clean and maintain equipment, paying particular attention to:
  - Adjusting and replacing belt drives
  - Insulating and repairing pipes and ducts (10-20% of is typically lost)
  - Frequent servicing of air conditioning equipment (20% energy savings)
  - Repairing seals on doors, windows, coolers, freezers, etc.
  - Abnormal equipment vibration or sounds
6. Assign rooms so that unoccupied areas can be shut down.
7. Have staff turn off pool pumps and exhaust fans overnight.
8. Run only full racks of dishes through dishwasher and full loads through washing machines.
9. Consider using natural sunlight to totally or partially dry laundry.

### Housekeeping Energy Check List

- ✓ When cleaning the room, turn off the air conditioning unit.
- ✓ Clean air conditioning filters and unit grille regularly.
- ✓ After cleaning room, ensure that blinds are kept closed, air conditioning equipment is off, lights and television are kept off and all windows and doors are closed.
- ✓ If room has a small fridge, after guest has checked out, switch off fridge, clean and leave door open.
- ✓ Dust light bulbs.
- ✓ Keep bathroom door closed, consider installing closing door arms on bathroom doors.
- ✓ Ensure that curtains or furniture is not blocking air conditioning ducts.
- ✓ Report any significant problems to maintenance.

Figure 5. Example of an energy conservation checklist for

**Please turn off  
lights when not in  
use.**



**Thank You!**

Figure 6. Example of signage to encourage guests and staff to turn off the lights when leaving a room.

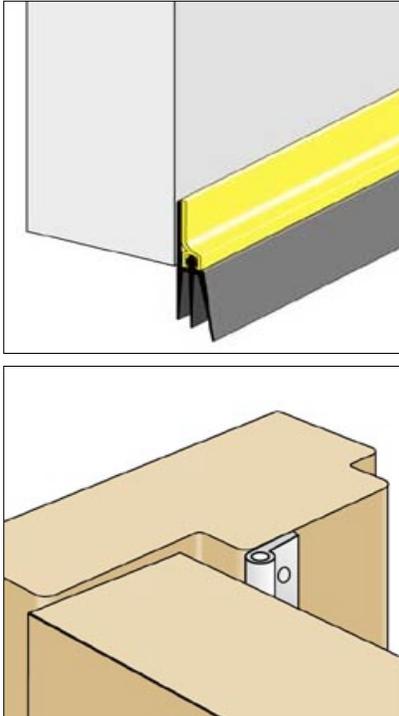


Figure 7. Weather-stripping



Equivalent CFL and Incandescent Bulb Wattages	
Incandescent Bulb Wattage	
120 W	
90 W	
75 W	
60 W	
40 W	
25 W	

Figure 8. Compact Fluorescent Lamps.

### The Best “Low-Cost/Quick Return” Energy Saving Measures

There continues to be major advances in the efficiency of lighting fixtures, appliances, motors, power tools and operating equipment. While these typically require some capital investment, the following have proven to both save energy and pay for themselves quickly.

1. **Ensure that air conditioned rooms are weatherized.** This can be achieved by installing door sweeps and weather strips on windows and doors (see Figure 7), and caulking all wall openings, especially those which facilitate the air conditioning refrigeration pipes. Installing a door closure on the bathroom door will prevent the conditioned air from escaping through the bathroom window.
2. **Install sensors and automatic controls.** Occupancy sensors can be used to control security lighting and public restroom lighting. They cost approximately US\$ 80 and can have a payback of less than one (1) year.
3. **Replace incandescent light bulbs with energy saving light bulbs such as Compact Fluorescent Lamps (CFLs – see Figure 8).** This is one of the most common energy conservation investments made. Since lighting is typically 8% to 15% of total energy consumption, the payback period on some lighting retrofits can be less than 1 year. Areas where lights are typically on for eight hours or more should be given priority, such as lobbies, gardens, hallways and outdoor lighting (retrofitting lamps that are not used for more than eight hours per day will have considerably longer payback periods). High efficiency fluorescent lamps/tubes require less than 1/3 of electricity of incandescent bulbs to achieve the same illumination level, and can last 5 to 10 times longer. It should be noted that some properties have experienced problems with the theft of CFLs, and others have had problems with lamps being damaged by poor power quality. Make sure to pilot test lamps to verify that they will work properly before making a large investment.
4. **Install guestroom controls.** Guestroom controls automatically turn off room air conditioning units when the guest is not in the room. This can save a minimum of 20% of air conditioning energy. Costs are approximately US\$ 250 installed per room with a payback of less than one (1) year in most Caribbean islands.
5. **Retrofit fluorescent tube lighting and lighting ballasts.** The newer fluorescent lighting technology with T8 tubes and electronic ballast can reduce energy use by 35% over standard electromagnetic ballast with T-12 tubes. New hotels should incorporate these energy efficient lighting systems into the design and specifications whilst existing hotels should retrofit damaged old tubes and ballast with the new energy efficient systems.

6. **Use LEDs** (light emitting diodes) lighting for places where light is on continually or for long periods (signs, exit sign, stairwells, front desk area, etc.).
7. **Use newer HID lamps** (High Intensity Discharge such as high-pressure sodium, metal halide, mercury vapor, and low-pressure sodium) for outdoor areas. These are among the most energy efficient lighting sources available, offering lots of light, high efficiency, long life, and rugged construction. They are good for outdoor areas and security lighting.
8. **Install timers to turn off lights and equipment when not in use.** Consider built-in timers on split type air conditioning units or install programmable timers or thermostats to automatically switch off air conditioning units when not required. Most applicable for conference room and offices air conditioning systems. Programmable 24 hour timers are most suitable for automatically switching on/off pool pumps, exhaust fans, lights and even air conditioning systems. They have a battery backup, which ensure that the programmed schedule is not compromised by power outages. Costs range from US\$ 100 to US\$ 150 with a payback of less than one (1) year.
9. **Replace damaged standard efficiency electrical motors with premium efficiency alternatives.** This action can reduce energy consumption by 3% to 8%. Ensure that all new equipment being purchased have high or premium efficiency motors.
10. **Magnetizers for fuel savings.** Monopole magnets have been proven to save between 5% to 15% of a hotel's LPG or natural gas fuel consumption. The magnets promote cleaner more efficient burning of fuel. The cost of a magnetic system depends on the fuel line size and can vary between US\$ 150 to US\$ 700 and providing a payback of less than one year.
11. **Ionizers for water descaling.** Ionizers have proven successful in removing scale build up from hot water heaters and more importantly softening water. They improve thermal conductivity and can improve hot water system efficiencies by as much as 10%.
12. **Heat recovery for hot water.** The waste heat from air conditioning systems can be used to provide hot water, as hot as 130 °F. These systems (called "desuperheaters" see Figure 10) also improve the efficiency of the air conditioning system. Costs vary depending on the size of the air conditioning system, but payback of less than one year can be attained. Heat recovery is best achieved on systems with cooling capacities of 3 tons and greater.
13. **Low-flow water devices.** Low flow showerheads and faucet aerators reduce the consumption of hot water hence save heating energy. These devices also save on water supply pump energy.

## Energy Conservation Case Study

### HOTEL MOCKING BIRD HILL Port Antonio, Jamaica

Hotel Mocking Bird Hill is a ten-room hotel with a maximum occupancy of 20 guests located on 6.5 acres in the hills above Port Antonio, Jamaica. The property includes a restaurant and bar, pool, art gallery/ gift shop, and meeting facilities. The owners made a conscious decision to develop the hotel using an existing structure to minimize the site disturbances caused by major construction.

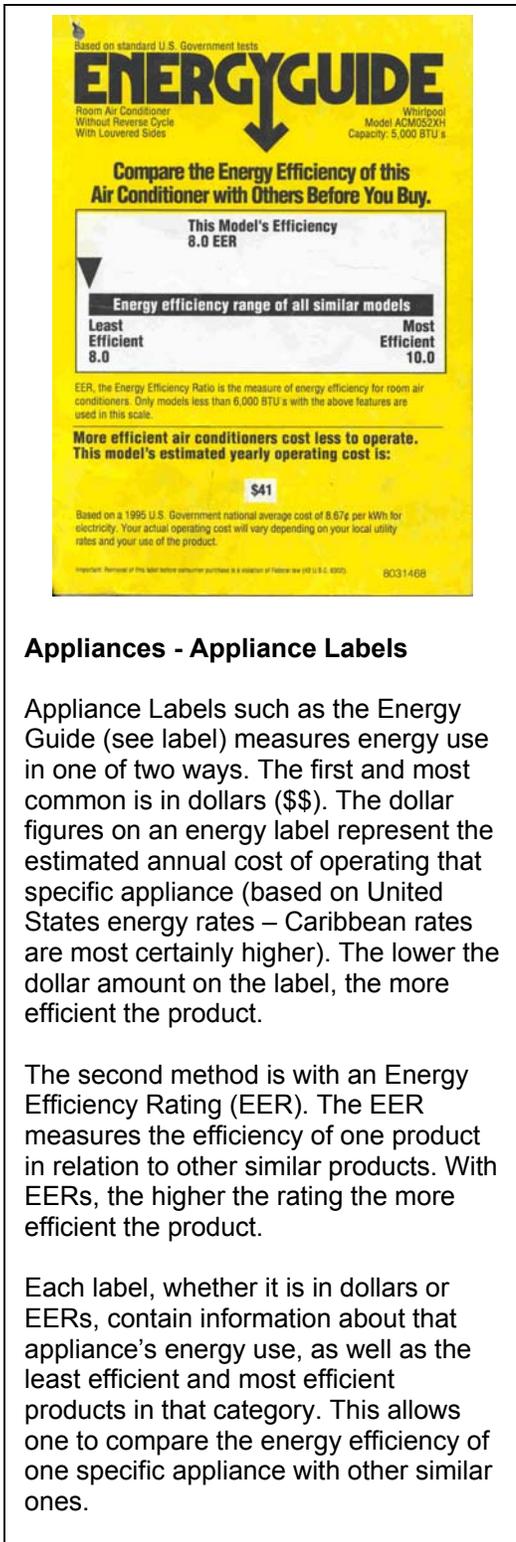
### Energy Conservation Measures Include:

- Hot water is provided by a solar hot water heating system. This significantly reduces electricity requirements.
- Notices in guest rooms request assistance in energy conservation by turning lights & fans off when leaving the room.
- Solar ovens are used on a regular basis (weather permitting) to bake all breads and roast chicken and meat.
- Public areas and rooms are tiled rather than carpeted to avoid the need to vacuum.

Figure 9. Energy Conservation Case Study



Figure 10. Desuperheater – used to recover waste heat from air-conditioning systems



### Appliances - Appliance Labels

Appliance Labels such as the Energy Guide (see label) measures energy use in one of two ways. The first and most common is in dollars (\$\$). The dollar figures on an energy label represent the estimated annual cost of operating that specific appliance (based on United States energy rates – Caribbean rates are most certainly higher). The lower the dollar amount on the label, the more efficient the product.

The second method is with an Energy Efficiency Rating (EER). The EER measures the efficiency of one product in relation to other similar products. With EERs, the higher the rating the more efficient the product.

Each label, whether it is in dollars or EERs, contain information about that appliance's energy use, as well as the least efficient and most efficient products in that category. This allows one to compare the energy efficiency of one specific appliance with other similar ones.

### The Best “Long Term” Energy Saving Measures

1. **Solar water heaters.** Using electricity to produce hot water typically consumes 15% to 20% of a Caribbean small hotel’s energy. Typical installed cost is approximately US\$ 1,500 for an 80-gallon unit, which can supply two (2) rooms. Hotels should ensure that the system is well designed and sized to minimize the need to use the back-up electrical heating element.
2. **Ceiling fans.** Ceiling fans use typically 15% of the energy consumed by an air conditioning unit, and can be an acceptable cooling option during cooler seasons and times of the day. Retrofitting a typical air-conditioned hotel room with a ceiling would cost US\$150 and will provide a three-month payback.
3. **Adding roof insulation.** Air conditioning accounts for over 60% of a small hotel electricity bill. Uninsulated roofs (and roofs without radiant barriers) permit a large amount of heat from the roof to be radiated into the room putting a larger load on the air conditioning system. Installing roof insulation (or a radiant barrier system) at a per room cost of US\$ 200 has resulted in pay back periods of one year, and energy savings of 15% to 20%.
4. **Landscaping.** The cooling effect of trees and other plants to shade walls, roofs and windows can be considerable. Research in Florida on the energy savings benefits of landscaping around buildings indicates that the natural shading provided over exposed glass and walls can result in as much as 20% energy savings.
5. **Alternative fuels.** Replacing electric water heaters with LPG water heaters can result in a 60% reduction in costs.
6. **High efficiency air conditioning units.** Air conditioning will account for approximately 60% of a hotel’s total energy cost. When building a new hotel or replacing an existing system, small hotel should consider alternative systems including:
  - (a) High efficiency minisplits
  - (b) Small chilled water systems with heat recovery for hot water
  - (c) Water cooled air conditioning package units
7. **Solar-control window-film.** Solar heat gain from glass accounts for over 30% of the heat load entering a guest room. Solar film with a shading co-efficient of 0.3 or less can reduce the amount of solar heat gain and can save air conditioning energy. Solar films cost approximately US\$ 3.00/ft<sup>2</sup> and will provide a payback of between 1.5 to 3.0 years, depending on the cost of energy.
8. **Refrigerant Management Systems (RMS).** RMS reduces the head pressure on air conditioning compressors, pump more refrigerant through the system and act as sub coolers saving between 10% to 20% of compressor energy. Payback of 1.0 to 2.0 years will be achieved as well as the life of the compressor will be increased.

Figure 11. Energy Efficiency Labels

## How do I determine the costs, savings and payback of energy efficiency opportunities?

The following example illustrates the method of calculating the payback period and annual savings of an energy saving opportunity. To ensure accuracy, make sure to quantify the full “Life-Cycle” costs of the existing option and the proposed alternative. This includes purchase price of the item, operating costs (e.g. electricity, water, LPG, chemical costs), and labor costs (for installation, maintenance, replacement, etc.)

	Incandescent	CFL
	75W	18W triple-twin
Light output (lumens)	1,190	1,200
Lamp lifetime (hours)	1,000	10,000
Power input (W)	75	18
Efficacy (lumens/W)	15.9	66.7
Annual energy use (kWh/year) = operating time <sup>1</sup> X power input	187.5	45
Annual energy cost (\$/year) = annual energy use x cost per kWh <sup>2</sup>	18.75	4.5
Annual energy savings (\$/year)	n/a	14.25
Lamp cost (\$/lamp)	1	5
Relamping labor cost (\$/lamp)	5	5
Annual lamp cost	2.5	5
Annual labor cost	12.5	1.25
Annual maintenance savings = (lamp+labor) (\$/year)	n/a	8.75
Annual operating cost = (energy + maintenance) (\$/year)	33.75	10.75
Annual operating cost savings (\$/year)	n/a	23
Payback on first CFL installed (years)	n/a	1.1
<sup>1</sup> Table Notes: Annual operating time = 2500 hours		
<sup>2</sup> Electricity cost = \$0.10/kWh		

### Calculating Payback Periods and Returns on Investment

**Payback Period** is a measure of the number of years (or months or days) required for the benefits of a measure to equal the required investment.

**Payback period = initial investment / net annual profits**

(Net annual profits = annual savings resulting from the measure - annual costs related to the implementation of the measure.)

**Return on Investment (ROI)** is the net profit resulting from a project in a set time period divided by the required investment. It is a simple indicator of profitability, but must cover a specific time period (e.g., 1 year). Like the payback period, it is appropriate for evaluating projects with relatively short time horizons (e.g., 1-2 years).

**ROI = net profit / initial investment**

Figure 12. Payback period and return on investment.

## Where do I get more information and assistance?

### **About the Small Hotels Toolkit Series**

This toolkit is one of a series of booklets designed to help small hoteliers improve their business operations, marketing and environmental performance. They are available in both printed and electronic format (STEP Resource Centre or [www.caribbeaninnkeeper.com](http://www.caribbeaninnkeeper.com)). Toolkits emphasize proven “best practices” appropriate to the Caribbean region, and include numerous case studies and real examples. Toolkits are supported by STEP Coordinators and experienced “coaches” to help hoteliers solve problems, implement desired actions, and secure additional expertise and information.

### **About STEP**

The Small Tourism Enterprises Project (STEP) for the Caribbean provides support and assistance related to marketing, better business management, effective technology adoption, and improved environmental performance. Major funding comes from the Organization of American States, the United States Agency for International Development, and the governments of participating Caribbean countries.

### **STEP Walk-in Resource Centres**

Walk-in Resource Centres include publications, videos, and other materials related to small hotels and the environment. They also have a computer work station and internet access. Each centre has a trained STEP Coordinator to help you find what you need. STEP will also be making available experienced professionals to provide “coaching” assistance on a number of topics. Contact your STEP Coordinator for information on coaching currently available.

### **Contact CAST:**

The Caribbean Alliance for Sustainable Tourism (CAST) offers technical services (walk-throughs, environmental assessments), lists of products and services, as well as videos and publications. CAST is located in San Juan, Puerto Rico and may be contacted by phone (787) 725-9139, fax (787)-725-9108, e-mail: [cast@caribbeanhotels.org](mailto:cast@caribbeanhotels.org) or visit their web site [www.cha-cast.com](http://www.cha-cast.com)  
The following materials are available from CAST:

- *Environmental Technologies in Caribbean Hotels: Buying Specifications and Lessons of Experience*
- *Case Studies: Water, Energy and Solid Waste Management in the Hotel Industry*
- *Various publications from The Green Bookshelf*
- *Environmental Management Toolkit for Caribbean Hoteliers*

### **Have an Environmental Walk-through Completed:**

To schedule an environmental walk-through (which will look at energy, water, solid waste and purchasing practices) contact your country STEP Coordinator or CAST.

### **Visit Your Virtual Walk-in Resource Centre:**

The [caribbeaninnkeeper](http://www.caribbeaninnkeeper.com) website ([www.caribbeaninnkeeper.com](http://www.caribbeaninnkeeper.com)) is a virtual walk-in assistance centre, with copies of most of the materials available walk-in centres, as well as additional services and resources.

### **Specific Energy Conservation Resources**

- Contact the Association of Energy Engineers (AEE), the leading Energy Association in the United States for literature, networking or more in depth technical information on Energy Conservation and related issues. Phone: 770-447-5083 website: [www.aeecenter.org](http://www.aeecenter.org)