



**Caribbean Community
Climate Change Centre**

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Energy Audit Guide

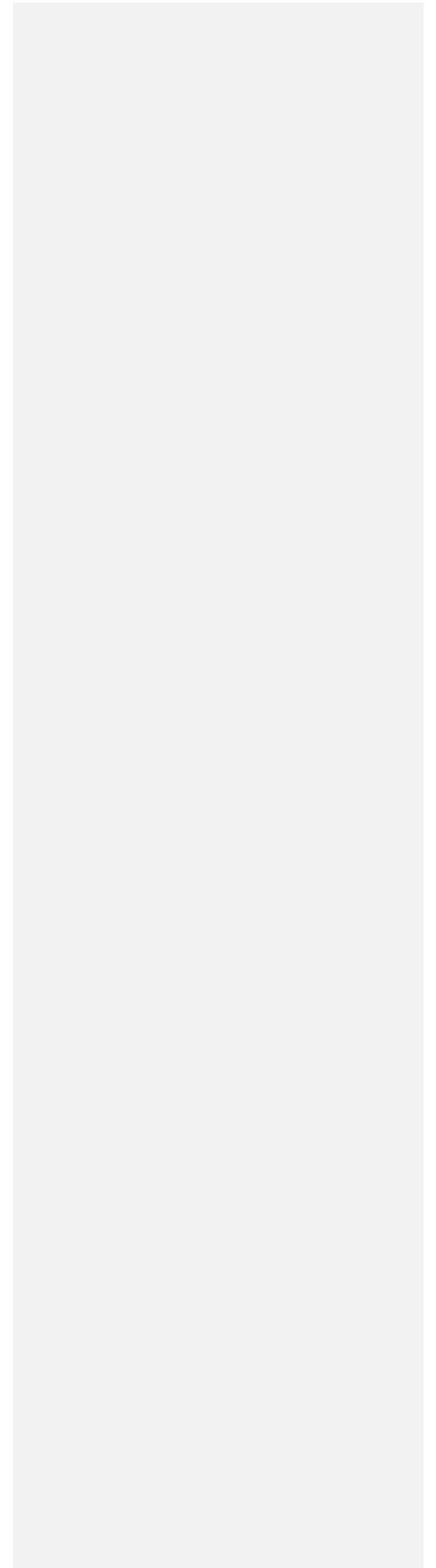
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2. Change parts in the reservoir of the toilet.
3. Change flushing mechanisms for urinal to ball valve.
4. Fix leaks.
5. Solar Panels
6. Install urinals for males.
7. Replace 5 gallon reservoir with 3.5 gallon or 1.6
8. Throttle basin tap pressure.

Hot Water Systems:

1. Source of hot water supply should be from a solar water heater; the most reliable and efficient thermal energy source.

A solar hot water system eliminates the need for electricity or gas to heat water in any environment; be it domestic housing, the hotel sector, or for pre-heating for industrial use.

Saving Btu's of energy is the basic goal.

A Btu is the energy required to raise one pound of water through one degree F.

When we raise the cold water temperature in a 50 gallon electric water heater from 80 F to 135 F we are adding 55F of temperature to the water. Every gallon of water weighs 8.34 lbs. So the number of Btu's we are creating looks like this:

$50 \text{ (volume)} \times 55 \text{ (temperature change)} \times 8.34 \text{ (weight of water per lb)} = 22,935 \text{ Btu's}$. To convert Btu's to kWh, divide the Btu by 3413. (It takes 3413 Btu's to make 1 kWh). So 22,935 Btu divided by 3413, gives us 6.719 kWh of energy required to raise the 50 gallons of water from a cold water temperature of 80F(typical in the Caribbean) to the hot water temperature of 135F.

When we use a cost of US\$0.30 per kWh (0.38kWh 2013–2014 Lucelec 2015),(assumed average cost across Caribbean countries except for Trinidad and Tobago) the daily cost to heat the 50 gallons of water by electricity is US\$2.01 per day; US\$ 60.30 per month and US\$723.60 per year.

The cumulative cost of hot water over a 15 year period with an increase in the cost of electrical energy of 5% every 2 years would look like this:

	Capital cost of	Annual Energy Cost	Cumulative Cost
Electrical heater			
Year1	US1, 500.00	723.60	2.226.60
Year 2		723.60	2.950.20
Year 3		759.78	3.709.98
Year 4		759.78	4.469.76
Year 5		797.76	5.267.52
Year 6		797.76	6.065.28
Year 7		837.64	6.902.92
Year 8		837.64	7.740.56
Year 9		879.52	8.620.08
Year10		879.52	9.499.60
Year 11		923.49	10.423.09
Year 12		923.49	11.346.58
Year 13		969.66	12.316.24
Year 14		969.66	13.285.90
Year 15.		1.018.14	U\$\$ 14.304.04

Please note that no maintenance or replacement of the electrical water heater has been taken into account. It is estimated that an electric element would need to be changed at least twice in the 15 year period. The magnesium anode would need to be changed as well.

One should estimate a minimum cost of \$300.00 x 2 times during this period. The typical expected life of an electric water heater as stated by USA water heater manufacturers is said to be 8 years. It is therefore possible that the capital replacement cost may need to be budgeted somewhere after year 8.

A SOLAR HOT WATER SYSTEM.. The Right choice.

The installation of an adequately sized, high performance solar hot water system would eliminate the recurring energy costs for hot water, traditionally provided by an electric or gas water heater.

RIGHT SIZING OF A SOLAR HOT WATER SYSTEM:

In sizing a solar hot water system, an increase of 30% to 60% in volume over that of an electric water heater has been found to be required to satisfy the needs of the same sized family. The size system for a family of 3 to 4 persons should therefore be 65 to 80 US gallons, at 135 F to 140 F. The rule of thumb is 15 to 20 gallons of hot water per person in family. This allows for a shower in the evening as well as one the morning following. If the volume in storage is inadequate, the family members using the shower last in the morning, will not have a satisfactory shower; requiring them to use the electric back-up booster often. The hot water used in the morning is that heated the previous day, and held in storage for up to 17 hours, while some of it has been used up the evening before. The water used in the evening is replaced by cold water entering the storage tank at the lowest level of the tank. The cold water being heavier stays at the lower level, while the lighter hot water floats in the upper level of the storage tank.

Size and temperature are the two most essential elements in having a satisfying solar hot water system experience.

The 15 to 20 gallons at 135F to 140F per person has been found to satisfy 98.6% of client needs. In calculating energy saved, an allowance of 5 days of supplementary energy by an electrical element installed with the system.

EXPECT INCREASED USE OF HOT WATER...

More liberal use of hot water obtains after the installation of a solar hot water system, as the family is no longer under the economic pressure of the frequent high electricity bill. More hot water is likely to be used in the shower, kitchen and laundry than obtained when electrical or gas heating was in use.

HOT WATER IN THE HOSPITALITY INDUSTRY:

The need for hot water in the tourism industry is well known. Hot water is one of the two creature comforts high on the satisfaction index of a visitor.

The other is of course air-conditioning.

A recent survey was conducted among Caribbean Hotels by The United Nations Environmental Programme (UNEP).

Among the hotels chosen were Turtle Beach Resort in Barbados, and Bay Gardens Hotels and Inn in Saint Lucia. Both hotels were sized on the basis of 20 gallons per guest, 40 gallons per room. The hotels rated their satisfaction with the performance of the solar hot water systems supplied by Solar Dynamics between 1997 and 1998, as 95% to 100%.

SUMMARY RESULTS

	ELEGANT TURTLE BEACH	BAY GARDENS HOTEL
Date installed	1997	1998
Number of rooms	161	111
Number of guests:	400	150 to 325
Volume:	6440 gallons	4,440 gallons
% of demand	100%	100%

Summary Results continued, Turtle Beach Resort and Bay Gardens Hotels.

	Turtle Beach Resort	Bay Gardens Hotel
Payback time:	1.3 years	1.5 years
Daily kWh Output	944.2 kWh	650.9 kWh
Monthly	28,326kWh	19,527
Annual	339,912	234,324 kWh
Value 2013/2014	US \$118,969.20	US \$91,386.36
Bdos 0.35kWh		St.Lucia 0.39 (Lucelec)
Capital cost	US\$100.00000	US\$100.000.00
ROI	118.96%	91.3%

ROI ON SOLAR HOT WATER SYSTEM

The return-on-investment (ROI) was one of the features reviewed. These hotels reported a 1.3 to 1.5 years to recoup their investment in the Solar Dynamics Hot Water System.

There is a win-win-win on lifespan, performance and return on investment..

On the basis of the lifespan: Solar Dynamics Hot Water Systems last longer than electrical water heaters. These reviewed are 15 years +.

On the performance of the systems: The satisfaction of the Solar Dynamics Hot Water System is rated between 95% and 100%.

On the return on investment. Annual returns of 118.96% for Turtle Beach and 91.3% annually for Bay Gardens Hotel are astounding.

The savings speak for themselves.

EFFICIENCY OF DELIVERY:

Solar Hot water systems need to be installed near to the location where the hot water is used. Some properties are designed with bathrooms and kitchen facilities far apart. It is more convenient and more efficient to install a system to serve these separate locations. This avoids the wastage of cold water while one waits to clear the the line of cold water.

Annex

Ballast

Magnetic Ballasts