EAST

Environmental Audits for Sustainable Tourism

Environmental Management Audit
Negril Tree House Hotel
Negril, Jamaica, W I

Final Report
EAST Report No 97-200

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Prepared for
EAST Project
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Executive Summary

What is an environmental management system?

- An environmental management system (EMS) is a management tool through which a property can evaluate and improve its environmental performance, and establish, achieve and sustain its own environmental performance objectives

Why should Tree House develop an EMS?

- An EMS will help Tree House sustain the social and physical environment on which it depends for its survival Tourists visit Negril to savor the beauty of its reefs, beaches and nature and to experience the warmth and kindness of its people The day Negril loses these valuable attributes will mark the end of its tourism industry

- Hotel guests are increasingly taking an interest in the environment A recent poll conducted by *Conde Nast Traveler* revealed that

  - 91% of the respondents were concerned about the environmental conditions at the destination to which they are making travel plans,
  - 50% claimed that the environment had become a factor in their travel planning over the last ten years,
  - 25% have changed travel plans because of what they perceived to be an environmental issue at their chosen destination

  The "green" image created and sustained through an effective EMS will therefore provide Tree House with an additional marketing tool

- Since many environmental measures are aimed at reducing the consumption of water energy, chemicals and materials, an effective EMS will help the property save money and ensure the sustainability of the measures and actions that yield these savings

  During the course of the audit, the EAST team reviewed Tree House s water energy chemicals and materials consumption practices evaluated its policies procedures and management structure identified ways to improve its environmental performance and develop an effective EMS As illustrated in the following section the audit revealed that Tree House could greatly benefit by becoming a more "environmentally friendly property

Summary of the Costs and Benefits of Selected Recommendations

The following table summarizes the costs and benefits of 14 of the more than 60 recommendations presented in this report The detailed analysis of these 14 recommendations, or projects, is presented in Section 5 of this report

Project no and description	Environmental benefits	Financial savings	Implementation cost	Payback period
1) Install flow aerators on all faucets	• Reduces water consumption and wastewater generation • Saves energy	2,770 J$/year for each typical back-of-house faucet	60 J$ per aerator	8 days
2) Install low-flow shower heads	• Reduces water consumption and wastewater generation • Saves energy	4,240 J$/year for each typical guest bathroom	300 to 850 J$ per shower head	< 2 5 months
3) Replace existing toilets with water-saving models	• Reduces water consumption and wastewater generation	930 J$/year for guest bathrooms	1,000 J$ per guest bathroom	13 moths
		2,920 J$/year for public restrooms	4,000 J$ per public restroom	1 4 years
4) Install flow diverters in toilet tanks	• Reduces water consumption and wastewater generation	7,470 J$/year for all guest rooms	4 000 J$	< 7 months
5) Install displacement devices in toilet tanks	• Reduces water consumption and wastewater generation	7 470 J$/year for all guest rooms	1,600 J$	< 3 months
6) Use rainwater for laundry operations	• Reduces the use of NWC water • Reduces the use of water softening chemicals	94,000 J$/year for a 20 000 ft^2 catchment area	not yet determined	probably <1 year
7) Convert from electric billing rate 20 to rate 40	• Reduces the cost of Tree House s electricity	732 000 J$/year	70 000 J$	5 weeks
8) Reduce the time of operation of the pool pump	• Reduces electricity consumption • Extends the service life of the pump	15 400 J$/year	Nil	immediate

9) Use energy efficient lighting in gardens	• Reduces electricity consumption	26,400 J$/year	478 J$ per energy-efficient bulb	< 9 months
10) Implement a waste management program	• Reduces the volume of waste generated by the property • Reduces the negative impact of the waste generated by the property	unknown	moderate	probably <1 year
11) Eliminate the routine use of Petrotherm	• Reduces the discharge of Petrotherm (i e , sulfuric acid) to the morass and to the property's tile fields	189,000 J$/year	labor = 10,400 J$/year equipment = 8,800 J$	< 3 weeks
12) Implement a linen and towel reuse program	• Reduces water consumption and wastewater generation • Reduces energy consumption • Reduces chemicals consumption	can reduce laundry costs by up to 40%	negligible	almost immediate
13) Switch air conditioners off in unoccupied rooms	• Reduces energy consumption • Increases the service life of the a/c units	139,000 J$/year	20,000 J$	< 2 months
14) Implement a composting program	• Reduces the volume of solid waste generated by the property • Provides the property with a free source of fertilizer and soil conditioner	unknown	low to moderate	probably <1 year

I. Introduction

1 1 EAST Project

The Environmental Audits for Sustainable Tourism (EAST) Project is an activity funded by the U S Agency for International Development (USAID) that is designed to assist the tourism and hospitality industry implement effective environmental management systems (EMS)

The specific objectives of this project are (1) to develop greater awareness and understanding of the benefits of environmental management systems and audits among hoteliers, restaurateurs, allied tourism businesses, as well as in the manufacturing industry, (2) to train Jamaican consultants on EMS auditing techniques, (3) to assist a select, representative number of tourism establishments in carrying out environmental audits, and (4) to help finance, on a cost-sharing basis, specific audit recommendations in the participating establishments to demonstrate the financial benefit of the systematic application of environmentally friendly practices and, thereby, encourage others in the tourism industry to do likewise EAST is being implemented by Hagler Bailly Services (USA) under the direction of USAID/Jamaica and the Jamaica Hotel and Tourist Association

1 2 Audit Team

The audit of the Tree House Hotel was conducted by an interdisciplinary team in August 1997 The team members included Hugh Cresser, EAST Project Coordinator, Peter Illig, Team Leader and EMS Specialist, Hagler Bailly (USA), Patricio Gonzalez, Environmental Engineer, Hagler Bailly (USA), Kimberly Moffitt, Hotel Operations Specialist, HVS International (USA), Adam Abelson, Hotel Marketing Specialist, HVS International (USA), Lloyd Marsh, Senior Energy Engineer, Metrocad (Jamaica), Dinsdale Williams, Energy Engineer, Metrocad (Jamaica)

The EMS audit consisted of a detailed analysis of all departments and key service areas designed to identify the environmental aspects and impacts of the property's activities, and to formulate recommendations on how to improve the property's environmental performance and its environmental management system (EMS)

1 3 Audit Protocol

The audit protocols used by the audit team covered the following issues

- ISO 1400 EMS gap analysis
- Water use and wastewater generation
- Energy use and efficiency
- Solid waste generation and handling
- Chemicals use and management
- Hotel procedures and operations

2. Background Information

2 1 Description of the Property

Tree House is a 66-room beachfront hotel located on Norman Manley Boulevard in Negril, Jamaica This property is owned by Mr Jimmy Jackson

Tree House has various facilities for its guests' comfort and entertainment, including

- a gift shop,
- a restaurant and bar in the main building,
- a pool-side restaurant and bar,
- a water sports center,
- a swimming pool and a Jacuzzi

2 2 Occupancy Data

The occupancy information given by Tree House to the audit team covers the 12-month period from August 1996 to July 1997 This data is summarized in the following table and is used as the basis for the calculations presented in this report

Month	Occupancy (room nights, RN)	Guest Nights (GN)
August 1996	1,705	4,088
September	903	1,752
October	1,173	2,360
November	1,363	3,168
December	1 394	3,107
January 1997	1 688	3,914
February	1 609	3 533
March	1 784	4 592
April	1 483	3 151
May	1 395	3 309
June	991	2 321
July	1 338	3 278
Annual total	16 826	38 573

This data yields the following occupancy criteria for Tree House

Average occupancy = 1,402 RN/month
= 3 214 GN/month

2 3 Water Consumption and Wastewater Generation

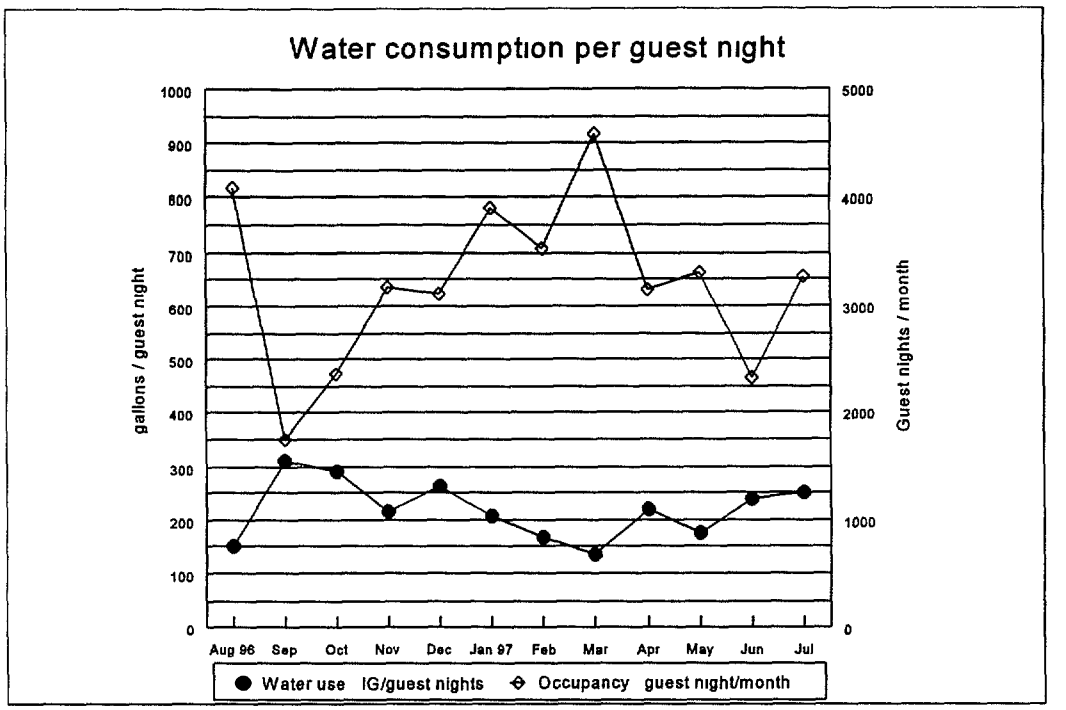
2 3 1 Current water use at Tree House

The water consumption information collected by the audit team is presented in the following tables and graph This data is used as the basis for the calculations presented in this report

NWC water consumption figures for the property's three water mains Consumption figures are given in Imperial gallons (IG)			
Month	**2" main meter #93120311**	**1" main - meter #36982621**	**1" main - no meter (1) (bill number 86298)**
August 1996	365,000	106,000	150,000
September	304,000	93,000	150,000
October	432,000	99,000	150,000
November	444,000	91,000	150,000
December	531,000	135,000	150,000
January 1997	522,000	136,000	150,000
February	324,000	112,000	150,000
March	366,000	100,000	150,000
April	419 000	120 000	150,000
May	359,000	76,000	150,000
June	315,000	90 000	150 000
July	581,000	91,000	150 000
Annual total	4,962,000 IG	1,249,000 IG	1 800,000 IG

Note (1) Tree House's second 1" main is not equipped with a meter NWC estimates the output of this main at 150,000 IG per month This issue will be further discussed in Section 4 of this report

Total NWC water consumption figures for the Tree House Hotel					
Month	**Water use IG/month**	**Water cost J$/month**	**Unit cost J$/1,000 IG**	**Occupancy GN/month**	**Use per GN IG/GN**
August 1996	621 000	121 038	194 9	4 088	152
September	547,000	106 184	194 1	1 752	312
October	681 000	132 656	194 8	2 360	289
November	685 000	133 433	194 8	3 168	216
December	816 000	159 226	195 1	3 107	263
January 1997	808 000	157 940	195 5	3 914	206
February	586 000	115 430	197 0	3 533	166
March	616 000	122 013	198 1	4 592	134
April	689 000	137 250	199 2	3 151	219
May	585,000	116,602	199 3	3 309	177
June	555 000	110,804	199 6	2 321	239
July	822,000	164 530	200 2	3 278	251
Annual total	8,011,000	1,577,106		38,573	



Based on this data, the average water and wastewater figures for Tree House are

Current water cost = 200 J$/1,000 IG

Average water use = (8,011,000 IG/year) / (12 months/year)
= 667,580 IG/month
= (8,011,000 IG/year) / (38,573 guest nights/year)
= 208 IG/guest night

As can be clearly seen in the graph Tree House's water consumption index (i e , the consumption of water per guest night) varies widely throughout the year In fact, the water consumption index for September (312 IG/GN), the lowest occupancy month is more than 2 times higher than that for March (134 IG/GN) the highest occupancy month Although the water consumption index is expected to vary with time because of changes in weather occupancy rates and guest type (e g large influx of college students during spring break) the 230% variation seen at Tree House is excessively high

Tree House should, therefore, investigate why it takes 2 3 times more water to provide a room night in June as it does in December

2 3 2 Impact of water conservation at Tree House

- Because of the high cost of water, it is in this property's best interest to engage in an aggressive water conservation program The comparison made in the following table between Tree House and a "water efficient" hotel (as defined by the International Hotels Environmental Initiative) shows that this property could achieve significant savings through water conservation In addition to the financial benefits, a reduction in water consumption will also reduce the hydraulic loading on the property's wastewater disposal system and, thereby, improve its performance Hydraulically overloaded septic tanks have short wastewater retention times which prevent the proper settling of solids and flotation of oils and fats Short retention times thus increase the discharge of solids from the septic tank and the risk of clogging the tile field

Average water consumption for hotels		**Savings if Tree House achieved the water consumption of a water efficient property**	
Location	**Water use**	**Water savings**	**J$ savings**
Water efficient hotel	128 IG/guest night	3,085,000 IG/year	617,000 J$/year
Tree House	208 IG/guest night		

Notes
- The figures presented in this table are based on the occupancy figures presented in section 2 2 of this report
- The International Hotels Environmental Initiative uses the following figures to rate the relative water efficiency of hotels

Property size (with gardens and laundry)	**Water efficiency rating - water use figures are in IG/guest night**				
	Good	**Fair**	**Poor**	**Very poor**	**Tree House**
50 150 rooms	< 128	128 - 148	148 - 177	> 177	208

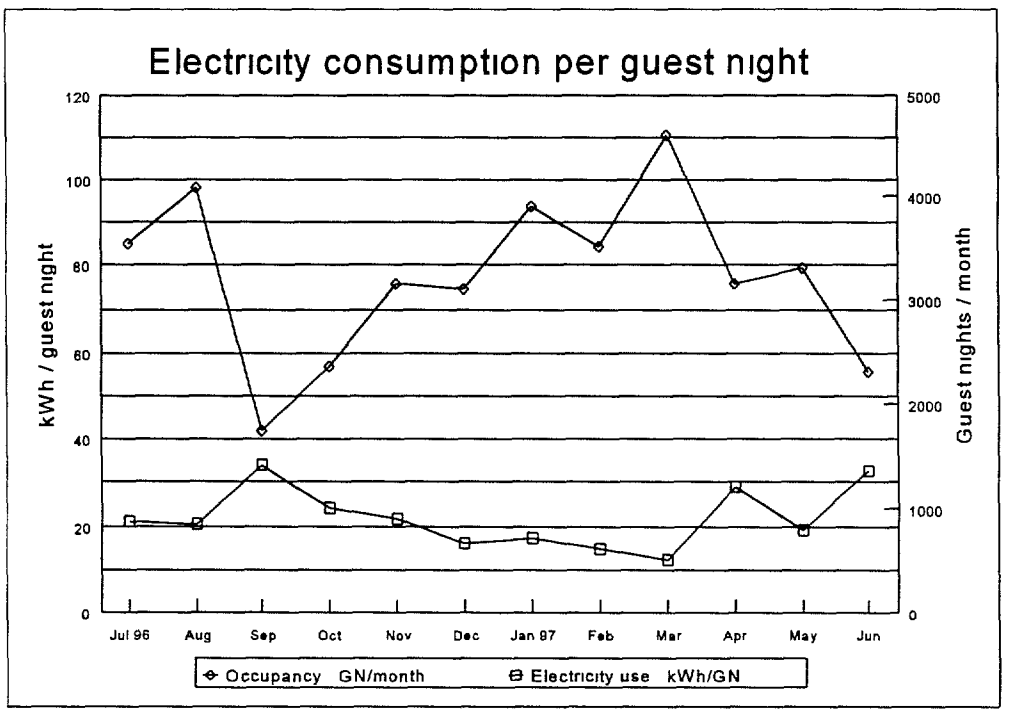
- It appears that, after the completion of Negril's new sewer system and wastewater treatment plant in mid-1999 the cost of the water supplied by the NWC will increase by a factor of two

The reader should therefore keep in mind that the water conservation measures proposed in this report will have in the near future an even greater impact on reducing Tree House s utility costs

2 3 Electricity Consumption

The electricity consumption information collected by the audit team from Tree House's JPSCO bills is presented in the following table and graph

Month	kWh/month	J$/month	J$/kWh (estimated)	GN/month	kWh/GN
July 1996	74,581	345,311	4 63	3,541	21 1
August	83,554	386,857	4 63	4,088	20 4
September	58,931	272,850	4 63	1,752	33 6
October	56,211	260,259	4 63	2,360	23 8
November	69,239	320,577	4 63	3,168	21 9
December	50 247	232,644	4 63	3,107	16 2
January 1997	67,339	311,780	4 63	3,914	17 2
February	53,198	246,306	4 63	3,533	15 1
March	57,202	264,845	4 63	4,592	12 5
April	91,901	425,500	4 63	3,151	29 2
May	64,004	296,338	4 63	3,309	19 3
June	75 688	350,435	4 63	2,321	32 6
Annual total	802,095	3,713,702		38,836	



Based on this data, the average electricity figures for Tree House are

Average energy consumption = (802,095 kWh/year) / (12 months/year)
= 66,841 kWh/month
= (802,095 kWh/year) / (38,573 guest nights/year)
= 20 7 kWh/GN

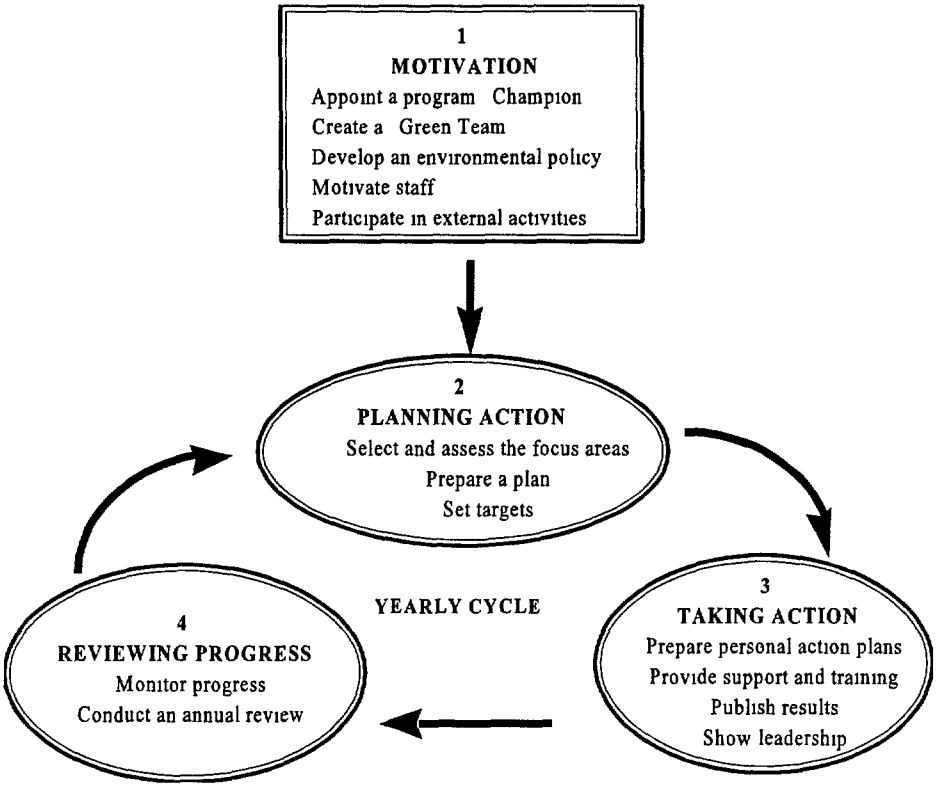
As can be seen in the graph, Tree House's electricity consumption index (i e , the consumption of electricity per guest night) varies widely throughout the year In fact, the electricity consumption index for September (33 6 kWh/GN), the lowest occupancy month, is 2 7 times higher than that of March (12 5 kWh/GN), the highest occupancy month Although the electricity consumption index is expected to vary with time because of changes in weather, occupancy rates and guest type (e g , large influx of college students during spring break), and because of the existence of power loads that are not affected by occupancy (e g , pool pumps, public area lighting), the 270% variation seen at Tree House is excessively high

Tree House should therefore investigate why its energy consumption per guest night is 2 7 times higher in September than in March

3. Guidelines for the Development of an Environmental Management System

3 1 Environmental Management System (EMS) Overview

Becoming an environmentally friendly property is not a challenge that can be met overnight It is a long-term commitment and a continuous process of improvement which should be integrated in the daily operations at a pace which is right for each property The key phases in the creation and development of an effective environmental management system are illustrated below



Note This EMS cycle is based on the approach developed by the International Hotels Environmental Initiative

The four phases are

- **Motivation** -- in which you begin to integrate the initiative in your property by appointing a ' Champion" to coordinate the program creating a ' Green Team" to assist in the implementation and monitoring of the program, developing a policy which defines the property's environmental objectives, and by motivating the staff to participate and contribute to the program

- **Planning action** -- in which you select and conduct a detailed review of the property's priority areas, identify measures to be taken, prepare an action plan and set a timetable for the implementation of the program

- **Making it happen** -- in which staff commitment is gained for the action plan, responsibilities are allocated, and the plan is implemented

- **Reviewing process** -- in which progress is monitored against set targets and objectives, an annual review of overall progress is conducted to assess the successes and failures, and priorities are set for the coming year

As shown above, phases 2, 3 and 4 form a yearly environmental management cycle Each year the property will go back though this cycle again, using the review of the previous year's successes and failures to improve the effectiveness of its EMS and revise, if necessary, its environmental policy

3 2 Motivation

Before Tree House can begin to motivate its staff to participate in an environmental program, it must address general staff morale issues The audit team found a poor employee morale and and a lack of cohesiveness among the staff at the hotel There seems to be an insufficient commitment to quality service and a feeling of discouragement Staff cooperation is essential to the success of the hotel and the success of any environmental effort, so addressing this issue should be a top priority

3 2 1 Appoint the environmental program's "Champion"

Once the hotel is ready to move ahead with its environmental program, Tree House will need to appoint a "Champion" who will have the responsibility for coordinating and implementing the environmental program This person must have a good operational knowledge of the hotel, the respect of other employees, a commitment to the project and the full support of the property's owners and top management The Champion will keep the environmental program on line, ensure good business and environmental results are achieved, and ensure the participation or cooperation of all staff members

3 2 2 Create a "Green Team"

The creation of a "Green Team' is crucial to ensure the introduction and the implementation of environmental policies The functions of the Green Team include

- assist the program Champion in the day-to-day management, supervision and troubleshooting of the environmental program,
- keep the property's staff motivated and dedicated to the principles of the environmental program,
- develop new ideas and strategies for improving the program,

- act as the principal link between the property and local community groups or environmental organizations

To be most effective, the Green Team must be composed of highly motivated individuals, selected from each of the property's departments and representing all levels of employee hierarchy -- from executive-level to line-level employees The actual size of the Green Team will depend on the requirements of Tree House's environmental program, however, when assembling the team, keep in mind that as the group gets larger, the team as a whole becomes less focused and less productive

The employees selected for the Green Team must have the motivation and the character needed to insure the success and the dissemination of the program Criteria for the selection of team members may include

- recommendations by managers or supervisors,
- nomination by fellow employees, or
- a simple application process which requires the candidates to explain their expected contribution to the environmental program and their reasons for wanting to join the team

Note Tree House should create more personalized names for the "Champion" and "Green Team" to reflect the property's "personality " In this report the terms "Program Champion" and "Green Team" are used as generic names to represent two key components of an effective EMS

3 2 3 Develop an environmental policy for Tree House

An environmental policy is an important tool for communicating, both internally to employees and externally to guests, that the property is serious about its role in preserving and protecting the environment The policy should therefore embody the property's commitment to the environment and define the goals it wishes to achieve

The formulation of the environmental policy should be a concerted effort, involving management, the program Champion the Green Team and all interested staff members This combined effort will insure that the environmental policy is understood and respected by all employees and will provide the staff with a sense of ownership over the property's environmental program

The breadth of the environmental policy adopted by the hotel will define the complexity and magnitude of the environmental management system that will be needed to put the policy s words into actions The property is therefore advised to develop a first policy that is appropriate to the nature and scale of its environmental impact, but not overly ambitious The first environmental policy should include manageable commitments which bring obvious benefits to the property or help remedy its most significant environmental impacts Examples of commitments appropriate for a first environmental policy include

- safeguarding natural resources by achieving a more efficient use of water, energy,

chemicals and materials,
- preventing pollution by reducing the amount of waste generated by the property,
- complying with all applicable environmental regulations

After mastering the basic principles and operations of its EMS, Tree House should broaden the scope of its environmental policy and review its objectives and targets Some examples of complete and comprehensive environmental policies are given below and in Appendix I

The environmental policy must be clearly communicated and explained to all current employees and all new hires It should be discussed in staff meetings, included in employee handbooks and posted on the staff notice board Once the property has put into practice the key elements of its EMS and achieved the first noticeable results, management should place a framed copy of the environmental policy in the hotel lobby, in full view to all guests and visitors

Hotel Code of Conduct

By the Negril Area Environmental Protection Trust (NEPT) and the Negril Chapter of the JHTA

We pledge our commitment to the environment of our area as well as that of the whole Earth and therefore strive always to

- *Make the best most efficient use possible of the resources available to us including water and energy knowing that in so doing we are not only being good neighbors in our resort community but also minimizing negative impacts inherent in the provision of these services*
- *Respect, preserve and protect the air water land plants and animals within our care*
- *Comply with all regulations and statutes concerning development and the environment*
- *Minimize waste and all forms of pollution*
- *Make the smallest impact possible on the natural beauty and bounty of our area our city our country and our world and to enhance this beauty and bounty wherever we can*
- *Create wise management policies to benefit our business our customers our staff and the environment realizing that these are integrated*
- *Work together with others to achieve wider environmental and development goals*
- *And in all way to be good stewards of our natural world for this and future generations*

3 2 4 Motivate the staff

Use staff meetings to inform all employees of the program's objectives and to call for their ideas and support Involving the staff not only helps gain their commitment to the initiative, but it also allows the program to benefit from their creativity and experience line-level employees often know best how to reduce waste and improve efficiency, and how to carry out specific programs and actions in the most practical manner The Champion and the Green Team should, therefore, strive to gain the support and collaboration of their colleagues at all levels and in all the departments of this property

In most cases, staff will not effectively practice environmentally-conscious behavior unless they are given proper training and motivated through an appropriate incentives program For example, employees will engage more willingly in good housekeeping practices once they are clearly instructed on what must be done, informed of the benefits of these practices, and encouraged and rewarded by management Since staff participation in the environmental program can generally save the property a lot of money, management should take the time to devise an appropriate and effective incentive program

Incentives can include monetary rewards such as sharing with the staff part of the water and energy savings achieved through the environmental program, or giving bonuses to particularly deserving employees Incentives can also include non-monetary rewards such as extra paid vacation days, parties and gifts (e g , t-shirts with the hotel's "green team" logo, gift certificates)

3 2 5 Participate in external activities

Tree House's management and staff should get involved in local and national initiatives, attend events, subscribe to environmental publications, discuss environmental issues with colleagues in the industry, and promote "networking" of good ideas through the Negril Chapter of the JHTA Participation in external activities will help the property gain a deeper understanding of the issues, learn of how others are tackling their environmental problems, and enhance the property's reputation in the industry

An effective and productive way for Tree House to further enhance its environmental program is by developing strong community relationships By actively participating in local civic and environmental activities Tree House will highlight its leadership role and bolster the motivation of its employees by allowing them to positively affect the community in which they live and by providing them an alternate means for professional growth

3 3 Planning Action

3 3 1 Select and assess the program's focus areas

The Green Team, under the leadership of the Program Champion, must review the property's activities in order to determine which areas, departments or issues should be targeted first by

the environmental management program This review process is generally conducted by

1) identifying the environmental aspects of the property's activities -- an environmental aspect is an element of a property's activity which interacts, in a beneficial or detrimental manner, with the environment,

2) evaluating these environmental aspects in order to determine which of these have a significant negative impact on the environment,

3) highlighting the areas of significant negative environmental impact that can be affected through the property's environmental program

The environmental aspects of the various activities carried out in hotels can generally be classified in at least one of the following categories

- water use,
- energy use,
- solid waste generation,
- generation of water pollutants,
- use of hazardous products,
- generation of air emissions, and
- damage to the eco-system

A description of the environmental impacts and the types of activities associated with Tree House's principal environmental aspects is given in Appendix II

The identification of environmental aspects and impacts provides the property with a sense of its current environmental performance and enables the property to establish the environmental targets and objectives of its future EMS activities The background information and the recommendations given in this report should help Tree House identify its principal priority areas

After selecting the priority areas for the environmental program, the Green Team will have to conduct a detailed review of each priority area The purpose of this review process is

1) To assess current performance in each particular priority area Current performance can be best evaluated by calculating environmental performance indicators from the property's energy water and solid waste bills, chemicals and materials purchase records, and hotel occupancy records Examples of the type of indicators which can be used by Tree House to gauge its current environmental performance include

   - gallons of water consumed by the property per guest night
   - kWh consumed by the property per guest night
   - number of tanker loads pumped from the septic tank per guest night
   - gallons of water consumed per pound of material processed through the laundry
   - pounds of laundry (or number of wash loads) processed per guest night
   - pounds of laundry chemicals used per guest night

- pounds (or volume) of solid waste hauled out of the property per guest night
- pounds of materials (glass, paper, plastic, metals) recycled per guest night
- pounds of a specific chemical product used per guest night

This initial assessment is very important since it provides the benchmark against which progress will be measured in a particular focus area (e g , the laundry room) or in the property as a whole

2) To identify improvement options The Green Team will need to identify what is already being achieved in order to gain an idea of where improvements can be made without sacrificing other operational criteria This is where discussion with key staff in each area is not only very useful (they often understand best where and how improvements can be made) but also essential if they are to be committed to the process

The findings and conclusions of this preliminary review process should be recorded so that they may be used, at the end of the yearly EMS cycle, to evaluate the results and achievements of the environmental program

3 3 2 Prepare a plan

The preparation of the action plan involves four important steps

- decide which of the actions identified by the review should be pursued first,
- define which steps are needed to implement each action,
- allocate responsibility for these steps,
- set target dates for action

The action plan should prioritize

- actions needed to meet environmental laws and standards,
- good management practices which are simple and will bring a combination of environmental and business benefits,
- investment measures which have a rapid payback

The action plan forms given in Appendix III illustrate the outputs of this task

The task of working up the plan of action may involve testing the performance, cost and operational implications of an option It may be wise to try out an idea before fully implementing it

The audit team recommends that the hotel begin with back-of-house environmental improvements first Since at the present time Tree House has very few environmental initiatives in place it would not be wise to start its environmental efforts with a program such as a Linens and Towels Reuse Program, which solicits guest participation These types of programs are best implemented (and the guests are more likely to willingly participate)

after the guest can see that the hotel has already made some efforts toward conservation or waste management

3 3 3 Set targets

The purpose of setting targets is to provide clear benchmarks against which to measure the success of the program However, since changing environmental practice takes time and effort, the Green Team should carefully evaluate the program's targets It is often better to set targets which are achievable and which can provide real satisfaction once achieved, than to set over-ambitious targets which only lead to failure and staff demoralization

The targets established by the Green Team for the property's environmental program can either be based on environmental performance indicators or on specific actions that must be completed by a given date

Examples of indicator-based targets include

- Reduce the amount of water consumed by the property per guest night in 1998 by 10% with respect to the 1997 figure
- Reduce the mass of solid waste hauled out of the property per guest night in 1998 by 20% with respect to the 1997 figure
- Before the end of 1998, achieve a water use ratio of 2 1 IG per pound of laundry processed

Examples of action-based targets include

- Start a composting program for all garden waste by March 1998
- Develop a check list for a guest room preventive maintenance program by January 1998 and begin the program by February 1998

3 4 Taking Action

3 4 1 Prepare personal action plans

Tree House's employees must clearly understand that responsibility for minimizing the waste of energy, conserving water, recycling materials, and other tasks defined by the property's environmental program is part of their job They must be aware that they will be recognized if they carry out these responsibilities successfully, and noticed if they do not The key to achieving this objective is to translate the overall action plan into personal action plans which detail the specific and general actions expected of specific employees

An example of a personal action plan is provided in Appendix IV

3 4 2 Provide support and training

The key to success for any environmental program is education Employees must learn how to perform their daily tasks in a manner that will maximize conservation, and understand

why Tree House is undertaking this effort and the positive effects this effort will have on them, their families and the local community This understanding will provide a sense of ownership in the environmental effort that will contribute to its long-term success

The objectives of the training program are simple to ensure that all employees understand the property's important environmental issues and have acquired the skills to perform their work in an environmentally responsible manner

3 4 3 Publish results

Employees want to know the results of their endeavors Management and the Green Team should therefore regularly post the results of monitoring on the staff notice board, congratulate success, and rewarding individuals or departments that have done particularly well

Many hotels put up energy and water consumption monitoring results on their staff notice boards The results for the current month are displayed in a simple graphic format and compared with the previous month and the same month in the previous year Staff take a great interest and pride in these results

Tree House may also decide to publicize the results of its environmental program in its promotional literature

3 4 4 Show leadership

Achieving staff commitment is an ongoing task -- if enthusiasm is to be maintained, staff need to be constantly reminded of the objectives and targets which have been set Management and the Green Team must demonstrate its continued commitment and leadership, notice when action is being taken and when lapses occur, and continually refresh enthusiasm in the challenge of transforming Tree House in an environmentally friendly property Like customer care, good environmental management practices must become part of the management culture

3 5 Reviewing Progress

3 5 1 Monitor progress

The saying "you can't manage what you don't measure, applies as much to environmental management as to other areas Tree House needs to establish good monitoring procedures to insure that the program is working and achieving its objectives Monitoring should be regular and scheduled (i e , readings should be taken at a predetermined hour) Monitoring should be sufficiently frequent to enable corrective action to be taken if there is a significant change in the average daily consumption or a large deviation from targeted performance Ideally, water and electricity meters should be checked on a daily basis This activity need

not take a member of staff more than 30 minutes per week

Examples of water and electricity monitoring forms are provided in Appendix V

Especially in the early days when progress will be patchy, and difficulties will arise, the Green Team should frequently hold short meetings with relevant individuals to review the progress made, and to help sort out problems as they arise

Effective utilities metering will pay back very rapidly Some hotels have installed separate utility sub-meters for specific property areas This enables them to better identify where energy or water wastage is occurring, and to track the utilities consumption of high usage areas such as the laundry and kitchen Typically the cost of installing new meters will be met from utility cost savings in the first year

3 5 2 Conduct an annual review

Once a year Tree House will need to step back to check the progress in its environmental performance This review might best be undertaken by the Champion and may take the form of a short report attaching competed targeting and monitoring forms of the initiatives undertaken Alternatively, management may prefer to use independent consultants if it feels that Tree House does not have the resources or expertise in house to perform this task The review should cover the property's environmental management capabilities as well as the progress made with specific environmental actions It should entail

- A general review of the property's environmental performance to assess what progress has been made, and to help re-prioritize action
- A summary of measured achievements against set targets and objectives
- Discussions with relevant staff to identify the difficulties that have arisen and the successes and their recommendations for future action

This review process is invaluable It will highlight problem areas as well as help identify the most appropriate environmental management approach for Tree House Management and the Green Team can then begin to plan for the coming year -- but this time on the basis of the experience acquired over the past year

4. Recommendations for Improving the Property's Environmental Performance

Table 1 provides a summary of the recommendations proposed by the audit team to help the property address many of its activities that have a negative impact on the environment It is important to note, however, that this list only contains the recommendations identified during the course of a three day audit, these recommendations should therefore be viewed as only a the first phase of the property's continuous EMS process

The recommended actions listed in Table 1 are classified by department or area of activity (e g , maintenance department, housekeeping department, guest rooms, gift shop) and by the environmental aspect category addressed by each recommendation (e g , water use, energy use, solid waste generation) Table 1 also provides an evaluation of the environmental impact, the implementation cost and the cost effectiveness of each recommended action The ratings used to qualify the recommendations are defined as follows

Criteria	Rating	Description of rating
Environmental benefit of the action	High (H)	Significant reduction of the property's impact on the environment (e g a large reduction in the toxicity or volume of generated waste, a significant improvement in the use of water, energy, chemicals or other products)
	Moderate (M)	Moderate reduction of the property's impact on the environment
	Low (L)	Low or insignificant reduction of the property's impact on the environment
Cost to implement the action	High	Cost > 1,750 J$ per room (> 50 US$ per room)
	Moderate	Cost = 350 to 1,750 J$ per room (10 - 50 US$ per room)
	Low	Cost < 350 J$ per room (< 10 US$ per room)
Cost effectiveness of the action	High	Payback < 2 months
	Moderate	Payback = 2 months to 1 year
	Low	Payback > 1 year

The property s management can use the ratings to select the recommendations that should be implemented first and to identify the recommendations that yield the greatest benefits -- that is High environmental benefit Low implementation cost and High cost effectiveness

The high priority actions are highlighted with the "✪" symbol These actions are those which either have an immediate payback (cost effectiveness = H) or have a high environmental benefit combined with a moderate payback (cost effectiveness = M)

Table I Recommendations for Improving the Property's Environmental Performance

Env aspect	Description and rating of the recommended action (H = high, M = moderate, L = low)		
MAINTENANCE DEPARTMENT			
General maintenance issues	Action's env impact = H	Cost = M	Cost effectiveness = H
	✪ Make it a top priority to hire additional maintenance workers While Mr Lindo has exhibited the highest level of professional service and competence, the costly inefficiencies that are evident throughout the property are a direct result of a severe shortage of maintenance workers The water, energy, equipment and other savings achieved with a well staffed maintenance department will easily offset the salary of the additional maintenance workers In the five best maintained Negril hotels audited by EAST, the maintenance staff to guest room ratio ranges from 1/9 to 1/20 In contrast, Tree house's maintenance staff to guest room ratio is 1/66		
General maintenance issues	Action's env impact = H	Cost = L	Cost effectiveness = H
	✪ Implement a program to regularly monitor the consumption of energy, water and chemicals and the generation of solid waste At the end of each month, the property should calculate how much electricity LPG, water, and chemicals was consumed and how much garbage was produced per guest night (i e , gallons of water / guest night, kWh/guest night, etc) This data will help the property • define its normal consumption patterns, • identify any unusual shifts in consumption which may indicate the existence of problems on the property or in its operations (e g , water leaks), • insure that employees are complying with water energy and materials conservation guidelines, • insure the effectiveness of preventive maintenance operations, and • evaluate the progress of the property's conservation and environmental efforts Monitoring should be sufficiently frequent to enable corrective action to be taken if there is a significant change in the average daily consumption or a large deviation from targeted performance Ideally water and electricity meters should be checked on a daily basis This activity need not take a member of staff more than 30 minutes per week Samples of water and electricity monitoring forms are presented in Appendix V		

Env aspect	Description and rating of the recommended action (H = high, M = moderate, L = low)		
General maintenance issues	Action's env impact = H	Cost = M	Cost effectiveness = H/M
	✪ Most of the equipment at Tree House is in a poor state of maintenance Once it receives the necessary means and staff, the maintenance department should establish and implement an effective maintenance program covering guest rooms, and public and back-of-house areas A regular and comprehensive preventive maintenance program will extend the service life and increase the operating efficiency of Tree House's equipment, and reduce the property's energy, water and chemical's consumption and costs		
General maintenance issues	Action's env impact = M	Cost = L	Cost effectiveness = not applicable
	Enter all repairs in a log book This will allow management and the maintenance department to identify inefficient equipment and to better manage maintenance operations		
Water use	Action's env impact = H	Cost = see specific actions	Cost effectiveness = see specific actions
	Water consumption at Tree House (208 IG per guest night) is much above the industry average for a water efficient property (128 IG per guest night) Given the high cost of NWC water (200 J$/1,000 IG), Tree House should engage in an aggressive water conservation program		

Env aspect	Description and rating of the recommended action (H = high, M = moderate, L = low)		
Water use	Action's env impact = M	Cost = L	Cost effectiveness = H

❂ Promptly fix all leaks in faucets, toilets, pipes and other fixtures Many of the hotel's toilets and faucets leak and waste a large volume of water and money For example, 5 out of 9 (56%) bathrooms inspected by the audit team had leaky toilets the toilet in room 53 was measured to lose 5 9 IG per hour, corresponding to a loss of 51,800 gallons of water per year and costing the hotel 10,400 J$ per year

Maintenance staff should replace damaged faucet washers, fix broken flush lever mechanisms adjust the water level in the toilet tanks, replace defective flapper valves, and check toilet tanks for scale deposits that may obstruct the flapper The cost of such routine maintenance operations is generally negligible

Maintaining Tree House's water-using fixtures in proper working order requires an effective preventive maintenance program and the collaboration of all the property's employees All staff members -- and in particular housekeepers, kitchen and laundry workers -- should be trained to detect leaks and malfunctioning toilets (leaky flapper valves, sticking flush mechanism overflowing toilet tanks), and to promptly report these problems to maintenance

Maintenance staff should be given the training and the means to promptly answer the maintenance requests and conduct a regular and effective preventive maintenance program As part of the preventive maintenance program, maintenance staff should

- replace missing or damaged faucet aerators,
- insure that there are no excessive leaks in the valves which divert water from the tub faucet to the shower head (i e , insure that only a minimum amount of water comes out of the tub faucet while the valve is on the "shower" position),
- insure that there are no excessive leaks around the packing of tub and sink faucets,
- periodically clean the carbonate deposits from shower heads (excessively clogged shower head may encourage guests to take baths rather than showers -- an average bath consumes 4 times more water than a shower),
- insure that tub and sink stoppers seal properly, repair or replace leaking stoppers
- check for broken flush lever mechanisms (a damaged or jammed flush mechanism can waste more than 5 IG/minutes until it is detected and corrected),
- check for damaged and leaky flapper valves,
- remove scale deposits in toilet tanks that may obstruct the flapper valve, and
- adjust the water level in toilet tanks to the minimum level required for proper operation

The cost of carrying out these preventive maintenance operations is generally minimal

Env aspect	Description and rating of the recommended action (H = high, M = moderate, L = low)		
Water use	Action's env impact = M	Cost = L	Cost effectiveness = H
	✪ Reduce water use in guest bathrooms and kitchenettes, public and employee restrooms, and back-of-house areas by installing flow aerators on all faucets that are not yet equipped with such water-saving devices The use of flow aerators is particularly important in places such as kitchen sinks where taps are used frequently or left running for long periods of time **This recommendation is further detailed in Project 1**		
Water use	Action's env impact = M	Cost = L	Cost effectiveness = H
	✪ In addition to the use of flow aerators, the output of faucets can also be controlled by adjusting the shut-off valves that are located on the lines which bring water the faucets In many cases, these valves are wide open and thus subject the faucets to the full pressure carried by the water distribution system In order to conserve water, this property should adjust these valves to reduce the water pressure acting on the faucets and thereby reduce the maximum flow output of the faucets		
Water use	Action's env impact = M	Cost = L/M	Cost effectiveness = M
	Continue the installation of low flow shower heads Since the low flow shower heads installed by Tree House use less than 1 5 IG/min as compared to more than 3 5 IG/min for standard shower heads, the installation of these devices is a very cost effective water conservation measure At the time of the audit, Tree House had already purchased and installed 40 such low-flow shower heads **This recommendation is further detailed in Project 2**		
Water use	Action's env impact = M	Cost = L/M	Cost effectiveness = L/M
	• Establish a policy to replace any damaged or unusable guest bathroom toilet with a water saving toilet (1 3 IG/flush) • Replace all conventional toilets with 1 3 IG/flush toilets in frequently used public or employee restrooms **This recommendation is further detailed in Project 3**		

Env aspect	Description and rating of the recommended action (H = high, M = moderate, L = low)		
Water use	Action's env impact = M	Cost = L	Cost effectiveness = M
	Install a flow diverter on the hose which feeds water to the to the bowl's refill pipe of conventional toilets By diverting back into the water tank part of the flow that normally drains to the toilet bowl, this simple device can be used to set a suitable water level in the toilet bowl and avoid the waste of water resulting from overfilling the toilet bowl Flow diverters can be easily installed on almost any conventional toilet (i e , 3 3 to 4 2 IG per flush) and can save from 0 4 to 0 8 IG per flush **This recommendation is further detailed in Project 4**		
Water use	Action's env impact = M	Cost = L	Cost effectiveness = M
	Install displacement devices in the water tanks of all non water-efficient toilets (3 3 to 4 2 IG tanks) The use of these devices can reduce the amount of water used for each flush by approximately 0 4 IG per flush **This recommendation is further detailed in Project 5**		
Water use	Action's env impact = M	Cost = L	Cost effectiveness = M/H
	❂ Make sure that all guest bathroom sinks are equipped with stoppers and that these stoppers do not leak The lack of properly fitting stoppers forces all guests to use running faucets whenever they shave, wash clothes, etc ❂ Make sure that if the tubs are equipped with stoppers these do not leak Poorly fitting or leaking stoppers lead guests to use more water whenever they take baths ❂ Since baths consume on average 4 times more water than showers Tree House may want to discourage guests from taking baths In such a case, it should remove all tub stoppers or dismantle all tub stopper mechanisms		
Water use	Action's env impact = H	Cost = M/H	Cost effectiveness = M
	❂ Given the high cost of NWC water (200 J$/1 000 IG) Tree House should seriously consider collecting and reusing the rainwater that falls on the rooftops of its cottages and buildings The principal uses for the collected rainwater include grounds irrigation and laundry (rainwater is naturally soft and would therefore eliminate the need for water softening chemicals) **This recommendation is further detailed in Project 6**		

Env aspect	Description and rating of the recommended action (H = high, M = moderate, L = low)		
Water use	Action's env impact = N/A	Cost = L	Cost effectiveness = M/H
	Install a private meter on the unmetered 1 inch main and monitor its water output Tree House is currently charged for an estimated water consumption of 150,000 IG/month from this main, but its output is probably considerably less than the estimated value The property's other 1" main has an average metered output of only 104,000 IG/month Use the data collected from the private meter to correct, if necessary, NWC's water consumption estimates		
Water use	Action's env impact = M	Cost = M/H	Cost effectiveness = L/M
	Use a sedimentation tank to pretreat the water supply A simple sedimentation tank could remove most of the sediments from the raw water flow and thus eliminate, or greatly reduce, the use of imported, disposable water filters The economic viability of this measure will depend on the amount of money currently spent by Tree House in purchasing its water filters Based on information given by Mr Lindo (8 filtration cartridges are discarded each week), the audit team estimates that Tree House spends at least 2,800 US$/year on wound filtration cartridges (each cartridge is estimated to cost 6 80 US$)		
Energy use electricity	Action's env impact = H	Cost = see specific actions	Cost effectiveness = see specific actions
	Electricity consumption at Tree House is above industry average, Tree House should therefore engage in an aggressive energy conservation program As part of this program Tree House should monitor its electricity consumption (i e , daily reading of the electricity meter) and calculate its monthly electricity consumption index (kWh/guest night) Meter readings and the electricity consumption index will allow Tree House to insure that its employees are practicing energy conservation practices, insure the effectiveness of preventive maintenance operations, and evaluate the progress of energy conservation efforts A sample electricity monitoring form is given in Appendix V		
Energy use electricity	Action s env impact = M	Cost = M	Cost effectiveness = H
	✪ Tree House is currently billed at rate 20 This property should consider converting to rate 40 in order to reduce its energy bills **This recommendation is detailed in Project 7**		

Env aspect	Description and rating of the recommended action (H = high, M = moderate, L = low)		
Energy use electricity	Action's env impact = M	Cost = L	Cost effectiveness = H
	❂ Although pool filter pumps are generally operated continuously, experience has shown that pool water quality can be maintained by running the filter pumps for 12 to 16 hours per day Tree House should therefore install a timer on its filter pump or manually shut it off at night This measure will save energy and increase the service life of the pump **This recommendation is further detailed in Project 8**		
Energy use lighting	Action s env impact = M	Cost = M/H	Cost effectiveness = M
	There is a large number of incandescent bulbs used around this property (especially for exterior illumination) Wherever possible, Tree House should consider replacing burnt-out incandescent bulbs with energy efficient fixtures (e g , compact fluorescent bulbs) **This recommendation is further detailed in Project 9**		
Energy use lighting	Action's env impact = M	Cost = L	Cost effectiveness = H
	❂ Corridor and guest room terrace lighting is generally excessive (100 watt incandescent bulbs) If Tree House cannot immediately purchase CF lights for these location, it should replace the 100 W bulbs with lower wattage bulbs to save energy, improve the atmosphere of the guest room terraces (current lighting in terraces is too bright and harsh), and lower electric costs		
Energy use lighting	Action's env impact = M	Cost = L	Cost effectiveness = M
	Install occupancy sensors or timers on the lighting in all storage rooms and walk-ins The lights in these areas are frequently left on by the staff		
Energy use lighting	Action's env impact = M	Cost = L	Cost effectiveness = H
	❂ Maintenance and management should encourage staff to turn off lights and equipment that are not in use The hotel should purchase signage to place near light switches or staff notice board to remind staff to do so		

Env aspect	Description and rating of the recommended action (H = high, M = moderate, L = low)		
Energy use air conditioning	Action's env impact = M	Cost = L	Cost effectiveness = H
	❂ Equip all air conditioning units with air filters and clean the filters (and the cooling coils if necessary) on a monthly or bi-monthly basis -- this operation is currently done only once or twice per year Most of Tree House's air conditioning units are clogged with dust and therefore operate very inefficiently		
Energy use air conditioning	Action's env impact = M	Cost = M	Cost effectiveness = M
	Many of the air conditioning units inspected are in disrepair and need servicing Tree House should implement a regular and planned maintenance program for a/c units		
Energy use air conditioning	Action's env impact = M	Cost = M	Cost effectiveness = M/H
	The louvered windows and the large gaps under the entrance doors result in a significant heat gain in the guest rooms and add to the load on the air conditioning units Repair damaged louver panes and install durable weather stripping on the louvered windows and at the base of the entrance doors to reduce heat gain and the energy consumed by the air conditioning units		
Energy use hot water supply	Action's env impact = M	Cost = M	Cost effectiveness = M
	Many water heaters are in need of servicing Tree House should implement a regular and planned maintenance program for all water heaters		
Energy use hot water supply	Action's env impact = M	Cost = L	Cost effectiveness = H
	❂ The thermostat setting on many of the property's water heaters is excessively high (for example, two of the inspected water heaters were set at 140 and 170°F) The maintenance department should adjust the thermostats to a lower temperature to reduce heat losses (from the surface of the water heater tanks and the hot water pipes) and eliminate the risk of scalding guests and employees In many parts of the US, setting water heaters higher than 125°F is prohibited by law		
Energy use hot water supply	Action s env impact = H	Cost = H	Cost effectiveness = L/M
	Consider installing additional solar panels such as those currently in place on some of the suites cottages		

Env aspect	Description and rating of the recommended action (H = high, M = moderate, L = low)		
Solid waste generation	Action's env impact = H	Cost = M	Cost effectiveness = M
	✪ Tree House should implement a hotel-wide recycling program to segregate glass, metal, cardboard, paper and green waste from its general waste stream **This recommendation is further detailed in Project 10**		
Use of hazardous chemicals	Action's env impact = H	Cost = L	Cost effectiveness = H
	✪ Eliminate the routine use of sulfuric acid (Petrotherm) as a "degreaser' for grease traps and to clear blocked drains This chemical is toxic, hazardous, and expensive and should therefore be used sparingly and only as a last resource In 1996, Tree House consumed more than 420 US gallons of Petrotherm at a cost of 210,000 J$ **This recommendation is further detailed in Project 11**		
Generation of air emissions	Action's env impact = H	Cost = M	Cost effectiveness = not applicable
	Implement a CFC phase-out program This program should cover the proper handling and recycling of Freon from old equipment (ice-making machines, refrigerators and air conditioners) and the gradual replacement of old equipment with CFC-free equipment		
Damage to the ecosystem	Action's env impact = H	Cost = M/H	Cost effectiveness = not applicable
	Tree House should stop discharging untreated gray water from laundry kitchen and a few cottages in the morass The discharge of sewage and noxious effluents in bodies of water is prohibited by Jamaica's Natural Resources Conservation Authority Act		

Env aspect	Description and rating of the recommended action (H = high, M = moderate, L = low)		
FRONT OFFICE AND GIFT SHOP			
Solid waste generation	Action's env impact = M	Cost = L	Cost effectiveness = M
	Implement a paper reuse program Once-used paper (i e , printed on one side only) can be reused as scrap paper for taking notes, writing inter-office memos, etc		
Solid waste generation	Action's env impact = L	Cost = L	Cost effectiveness = H
	❂ In the gift shop, replace the brown paper currently used to wrap breakable items with used newspaper		
Solid waste generation	Action's env impact = L	Cost = L	Cost effectiveness = H
	❂ Whenever feasible, don't automatically give out plastic bags for gift shop purchases Instead ask guests if they would like one and replace plastic bags with paper bags		

Env aspect	Description and rating of the recommended action (H = high, M = moderate, L = low)		
PURCHASING DEPARTMENT			
Solid waste generation	Action's env impact = M	Cost = L	Cost effectiveness = not applicable
	Purchase as many recycled paper products as possible (office paper, toilet paper, facial tissues paper towels, etc) Most paper products manufacturer have environmentally friendly alternatives which contain a minimum of 20% POST CONSUMER waste The price and quality of recycled paper products are often comparable to those of virgin paper products		
Solid waste generation	Action's env impact = M	Cost = L	Cost effectiveness = M
	An effort should be made to standardize and consolidate purchases between departments For example there are several types of facial tissues used throughout the hotel -- some containing 100% post consumer waste and some containing none		
Use of hazardous products	Action's env impact = H	Cost = L	Cost effectiveness = not applicable
	✪ Obtain ingredient lists or material safety data sheets (MSDS) from chemical manufacturers or distributors and keep them on file This will help the property identify and possibly discontinue the use of certain hazardous products It will also allow the property to better respond to emergencies related to the use of these hazardous chemicals		

Env aspect	Description and rating of the recommended action (H = high, M = moderate, L = low)		
HOUSEKEEPING AND LAUNDRY			
General issues	Action's env impact = H	Cost = L	Cost effectiveness = H
	✪ Tree House should implement a formal system to report malfunctioning guest room equipment to the maintenance department This system should include written and tracked maintenance request forms Supervisors should be made more aware of the importance of reporting faulty equipment such as leaky toilets, a great consumer of water and dollars		
Energy and water use	Action's env impact = H	Cost = L	Cost effectiveness = H
	✪ Implement a linen and towel reuse program International and Jamaican (JHTA) experience has revealed that such an option can reduce the laundry load by up to 40% By reducing the volume of material processed through the laundry, the property can lower its water, chemical usage, and energy costs, lengthen the useful life of its laundry room equipment, and reduce its discharge of pollutants to the environment **This recommendation is further detailed in Project 12**		
Energy use air conditioning	Action's env impact = M	Cost = L	Cost effectiveness = H
	✪ Turn air conditioners off during room cleaning operations, especially if doors are left open After cleaning the rooms leave the air conditioning units off or, if requested by the guests turn them back on at a low energy setting **This recommendation is further detailed in Project 13**		
Solid waste generation	Action's env impact = L	Cost = L	Cost effectiveness = H
	✪ Eliminate the use of paper wrap for guest room drinking glasses Instead, store the drinking glasses upside-down		
Solid waste generation	Action's env impact = M	Cost = L	Cost effectiveness = M
	Discontinue the practice of wrapping linens and towels in plastic bags Purchase baskets or durable reusable canvas bags instead		

Env aspect	Description and rating of the recommended action (H = high, M = moderate, L = low)		
Solid waste generation	Action's env impact = M	Cost = L	Cost effectiveness = M
	Discontinue the practice of wrapping guest laundry in plastic Instead of using plastic bags, the laundry could be folded and returned in small, reusable wicker baskets		
Solid waste generation	Action's env impact = M	Cost = L	Cost effectiveness = M
	Reduce spillage and overuse of laundry detergent and chemicals by using suitable measuring cups rather than the existing spoons		
Use of hazardous products	Action's env impact = H	Cost = L	Cost effectiveness = M
	❂ Label all chemical containers An effort should be made to retain the labels on all chemical containers in order to avoid potential injury to employees and guests and to prevent the misuse or unnecessary disposal of these products		

Env aspect	Description and rating of the recommended action (H = high, M = moderate, L = low)		
KITCHEN			
Water use	Action's env impact = M	Cost = L	Cost effectiveness = H
	✪ Reduce unnecessary use of water in food preparation by washing vegetables in basin and thawing foods in the refrigerator rather than under running water		
Water use	Action s env impact = L	Cost = L	Cost effectiveness = H
	Clean the kitchen floor with a mop and bucket instead of a hose		
Water use & energy use	Action's env impact = L	Cost = L	Cost effectiveness = M
	Improve the efficiency of dish washing operations by scraping and pre-soaking dishes and pans that are heavily soiled, and making sure that the dishwasher only runs with a full load		
Energy use refrigeration	Action s env impact = M	Cost = M	Cost effectiveness = M
	Kitchen freezers and coolers are in a poor state of maintenance and should be serviced		
Energy use refrigeration	Action's env impact = M	Cost = M	Cost effectiveness = M
	Repair all broken temperature gauges to ensure that appliances are operated at the required temperature		
Energy use air conditioning	Action's env impact = M	Cost = L	Cost effectiveness = H
	✪ Turn off the air conditioner at night (or at least operate it at a low energy setting) and turn off all cooking equipment when it is not needed in order to reduce energy consumption		
Energy use	Action s env impact = M	Cost = L	Cost effectiveness = M
	The stove top should be cleaned every day and the griddle should be scraped after each meal service rather than at the end of the day These practices will increase the efficiency of the equipment and reduce fire hazards		

Env aspect	Description and rating of the recommended action (H = high, M = moderate, L = low)		
Solid waste generation	Action's env impact = L	Cost = L	Cost effectiveness = M
	Purchase sealable, reusable plastic containers (e g , Tupperware) to reduce the use of disposable plastic wrap for food storage		
Solid waste generation	Action's env impact = M	Cost = L	Cost effectiveness = M
	Reduce packaging waste and costs by purchasing sugar, jellies and jams, butter and cereal in bulk		
Solid waste generation	Action's env impact = M	Cost = L	Cost effectiveness = L
	Use durable plate covers instead of plastic wrap for room service deliveries		
Use of hazardous products	Action's env impact = M	Cost = L	Cost effectiveness = not applicable
	Discontinue the use of bleach as a cleaning agent Purchase a citrus-based cleanser as an alternative		

Env aspect	Description and rating of the recommended action (H = high, M = moderate, L = low)		
RESTAURANT AND BAR			
Solid waste generation	Action's env impact = M	Cost = L	Cost effectiveness = M
	Replace disposable plastic wares and paper plates and cups at the beach bar with reusable alternatives Tree House's beach is littered with used plastic plates and cups		
Solid waste generation	Action's env impact = M	Cost = L	Cost effectiveness = H
	❂ Discontinue the practice of supplying guests with new paper cups or glasses for each drink they order If a guest orders the same beverage twice, offer to refill the glass as an alternative to giving a new glass This measure will cut down on water used for dish washing, chemical use, and the generation of solid waste		
Solid waste generation	Action's env impact = L	Cost = L	Cost effectiveness = H
	❂ Do not give straws out automatically with drinks Place straw dispensers on the bar or ask guests if they need a straw before serving the drinks Also, replace plastic straws with paper straws		
Solid waste generation	Action's env impact = M	Cost = unknown	Cost effectiveness = unknown
	Reduce packaging waste by purchasing concentrated juices as an alternative to canned juices		
Solid waste generation	Action's env impact = L	Cost = L	Cost effectiveness = L
	Replace paper napkins with linen napkins during breakfast and lunch		
Solid waste generation	Action s env impact = L	Cost = L	Cost effectiveness = L
	Eliminate the use of daily special menus at the restaurant and beach bar by using black boards or glow boards' to announce the special menu items The board can be placed at the restaurant or bar entrance and servers can recite the special menu items at the table		
Use of hazardous products	Action s env impact = M	Cost = L	Cost effectiveness = not applicable
	Discontinue the use of bleach as a cleaning agent Purchase a citrus-based cleanser as an alternative		

Env aspect	Description and rating of the recommended action (H = high, M = moderate, L = low)		
POOL, BEACH AND WATER SPORTS			
Solid waste generation	Action's env impact = M	Cost = M	Cost effectiveness = M
	Discontinue the use of disposable wares on the "Island picnic" tour Reusable plastic alternatives should be used instead		
Solid waste generation	Action's env impact = H	Cost = L	Cost effectiveness = not applicable
	✪ Implement a program to recycle old batteries and motor oil from the jet skis		
Use of hazardous products	Action's env impact = H	Cost = L/M	Cost effectiveness = not applicable
	✪ Identify and use an environmentally friendly alternative to the diesel/pesticide mixture presently used to "fog" the beach		
GARDENS			
Water use	Action's env impact = M	Cost = L	Cost effectiveness = H
	✪ Irrigate in evening and early morning to reduce the amount of water lost by evaporation		
Solid waste generation	Action's env impact = H	Cost = L	Cost effectiveness = M
	✪ Discontinue the practice of incinerating green waste Mr Morris should start a compost heap for grass, shrub trimmings, and the sea grass collected daily from the beach This compost can be used on the hotel grounds as well as Mr Jackson's farm to replace chemical fertilizers **This recommendation is further detailed in Project 14**		
Solid waste generation	Action's env impact = M	Cost = L	Cost effectiveness = M/H
	✪ Use a wheelbarrow yard cart or durable reusable canvas bags rather than disposable plastic bags to gather green garden waste		
Solid waste generation	Action's env impact = M	Cost = L	Cost effectiveness = not applicable
	All employees should be required to pick up any trash which may be laying around the property The audit team found significant littering on the hotel grounds It may be necessary to add more trash cans around the property for guest use		

5. Detailed Analysis of Selected Recommendations

Project I: Install flow aerators on all faucets

Summary of results and benefits

- Reduces water consumption and wastewater generation by 13,870 IG/year, corresponding to savings of 2,770 J$/year for each flow aerator installed in a typical back-of-house faucet
- Saves energy by reducing the use of hot water from faucets
- The payback period of this water conservation measure is typically 8 days

Current situation Many faucets in guest rooms (bathrooms and kitchenettes), back-of-house areas (laundry room, kitchen, bars), and public areas (public restrooms) are not equipped with flow aerators Flow aerators are inexpensive water-saving devices which reduce the output of a faucet without affecting the "feel" of the flow The effectiveness of aerators can be illustrated by the following measurements that were taken on two guest room kitchenette faucets

- Maximum output of faucet with aerator = 1 0 IG/minute
- Maximum output of faucet without aerator = 3 1 IG/minute
- Savings achieved by the faucet aerator = 2 1 IG/minute

Recommendations Install faucet aerators on all faucets which can be equipped with these water saving devices Standard aerator models have maximum flow outputs ranging from 1 3 to 2 1 IG/min 1 3 or 1 7 IG/min aerators are generally used for bathroom faucets, while 2 1 IG/min models are generally installed on kitchen faucets The use of flow aerators is particularly important in areas where taps are used frequently (e g , public and employee restrooms), are left running for long periods of time (e g , kitchen, bar and laundry rooms), or have exceedingly high outputs (e g , the output of kitchen faucets generally ranges from 4 to 10 IG/minute)

Input, assumptions and calculations

a) Water savings achieved by installing a flow aerator on a typical back-of-house faucet

- Assume a typical back-of-house faucet is operated for 20 minutes per day
- The typical flow of a back-of-house faucet with no aerator is 4 0 IG/min By installing an aerator this flow can be reduced to less than 2 1 IG/min
- Currently the cost of the water used at Tree House is 200 J$/1 000 IG

The savings achieved by installing a flow aerator on a single back-of-house faucet are

Water savings = (20 min/day/faucet) x (4 0 IG/min - 2 1 IG/min) x (365 days/year)
= 13,870 IG/faucet/year
= (13,870 IG/faucet/year) x (200 J$/1,000 IG)
= 2,770 J$/faucet/year

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b) Implementation cost and payback period

- The cost of a faucet aerator ranges from 30 to 60 J$ Therefore, the cost effectiveness of this measure is calculated as follows

Total implementation cost = 60 J$/faucet

Payback period = (60 J$/faucet) / (2,770 J$/faucet/year)
< 8 days

Comments

- The savings achieved with flow aerators can justify, in certain cases, the cost of purchasing new fixtures to replace old fashioned faucets that cannot be equipped with flow aerators The following table illustrates this point by presenting the savings resulting from the purchase of aerators and new fixtures for faucets that are operated from 5 to 60 minutes each day

Faucet use (min/day)	Water savings (IG/year)	Water savings (J$/year)	Payback period for a 60 J$ aerator	Payback period for a 3,000 J$ faucet
5	3,470	694	1 month	4 3 years
10	6,935	1 388	16 days	2 2 years
20	13 870	2 776	8 days	1 1 year
40	27 740	5 550	4 days	6 5 months
60	41 610	8 328	3 days	4 5 months

Note
- The savings presented in this table are based on the same flow assumptions used in the preceding calculations -- that is, initial flow of 4 0 IG/min reduced to 2 1 IG/min with the use of an aerator or with a new fixture equipped with an aerator The cost of a new faucet is estimated at 3,000 J$
- In areas where hot water is drawn from the faucets, the installation of a flow aerator will also save energy by reducing the consumption of hot water

Project 2: Install low-flow shower heads in all bathrooms and beach showers

Summary of results and benefits

- Installing a low-flow shower head in a single guest bathroom reduces water consumption by 5,840 IG/year and electricity consumption by 650 kWh/year, and saves the property 4,240 J$/year in water and electricity
- The payback period for this water and energy conservation measure is typically less than 2 5 months

Current situation Tree House has already purchase and installed 40 low-flow shower heads However, many guest bathrooms and beach showers are still equipped with inefficient shower heads (some of the beach showers have no shower heads at all)

The effectiveness of low-flow shower heads can be illustrated by the flow measurements taken by the audit team at Tree House

- Output of a old style shower head = 3 5 to 4 5 IG/minute
- Output of Tree House's low-flow shower heads = 1 to 1 5 IG/minute
- Typical output of "cut pipe" shower = 4 to 10 IG/min

Recommendations Install low-flow shower heads in all guest bathrooms employee changing rooms and beach showers

Input, assumptions and calculations

a) Water and energy savings for each low-flow shower head installed in a guest bathroom

- Assume one 5-minute shower per guest night Since Tree House is a beach hotel, this assumption is very conservative
- Assume a piped water temperature of 70°F (21°C) and a shower water temperature of 105°F (41°C)
- Tree House's low-flow shower heads consume less than 1 5 IG/min while the old shower heads consume more than 3 5 IG/min
- The cost of the water used at Tree House is 200 J$/1,000 IG
- The property has 66 guest rooms and an occupancy of 38,573 guest nights per year This corresponds to an average of 584 GN/year/room
- The electricity consumed by Tree House s electric water heaters costs 4 72 J$/kWh and yields 860 kcal/kWh The water heaters have an assumed efficiency of 95%

Given this information, the water and energy savings achieved by installing a low-flow shower head in a guest bathroom are calculated as follows

Water savings = (5 min/GN) x (3 5 IG/min - 1 5 IG/min)
= 10 IG/GN
= (10 IG/GN) x (584 GN/year/room)
= 5,840 IG/year/room or 26,570 liters/year
= (5,840 IG/year/room) x (200 J$/1,000 IG)
= 1,170 J$/year/room

Energy savings = (26,570 lit/year/room) x (1 kcal/lit/°C) x (41°C - 21°C) x (1/0 95)
= 559,000 kcal/year/room
= [(559,000 kcal/year/room) / (860 kcal/kWh)] x (4 72 J$/kWh)
= (650 kWh/year/room) x (4 72 J$/kWh)
= 3,070 J$/year/room

Total savings = water savings + energy savings
= 4,240 J$/year

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b) Implementation cost and payback period

- The cost of a low-flow shower head ranges from 300 to 850 J$, but, the following calculations will use a conservative cost of 850 J$/unit The cost effectiveness of this water and energy conservation measure is

Implementation cost = 850 J$/shower head

Payback period = (850 J$/shower head) / (4,240 J$/year/shower head)
= 2 5 months

Comments

- Low-flow shower heads must be cleaned periodically to remove the scale deposits and other impurities which may affect the quality of the water stream

- It may be necessary to install theft proof shower heads on the beach and other areas A theft proof feature generally increases the cost of the shower head by less than 50 J$

Project 3: Replace existing 3.3 to 4.2-IG/flush toilets with water-saving toilets

Summary of results and benefits

- Reduces water consumption and wastewater generation by 4,670 IG/year per guest bathroom toilet and 14,600 IG/year per public restroom toilet
- Saves the property 930 J$/year per guest bathroom toilet and 2,920 J$/year per public restroom toilet
- Lowers the hydraulic loading of the septic tanks thereby improving the performance of the property's wastewater disposal system and reducing the frequency of septic tank pumping
- The payback for replacing a guest bathroom's damaged 3 3 IG/flush toilet with a water efficient model is approximately 13 months
- The payback for replacing an operational 3 3 IG/flush public restroom toilet with a water efficient model is 1 4 years

Current situation Even though Tree House has installed 15 water-saving toilets in its suites, most guest bathrooms and public restrooms are equipped with conventional toilets which consume from 3 3 to 4 2 IG per flush

Recommendations

- For guest bathrooms, establish a policy to replace any damaged or unusable toilet with a water-saving model which uses 1 3 IG/flush (1 6 US gallon/flush)

- For all frequently used public or employee restrooms, replace all conventional toilets with 1 3 IG/flush toilets

Input, assumptions and calculations

a) Water savings resulting from installing a water-saving toilet in a guest bathroom

- Assume 4 flushes per guest night
- Water-saving toilets use 1 3 IG/flush while most of Tree House's toilets use more than 3 3 IG/flush
- The cost of the water used at Tree House is 200 J$/1 000 IG
- The property has 66 guest rooms and an occupancy of 38 573 guest nights per year This corresponds to an average of 584 GN/year/room

Given the preceding information, the savings achieved from replacing an existing guest room toilet with a 1 3 IG/flush toilet are

Water savings = (4 flushes/GN) x (3 3 IG/flush - 1 3 IG/flush) x (584 GN/year/room)
= 4,670 IG/year/room
= 930 J$/year/room

b) Implementation cost and payback for replacing a guest bathroom's damaged 3 3 IG/flush toilet with a 1 3 IG/flush toilet

- Cost of a conventional toilet = 3,000 J$
- Average cost of a 1 3 IG/flush toilet = 4,000 J$
- The following calculations assume that the property's standard practice is to replace a damaged guest bathroom toilet with a new 3 3 IG/flush toilet rather than a water-saving model

The cost effectiveness of replacing a damaged guest bathroom toilet with a water-saving model rather than a conventional model is calculated as follows

Implementation cost = (4,000 J$/room - 3,000 J$/room)
= 1,000 J$/room

Payback period = (1,000 J$/room) / (930 J$/room/year)
= 13 months

Comments

- The preceding analysis shows that it is economically beneficial to replace any damaged conventional toilet with a water saving toilet even in low use areas, such as guest bathrooms After the completion of Negril's sewer system, the payback period for this recommendation will be reduced to 6 5 months

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c) Water savings resulting from replacing a 3 3 IG/flush public restroom toilet with a 1 3 IG/flush toilet

- Assume that on average a public or employee restroom toilet is flushed 20 times per day
- The cost of the water used at Tree House is 200 J$/1,000 IG

The water savings achieved by replacing a 3 3 IG/flush public restroom toilet with a 1 3 IG/flush model are

Water savings = (20 flushes/day/toilet) x (3 3 IG/flush - 1 3 IG/flush) x 365 days/year
= 14 600 IG/year/toilet
= 2,920 J$/year/toilet

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d) Implementation cost and payback for replacing an operational 3 3 IG/flush public restroom toilet with a 1 3 IG/flush model

- Average cost of a 1 3 IG/flush toilet = 4 000 J$
- These calculations assume the replaced conventional toilet has no economic value

The cost effectiveness of this water conservation measure is

Implementation cost = 4,000 J$/toilet

Payback period = (4,000 J$/toilet) / (2,920 J$/year/toilet)
= 1 4 years

Comments

- The preceding analysis shows that it is economically beneficial to replace all frequently used public restroom toilets with new water-saving units, even if the existing toilets are still perfectly operational After the completion of Negril's sewer system, the payback period for this recommendation will be reduced to 8 months

- In order to minimize the clogging problems associated with some water-saving toilet models, the property is strongly encouraged to identify and purchase water-saving toilets that have a proven performance record The purchase of low-cost water-saving toilets of uncertain performance may end up costing the property dearly and causing much aggravation The property is also encouraged to purchase and test a few water-saving units before implementing this recommendation throughout the property

Project 4: Install flow diverters in toilet tanks

Summary of results and benefits

- Reduces water consumption and wastewater generation by 37,400 IG/year if flow diverters are installed in 60 % of all guest room toilets
- Saves the property 7,470 J$/year in reduced water bills
- Lowers the hydraulic loading of the septic tanks thereby improving the performance of the property's wastewater disposal system and reducing the frequency of septic tank pumping
- Tree House will recover the investment required to implement this recommendation in less than 7 months

Current situation Most guest bathrooms and public restrooms are equipped with conventional toilets which consume more than 3 3 IG per flush None of the conventional toilets inspected by the audit team had any type of water conservation device in place

Recommendations Whenever possible, install a flow diverter on the hose which feeds water to the toilet bowl refill pipe of the conventional toilets By diverting back into the water tank part of the flow that normally drains to the toilet bowl, this simple device can be used to set a suitable water level in the toilet bowl and avoid the waste of water resulting from overfilling the toilet bowl In most cases, flow diverters do not affect the performance of the toilet because they do not reduce the water level in the toilet tank or the amount of water used to flush the waste from the bowl Flow diverters can be easily installed on most conventional toilets (i e , 3 3 to 4 2 IG per flush) and can save from 0 4 to 0 8 IG per flush Flow diverters are used in many US hotels which are not equipped with water-saving toilets

Input, assumptions and calculations

a) Water savings resulting from the use of flow diverters

- Assume 4 flushes per guest night
- Assume flow diverters reduce by 0 4 IG the amount of water used to refill the bowl after each flush
- Assume that flow diverters can be installed on 60 % of guest bathrooms (i e , 40 toilets)
- The cost of the water used at Tree House 200 J$/1,000 IG
- The property has 66 guest rooms and an occupancy of 38 573 guest nights per year This corresponds to an average of 584 GN/vear/room

The savings achieved by installing flow diverters in a single guest room toilets are

Water savings = (4 flushes/GN) x (0 4 IG/flush) x (584 GN/year/bathroom)
= 934 IG/bathroom/year
= (934 IG/bathroom/year) x (200 J$/1,000 IG)
= 186 J$/bathroom/year

The savings achieved by installing flow diverters in 60 % of Tree House's bathrooms

Total water savings = (934 IG/bathroom/year) x 40 bathrooms
= 37,400 IG/year
= 7,470 J$/year

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b) Implementation cost and payback period

- Flow diverters cost approximately 100 J$/unit The cost effectiveness of this measure is

Total implementation cost = (100 J$/bathroom) x 40 bathrooms
= 4,000 J$

Payback period = (4,000 J$) / (7,470 J$/year)
< 7 months

Comments

- Flow diverters should also be installed in all public and employee restrooms Since these facilities are used more frequently than guest bathrooms, flow diverters installed in public or employee restrooms will achieve significantly higher water savings than those calculated above

- Flow diverters should not be installed in water-saving (1 3 IG/flush) toilets

- Possible supply sources for flow diverters include

  Mr John Albino
  Aquasaver Sales Inc
  5062 South 108th Street #291
  Omaha, NE 68137
  Tel (402) 895-4073

  The flow diverters (AquaSaver™) supplied by AquaSaver Sales cost 2 50 USD/unit
  Shipping 50 - 100 flow diverters from the US to Jamaica costs approximately 10 USD

Project 5: Install displacement devices in the water tanks of conventional toilets

Summary of results and benefits

- Reduces water consumption and wastewater generation by 37,400 IG/year if displacement devices are installed in 60 % of guest bathrooms
- Saves the property 7,470 J$/year in reduced water bills
- Lowers the hydraulic loading of the septic tanks thereby improving the performance of the property's wastewater disposal system and reducing the frequency of septic tank pumping
- Tree House will recover the investment required to implement this recommendation in less than 3 months

Current situation Most guest bathrooms and public restrooms are equipped with conventional toilets which use more than 3 3 IG per flush None of the conventional toilets inspected by the audit team had any type of water conservation device in place

Recommendations Whenever possible, equip conventional toilets (3 3 IG/flush) with displacement devices to reduce the amount of water used in each flush Displacement devices include home-made plastic bottles filled with pebbles, flexible panels, and filled bags, these devices are placed in the storage tank of conventional toilets to reduce the volume but not the height of the stored water The device must be compatible with the existing toilet and not interfere with the flush mechanism Tree House should test the effectiveness of the displacement units in a few guest or employee bathrooms before implementing this water conservation measure throughout the property

Input, assumptions and calculations

a) Water savings resulting from the use of displacement devices

- Assume 4 flushes per guest night
- Assume the displacement devices reduce by 0 4 IG the amount of water used in each flush Reported water savings range from 0 4 to 0 8 IG per flush
- Assume that displacement devices can be installed on 60 % of guest bathrooms (i e , 40 toilets)
- The cost of the water used at Tree House is 200 J$/1,000 IG
- The property has 66 guest rooms and an occupancy of 38 573 guest nights per year This corresponds to an average of 584 GN/year/room

The savings achieved by installing displacement devices in a single guest room toilets are

Water savings = (4 flushes/GN) x (0 4 IG/flush) x (584 GN/year/bathroom)
= 934 IG/bathroom/year
= (934 IG/bathroom/year) x (200 J$/1,000 IG)
= 186 J$/bathroom/year

The savings achieved by installing flow diverters in 60 % of Tree House's bathrooms

Total water savings = (934 IG/bathroom/year) x 40 bathrooms
= 37,400 IG/year
= 7,470 J$/year

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b) Implementation cost and payback period

- The cost of a commercial displacement device is approximately 170 J$ However, Tree House's maintenance staff could produce home-made displacement devices at a negligible cost (e g , a recycled plastic bottle filled with pebbles or concrete) The following calculations assume a cost of 40 J$ for a home-made displacement device

The cost effectiveness of this water and energy conservation measure is

Total implementation cost = (40 J$/bathroom) x (40 bathrooms)
= 1,600 J$

Payback period = (1,600 J$) / (7,470 J$/year)
< 3 months

Comments

- These devices should also be installed in all public and employee restrooms Since these facilities are used more frequently than guest bathrooms, displacement devices installed in public or employee restrooms will achieve significantly higher water savings than those calculated above

- Displacement devices should not be used in water-saving (1 3 IG/flush) toilets

Project 6: Use rainwater for laundry or other operations

Summary of results and benefits

- A 20,000 ft^2 rain catchment will reduce the purchase of NWC water by 470,000 IG/year and save the property 94,000 J$/year
- The use of rainwater for laundry operations should reduce the property's consumption of water softening chemicals by 70% It should also significantly reduce the need for rust removing chemicals
- Collecting rainwater from Tree House's impervious surfaces will reduce the ponding of water on the hotel's grounds and lower the saturation of the soil, thereby improving the performance of the tile fields

Current situation On average, the Negril area receives 57 inches of rainfall per year, therefore, each ft^2 of rain catchment surface could theoretically collect 29 4 Imperial gallons of water per year At the present time, Tree House does not collect and reuse any of the rainwater that falls on the property

Recommendations Consider collecting and reusing the rainwater that falls on the property s rooftops The collected rainwater could then be used for laundry room operations or for irrigation Since rainwater is virtually free, plentiful during at least 6 months of the year, and relatively clean, it is an ideal source of water for laundry room operations Collected rain water contains little dissolved iron which stains white linens and towels, it is also naturally soft and should therefore greatly reduce the need for the water softening chemicals currently added to the wash water With a properly designed rainwater catchment and storage system, Tree House will need to use water softening chemicals only occasionally (i e , when there is not enough rainwater in the storage tank)

Since times of peak rainwater supply always coincide with times of minimum irrigation, the use of collected rainwater for grounds irrigation is a less attractive alternative

Input, assumptions and calculations

a) Water savings resulting from using collected rainwater in laundry room operations

- The cost of water at Tree House is 200 J$/1 000 IG
- Since the amount of water consumed by Tree House s laundry is unknown the following calculations will assume it to be equal to 56 000 IG/month The 56 000 IG/month estimate was derived as follows
  - Industry surveys show that towel/linen use in hotels ranges from 4 to 6 lb per guest night and, according to commercial laundry equipment manufacturers, institutional washing machines use from 1 7 to 2 1 IG per pound of linen laundered It is assumed that a beach property such as Tree House uses 13 IG of laundry water per guest night (i e , 6 lb/GN x 2 1 IG/lb of laundry)
  - It is assumed that linens and towels account for 75% of the total laundry load

Laundry water consumption = (13 IG/GN) x (38,573 GN/year) / (0 75)
= 669,000 IG/year
= 56,000 IG/month

- Assume that Tree House can collect rainwater over a 20,000 ft² area (i e , a surface area equal to that of 4 tennis courts)
- Due to a lack of information, these calculations will not take into account the savings resulting from reducing the consumption of water softener
- The precipitation data for Negril is given in the following table

Month	1997 precipitation		30 year mean precipitation	
	mm	IG/ft²	mm	IG/ft²
Jan	58	1 19	97	1 99
Feb	134	2 74	44	0 90
Mar	15	0 31	57	1 16
Apr	67	1 37	92	1 88
May	212	4 34	164	3 35
Jun	170	3 48	158	3 23
Jul	149	3 05	160	3 26
Aug	157	3 22	175	3 57
Sep	119	2 43	155	3 16
Oct		-	180	3 80
Nov		-	80	1 64
Dec	-	-	71	1 45
Annual total	-		1 433 mm	29 4 IG/ft²

Based on this information, the average monthly precipitation is 3 40 IG/ft² from May to October, and 1 50 IG/ft² from November to April

- Assume that 80% of the rain which falls over the catchment area is collected and stored (i e , 20 % loss)

Volume of collected rainwater (May - Oct) = 80 % x (3 40 IG/ft²/month) x 20,000 ft²
= 54,400 IG/month
= 97 % of the monthly laundry water needs

Volume of collected rainwater (Nov - Apr) = 80 % x (1 50 IG/ft²/month) x 20,000 ft²
= 24,000 IG/month
= 43 % of the monthly laundry water needs

Total water savings = [(54 400 IG/mo) + (24 000 IG/mo)] x 6 months/year
= 470 000 IG/year
= 94 000 J$/year

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b) Implementation cost and payback period

- No information is available at the present time on the cost of a rain collection and storage system The property should contact a local contractor to obtain a cost estimate for this system

Project 7: Convert from billing rate 20 to rate 40

Summary of results and benefits

- Reduces Tree House's energy bills by 732,000 J$ per year
- Tree House will recover the investment required to implement this recommendation in 5 weeks

Current situation

- The requirements needed to qualify for billing rate 40 are
  - Minimum peak demand of 20 kW
  - Service character 3 phase, 50 Hz, 220 V delta or 415/240 star system
- The property's service is 220 V, 3 ph, delta connected, and its peak demand is greater than 20 kW Therefore, Tree House is qualified to be billed under rate 40

Recommendations Tree House should convert from billing rate 20 to rate 40

Input, assumptions and calculations

- Tree House' assumed average peak demand = 150 kW
- Tree House' average monthly energy consumption = 67,000 kWh (see Section 2 3)
- The fees related to the two billing rate codes are as follows

	Rate code 20	Rate code 40
Customers charge	6 J$/month	497 J$/month
Demand charge	none	176 J$/kW
Energy charge	2 286 J$/kWh	1 215 J$/kWh
Fuel charge	1 276 J$/kWh	1 259 J$/kWh
Foreign exchange adjustment	32 6%	32 6%

a) Average electricity bill for Tree House under rate 20

Cost / kWh for rate 20 = [(2 286 J$/kWh) + (1 276 J$/kWh)] x 1 326
= 4 72 J$/kWh

Average bill for rate 20 = [(67 000 kWh/month) x ($4 72/kWh)] + (6 J$/month x 1 326)
= 316 000 J$/month

b) Average electricity bill for Tree House under rate 40

Cost / kWh for rate 40 = [(1 215 J$/kWh) + (1 259 J$/kWh)] x 1 326
= 3 28 J$/kWh

Demand charge for rate 40 = 150 kW x 176 J$/kW/month x 1 326
= 35,000 J$/month

Average bill for rate 40 = [(67,000 kWh/month) x ($3 28/kWh)] + 35,000 J$/month
+ (497 J$/month x 1 326)
= 255,000 J$/month

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c) Savings achieved by converting from rate 20 to rate 40

Difference between rate 20 and rate 40 bills = (316,000 - 255,000) J$/month
= 61,000 J$/month
= 732,000 J$/year

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d) Implementation cost and payback period

- Tree House will need to hire a consultant to develop the proposal and prepare the application for the rate change to JPSCO The consulting fee is estimated at 70,000 J$

Implementation cost = 70,000 J$

Payback period = (70,000 J$) / (732,000 J$/year)
= 5 weeks

Project 8: Reduce the time of operation of the pool filter pump

Summary of results and benefits

- Reduces Tree House' energy consumption by 3,270 kWh/year, resulting in savings of 15,400 J$/year
- Extends the service life of the pool filter pump
- This recommendation has an immediate payback

Current situation The swimming pool's filtration system is equipped with a 1 5 HP (1 12 kW) pump This pump operates 24 hours per day

Recommendations Experience shows that, in most cases, pool water quality can be maintained by running the filter pumps for 12 to 16 hours per day Tree House should therefore shut off its filter pump at night in order to save energy and to increase the service life of the pump The pump can either be shut off manually or Tree House may decide to purchase an automatic timer for its pool filter system

Input, assumptions and calculations

- Assume that the pools filter pump is shut off from 10 PM to 6 AM
- The pump's power draw is 1 12 kW
- The cost of energy at Tree House is 4 72 J$/kWh

a) Energy savings resulting from shutting off the pump during nighttime

Energy savings = 8 hr/day x 1 12 kW x 365 days/year
= 3,270 kWh/year
= 15,400 J$/year

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b) Implementation cost and payback period

- The following calculations assume that Tree House decides to manually control the operation of the pool pump The implementation cost is therefore negligible and the payback of this recommendation is immediate

Project 9: Use energy efficient lighting in gardens

Summary of results and benefits

- Reduces Tree House's energy consumption by 6,276 kWh/year and saves the property 26,400 J$/year
- Tree House will recover the investment required to implement this recommendation in less than 9 months

Current situation

Most garden/exterior lamps are equipped with 60 W incandescent bulbs Although, the audit team also discovered several 100 W used for patio illumination, these calculations will conservatively assume that all exterior lights us 60 W incandescent bulbs

Recommendations

Replace all burnt 60 W incandescent bulbs with 17 W compact fluorescent bulbs Both the 60 W incandescent and the 17 W compact fluorescent bulbs generate the same amount of light, therefore the switch will not affect the quality of the property's exterior lighting

Input, assumptions and calculations

- There are 40 incandescent bulbs (60 W) used for garden illumination On average, garden lights are operated from 10 to 12 hours per day The following calculations will assume that garden lights are on for 10 hours per day
- The cost of energy is 4 72 J$/kWh
- The characteristics of the incandescent and CF bulbs are as follows

Cost of a 60 W incandescent bulb	= 22 J$/bulb
Service life of an incandescent bulb	= 800 hours/bulb
Cost of a 17 W compact fluorescent bulb	= 500 J$/bulb
Service life of a compact fluorescent bulb	= 10,000 hours/bulb

a) Operating cost of a single lamp equipped with a 60 W incandescent bulb

Hours of operation = 10 hr/day/lamp x 365 days/year
= 3 650 hr/year/lamp

Energy cost = 60 W x 3,650 hr/year/lamp
= 219 kWh/year/lamp
= 1 034 J$/year/lamp

Cost to replace burnt bulbs = [(3,650 hr/year/lamp) / (800 hr/bulb)] x 22 J$/bulb
= 100 J$/year/lamp

Total operating cost = energy cost + cost to replace burnt bulbs
= 1,134 $/year/lamp

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b) Operating cost of a single lamp equipped with a 17 W compact fluorescent bulb

Hours of operation = 3,650 hr/year/lamp (same as above)

Energy cost = 17 W x 3,650 hr/year/lamp
= 62 1 kWh/year/lamp
= 293 J$/year/lamp

Cost to replace burnt bulbs = [(3,650 hr/year/lamp) / (10,000 hr/bulb)] x 500 J$/bulb
= 182 J$/year/lamp

Total operating cost = energy cost + cost to replace burnt bulbs
= 475 J$/year/lamp

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c) Savings achieved by replacing all exterior incandescent bulbs with CF bulbs

Total energy savings = (219 kWh/year/lamp - 62 1 kWh/year/lamp) x 40 lamps
= (156 9 kWh/year/lamp) x 40 lamps
= 6,276 kWh/year

Total financial savings = (operat cost of incand bulbs - operat cost of CF) x 40 bulbs
= [(1,134 J$/year/lamp) - (475 J$/year/lamp)] x 40 bulbs
= 659 J$/year/lamp x 40 lamps
= 26,400 J$/year

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d) Implementation cost and payback period for replacing a burnt incandescent bulb with a compact fluorescent bulb

Implementation cost = cost of a CF bulb - cost of an incandescent bulb
= 500 J$/bulb - 22 J$/bulb = 478 J$/bulb

Payback period = implementation cost / savings for 1 lamp
= (478 J$/bulb) / (659 J$/year/bulb)
< 9 months

Comments

- Before purchasing CF bulbs for garden illuminations
  - Find out from other local hoteliers or other reliable sources which brands of CF bulbs have a good track record in Negril
  - If you suspect that theft of CF bulbs will be a problem on your property, make sure that the CF bulbs purchased are equipped with an anti-theft feature This locking mechanism increases only slightly the cost of the compact fluorescent bulbs (approximately 40 J$/bulb)
- Many of the incandescent bulbs are used in other parts of the Tree House hotel should also be replaced with energy-saving compact fluorescent bulbs Although it is economically beneficial to replace all incandescent lights with CF bulbs, Tree House should first focus on replacing the incandescent bulbs that have a medium to high wattage (60 W or greater) or that burn for long periods of time (> 8 hours per day)

Project 10: Implement a property-wide waste management program

Introduction

A waste management program will help Tree House reduce the amount of waste it produces, save materials, resources, energy and money, and reduce the property's impact on the environment by drastically reducing the amount of solid waste disposed in its dump or other locations The principal elements of an effective waste management program include what is generally called the three R's reduce, reuse and recycle These three elements are detailed below

A waste management program beings with a waste review, where the quantity and type of waste produced in the property are examined Once this review is completed, the possibilities for the waste management program can be assessed by considering each kind of waste and deciding whether it is possible to avoid the generation or the disposal of this waste through the reduce, reuse and recycling options Whatever waste cannot be avoided through the reduce, reuse and recycle components of Tree House's waste management program will have to be discarded In most cases, however, an effective waste management program can have a significant impact in reducing the amount of waste generated by a property

Reduce

Reduce the quantity and the impact of the waste produced by the property by avoiding natural wastage, by using more durable goods that will need to be disposed less frequently, by avoiding the purchase of excessively packaged goods, and by minimizing the use of hazardous materials or other products which have a significant impact on the environment The reduce component of the waste management program is obviously the first option that should be considered by the property By reducing the generation of wastes, Tree House will conserve resources, reduce its use of natural resources, and reduce the amount of materials its employees will need to handle and the volume of waste the property will need to dispose

The bulk of the responsibility for the "reduce" element of the waste management program lies with the purchasing department, since the less material that is brought into the property, the less the property will have to discard (be it by disposal to a dump site, donation, or recycling) Employees who have the authority to decide what is discarded as waste also play an important role in reducing the property s waste output The type of actions that are typically taken by hotels to reduce the production of waste and to lower the impact of the generated waste include

- Avoid purchasing items (e g foods chemicals appliances parts maintenance items) that are excessively packaged In North America packaging alone can account for up to 40% of a hotel s waste stream
- Purchase food items in bulk rather than in individually packaged portions (e g sugar salt, pepper, jams/jellies condiments butter cereals syrup cream, juice, etc) Bulk items are less expensive and create less waste
- Reduce or eliminate the use of disposable plates place mats, wares, and cups Inexpensive reusable plastic plates tableware, and glassware can be used at guest and employee functions held outside

- Use refillable containers for chemicals, cleaners and foods
- Reduce the use of straws Provide straw dispensers for customers or ask guests if they need straws instead of automatically serving all drinks with straws
- Replace plastic straws with paper straws
- Do not automatically supply guests with new glasses or paper cups for each drink ordered at the bar, but offer to refill the glass if a guest orders the same beverage twice
- Eliminate the use of paper wrap for guest room drinking glasses Instead, store the drinking glasses upside-down
- Use cloth rather than paper towels and napkins
- Use cloth napkins instead of disposable doilies for buffet lines, platters, high-tea service, and in bread baskets
- Purchase durable coasters for use in the bar and restaurants instead of using paper napkins and replacing them with each drink
- Use cloth or canvas bags or a small basket to collect and return guest laundry, towels, and linens
- Use cloth or canvas bags or a wheelbarrow or yard cart to collect garden waste rather than disposable plastic bags
- Install liquid soap dispensers in guest bathrooms, public bathrooms, and employee locker rooms
- Purchase reusable plastic containers for food in the refrigerators and freezers and covers for the pastry racks in the kitchen The hotel currently uses a great deal of plastic wrap for both of these purposes, which wastes money and creates additional waste
- Avoid using laundry, kitchen or housekeeping detergents which contain phosphates
- Minimize the purchase and keep track of the use of harsh or hazardous chemicals (e g , drain cleaning agents, solvents, bleach)
- Purchase rechargeable or mercury-free batteries

Reuse

Reuse items in their original form for the same or a different purpose rather than disposing of them If an item cannot be reused by the property, Tree House should investigate the possibility of selling or donating them to employees outsiders, charitable organizations, local schools and businesses Examples of reuse actions are listed below

- Reuse computer or other paper (i e , printed on one side only) as scrap paper for taking notes and writing internal memos
- Purchase soft-drinks and water in reusable rather than disposable bottles
- Give preference to vendors which supply their products in returnable/refillable containers For example, one hotel in Negril indicated that Country Bucket will provide ice cream in 3-gallon reusable containers with a deposit of 200 J$ each This should save the hotel money and will reduce the amount of waste disposed of by the hotel
- Only remove used soaps from guest rooms at checkout The collected pieces of soap should then be reused around the property or given to staff or charities Soap bars can be used in employee bathrooms, flaked and used in certain laundry machines or used to carry out a variety of cleaning operations around the property (either in the form of soap bars or as home-made liquid soap) Small pieces of soap which cannot be conveniently reused can be collected, melted down (with a small amount of water at low heat), and cast in a suitable mold (e g , a rectangular box) to produce a large bar of soap

- Give used amenities to any interested parties (e g , charities, local schools, employees) rather than discarding them
- Replace the trash can liners only when these are soiled or unsuitable for further use
- Repair and reuse damaged furniture or donate it to interested parties (e g , charities, schools, employees, businesses)
- Offer all leftovers foods, including the soup of the day, to employees in the employee cafeteria Food should only be disposed of when it can no longer be served to the staff

Recycle

Many items that cannot be reused in their original form can be sold or given away to processors for recycling Even if the hotel cannot make a profit from its recycling efforts, diverting items from the waste stream should allow the hotel to reduce the frequency of trash collection, which will save the hotel money The type of products which can generally be recycled include

- Green waste from kitchen and garden (this material can be composted on site or given to a local composting program)
- White paper and mixed paper
- Glass bottles and jars
- Plastic bottles and containers made of PET (typically used for soft-drink and water bottles) and HDPE (typically used for milk jugs and chemical containers)
- Aluminum cans and foil
- Steel cans or "tins"
- Steel scrap such as old pipes and appliances
- Other metals such as copper and brass
- Frying oil and grease
- Motor oil (from cars, motor boats and jet skis)

At the present time only one company (RYCO-JA, a recycler of waste oil and grease) collects recyclable materials in the Negril area However, the EAST project, in collaboration with the Negril Chapter of the JHTA and the Negril Area Environmental Protection Trust (NEPT), will strive to organize a recycling project for the Negril area by acting as a link between the interested hotels and the recycling companies based on the island Although EAST's survey of Jamaican recycling companies is not yet complete, the companies listed below have already been identified At the conclusion of this survey the EAST project will provide Tree House with an updated list of recycling companies and details on the requirements related to the collection, sorting, quality and packaging of the recyclable materials

Glass Recycling

West Indies Glass Company Contact - Michael Austin (809) 923-0787-9 Glass must be sorted into three color groups clear brown and green The company pays 300 J$ per ton (2,000 lbs) and will provide free transportation to pick up the recyclables when there are five tons of any color glass available at any site Many of the glass bottles sold in Jamaica can be returned to the bottler for reuse, which should be the first priority However, if the hotel produces enough other glass that is suitable for recycling (drink bottles or food jars and containers), a glass recycling program should be implemented Recycling bins should be

placed under the bars and in the kitchen to collect this glass separate from other recyclables The bins should be clearly labeled as to what color glass can be placed in them, and the signage should strongly discourage staff from contaminating the bin with other non-glass items A heavy plastic or cloth bag should be used inside of the bin so that the bag can easily be removed when the bin is full and the hotel will not have to worry about tearing if the glass breaks The West Indies Glass Company can help the hotel to estimate visually when five tons have been collected The hotel can then determine if it wants to deliver the glass itself or accumulate the glass in the loading dock area until there is enough to qualify for the free pickup

Plastics

Wysinco Environmentals, Ltd Contact- Mrs Pat Wright, (809) 943-9800 As of October 1997, this company only collects plastic (PET) bottles from schools and specific media-announced pickup points Therefore, they ask that plastic bottles be donated to a school in the community, which earns "points" for kilograms of plastic and trades them in for computers, videos, paint, tools, etc If the hotel wishes to drop off PET bottles at the Wynsinco Recycling Plant (located at PO Box 367 White Marl, Spanish Town, St Catherine, Jamaica), the company will pay the hotel 8 J$ per kilogram for them If the hotel produces a significant amount of plastic and wishes to begin collecting either for a local school or for profit, recycling bins should be placed in the areas where the majority of the plastic waste is produced (i e the kitchen) These bins should also be properly labeled so that the staff will know what can and cannot be placed in them Once enough plastic has been collected the hotel can either take it to a local school or transport it to Spanish Town

Plastic/Metal Drums

Kemcan Development Company Contact - Ms Usherwood, (809) 922-5270 At present, this company is only recycling plastic and metal drums, which it will pick up provided there are 30-50 drums Again, the hotel's first resort should be to return these drums to the supplier for reuse whenever possible However, any drums that cannot be returned should be collected in the loading dock area until there are enough to warrant a pickup

Paper

Nature's Handmade Paper Contact - Ms Gloria Dorman, (809) 993-8172 Nature's Handmade Paper is a small company set up with the assistance of the Peace Corps in 1986 This company is prepared to do a special project for the Negril hotels, whereby they will provide hotel stationery, guest cards, etc made out of the paper that the hotels recycle The cost of the paper recycling is negotiable

JA Pottinger & Co , Ltd Contact - Mr Pottinger or Ms Nadine Higgins, (809) 926-8957 This company picks up paper products from hotels – provided there is one truck load full (50 large garbage bags) – and exports the paper for recycling The price for this service is negotiable and the company is prepared to meet with EAST/ JHTA to discuss a program for the Negril area Recycling bins for paper should be placed in the housekeeping area (to collect paper from guest rooms), at the front desk, and in offices at a minimum Each desk in the office area should receive its own recycling bin It is important, especially with paper, to collect the recyclables as close to their source as possible Paper must be clean and dry to be

recyclable The hotel should first reuse paper whenever possible and then should collect the paper for recycling If the bags of paper are exposed to the elements, it is important that plastic bags be used and that the bags be properly sealed to prevent the paper from getting wet If the bags are to be stored in a weather-proof area, the hotel should talk to JA Pottinger & Co about using reusable cloth bags that are returned to the property for reuse after the recycler collects the paper

Another paper recycling option is to sell it to companies needing packaging materials, such as Exotic Flowers of Montego Bay If the hotel decides to pursue this option, it should purchase a shredder to ensure that confidential documents are not released from the property

Metal/Aluminum

Contact Louis Daley for information regarding the recycling efforts organized by Mr McLaughlin in Mandeville

Waste vegetable oil (frying oil) and grease

Recycling Corp of Jamaica (RYCO-JA) Contact - Mr Kevin Mullane, (809) 968-7002, (1-800) 991-7926 RYCO-JA collects used vegetable oils and grease from kitchens which is then recycled in the production of chicken feed RYCO provides, free of charge, covered steel drums for the storage of the used oil and grease and collects the material from each participating property on a regular schedule This recycling scheme benefits the hotel by reducing the discharge of oil and grease to the septic tank (thus reducing potential clogging problems in the tile field) and helps the country by reducing the amount of yellow grease imported into Jamaica for the production of animal feed If the hotel chooses to recycle its cooking grease, it is important that the drum be kept covered (to prevent the rainwater dilution) and be kept free of contaminants, which will make the grease non-recyclable

Other Waste Management Issues

The hotel should ensure that there are adequate trash receptacles and ash trays at the beach, around the grounds, and throughout the public areas so that guests can easily find one when they need it The audit team found a great deal of waste and cigarette butts on the ground in these areas because there are not enough receptacles Guests will usually make an effort to dispose of trash and cigarette butts properly if they can easily find a receptacle

Project II: Eliminate the routine use of Petrotherm

Summary of results and benefits

- Reduces Tree House's consumption of Petrotherm, a highly hazardous chemical, by 90% and saves the property 189,000 J$/year
- Tree House will recover the investment required to implement this recommendation in less than 3 weeks

Current situation

Tree House's maintenance department is severely understaffed and therefore relies on expensive shortcuts to attend to all of its responsibilities One such shortcut involves the routine "cleaning" of grease traps with Petrotherm, a drain clearing chemical composed primarily of sulfuric acid Petrotherm dissolves grease and organic matter and, therefore, eliminates the need to manually remove the waste that accumulates in the grease traps After treatment with Petrotherm, the dissolved grease and Petrotherm residue drain to the morass (which is illegal) or to a septic tank (where it disrupts the proper operation of the on-site wastewater treatment system)

In 1996, Tree House consumed more than 420 US gallons of Petrotherm at a cost of 210,000 J$

Recommendations

Eliminate the routine use of Petrotherm as a "degreaser" for grease traps and for blocked drains This chemical is toxic, hazardous, and expensive, it should therefore be used sparingly and only as a last resource Furthermore, when a chemical such as Petrotherm is discharged to an on-site wastewater treatment system, it kills the bacteria which decompose and purify the waste in the septic tank and tile field The destruction of these beneficial bacteria increases the rate at which solids accumulate in the septic tanks, increases the mass of pollutants which reach the ground water table and eventually the sea, and increases the risk of clogging the tile field (the grease dissolved with sulfuric acid eventually re-solidifies)

The excessive usage of drain cleaner could easily be curtailed by implementing the measures described below

- Provide proper and regular (every 3 days if necessary) maintenance to the grease traps Regular grease trap maintenance consists of manually removing the floating layer of fat/grease and the solids which accumulate at the bottom of the grease trap
- Use strainers on all kitchen and bar sinks to prevent the excessive discharge of solids to the drain and grease trap
- Train kitchen and bar employees to minimize the amount of solids and grease discharged to the drains
- Provide the maintenance staff with a snake (or rod) that is **easy to operate** and could

therefore replace the routine use of Petrotherm to unclog drains Snakes are long, highly flexible metal wires or coils which are used to clean and unclog drains, they can be operated manually or powered through a drill-like device The cost of these tools range from 20 US$, for a manual snake, to 250 US$, for a top-of-the-line power-driven snake

- Monitor the consumption of Petrotherm (and of other hazardous chemicals) to avoid the excessive use of this product

Input, assumptions and calculations

- Proper maintenance of Tree House's grease traps should not require more than 4 hours of labor per week The cost of labor is assumed to be 50 J$/hour
- It is expected that by implementing the simple measures discussed in the preceding section, Tree House will reduce its consumption of Petrotherm by 90%

a) Savings resulting from the reduced consumption of Petrotherm

Savings in chemical purchases = 90 % x 210,000 J$/year
= 189,000 J$/year

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b) Implementation cost and payback period

Labor cost = (4 hours/week) x (50 J$/hour) x (52 weeks/year)
= 10,400 J$/year

Equipment cost = 8,800 J$ (for the purchase of a power-driven snake)

Payback period = (equipment cost) / [(saving on chemical purchases) - (labor costs)]
= (8,800 J$) / [(189,000 J$/year) - (10,400 J$/year)]
< 3 weeks

Project I2: Implement a linen and towel reuse program

Many hotels around the world have found success with a program in which the guest determines when sheets and towels are replaced The audit team suggests that Tree House consider implementing a program of this type once other initiatives are underway Guest reaction is typically more positive if they can see that the hotel is truly concerned with protecting the environment They do not want to feel like they are making all of the sacrifices or that the hotel is simply trying to save money

This program informs the guest that the hotel is interested in protecting the environment by reducing the amount of water and chemicals that it uses The towels portion of the program is pretty straightforward guests are asked to leave their towels hanging up if they wish to use them again or put them on the floor if they would like to have them replaced The sheets portion of the program is designed in one of two ways

- The guest is told that the hotel would like to save water by reducing the number of sheets washed each day The guest is asked to leave a card on the door or on the bed indicating that it is not necessary to change the sheets that day Otherwise, the guest's sheets are changed every day This method works but gets fairly low guest participation, since even environmentally-concerned guests often forget to indicate that it is not necessary to change their sheets In their rush to leave the room in the morning, they neglect to leave the card in the correct place

- The guest is told that in an effort to save water, the hotel only changes sheets every two or three days (depending on the wording on the materials selected) If the guest would like to have the sheets changed more frequently, the materials ask that a card be placed on the door or on the bed to have them changed that day This method puts the burden on the guest and therefore results in considerably higher participation Hotels that have implemented this type of program in conjunction with towel reuse have found that their laundry costs are reduced by as much as 30% to 40%

Once the hotel is ready to begin this program, it should purchase attractive, colorful in-room materials to communicate the program to the guest These materials are available through a variety of sources, including the Caribbean Hotel Association The CHA cards offer two key advantages over some of the other cards on the market

- The design of the CHA materials will capture the guests' attention better than many other cards It is important that the guests be clearly told abut the program so that they feel that they have been given the opportunity to make a choice The program is not designed to trick the guest into participating but that is how they will feel if the program is not properly communicated

- The CHA materials state that it is the hotel s policy to change sheets every three days unless the guest would like to have them changed more often As indicated above this is the verbiage that results in the greatest savings

If this program is implemented, housekeepers need to be properly trained to carry it out

effectively Most hotels have found the greatest success with one of the following procedures

- Designating certain days as sheet changing days Under this format, all of the sheets in the hotel are changed on certain days of the week (for example Tuesdays and Fridays) instead of every three days This method makes it easy for the hotel to increase housekeeping and laundry staff on those days if necessary and also gets the housekeepers in the habit of recognizing those days as sheet change days On the other days, the housekeepers will only change sheets in checkout rooms and rooms where the guest has requested a change

- Actually counting off every three days and posting a notice in the housekeeping area on the sheet changing days This ensures that the sheets are changed on the exact schedule noted on the in-room materials and still makes it relatively easy for the housekeepers to know when to change the sheets As mentioned in the paragraph above, on the other two days the sheets would only be changed in the checkout rooms and rooms where the guest has requested a change

Hotels have had difficulty tracking the length of time that each guest has actually been in the room so that each guests' sheets are changed three days after they check in and then every three days after that Unless the hotel has a very complex reservation system, this method of tracking sheet changing is nearly impossible If this method is possible, it results in the greatest savings, since either of the above alternatives will often result in changing a guest's sheets one of the two days following check-in when they technically are not yet ready to be changed

The hotel will have to determine which method it believes will work best and then make modifications as needed Regardless of the method chosen to implement the program, it is important that all of the housekeepers be fully trained to understand their role in the initiative If they do not do what they are supposed to do the program cannot be successful

Two other issues are key to the success of this program

- Even if the guest does not request that the sheets be changed on a given day, if the housekeeper determines that the sheets are soiled, they should be changed anyway A bed should never be made with dirty linens

- If a guest checks out early on a day when sheets were not changed it is important that someone be designated to change the sheets before a new guest checks in One way to know for sure whether the sheets were changed is to leave the bedspread in a turn-down type of configuration when the sheets are left on the bed If the bed is completely remade it will look just like a bed with fresh sheets, but leaving the bedspread partly turned back will allow anyone entering the room to know that the sheets have been used

This program can result in tremendous savings for the hotel but only if it is implemented properly It is important that the proper materials be used, that the housekeepers be fully trained, and that everyone is left feeling good about the program

Project I3: Switch air conditioners off in unoccupied rooms

Summary of results and benefits

- Lowers the property's electricity consumption by 29,400 kWh/year, resulting in annual savings of 139,000 J$
- Tree House will recover the investment required to implement this recommendation in less than 2 months

Current situation

- Many guests leave the a/c running after leaving their rooms for their daily activities
- Housekeepers do not shut off or lower the cooling setting on the a/c units before leaving a guest room that was just cleaned
- Many housekeepers leave the doors open while preparing guest rooms even if the a/c unit is running This practice results in an unnecessary waste of energy

Recommendations

- Place a tactful note in all guest rooms to encourage guests to turn off air conditioners, televisions, and lights whenever they leave their rooms for extended periods of time Many Tree House guest rooms currently have such signs, however, these are very small and do not attract the guest's attention
- When entering a guest room, ask the housekeepers to turn the a/c units off or, if this is unacceptable to the guests, to adjust the a/c thermostat to a "low cool" setting (or the lowest possible setting)
- Request that housekeepers keep the guest room door closed during guest room preparation this will keep the room cooler and prevent insects (especially mosquitoes) from entering the room If the door must be left open during guest room preparation, ask housekeepers to turn off the a/c units
- Investigate the possibility to control the operation of the a/c units with infrared sensors and magnetic door switches

Input, assumptions and calculations

a) Energy savings achieved by asking guests and housekeeping staff to turn off the a/c units when rooms are unoccupied

- Assume that 50% of the guests leave the a/c running after leaving their rooms and that on average guests are outdoors between 10 AM and 5 PM
- Assume that through guest participation and housekeeping staff training the amount of energy wasted by a/c units during the 10 AM to 5 PM period can be reduced by 50%
- The maximum power demand of one a/c unit is 2 kW The average power demand of the a/c units is estimated to be 1 kW
- The occupancy at Tree House is 16,826 room nights per year
- The energy cost at Tree House is 4 72 J$/kWh

Given this information, the energy savings are

Energy savings = (50% x 16,826 RN/year) x (50% x 7 hours/day x 1 kW/room)
= 29,400 kWh/year
= (29,400 kWh/year) x (4 72 J$/kWh)
= 139,000 J$/year

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b) Implementation cost and payback period

- The following calculations assume that the cost of the guest room information cards and staff training does not exceed 20,000 J$ Therefore, the cost effectiveness of this measure is

Total implementation cost = 20,000 J$

Payback period = (20,000 J$) / (139,000 J$/year)
< 2 months

Comments

Tree House could achieve even greater energy savings by controlling the operation of its guest room a/c units with infrared sensors and magnetic contact switches Such devices ensure that the a/c units are either turned off or adjusted to a lower cooling setting whenever a room is unoccupied However, the installation of sensors and switches requires a sizeable investment on behalf of Tree House The estimated implementing cost for this option is

UL-listed passive infrared sensor = 2,660 J$/room
Magnetic contact switches = 1,750 J$/room
Installation cost = 1,750 J$/room

Estimated implementation cost = 6,160 J$/room
= 407 000 J$ (for all 65 rooms)

Project I4: Implement a composting program

Composting has become the increasingly popular method by which to dispose of food scraps, floral waste and garden waste The hotel should start with a basic green waste (yard waste) composting program and then expand it to include food waste as well

A well-run composting programs yields significant benefits including

- a reduction in the cost of waste handling and disposal,
- a reduction in the environmental impact resulting from the disposal of wastes in dumps or landfills,
- it provides the property with a high-profile program which can be advantageously used in public relations and media efforts,
- it provides the property with a constant supply of high quality fertilizer and soil conditioner

Studies have revealed that up to 75% of waste generated in food service functions consists of compostable food scraps and other organic materials If the compostable material, along with the recyclable plastic, glass, and metal items are diverted from the waste stream, the property can achieve a truly significant reduction in the amount of waste generated by the food service area

Both pre-consumer and post-consumer food scraps can be composted Pre-consumer food scraps include cuttings left from vegetable preparations, as well as complete servings of food which have been prepared, left unserved, and cannot be reused Post-consumer scraps are food left on dishes after meals have been served Although food scraps will be numerous and diverse, other wastes can be composted as well Below is a list of commonly composted wastes

- Produce – vegetables, fruits, peels, rinds, salads, etc
- Bread and pastries, excess batter
- Frozen foods
- Coffee grounds/filters, tea bags
- Egg shells
- Flower waste (wilted cut flowers from restaurants and guest rooms)
- Green waste from the garden and beach (grass, leaves, twigs branches seaweed)
- Paper items – paper napkins, paper towels, paper plates and cups, paper food wrappers
- Dairy products (see note 1)
- Seafood (see note 1)
- Meat trimmings without bones or large quantities of grease or fat (see note 1)

Note (1) Although these items can be composted, they often generate foul odors and attract animals and pests If the compost pile will be located close to public or work areas, Tree House should exclude these items from its composting program If these items are composted, the compost pile should be kept covered

Not everything is compostable, and some materials can lower the quality of the finished compost or hamper the composting process The staff should be educated on the importance of preventing the following items from being placed in the composting receptacles and the composting pile

- Garden waste contaminated with pesticides
- Weeds with heads/ seeds (these will reproduce quickly in the compost heap)
- Glass
- Metals
- Unsoiled paper (if it can be recycled)
- Cardboard
- Plastics
- Aluminum foil or plastic wrap
- Batteries
- Diseased plants
- Wood chips from chemically treated wood products

Contamination of compostable material can be avoided only if employees know which items should not be discarded in the container for compostable materials Continuous employee education and motivation and appropriate signage will help In most instances, placing a sign on a container which reads "Compost only – no bones, plastics, glass or metals" should make the point

Hotels and resorts often find it easier to have the composting program evolve slowly, that is, to start with flower and garden wastes and pre-consumer food scraps from prep stations in the kitchens, then add additional materials like paper, and finally add post-consumer leftovers from guests' and employees' plates This is the process that is recommended for the Tree House The hotel is already composting most of its yard waste and should now slowly phase-in the other elements that will make the program even more successful

The Tree House may find it beneficial to purchase a wood chipper and paper shredder to allow even more items to be composted Large pieces of wood (branches, lumber) and full pieces of paper cannot be added to the compost pile The chipper and shredder can be used to convert these items to a more manageable size (less than one inch) so that they will decompose more readily

In addition, the current composting site should be modified slightly to improve the program The site needs to be expanded to make a space large enough for all phases of composting (unloading materials storing items before they are added to the compost aerating/ mixing the compost, storing equipment such as the chipper, and storing the finished compost before it can be used) There is currently not enough space for all of these activities to take place The hotel should also build a fence around the composting site to hide it from guest view and to prevent rodents and other animals from entering the area Some items used in a compost pile will be unattractive or will attract animals, making this fence necessary The hotel should also ensure proper drainage from the site quickly clean up any food spills, and add food waste to the center of the pile to prevent bad odors

It is especially important to ensure that the compost pile is properly aerated Aeration helps

the bacteria in the pile to grow faster, which speeds the decomposition process The staff overseeing the composting program should aerate the pile, either manually or with a small bulldozer (depending on the size of the pile), at least once each week Without proper aeration, the compost pile will develop a rotten-egg odor and will take much longer to fully decompose

It is important to keep the program simple and efficient, in the long-run, it should not require additional staff time In fact, the system, in coordination with a comprehensive recycling program, can streamline the entire disposal system from both a labor and a space efficiency standpoint

Once the compost is ready for use (usually in about one month if the pile is managed properly), the resulting product should be used on the grounds Compost is classified as a soil conditioner, not a fertilizer, because its levels of nitrogen, potassium, and phosphorus are not as high as commercial fertilizers Finished compost will add these elements to the soil but will add them much more slowly and in lower quantities than fertilizers Unlike fertilizers, compost also adds organic material to the soil, increases the water-retaining capabilities of sandy soil, and promotes root growth The compost should be used over grassy areas or as a mulch around plants

Appendix I

Hotel Environmental Policy

By the International Hotels Environmental Initiative

We recognize that our business has an important role to play in protecting and enhancing the environment for future generations and to help secure the long term sustainability of the tourism industry

To this end our hotel is committed to tanking action

- To achieve sound environmental practices across our entire operation
- To comply fully with all environmental legislation
- To minimize our use of energy, water and materials
- To reduce our pollution to a minimum and, where appropriate, to treat effluents
- To invite our customers suppliers and contractors to participate in our efforts to protect the environment
- Where we can to work with others in the tourism industry, in public agencies and the community to achieve wider environmental goals
- To provide all employees with the training and resources required to meet our objectives
- To openly communicate our policies and practices to interested parties
- To monitor and record our environmental impacts on a regular basis and compare our performance with our policies objectives and targets

Appendix II: Summary of Tree House's environmental aspects, impacts and EMS objectives

Type of environ aspect of the hotel's activities	Type of activities which have these environmental aspects	Environmental impact of the activities	Objective of the property's EMS
WATER USE	- Use of guest room and public bathrooms - Laundry room and operations - Housekeeping and cleaning operations - Kitchen and bar operations - Garden upkeep	- Inefficient use of a valuable resource - Excessive consumption affects the availability of water in the Negril community	- Reduce water consumption
ENERGY USE	- Operation of a/c units, water heaters, washing machines, dryers and pool pumps - Use of hot water and lighting	- Inefficient use of valuable and non-renewable resources - Generates air pollution (mainly at the power plant), greenhouse gases, acid rain	- Reduce energy consumption
SOLID WASTE GENERATION	- Office operations (paperwork) - Food purchasing, preparation and serving - Bar operations Maintenance operations - Garden and beach upkeep	- Disposal of solid wastes in inadequate municipal dumps - Contamination of groundwater and surface water - Loss of raw materials	- Reduce the amount of solid waste generated by the property
GENERATION OF WATER POLLUTANTS	- Laundry room operations (e g use of phosphate based detergents) - General housekeeping and cleaning operations (excessive use of chemical cleaning and disinfecting products) - Maintenance operations (improper disposal of used oil and spent solvents) - Food preparation (disposal of grease/oil)	- Increases pollutant load discharged to surface and groundwater - Reduces the effectiveness of septic tanks and wastewater treatment systems	- Reduce the pollutant load contained in the hotel's effluent
USE OF HAZARDOUS PRODUCTS	- Laundry room operations (use of bleach, and acid or caustic cleaners) - General housekeeping and cleaning operations (use of bleach toxic cleaning chemicals, insecticides) - Maintenance operations (use of lead paint drain clearing chemicals) - Grounds keeping (pesticides/insecticides)	- Exposes guests and employees to hazardous products	- Reduce the number and amount of hazardous products used on the property
GENERATION OF AIR EMISSIONS	- Maintenance operations (e g release of CFC from air-conditioning units use of solvents) - General housekeeping and cleaning operations (use of aerosols) Grounds keeping (insecticide fogging)	- Release of CFCs to the atmosphere - Exposes guests and employees to hazardous air pollutants	- Phase out CFC refrigerants - Reduce the use of solvents insecticides pesticides
DAMAGE TO THE ECOSYSTEM	Discharge of untreated gray water in wetlands Use of fertilizer, insecticides and pesticides in the gardens	- Damages the environment and ecosystem surrounding the property	- Reduce the damage caused by the property's operations on the ecosystem

Appendix III

ACTION PLAN FORM
MAINTENANCE DEPARTMENT - WATER CONSERVATION ISSUES

Action	By whom	Target date	Actual date
Implement a leak detection and prevention program			
• Prepare a plan for carrying out a monthly inspection of the property's water distribution system, guest bathrooms, public restrooms, kitchen, bar, beach showers, and irrigation system	J Doe	12/1/97	
• Develop the checklist forms that will be used to track the preventive maintenance work conducted by this program	J Doe	1/1/98	
• Hold a training workshop to teach housekeeping staff on how to detect and report malfunctioning equipment and leaks Prepare a summary of this information for inclusion in housekeeping staff's training manual	G Bush	1/15/98	
• Begin the first round of inspections Repeat the cycle of inspection each month	Maint staff	2/1/98 - onw	
• After each round of inspection present summary of findings to general manager	J Doe	3/1/98 - onw	
Install 1 6 US gallon/flush toilets in the beach-side public restrooms			
• Identify the type/brand of 1 6 US gal/flush toilets which have given satisfactory results in Negril Get recommendations from maintenance staff of other hotels	P Peters	2/1/98	
• Contact vendor and place order for 4 units	S Holmes	3/1/98	
• Install the units	P Peters	< 1 mth after receipt	
• Monitor weekly to insure proper performance Continue the weekly monitoring for two months following installation	P Peters	after installation	
Water consumption monitoring program			
• Prepare the forms that will be used to collect data from the property's 3 meters	T Rex	12/1/97	
• Train all members of the maintenance staff on how to properly read the meters, enter the information on the forms and calculate the property s weekly water consumption	T Rex	12/15/97	
• Begin collecting the water consumption monitoring program	Maint staff	1/1/98 - onw	
• On the first day of each month calculate the total water consumption and collect total guest night figures for the previous month Calculate IG/GN value for the previous month Provide the IG/GN figure to the Green Team	P Peters	2/1/98 - onw	

Appendix IV

Personal Action Plan - Housekeeping staff		
Action	**By whom**	**Date**
Guest room preparation checklist • If the guests have left their a/c running, leave the guest room door closed during room preparation If the door must be left open, turn the air conditioner off • Do not replace the trash can liners (plastic bags) unless these are soiled or otherwise unacceptable for further use • Report all malfunctioning equipment to the hotel operator -- contact the maintenance department directly only if the need for repair is urgent Pay particular attention to water leaks in toilets, faucets and shower heads, excessively high flows from faucets or shower heads sticking toilet flush handles, sink and bathtub stoppers which don't work or don't fit properly, damaged windows or louvers, scalding hot water, malfunctioning air conditioners • Collect all recyclable items placed in the guest room green recycling containers Recyclable item consist of ◦ clear green and amber glass bottles ◦ plastic beverage bottles ◦ aluminum beverage cans ◦ metal cans ◦ newspaper ◦ white paper • At the end of your shift place all collected recyclables in the appropriate recycling bins located by the laundry room • Before leaving the guest room ◦ turn off all lights televisions and radios ◦ turn the a/c unit to the 'low cool' setting if the guests have left the a/c running, ◦ if the a/c is left on make sure that all windows and louvers are properly closed ◦ ensure that faucets and toilets are not running	All house-keeping staff	Start on 12/01/97
Towel and linen reuse program • • •		

Appendix V

Water - Monitoring form				
Meter number		Month and year		Reading units
Day	By	Meter reading	Consumption	Comments or corrective action
			⇦ Insert here the last meter reading of the previous month	
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				
25				
26				
27				
28				
29				
30				
31				
Total monthly consumption				

Number of guest nights for the month = _____

Water consumption index = (monthly water consumption) / (number of guest nights) =

Appendix V

Example of a partially completed water monitoring form

Water - Monitoring form				
Meter number 34,524,356		Month and year December 1997		Reading units Thousand imperial gallons
Day	By	Meter reading	Consumption	Comments or corrective action
		15,234 600	⇦ Insert here the last meter reading of the previous month	
1	PGM	15,256 700	15 256 700 - 15,234 600 = 22 100	
2	PGM	15 278 300	15 278 300 - 15 256 700 = 21 600	
3	PGM	15,302 500	24 200	
4	PGM	15,322 200	19 700	
5	PGM	15,342 700	20 500	
etc				
25	PGM	15 768 700	21 800	
26	PGM	15,791 600	22 900	
27	PGM	15 880 900	89 300	Because of jump in water consumption, maintenance began inspection of water distribution system
28	PGM	15 976 400	95 500	Discovered leak in property's main distribution line Leak was fixed at 10 30 PM
29	PGM	16 006 200	29 800	
30	PGM	16,027 500	21 300	
31	PGM	16,050 300	22 800	
Total monthly consumption			16 050 300 15 234 600 = 815 700 thousand imperial gallons	

Number of guest nights for the month = 3 077 GN (obtained from front desk records)

Water consumption index = (815 700 Imperial gallons) / (3 077 GN)
= 265 1 Imperial gallons/GN

Appendix V

Electricity - Monitoring form				
Meter number		Month and year		Multiplier
Day	By	Meter reading	Change in meter reading	Comments or corrective action
			⇦ Insert here the last meter reading of the previous month	
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				
25				
26				
27				
28				
29				
30				
31				
Total change in meter reading for the month				

Total monthly electricity consumption = total change in meter reading x multiplier = _____ kWh
Number of guest nights for the month = _____
Electricity consumption index = (monthly elec consumption) / (number of guest nights) =