Implementation of Sustainable Tourism in Puerto Rico

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Abstract

This project, prepared for the Puerto Rico Tourism Company, assessed and documented desired incentives and evaluated the environmental, social, and economic implications of expanding sustainable tourism in Puerto Rico. Sustainable tourism is defined as tourism that conserves environmental resources while preserving local culture and ensuring economic stability for all stakeholders. We collected and analyzed the data obtained through background research, reference interviews and distributed questionnaires. In addition we created six cost analyses on sustainable practices. Based on our results, we formed conclusions and recommendations for the PRTC to use to promote sustainable tourism in Puerto Rico.

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Title Page	Demetra Orthodoxou
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Table of Contents	Demetra Orthodoxou
List of Figures	Chase Terrio
List of Tables	Chase Terrio
Executive Summary	Geoffrey Batstone
1.0 Introduction	Karissa Barnes
2.0 Background	Geoffrey Batstone
2.1 Sustainable Development	Geoffrey Batstone
2.1.1 Green Globe Certification	Geoffrey Batstone
2.1.2 Rainforest Alliance	Chase Terrio
2.1.3 Design Guide for Ecotourism and Sustainable Tourism Facilities	Karissa Barnes
2.2 Tourism	Karissa Barnes
2.2.1 Characteristics of Tourism Development	Karissa Barnes
2.2.2 Tourism in Specific Regions	Karissa Barnes
2.2.3 Tourism in Puerto Rico Today	Demetra Orthodoxou
2.2.4 Diversification of Tourism in Puerto Rico	Demetra Orthodoxou
2.3 Sustainability in Puerto Rico	Demetra Orthodoxou
3.0 Methodology	Chase Terrio
4.0 Results and Analysis	Geoffrey Batstone & Demetra Orthodoxou
5.0 Conclusions and Recommendations	Karissa Barnes & Chase Terrio
References	Karissa Barnes & Geoffrey Batstone
Appendix A	As a team
Appendix B - Key Informant Interview 1	Demetra Orthodoxou
Appendix B - Key Informant Interview 2	Chase Terrio
Appendix B - Key Informant Interview 3	Karissa Barnes
Appendix B - Key Informant Interview 4	Geoffrey Batstone
Appendix C – Cost Analyses	As a team
Appendix D - Custom Cost Analysis Worksheets	Karissa Barnes and Chase Terrio
Appendix F - Sponsor Description	Chase Terrio

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Table of Contents

List of Figures

List of Tables

Executive Summary

Beautiful Puerto Rico, with its pristine beaches, coral reefs, warm weather, music, and art is a rich cultural haven for vacationers seeking to get away from the hustle and bustle of everyday life and find a place to simply relax and enjoy living. As a result, the current tourism industry in Puerto Rico has been primarily concentrated on the development of hotel and resort locations near the coast. Unfortunately, this type of "sun and fun" tourism is rapidly depleting Puerto Rico's fragile ecosystems. In response to this problem the Puerto Rico Tourism Company (PRTC) is actively seeking the development of sustainable tourism practices to help protect Puerto Rico's natural environment in such a way that it benefits both business owners and tourists alike.

According to the PRTC, sustainable tourism conserves environmental resources, respects the cultural authenticity of the community, and provides economic benefits to all stakeholders. Thus, sustainable development is responsible for making optimal use of environmental resources in an attempt to preserve natural heritage and biodiversity while conserving the authenticity and traditions of local cultures and ensuring economic stability for all organizations involved. Unfortunately, sustainable practices in Puerto Rico are only just beginning to develop and convincing hotel and tour operators of the economic and environmental benefits of sustainability is not always easy.

The goal of this project was to determine the desired incentives that the tourism industry would like to receive in order to implement more sustainable practices and to evaluate the financial implications of implementing these practices. With the help of the PRTC and reference interviews with local sustainable organizations and businesses, we were able to develop a list of sustainable practices that could realistically be implemented

in Puerto Rico. Once this list was developed we created three questionnaires that we used to evaluate the attitudes of lodging facility managers, developers, community groups and tour operators with respect to sustainable tourism. These surveys were also used to determine what types of sustainability practices were already being used and those that companies would be willing to implement along with what incentives they would prefer to make implementing sustainability easier.

In order to visually illustrate our data we used the Microsoft Office program "Excel" to create a series of graphs and charts. We also performed cost analyses on a list of six sustainability practices that directly addressed the conservation of water and electricity, two resources that have grown increasingly more expensive in recent years. In these analyses, we compared the current operating costs with the costs of implementing and maintaining sustainable practices.

Utilizing our analyses we were able to develop conclusions and recommendations that the PRTC could use to promote sustainable tourism in Puerto Rico. First, we have concluded that, in general, the tourism industry feels that sustainable tourism would positively benefit the island. Despite this positive attitude, many tourism operations do not currently follow sustainable practices and associate sustainability with large initial costs. Therefore, we recommend that the PRTC use the cost analyses we have developed to illustrate recovery periods on initial investments and reduction in resource consumption. Sustainable practices such as low-flow shower heads and energy efficient light bulbs require a small initial investment and could save tourism operations large amounts of money over time. We also recommend that the PRTC assist tourism operations to secure the required funding for the implementation of sustainable practices.

Offering financial incentives such as tax exemptions and guaranteed funds to aid companies with their initial investments would also help to increase sustainability.

Finally, we have concluded that the consensus among tourism operations is that education will be equally as important as any financial incentive. One of the largest obstacles facing the promotion of sustainability is that many people are unaware of the financial and environmental benefits of sustainable tourism. It is our recommendation that the PRTC help develop curricula that will teach children and adults alike the importance of sustainability for Puerto Rico.

By completing this project we have informed the PRTC about the existing condition of sustainable tourism as well as possible steps they could take to make the island's tourism industry more sustainable. We are confident that the results of this project will be used by the PRTC to develop a foundation for the implementation of sustainable tourism in Puerto Rico. It is also our hope that Puerto Rico's fragile ecosystems continue to be preserved so that tomorrow's generation will have the opportunity to enjoy their natural beauty.

1.0 Introduction

As a result of rapidly depleting natural resources, many countries have established new "sustainable development" methods. The exact definition of sustainable development varies among international organizations, but in general the concept refers to a form of environmentally conscious development that focuses on limited usage of natural resources, preservation of culturally and socially acceptable practices, minimal environmental impacts and long term economic benefits for the local community. Therefore, the goal of sustainable development is to develop in such a way so as not to inhibit future generations. Sustainable development is particularly applicable to tourism operations because they are part of a constantly expanding industry.

Much of the development of Puerto Rico's tourism industry consists of beach resorts and hotels that cannot be described as "sustainable" because of environmentally hazardous construction methods and waste management techniques. If the development of the industry continues on its current path, portions of Puerto Rico's fragile and unique ecosystems will be destroyed. Therefore, the Puerto Rico Tourism Company (PRTC) would like to develop a plan of action to address the issue of reducing these negative environmental impacts, and make current tourism operations more sustainable. However, the PRTC needs more information on the industry's view on sustainable tourism to understand how to best implement sustainable practices.

Copamarina, a hotel located near the Dry Forest in Guánica, Puerto Rico, serves as a model for the long-term economic benefits that result from more sustainable practices. During the past four years, Copamarina implemented several sustainability measures while working toward Green Globe certification, which is achieved by meeting selected

sustainability criteria outlined in recent environmental legislation. The resort documented the costs and savings associated with meeting these criteria and demonstrated that within a few years, the savings surpass the initial costs. However, the general attitude of the tourism industry toward the implementation of sustainable practices presents a challenge. The PRTC believes that the tourism industry does not welcome the idea of sustainability primarily because of the initial costs that would be incurred by the implementation of some sustainable practices.

Even though the PRTC has tried in the past to convince tourism operations to implement sustainable practices, this has not been possible due to the lack of numerical evidence that would show initial costs versus long-term economic benefits. In addition, the PRTC needs to gather information about incentives that could be offered to tourism operations to make them more inclined to consider sustainability.

In order to work toward a solution, our research assessed the existing perception of sustainable tourism. We also determined desirable incentives for assisting tourism operations in the implementation of sustainable practices through the distribution of questionnaires and the completion of four key informant interviews. The PRTC will use our recommendations, combined with an analysis of the costs and savings incurred by operating in a more sustainable manner, to promote sustainable tourism. As a result of our research, the PRTC has the critical tools needed to develop a more sustainable tourism industry, resulting in the further protection of the island's fragile ecosystems and improvement of the industry's long-term viability.

2.0 Background

The purpose of this chapter is to discuss existing research on the topic of sustainable tourism. Therefore, the chapter begins with a discussion of sustainable development, followed by a discussion of the various sources from which we obtained the sustainability criteria used elsewhere in the report. Next, we included a discussion of the tourism industry and specifically examined tourism in island economies. The chapter concludes with a comparison of mass and sustainable tourism within Puerto Rico.

2.1 Sustainable Development

Above all, the Puerto Rico Tourism Company and companies like it are always trying to diversify attractions while maintaining sustainable development. Most people agree that the general goal of sustainable development is to use the resources available today in such a way that we do not compromise the availability of those resources for future generations. Part of the problem with sustainable development is that there are few people who know exactly how this term is defined or what is physically required to be more sustainable. Therefore, before a discussion of sustainable development can occur, we must layout and examine some basic definitions.

The term sustainable development first appeared in a 1987 release of the United Nations called *Our Common Future*, now commonly referred to as the Brundtland Report (Willers, 1994). In this report the term was first defined as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (p.1146). Another publication entitled *Caring for the Earth: A Strategy for Sustainable Living,* put out by the World Conservation Union (Willers, 1994) stated that

sustainable development is, “improving the quality of human life while living within the carrying capacity of supporting ecosystems” (p. 1146).

Sustainability is an issue that pertains to individual countries as well. Previous United Kingdom governments have tried to focus sustainable development on simply balancing economic development with environmental protection (Custance & Hillier, 1998, p. 282). However, the present government has tried to focus on a third aspect of sustainable development: achieving social progress which recognizes the needs of all people. Nevertheless, it is important to recognize that there are three main elements of sustainable development that most people tend to agree upon. These elements include, “maintenance of economic growth, protection of the environment and prudent use of natural resources, and social progress which recognizes the needs of everyone” (Custance & Hillier, 1998, p. 281).

Sustainable development is a broad issue that is addressed by many different organizations. Each of these organizations has its own set of criteria for the characteristics that make a facility or operation “sustainable.” These organizations are discussed in the following sections in order to give context to the actual sustainability criteria.

2.1.1 Green Globe Certification

In the sustainable tourism industry there are standards that organizations must meet in order to be considered “sustainable.” Agenda 21 was a conference of 182 heads of state that took place at the United Nations Rio De Janeiro Earth Summit in 1992 and established standards for sustainable travel and tourism. The Agenda 21 conference set the precedent for the implementation of many new sustainable tourism measures that are

commonly in use today and laid the ground work for what is known as Green Globe 21 certification. According to the Green Globe organization, "GREEN GLOBE 21 is *the* global Affiliation, Benchmarking and Certification program for sustainable Travel & Tourism" (Green Globe, 2003a, p. 2). Today there are about 500 organizations that are either certified or affiliated with Green Globe and its standards.

In order to become a Green Globe (2003a, p. 4) certified entity there are many criteria that must be met and a series of benchmarks that can be achieved on the way to Green Globe certification. The first of these is called the Green Globe Affiliate benchmark and is achieved when a company has reached a high level of awareness and understands the benefits of being certified. The next attainable level in the process is to become "Green Globe 21 Benchmarked." Organizations that have been benchmarked by Green Globe 21 have proven that they maintain all their standards above the baseline and are able to use the Green Globe 21 logo to promote their business. Finally, to reach an official Green Globe 21 certification, an organization must satisfy all the criteria laid out by the company standard and be approved by an accredited third party auditor. Only then can the company bear the seal of Green Globe certification with a check mark in the center. The seal is illustrated in Figure 2.1.

Figure 2.1: Green Globe 21 certification logo

According to Green Globe (2003b), Green Globe 21 works with travel and tourism companies to insure that these organizations maintain good environmental and social practices while delivering benefits to all interested parties. Green Globe stresses, "better environmental performance, improved community interactions, savings through using fewer resources, and greater yields from increased consumer demand" (p. 2).

Green Globe certification stresses a few main focus areas as laid out in their certification standard including greenhouse gas emissions, energy efficiency, water management, ecosystem conservation and management, management of social and cultural issues, and waste minimization including reuse and recycling. These main focus areas must meet specific criteria guidelines in order to reach the level of "Green Globe Certified." In order to accommodate these different focus areas, Green Globe has developed four different standards, which are applicable to businesses, design and construction firms, community groups, and ecotourism operations. Each of these different organization types is held to standards that accurately reflect their operations.

Different standards and operational habits make it difficult to set specific universal standards that apply to all organizations. For this reason, the standards laid out by Green Globe 21 are not given by specific numerical values but more as recommendations and policies that will be evaluated later by an accredited auditor (Green Globe, 2003c, p. 4). Since Green Globe provides standards for four different types of organizations, it is useful for both future and existing facilities and could benefit each of these equally.

2.1.2 Rainforest Alliance

According to the Rainforest Alliance website (2006), their mission is "to protect ecosystems and the people and wildlife that depend on them by transforming land use

practices, business practices, and consumer behavior" (About Us). The Alliance published a guide aimed at community tourism operations and small to medium entrepreneurial businesses. The guide provides a full list of "Sustainable Tourism Best Practices" focusing on the environment, socio-cultural, and economic issues in an effort to "satisfy current tourism and host community needs, while protecting and improving future opportunities" (Rainforest Alliance, 2005, p. 5). Ultimately this global organization hopes to provide manageable steps that communities can take to achieve sustainable development.

Rainforest Alliance provides specific operational techniques for the promotion of sustainable development. Various issues are addressed including conservation of water and energy, protection of historical-cultural heritage, laws and regulations, as well as staff training and marketing strategies. The Rainforest Alliance Guide stands as an excellent model for the proper execution and development of sustainable tourism, however, the Rainforest Alliance does not provide any type of certification and although it provides criteria for sustainable development, there is no quantitative standard for which an organization can aim to meet. The Rainforest Alliance *Guide for Sustainable Tourism Best Practices* could serve as a guide in both new construction and for existing structures to better establish sustainable policies (Rainforest Alliance, 2005, p. 5-50).

2.1.3 Design Guide for Ecotourism and Sustainable Tourism Facilities

Much like the sustainability criteria provided by Green Globe and the Rainforest Alliance, the *Design Guide for Ecotourism and Sustainable Tourism Facilities* (Abruña, 2006, p. 6) presents a set of design criteria to be used within the tourism industry. The fourth edition of this guide, co-authored by Dr. Fernando Abruña, an architect located in

San Juan, and the Puerto Rico Tourism Company, was published in February 2006. The guide is meant to be used by all sectors of development (public, private and community), but is directed to the developers, owners, architects and engineers. The guide is most applicable to facilities that have not yet been constructed, but it may also be useful for organizations with existing facilities that are looking for ways to become more sustainable.

The guide is divided into three main topics. The first topic involves the participation of local communities and states that the design team should maintain interaction with the local community throughout the life of the project. The second topic covers the project's design, which discusses required criteria for the design and construction of facilities through the use of local techniques and reflection of local architecture, culture, and environment. The third topic discusses the need for an efficient use of natural resources, including criteria that call for reuse of existing buildings and infrastructure, as well as the use of a certain percentage of recycled materials during new construction (Abruña, 2006, p. 11).

Within the guide, Director González Denton and Dr. Abruña provide a definition for sustainable tourism that encompasses the three topics discussed above. In summary, they define sustainable tourism as tourist activity that satisfies the needs of tourists and the effected regions while bettering opportunities for the future (Abruña, 2006, p. 17). In order for sustainable tourism to be successful, it is critical to manage all the resources in the best way possible that satisfies economic, social and aesthetic needs while maintaining cultural integrity, essential ecological processes and biological diversity. Sustainability can only be achieved through a continuous process that requires constant

monitoring of impacts, while introducing preventive and corrective measures as needed. The end result should provide a high level of tourist satisfaction, while creating an awareness of the issues related to sustainability and causing the implementation of more sustainable practices by the tourists themselves.

2.2 Development of Tourism and Tourism in Specific Locations

According to Harrison (2004), the history of international tourism dates back about fifty years to the period where transportation by sea and air became available and practical to the general population. International tourists are primarily people from the middle and upper classes who are either on vacations or business trips. Historically, the appeal for the international aspect of tourism has come from the availability of a desired vacation experience at a price that is lower than can be found locally (p. 3). For example, "Early 19th century fishing villages became urban seaside resorts... only to see their economic fortunes decline as the search for the sun and improved communications (roads and air transport) facilitated travel to easily accessible and often cheaper destinations overseas" (Harrison, p. 3). This modern trend toward international travel, combined with the appeal of warm, coastal beaches, has contributed significantly to the development of tropical islands as tourist destinations.

2.2.1 Characteristics of Tourism Development

As tourism expands in a given location, there are certain characteristics that cause and accompany its growth. According to Harrison (2004), the effects of the development of a location as a tourist destination are permanent. On an economic level, the changes are obvious. The economy will transition away from its traditional forms of employment, mostly rural and agriculturally related jobs, toward more urban occupations as locals

become a part of the tourism industry. However, the impacts of tourism go beyond economic change. A change in the attitude of local residents toward tourists has been observed in many cases. Usually the presence of mass tourism leads local residents "to displays of antagonism," causing a need for remedial planning and promotion of the location as a tourist destination. It has been observed that this attitude among locals typically changes into a distant, professional attitude toward tourists as they grow accustomed to the presence of these short-term visitors (p. 24).

Harrison (2004) also argues that this attitude can greatly influence the location's popularity as a tourist destination as tourists in general are prone to make repeat visits to the same locations, preferring the known to the unknown. If the tourists find an agreeable, or at least professional, attitude from the host community, then they are more likely to return. This in turn leads to the greater likelihood of the tourist choosing to migrate to or retire in the host community, leading to even more tourism as friends and relatives of the new residents make visits to their families (p. 24).

According to the article *Tourism* on wikipedia.com (2006), other causes impact tourism growth as well. This website credits Thomas Cook as the father of modern mass tourism because he organized the first package tour in history, from Leicester to Loughborough, on July 5, 1841. For the next century, domestic tourism was the norm, facilitated by the ease of travel by train and expanding railway networks. Followed by the passage of new laws requiring vacation time for workers and the development of air travel, international travel became more accessible to the middle class.

Wikipedia (2006) discusses some other issues that have recently contributed to the development of tourism, crediting higher levels of disposable income and greater

amounts of leisure time as factors contributing to the increase in tourism over the last few decades. In addition, recent developments in technology and transportation have made cruises and long-distance traveling more affordable and accessible. The adoption of a "tourism lifestyle," primarily by the market created by people who are 45 and over, has also contributed to industry growth. This lifestyle is characterized by essentially living as a tourist year-round, engaging in activities such as eating out several times per week, going to the theater, taking day trips, and taking several short vacations each year. Much of this lifestyle is facilitated by the internet, which provides "dynamic packaging," defined as the availability of tailor-made travel packages for a single quoted price.

2.2.2 Tourism in Specific Regions

While there are many traits common to the international tourism industry, it will be helpful to consider individual experiences from small, tropical islands. Studying examples of various tourism endeavors, from locations that are geographically and economically comparable to Puerto Rico, ensures relevance for application to Puerto Rico.

Fiji

Fiji consists of about 330 islands in the South Pacific that have a total land area of about 18,333 square kilometers (Harrison, 2004). A brand new company, Rivers Fiji, began developing a plan to establish a whitewater rafting tourist operation near two villages. Through the development of their business, Rivers Fiji had plans to incorporate two characteristics of sustainable tourism: conservation of natural resources and involvement from local communities. Over the course of approximately two and half years while Rivers Fiji made the necessary preparations to open for business, they were

extremely careful to plan with government agencies and local landowners. The company went to great lengths to ensure that logging did not occur in the proximity of the natural canyons that held the rivers they planned to use (p. 247).

Rivers Fiji emphasized the benefits of bringing tourism, especially white water rafting, to that specific region. In time, the company developed a trusting business relationship with local communities that helped insure long-term viability for the company. Using focus groups, Rivers Fiji also talked with locals about the expected results of opening their region to tourism and what they expected a tourist's experience to be like (Harrison, 2004, p. 242). As a result of their efforts to communicate with, work with, and understand the local communities, Rivers Fiji now enjoys a positive response from them. Combined with the company's attempts to preserve the environment that they utilize, Rivers Fiji has laid the foundation for long-term stability for the business.

Hawaii

The *Hawaiian Business* Magazine interviewed some of Hawaii's most outspoken leaders on the problems and possible solutions with the Hawaiian tourism industry. According to Tom Kiely (Hawaiian Business, 1994, p. 1) of the Hawaii Visitors Bureau, the tourism industry in Hawaii is doing many things effectively and produces one-third of their gross state product and over 250,000 jobs. Despite these contributions to Hawaii's economy, in 1993 the visitor inventory was only 70% full. According to Kiely, it needs to be about 75% full, which means 170,000 daily tourists, to support the industry and community. He stresses the importance of expanding marketing in both the public and private sectors and for all of the different branches of the tourism industry on the island to work together.

The Caribbean

Much like Hawaii, tourism plays a large role in Caribbean economies. In fact, tourism contributions to gross national product (GNP) in the magnitude of 20– 50% are typical among the region's smaller states and dependencies, a level matched elsewhere only by isolated countries or dependencies within the South Pacific, the Indian Ocean and the Mediterranean (Harrison, 2004, p. 174). This domination of the economy usually occurs when the tourism destination is geared toward "mass tourism," which commonly manifests itself in the form of large, coastal resorts. According to Harrison (2004, p. 164), mass tourism varies with regard to its level of sustainability, which depends on the enforcement of strict regulations.

However, in some cases, a dominant tourism industry does not necessarily have to take the form of mass tourism. For example, according to the *Amsterdam Manor Beach Resort* article on the Green Globe website (2005, Case Studies), the Amsterdam Manor Beach Resort in Aruba is a small hotel that makes a big contribution to Aruba's tourism industry. This hotel achieved Green Globe Certification in 2002 after the implementation of sustainable practices in a variety of areas that include energy, waste management, resources conservation, social policy, and more. Amsterdam Manor Beach Resort received the American Express green hotel of the year award in 2001 and was ranked the Number 1 Top Hotel in 2005 by the Freeman Group and their quality inspections team. The resort also won *Caribbean Life & Travel* magazine's 2005 Best of the Caribbean award in the small hotels category, demonstrating the overall success of this green hotel and making it a prototype for future endeavors.

2.2.3 Tourism in Puerto Rico Today

Puerto Rico's cuisine, music and people are a living testimony of its unique blend of cultures. Thus, it is no wonder that the island attracts a large number of tourists every year. With Puerto Rico's 250 beaches, the majority of tourists that are attracted to the island are part of the "sun and fun" mass tourism that is evident on so many similar islands. The PRTC acknowledges this fact and through campaigns and funding, promotes advertisement to attract increasing numbers of tourists to the island. After a decline in hotel occupancies from 2001 to 2004, the company has made particularly strenuous efforts and taken several measures to increase the tourism revenue.

As part of these measures the PRTC gave incentives to cruise lines so that they would make either day or overnight stops in Puerto Rico. This brought an income of $500 million from the cruise industry alone over a period of five years (Travel Weekly, 2005, p. 59). The PRTC also felt that Puerto Rico needed to be advertised as a tourism destination on a more global scale (PR Week, 2005, p. 5); therefore, the advertising agency "Edelman" was recruited to expand the island's publicity to Spain and Canada. The strongest points of advertisement included the seventeen championship golf courses that are available on the island as well as the opportunities for kayaking, snorkeling, surfing, diving, and numerous other outdoor activities.

2.2.4 Diversification of Tourism in Puerto Rico

The PRTC also noted that hotels and resorts may not welcome family-type tourism, and this led to the development of a fund to help small businesses that would be more suitable for families (Myers, 2003, p. 31). The fund was set up with the help of the Economic Development Bank of Puerto Rico and the businesses that benefited most from

it were the island's twenty-three "paradores." Paradores can be described as country inns that are privately owned and operated and are located outside of San Juan. The PRTC recommends that such facilities are located in areas where there are some attractions, either natural or man-made, but this is not a requirement. Even though paradores do not provide occupants with as many amenities as those found in hotels and resorts, they can serve as an alternative lodging choice for families and a good option for the budget traveler because they are relatively inexpensive.

Nature tourism is another way by which the PRTC brings diversity to the tourist population in Puerto Rico. Young (1992) describes nature tourism as "tourism to natural areas that promotes understanding of the environment, appreciation and conservation of the culture and lifestyle of the local population" (as cited in Allegheny College website). In Puerto Rico, a popular destination among nature tourists is the El Yunque rainforest.

The island of Vieques, which is famous for its bioluminescent bay, is also a popular nature tourism destination in Puerto Rico. Microorganisms which exist in the waters of this bay become luminous once they are disturbed and this creates the bioluminescent phenomenon. With the new Hi-Speed Ferry leaving Old San Juan daily to transport tourists to Vieques (Rogers, 2005, p. 18), the island's natural tourist attractions are easily accessible.

2.3 Sustainability in Puerto Rico

Even though nature tourism is quite widespread in Puerto Rico, sustainable tourism is just now beginning to develop. The following section provides an overview of the small number of tourism operations in Puerto Rico that are currently making an attempt to be sustainable.

2.3.1 Lodging Facilities

Perhaps one of the most important examples of how an already existing facility can achieve sustainability is provided by the Copamarina resort in Guánica, on the south west part of Puerto Rico. The manager of the resort, Mr. José Padín, has been working toward sustainability for the past four years, implementing such practices as recycling, grey-water treatment, energy efficient appliances and low-flow shower heads and toilets (J. Padín, personal communication, March 17, 2006). The resort also achieves sustainability by including the local community through employment, buying artifacts from local artisans to decorate the hotel, and beach cleaning campaigns that also include the schools of Guánica.

The grey-water treatment, which cleans and recycles all the water that is being used in the facility, is particularly important to the resort as it is located in the dry region of the island. Since the resort is so close to the dry forest, which is under the protection of UNESCO, Copamarina offers hiking trips for its guests as well as kayaking and snorkeling in the nearby areas. Mr. Padín stressed the fact that through the education of their guests, they try to be as sustainable as possible in all the tours that they organize.

2.3.2 Tour Operators

The tour operators that are endorsed by the PRTC, and lead tours around Puerto Rico's beautiful and historic areas, do not follow many sustainable practices. The biggest cause of this situation is that currently, one does not need to be certified in order to become a tour operator. Hilda Morales, who is working closely with the PRTC to try to change this, is organizing a program on sustainable tourism at the University of Puerto Rico Mayagüez, (H. Morales, personal communication, March 24, 2006). The program

will offer courses such as "Ecotourism" and "Sustainability" along with field trips, to try to make the future tour operators of the region more aware of the importance of being sustainable in their practices later on. Ms. Morales is also a tour operator herself who specializes in sustainable touring. She achieves sustainability by giving tours to only small groups of people (no more than five people at a time), if she is certain that no damage will be made to the environment, and by using alternative hiking trails every time.

2.3.3 Developers

On an island like Puerto Rico it is expected that new facilities are continuously constructed, however most of these facilities are not constructed in a sustainable manner. Dr. Fernando Abruña, who has worked with the PRTC on the composition of the *Design Guide for Ecotourism and Sustainable Tourism Facilities*, is an architect who undertakes sustainable projects (F. Abruña, personal communication, March 22, 2006). One of the most important projects he is involved with is the construction of a sustainable school on Culebra. Some of the practices that have been implemented in the school include photovoltaic panels to collect electricity and a grey-water system. These practices can be used as examples for future construction related to the tourism industry.

2.3.4 Community Groups

Community groups are also involved in the effort to increase sustainability in Puerto Rico. The Cabo Rojo Salt Flats Interpretative Center, directed by Joel Colón was created by the community group Caborrojeños pro Salud y Ambiente in cooperation with the Fish and Wildlife Service (J. Colón, personal communication, March 31, 2006). The center, which started operating two years ago, is comprised of a small building with some

information about the reserve of which it is part, a small souvenir shop and compost toilet restrooms. The facility is powered by ten photovoltaic panels located on its roof, and gets some of its water though the runoff from the roof whenever it rains. The center also gives tours to visitors around the reserve and tries to be as sustainable as possible by educating their guests.

Even though we have only discussed isolated examples, they can provide excellent models for the implementation of sustainable practices in all the different areas of tourism in Puerto Rico.

3.0 Methodology

The goal of our project was to assess what the Puerto Rico tourism industry needs in order to implement sustainable practices. Upon our liaison's request, we looked exclusively at the tourism operations that are endorsed by the Puerto Rico Tourism Company because operations that are not endorsed lack services and/or amenities that the PRTC considers critical. In order to achieve our goal we used several methods including questionnaires, interviews, and cost analyses. These methods were carefully selected to accomplish our objectives, the first of which was the evaluation of the tourism industry's attitude concerning sustainability. Another objective was to create a list of potential sustainable practices that are applicable to Puerto Rico and identify possible incentives that could be given to the different sectors of the industry to help with the implementation of these practices. Finally, our last objective was to determine the financial viability of implementing additional sustainability practices by performing cost analyses.

3.1 Create a List of Sustainable Practices

One of our first observations about this project was that there are three distinct groups in the tourism industry in Puerto Rico and thus three different questionnaires had to be created. The first group, which we called "existing operations," consists of all lodging facilities as well as three community groups that already have an existing facility. The second group, called "future operations," includes the remaining community groups and all the developers on the island that are looking into building facilities in the future. Finally, the third group includes all the tour operators. We realized that there would be different sustainable practices that would be applicable to each of these groups, and so we used archival research that focused on organizations such as Green Globe, the Rainforest

Alliance and the PRTC to compile a long list of criteria that could be used to either create or identify a sustainable facility.

To help sort the list and determine the feasibility of these practices, we conducted four key informant interviews. The interviewees were identified by our liaison and chosen to represent each of the groups that would be addressed through our questionnaires. Our first interview was at the Copamarina, a hotel that has recently achieved Green Globe Affiliate status. We asked Mr. José Padín, the general manager of the hotel and the person responsible for increasing the hotel's level of sustainability, about the practices that he implemented, the costs and benefits associated with those practices, and possible incentives that would have made the process easier.

The second interview focused on obtaining information about the practices that could be used by developers in the construction of sustainable facilities. Our liaison identified Dr. Fernando Abruña, a local architect specializing in the design of sustainable facilities and co-author of the PRTC's *Design Guide for Ecotourism and Sustainable Tourism Facilities*, as an appropriate source for this information. At the interview we asked Dr. Abruña questions about his previous sustainable projects and the sustainable characteristics he included in his designs.

Next, we interviewed Ms. Hilda Morales in order to obtain information about sustainability practices used by tour operators. She talked to us about what she does to make her tours more sustainable and what future tour operators need to know about sustainability. Ms. Morales also discussed the current tour guide certification process and the steps that are being taken to improve it.

Our fourth key informant interview took place in Cabo Rojo where we met with Mr. Joel Colón, the manager of the Cabo Rojo Salt Flats Interpretative Center. The Center was founded by the Caborrojeños pro Salud y Ambiente and is part of a wildlife refuge formed by the Department of Fish and Wildlife. This location was identified by our liaison because of the sustainable characteristics incorporated within their facilities and their involvement with the local community. During the interview, we asked Mr. Colón about operating costs, sustainable practices that they follow and employee education.

Using our liaison's knowledge as well as the information obtained by our key informant interviews, we decided which sustainable practices would be most applicable to the different groups in Puerto Rico's tourism industry. After making those distinctions, we created separate tables of practices for each of the three questionnaires. For example, practices such as taking small groups of people on tours are mostly applicable to tour operators and were only included on the "tour operators" questionnaire. On the other hand, practices such as educating personnel about the importance of sustainability are applicable to all groups and were included on each questionnaire. We used these tables to determine which practices tourism operations are currently following and which ones they would be willing to implement.

3.2 Identify Existing Attitudes and Desired Incentives

We sent our questionnaires to all of the endorsed tourism operations on the island and due to the large number of questionnaires that had to be distributed we chose to use a fax machine. In certain cases where faxing was not possible, questionnaires were either e-mailed or sent via mail to the operations. The questionnaires, which can be found in Appendix A, consist of closed questions that were used to determine willingness to

implement sustainable practices, the perceived implications of sustainable tourism for Puerto Rico, as well as the incentives that the industry would prefer in order to aid in the implementation of sustainable practices. There were also two open-ended questions, one to allow for additional comments and one to ask about how the participant thinks sustainability will affect his or her operation.

After reaching the deadline for the return of all the questionnaires, we called the tour operators, developers and community groups that received our fax but did not respond, asking them again to send us their responses. Once the questionnaires were collected, we examined the distribution of our responses with respect to region, type and size of operation and it became evident that we had no responses from the south. Therefore, we arranged a day trip to Salinas, Ponce and Adjuntas, where we visited hotels and community groups to personally distribute our questionnaires. Due to their proximity to our location in San Juan, we also distributed questionnaires to the Condado and Isla Verde areas in person. After the completion of our data collection, we had a response rate of less than fifteen percent.

We analyzed the results of our questionnaires by using the Microsoft Office program "Excel" to look for trends in the data. Specifically, we looked at trends in the amount of money that tourism operations would be willing to spend to implement sustainable practices and the most preferred incentives.

3.3 Cost Analyses

Based on our tables of sustainable practices and the information obtained from our key informant interviews, we decided to perform cost analyses on six sustainable practices. We decided it was important to perform our analyses on practices that save

energy and water since the costs of both of these utilities continuously increase and are some of the largest expenses in the hotel industry. For energy conservation, we decided to look at energy efficient light bulbs because they are very easy to purchase and install and we felt that over time they would help reduce electricity costs. We also analyzed the cost of solar water heating since it is relatively inexpensive to install and should work well in Puerto Rico because of the year-round sunshine. For water conservation, we decided to perform analyses on grey-water treatment plants, which recycle a portion of the waste water produced by the hotel and allow that water to be reused in the hotel. We also performed analyses on low-flow shower heads and low-flow toilets because they can either be installed in an existing facility or in a facility as it is constructed. Finally, we chose to analyze costs associated with compost toilets because they do not use any water at all.

For each sustainable practice, we began the analysis by calculating the initial costs, such as purchasing and installing the required materials, the costs of operation, such as any electricity needs or labor, as well as the cost of maintenance for an existing hotel with 50, 100 and 200 rooms. Next, we calculated the cost of the existing, conventional practice that would be replaced by the more sustainable practice. By comparing the costs of conventional and sustainable practices we calculated the monthly and yearly savings that would result from the change in practice. Since water and electricity costs are constantly changing, we also calculated savings in terms of gallons of water and kilowatt-hours. Finally, we calculated the pay-back period, which is the amount of time required for the savings resulting from the sustainable practice to equal the initial cost.

Since most of the calculations for these practices required electricity and water, we established values that reflect current electricity and water costs to use in each of our analyses. We used eight cents per kilowatt-hour for the cost of electricity and $2.18 per cubic meter for the cost of water.

The following section discusses the results obtained from the methods described in this chapter and provides an analysis of those results.

4.0 Results and Analysis

This chapter presents and analyzes the results we obtained through the methods described in the previous chapter. We used these methods to work toward our goal which is to assess and document existing sustainability practices in an attempt to evaluate the implications of increasing sustainable tourism in Puerto Rico. We begin this chapter by evaluating the tourism industry's attitudes toward sustainable tourism and continue by determining the sustainable practices that are currently followed and the practices that the industry would be most willing to implement. Next, we determine which incentives the tourism industry would prefer in order to implement sustainable practices. Finally, we discuss the outcomes of our cost analyses. Please note that the number of responses that we received is not statistically representative of all tourism operations in Puerto Rico. However, we do believe that the number of responses is adequate to show common trends within the tourism industry.

4.1 Attitudes Toward Sustainable Tourism

In order to determine the tourism industry's attitudes toward sustainability, our three questionnaires included several closed questions about people's opinions on sustainable tourism. The first two closed questions were "In general, how do you think the tourism industry in Puerto Rico views sustainable tourism?" and "How do you think sustainable tourism would affect Puerto Rico?" There were four possible answers to these questions and the combined results from all three surveys are presented below in Figure 4.1.

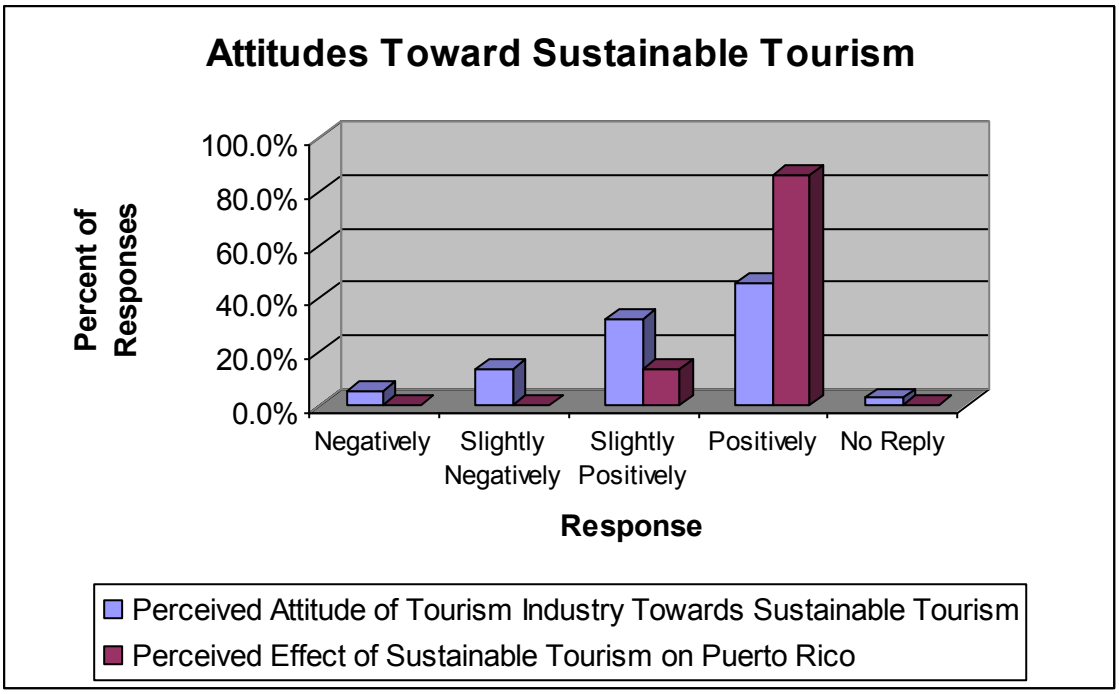

Figure 4.1: Attitudes Toward Sustainable Tourism

It is important to note that 100% of the respondents indicated that they believe sustainable tourism would affect Puerto Rico either slightly positively or positively. In addition, 78.3% of the respondents believe that the tourism industry in Puerto Rico has a positive view on sustainable tourism. This positive attitude is common within each sector of the tourism industry. For example, when one developer was asked if he thought sustainable tourism would benefit his company he said, "Absolutely. In today's competitive climate product differentiation coupled with community involvement and design enhancement give you a home run." In response to the same question, a hotel owner stated that sustainable tourism would help their hotel in their promotional and marketing efforts as well as increase their revenue.

The attitude toward sustainability was further investigated by another question on the questionnaires, which asked how the participant thought that the implementation of

sustainable practices would affect operating costs in the long run. Figure 4.2 displays the responses to this question from all three surveys.

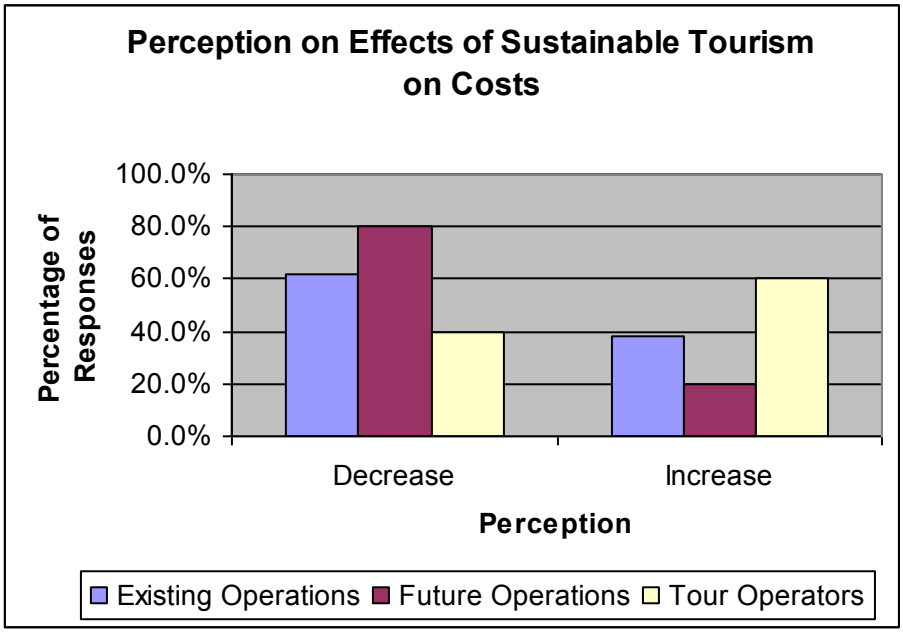

Figure 4.2: Perceptions of effects of sustainability on costs.

As shown in the graph above (Figure 4.2) the majority of respondents think that operating costs will decrease over time. More specifically, both existing and future operations think that operational costs will decrease and this result may be helpful as the Puerto Rico Tourism Company tries to motivate existing and future operations to implement more sustainable practices. In contrast, the majority of tour operators believe that operational costs will increase over time. This could be because the changes that tour operators would need to make in order to become more sustainable are different than those that a hotel owner or a developer would need to make. For instance, one of the tour operators, who responded that more sustainable measures would greatly increase his operating costs, stated that "changing vehicle specifications is too costly."

Even though a large proportion of respondents believe that sustainable practices would decrease operational costs, opinions varied when asked how much they would be willing to spend on the implementation of sustainable practices if they were to make their money back in five years. Figure 4.3 shows how this question was answered by the respondents of the "existing operations" questionnaire.

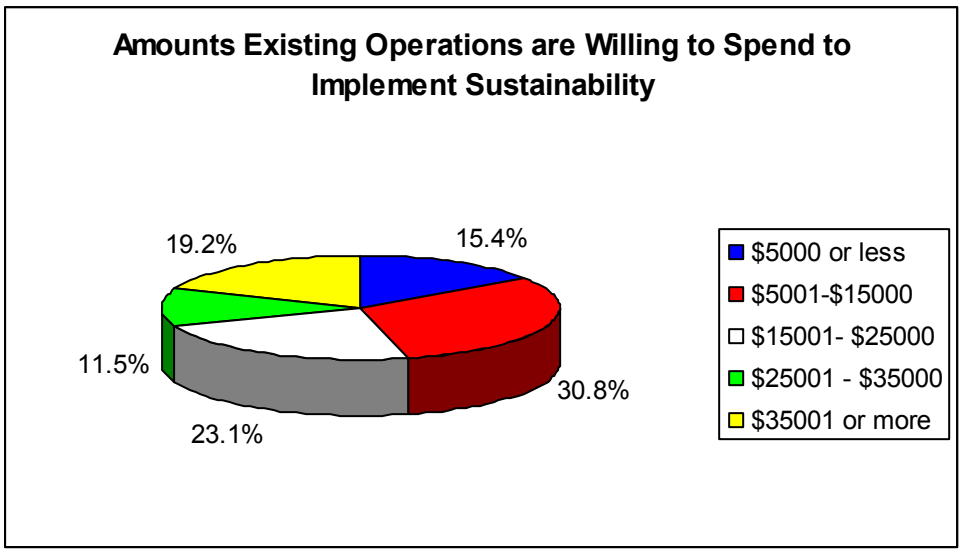

Figure 4.3: Amount Existing Operations are Willing to Spend to Implement Sustainability

The above pie chart shows that the greatest percentage of respondents, 30.8%, would be willing to spend between five and fifteen thousand dollars to implement further sustainable practices, whereas only 19.2% would be willing to spend more than thirty-five thousand dollars. However, looking more closely at the data one can see that 69.2% of the existing operations respondents would be willing to spend less than twenty-five thousand dollars. The following pie chart (Figure 4.4) illustrates this.

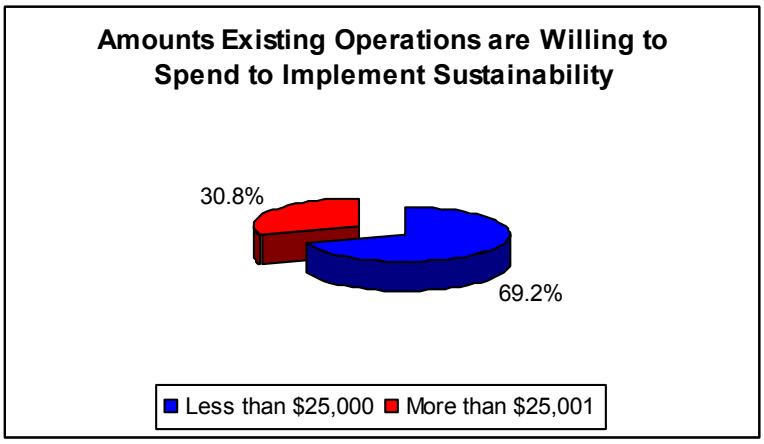

Figure 4.4: Amount Existing Operations are Willing to Invest in the Implementation of Sustainable Practices

An important aspect to consider when analyzing these data is that the existing operations survey was performed on community groups that already have a facility, as well as lodging facilities of various sizes: small (less than 80 rooms), medium (81-199 rooms) and large (more than 200 rooms). Table 4.1 shows an analysis of the amounts that lodging facilities of various sizes, existing and future community groups, developers, and tour operators would be willing to invest.

Facility Type	Amount Willing to Spend to be More Sustainable	Percentage of Respondents Willing to Spend that Amount
Existing-Small	Less than $15,000	67%
Existing-Medium	More than $25,001	67%
Existing-Large	Less than $25,000	80%
Existing Community Groups	Less than $25,000	100%
Future Community Groups	More than $35,001	100%
Developers	More than $35,001	100%
Tour Operators	Less than $15,000	80%

Table 4.1: Initial investments that tourism operations are willing to make based on size and type.

As displayed in Table 4.1, large existing facilities were not willing to spend as much as medium existing facilities. Looking more closely at the data, many of the large hotels

are in an urban setting such as Condado, Isla Verde, and Ponce. After talking with managers of these hotels, we found that they are already taking several steps towards being more sustainable and the lack of space is a limiting factor for the implementation of some additional sustainable practices such as a grey-water treatment system.

Table 4.1 also shows that 67% of small lodging facilities are willing to invest less than $15,000 on sustainable practices. After speaking with the owners of guest houses and small lodging facilities on Vieques we found that one reason for their willingness to invest only small amounts of money was a fear of tourists' response concerning the lack of "luxuries" in their facilities. For example, one owner explained that when they did not have air conditioning, guests were not willing to consider making a reservation with that hotel. Another reason for small facilities' willingness to make a limited investment in sustainability was that they had already implemented many sustainable practices. For example, one facility on Vieques that was willing to spend no more than $5,000 had already received many awards by the Puerto Rico Tourism and Hotel Association for being a "green" facility.

It is important to note that the results from the future operations questionnaires show that all of them would be willing to spend more than $35,000. On the other hand, tour operators were willing to spend less money on the implementation of sustainability practices, with 80% of respondents stating that they were willing to spend less than $15,000. This could be attributed to the fact that, as mentioned above, tour operators believe their operating costs will increase by the implementation of sustainable practices such as the purchase of non- motorized vehicles.

Through the analysis of the responses to the questions pertaining to attitudes toward sustainable tourism, it is clear that the tourism industry in Puerto Rico realizes that, as one hotel owner stated, more people are becoming interested in "staying in a hotel that resembles the culture of the town or country that they visit."

4.2 Current Sustainable Practices in the Tourism Industry

In an attempt to determine which practices are most commonly used by the tourism industry at the moment, each questionnaire provided the participants with a table of sustainable practices and asked them to check the ones they were actively practicing as well as the ones they would be willing to implement.

Responses indicate that practices such as hiring employees from the local community, supporting local artisans and using energy efficient appliances are the ones that are most commonly used by existing operations. This is due to the fact that these practices could be implemented most conveniently and have lower costs. The five most popular practices that existing operations are currently following are illustrated in Figure 4.5.

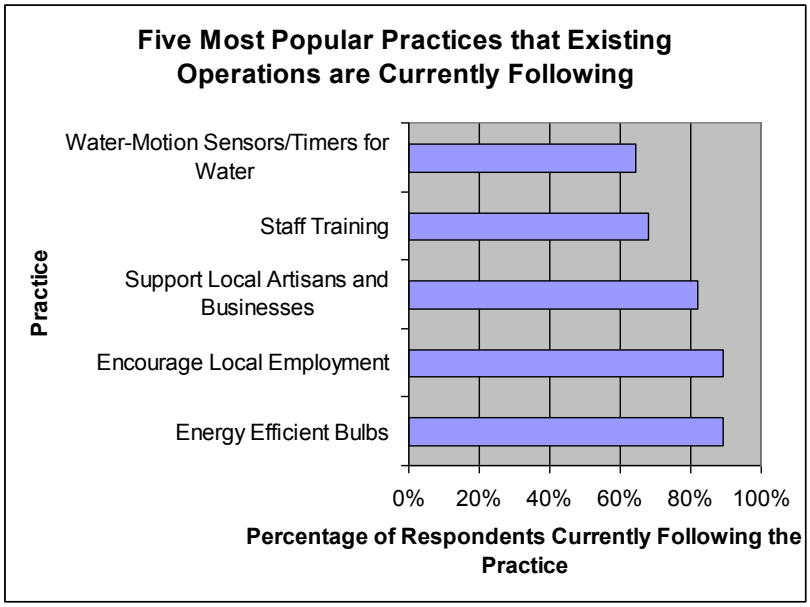

Figure 4.5: The five most popular practices that existing operations are currently following

Tour operators are also currently using practices that are convenient and associated with a low cost, such as educating the tourists and incorporating local and cultural events into their tours. In contrast, the questionnaires that we received from developers show that this sector of the tourism industry has implemented few sustainable practices. Very few respondents stated that they use practices such as wall color reflectivity to conserve electricity from lighting, low-flow shower heads and toilets and energy efficient appliances when designing and building a new facility. This could be attributed to the fact that developers usually want to build facilities at the lowest possible cost and the implementation of sustainable practices would increase their costs and thus force the selling price of the facility to increase.

Although some practices could be implemented with relative ease by all sectors of the tourism industry, all three surveys show that many facilities and/or companies are not currently practicing any of them.

4.3 Practices that Tourism Operations are Most Willing to Implement

As mentioned above, the respondents were asked to indicate all the sustainable practices they would be willing to implement in their facilities or operations. Staff training is the one practice that over 90% of the entire tourism industry is either practicing or willing to implement. Figure 4.6 illustrates the comparison between the percentage of operations practicing or willing to implement staff training.

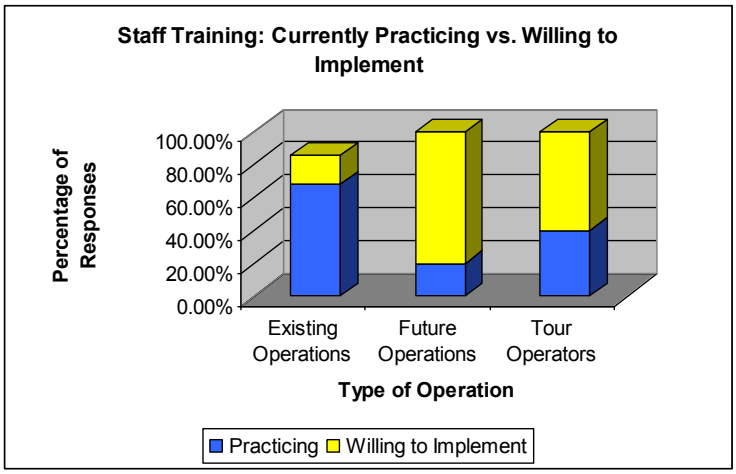

Figure 4.6: Percentages of tourism operations practicing or willing to implement staff training

Existing operations' responses also showed that they would be willing to establish practices such as the use of solar panels for energy as well as for heating water. The following graph shows the five most popular practices for existing operations as well as the percentage of respondents who said that they would be willing to implement them.

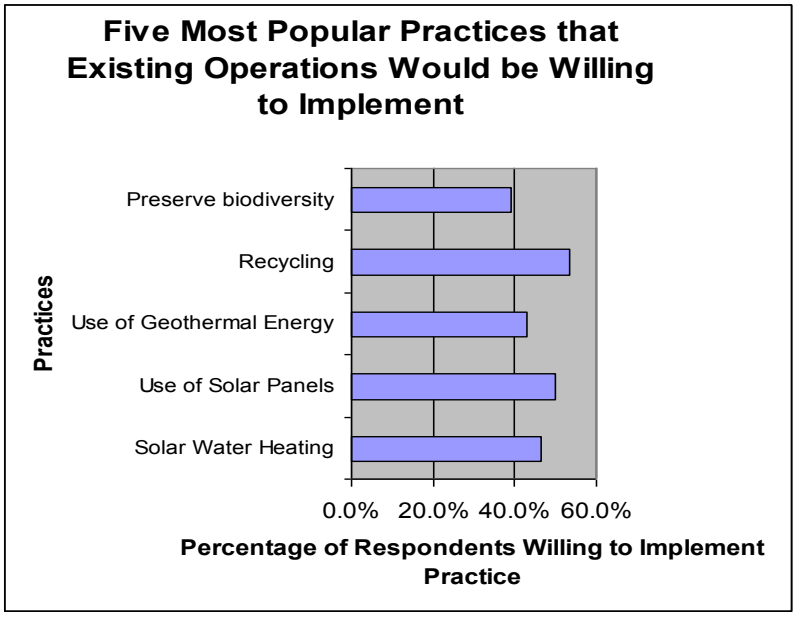

Figure 4.7: The most popular practices that the existing operations would be willing to implement.

The analysis of the responses received from tour operators showed that they would be willing to use more energy efficient vehicles as well as non-motorized means of transportation. However, as mentioned above, high initial costs are a problem associated with these practices. Tour operators would also be willing to participate in recycling. According to one respondent Puerto Rico is one of the top waste producers in America with one of the worst recycling programs.

Developers' responses also showed that they would be willing to implement recycling as well as practices that would contribute to the saving of energy consumed by lighting, such as the use of skylights, dimmer switches and motion sensors. As far as the social aspect of sustainability is concerned, future operations, and more specifically developers, indicated that they would be willing to include the community as well as take local architecture into account when designing and building a facility. These practices are the most appealing to future operations since at the moment there is a lack of community

focus on behalf of the developing companies, and as one of the developers commented "there must be a social and community focus for corporate and entrepreneurial responsibility."

4.4 Preferred Incentives

Another purpose of our surveys was to help us determine which incentives the tourism industry would prefer in order to implement further sustainability practices. Primarily, we met this objective through a question that asked all the participants to rank which type of incentives they would prefer (financial, educational, promotional and marketing, and human resources), followed by a series of questions pertaining to specific types of those incentives.

Figure 4.8 displays the combined numbers of participants who ranked each of the four incentive types as their first choice. Financial incentives were ranked as the first choice by 54.4% of the respondents, whereas 27.3% ranked educational incentives as their first choice.

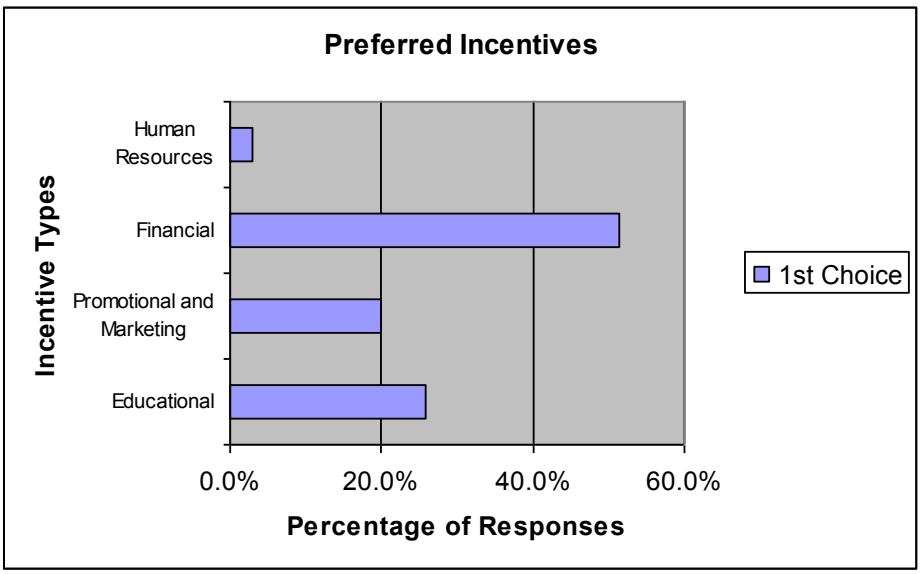

Figure 4.8: Preferred incentives from all sectors of the tourism industry

Results show that the three surveyed groups preferred different specific financial incentives. The existing and tour operator groups both ranked tax exemptions as their first choice while the future group, that consists of developers and community groups, ranked grants as their first choice. The following three graphs illustrate more specifically the percentages of respondents from each group that preferred each incentive.

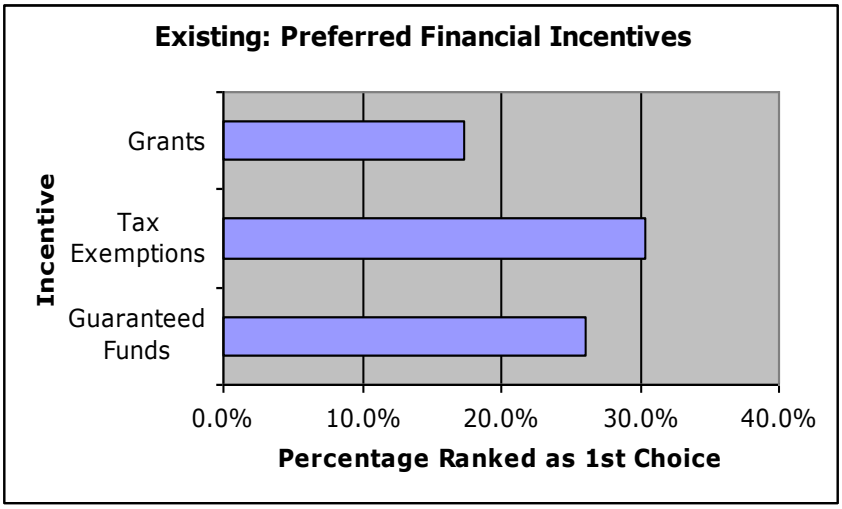

Figure 4.9: Preferred first choice financial incentives for existing operations

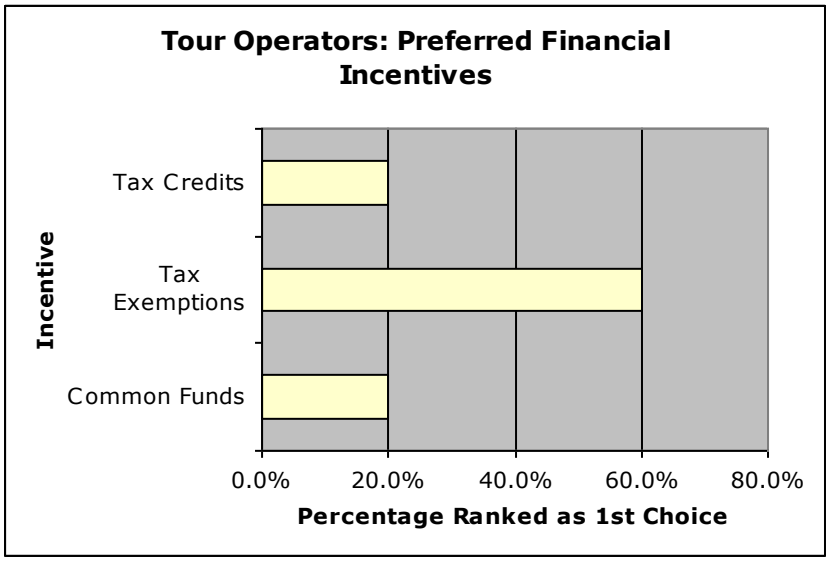

Figure 4.10: Preferred first choice financial incentives for tour operators

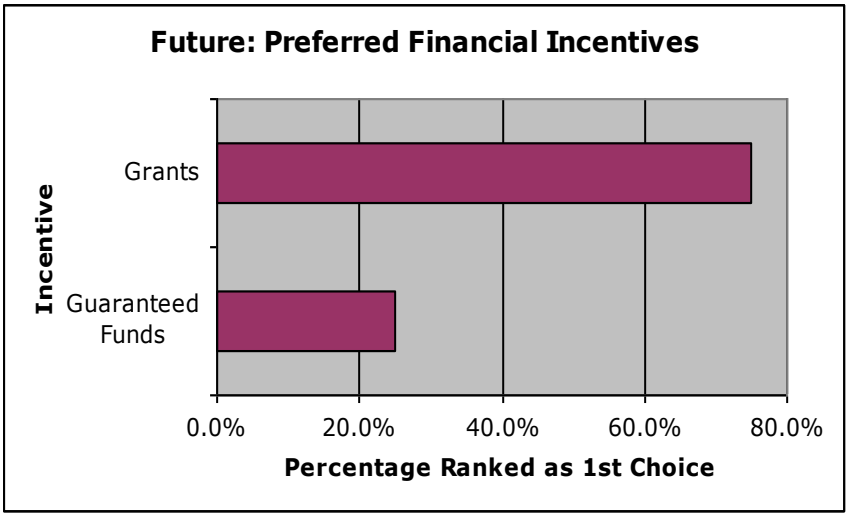

Figure 4.11: Preferred first choice financial incentives for future operations

Educational incentives were the second most popular choice. Figure 4.12 illustrates the preferred educational incentives for existing and future operations as well as tour operators. Staff training was the overwhelmingly preferred incentive among existing and future operations with 62.5% of existing operations and 60% of future operations indicating it as their first choice. In contrast, desired educational incentives for tour operators were significantly different with 60% indicating educational curricula as their first choice. In our reference interview with Ms. Hilda Morales, she stressed the importance of educating present and future tour operators about sustainability. According to Ms. Morales, the preference for educational curricula can be attributed to the new regulations that require all tour operators to meet educational requirements for certification (H. Morales, Personal Communication, 24 March, 2006).

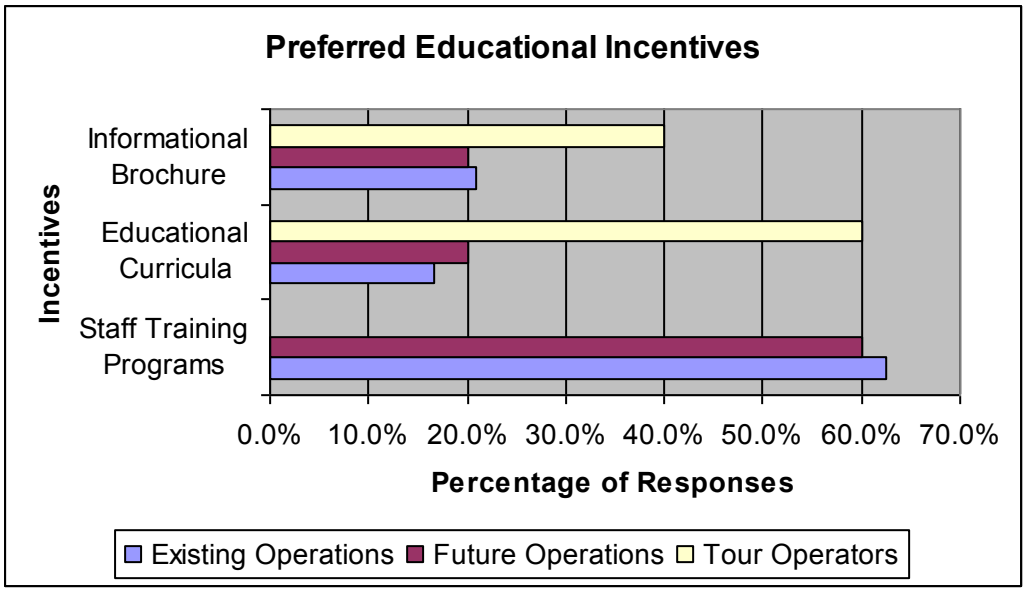

Figure 4.12: Preferred first choice educational incentives for all sectors of the tourism industry

In other categories, preferred incentives varied from group to group, however all groups agreed that free advertisement abroad would be a beneficial incentive. Developers and respondents answering the existing operations questionnaire also ranked wage reimbursement highly as an incentive that they would like to receive in order to implement sustainability.

4.5 Cost Analyses

In order to provide the PRTC with the means to convince the tourism industry to invest in sustainable tourism we developed cost analyses to concretely illustrate the costs associated with the implementation of sustainable tourism. We looked into the development of several cost analyses, however we only completed six because many of the other practices seemed unfeasible for Puerto Rico. In order to perform these analyses, we looked at initial costs, which include equipment and installation involved with the implementation of each practice, along with annual savings and pay-back periods. A

pay-back period is the time required for a sustainable measure to pay for its initial costs. Figure 4.9 illustrates the initial investment and annual savings associated with a water treatment system, compost toilets, energy efficient light bulbs, low-flow shower heads, and low-flow toilets.

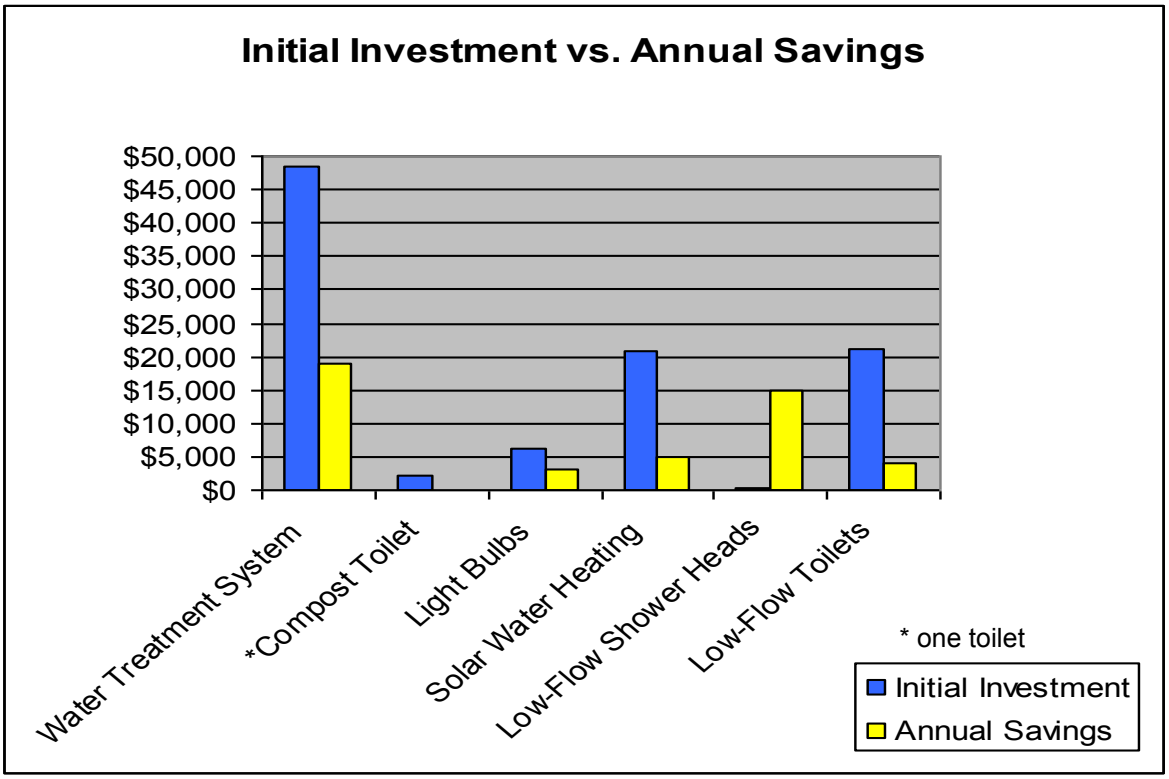

Figure 4.13: Initial Investment vs. Annual Savings

The figure shows that there are various levels of initial costs as well as various levels of annual savings. For example, low-flow shower heads have a very low initial investment associated with them and high annual savings, making them a cost effective sustainable practice. On the other hand, practices like low-flow toilets are associated with high initial costs and low annual savings. However, regardless of initial costs each of these sustainable practices will eventually save money.

More specifically, one can compare the potential water conservation and monetary savings for a hotel with 100 rooms through the replacement of conventional toilets and conventional shower heads with low-flow toilets and low-flow shower heads. The results show that it would take approximately 11 years to recover the initial cost of replacing the 3.5 gallon per flush toilets with 1.6 gallon per flush toilets. In contrast, it would take less than one month for that same hotel to recover the initial cost of replacing conventional shower heads with low-flow shower heads. Additionally, they would reduce their water usage by approximately nine times the amount reduced by replacement of conventional toilets. This comparison is displayed in more detail in Figure 4.10.

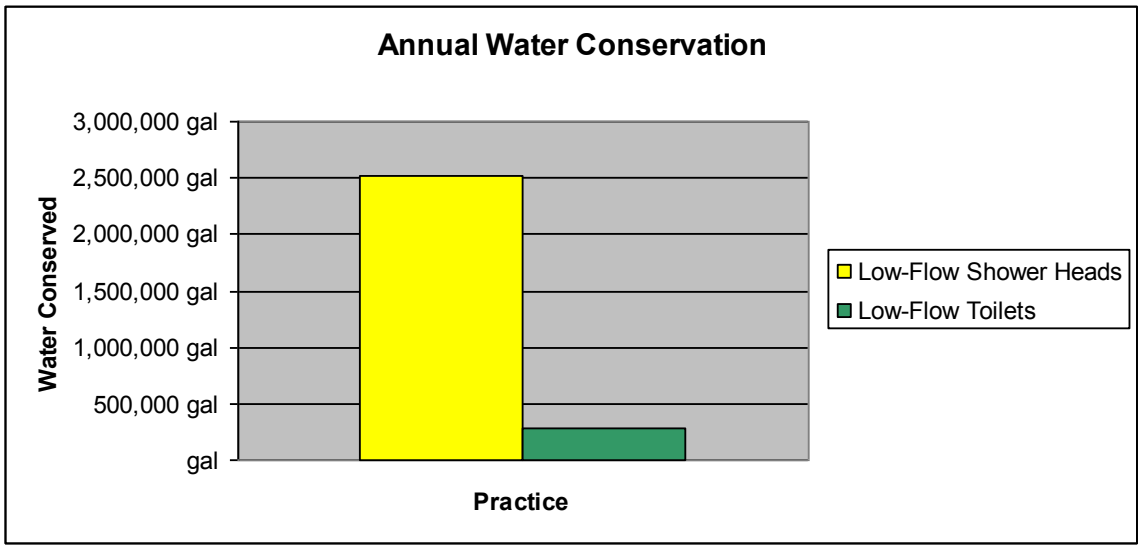

Figure 4.14: Annual water conservation for a 100-room hotel

Water can also be conserved through the use of grey-water treatment systems. However, this sustainability measure cannot be directly compared to low-flow showerheads and low-flow toilets since it requires specific physical provisions. If a hotel with 100 rooms is able to make these special provisions, the initial cost for a treatment system is approximately $48,500 and the annual savings is about $19,000. This results in

a pay-back period of 32 months and an annual water conservation of about 2,760,000 gallons.

Compost toilets also have special limitations because they can only be used on the ground floor of a structure and so they are typically only applicable for community group and ecotouristic facilities. Therefore, we performed a cost analysis for the installation of one compost toilet and found that the initial investment would be about $2,200 and the annual savings would be approximately $45. This results in a pay-back period of over 50 years and the conservation of about 60,500 gallons of water per year. Refer back to Figure 4.13 for a visual comparison of the initial investment and annual savings associated with these two sustainable practices.

Electricity is an equally valuable resource and the consequences of more sustainable electricity usage can be compared in a similar manner as water usage. For example, if a hotel with 100 rooms replaces their 60 watt conventional light bulbs with high-efficiency compact fluorescent light bulbs, the required initial investment is approximately $6,250 and the annual savings is approximately $3,250. The result is a pay-back period of slightly less than two years and the annual conservation of almost 50,000 kWh of electricity. In contrast, the same hotel that installs a solar water heating system will make an initial investment of $20,700 and realize an annual savings of approximately $6,000. The result is a pay-back period of slightly more than four years and the annual conservation of over 62,000 kWh of electricity. The comparison of the reduction in electricity usage is presented in Figure 4.15.

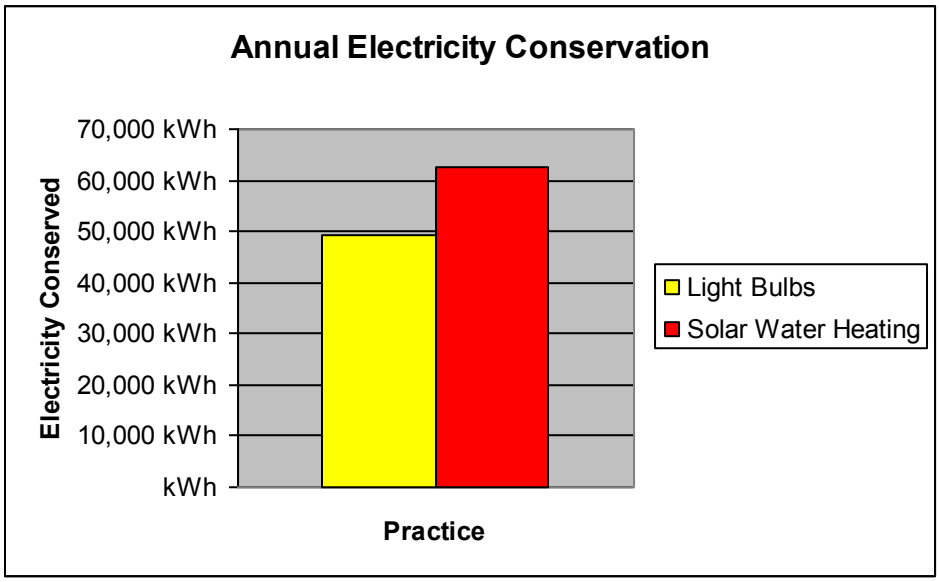

Figure 4.15: Annual electricity conservation for a 100-room hotel

Overall, the solar water heating system will conserve more electricity and save more money annually. For tourism operations that cannot make the initial investment required for a solar water heating system, high efficiency light bulbs may be a better solution because of the lower initial cost and shorter pay-back period. In addition, the light bulbs are considerably easier to purchase and install while still conserving a significant amount of electricity.

Up to this point, we have discussed cost analyses as applicable to a hotel with 100 rooms. However, we also completed analyses on the same six practices for a hotel with 50 rooms and a hotel with 200 rooms. For low-flow toilets, solar water heating and grey-water treatment systems the pay-back period changed with the number of rooms. As presented in Figure 4.16, the pay-back period decreased as the number of hotel rooms increased for each practice that is listed. Therefore, if the pay-back period is a concern for a larger facility, these practices may be the most feasible for that facility.

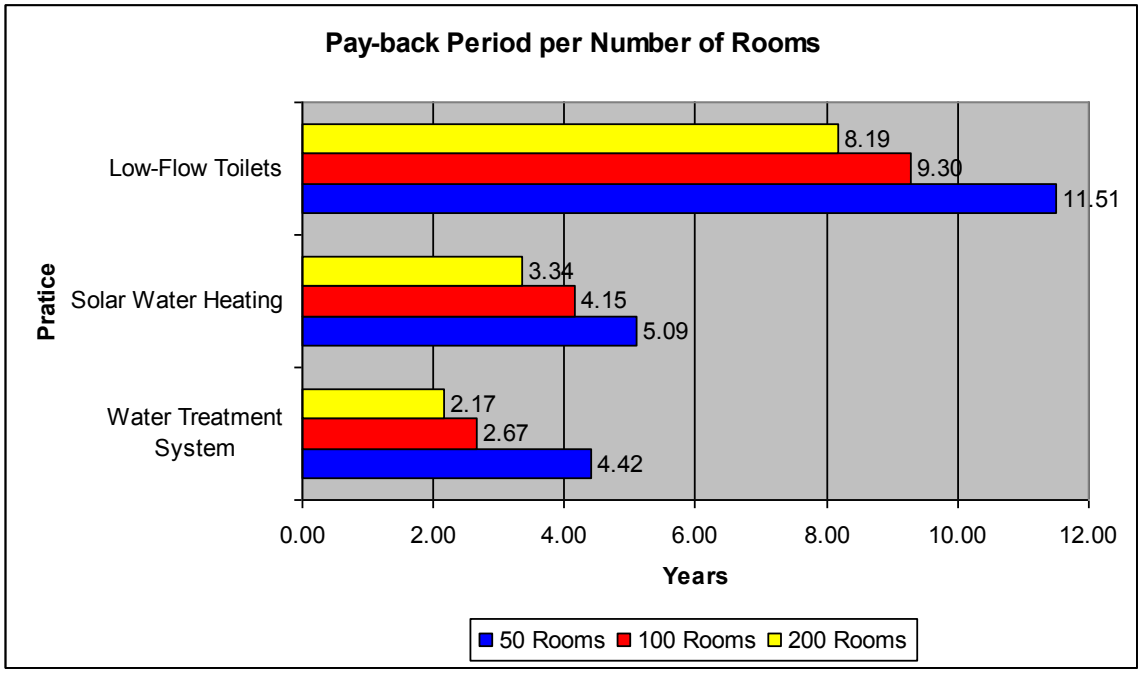

Figure 4.16: Pay-back period per number of rooms

Based on these cost analyses, the tourism industry's attitude, the current state of and willingness to implement more sustainable practices, we formed the conclusions and recommendations discussed in the following chapter.

5.0 Conclusions and Recommendations

In this chapter we discuss our conclusions regarding the tourism industry's attitudes toward sustainable tourism and the practices that are currently followed. In addition, we provide our recommendations for the further implementation of sustainable practices and the incentives that the industry would prefer, based on the results of our research and analysis. Finally, we provide recommendations from our cost analyses, including which practices would be most cost effective and worthwhile to promote.

5.1 Recommendations About Existing Operations

Existing tourism operations showed a strong willingness to implement further sustainable practices, such as recycling, use of photovoltaic cells for the production of electricity and use of solar panels for water heating. Generally existing operations would like to invest $25,000 or less on the implementation of sustainable practices, however this amount varies according to whether the establishment is a lodging facility or a community group, as well as according to size. Therefore, it is important to realize that existing operations should not be considered as one group, rather they should be looked at individually. In order to determine which sustainability practices could be implemented most efficiently for individual facilities, the PRTC could provide the custom cost analysis sheets that are included Appendix D. However, these sheets pertain only to low-flow shower heads, low-flow toilets, and compact fluorescent light bulbs. We recommend that the PRTC works on the creation of more of these worksheets so that facilities could investigate the feasibility of investing on a wider variety of sustainable practices, such as dimmer switches and motion sensors.

5.2 Recommendations About Tour Operators

Tour operators were the only aspect of the tourism industry that felt their operating costs would increase due to the implementation of sustainable practices. However, their responses still showed a willingness to implement certain practices such as the use of energy efficient vehicles for their tours. When we looked into the use of bio-diesel as an alternative to diesel or gasoline, we discovered that in Puerto Rico there are currently no distributors of bio-diesel. In order to promote the use of energy efficient vehicles, the PRTC with the help of the government could approach a distributor about the establishment of distribution on the island even on a very small scale. The PRTC could also inform tour operators about the option of carrying out the process of turning oils into bio-diesel on an individual level.

Like existing and future operations, tour operators also showed a willingness to establish recycling programs. However, there is no organized recycling program in Puerto Rico and it will take much time and effort to establish one. The process could be made much easier if the PRTC could create one central source of regional information providing locations where recyclable materials can be accepted, and contacts for the large scale collection of recyclables generated by the tourism industry.

5.3 Recommendations About Future Operations

Community involvement seemed to be the greatest concern for future operations, since the respondents seemed to believe that currently there is a lack of communication between the community and the developers. We believe that this could be due to the lack of resources educating the developers on how to include the community in their design and construction decisions. However, the PRTC has published the *Design Guide for*

Ecotourism and Sustainable Tourism Facilities and could use that to educate developers. We recommend that the PRTC send a copy of the guide to all the developers and encourage them to use it. In our opinion and based on the responses to our questionnaire, future operations would be willing to implement the practices suggested in the guide.

5.4 Additional Recommendations

Education is a reoccurring theme for all the sectors of the tourism industry. At the moment this is a very important issue for the tour operators due to the new legislation that requires all tour operators to be certified. Currently there is only one university program being organized on sustainable tourism and it will be offered at UPR-Mayagüez. With this great demand for education, the PRTC should establish similar programs that will be more easily accessible, perhaps by working with other universities or colleges around the island. An online certification course would be another option for making the program more accessible.

We also reached the conclusion that staff training on sustainable practices seems to be one practice that most operations are willing to implement. The PRTC could offer the option of sending a representative to hotels to deliver a presentation on educational information and suggestions for sustainability to the staff of the hotel. Another similar suggestion would be for the PRTC to hold seminars in different parts of the island where they could invite hotel managers and inform them about different ways that they could train their staff in sustainability. This would be a cost effective means of communication and education.

Additionally, the tourism industry finds it difficult to implement sustainability because of the lack of information provided by one common source. It is difficult, for

example, to find information on sustainable products, sources for materials, and contractors that specialize in sustainable construction. We strongly suggest that the PRTC create a website that would provide a thorough directory of resources one can contact to help with sustainable development. The site would provide a list of names and contact information of distributors of sustainable products, contractors that practice sustainable construction or areas that will accept recyclables as well as educational information. Once the website has been established, the PRTC could launch an advertising campaign to inform the industry as well as the general public about its existence and to educate them about sustainable tourism.

Respondents from all the sectors of the tourism industry indicated that they would like to receive free advertisement abroad as an incentive to further implement sustainability practices. We recommend that the PRTC launch an advertising campaign, similar to the one they are currently using ("Explore Beyond the Shore"), targeted specifically to sustainable tourism on the island. In this campaign the PRTC could refer people to their website where a link could be found that would provide a list and description of all the facilities on the island that follow sustainable practices. This campaign could be effectively advertised on television as well as in magazines such as *Travel Weekly* and *Budget Traveler*.

However, all of these recommendations are based on the responses received from a small portion of the PRTC endorsed tourism operations in Puerto Rico's tourism industry and we cannot claim that they are representative of the entire industry. Therefore, we strongly recommend that the PRTC hire a private survey firm to conduct a survey that achieves a number of responses that is large enough to give statistical validity and

includes tourism operations that are not endorsed by the PRTC, as they may have different ideas about sustainable tourism.

Ultimately, the tourism industry in Puerto Rico shows a desire to participate in sustainable tourism. For sustainable tourism to grow, there needs to be more communication and financial support facilitated by the PRTC. Through advertisement, incentives, resources and education the tourism company can best develop sustainable tourism in Puerto Rico.

References

Abruña, F., & González Denton, T. (2006). Guías de diseño para instalaciones ecoturísticas: San Juan, Puerto Rico: Author.

This source is a design guide for the development of ecotourism and sustainable tourism in Puerto Rico. Authored by the Executive Director of the Puerto Rico Tourism Company and a Puerto Rican Architect, the guide begins with a message from the executive director that states the importance of relaying the message that it is important to be environmentally conscious. The guide then describes a three-step process for implementing ecotourism and sustainable tourism, lists some requirements for hotels to achieve a "green" certified status, and contains a long list of relevant defined terms.

Amsterdam Manor Beach Resort. (2005, September). Retrieved on April 1, 2006, from http://www.greenglobe21.com/Documents/CaseStudies/Amsterdam%20Manor%20Beach%20Resort%20Case%20Study%20Corrected.pdf

Custance, J., & Hillier, H. (1998). Statistical Issues in Developing Indicators of Sustainable Development. *Journal of the Royal Statistical Society*. *Series A (Statistics in Society), 161*, 281-290.

Green Globe 21. (2003a). *Community Standard.* Retrieved March 20, 2006, from http://www.greenglobe21.com

Green Globe 21. (2003b). *Company Standard for Travel & Tourism.* Retrieved March 20, 2006, from http://www.greenglobe21.com

Green Globe 21. (2003c). *Design and Construct Standard.* Retrieved March 20, 2006, from http://www.greenglobe21.com

Harrison, D. (Editor). (2002). *Tourism and the Less Developed World*. Retrieved February 2, 2006, from http://site.ebrary.com/lib/wpi/Doc?id:10066746

Hawaii Business. (January, 1994). Voices from Within [Electronic version]. *Hawaii Business* 39(7), 22.

Lee, W.H., & Moscardo, G. (2005). Understanding the Impact of Ecotourism Resort Experiences on Tourists' Environmental Attitudes and Behavioral Intentions. *Journal of Sustainable Tourism,13,* 546-565.

This study explored the conservation benefits of environmental management practices and nature experiences provided at a major Australian ecotourism resort. To achieve this purpose the study investigated changes in tourists' environmental knowledge, awareness, attitudes and behavioral intentions between pre-visit and post-visit stages. Overall, there were few statistically significant differences between the pre-visit and post-visit samples. This study found, however, significant effects of (1) visitor awareness of, (2) involvement in, the environmental management practices, and (3) participation in nature tour activities on environmental attitudes and behaviors. It is suggested that awareness of in-resort environmental practices and satisfying experiences in ecotourism accommodation may lead to reinforcing visitors' favorable environmental attitudes, thus increasing their interest in further ecotourism experiences. Through these cumulative effects, ecotourism accommodation could achieve its educative goal.

McPhaul, M.J. (2005). Puerto Rico's promise for ecotourism: the sky's the limit. *Caribbean Business, 33*(5), 18-22.

Myers, G.N. (2003). Puerto Rico promotes its paradors. *Travel Weekly. 62*(46), 31.

Nature Tourism in Northwest Pennsylvania. (2003, August). Retrieved on April 19, 2006, from http://naturetourism.allegheny.edu

Newome, D., Moore, A. S., & Downing, R. K. (2002). *Natural area tourism [electronic resource]: ecology, impacts and management*. Buffalo: Channel View Publications.

This book acts as a complete guide as to how tourism and the environment can coexist in harmony. It gives examples of how natural areas are affected by tourism as well as guidelines of how that can be avoided. The book also provides the reader with a number of strategies that could be used to manage natural areas where tourism occurs. It also notes the importance of monitoring these areas to avoid damage.

Orams, M.B. (1995). Towards a more desirable form of ecotourism. *Tourism Management, 16*(1), 3-8.

PR Week (US). (2005, Sept 19). Puerto Rico tourist board extends its Edelman account. (Brief Article). p. 5.

Rainforest Alliance. (2005). *Guide for Sustainable Tourism Best Practices.* New York: Rainforest Alliance.

Rogers, M. (2005). Puerto Rico Builds for the Future: Cruise incentives, paradores and a new convention center give retailers more reasons to sell the destination. *Travel Agent, 321*(3), 16-19

Serrano, Mariella Perez. (June, 2005). Puerto Rico Tourism Co.'s Fiscal 2006 Budget Reaches $119 Million. [Electronic Version]. *Caribbean Business 33*(22), 25.

Travel Weekly. (2005). Puerto Rico offers cash for cruisers. *Travel Weekly: the choice of travel professionals. 1797*, 59.

Wikipedia. (2006, March). *Tourism*. Retrieved on March 30, 2006, from http://en.wikipedia.org/wiki/Tourism

United Nations Conference on Environment and Development (UNCED). (1992). *Agenda 21 for the Travel and Tourism Industry.* Earth summit.

This document is a summary of the United Nations findings on the promotion of environmentally friendly tourism. They provide general background on the subject in addition to what local government should do on top of how individual companies and the industry can improve tourism.

Willers, B. (1994). Sustainable Development: A New World Description. *Conservation Biology, 8,* 1146-1148.

Cost Analysis References

Aqua Alternatives. (2005). *2005 Toilet Prices.* Retrieved April 18, 2006, from http://www.enviroalternatives.com/toiletprices.html

American Standard Companies. (2006). *Toilets.* Retrieved April 18, 2006, from http://www.americanstandard-us.com/ProductThumb.asp?prodcatID =3&brandID=1,2,3

American Waterworks Association. (2003, August). *ICI Demand and Contribution to Wastewater Flow*. Retrieved April 17, 2006, from http://www.awwa.org/WaterWiser/ watch/index.cfm?ArticleID=210

Ampac. (2000). *Heavy Commercial*. Retrieved April 17, 2006 from http://www.ampac1.c om/newpage4.htm

Association of American Geographers. (1997). *Student Worksheet 1.3.* Retrieved April 18, 2006, http://www.aag.org/HDGC/www/intro/units/unit1/worksheets/wksheet1 -3.PDF#search='average%20daily%20toilet%20usage'

Autoridad de Acueductos y Alcantarillados. (2006). *Nueva Estructura Tarfaria*. Retrieved April 17, 2006, from http://www.acueductospr.com/tabla_cmb_comgobind_agua_ alca n.htm

Bulbbarn, Inc. (2006). *2 Piece Compact Fluorescent HPF 15 Watts Standard Base.* Retrieved April 18, 2006, from http://www.bulbbarn.com/main.aspx?prod=3277 -2-161&list=t

Pacific Institute. (2006). *Details of Commercial and Industrial Assumptions, by End Use.* Retrieved April 18, 2006, from http://www.pacinst.org/reports/urban_usage/appendix_d.pdf

San Diego Regional Energy Office (2006). *Gifts of Energy Saving*. Retrieved April 17, 2006, from http://www.sdenergy.org/eMessages_View.asp?MsgID=154

Home Depot. (2006). Retrieved April 17, 2006, from http://www.homedepot.com/prel80/HDUS/EN_US/diy_main/pg_diy.jsp? CNTTYPE=PROD_META&CNTKEY=misc%2fsearchResults. jsp&BV_SessionID=@@@@ 1879948245.1146001973@@@@&BV _EngineID=ccciaddhimikhdecgelceffdfgidgng.0&MID=9876

NAHB Research Center. (2005). *Low Flow Plumbing Fixtures.* Retrieved April 18, 2006, from http://www.toolbase.org/techinv/techDetails.aspx?technologyID=190

Rowlett, Russ. (2000, July). *How Many? A Dictionary of Units of Measurement*. Retrieved April 17, 2006, from http://www.unc.edu/~rowlett/units/dictH.html

Sonideft Solar. (2005). *G32-P :: Solar Collector - Grid Style.* Retrieved April 18, 2006, http://www.heatwithsolar.com/partstocart.do?product=G32-P

ToolBase Services. (2006). *Solar Water Heating.* Retrieved April 18, 2006, http://www.toolbase.org/tertiaryT.asp?DocumentID=3216&CategoryID=949

U.S. Department of Energy. (2000). *Energy Efficient Light Bulbs: A Bright Idea.* Retrieved April 18, 2006, from http://www.ftc.gov/bcp/conline/pubs /products/ffclight.htm

Zoe Industries, Inc. (2006). *Water Saving Shower Heads*. Retrieved April 17, 2006, from http://showerbuddy.com/Showroom/_Shower_Head/Low_flow_shower_h eads/low_flow_shower_heads.html

Appendix A - Questionnaires

Existing Facilities Questionnaire

Dear Valued Participant,

We are a student project group working with the Puerto Rico Tourism Company (PRTC) on a study to gather information about your business' interest in sustainable tourism and you have been selected to participate in this study.

According to the PRTC, sustainable tourism conserves environmental resources, respects socio-cultural authenticity, and provides socio-economic benefits to all stakeholders. Thus, sustainable development is responsible for making the most use of environmental resources in an attempt to preserve natural heritage and biodiversity while conserving the authenticity and traditions of local cultures and ensuring economic stability for all organizations involved.

Thank you for taking the time to complete this survey, your response is very important to us. If you need further clarification, please call (787) 721-2400 x3100.

Please fax your reply to (787) 721-6561 by Wednesday, March 29th.

Sustainable Tourism Survey

1. In general, how do you think the tourism industry views sustainable tourism?

Negatively	Somewhat Negatively	Somewhat Positively	Positively

2. How do you think sustainable tourism would affect Puerto Rico?

Negatively	Somewhat Negatively	Somewhat Positively	Positively

3. In the following table, please check (in the appropriate column) each practice that you are currently following and that you would be willing to implement.

Practices	Actively Practicing	Willing to Implement
Water		
• Low-flow shower heads and toilets		
• Water treatment plant		
• Water-solar heating to reduce need for water heater		
• Re-use of grey water		
• Motion sensors/timers		
Energy		
• Energy efficient appliances		
• Use of solar panels		
• Use of geothermal energy		
• Insulation		
Lighting		
• Energy efficient bulbs		
• Wall color for light reflectivity		
• Dimmer switches		
• Motion sensors		
• Sky lights		
Waste Management		
• Recycling		
• Management of hazardous materials		
• Compost piles		
Natural Area Conservation		
• Non-motorized water sports		
• Preserve biodiversity		
• Environmentally conscious tours		
Community Involvement		
• Encourage local employment		
• Support local artisans and businesses		
• Staff Training		

4. Which of the above practices would be the easiest and the most difficult to implement in your organization?

Easiest_____

Most Difficult_____

5. Do you think that sustainable tourism would benefit your company? Why or why not?

6. How do you think that the implementation of sustainable practices will affect operating costs in the long run? (please circle one)

Greatly Decrease	Decrease	Increase	Greatly Increase

7. How much would you be willing to spend on sustainable practices if you would see a return on your investment within five years? (please circle one)

$5,000 or less	$5,001-$15,000	$15,001-$25,000	$25,001 - $35,000	$35,001 or more

8. If your company were to be given incentives to implement sustainable tourism, which ones would be most important to you? Please rank with 1 being the most important:

__ Educational

__ Promotional and marketing

__ Financial

__ Human Resources

9. Which of the following educational incentives would be most effective for your business? Please rank with 1 being the most important:

__ Staff training programs

__ Educational curriculums

__ Informational brochure

__ Other (please explain) _____

10. Which of the following promotional and marketing incentives would be most effective for your business? Please rank with 1 being the most important:

    __ Free facility brochures

    __ Free advertisement abroad (magazines, television, internet, etc.)

    __ Package deals with tour operators

    __ Other (please explain) _____

11. Which of the following financial incentives would be most effective for your business? Please rank with 1 being the most important:

    __ Guaranteed funds

    __ Common funds

    __ Low interest rates

    __ Tax credits

    __ Tax exemptions

    __ Tax deductions

    __ Grants

    __ Reimbursement of paid certification (i.e. Green Globe)

    __ Other (please explain) _____

12. Which of the following human resources incentives would be most effective for your business? Please rank with 1 being the most important:

    __ Wage reimbursements

    __ Employment programs

    __ Other (please explain) _____

13. Do you have any other suggestions or ideas for promoting the development of sustainable tourism in Puerto Rico?

14. Please write the name of your business.

Future Facilities Questionnaire

Dear Valued Participant,

We are a student project group working with the Puerto Rico Tourism Company (PRTC) on a study to gather information about your business' interest in sustainable tourism and you have been selected to participate in this study.

According to the PRTC, sustainable tourism conserves environmental resources, respects socio-cultural authenticity, and provides socio-economic benefits to all stakeholders. Thus, sustainable development is responsible for making the most use of environmental resources in an attempt to preserve natural heritage and biodiversity while conserving the authenticity and traditions of local cultures and ensuring economic stability for all organizations involved.

Thank you for taking the time to complete this survey, your response is very important to us. If you need further clarification, please call (787) 721-2400 x3100.

Please fax your reply to (787) 721-6561 by Wednesday, March 29th.

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Negatively	Somewhat Negatively	Somewhat Positively	Positively

2. How do you think sustainable tourism would affect Puerto Rico?

Negatively	Somewhat Negatively	Somewhat Positively	Positively

3. In the following table, please check (in the appropriate column) each practice that you are currently following and that you would be willing to implement.

Practices	Actively Practicing	Willing to Implement
Water		

• Low-flow shower heads and toilets		
• Water treatment plant		
• Water-solar heating to reduce need for water heater		
• Re-use of grey water		
• Motion sensors/timers		
Energy		
• Energy efficient appliances		
• Use of solar panels		
• Use of geothermal energy		
• Insulation		
Lighting		
• Energy efficient bulbs		
• Wall color for light reflectivity		
• Dimmer switches		
• Motion sensors		
• Sky lights		
Waste Management		
• Recycling		
• Management of hazardous materials		
• Compost piles		
Natural Area Conservation		
• Non-motorized water sports		
• Preserve biodiversity		
• Environmentally conscious tours		
Community Involvement		
• Include community representatives in design process		
• Send letters to relevant community groups		
• Hold community meetings to get input from community members		
Construction and Design		
• Incorporate local architecture		
• Minimize impermeable area		
• Use existing infrastructure when possible		
• Erosion Control		

• Staff Training		

4. Which of the above practices would be the easiest and the most difficult to implement in your organization?

Easiest_____

Most Difficult_____

5. Do you think that sustainable tourism would benefit your company? Why or why not?

6. How do you think that the implementation of sustainable practices will affect operating costs in the long run? (please circle one)

Greatly Decrease	Decrease	Increase	Greatly Increase

7. How much would you be willing to spend on sustainable practices if you would see a return on your investment within five years? (please circle one)

$5,000 or less	$5,001-$15,000	$15,001-$25,000	$25,001 - $35,000	$35,001 or more

8. If your company were to be given incentives to implement sustainable tourism, which ones would be most important to you? Please rank with 1 being the most important:

__ Educational

__ Promotional and marketing

__ Financial

__ Human Resources

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__ Staff training programs

__ Educational curriculums

__ Informational brochure

__ Other (please explain) _____

10. Which of the following promotional and marketing incentives would be most effective for your business? Please rank with 1 being the most important:

__ Free facility brochures

__ Free advertisement abroad (magazines, television, internet, etc.)

__ Package deals with tour operators

__ Other (please explain) _____

11. Which of the following financial incentives would be most effective for your business? Please rank with 1 being the most important:

__ Guaranteed funds

__ Common funds

__ Low interest rates

__ Tax credits

__ Tax exemptions

__ Tax deductions

__ Grants

__ Reimbursement of paid certification (i.e. Green Globe)

__ Other (please explain) _____

12. Which of the following human resources incentives would be most effective for your business? Please rank with 1 being the most important:

    __ Wage reimbursements

    __ Employment programs

    __ Other (please explain) _____

13. Do you have any other suggestions or ideas for promoting the development of sustainable tourism in Puerto Rico?

14. Please write the name of your organization.

    _____

Tour Operators Questionnaire

Dear Valued Participant,

We are a student project group working with the Puerto Rico Tourism Company (PRTC) on a study to gather information about your business' interest in sustainable tourism and you have been selected to participate in this study.

According to the PRTC, sustainable tourism conserves environmental resources, respects socio-cultural authenticity, and provides socio-economic benefits to all stakeholders. Thus, sustainable development is responsible for making the most use of environmental resources in an attempt to preserve natural heritage and biodiversity while conserving the authenticity and traditions of local cultures and ensuring economic stability for all organizations involved.

Thank you for taking the time to complete this survey, your response is very important to us. If you need further clarification, please call (787) 721-2400 x3100.

Please fax your reply to (787) 721-6561 by Wednesday, March 29th.

Sustainable Tourism Survey

1. In general, how do you think the tourism industry views sustainable tourism?

Negatively	Somewhat Negatively	Somewhat Positively	Positively

2. How do you think sustainable tourism would affect Puerto Rico?

Negatively	Somewhat Negatively	Somewhat Positively	Positively

3. In the following table, please check (in the appropriate column) each practice that you are currently following and that you would be willing to implement.

Practices	Current	Willing to Implement

• Stay on trail when hiking		
• Do not take anything from the natural environment		
• Use of energy efficient vehicles		
• Do not litter		
• Staff Training		
• Avoid noise pollution		
• Incorporate local and cultural events		
• Encourage local employment		
• Educate tour participants		
• Recycle		
• Use of non-motorized transportation		

4. Which of the above practices would be the easiest and the most difficult to implement in your organization?

Easiest_____

Most Difficult_____

5. Do you think that sustainable tourism would benefit your company? Why or why not?

6. How do you think that the implementation of sustainable practices will affect operating costs in the long run? (please circle one)

Greatly Decrease	Decrease	Increase	Greatly Increase

7. How much would you be willing to spend on sustainable practices if you would see a return on your investment within five years? (please circle one)

$1,000 or less	$1,001-$5,000	$5,001-$15,000	$15,001 - $25,000	$25,001 or more

8. If your company were to be given incentives to implement sustainable tourism, which ones would be most important to you? Please rank with 1 being the most important:

   __ Educational

   __ Promotional and marketing

   __ Financial

   __ Human Resources

9. Which of the following educational incentives would be most effective for your business? Please rank with 1 being the most important:

   __ Staff training programs

   __ Educational curriculums

   __ Informational brochure

   __ Other (please explain) _____

10. Which of the following promotional and marketing incentives would be most effective for your business? Please rank with 1 being the most important:

    __ Free advertisement abroad (magazines, television, internet, etc.)

    __ Package deals with lodging facilities

    __ Other (please explain) _____

11. Which of the following financial incentives would be most effective for your business? Please rank with 1 being the most important:

    __ Guaranteed funds

    __ Common funds

    __ Low interest rates

    __ Tax credits

    __ Tax exemptions

__ Tax deductions

__ Grants

__ Other (please explain) _____

12. Which of the following human resources incentives would be most effective for your business? Please rank with 1 being the most important:

__ Wage reimbursements

__ Employment programs

__ Other (please explain) _____

13. Do you have any other suggestions or ideas for promoting the development of sustainable tourism in Puerto Rico?

14. Please write the name of your organization.

_____

Appendix B

Key Informant Interview 1

José Padín, General Manager Copamarina Resort, Guánica
17 March 2006

Information:
The hotel is near the Biosphere reserve (Dry Forest). They try to get involved with recycling, ecotourism etc. There is a green team in place at the hotel: as many people from all departments, as well as supervisors to guide implementation procedures. There is environmental management: waste, energy, water conservation and waste water treatment. In this area there is no sewage system: all water is recycled. The recycled water is used to water the landscape. Two people are responsible for that.

The efficiency of the hotel is measured in kWh and not in amounts of money as that can change from year to year. In the last 2 years there has been a decrease of 20% in energy.

Tour with Mr. Padín's comments:

- Bar: Garbage is treated. There are different trash cans for glass, aluminum, plastic etc. Every night all the garbage is sent to a specific area. The waiters have a separate area where they can separate garbage.
- Kitchen: All the equipment (fridge, freezer etc) was replaced by energy-efficient equipment. To control the heat in the kitchen new insulation and ventilation systems where installed, therefore there is no need for AC. There is one walk-in refrigerator in the kitchen: every time the door opens the whole system stops. Left-over food is all collected and given away to pig farms.
  There is a large trashcan outside the kitchen and it is used to collect all the waste oil used to cook. This oil is then collected by a company that uses it to make mechanical lubricants and fluids.
  There is also a large fridge outside. This was an old fridge, a new compressor and insulation were added to it and it is now used to store long-term and rarely used food. In this way it is not opened regularly and energy is conserved.
- This hotel is a Green Globe 21 affiliate. Every year Green Globe gives them a set of goals that they have to reach by the next year. For example they could ask them to decrease the amount of waste etc. Once they become an affiliate of the organization then they can get marketing benefits.

  Ms. Gayá: Is it the marketing that makes you interested in Green Globe?

  Mr. Padín: As a hotel it's mostly the conservation of energy. Now, a lot of people care about the environment so when they see that you are an affiliate then they will choose your hotel over others. Now we are waiting for the benchmark and then the inspection.

  Karissa: Is there a fee?

Mr. Padín: Yes, there is an annual fee.

Karisa: Do you think it pays off?

Mr. Padín: Yes, we get the money back in marketing value. It's a good housekeeping seal.

- Rooms: There is a pamphlet from CHA (Caribbean Hotel Association) in every room. This pamphlet asks the guests to reuse towels, control the AC (if they leave the room then they should turn it off. There is also a sticker for that on the AC) etc. Guests are also given a recommended temperature to prevent condensation. For lighting, special bulbs are used which conserve energy. The guests are provided with a sign that they can put on the bed when they need their linen changed.

  Chase: Was there a problem with the employees?

  Mr. Padín: At first yes. They were so used to changing the linen and towels. Now the personnel also give instructions to guests on how to use the sign for the changing of linen.
  All the toilets in the rooms have small 1 gallon tanks. They have a system where they can use only half of the tank. The faucet flows on a rate of 1.5 gallons per minute (the maximum allowed to be part of the program is 2 gallons/minute). There are also low-flow shower heads in use. Some people complain about the pressure of the water, but most people understand.

  Chase: Are guests willing to participate?

  Mr. Padín: Oh yes! You would be surprised. Some of them also give us additional ideas.

- Corridors: Blue bins are around the corridors with signs telling the guests what they can put in them. People are more than glad to do that.

Mr. Padín: We care and benefit a lot from ecotourism. Our kiosk (in the garden-beach area) offers different tours to the guests. All the boats are not motorized. We want to keep the area quiet. It's very common to see dolphins and manatees. We instruct people not to take anything from the coral reefs (no fishing, no removal of pieces of corals etc). We offer hikes to the Dry Forest. We have a little booklet that we give to our guests for free, with trails and information about the forest. We also offer tours to the caves and the Dwarf Forest. Our most popular activities are snorkeling and kayaking.
All around the resort we have flowers and trees, and although not all are native to Puerto Rico they are all easy to maintain. We have 20 different types of palm trees around the hotel. At one point we thought of putting signs near them with

information, but we didn't like the look of that; however we have a big book and give it to the guests to find the palm trees by themselves. This is also fun for a lot of people.

- Greenhouse: Instead of having to buy plants all the time, we try to grow all the plants that we use in the hotel.
- Water treatment plant: This has three stages. In stage 1 the solids are separated from the liquid. In stage 2 the bacteria area gets all the nutrients necessary and in stage 3 we have the chlorination process. Then the water goes to the "pool" (a storage tank). The leftover solids are collected by a company whenever needed. Some times we have too much recycled water, so to prevent flooding of the "pool", we use it to water an approximately 4 acres piece of land that lies around the hotel even though we don't really use it for anything. One more stage of processing would actually make this water suitable for drinking, or at least for use in the toilets and the showers etc. However, we were not able to do this because it would mean re-piping the entire facility.

  Chase: Was it difficult to put in the grey-water system?

  Mr. Padín: No, there are a few companies that do that. The system existed since about 1980. At first the water was damped into the ocean, but now we recycle it.

  Ms. Almodóvar: Do you get supervised by any agency?

  Mr. Padín: No, but we have to keep logs. The responsible agency (EPA) can send someone here anytime and we have to show them the logs.
  The good thing of having the "pool" is that rain water can be collected whenever it rains (rarely rains in that area).

  Demetra: When you were starting to implement these practices did you have help from any agency?

  Mr. Padín: We had some help from the government and especially from the municipality of Guánica. They provided us with a list consisting of companies we could call fro recycling. For the leftover food, oils etc that we have, we had to ask around. It was kind of hard to find people who could recycle them but we eventually figured it out.

  Karissa: What is the involvement from the locals?

  Mr. Padín: Most of the employees are from the area and are involved. Their families and the schools in the area also work with us, for example on beach cleaning campaigns.

- Decoration: most of it is by local artisans. They also have shows sometimes. Within the next year they want to get better at socio-cultural sustainability.

Karissa: Was there a change in the types of guests?

Mr. Padín: There has been an increase in the number of couples, followed by families. The hotel is ideal for relaxation; there are no casinos and no discos. It is all about nature. We have some music around the hotel but it's only for relaxation purposes. Families are oriented to outdoors activities. Our website helps us to advertise that. During the holiday period we get mostly families but the rest of the year we get mostly couples. That is probably due to sustainability.

Market is primarily the U.S. and then P.R.

- Cleaning systems: ECOLAB – very environmentally friendly. The cleaning products come in little packages and are diluted. In the rooms: in the shower there are big bottles of shampoo etc and this saves money and does not consume as much plastic as buying small bottles. This is called a bulk system.

  Ms. Almodóvar: What are your plans for the future?

  Mr. Padín: We hired a supervisor to take care of the green team and sustainable tourism. We are the first hotel in P.R. to do this. This person can take as many classes on sustainable tourism as we can provide. Once that person has all the necessary knowledge we will do more.

  Chase: What was the hardest thing you had to do?

  Mr. Padín: Money! The whole thing was my idea. Employee compliance was hard as well, but to convince the ownership to provide the funding was really hard. Our next step is to convert the heaters in the rooms to solar power heaters. It will take about 5 years to get all that money back but then it will be very beneficial.

  Chase: Where did you see the biggest return?

  Mr. Padín: Biggest returns were in electricity followed very closely by water. Especially since the government increased the water cost.

  Ms. Gayá: Do you have comment cards for tourists?

  Mr. Padín: Yes, we use the PRTC cards. People are very happy with it. Referrals is our number one marketing tool. We get most people from word of mouth. We always ask people how they found out about us and about 40% of them say from word of mouth.

  This is the fourth year that Copamarina operates as a sustainable hotel. Ever since, they have received awards every year.

Ms. Gayá: How about other hoteliers. What is their perception not to get into sustainability? What can we do?

Mr. Padín: Most people don't want to spend the money. You have to show those people statistical information. We calculate the cost/room. In the first year we saved $55,000 in electricity. From recycling you don't get a lot of money but you are helping the environment. Our island has a lack of garbage space. Our most garbage here at the hotel comes from plastic and aluminum comes next. We try to buy everything recycled.

When the hotel prioritized the practices that they used they did it according to cost.

Chase: Looking back is there anything that would make it easier?

Mr. Padín: Assistance from the government. At first they didn't take us seriously.

Approximate costs for practices (~100 rooms):

Light bulbs:	$5,000
Faucets:	$6,000
Toilets:	$12,000
Water Recycling:	$15,000 to improve it
Total:	$38,000

The hotel gets 11% reduction in electricity costs as an incentive. If the government continues to provide incentives like that more people will be willing to participate.

Ms. Almodóvar: What is your relationship with the Dry Forest?

Mr. Padín: Concession with tour operator "Adventuras de P.R.". Privately we do 2-3 tours a week. It is not a package, it is part of our activities. We have people coming here for bird watching. Now we are promoting kayaking and hiking for free to promote ecotourism. Most people who take the trip come back the next day and rent equipment to go again by themselves, therefore it is good for the economy of the hotel.

The resort works closely with the Conservation Trust, the National Resources Department and the National Parks Company.

Key Informant Interview 2

Interview with Dr. Fernando Abruña (architect)
Wednesday, March 22, 2006

Dr. Abruña: What can I do for you?
Chase explained the purpose of our project

Dr. Abruña: We've been practicing architecture for 20 years but during the last 8 years we were able to design and build sustainable buildings. The main problem in Puerto Rico is that if you are not politically correct it's difficult to get commissions. It took us 20 years to make people aware of and get involved with sustainability. Only after that we got a commission to build a sustainable school. It's the first ecological school for the public education system and it's on Culebra. For the past 3 years Culebra has been promoted as having some of the nicest beaches in the world. The school is almost finished now and it will generate about 40% of its electric needs through photovoltaic panels.

It was a challenge to convince the authorities (to use them) because they were scared of their maintenance. Now, it's a problem to convince PREPA to allow net metering. At the moment if you produce electricity you can sell it back. However, they sell it to you at 12 cents per kWh and buy it from you at only 5cents per kWh. So, they are planning to install 2 meters at the school, one for buying and one for selling, instead of 1 meter. We want to let the public know about this. We want only one meter→ net metering.

The electricity authority keeps burning fossil fuels. About 86-88% of Puerto Rico's energy is produced by the burning of oils, about 9% through natural gas, about 2% from coal and about 1% from hydroelectric power.

The school is an elementary school of about 250 students. It has a 25,000 gallon water harvesting system that will be used to run all the toilets and urinals in the school as well as to clean up areas of the school. The department of education was convinced to put in a grey-water system; however we could not convince them to install compost toilets as they are harder for children to adapt to. Only 25% of the facility is mechanically cooled, the rest is cooled through natural ventilation. Even during the summer there is perfect ventilation. As far as light is concerned there are a lot of windows as well as light trays (used to localize the light).

The school was supposed to connect to a sanitary system but this process would take 3 to 4 months and the school will be ready in less than a month. Therefore, now we are trying to install a tertiary water installation that can technically make the water potable. We had to use the one system that would be less harmful to the environment. We designed a evaporative system. Culebra barely filters any rain water because it's so close to sea level. We will be installing a series of very thin plastic pipes which will throw a little mist during the day. The mist will evaporate into the environment. This will increase the

moisture of the earth and allow for the creation of a green area and it is also a good way to process the sanitary water.

Chase: Was it harder to build a sustainable school rather than a normal school?

Dr. Abruña: It's very difficult to build on small islands. It takes time. We have been building the school for four years and the estimated time for completion was 36 months. It is difficult to find trained labor, especially local labor. There are 140 laborers at the school and only 1 of them was actually from Culebra. The rest came from Fajardo and Ponce. We had to provide housing for them during the week and transportation back to their houses for the weekends. This means that we had about 4 working days every week.

We used recycled rubber and tires for the recreation area of the school. Some of the technologies that we used are not common here. The contractor had to adjust to many of our demands, however he was adamant about taking a risk of failure of the green roof structure.

Green Roof: roof with waterproofing membrane. On top of that membrane there is a filtering material (a wire mesh) and on top of that there is dirt where plants are grown. You can also use separate trays on the roof and that would make it easier to correct problematic areas. You can just replace the tray. When the rain water drips it gets cleaned and it ends up as storm water. You can either collect it or it can end up as a retention pond. A retention pond can reduce the possibility of floods in an area because it takes longer for water to percolate through the ground. The green roof also helps with temperature control and it is aesthetically pleasing.

Chase: Are you following a set of criteria or guidelines?

Dr. Abruña: The local Caribbean Green Building Chapter meets in my office the first Tuesday of every month. We are trying to meet with regional Chapter in Florida to discuss sustainability. A second sustainable school has been designed for Dorado. It is important to note that some of the criteria that are available in some guides like Green Globe have to be adjusted to our island because of different comfort levels for example in temperature. In general we try to use the L.E.E.D. criteria. We also worked with the PRTC on a design guide for ecotourism and sustainable practices. These guidelines are now being applied to Humacao Natural Reserve. The Community Groups were the most difficult to convince about sustainability practices.

Chase: How does the cost of building a sustainable facility compare to the cost of building a regular facility?

Dr. Abruña: The cost depends on how you design a facility. Personally I believe that if you don't use alternative energy producing machines it should be cheaper.

Chase: But if you use such alternatives do you save up some money in the long run?

Dr. Abruña: At first it was hard to convince the authorities but the cost of oil has gone up so much that the pay-back period has become much shorter. For an ecological house that we built 4 years ago we expected the pay-back period to be 12 years, now with the current prices it's 8 years and soon it will become even shorter.

Chase: How many sustainable buildings have you already constructed?

Dr. Abruña: We have a house in Bella Alta, the school in Culebra and some pre-designed sustainable houses with a local company. You can buy all you need for $90,000 plus $30,000 for labor. So, $120,000 for a two bedroom sustainable house. The company that sells them, Villas Mi Antojio, is very happy. It's their most successful selling item ever. We also do a lot of sustainable work in recycling buildings and historic restoration. We reuse the bricks, the beams and part of the supporting structures. We have been working with several big projects in San Juan. We ended up with 16 buildings and we convinced the contractors to use electric panels.

Karissa: When designing a building, do you take the surrounding architecture into account?

Dr. Abruña: That's an issue that's not addressed a lot. Instead of making an architectural statement we build structures that blend in. Our buildings do not reflect a style. There are very simple geometries in Culebra-very bright colors and a lot of windows. Cultural and climatic contexts are very important in sustainable practices.

Demetra: Which practices are easier to implement on an already existing building?

Dr. Abruña: Use of grey-water: initial costs are relatively low and the pay-back period is 2 years or less.

Photovoltaic panels: more expensive and the pay-back period is about 8 years.

Solar heating: pay-back period is 1.5 years

Composting toilets: just beginning to be used. There are only 5 in P.R., but with time the water problem in P.R. will be a very big issue. PRASA has major issues in delivering water and has problems with collecting used water.

Key Informant Interview 3

Interview with Hilda Morales
March 24, 2006

Karissa: Tell us about a typical tour.

Ms. Morales: We do mainly private tours and specialize in bird watching; also do day and night tours in El Yunque, biking, and kayaking; they take groups of up to 4 people; tourists usually just meet the tour guide at the site but Hilda has a small car and will pick people up if she needs to

Karissa: What are some sustainable practices that you follow?

Ms. Morales: I have a second home near El Yunque because we do night tours there (only small groups); one of the tours is going to the coffee plantation; small groups have low impact on the places we go, they respect the property and economy by eating at local restaurants and shopping at local businesses

Karissa: How are your tours low impact?

Ms. Morales: Taking small groups by bicycle could be impacting the area because people don't know where birds are nesting, etc.; night tours in El Yunque on a short trail- in the morning takes 20 minutes but at night it takes 1.5 hours because of the Coqui; last time we went there, there were small baby frogs on the trail so I prefer not to take people there every week; we were offering tours in Laguna in Fajardo but we stopped doing that since 2000 because of so many people and it was impacting the mangroves; now we only do those tours during the day and only if asked

Karissa: Is there a certain set of guidelines that you follow?

Ms. Morales: I'm president of the association of interpreters and we have met with representatives from the government and we are making a guide; we use the guidelines provided by the Rainforest Alliance; but we want to follow practices that are in accordance with PR law; for example, you can't touch anything; you have to make people feel and understand the hike; now we are in a 2 year process to establish a law; we've published the manual and now we are waiting; for example, in El Yunque the manual tells people to go on different trails and not use the same one all the time

Chase: Who enforces the guidelines?

Ms. Morales: Natural Resources Department, Federal Government, Institute of Culture; if you have no type of training, you do things that are wrong because you don't know what the right thing is; everyone who works as a tour guide has to go through training; not many people understand what sustainable tourism is so you have to start from the beginning; everyone has to be educated

Karissa: Is there any sort of certification tour guides have to receive?

Ms. Morales: For tour guides, there is a certification; now the Dept. of State will make all the guides who are not certified take an exam (Law 535 (?)); We are asking all that do not have vehicles to be certified; now all tour guides can receive a permit but could not be certified – we are asking everyone to become certified

Demetra: How do people get certified?

Ms. Morales: Curriculum going through Dept. of Education or University; now we have a bachelor's degree in cultural tourism, there will be an assoc. degree for ecotourism and I'm suggesting that they change it to sustainable tourism

Karissa: How is the local community involved?

Ms. Morales: I have divided the business from the association (interpreters); the association is working with community for bird watching; in business we look for tour guides that are from the area, but in the association, it's mostly about educating the people

Karissa: What types of people go on the tours?

Ms. Morales: I'm very picky when I select my clients; part of the ecotouristic profile is in terms of their education and part is in terms of their income; these people know more about Puerto Rico and where they want to go than us; they are very educated, especially the people who want to go bird watching; you can learn a lot from your client

Karissa: Are people specifically looking for sustainable tours?

Ms. Morales: People who go bird watching and people asking for hikes are specifically looking for sustainability

Karissa: Do you try to educate people about sustainability during your tours?

Ms. Morales: We have a questionnaire that they have to fill out when they call us, we see what they know and we educate them

Karissa: Have the tours been affected by the oil shortage?

Ms. Morales: I've noticed that the tours cost the same even though the operating costs have gotten higher; there is no type of government compensation

Karissa: Is sustainable tourism more expensive to operate?

Ms. Morales: it is more expensive for the client because they typically only go in groups of like 2-3 people; some people don't care how much it costs because they want the experience; it is mainly because of the way we present our tours on the website; my tours are different; for example, in El Yunque, we take a trail that no one else really uses, we shop at a local convenience store, show them the house of the governor of PR (it will be turned into a museum); smaller groups also allow for more conversation; at the university I train tour guides and teach ecotourism, I was supposed to have 40 people in my class but I said no, so they lowered it to 24 but now we only have 11 students because of all requirements; everyone who wants to be a tour guide has to have 30 hours of university credits

Chase: What classes are required?

Ms. Morales: Sustainable Tourism, English (basic and conversational), History of Puerto Rico and Mayagüez, Human Relations, Customer Service, Museology, Sport Fundamentals, First Aid, Excursion Techniques, ABCs of Tour Guides, Art Appreciation, Puerto Rico as a Destination, Porta del Sol as a Destination; 700 hours total including 55 hours of internship; the classes are based on the needs of Mayagüez (that's where the school is), but classes near Vieques would be different.

Karissa: What do you teach in your sustainability classes?

Ms. Morales: Definition of sustainability; case studies from what's going on in other countries; a lot of the information comes from local newspapers and also historic cases; students also learn all the laws on tourism; corporate social responsibility – take back our garbage, use a big bottle of water instead of having a lot of small bottles of water

Demetra: Which practices do you think are easiest and most sustainable?

Ms. Morales: We have to get people to change their minds and go through the education; also, we have to get people to comply with the regulations; educate employees and involve them so that they know what they're doing; some people only contact tour guides on the basis of knowing that they speak English

Key Informant Interview 4

Interview with Joel Colón, Director of the Cabo Rojo Salt Flats Interpretative Center
31 April 2006

The Center was created by the community group Caborrojeños in cooperation with the Fish and Wildlife Authority. The Center has been in operation for 2 years and is part of the reserve that was created in the area in 1999. Before the interview we were given a tour of the nearby dry forest by one of the tour guides who works there, Oscar Lugo Sosa. Below lies a summary of the tour:

Oscar gave us an introduction before we even went on the tour, letting us know that we should be aware of what is around us. He warned us about a poisonous tree that can be found in the forest and asked whether we had any medical conditions that might not allow us to take the tour. He also said "I don't want you to touch anything" stressing the importance of not disturbing the surrounding ecosystem. The soil outside the center is called serpentine and it is the oldest type of rock in Puerto Rico. It was brought to the area, because trucks got suck in the native soil of the area. However, the serpentine does not change the ecosystem because the surrounding areas are full of it.

The salt that is extracted from the flats is used in the cattle industry, as well as in pharmaceuticals, leather, water treatment and even for. According to Oscar the Center gets a lot of visitors. There is some garbage in the forest that was thrown there before the creation of the reserve in 1999. Now they cannot extract the waste because it has become part of the ecosystem and they don't want to disturb it. Salt has been extracted from the area since 1511 and it is a process that cannot stop because it will disturb the balance between the two salt lagoons and as a result all the migratory birds that visit the lagoons throughout the year would stop doing that.

After the tour we watched a 17 minute video about the reserve and all the birds that visit it or live there. When the video was finished we proceeded with the interview.

Chase: How did the association start?

Mr. Colón: We've been here for 2 years and the association of Fish and Wildlife Services collected money to build this facility. A special permit was necessary for the mines to work because it is an industry. However, the association receives rent for the use of the salt mines and their use also conserves the environment. The salt industry has nothing to do with us; they educate us on what they do and we work together. People who visit the reserve have to be in here with a guide because I'm responsible for this area. If they don't want to use a guide then they have to go through a different entrance. We have many organizations and corporations helping us and we get their help through proposals that we submit. However, they don't all help us by giving us money. For example, UPR Mayagüez allows my colleagues and me to take classes there for free.

Chase: Do you require your employees, for example your tour guides, to take classes?

Mr. Colón: No, our group works mostly with volunteers. I've been the third paid employee of this organization. For Oscar to be a tour guide he had to attend some seminars. One of them was provided by the PRTC. Tour guides who work here have to know how to speak English and Spanish. We have some seminars going on here where people come in from different organizations and educate us. We are starting a butterfly trail and so we have a professor from the university who knows a lot about us and gave us a lot of info. She comes here once a month, collects the butterflies and gives us information about them. Maybe, in the future, we'll have a butterfly garden here.

Chase: What are some of the sustainable practices that you follow here?

Mr. Colón: We recycle water using runoff from the roof. We do get water and electricity from the government, but those are mostly for emergency use. The tanks in the toilets are plastic and that means that there is no filtration of waste into the soil, and therefore no contamination. If nutrients from the toilets were allowed to reach the sea, a lot of algae would form and that would destroy the coral reefs as well as the salt lakes.

Previously Oscar had told us about the practices that they use:
Solar energy is used for electricity through 10 photovoltaic panels located on the roof. There are 15 batteries attached to them and they can hold the entire building's energy for 5 days.
Compost toilets are also used. These are made by having a hole below the toilet and at the bottom of it there is a tank lined with white pine. Bacteria are added to the tank and they decompose the waste without releasing any smells. The liquid waste is extracted and used for watering the plants. When the tanks are full of waste, they can be replaced and the solid waste can be used as fertilizer.
The restrooms are illuminated through skylights.

Chase: How high are your operating costs?

Mr. Colón: We spend about $70,000 but it's mostly for employees etc. In terms of energy and water we don't pay anything. Only the AC is connected to the government energy and Fish and Wildlife pays for all the utilities.

Karissa: I've noticed the glass on the upper part of the side walls. What is that for?

Mr. Colón: The Plexiglas panels on the sides let light in and therefore save on energy, even though any electric lights that we use are energy efficient. The triangular shape of the roof is important to allow water runoff.

Chase: How do you maintain your relationship with the community?

Mr. Colón: The first thing we do is to invite them here. The nearby school established a science class and brings children here for educational purposes. The children will tell their families and word will spread. At first when we closed off the park people were

upset because we closed off their way to the beach. We had to educate them about it. There are confrontations with the community and the industry but there is also a lot of communication.

Chase: Looking back would anything have made this easier for you?

Mr. Colón: The center opened too quickly and we were not prepared for the tours and the community. In order to be sustainable we had to have this shop (a souvenir shop located in the facility) set up before the opening of the center. Now, we are trying to see what sells more and what is unique here. Everything that has to do with salt is unique to this area. We have to combine education with business and make it work.

Chase: Is there any advice that you would give to other community groups?

Mr. Colón: Talk to us, we've been through it. I've been to Vieques because they are trying to create a new reserve there, again with Fish and Wildlife. They could talk to us and learn from us. If you have a strategic plan it will work for you. The plan is also necessary for when you do proposals.

Taking a last look around the facility we noticed a large paining on the porch. Mr. Colón said that a local artist, made it for the center and it represents the different types of mangroves that can be found in the forest as well as some types of birds. Other than decoration, the painting is also used to educate school children who visit the facility.

Appendix C – Cost Analyses

Water Treatment - 50 Rooms		
Conventional Usage & Cost	**Usage**	**Cost**
Water purchased per room per day (m^3)	0.57	$1.24
Water purchased per 50 rooms per day (m^3)	28.41	$61.93
Water purchased 50 rooms per month (m^3)	852.27	$1,857.95
Water Saved by AP 19k (55%) per month (m^3)	468.75	
Usage & Cost with AP 19k		
Water purchased per 50 rooms per month (m^3)	383.52	$836.08
Electricity usage per day (kWh)	134.28	$10.74
Electricity usage per month (kWh)	4028.40	$322.27
Equipment		
AP19k	-	$22,000.00
2 tanks	-	$2,000.00
Total Costs		
Initial		
Installation	$500.00	
Equipment	$24,000.00	
Total Initial:	**$24,500.00**	
Monthly		
Operation	$322.27	
Maintenance	$220.00	
Total Monthly:	**$542.27**	
Total Savings		
Total Monthly Water Savings:	**$1,021.88**	
Total Monthly Savings:	**$479.60**	
Pay-back Period:	**53**	**months**
Assumptions:		
Water usage =sewer flow		
Electricity = $.08/kWh		
Average hotel room uses 150 gal of water per day		
100% occupancy 360 days/year		
Maintenance costs are for 1 $55 filter every 3 months		
Sources:		*Information Retreived:*
http://www.unc.edu/~rowlett/units/dictH.html		1hp = .746 kWh
http://www.acueductospr.com/tabla_cmb_comgobind_agua_alcan.htm		Cost of water ranges between $2.00 per m^3 and $2.35 per m^3; $1m^3$ = 264 gal
http://www.awwa.org/WaterWiser/watch/index.cfm?ArticleID=210		Water usage = sewer flow
http://www.ampac1.com/newpage4.htm		AP19k info
Notes:		
AP19k is a stand alone reverse osmosis water treatment system, requiring minimal maintenance and additional equipment for operation.		
AP19k has a 7.5hp engine		
AP19k has the capacity for twice the water needed by a 50-room hotel to compensate for times of the day with higher water usage		
AP19k treats sewer water enough to make it usable in hotel rooms (sink, shower, toilet, etc.)		

Water Treatment - 100 Rooms

Conventional Usage & Cost	**Usage**	**Cost**
Water purchased per room per day (m^3)	0.57	$1.24
Water purchased per 100 rooms per day (m^3)	56.82	$123.86
Water purchased per100 rooms per month (m^3)	1704.55	$3,715.91
Water Saved by AP 30k (60%) per month (m^3)	1022.73	
Usage & Cost with AP 30k		
Water purchased per 100 rooms per month (m^3)	681.82	$1,486.36
Electricity usage per day (kWh)	179.04	$14.32
Electricity usage per month (kWh)	5371.20	$429.70
Equipment		
AP 30k	-	$44,000.00
2 tanks	-	$4,000.00
Total Costs		
Initial		
Installation	$500.00	
Equipment	$48,000.00	
Total Initial:	**$48,500.00**	
Monthly		
Operation	$429.70	
Maintenance	$220.00	
Total Monthly:	**$649.70**	
Total Savings		
Total Monthly Water Savings:	**$2,229.55**	
Total Monthly Savings:	**$1,579.85**	
Pay-back Period:	**32**	**months**

Assumptions:

Water usage =sewer flow
Electricity = $.08/kWh
Average hotel room uses 150 gal of water per day
100% occupancy 360 days/year
Cost of AP 30k is assumed to be about twice the cost of the AP 19k, a system that can process about half as much water
Maintenance costs are for 1 $55 filter every 3 months

Sources:	*Information Retreived:*
http://www.unc.edu/~rowlett/units/dictH.html	1hp = .746 kWh
http://www.acueductospr.com/tabla_cmb_comgobind_agua_alcan.htm	Cost of water ranges between $2/per m^3 and $2.35 per m^3; $1m^3$ = 264 gal
http://www.awwa.org/WaterWiser/watch/index.cfm?ArticleID=210	Water usage = sewer flow
http://www.ampac1.com/newpage4.htm	AP 30k info

Notes:

AP 30k is a stand alone reverse osmosis water treatment system, requiring minimal maintenance and additional equipment for operation.
AP 30k has a 10 hp engine
AP 30k has the capacity for twice the water needed by a 100-room hotel to compensate for times of the day with higher water usage
AP 30k treats sewer water enough to make it usable in hotel rooms (sink, shower, toilet, etc.)

Water Treatment - 200 Rooms		
Conventional Usage & Cost	**Usage**	**Cost**
Water purchased per room per day (m^3)	0.57	$1.24
Water purchased per 200 rooms per day (m^3)	113.64	$247.73
Water purchased per 200 rooms per month (m^3)	3409.09	$7,431.82
Water Saved by AP 60k (60%) per month (m^3)	2045.45	
Usage & Cost with AP 60k		
Water purchased per 200 rooms per month (m^3)	1363.64	$2,972.73
Electricity usage per day (kWh)	179.04	$14.32
Electricity usage per month (kWh)	5371.20	$429.70
Equipment		
AP 60k	-	$88,000.00
2 tanks	-	$8,000.00
Total Costs		
Initial		
Installation	$500.00	
Equipment	$96,000.00	
Total Initial:	**$96,500.00**	
Monthly		
Operation	$429.70	
Maintenance	$220.00	
Total Monthly:	**$649.70**	
Total Savings		
Total Monthly Water Savings:	**$4,459.09**	
Total Monthly Savings:	**$3,809.39**	
Pay-back Period:	**26**	**months**
Assumptions:		
Water usage =sewer flow		
Electricity = $.08/kWh		
Average hotel room uses 150 gal of water per day		
100% occupancy 360 days/year		
Cost of AP 60k is assumed to be about twice the cost of the AP 30k		
Maintenance costs are for 1 $55 filter every 3 months		
Sources:		*Information Retreived:*
http://www.unc.edu/~rowlett/units/dictH.html		1hp = .746 kWh
http://www.acueductospr.com/tabla_cmb_comgobind_agua_alcan.htm		Cost of water ranges between $2/per m^3 and $2.35 per m^3; $1m^3$ = 264 gal
http://www.awwa.org/WaterWiser/watch/index.cfm?ArticleID=210		Water usage = sewer flow
http://www.ampac1.com/newpage4.htm		AP 60k info
Notes:		
AP 60k is a stand alone reverse osmosis water treatment system, requiring minimal maintenance and additional equipment for operation.		
AP 60k has a 10hp engine		
AP 60k has the capacity for twice the water needed by a 100-room hotel to compensate for times of the day with higher water usage		
AP 60k treats sewer water enough to make it usable in hotel rooms (sink, shower, toilet, etc.)		

Light Bulbs - 50 Rooms				
Usage & Cost	**Incadescent 60 W light bulb:**		**Compact Fluorescent 15 W light bulb:**	
Number of light bulbs per room:	5		5	
Number of rooms per hotel:	50		50	
Number of light bulbs per hotel:	250		250	
Life expectancy (hr):	750-1000		10000	
Average life expectancy (hr):	875		10000	
Average bulb burn time per day (hr):	6		6	
Bulbs per year:	2.50		0.22	
Cost per unit bulb ($):	$0.52		$12.45	
Cost per year per bulb ($):	$1.30		$2.73	
Energy use per year per bulb(kW):	131.4		32.85	
Electricity cost ($/kWh):	$0.08		$0.08	
Electricity cost per bulb per year ($):	$10.51		$2.63	
Total cost per bulb per year ($):	$11.81		$5.35	
Total room lighting cost per hotel per year:	**$2,953.37**		**$1,338.64**	
Total Savings per year:	**$1,614.73**			
Initial Investment:	$3,112.50			
Payback Period:	**1.93**	**years**		
Assumptions:				
We only took into account the bulbs in the guest rooms				
50 room hotel				
5 bulbs per room				
Electricity costs $.08/kWh				
Sources:		*Information Retreived:*		
http://www.bulbbarn.com/main.aspx?prod=3277-2-161&list=t		Cost of compact fluorescent bulbs		
http://homedepot.com		Cost of incadescent bulbs		
http://www.ftc.gov/bcp/conline/pubs/products/ffclight.htm		Life expectancy for both types of bulbs		

Light Bulbs - 100 Rooms			
Usage & Cost	**Incadescent 60 W light bulb:**		**Compact Fluorescent 15 W light bulb:**
Number of light bulbs per room:	5		5
Number of rooms per hotel:	100		100
Number of light bulbs per hotel:	500		500
Life expectancy (hr):	750-1000		10000
Average life expectancy (hr):	875		10000
Average bulb burn time per day (hr):	6		6
Bulbs per year:	2.50		0.22
Cost per unit bulb ($):	$0.52		$12.45
Cost per year per bulb ($):	$1.30		$2.73
Energy use per year per bulb(kW):	131.4		32.85
Electricity cost ($/kWh):	$0.08		$0.08
Electricity cost per bulb per year ($):	$10.51		$2.63
Total cost per bulb per year ($):	$11.81		$5.35
Total room lighting cost per hotel per year:	**$5,906.74**		**$2,677.28**
Total Savings per year:	**$3,229.47**		
Initial Investment:	$6,225.00		
Payback Period:	**1.93**	**years**	
Assumptions:			
We only took into account the bulbs in the guest rooms			
100 room hotel			
5 bulbs per room			
Electricity costs $.08/kWh			
Sources:		*Information Retreived:*	
http://www.bulbbarn.com/main.aspx?prod=3277-2-161&list=t		Cost of compact fluorescent bulbs	
http://homedepot.com		Cost of incadescent bulbs	
http://www.ftc.gov/bcp/conline/pubs/products/ffclight.htm		Life expectancy for both types of bulbs	

Light Bulbs - 200 Rooms			
Usage & Cost	**Incadescent 60 W light bulb:**		**Compact Fluorescent 15 W light bulb:**
Number of light bulbs per room:	5		5
Number of rooms per hotel:	200		200
Number of light bulbs per hotel:	1000		1000
Life expectancy (hr):	750-1000		10000
Average life expectancy (hr):	875		10000
Average bulb burn time per day (hr):	6		6
Bulbs per year:	2.50		0.22
Cost per unit bulb ($):	$0.52		$12.45
Cost per year per bulb ($):	$1.30		$2.73
Energy use per year per bulb(kW):	131.4		32.85
Electricity cost ($/kWh):	$0.08		$0.08
Electricity cost per bulb per year ($):	$10.51		$2.63
Total cost per bulb per year ($):	$11.81		$5.35
Total room lighting cost per hotel per year:	**$11,813.49**		**$5,354.55**
Total Savings per year:	**$6,458.94**		
Initial Investment:	$12,450.00		
Payback Period:	**1.93**	**years**	
Assumptions:			
We only took into account the bulbs in the guest rooms			
200 room hotel			
5 bulbs per room			
Electricity costs $.08/kWh			
Sources:		*Information Retreived:*	
http://www.bulbbarn.com/main.aspx?prod=3277-2-161&list=t		Cost of compact fluorescent bulbs	
http://homedepot.com		Cost of incadescent bulbs	
http://www.ftc.gov/bcp/conline/pubs/products/ffclight.htm		Life expectancy for both types of bulbs	

Low-Flow Shower Heads - 50 Rooms

Usage & Cost	Conventional Shower Head		Low-Flow Shower Head
Water in gal per minute	6		2.5
Water used per room per day (m^3)	0.45		0.19
Water used per 50 rooms per day (m^3)	22.73		9.47
Water used per 50 rooms per month (m^3)	681.82		284.09
Cost per 50 rooms per month	$1,486.36		$619.32
50 Shower Heads	-		$187.50
Total Costs			
Initial cost to convert to Low-Flow Heads			
Installation	0		
Equipment	$187.50		
Total Initial:	$187.50		
Monthly			
Conventional	$1,486.36		
Low-Flow	$619.32		
Total Savings			
Total Monthly Savings:	$ 619.32		
Pay-back Period:	**0.30**	**months**	
Assumptions:			
Average shower length = 10 minutes			
2 showers per day			
Water costs $2.18 per m^3			
Sources:		*Information Retreived:*	
http://www.sdenergy.org/eMessages_View.asp?MsgID=154		Shower head flow rates	
http://showerbuddy.com/Showroom/_Shower_Head/Low_flow_shower_heads/low_flow_shower_heads.html		Low-flow shower head cost	

Low-Flow Shower Heads - 100 Rooms

Usage & Cost	Conventional Shower Head		Low-Flow Shower Head
Water in gal per minute	6		2.5
Water used per room per day (m^3)	0.45		0.19
Water used per 100 rooms per day (m^3)	45.45		18.94
Water used per 100 rooms per month (m^3)	1363.64		568.18
Cost per 100 rooms per month	$2,972.73		$1,238.64
100 Shower Heads	-		$375.00
Total Costs			
Initial cost to convert to Low-Flow Heads			
Installation	0		
Equipment	$375.00		
Total Initial:	$375.00		
Monthly			
Conventional	$2,972.73		
Low-Flow	$1,238.64		
Total Savings			
Total Monthly Savings:	$1,238.64		
Pay-back Period:	**0.30**	**months**	
Assumptions:			
Average shower length = 10 minutes			
2 showers per day			
Water costs $2.18 per m^3			
Sources:		*Information Retreived:*	
http://www.sdenergy.org/eMessages_View.asp?MsgID=154		Shower head flow rates	
http://showerbuddy.com/Showroom/_Shower_Head/Low_flow_shower_heads/low_flow_shower_heads.html		Low-flow shower head cost	

Low-Flow Shower Heads - 200 Rooms

Usage & Cost	Conventional Shower Head		Low-Flow Shower Head
Water in gal per minute	6		2.5
Water used per room per day (m^3)	0.45		0.19
Water used per 200 rooms per day (m^3)	90.91		37.88
Water used per 200 rooms per month (m^3)	2727.27		1136.36
Cost per 200 rooms per month	$5,945.45		$2,477.27
200 Shower Heads	-		$750.00
Total Costs			
Initial cost to convert to Low-Flow Heads			
Installation	0		
Equipment	$750.00		
Total Initial:	$750.00		
Monthly			
Conventional	$5,945.45		
Low-Flow	$2,477.27		
Total Savings			
Total Monthly Savings:	$2,477.27		
Pay-back Period:	**0.30**	**months**	
Assumptions:			
Average shower length = 10 minutes			
2 showers per day			
Water costs $2.18 per m^3			
Sources:		*Information Retreived:*	
http://www.sdenergy.org/eMessages_View.asp?MsgID=154		Shower head flow rates	
http://showerbuddy.com/Showroom/_Shower_Head/Low_flow_shower_heads/low_flow_shower_heads.html		Low-flow shower head cost	

Low-Flow Toilets - 50 Rooms

Usage & Cost	Conventional 5 gal toilet		Conventional 3.5 gal toilet		Low-Flow 1.6 gal toilet
Water used per flush (m^3)	0.02		0.01		0.01
Water used per room per day (m^3)	0.08		0.05		0.02
Water used per 50 rooms per day (m^3)	3.79		2.65		1.21
Water used per 50 rooms per month (m^3)	113.64		79.55		36.36
Cost per 50 rooms per month	$247.73		$173.41		$79.27
1 Toilet	-		-		$160.00
50 Toilets	-		-		$8,000.00
Installation	-		-		$5,000.00
Total Costs					
Initial cost to convert to Low-Flow Toilets					
Installation	$5,000.00	Installation	$5,000.00		
Equipment	$8,000.00	Equipment	$8,000.00		
Total Initial:	$13,000.00	**Total Initial:**	$13,000.00		
Monthly					
Conventional 5 gal toilet	$247.73	Conventional 3.5 gal toilet	$173.41		
Low-Flow	$79.27	Low-Flow	$79.27		
Total Savings					
Total Monthly Savings:	**$168.45**	**Total Monthly Savings:**	**$94.14**		
Pay-back Period:	**77 months**	**Pay-back Period:**	**138 months**		
Assumptions:					
4 flushes per day					
Water costs $2.18 per m^3					
Sources:			*Information Retreived:*		
http://www.americanstandard-us.com/ProductThumb.asp?prodcatID=3&brandID=1,2,3			Average toilet price		
http://www.toolbase.org/techinv/techDetails.aspx?technologyID=190			3.5 gallon toilet flush		
http://www.aag.org/HDGC/www/intro/units/unit1/worksheets/wksheet1-3.PDF#search='average%20daily%20toilet%20usage'			5 gallon toilet flush		
http://www.pacinst.org/reports/urban_usage/appendix_d.pdf#search='average%20hotel%20toilet%20flushes'			4 flushes per day		

Low-Flow Toilets - 100 Rooms

Usage & Cost	Conventional 5 gal toilet		Conventional 3.5 gal toilet		Low-Flow 1.6 gal toilet
Water used per flush (m^3)	0.02		0.01		0.01
Water used per room per day (m^3)	0.08		0.05		0.02
Water used per 100 rooms per day (m^3)	7.58		5.30		2.42
Water used per 100 rooms per month (m^3)	227.27		159.09		72.73
Cost per 100 rooms per month	$495.45		$346.82		$158.55
1 Toilet	-		-		$160.00
100 Toilets	-		-		$16,000.00
Installation	-		-		$5,000.00
Total Costs					
Initial cost to convert to Low-Flow Toilets					
Installation	$5,000.00	Installation	$5,000.00		
Equipment	$16,000.00	Equipment	$16,000.00		
Total Initial:	$21,000.00	**Total Initial:**	$21,000.00		
Monthly					
Conventional 5 gal toilet	$495.45	Conventional 3.5 gal toilet	$346.82		
Low-Flow	$158.55	Low-Flow	$158.55		
Total Savings					
Total Monthly Savings:	$336.91	**Total Monthly Savings:**	**$188.27**		
Pay-back Period:	**62 months**	**Pay-back Period:**	**112 months**		
Assumptions:					
4 flushes per day					
Water costs $2.18 per m^3					
Sources:			*Information Retreived:*		
http://www.americanstandard-us.com/ProductThumb.asp?prodcatID=3&brandID=1,2,3			Average toilet price		
http://www.toolbase.org/techinw/techDetails.aspx?technologyID=190			3.5 gallon toilet flush		
http://www.aag.org/HDGC/www/intro/units/unit1/worksheets/wksheet1-3.PDF#search='average%20daily%20toilet%20usage'			5 gallon toilet flush		
http://www.pacinst.org/reports/urban_usage/appendix_d.pdf#search='average%20hotel%20toilet%20flushes'			4 flushes per day		

Low-Flow Toilets - 200 Rooms

Usage & Cost	Conventional 5 gal toilet		Conventional 3.5 gal toilet		Low-Flow 1.6 gal toilet
Water used per flush (m^3)	0.02		0.01		0.01
Water used per room per day (m^3)	0.08		0.05		0.02
Water used per 200 rooms per day (m^3)	15.15		10.61		4.85
Water used per 200 rooms per month (m^3)	454.55		318.18		145.45
Cost per 200 rooms per month	$990.91		$693.64		$317.09
1 Toilet	-		-		$160.00
200 Toilets	-		-		$32,000.00
Installation	-		-		$5,000.00
Total Costs					
Initial cost to convert to Low-Flow Toilets					
Installation	$5,000.00	Installation	$5,000.00		
Equipment	$32,000.00	Equipment	$32,000.00		
Total Initial:	$37,000.00	**Total Initial:**	$37,000.00		
Monthly					
Conventional 5 gal toilet	$990.91	Conventional 3.5 gal toilet	$693.64		
Low-Flow	$317.09	Low-Flow	$317.09		
Total Savings					
Total Monthly Savings:	$673.82	**Total Monthly Savings:**	**$376.55**		
Pay-back Period:	**55 months**	**Pay-back Period:**	**98 months**		
Assumptions:					
4 flushes per day					
Water costs $2.18 per m^3					
Sources:			*Information Retreived:*		
http://www.americanstandard-us.com/ProductThumb.asp?prodcatID=3&brandID=1,2,3			Average toilet price		
http://www.toolbase.org/techinv/techDetails.aspx?technologyID=190			3.5 gallon toilet flush		
http://www.aag.org/HDGC/www/intro/units/unit1/worksheets/wksheet1-3.PDF#search='average%20daily%20toilet%20usage'			5 gallon toilet flush		
http://www.pacinst.org/reports/urban_usage/appendix_d.pdf#search='average%20hotel%20toilet%20flushes'			4 flushes per day		

Compost Toilets - 1					
Usage & Cost	**Convetional 3.5 gal toilet**		**Conventional 5 gal toilet**		**Compost Toilet**
Water used per flush (m^3)	0.013		0.019		0.000
Water used per day per toilet (m^3)	0.053		0.076		0.000
Water used per month per toilet (m^3)	1.591		2.280		0.000
Water cost per month	$3.47		$4.97		$0.00
Compost Toilet Equipment	-		-		$2,000.00
Compost Toilet Installation	-		-		$200.00
Total Costs					
Initial					
Installation	$200.00		$200.00		
Equipment	$2,000.00		$2,000.00		
Total Initial:	**$2,200.00**		**$2,200.00**		
Monthly					
Conventional	$3.47		$4.97		
Compost	$0.00		$0.00		
Total Savings					
Total Monthly Savings:	**$3.47**		**$4.97**		
Pay-back Period:	**634**	**months**	**443**	**months**	
Assumptions:					
4 flushes per day					
$1m^3$ = 264 gal					
$2000 is approx. cost for toilets because they vary by model					
Water costs $2.18 per m^3					
Sources:	*Information Retreived:*				
http://www.pacinst.org/reports/urban_usage/appendix_d.pdf	Hotel room average of 4 flushes per day				
http://www.enviroalternatives.com/toiletprices.html	Compost toilet prices				

Compost Toilets - 5

Usage & Cost	Convetional 3.5 gal toilet		Conventional 5 gal toilet		Compost Toilet
Water used per flush (m^3)	0.013		0.019		0.000
Water used per day per 5 toilets (m^3)	0.265		0.379		0.000
Water used per month per 5 toilets (m^3)	7.955		11.364		0.000
Water cost per month	$17.34		$24.77		$0.00
Compost Toilet Equipment (5)	-		-		$10,000.00
Compost Toilet Installation (5)	-		-		$1,000.00
Total Costs					
Initial					
Installation	$1,000.00		$1,000.00		
Equipment	$10,000.00		$10,000.00		
Total Initial:	**$11,000.00**		**$11,000.00**		
Monthly					
Conventional	$17.34		$24.77		
Compost	$0.00		$0.00		
Total Savings					
Total Monthly Savings:	**$17.34**		**$24.77**		
Pay-back Period:	**634**		**444**	**months**	
Assumptions:					
4 flushes per day					
$1m^3$ = 264 gal					
$2000 is approx. cost for toilets because they vary by model					
Water costs $2.18 per m^3					
Sources:	*Information Retreived:*				
http://www.pacinst.org/reports/urban_usage/appendix_d.pdf	Hotel room average of 4 flushes per day				
http://www.enviroalternatives.com/toiletprices.html	Compost toilet prices				

Compost Toilets - 10					
Usage & Cost	**Convetional 3.5 gal toilet**		**Conventional 5 gal toilet**		**Compost Toilet**
Water used per flush (m^3)	0.013		0.019		0.000
Water used per day per 10 toilets (m^3)	0.530		0.758		0.000
Water used per month per 10 toilets (m^3)	15.909		22.727		0.000
Water cost per month	$34.68		$49.55		$0.00
Compost Toilet Equipment (10)	-		-		$20,000.00
Compost Toilet Installation (10)	-		-		$2,000.00
Total Costs					
Initial					
Installation	$2,000.00		$2,000.00		
Equipment	$20,000.00		$20,000.00		
Total Initial:	**$22,000.00**		**$22,000.00**		
Monthly					
Conventional	$34.68		$49.55		
Compost	$0.00		$0.00		
Total Savings					
Total Monthly Savings:	**$34.68**		**$49.55**		
Pay-back Period:	**634**	**months**	**444**	**months**	
Assumptions:					
4 flushes per day					
$1m^3$ = 264 gal					
$2000 is approx. cost for toilets because they vary by model					
Water costs $2.18 per m^3					
Sources:	*Information Retreived:*				
http://www.pacinst.org/reports/urban_usage/appendix_d.pdf	Hotel room average of 4 flushes per day				
http://www.enviroalternatives.com/toiletprices.html	Compost toilet prices				

Solar Water Heater - 50 Rooms

Initial Costs:

Product	Quantity	Cost
Grid style solar collectors	13	$8,139.00
Single-ended clips for mounting collectors	4	$14.28
Double-ended clips for mounting collectors	24	$141.18
Heat transfer fluid	31	$136.00
Temperature Sensor	2	$44.00
Solar Controller	1	$114.00
Circulator (cast iron)	1	$94.50
Flanges	2	$53.00
Copper threaded adapter	4	$14.70
Thermostatic mixing valve	1	$132.06
Air scoop	1	$24.36
Ball Valve	3	$24.82
Check valve	1	$22.35
drain valve	2	$12.01
Copper adapter	2	$9.64
Brass tee	1	$6.52
Brass nipple	1	$8.08
Circulator (stainless steel)	1	$222.00
Thermal Expansion Tank	2	$95.51
Tube and Shell Heat Exchanger	1	$856.19
Packaging:		**$320.06**
Shipping:		**$2,000.00**
Installation:		**$3,000.00**
Total Initial Costs		**$15,484.26**

Energy needs for hot water in 100 room hotel/year:	45,909	kWh	
Energy Produced by System:	38,010	kWh	
Electricity Cost to Heat Water per year:		$3,673	
Amount Saved by Energy Produced by System per year:		**$3,041**	
Pay-back Period:		**5.1**	**Years**

Assumptions:

- 100% occupancy
- 20 gallons of hot water per hotel room per day
- Shipping rates: 27 packages for a total weight of 2297 lbs
- Electricity Cost: 8c per kWh
- Desired output temperature = 55 degrees celsuis
- Installation cost is an average of installation costs for solar water heating systems in hotels

Sources:	*Information retreived:*
http://www.heatwithsolar.com/partstocart.do?product=G32-P	Equpiment costs
http://www.toolbase.org/tertiaryT.asp?DocumentID=3216&CategoryID=949	Installation costs

Solar Water Heater - 100 Rooms

Initial Costs:

Product	Quantity	Cost
Grid style solar collectors	21	$12,979.00
Single-ended clips for mounting collectors	4	$14.10
Double-ended clips for mounting collectors	40	$232.29
Heat transfer fluid	46	$200.00
Temperature Sensor	2	$43.00
Solar Controller	1	$113.00
Circulator (cast iron)	1	$93.30
Flanges	2	$52.00
Copper threaded adapter	4	$14.51
Thermostatic mixing valve	1	$130.37
Air scoop	1	$24.05
Ball Valve	3	$24.51
Check valve	1	$22.07
drain valve	2	$11.86
Copper adapter	2	$9.51
Brass tee	1	$6.43
Brass nipple	1	$7.98
Circulator (stainless steel)	1	$219.00
Thermal Expansion Tank	3	$141.43
Tube and Shell Heat Exchanger	1	$845.27
Packaging:		**$510.42**
Shipping:		**$2,000.00**
Installation:		**$3,000.00**
Total Initial Costs		**$20,694.10**

Energy needs for hot water in 100 room hotel/year:	75,367	kWh	
Energy Produced by System:	62,382	kWh	
Electricity Cost to Heat Water per year:		$6,029	
Amount Saved by Energy Produced by System per year:		**$4,991**	
Pay-back Period:		**4.1**	**Years**

Assumptions:

- 100% occupancy
- 20 gallons of hot water per hotel room per day
- Shipping rates: 27 packages for a total weight of 2297 lbs
- Electricity Cost: 8c per kWh
- Desired output temperature = 55 degrees celsuis
- Installation cost is an average of installation costs for solar water heating systems in hotels

Sources:	*Information retreived:*
http://www.heatwithsolar.com/partstocart.do?product=G32-P	Equpiment costs
http://www.toolbase.org/tertiaryT.asp?DocumentID=3216&CategoryID=949	Installation costs

Solar Water Heater - 200 Rooms

Initial Costs:

Product	Quantity	Cost
Grid style solar collectors	52	$32,554.00
Single-ended clips for mounting collectors	4	$14.28
Double-ended clips for mounting collectors	24	$141.18
Heat transfer fluid	31	$136.00
Temperature Sensor	2	$44.00
Solar Controller	1	$114.00
Circulator (cast iron)	1	$94.50
Flanges	2	$53.00
Copper threaded adapter	4	$14.70
Thermostatic mixing valve	1	$132.06
Air scoop	1	$24.36
Ball Valve	3	$24.82
Check valve	1	$22.35
drain valve	2	$12.01
Copper adapter	2	$9.64
Brass tee	1	$6.52
Brass nipple	1	$8.08
Circulator (stainless steel)	1	$222.00
Thermal Expansion Tank	2	$95.51
Tube and Shell Heat Exchanger	1	$856.19
Packaging:		**$1,280.23**
Shipping:		**$2,000.00**
Installation:		**$3,000.00**
Total Initial Costs		**$40,859.43**

Energy needs for hot water in 100 room hotel/year:	182,707	kWh	
Energy Produced by System:	152,731	kWh	
Electricity Cost to Heat Water per year:		$14,617	
Amount Saved by Energy Produced by System per year:		**$12,218**	
Pay-back Period:		**3.3**	**Years**

Assumptions:

100% occupancy
20 gallons of hot water per hotel room per day
Shipping rates: 27 packages for a total weight of 2297 lbs
Electricity Cost: 8c per kWh
Desired output temperature = 55 degrees celsuis
Installation cost is an average of installation costs for solar water heating systems in hotels

Sources:	*Information retreived:*
http://www.heatwithsolar.com/partstocart.do?product=G32-P	Equpiment costs
http://www.toolbase.org/tertiaryT.asp?DocumentID=3216&CategoryID=949	Installation costs

Appendix D – Custom Cost Analysis Worksheets

Low-Flow Toilets

This worksheet is designed to help you compare your current water costs and consumption to the potential savings that result from the installation of low-flow toilets.

Instructions: For each line, fill in the number that is representative of your facility and carry out the calculations as directed in parenthesis.

	Current Water Usage		
Line 1	Number of rooms:	_____	rooms
Line 2	Current type of toilet (gallons per flush):	_____	gal
Line 3	Total flushed gallons per day (Line 1 x Line 2 x 4): *4 = flushes per day per toilet	_____	gal
Line 4	Total flushed gallons per month (Line 3 x 30): *30 = days per month	_____	gal
Line 5	Convert to m^3 (Line 4/264): *264 gal = 1m^3	_____	m^3
Line 6	Monthly water costs (Line 5 x $2.18): *$2.18 is average cost of water per m^3	$ _____	
	Water Usage with Low-Flow Toilet		
Line 7	Number of rooms:	_____	rooms
Line 8	Gallons per flush using Low-Flow Toilet:	1.6	gal
Line 9	Total flushed gallons per day (Line 7 x Line 8 x 4):	_____	gal
Line 10	Total flushed gallons per month (Line 9 x 30):	_____	gal
Line 11	Convert to m^3 (Line 10/264):	_____	m^3
Line 12	Monthly water costs (Line 11 x $2.18):	$ _____	
	Savings		
Line 13	Monthly water saved (Line 4 - Line 10):	_____	gal

Line 14	Monthly water saved in m^3 (Line 13/264):	_____	m^3
Line 15	Monthly cost reduction (Line 6 - Line 12):	$ _____	
	Initial investment		
Line 16	Number of toilets (equal to line 7)	_____	
Line 17	Cost of toilets (Line 16 x $160.00) * $160.00 =average toilet cost	$ _____	
Line 18	Cost of labor for installation *generally assume $5000.00 for 100 rooms	$ _____	
Line 19	Total initial investment (Line 17 + Line 18)	$	
	Payback Period		
Line 20	Time required for savings to equal investment (Line 19 / Line 15)	_____	months

Low-Flow Shower Heads

This worksheet is designed to help you compare your current water costs and consumption to the potential savings that result from the installation of low-flow toilets.

Instructions: For each line, fill in the number that is representative of your facility and carry out the calculations as directed in parenthesis.

	Current Water Usage		
Line 1	Number of rooms:	_____	rooms
Line 2	Current type of shower head (gallons per minute):	_____	gal/min
Line 3	Total gallons per day (Line 1 x Line 2 x 20) *20 = average daily shower usage in minutes	_____	gal
Line 4	Total gallons per month (Line 3 x 30): *30 = days per month	_____	gal
Line 5	Convert to m^3 (Line 4/264): *264 gal = 1m^3	_____	m^3
Line 6	Monthly water costs (Line 5 x $2.18): *$2.18 is average cost of water per m^3	$ _____	
	Water Usage with Low-Flow Shower Head		
Line 7	Number of rooms:	_____	rooms
Line 8	Gallons per minute using Low-Flow Shower Head:	2.5	gal/min
Line 9	Total gallons per day (Line 7 x Line 8 x 20):	_____	gal
Line 10	Total gallons per month (Line 9 x 30):	_____	gal
Line 11	Convert to m^3 (Line 10/264):	_____	m^3
Line 12	Monthly water costs (Line 11 x $2.18):	$ _____	
	Savings		
Line 13	Monthly water saved (Line 4 - Line 10):	_____	gal
Line 14	Monthly water saved in m^3 (Line 13/264):	_____	m^3

Line 15 Monthly cost reduction (Line 6 - Line 12): $ _____

Initial Investment

Line 16 Cost of shower heads (Line 7 x $3.75) $ _____
*$3.75 = price of each shower head

Payback Period

Line 17 Time required for investment to equal savings _____ months
(Line 16 / Line 15)

Compact Fluorescent Light Bulbs

This worksheet is designed to help you compare your current water costs and consumption to the potential savings that result from the installation of low-flow toilets.

Instructions: For each line, fill in the number that is representative of your facility and carry out the calculations as directed in parenthesis.

	Current Electricity Usage and Bulb Costs		
Line 1	Number of rooms:	_____	rooms
Line 2	Total guest room light bulbs (Line 1 x 5): *5 = light bulbs per room	_____	bulbs
Line 3	Electricity used per month per bulb: *based on average burn time of 6 hours per day for a 60 watt bulb	10.95	kWh
Line 4	Total electricity used per month (Line 2 x Line 3):		kWh
Line 5	Monthly electricity costs (Line 4 x $0.08): *$0.08 = electricity cost per kWh	$	
Line 6	Bulbs per month per room (.208 x 5) *.208 = bulbs per month per socket *5 = light bulbs per room	1.04	bulbs
Line 7	Monthly bulb costs (Line 1 x Line 6 x $0.52): $0.52 = bulb unit cost	$	
Line 8	Total monthly cost (Line 5 + Line 7):	$	
	Electricity Usage and Bulb Costs with Compact Fluorescent Light Bulbs		
Line 9	Number of rooms:	_____	rooms
Line 10	Total guest room light bulbs (Line 9 x 5): *5 = light bulbs per room	_____	bulbs
Line 11	Electricity used per month per bulb: *based on average burn time of 6 hours per day for a 60 watt bulb	2.74	kWh
Line 12	Total electricity used per month (Line 10 x Line 11):		kWh

Line 13	Monthly electricity costs (Line 12 x $0.08): *$0.08 = electricity cost per kWh	$
Line 14	Bulbs per month per room (.018 x 5) *.018 = bulbs per month per socket *5 = light bulbs per room	0.09 bulbs
Line 15	Monthly bulb costs (Line 9 x Line 14 x $12.45): $12.45 = bulb unit cost	$
Line 16	Total monthly cost (Line 13 + Line 15):	$
	Savings	
Line 17	Monthly electricity saved (Line 5 - Line 13):	$
Line 18	Monthly bulb cost difference (Line 15 - Line 7):	$
Line 19	Monthly cost reduction (Line 17 - Line 18):	$

Appendix E – Raw Data

Please see “Raw Data” folder.

Appendix F - Sponsor Description

The Puerto Rico Tourism Company, which was founded in 1970 by the Commonwealth of Puerto Rico as a public corporation, is responsible for the development of everything relating to tourism in Puerto Rico. The company is capable of generating its own funding and, according to Perez Serrano (2005, p. 25), within the last few years the yearly budget of the PRTC has reached $119 million. The company employs 654 full time workers with an average salary of $51,000/worker/year.

Currently, the executive director of the PRTC is Ms. Terestella Gonzalez Denton. Two sub-directors work under the executive director and then the company branches into many departments, like the departments of marketing, accounting and events. The organogram of the company can be seen in Figure F-1 on page 107.

The mission of the organization, as stated on its website www.gotopuertorico.com, includes the pursuit of a "world-class tourism policy" for both recreational tourism and business. While working with the Department of Economic Development Corporation to increase the revenue derived from the tourism industry, the PRTC must ensure that the improvement and growth of the industry has a minimal impact on Puerto Rico's fragile ecosystems. In order to ensure minimal environmental impacts, the PRTC is looking at sustainable tourism practices. Due to the nature of our project we will be working with the Department of Research and Development.

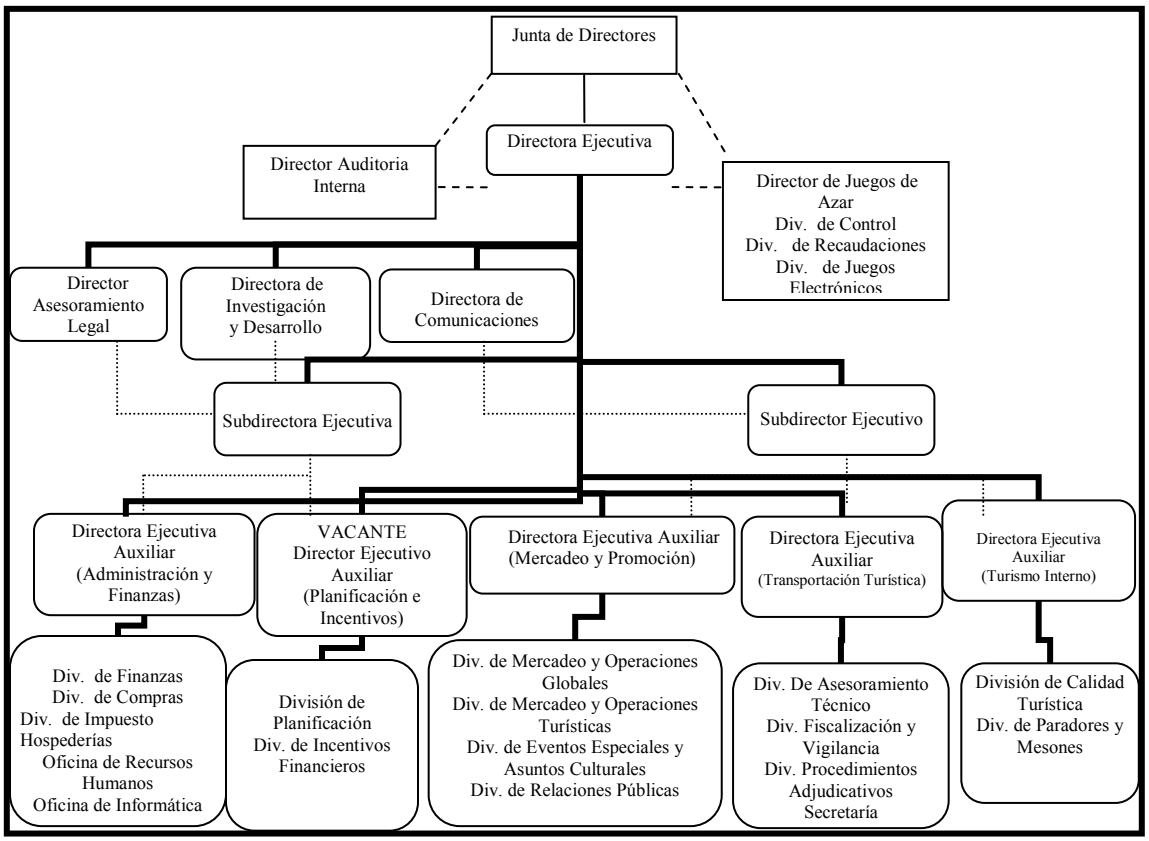

Figure F-1: Organogram of the Puerto Rico Tourism Company