

May 3, 2007

Sr. José Rivera Urrutia
FirstBank
San Juan, Puerto Rico

Dear Sr. Rivera:

Enclosed is our report entitled “An Evaluation of the Recycling Practices on the Island of Puerto Rico”. It was written at FirstBank Puerto Rico during the period March 10 through May 3, 2007. Preliminary research was completed in Worcester, Massachusetts prior to our arrival in San Juan. Copies of this report are being simultaneously submitted to Professors Gerstenfeld and Vernon-Gerstenfeld for evaluation. Upon faculty review, the original copy of this report will be catalogued in the Gordon Library at Worcester Polytechnic Institute. We appreciate the time that you have devoted to us.

We would like to thank you for the opportunity to work with you; it was a valuable experience. We greatly appreciate the time you dedicated to our project and the support you provided throughout.

Sincerely,

Joseph A. Bosman
Patrick J. Milano
Stephanie Youkana

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AN EVALUATION OF THE RECYCLING PRACTICES ON THE ISLAND OF
PUERTO RICO

May 3, 2007

This project report is submitted in partial fulfillment of the degree requirements of Worcester Polytechnic Institute. The views and opinions expressed herein are those of the authors and do not necessarily reflect the positions or opinions of FirstBank or Worcester Polytechnic Institute.

This report is the product of an education program, and is intended to serve as partial documentation for the evaluation of academic achievement. This report should not be construed as a working document by the reader.

ABSTRACT

The focus of this report, prepared for FirstBank of Puerto Rico, is on the current waste management issues of Puerto Rico and the impact of a recycling program. The goal of this project was to analyze current recycling programs through interviews with municipality recycling coordinators and recommend changes that will help to create a more successful recycling program. From these interviews we concluded that recycling programs in Puerto Rico need to be better developed in the way they are coordinated, managed, and implemented. Strong education programs and committed leadership are also main factors in running a recycling program. This paper discusses several recommendations for improvement of the recycling system. These recommendations are specific to municipalities, state government, and Puerto Rican citizens; they include incentive-based programs such as Pay-As-You-Throw and a bottle bill, amendment to Law 61 and Law 411, and recycling programs for condominiums. This project could greatly impact the majority of the population of Puerto Rico; if these recommendations were put into effect the recycling rates on the Island of Puerto Rico could be much better than their current recycling rates.

ACKNOWLEDGMENTS

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We would also like to thank Nelson Reyes. He greatly helped us to understand the current recycling situation on the Island. He worked closely with us throughout the project and aided us in much of our background research.

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EXECUTIVE SUMMARY

Currently in Puerto Rico, solid waste production is increasing and the available space for dumping is decreasing. Recycling efforts are minimal, at best, in some municipalities; in others, there has been a surge of support for recycling programs. The goals of our project were to determine what factors contribute to a successful recycling program, develop a public policy, and develop a recycling plan for condominiums on the Island.

Having stated this, we focused our project on three different recycling programs and how they are managed in the municipalities of Naguabo, Comerío, and Guaynabo. We worked with FirstBank to achieve these goals. To do so, we had four main objectives that we set. The first of these objectives was to analyze the current waste disposal costs of the municipalities we visited. We had to determine how much waste they were disposing, how they were disposing of the waste, and how much they were paying to dispose of the waste. The second of our objectives was to analyze the savings opportunities associated with a recycling program. We took the information we gathered on the costs of waste disposal and determined how much money could be saved if specific amounts of waste were recycled. Our third objective was to analyze the recycling programs of the three municipalities of Naguabo, Comerío, and Guaynabo and identify the aspects of a successful recycling program based on our analysis of the programs run in each of these municipalities. Finally, our fourth objective was to analyze the waste disposal methods of condominiums in Puerto Rico and analyze the benefits of a recycling program within condominiums.

In order to understand the full scope of our project we had to become familiar with current successful recycling practices in various areas other than Puerto Rico. We focused our background research on areas of the United States that have had successful recycling programs. The main types of programs we found were incentive-based. Bottle bills and the Pay-As-You-Throw plan have had success in different areas of the United States and were used as models for our recommendations to Puerto Rico.

In order to understand how recycling and waste management are handled in Puerto Rico we conducted three interviews with recycling coordinators from Naguabo, Comerío, and Guaynabo. These interviews enabled us to determine which methods of recycling were working best on the Island. We compared the three municipalities' methods for running their recycling programs and developed recommendations for the municipalities from the findings.

To understand the recycling system in Puerto Rico we interviewed two recycling companies. We gathered data on the collection processes and processing methods at the facilities. The information we gathered gave us a better idea of how the collection of recyclable materials on the Island is done and if there are any improvements or changes that could be made.

A major issue in Puerto Rico is the lack of landfill space. We needed to determine how many landfills were open, the amount of waste that each was holding, and how long these landfills were expected to remain open. To do this, we interviewed the Environmental Protection Agency (EPA) and the Solid Waste Authority, also known as the Autoridad de Desperdicios Sólidos (ADS). We obtained published reports from the ADS that allowed us to compile a table of all the landfills in Puerto Rico, their estimated

lifespan, the amount of waste they collect everyday, and the number of municipalities that use each landfill.

The interviews with the municipalities led us to conclusions about what made some of the recycling programs more successful than others. By comparing the manner in which the different recycling coordinators administer their programs we were able to conclude that in order for a recycling program to be successful, it has to have dedicated leadership and include an education program within the school system.

The interviews we conducted with the two recycling companies helped us draw conclusions about the flaws in the recycling systems on the Island. While the companies we interviewed were, in fact, recycling all of the material that they were receiving, they conveyed to us that they were not running at their full capacity. From their information we concluded that one of the major problems in the recycling system in Puerto Rico is the collection portion of the process. If more were done in the way of collection, more goods would be collected from companies and residents; thus, the recycling companies would have more goods to work with and they would be recycling more.

In addition to the study of existing recycling companies, we did an analysis of how much money our sponsor could potentially save if it enforced recycling and increased its recycling rates. Calculations were made and it was determined that if FirstBank recycled 70 percent of the paper thrown away each day in all of its facilities across the Island it could save nearly \$100,000 each year.

From the conclusions that we drew we were able to develop ten recommendations for the municipalities, the state government, and the citizens of Puerto Rico. We recommended that the municipalities all develop an educational program in their schools

where students learn the importance of recycling and the basics of the recycling system. We also recommended that municipalities provide more focus on recycling in highly populated areas and establish more drop-off sites for their residents.

We made recommendations to the state government as well. First, more enforcement of laws is necessary for a successful program to be established. In order for municipalities to adhere to established laws, penalties for failure to comply should be associated with each law. Also, an amendment to Law 61 was recommended to include building renovations rather than only newly built condominiums.

For Puerto Rican citizens we recommended bottle bills be established. We also made the recommendation that individual condominium buildings establish recycling programs within their building. This could cut back on waste disposal and save the condominiums money as well as increase the recycling rate in Puerto Rico.

If these recommendations were put into effect the recycling rates on the Island of Puerto Rico could increase greatly. This project could greatly impact the majority of the population of Puerto Rico. There would be less need for landfills and less pollution to the environment with increased recycling rates. Businesses could save money by disposing of less waste. Jobs could be created and small businesses associated with recycling could be started. The amount of space for landfills is decreasing and dumping cannot be the sole method of waste disposal for the future. The entire Island of Puerto Rico must improve its recycling program before all space runs out in landfills and options for waste disposal become fewer and fewer. Responsibility must be taken and changes must be made to the waste disposal and recycling systems of Puerto Rico.

CHAPTER 1: INTRODUCTION

Global pollution, the misuse of landfills, and the failure to recycle at optimal levels have become major issues in our society over the past few decades. According to Lomborg (2001), as of 2001, the world's population was growing at an estimated rate of 76 million people per year. The increase in the population levels has led to a positive correlation in the amount of waste that is being produced each year. As a consequence, waste generation is increasing across the world. Japanese, French, and Americans each produce 1.1, 1.3, and 2.0 kilograms, respectively, of waste per day (Lomborg, 2001). Most of the waste that is not incinerated or recycled, both Lomborg and José Font (personal communication, March 29, 2007) assert, goes into landfills because landfills are the primary way to remove waste from society that is not disposed of by the use of incineration.

According to Lomborg, the problem with waste is how it is managed. Landfills continue to be the easiest and simplest solution to address our growing waste problem. However, there are drawbacks to the use of landfills as suitable and commonly accepted forms of disposal. One problem arising from using landfills is that waste that is recyclable inevitably ends up decomposing there. Landfills fill up far too quickly and recycling would help cut down on this time. According to Gibson, Leahy, and Mallon (2007), there are advantages to recycling over landfills. There is less energy consumption and this cuts down on the environmental damage that is caused through things such as gas emissions.

The question becomes, how do we properly manage waste so that it does not contribute to the larger issue of global pollution? Lomborg (2001) believes that the way

to cut back on current waste production is to pursue the use of more rigorous recycling and create incentives. This would result in the increased use of recycling and help to decrease the amount of waste going to landfills or being disposed of in other ways, such as exportation of waste off the Island. Recycling conserves energy and materials by decreasing production costs of certain items. The conservation of energy and materials adds another advantage to recycling over landfill dumping. Gibson, Leahy, and Mallon (2007) also claim that with recycling, the amount of overall materials used is reduced and the life of these materials is extended through reusing them. This material reduction and material extension cuts back on material production from raw sources and therefore cuts back on energy consumption and raw resource depletion.

Albaniese (2006) asserts that space for available landfills is dwindling all over the world, making it necessary to identify new measures that need to be taken in order to preserve the land and prevent pollution. He also states that along with the shrinking amount of available space for dumping, energy and natural resources are being depleted. In order to solve the environmental problems the world is facing, innovative waste reduction and recycling programs need implementation by government officials and adherence to the laws on the part of residents. The process of taking solid waste and recycling, refining, and processing it into usable forms is just one step in the overall conservation of natural resources, energy, land space, and the reduction of pollution (Mass DEP, 2004).

Both the Massachusetts DEP (2007) and the Pennsylvania DEP (2007) state that the earth's natural resources are being rapidly depleted and there are few ways to replenish the supply of most of these resources. Using recycled products in

manufacturing rather than raw materials reduces the need to excavate oil and minerals (MassDEP, 2007). Recycling is also beneficial because it saves energy. According to the Pennsylvania Department of Environmental Protection (Pennsylvania DEP, 2007), it generally takes less energy to supply industries with recycled materials than it does with natural resources. When using recycled materials, the extraction and refinement parts of the process are eliminated, cutting down on the amount of energy it takes to produce goods (Pennsylvania DEP, 2007). According to the Pennsylvania Department of Environmental Protection (2007), it can take up to 45 percent less energy to produce paper from recycled materials than starting with raw materials. The same goes for recycled glass; it takes 25 percent less energy to produce glass from recycled materials. Not only are there more jobs available in industries involved with the recycling process than those involved with landfills, but also it is more cost effective to use recycled goods (Louisiana DEQ, 2007).

On the Island of Puerto Rico, the need for appropriate waste management is of great importance due to the ecological implications that arise through the failure to comply with established government laws and policies. In House Report No. 847 (2002), Law 61 was described which states that anytime a new high-rise or condominium is built, there must be a designated area for recycled goods to be stored until pick up and delivery to a facility is available. The issue here is that older housing complexes are not required to have recycling facilities; therefore they do not have to recycle. In Law 61 it is stated that not only must the government legislate these laws, but they must also act and commit themselves to the protection of the environment. In House Report No. 2573 (2000), Law 411 is outlined which states that any industry, store or commerce that has greater than ten

employees must institute a plan of recycling. Some municipalities have adopted these laws, but most are not complying with them.

Puerto Rico's population is increasing, however, the land space available for solid waste dumping is not increasing. According to the World Fact Book (2007), the population on the Island of Puerto Rico is increasing at an annual rate of 4 percent, and as of July of 2006, the population of the Commonwealth of Puerto Rico was 3,927,188. An ever-increasing population generates more waste. According to the Caribbean Recycling Foundation (2004), the amount of space the Island has to dedicate to landfills and waste disposal is decreasing as there is a finite land mass in which to dispose of solid waste. At a production rate of 13,300 tons of solid waste per day, the landfills of Puerto Rico are filling up very quickly; they are filling up at the rate of three-quarters of an acre per day. Through last year, all of this waste was being stored in the thirty-one existing landfills on the Island, a number that has been cut in half since the early 1990s (Associate Press, 2006).

Landfills can cause myriad problems such as leachate, which is seepage that can cause water pollution, gas production, odor, noise pollution, aesthetic problems, air pollution, dust, fires, rats, flies, mosquito infestations, and birds (ADS, 2007). The previously mentioned International Herald Tribune (2006) article also states that many of the existing landfills do not comply with Commonwealth and Federal landfill requirements. This fact was verified through an interview with José Font, deputy director of the United States EPA, (2007) who stated in the interview that the major problem with waste management is compliance on the part of landfill companies. Therefore, the landfills are contributing factors in the leading causes of contamination of the

environment and are subsequently being shut down. Recently, nine of the thirty-one landfills, which receive approximately 40 percent of the Island's waste, have been under investigation for contamination of local ground water in Karst country in northern Puerto Rico (Albaniese, 2006). Since the start of 2007, the Environmental Protection Agency has ordered the closing of five landfills in Puerto Rico (J. Font, personal communication, March 29, 2007).

The benefits of recycling are numerous and are a huge step in the conservation of land and resources. In order to combat the problems with landfills, specifically in Puerto Rico, there needs to be a reduction in the amount of waste being produced and an increase in the percentage that is being recycled. The data required to accomplish this was gathered through contact and research with existing companies in Puerto Rico and reviewing precedents set forth by Puerto Rican laws for recycling.

The contact with companies in Puerto Rico included interviews with company officials, such as municipality recycling coordinators and educators from the Solid Waste Authority, and analysis of the established programs on the Island; the methods we used to conduct this research were further outlined in our methodology section. Addressing these areas helped provide the knowledge needed to lay out public policy for the Island and establish the necessary components needed for start-up companies as well as provide approaches towards funding for existing companies.

Once sufficient research in Puerto Rico was conducted, the methods needed to solve the problem of public education and compliance to laws was much clearer. Monetary incentives for those who own and manage the waste and recycling companies, along with financial compensation for the general population, may potentially lead to a

greater investment and better outcome for the Island's populace. This can be justified by looking at programs such as the RecycleBank program, which has seen success in places such as New Jersey and Pennsylvania. This company is discussed further in the background chapter, including facts and figures on its success.

Puerto Rico has major problems with landfill space and trash reduction. Our project involves the company FirstBank of Puerto Rico. As our sponsor, they asked us to look into the public policy of Puerto Rico, especially the municipalities of Naguabo, Guaynabo, and Comerío . Through contact with our sponsor, the established goal of this project was to develop a public policy and propose a possible recycling program in collaboration with FirstBank that could be implemented, particularly in the municipalities mentioned. These three specific municipalities were chosen by our liaison because of the unique pattern seen in their recycling rates; Guaynabo is an urbanized area, Naguabo is a costal city, and Comerío is central city. For example, according to him, Comerío is the poorest of the three municipalities mentioned, yet it has a recycling rate upwards of 68 percent. However, Guaynabo is the wealthiest and its recycling rate is approximately 13 percent. The public policy created proposes new recycling programs and changes the way current programs are being run. This new program will include public education, where feasible, and cost-benefit analysis and environmental benefit analysis of the overall program.

CHAPTER 2: BACKGROUND

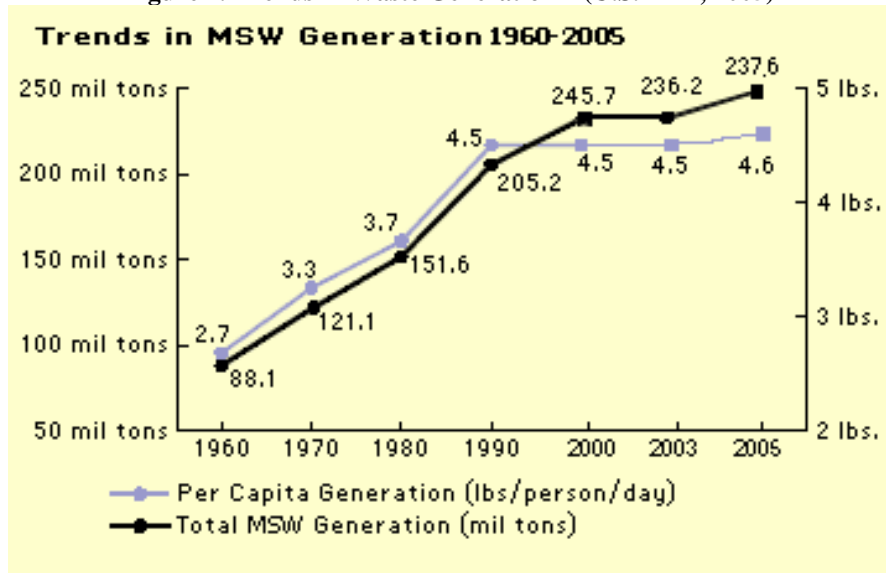
This chapter discusses current information that is available on recycling. It covers waste management and recycling in the United States as well as Puerto Rico. It outlines the basic waste management operations and recycling programs in both the U.S. and Puerto Rico and how they compare to one another. In addition, it provides an overview of the recycling process and benefits of recycling over simple solid waste dumping. There is also information on successful recycling practices that are currently being implemented in the United States that could potentially be brought to Puerto Rico in the future.

WASTE MANAGEMENT IN THE UNITED STATES

Every year, the people of the United States produce more and more waste. Landfills fill up quickly and the amount of space that is available for dumping is decreasing rapidly. According to Lelika Arias, Educadora Ambiental from the Autoridad de Desperdicios Sólidos, even with laws and regulations about solid waste in place, citizens are not adhering to the policies (personal communication, March 26, 2007).

In the following graph, one can see that the amount of municipal solid waste (MSW) being generated in the United States is increasing; this is leading to the increasing use of landfills. While MSW is increasing, the land available for dumping is not and landfills are filling up at an increasing rate. According to the U.S. EPA (2005), the number of landfills in the United States has decreased from 8,000 in 1988 to 1,654 in 2005. Due to lack of available land space, more landfills cannot be built.

Figure 1. Trends in Waste Generation 1 (U.S. EPA, 2005)



Waste is what consumers and producers consider to be valueless; thus, having no use it is disposed of. Waste management is one of the growing concerns for environmentalists in today's throw-away society. With the amount of waste being produced on the rise, societies are running out of landfill space. Landfills are either being shut down due to environmental issues such as contamination, or because they have reached their capacity. Rhyner (1995) states that the cost of disposing solid waste has also become a huge factor, costing up to \$100 a ton to be removed (Rhyner, 1995).

In 2005, United States businesses, institutions, and residents produced greater than 245 million tons of trash (U.S. EPA, 2005). According to Tufts Recycles (2004), over a ten-year span recycling practices have only increased by 6 percent. Tufts researchers believe that one of the best ways to reduce the amount of waste is source reduction. If people were able to reduce the amount of waste they produced, landfills would not fill up so quickly, and they would have fewer negative effects on the

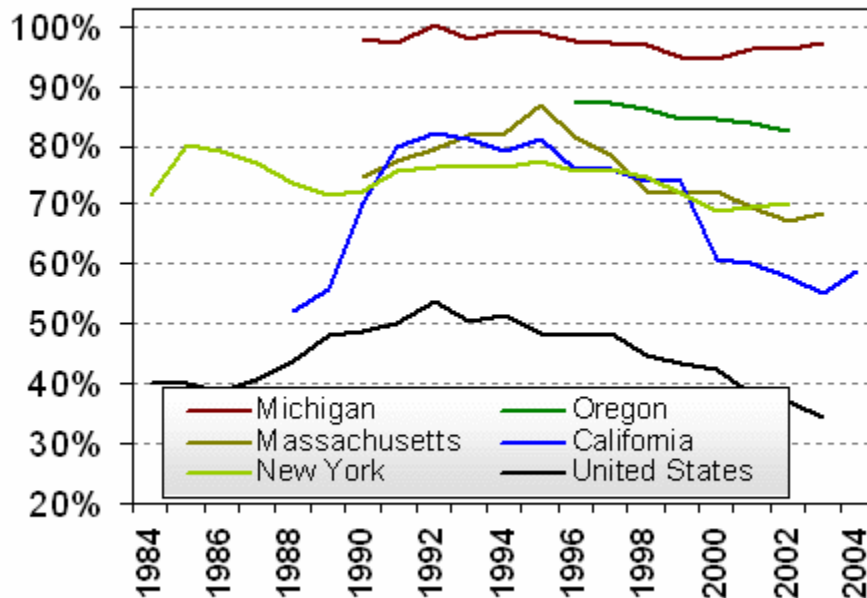
environment. Recycling practices would greatly reduce the amount of waste produced; recycling rates are not increasing as quickly as the amount of waste production is.

The collection and disposal of solid waste has been a very expensive component of the solid waste management system. According to Rhyner (1995), in the past few decades, the cost of collection and disposal has accounted for up to three-fourths of the total cost of all waste management. Jon Norton (personal communication, January 27, 2007) claims that it costs approximately \$70 to dispose of one ton of solid waste. However, Norton also claims that it costs approximately \$25 to recycle one ton. On average, each American produces about 4.5 pounds of solid waste per day (U.S. EPA, 2005). Growing waste management concerns are warranted; these numbers will increase with an increasing population if recycling programs are not implemented and adhered to. If a solution is to be reached, it will have to be through recycling and better waste management efforts.

RECYCLING LEGISLATION IN UNITED STATES

One of the most effective legislations regarding recycling in the United States has been the bottle bill. Bottle bills place a redemption value on certain containers such as soda cans and beer bottles. This redemption value offers a cash incentive for people to recycle. Implemented in California, Connecticut, Hawaii, Iowa, Maine, Massachusetts, Michigan, Oregon, New York, and Vermont, these bills have brought on drastically higher recycling rates in these states when compared to the national average. The following graph, taken from the Container Recycling Institute (2007), illustrates that in the states that have a bottle bill implemented, there have been higher recycling rates than the United States has had on average.

Figure 2. Bottle Bill vs. National Avg 1 (CRI, 2005)
Beverage Container Redemption Rates in Selected Deposit States, v.s. the U.S. Average



(C) Container Recycling Institute, 2005

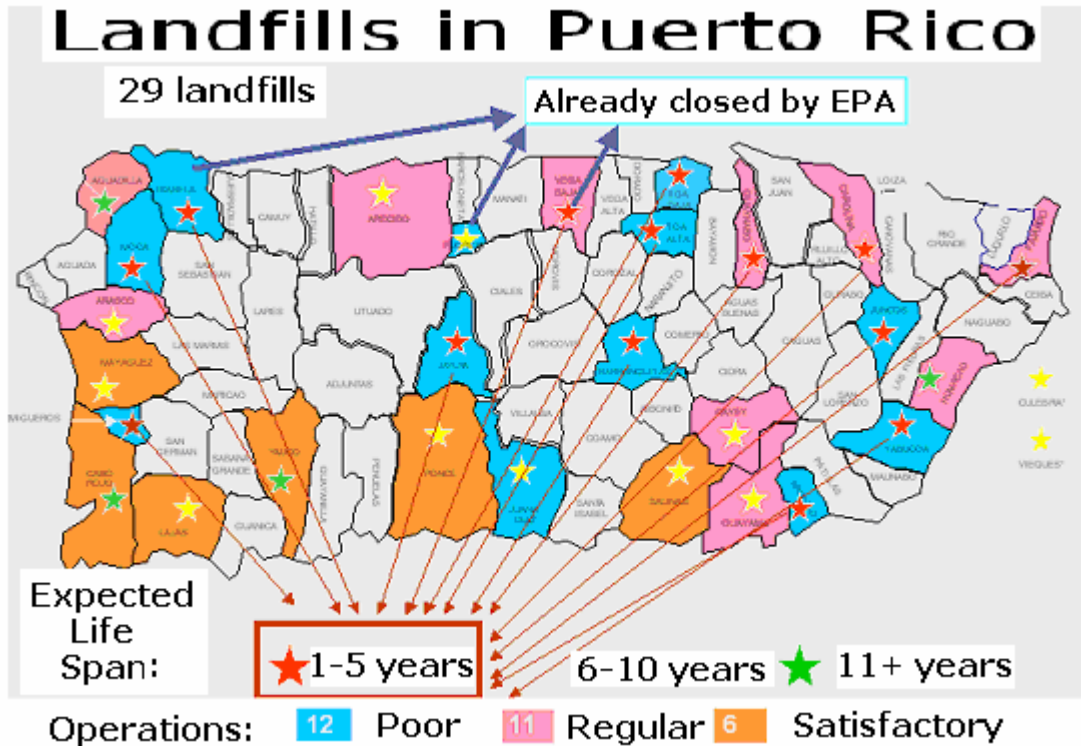
The graph shows that some states have a higher redemption rate than others. This can be attributed to the fact that some states have higher redemptive values placed on bottles. Also, the beginning part of the line is the start of the bill. There is no established reason for a decrease in redemption rates for some states; there is no study available to explain why a decrease occurs.

WASTE MANAGEMENT IN PUERTO RICO

The primary way that waste is dealt with on the Island of Puerto Rico is by dumping it into landfills. There are thirty-two currently open landfills in Puerto Rico. However, with the failure to abide by established laws, many of these landfills will be closed within the next few years. The EPA has already ordered the official closing of

five of these landfills in the past two years; according to Angel Salgado, by the end of the year only twenty-five will remain open (personal communication, March 29, 2007). The following picture illustrates the current number of landfills and their locations. It also includes their expected life spans and the condition that they are in regarding operation.

Figure 3. Lanfill locations (ADS,2007)



Note. This figure is adapted from information found in the Solid Waste Management Authority. Retrieved April 12, 2007, from <http://www.ads.gobierno.pr/secciones/planificacion/planificacion.htm>.

According to the following table adapted from Soto (2004), originally taken from the ADS (2002), by 2008 only ten of these landfills are expected to remain open.

Table 1. Landfills to remain opened in 2008 (ADS, 2002)

Landfills to remain open in 2008 in Puerto Rico		
Center #	Name	Supply (tons/day)
1	Añasco	150
2	Arecibo	850
3	Cabo Rojo	140
4	Fajardo	346
5	Florida	30
6	Humacao	2300
7	Mayagüez	350
8	Ponce	1200
9	Salinas	417
10	Yauco	425
Total		6208

Since many of the existing landfills do not abide by established laws and endanger the environment and public health they have to be shut down (J. Font, personal communication, March 27, 2007).

A major factor in waste reduction could be recycling. With recycling programs in place, the amount of waste being placed in landfills can be drastically reduced. According to Amador Rosario, recycling coordinator for the municipality of Naguabo, approximately 75 percent of all waste is recyclable (personal communication, March 19, 2007). In Puerto Rico House Report No. 847, law 61 (2002) also claims that approximately 70 percent of waste generated in Puerto Rico is recyclable. With an effective program, effective laws, and effective legislation, most waste that is being dumped into landfills could actually be reused.

RECYCLING LEGISLATION IN PUERTO RICO

Despite the fact that most of the legislation in Puerto Rico is not actually enforced by individual municipalities, there are still several laws that address recycling on the Island. In Puerto Rico House Report No. 2573 (2000), an amendment to the Reduction and Recycling Act of 1992 was outlined. With this amendment, the general public, state agencies, and public corporations that generate solid waste are required to properly separate the recyclable materials. In addition to this, any industry, factory, store, commerce, commercial or noncommercial establishment of greater than ten employees must institute a plan of recycling. They must properly separate these recyclable goods and help reduce the amount of solid waste they generate.

In Puerto Rico House Report No. 847 (2002), Law 61 regarding housing complexes was described. This law states that any private or public housing complex, apartment or residence built after July 1, 2003 must have a designated area for recyclable goods. This space needs to have storage for recyclable goods until the designated company can come and transport it to the proper facilities.

THE PROCESS AND BENEFITS OF RECYCLING

After recycled goods are picked up from either houses or redemption centers, there is more to the process before they can be sold as recycled goods to consumers. They are taken to a facility where they are sorted either by mechanical machines or by a manual process (MassDEP, 2007). Anything that is not recyclable is removed and the next step in the process is called “reprocessing”; this is when the goods are broken down

to their basic composition (MassDEP, 2007). Once reprocessed, these recycled materials can be used to produce other products.

Economic Benefits of Recycling

The benefits of recycling are numerous and go beyond land conservation and energy and resource reduction. Recycling has many economic benefits to it as well. According to the U.S. Recycling Economic Information Study, sponsored by the United States EPA (2006), recycling has a direct impact on the economy of a state in the United States; jobs are created and recyclable goods are made available for sale on the market. The purpose of that study was to establish the effectiveness of the recycling, reuse, and remanufacturing industry, and how it benefits the economy of a given region.

The process of recycling goes beyond collection; processing and manufacturing are involved as well. In the United States alone, there are 56,061 recycling companies that employ about 1.1 million people (U.S. EPA, 2006). The following table summarizes the direct economic effect recycling and all of the involved industries have on the United States economy.

Table 2. Estimates of Direct Economic Activity in U.S. (EPA, 2006)
Annual Payroll and Estimated Receipts are in \$1,000.

Data Type	Recycling Collection	Recycling Processing	Recycling Manufacturing	Reuse and Remanufacturing	Industry Total
Establishments	9,247	12,051	8,047	26,716	56,061
Employment	32,010	160,865	759,746	169,183	1,121,804
Annual Payroll	956,875	3,826,360	29,181,749	2,747,498	36,712,482
Estimated Receipts	1,974,516	41,753,902	178,390,423	14,182,531	236,301,371

Note. Table is adapted from information found at The United States Environmental Protection Agency. Retrieved April 4, 2007, from <http://www.epa.gov/jtr/econ/index.htm>

Recycling is consequently a huge employer in the United States. In Massachusetts, for example, recycling employs as many people as the child care industry, the electrical utility industry, or the accounting industry (MassDEP, 2004). Thus, recycling benefits the job market and the economy a great deal. With such huge economic benefits involved with the recycling, reuse, and remanufacturing industry, communities could potentially benefit from having a strong recycling system implemented.

RECYCLING IN THE UNITED STATES

In the United States, recycling is known to be an established industry that has a proven record of success. In individual states, government agencies offer assistance that encourages compliance and participation in recycling programs (United States DEP, 2003). According to the Mass DEP (2007), in Massachusetts for example, 95 percent of municipalities offer residential recycling, making it difficult to avoid such a simple, cost-effective alternative to dumping. Known as the 'recycling loop', the process of collection, refinement and resale is established to ensure a successful program (MassDEP, 2007). Municipalities and businesses make collection efforts through the programs that they run and the supply of recyclable materials is kept constant. These recyclable materials include things such as cans, bottles, newspaper, office paper, metals and plastics. The loop is completed with the purchase of the goods that have been made from these recycled goods.

Many states through out the country put forth a great effort to ensure recycling efforts are successful. For example, in Massachusetts, the bottle bill places a five-cent redemption value on certain containers (MassDEP, 2007). This incentive encourages

people to recycle because they are receiving monetary compensation for their efforts. People seem to respond to incentive-based programs. In the ten existing states that currently have a bottle bill, there has been an average recovery rate of 70 percent. States that do not have a bottle bill implemented have seen less than a 10 percent recovery rate (Franklin, 2004). Recycling efforts in places such as Philadelphia show increased numbers in recycling participation and monetary savings. These numbers are presented later in the review. Norton (personal communication, January 27, 2007) believes that people will put the effort into recycling if they will see personal benefits from it, especially ones that involve cash incentive.

Enforcement of the Recycling Policies

The Massachusetts DEP is a good example to illustrate the importance of enforcement of environmental statutes in the overall success of recycling programs. By using its authority to enforce compliance with environmental requirements, punish those who violate the policies, and sustain future compliance, Massachusetts has a successful recycling program with a 30 percent success rate (MassDEP, 2007).

Other states, such as Texas and Pennsylvania, have had great success with the programs they have developed and implemented. On August 1, 2004, San Antonio set forth a pilot program that involved single-stream recycling practices (Ryan & Hess, 2004). Single-stream recycling allows the people in a community to place all of their recycled goods in one container and not sort through anything. The system is much easier than having people sort their own goods; not sorting their own recyclables seems to cause incentive for people to recycle. The parts of San Antonio, Texas that began using this system achieved great financial gain from the program because of the success it had

in implementation. In the first year alone, San Antonio recycling programs had \$800,000 in savings and at the time expected about \$400,000 a year after that initial period (Ryan & Hess, 2004). Pennsylvania also had great success with their programs. Pennsylvania neighborhoods involved with the RecycleBank program saw an increase in recycling participation from 25 percent to 38.6 percent after the implementation of the program (Wellington, 2006).

As with the recycling of cans and bottles in Massachusetts, recycling efforts would be more successful if there were incentives offered. Incentive-based recycling has already started up in places such as Clayton, New Jersey and Wilmington, Delaware. Evidence of the success of these programs is seen in the success rate statistics presented in Table 2 later in the chapter. With the implementation of an incentive-based recycling program, discussed in the next section, parts of Pennsylvania saw diversion cost rates rise from an average of 11 percent to an average of 38 percent in the communities involved (Wellington, 2006). Diversion cost rates refer to the amount of money saved from using recycled goods rather than raw materials. As we learned in our interview with Jon Norton, people are not likely to put forth recycling efforts if it is going to cost them money to do so. This can be exemplified with the bottle bill in the U.S. where higher recycling rates are seen in states where bottles and cans can be redeemed for money.

Effective Models of Recycling

In most parts of the United States waste removal is funded by either a property tax or a fixed amount of funding established by a bill without any regards for the amount of trash being thrown away. One program that is offered in over 7,000 communities throughout the United States, 25 percent of the population, is the Pay-as-You-Throw

(PAYT) plan (Skumatz, 2006). With the PAYT plan, residents pay for trash services based on the amount that is thrown away. With this plan, people pay for each unit of trash that they dispose of, rather than paying a set fee (MassDEP, 2007). This system involves fairness and consumer involvement. By having the consumers pay for the amount that they throw away, houses that generate less trash pay a smaller fee. Also, consumers are more likely to recycle since it is cheaper than trash disposal. This is a good incentive for them to get involved with recycling and to generate less waste. According to Skumatz (2006) in a report prepared for the United States EPA, in communities that have PAYT waste disposal declined 14 to 27 percent. PAYT not only helps reduce the amount of trash generated, thus reducing the costs of solid waste disposal, but also increases the recycling rates. Skumatz (2006) also states that in the communities with PAYT plans, recycling rates increased 32-59 percent. In addition, between 4.6 and 8.3 million tons of municipal solid waste (MSW) is taken out of landfills annually in the United States with the addition of this program (Skumatz, 2006). Waste reduction will lead to the conservation of energy, natural resources and money.

Another recycling plan that is only in its infancy but shows great promise is the RecycleBank program. This program is already being run in Wilmington, Delaware and Clayton, New Jersey. According to Norton (personal communication, January 27, 2007), recycling coordinator to the town of Everett, Massachusetts, this plan will also be implemented in Everett in the near future, and possibly other Massachusetts communities.

To best understand the impact that the RecycleBank program has had on Philadelphia, one needs to understand the history of recycling in that city; that history is

provided by Wellington (2006). Until its closing in 1985, Philadelphia exported all of its solid waste to a landfill in New Jersey. The closure of that major landfill resulted in the need for a new system of disposal in this large city. Incineration, which was the current measure being taken, was not well accepted by the people of Philadelphia, and also a very bad environmental choice. Recycling is a great waste-diversion method. It reduces landfill space, stimulates the economy by creating jobs, and saves valuable natural resources in the manufacturing process. Wellington (2006) asserts that for a community with few options, recycling was the best option; a program was installed in 1987, however it did not last very long. Due to poor enforcement of established policies the program failed by the late 1990s and another method was needed (Wellington, 2006).

In 2004, in partnership with Blue Mountain Recycling, RecycleBank collaborated with the city of Philadelphia to bring a single-stream, incentive-based program to the two neighborhoods of Chestnut Hill and West Oak Lane.

An incentive-based program monetarily rewards the consumer for the amount of goods they recycle. According to Jon Norton (personal communication, January 27, 2007) residents in the given areas receive a recycling bin that has a barcode on it specific to their household. When their bin is picked up once weekly, the barcode is scanned by the recycling truck and the amount of recyclables is weighed; this information is stored in a computer. The recycling company, RecycleBank, then rewards the residents with RecycleBank dollars that can be used at a variety of retailers in the area; these range from large corporate companies to local businesses willing to participate in the program.

The starts up costs for the community for a plan like this are minimal. RecycleBank provides the households with recycle bins and outfits the existing trucks

with new equipment to cater to this type of single-stream recycling. Residents do not even have to separate their own recycled goods. All goods go into one container and are sorted at the recycling facility providing for a very easy set-up.

The success of this program is evident in the increase in participation and recycling rates in the two Philadelphia neighborhoods it was implemented. The following table illustrates these rates before and after the implementation of the RecycleBank program.

Table 3. RecycleBank Recycling Rates in Philadelphia

City of Philadelphia: RecycleBank Incentive-Based Recycling Pilot	
Average recycle rate before (Dec 2004) implementation	10.6 %
Average recycle rate after (June 2005) implementation	38.6 %

Note. Table is adapted from information found in *The Status of Recycling in Philadelphia: Analysis and Recommendations for Philadelphia’s Floundering Recycling Program* by M. Wellington (2006).

RECYCLING IN PUERTO RICO

In 1992, Law 70 was instituted to obtain a recycling rate of 35 percent by the year 2000. Eventually, this law was amended and Law 411 was created to extend the deadline to the year 2006. In the year 2006, it was reported that Puerto Rico had a recycling rate of approximately 18 percent according to Nelson Reyes, recycling consultant for ConsultCom (personal communication, March 12, 2007). However, the recycling coordinators for the towns of Naguabo and Comerío, Amador Rosario and Lourdes Torres, believe that this number is inflated with the actual recycling rate being

approximately 13 percent. They believe this number is inflated because certain factors such as illegal landfills are not taken into account. The reasons that laws 70 and 411 are ineffective are unknown. The reasons could be attributed to lack of education, lack of leadership and initiative, or materials that are meant to be recycled are simply taken to the landfills. Therefore, no one simple solution can be drawn up in order to combat the ineffectiveness of the recycling on the Island.

In the following table information from the ADS (2007) is presented that summarizes the amount of waste produced on the Island of Puerto Rico daily. By taking the total tons that are produced weekly and calculating the estimated tons produced in one year then converting it to pounds, we were able to determine how many pounds each person will potentially produce a day. According to the U.S. EPA (2006), in the United States each person produces approximately 4.5 pounds per day compared to the approximately 5.2 pounds per day in Puerto Rico.

Table 4. Amount of waste produced in Puerto Rico

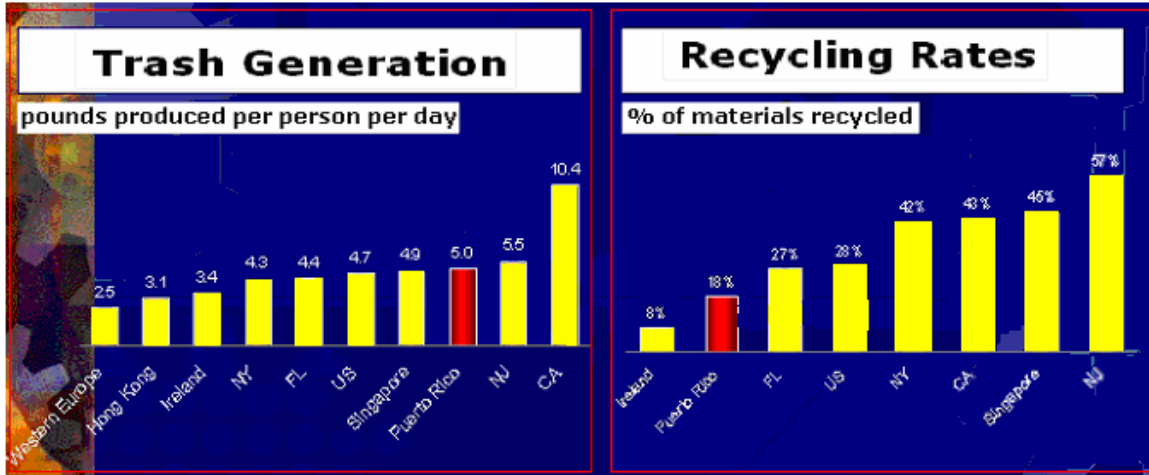
RESULTS	
Total tons produced weekly	69,211
Weeks in a year	52
Estimated tons produced in one year	3,598,972
Days in a year	365
Estimated tons produced per day	9,860
Estimated pounds produced per day	19,720,000
Estimated population	3,808,610
Estimated pounds produced per person per day	5.18

Note. Table is adapted from information found at the Solid Waste Management Authority (2007). Retrieved April 12, 2007, from <http://www.ads.gobierno.pr/secciones/planificacion/planificacion.htm>

While Puerto Rico has relatively high waste generation rates when compared to Western Europe and Hong Kong, their recycling rates are far below many others. In the

following two graphs, adapted from data taken from the ADS (2007), one can see that this statement is true.

Figure 4. Trash Generation 1



Note. Table is adapted from information found at the Solid Waste Management Authority (2007). Retrieved April 12, 2007, from <http://www.ads.gobierno.pr/secciones/planificacion/planificacion.htm>

Project Sponsorship

Our project is sponsored by FirstBank of Puerto Rico. The mission of FirstBank, also known as BanCorp, is to provide a reputable service to their customers. José Rivera, of FirstBanCorp, holds a personal interest in the recycling efforts of Puerto Rico. He conveyed to us that he would like FirstBank to use its political power to help the community. Besides José's personal commitment to a recycling project, FirstBank must meet all requirements of the Community Reinvestment Act (CRA).

Community Reinvestment Act

According to the Board of Directors Compliance Manual (2006), which is a federally established manual to ensure that banks comply with all FDIC requirements, the CRA was instituted in 1996 and was enacted to ensure that low and moderate income borrowers were treated fairly by financial institutions such as FirstBank. Periodically, the bank is evaluated on lending, investment, service and how these aspects relate to community development.

The banks lending practices are evaluated by their loan-to-deposit ratio. This ratio is determined by the Board of Directors based upon the bank's capacity to lend, comparison to other banks of the same approximate size, demographics of the loan area, economics of the loaning area and the financial demand of the community the bank is involved in.

Depending on the financial needs of the community and how well the institution is addressing them, a CRA rating is awarded to the bank. The bank receives rankings based on their community involvement that can either be an outstanding, a high satisfactory, a low satisfactory, a needs improvement or a substantial noncompliance. The bank's evaluation will come in intervals that are dependent on how well they do on the evaluation. If the bank receives a needs improvement or lower, a holds is placed on them for twelve months and no buying or growth is allowed within the institution.

CHAPTER 3: METHODOLOGY

The goal of this project was to write a public policy that outlined recommendations on how to improve recycling programs in Puerto Rico. The recommendations were based upon the findings from comparison of the recycling progress in Comerío, Guaynabo, Naguabo, and condominiums across the Island. To achieve this goal the following topics were analyzed:

- Current waste disposal costs of Comerío, Naguabo, and Guaynabo.
- Savings opportunities associated with recycling programs.
- Recycling programs in the municipalities.
- Waste disposal methods of condominiums.

To analyze the four topics above, we conducted three interviews with recycling coordinators in Comerío, Guaynabo, and Naguabo to learn how the recycling programs in the municipalities are operated, visited two existing recycling facilities that have established successful programs to learn how recycling companies are operated, and examined the current programs on the Island by conducting three interviews at the Autoridad de Desperdicios Sólidos (ADS) and the United States Environmental Protection Agency (EPA). Through these methods, we determined if establishing new recycling programs in Naguabo, Guaynabo, and Comerío is feasible and how they could be implemented.

Table 5. Interview Table

Name of Interviewed	Company Employed	Position within Company
John Norton	City of Everett, Massachusetts	Recycling Coordinator, Chairman of Conservation Commission
Amador Rosario	Municipality of Naguabo	Recycling Coordinator
Lelika I. Arias Pagán	Autoridad de Desperdicios Sólidos	Educadora Ambiental II
Angel E. Salgado-Torrellas	Environmental Protection Agency (EPA)	Environmental Scientist
José C. Font	Environmental Protection Agency (EPA)	Deputy Director, CEPD
Lourdes E. Torres Romero	Municipality of Comerío	Recycling Coordinator
Emmanuel Rodriguez	Rubber Recycling and Manufacturing, Inc. (REMA)	Mechanical Engineer
Guillermo Tous	IFCO	CEO
Reynyer Cordova	Municipality of Guaynabo	Recycling Coordinator

Determining Individual Recycling Practices in Puerto Rico

The first step in our research was to interview three people involved in the recycling programs who are coordinators that have knowledge of the actual recycling rates and practices of the municipalities.

The first interview we conducted was with Amador Rosario, recycling coordinator for Naguabo. Through this interview we were able to obtain information on the recycling program that is currently working in Naguabo and the success rates of the program. We also interviewed the recycling coordinator for Comerío, Lourdes E. Torres Romero. From this interview, we obtained information about how their programs are run

and regulated. In order to verify the information from these interviews, we also interviewed an educator with the Autoridad de Desperdicios Sólidos (ADS) of Puerto Rico, Lelika I. Arias Pagán. She was able to provide us with basic information about how recycling and solid waste management is managed within each municipality by the ADS.

Determining the Cost-Effectiveness and Savings Opportunities

In order to determine the cost-effectiveness and savings opportunities of certain recycling programs, we analyzed the amount of funds currently spent on waste management. Our focus was specifically on condominiums and walk-ups and the costs of waste removal to them.

To begin, we first needed information on the current waste management organization of a typical condominium or walk-up. We chose two condominiums as examples: Ponorme Plaze in El Senorid, Rio Piedras and Condominio Plaza Iunciculoda in Santurce, San Juan. We developed a questionnaire in English and Spanish. From the questionnaire we obtained the information on how many residents lived in the buildings and how much they currently spend on waste disposal. By obtaining the number of residents in the Condominio Plaza Iunciculoda, 197, and Ponorme Plaze, 192, we were able to calculate how much trash the condominiums produced as a whole. We used the average waste produced per person per day in Puerto Rico, 6.13 pounds a day, to do so. This allowed us to determine how much trash was produced in the building per day, per week, and per year. We then were able to determine how often a 50 cubic yard dumpster would have to be emptied without a recycling program in place. Finally, using values we obtained through research and interviews, we calculated the amount of waste that would

potentially be recycled. According to both Amador Rosario (personal communication, March 19, 2007) and Law 61 (2000), 70 percent of solid waste is recyclable. We then determined how much waste would be produced in this condominium with a recycling program in place, and then calculated how often a dumpster would have to be emptied under these conditions. With this information and these conclusions we gathered, we then illustrated how much money this particular condominium could save if a recycling program was implemented.

Determining the Environmental Benefits of a Recycling Program

The main goal of this project as outlined by our sponsors was to develop a public policy document that analyzed the environmental and economic benefits of recycling in Puerto Rico. A major part of determining the environmental benefits of a recycling program was to understand how successful programs work in the United States. We conducted background research on programs and legislation run in the United States such as the bottle bill, the pay-as-you-throw plan, and RecycleBank. The information on the bottle bill and the pay-as-you-throw plan was gathered through published reports and government web sites such as the United States EPA site. The information we gathered about the RecycleBank program was obtained through an interview with Jon Norton, recycling coordinator and chairman to the Conservation Commission in the city of Everett, Massachusetts.

In order to determine the environmental benefits of a recycling program implemented in Puerto Rico we contacted the Environmental Protection Agency (EPA). Specifically, we interviewed Angel E. Salgado-Torrellas, an Environmental Scientist, and José C. Font, the deputy director of the Caribbean Environmental Protection Division.

They provided us with basic information about landfill capacity on the Island and the need for a more effective plan. For more evidence on the environmental impact a recycling program would have, we consulted the ADS report published in 2007.

Determining Recycling Company Methods

In order to determine how recycling companies function on the Island, we met with several different representatives from recycling companies to tour the facilities and better understand how they were run. One company was Rubber Recycling and Manufacturing, Inc., located in Caguas. There we interviewed Emmanuel Rodriguez, a mechanical engineer working for the company. Also known as REMA, the company recycles tires to produce high quality crumb rubber that is steel and fiber free and comes in a variety of mesh sizes. Specifically, we were interested in obtaining information on how many tires the company recycled in comparison with how many they collected, and how many tires are actually on the Island. We wanted to know if more tires could be collected, or if collected was being run at its maximum capacity. If this were the case, we wanted to know if the facility was running at its maximum capacity in terms of recycling the most tires that they could per day.

Another company that was interviewed was IFCO, also located in Caguas. At IFCO, we interviewed Guillermo Tous, CEO of the company. We asked him about the collected practices of the company and how collection was run. We also inquired about how much they were possibly able to recycle and if they were recycling the most materials they could on a daily basis.

Chapter 4: Data Analysis

After gathering our information, we divided it into seven categories to help us better identify any patterns and similarities between the municipalities and any ways recycling could be improved in Puerto Rico. These categories were landfill information for each municipality, general information on each municipality, recycling programs in the municipalities, recycling companies in Puerto Rico, waste production rates, recycling within condominiums, and recycling at FirstBank. By comparing the information we gathered from each municipality to the others, we could identify any similarities in the way waste management and recycling is operated within each municipality and develop general guidelines for a successfully run program.

LANDFILLS IN THE MUNICIPALITIES

On the island of Puerto Rico there are currently thirty-one open landfills. By the end of this year, 2007, there will be twenty-five due to closings ordered by the Environmental Protection Agency (EPA) and also the closing of the Guaynabo landfill because it will have reached its maximum capacity. The EPA rates landfills on their conditions; they either receive a poor, regular, or satisfactory rating depending on their environmental condition and regulation adherence.

In the following table, we present the information gathered from several sources to summarize the current conditions of landfills on the island. Each day there are approximately 13,300 tons of solid wastes dumped into the thirty-one landfills listed below. By the end of this year, five of these landfills will have been completely closed.

The five landfills that will be closed contain approximately 15 percent of the daily solid waste dumping.

Table 6. Landfill Information

Landfills with 1-5 years left in operation				Number of municipalities that use landfill	Tons/Day	Tons/Week
		Condition	Operator			
1	Hormigueros	Poor	Municipality	1	55	302.5
2	Moca	Poor	Municipality	6	389	1,947
3	Isabela	Poor	Municipality	1	52	260
4	Jayuya	Poor	Municipality	2	48.5	291
5	Vega Baja (closing EPA)	Regular	AR Waste Disposal	4	446	2,454
6	Toa Baja (closing EPA)	Poor	Landfill Technologies	5	1,300	7,800
7	Toa Alta	Poor	Landfill Technologies	3	525	2,887
8	Barranquitas	Poor	Municipality	2	78	468
9	Guaynabo	Regular	Landfill Technologies	1	400	2,000
10	Carolina	Regular	Landfill Technologies	1	359.4	1,976
11	Juncos	Poor	Municipality	5	588	3,235
12	Fajardo	Regular	Landfill Technologies	7	683.4	17,085
13	Yabucoa	Poor	Landfill Technologies	3	99	544
14	Arroyo	Poor	L & M Waste	2	140	770
15	Santa Isabel (closing EPA)	Poor	Municipality	1	30	165
Landfills with 6-10 years left in operation				Number of municipalities that use landfill	Tons/Day	Tons/Week
		Condition	Operator			
1	Mayagüez	Satisfactory	Waste Management	2	340	1,700
2	Añasco	Regular	Municipality	1	110	605
3	Lajas	Satisfactory	Prime Inc.	1	141	707
4	Arecibo	Regular	Landfill Technologies	6	865	5,190
5	Florida (closing EPA)	Poor	Waste Disposal Management	1	156	780
6	Ponce	Satisfactory	BFI	3	2,000	10,000
7	Juana Díaz	Poor	L & M Waste	3	243	1,215
8	Salinas	Satisfactory	BFI	2	490	2,695
9	Cayey	Regular	Municipality	1	106	530
10	Guayama	Regular	Carlos Rental Equipment	1	75	413
11	Culebra	Regular	Municipality	1	17.9	89
12	Vieques	Regular	Municipality	1	30	165
Landfills with 10+ years left in operation				Number of municipalities that use landfill	Tons/Day	Tons/Week
		Condition	Operator			
1	Aguadilla (closing EPA)	Regular	Landfill Technologies	1	89	623
2	Cabo Rojo	Satisfactory	Landfill Technologies	1	185	1,018
3	Yauco	Satisfactory	L & M Waste	6	569	2,844
4	Humacao	Regular	Waste Management	3	2,226	12,246
Landfills with unknown duration				Number of municipalities that use landfill	Tons/Day	Tons/Week
		Condition	Operator			
1	Peñuelas (Industrial)	Unknown	Waste Management	0	506	2,530

Note. Table is adapted from information found in Plan Estratégico para el Manejo de los Residuos Sólidos en Puerto Ric by G. Riera.

GENERAL MUNICIPALITY INFORMATION

The three municipalities we visited to gather information on recycling and waste management programs were Naguabo, Comerío, and Guaynabo. Naguabo has a population of 24,800 people. The average household income is approximately \$7,000, which is far below the \$18,000 average income for the entire island. From the interview we conducted with Amador Rosario (personal communication, March 19, 2007), the recycling coordinator for Naguabo, we found that Naguabo produces forty tons of waste each day. This is equivalent to 3.3 pounds per person per day. The population of Comerío is 20,000 people and the average household income in this municipality is less than \$5,000, also well below the Island's average. Guaynabo has a population of 107,780 people and an average annual income of approximately \$18,000. From our interviews with the recycling coordinator of Comerío, Lourdes E. Torres (personal communication, March 27, 2007), we established that Comerío produces only six tons of trash per day, which is 0.6 pounds per person per day.

RECYCLING PROGRAMS IN THE MUNICIPALITIES

In Naguabo we interviewed Amador Rosario (personal communication, March 19, 2007), the recycling coordinator for Naguabo. Naguabo has the second highest recycling rate of the municipalities that we visited on the Island. Recycling rates are determined based upon the percentage of garbage that is recycled. Including composting, Naguabo has a 34.4 percent recycling rate. Commitment is a large factor in the municipality of Naguabo. For example, Amador Rosario collects all of the compost material in Naguabo on a daily basis himself and grinds it as well. All municipalities in

Puerto Rico are supposed to include composting in their recycling processes, but Naguabo is one of the few that does.

The Autoridad de Desperdicios Sólidos (ADS) provides each municipality with three trucks and one van that are designated for recycling only. According to Amador Rosario, most municipalities do not use these trucks for their intended purpose, however, Naguabo does. Naguabo seems to follow the rules of operation as outlined by the ADS. This may possibly contribute to the success of their recycling program. By using all three trucks and one van for the sole purpose of recycling, Naguabo can pick up more recyclables more often. This makes their program larger and more efficient.

One major point that Amador Rosario stressed to us was the importance of public education. Naguabo is number one on the island in terms of a public education program for recycling. The program includes both private and public schools, and involves a friendly competition between grade levels to motivate students. Prizes based on the amount of goods recycled are awarded to schools and individual students, thus creating a goal for students to reach. Amador Rosario stressed that motivation and commitment are keys to a successful recycling program. This not only applies to students in education programs, but leaders of these programs as well.

Rosario has a background in environmental science, one of three people on the Island who have such backgrounds and who manage recycling programs. He conveyed to us that he understands where the major problems in recycling are and he is very dedicated to improving his program to reach the needs of the entire population. Rosario has established a recycling plan for the future and is working towards a goal of a recycling percentage of 50 percent by the year 2010.

One aspect of our project was the issue of recycling within condominiums. Amador Rosario has started a program to educate the condominium associations. He stated that the importance of his program was in illustrating to the condominium associations that there was money to be saved in recycling. He placed recycle bins in several condominiums and picked up the goods weekly. The condos began to cut back on the amount of waste that they were throwing away and they began saving money.

For Naguabo's recycling program, as with any program, there were strengths and weaknesses. One of the strengths of the program Amador Rosario is running is that 50 percent of his recycled material is compost, making it one of the strongest compost recycling programs on the island. Also, all schools in the municipality have a recycling program, and finally, Amador Rosario is very dedicated to recycling in Naguabo.

There are some weaknesses in the structure of the recycling program in Naguabo. Community recycling pick-up is only offered in half of the neighborhoods in Naguabo. Therefore, over half of the population must drop off their recycled goods to recycling facilities, something that is not necessarily enforced. Naguabo also has a very high trash production rate per person, and there are twenty-six illegal landfills in this municipality alone.

The second municipality that we visited was Comerío. The recycling coordinator of Comerío, Lourdes E. Torres (personal communication, March 27, 2007), administers the program in this municipality very similar to the way that Amador Rosario administers the program in Naguabo. Comerío has a 68 percent recycling rate with a smaller population. It has a recycling program in all sixteen of its schools, which is similar to Naguabo.

Lourdes Torres claims that it costs \$5.75 to dispose of one yard of waste. There are 59,208 yards of waste produced each year in Comerío. The total cost of waste disposal per year is \$340,000. This number is obtained by taking \$5.75 and multiplying it by 59,208. However, with a 68 percent recycling rate, Comerío is actually saving \$231,503 of the money spent by recycling. There is also the cost of taking the trucks to the landfills; at \$215 a truck, there is an addition \$33,540 spent on waste removal each year. In total, with a successful recycling program, Comerío was able to save approximately \$265,000 last year.

Comerío has a very successful recycling program, which can be attributed to several things. They are able to implement recycling programs on many levels; there are recycling units in schools, businesses, and homes throughout the municipality. Also, public education exists in the schools and Comerío has the lowest waste production rate on the Island.

Guaynabo was the third municipality we visited. Here we interviewed the recycling coordinator, Reynyer Cordova (personal communication, April 20, 2007). Guaynabo has a 13 percent recycling rate and 90 percent of the population of the municipality has recycling services available to them. Guaynabo also has a recycling program within twenty-one of its condominiums; each condominium has two bins for solid waste and two bins for recyclable goods. The recycle bins are picked up with no charge; however, the solid waste bins cost the condominium \$64 each time they are emptied. This recycling program within the condominiums helps to boost the recycling rate in the municipality.

Guaynabo also has a public education program in their school system. While both Comerío and Naguabo have recycling education programs set up for children in elementary school, Guaynabo also includes universities in their program. Guaynabo currently has a program with one of the universities that has sixty students each year working on ways to improve recycling in the municipality. The program not only teaches students how to recycle but also gets them involved with helping the community improve its recycling efforts.

Guaynabo has great success in providing the community with recycling services; however, getting most of the residents to comply has proven to be a major issue within the municipality. Effective in May 2007 there will be a new city ordinance. This ordinance will require all citizens of Guaynabo to recycle. If recyclable goods are found in their waste bins, they will be fined. This same ordinance also requires all condominiums to have a recycling plan that they must present to the Department of Recycling.

The following table summarizes the basic information we obtained from our three interviews with recycling coordinators in Naguabo, Comerío, and Guaynabo.

Table 7. Comparison of Naguabo, Comerío, and Guaynabo

	Naguabo	Comerío	Guaynabo	Average in Puerto Rico
Population	24,803 people	20,000 people	107,783 people	N/A
Average annual income per household	\$6,960	\$4,972	\$16,287	\$18,000
Solid waste produced per year	30,000,000 lbs.	4,300,000 lbs.	208,000,000 lbs.	8 billion lbs.
Amount of recycled waste per year	10,200,000 lbs.	2,900,000 lbs.	26.5 million lbs.	Between 730 million and 1 billion lbs.
Pounds of trash produced per person per day	3.3 lbs.	0.6 lbs.	5.7 lbs.	6.13 lbs.
Current recycling rates	34.4%	68%	13%	Between 10%-13%

RECYCLING COMPANIES IN PUERTO RICO

The three parts to a successful recycling program are reducing, recycling, and reusing. In Puerto Rico there does not seem to be a strong enough connection between the three steps to have a successfully established recycling program. To better understand how specific recycling companies are managed on the Island, we interviewed two.

The first company we visited was Reunión-Entrevista en Industrial Fibers (IFCO), which is located in Caguas. At the company we interviewed Guillermo Tous, the CEO of IFCO (personal communication, April 10, 2007). The company deals mainly with fiber recycling, such as cardboard, newspapers, and paper. In 1997 they began recycling all types of materials, but cardboard, newspapers, and paper still remain their most recycled material. IFCO deals solely with companies and does not do collection with residential

neighborhoods. There is a monthly fee charged to those companies, and IFCO provides a pick-up service to them. IFCO says they receive approximately five hundred tons of recyclable goods each day from a total of twenty municipalities. From discussions with Tous we determined several flaws in the recycling system of not only IFCO, but also Puerto Rico as a whole. First of all, IFCO ships out all of their products to places such as Southeast Asia and Spain. They are not keeping their products on the Island; therefore, they are not helping to stimulate the market for goods made from recycled materials.

Another major issue that hinders the ultimate success of IFCO is the collection of recyclable materials. At this point in time, Tous claims that IFCO is collecting only 60 percent of the total recyclable goods that they possibly could be. Since the company is not running at its full capacity, the need for more recycling companies on the Island is minimal. From this interview we learned that the major issue with recycling on the Island lies in the collection process.

The second company that we visited was Rubber Recycling and Manufacturing (REMA). At this company we interviewed Emmanuel Rodriguez (personal communication, April 10, 2007). In Puerto Rico there are about five million tires thrown away each year. REMA processes 2.6 million of these tires into crumb rubber every year. REMA does not offer any residential or company pick-up therefore, all of the tires they process come from voluntary drop-offs. However, they do not charge residents or companies for their service. Like IFCO, REMA's recycling issues are with collection. Since REMA's plan allows them to recycle only tires that are dropped off to their facility, there are many companies and people that do not bring their old tires in to be recycled.

This finding helped to affirm our previous assumptions about IFCO; if collection processes were better, recycling rates would be a higher.

WASTE PRODUCTION RATE CALCULATIONS

Given that the weekly waste production in Puerto Rico is 84,534.75 tons and the population is 3,927,776 people, we calculated the total pounds of waste produced per person per day. The following formula was used; our calculations reveal that on average, the amount of trash produced per person per day in Puerto Rico is 6.13 pounds.

$$\frac{84,534.75 \text{ tons}}{1 \text{ week}} * \frac{52 \text{ weeks}}{1 \text{ year}} * \frac{1 \text{ year}}{365 \text{ days}} * \frac{2000 \text{ lbs.}}{1 \text{ ton}} * \frac{1 \text{ Puerto Rico}}{3,927,776 \text{ people}}$$

$$= \frac{6.13 \text{ lbs.}}{\text{person*day}}$$

Similar calculations were done for the United States given that the U.S. produced 245 million tons of trash in 2005 and the population is 299,398,484 people. The following formula was used; our calculations reveal that on average, the amount of trash produced per person per day in the United States is 4.5 pounds.

$$\frac{245 \text{ million tons}}{1 \text{ year}} * \frac{2000 \text{ lbs.}}{1 \text{ ton}} * \frac{1 \text{ year}}{365 \text{ days}} * \frac{1 \text{ United States}}{299,398,484 \text{ people}}$$

$$= \frac{4.5 \text{ lbs.}}{\text{person*day}}$$

RECYCLING WITHIN CONDOMINIUMS

In order to determine the ways condominiums could potentially save money through recycling, we first needed to obtain some basic information on their current waste disposal practices. In order to do this, we created a survey for condominiums to fill out. We were able to get two condominiums to answer the questions on our survey. The condominiums we gave our survey to and obtained answers from were the Ponorme Plaze in El Senorid, Rio Piedras and Condominio Plaza Iunciculoda I and II in Santurce, San Juan. The essential pieces of information that we needed in order to determine how much each condominium could save were the monthly cost for waste disposal, the number of units in each condominium, and the number of times waste was picked up from the condominium every week. From this data we were able to estimate how much each condominium could potentially save through recycling. As can be seen in Table 8 below the Ponorme Plaze could potentially save \$5,200 per year by recycling. The Condominio Plaza Iunciculoda I and II could potentially save \$10,400 per year by recycling. The projected savings for both condominiums are if the condominiums are able to reach a recycling rate of approximately 70 percent. The projected increase in savings could be increased if the condominium chose to return its recyclables to a recycling plant.

Table 8. Condominium Analysis

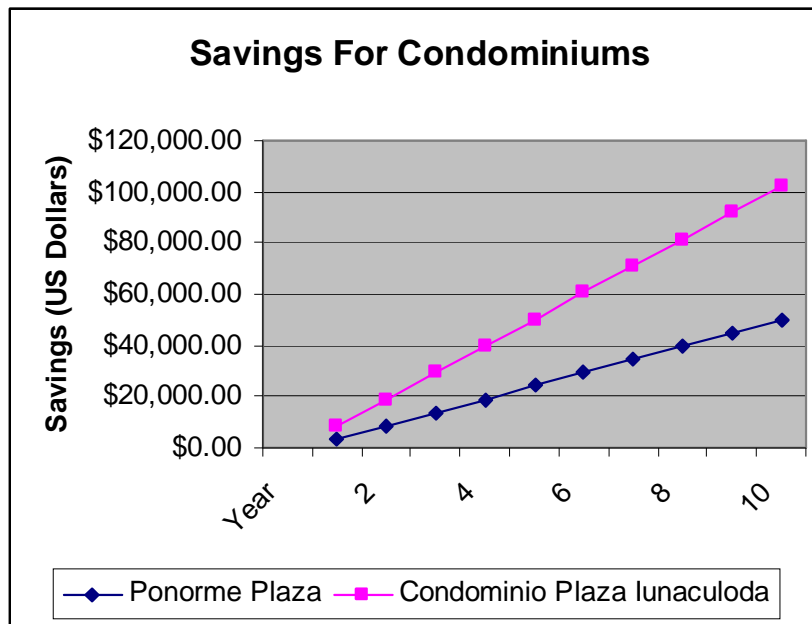
<i>Condominium</i>	<i>Ponorme Plaza</i>	<i>Condominio Plaza lunaculoda</i>	
Units	197	192	
Pick ups per week	3	3	
Average Pick Ups Per Month	12	12	
Cost for Pick Up	\$650.00	\$1,300.00	
Average Cost Per Pick Up	\$54.17	\$108.33	
Waste Produced Per Month*	3622.8	3530.9	
			Theoretical Needed Pick Ups
Amount Recycled With Rate Of:			Per Month
0.25	905.7	882.7	8
0.5	1811.4	1765.4	6
0.7	2536.0	2471.6	4
Savings Each Month With Recycling Rate Of:			
0.25	\$216.67	\$433.33	
0.5	\$325.00	\$650.00	
0.7	\$433.33	\$866.67	
Projected Savings Per Year			
0.25	\$2,600.00	\$5,200.00	
0.5	\$3,900.00	\$7,800.00	
0.7	\$5,200.00	\$10,400.00	
*Based on Puerto Rico rate of 6.13 lbs/(person*day) and also average family size of 3			

We also did a projection for each one of the condominiums to display how much they could save each year, which can be seen in Table 9 and **Error! Reference source not found.** below. In order to provide a more accurate projection, we also included a deduction from the savings for the cost of one eight-yard recycle bin, which costs \$1,800. The cost was taken from the cost of an eight-yard recycle bin; this figure was provided to us by the municipality of Guaynabo.

Table 9. Projected Savings For Condominiums

Projected Savings With A 70% Recycling Rate		
Cost of an 8 yard recycle bin \$1,800.00		
	Ponorme Plaza	Condominio Plaza lunaculoda
Year		
1	\$3,400.00	\$8,600.00
2	\$8,600.00	\$19,000.00
3	\$13,800.00	\$29,400.00
4	\$19,000.00	\$39,800.00
5	\$24,200.00	\$50,200.00
6	\$29,400.00	\$60,600.00
7	\$34,600.00	\$71,000.00
8	\$39,800.00	\$81,400.00
9	\$45,000.00	\$91,800.00
10	\$50,200.00	\$102,200.00

Figure 5. Projected Savings For Condominiums



RECYCLING AT FIRSTBANK

Based on the information we gathered throughout our research we conducted an analysis on the amount of money FirstBank could save if they fully enforced paper recycling in their facilities all over the Island. In Puerto Rico, FirstBank has 3,000 employees. The average amount of recyclable material produced per person per day in industry is 3.5 pounds. This number was provided to us by the ADS. The majority of waste produced on a daily basis by a company is paper. Most of this paper is recyclable. Therefore, our estimate of paper produced per person per day in industry is 1.5 pounds. We calculated that the average Puerto Rican works 230 days a year. IFCO, a recycling company in Caguas that we visited, told us that they pay \$0.15 per pound of paper that is brought to them. We did our calculations figuring FirstBank could recycle 70 percent of the paper that they throw away every day. The following table was used to calculate the total savings that FirstBank could have.

Table 10. FirstBank Savings Opportunity

FirstBank Savings Opportunity	
Number of Employees	3,000
Average pounds of paper trash produced per day	1.5
Projected recycling rate	70%
Number of working days per year	230
Price per pound of trash returned to IFCO	\$0.15
Projected Start-up expenses for a recycling program	\$10,000
Total Savings	\$98,675

Using the above table, we determined that in one year, FirstBank could save \$98,675. This number could increase with time as paper prices increase, waste disposal for FirstBank decrease, and trash collected for FirstBank decrease.

CHAPTER 5: CONCLUSIONS AND RECOMMENDATIONS

RECYCLING IN PUERTO RICO

Based on the analysis of our data and information collection, we have concluded that the recycling system in Puerto Rico needs a great deal of improvement in the way that it is coordinated, managed, and implemented. We have also concluded that a successful recycling program requires strong, committed leadership to motivate citizens and keep recycling programs running. A public education program is also extremely important to a strong recycling program.

Many municipalities have recycling programs operating; however, some are proving to be more successful than others. After carefully studying the literature, conducting nine interviews, and carefully studying our data collection, we concluded that a successful recycling program requires several things. First of all, dedicated leadership is probably the most vital part of a successful recycling program. With strong leadership comes strong implementation; a stronger recycling program within the municipality will result from this. The major problem with Guaynabo's recycling program was getting all residents involved. While 90 percent of the population had a recycling program available to them, most did not participate.

Education programs within schools seem to be effective in educating the population. Beginning to educate students at a young age creates awareness and helps them to understand how recycling works early on. In the municipalities of Naguabo, Comerío, and Guaynabo, education programs got students involved in recycling and motivated them to learn more and recycle more. Leadership can greatly influence how an

education program is run. A strong leader can push for a strong education program; both can improve recycling.

Currently in Puerto Rico, 13.5 percent of the population lives in condominiums and walk-ups. As the population continues to grow and more condominiums are being built, this number will increase. As was already mentioned, Law 61 (2000) requires only newly built condominiums to have a designated recycling area. This is a major hindrance to the recycling effort in Puerto Rico. With approximately 540,000 people, 13.5 percent of the Island's population, living in condominiums, recycling efforts should be geared toward these facilities. We have concluded that if recycling programs were mandatory in all condominiums, not just renovated buildings, recycling rates could potentially increase anywhere from 18 to 23 percent on the Island.

RECOMMENDATIONS

Based on the data and information we collected, all of our reading, examination of data, and the conclusions we drew from this examination, we have formed ten recommendations for the solid waste disposal and recycling programs of Puerto Rico.

Municipalities

Our first recommendation is for municipalities to elect recycling coordinators based on experience and education background. If recycling coordinators are chosen in this manner, they are more likely to understand the aspects of a recycling program and how it needs to be run. Currently, many coordinators are chosen based on political reasons. They may not have backgrounds in environmental science, or areas similar to this, and they may not have the personal interest needed to dedicate them to improving recycling.

Our second recommendation is for mandatory education programs within schools. Each school in Puerto Rico would be required to set up a recycling unit in their building. This recycling unit would be a designated area for recyclable goods to be separated and stored until they were collected. In addition to a recycling unit, there would also be a recycling education portion. Students would be taught how to recycle, the importance of recycling, and the dangers of not recycling. Teaching the importance of a strong recycling program to students at a young age will get them in the habit of recycling. They will be more likely to retain the information, continue to recycle, potentially influence their parents to recycle, and be environmentally conscious in the future.

The economic and environmental benefits of recycling also need to be illustrated to the general public. If people know that they can save money by recycling they will be more likely to do so. The fact that recycling can save money needs to be conveyed to residents in the municipalities in some manner. This could potentially be done through brochures, advertisements, or local town and neighborhood meetings.

Our third recommendation is to implement incentive-based recycling programs in Puerto Rico. Based on prior research we conducted on successful recycling programs in the United States, we concluded that incentive-based programs would be beneficial to the municipalities of Puerto Rico. If residents of low-income municipalities were able to save money while recycling more, they would be more likely to recycle. If waste disposal costs were based upon how much residents and companies threw away, they would recycle more to save money on waste disposal.

A specific incentive-based program that has been successful in eleven states in the United States is the bottle bill. If a program such as the bottle bill were to be implemented in Puerto Rico, recycling of cans and bottles could increase a great deal. Pay-As-You-Throw is another incentive-based recycling program that could greatly benefit Puerto Rico. These two programs would have to be implemented by municipalities and not island-wide to be successful.

Our fourth recommendation is for condominiums to develop recycling units and improve recycling programs within their buildings. In places such as San Juan where there is a very high concentration of people, condominiums are numerous. As the population increases so will the number of condominiums. Based on our data collection and analysis, strong recycling programs within condominiums across the Island could potentially increase the recycling rate from its current 10 to 13 percent up to 18 to 23 percent.

Our fifth recommendation is for money to be awarded to the municipalities of Puerto Rico based on their size and population as well as their financial situation. The municipalities receive money from the government to fund their recycling programs. However, this funding is awarded based on size of the municipality, and some municipalities must compete for a set amount of money. Generally, smaller municipalities receive less funding, making it harder for them to establish recycling programs. This method would ensure that municipalities received enough money to establish recycling programs that could encompass their entire population.

Our sixth recommendation is for an increased number of drop-off sites to be established in the municipalities across the Island. Another weakness in the recycling

programs of the municipalities is the number of drop-off sites that are available to residents. Currently, most municipalities only have one to two drop-off sites. In larger municipalities, this number is far too small to accommodate the entire population. This would offer residents more places to bring their recycling, making it more likely for them to drop it off. If drop-off sites are closer to residential locations and residents do not have to travel as far, recycling is made easier and they will be more likely to do it.

State Government

Our seventh recommendation regards the enforcement of recycling laws in Puerto Rico. Currently, there are two laws that we have highlighted that address recycling. These laws are in place, but they are not effective. Our recommendation for the state government is to have better enforcement of these laws and establish penalties for not adhering to the laws.

Our eighth recommendation is for an amendment to Law 61. Currently, this law only requires newly built condominiums to have a designated area for recycling. If Law 61 were amended, it could possibly include renovations to condominiums as well. If this were to happen, the law would require more condominiums to establish recycling programs.

Our ninth recommendation is for an amendment to Law 411. This law currently states that it is the obligation of the people of Puerto Rico, state agencies, and public organizations to properly separate and recycle any recyclable goods. A change that could be made to this law is to assign recycling quotas to citizens, companies, and organizations to ensure that they are recycling to the best of their abilities. In addition, we recommend that fines be established that penalize companies and residents that do not recycle.

FirstBank

Our tenth recommendation is for FirstBank to educate its employees about recycling. We analyzed how much money FirstBank could save if they fully enforced paper recycling. FirstBank has bins set up for paper collection however, the employees are not all aware of the location and the purpose of the bins. As part of basic training we recommend that FirstBank also educate its employees on the proper way to separate and dispose of paper.

We believe that if the ten recommendations we made are put into affect, Puerto Rico could have a stronger, improved recycling program. With time, Puerto Rico could have a successful recycling program and potentially become a model for other countries in the future.

Appendix A

The following information was obtained from the First BanCorp website which is listed in our references. The website for this company is <http://www.snl.com/irweblinkx/corporateprofile.aspx?iid=4041406>.

Description of FirstBank

FirstBank was first established in 1948 as the first S&L institution in Puerto Rico. The establishment is very involved with the economy and societal issues of Puerto Rico. They employees take initiative in improving the quality of living of the citizens; they help many in the purchase of their first home.

In 1984 the bank converted to a commercial bank and three years later it went public, trading on Nasdaq. In 1998 it was recognized into a holding company as First BanCorp.

FirstBank Code of Ethics and Company Mission

The mission of FirstBank, also known as BanCorp is to provide a reputable service to their customers. The bank takes the trust of its customers very seriously, and want to deliver a committed and superior service that they can count on.

FirstBank Annual Report

A public company is required to release a report stating all the details of the past year of business. Information about the company is provided, mainly for investors. The annual report for FirstBank can be found at the following link: <http://www.snl.com/irweblinkx/ShowFile.aspx?KeyFile=2823568>.

Appendix B

Interview with Jon Norton
City of Everett
Recycling Coordinator
Chairman, Conservation Commission
Saturday, January 27, 2007

Jon E. Norton
City Hall
484 Broadway
Everett, MA 02149-3694

- How long does it take to implement this type of recycling program (RecycleBank program)?
- How much are the start up costs for trucks and bins with barcodes and computers?
- What are the incentives for the companies involved?
- What is the take on the part of RecycleBank?
- Is it required to have the bins, and if so, is there a cost to the bins?
- Where does the recycle bin go?
- Is there a special type of recycling plant?
- What are the technological needs for a project of this size?
- What are the current recycling rates and what are the projected numbers is such a program is implemented?

Interview Summary

- RecycleBank has implemented a program in Pennsylvania.
- This recycle plan is single- stream. Goods are taken to a sorting facility and recycling is made very easy.
- It costs \$70,000 to convert trash trucks to this system because of the computer system that needs to be placed in each truck.
- Families that participate in the RecycleBank program can earn up to \$400 a year.
- The trash hauler company for the city must cooperate and be willing to pick up the recyclables.
- Everett, MA wants to convert two trucks to this system.
- Weather could potentially affect the trash removal.
- Two people are now needed to operate just one truck. Fewer trash trucks are needed for regular pick up.
- RecycleBank needs to come to city and employ local businesses to comply.
- There may be language barriers.

- All people must agree to the system (haulers, residents, government officials).
- Boston could not implement the RecycleBank program throughout the entire city because Boston is too large.
- Everett will include the entire city in the RecycleBank program eventually.
- Time frame: If started now the program could be running in November?
- 15,000-17,000 recycle bins for recycled goods would be needed in Everett.
- The suggestion by Norton would be to implement the program by district in San Juan.
- Wilmington, PA is low income and the program is being run there.
- Wilmington does not offer pick-up to condominiums.
- Certain market conditions must exist for recycled goods to be in demand.
- We obtained RecycleBank's telephone number.
- RecycleBank gets 50 percent of the savings from disposal waste savings costs.
- Start up cost for a city is \$0. RecycleBank will set up and maintain all the equipment.
- Certain sorters are needed because this is single-stream recycling.
- Sorted vs. streamline- there are special facilities for both methods of recycling.
- Everett has five- year contract with RecycleBank.
- There are no personal charges to residents for the recycle bins.
- Recycling exists in the school systems also.
- Good code enforcement is necessary for this program to be successful.
- There are pick up and tipping fees in solid waste disposal.
- It costs \$70 a ton to dispose of waste. Over \$1 million is spent a year for solid waste disposal in U.S. therefore recycling is much cheaper.
- Pay-As-You-Throw is a very successful plan also.
- People do not want to pay for trash removal.
- It would take two weeks for a family of four to fill one trash bag if recycling was used to its fullest potential.
- Public education is a must.

Appendix C

Interview with Amador Rosario
Recycling Coordinator for Naguabo
Programa de Reciclaje- Municipio de Naguabo
Monday, March 19, 2007 9:00 AM

- How much waste is currently being produced in Naguabo?
 - ¿Cuanta basura se produce en Naguabo?
- How much of that waste is currently being recycled?
 - ¿Cuanta de esa basura se recicla?
- Are there any recycling programs being run? How are they run?
 - ¿Existe programas de reciclaje? ¿ Como los operan?
- What are your plans regarding the landfill situation? Since landfills are being shut down and most are predicted to be closing within 5-10 years, how do you plan on managing the disposal of solid waste?
 - ¿Cual es el plan con relacion a los vertederos? Reconociendo que estos seran cerrados en los proximos 5 a 10 años. ¿ Como van a manejar desperdicio de la basura?
- How is waste management run? Are there private companies that are hired?
 - ¿Como es el manejo de la basura? ¿ Tienen compañías privadas que son contratadas?
- What efforts are you currently making to improve recycling?
 - Actualmente que esfuerzos se estan tomando para mejorar el reciclaje
- Are there any public education programs in place?
 - ¿Tiene programas de educacion al publico que se esten proveyendo?
- Have you looked into alternatives to landfills?
 - ¿Han investigado en otra alternative a los vertederos?
- How much are you paying to dispose of the solid waste?
 - ¿ Cuanto estan pagando para disponer de la basura?
- How do you pay for it? What source of funds are utilize?
 - ¿Como cubren el costo de disponer de la basura? ¿Qué fondos se utilizan?
- If there is any recycling program, what are the costs associated with it and where is the funding coming from?
 - Si hay un programa de reciclaje; ¿Cuál es el costo de este y de donde viene el fondo para el pago de este?
- What materials is the Municipality able to recycle? And why?
 - ¿Que materials se estan reciclando? y ¿Por que?
- If not program available, Have you considered beginning a recycling program to cut down on the amount of waste being deposited in the landfills?
 - Si no hay programa disponible, ha pensado en comenzar un programa de reciclaje para contra restar la cantidad que se deposita en los vertederos?
- Why do you think recycling programs have has taken so long to be implemented or fail on the Island?

- ¿Por que cree que los programas de reciclaje han tardado tanto en implantarse en la isla? o no han funcionado
- Recognizing that the new construction is walk-ups or condominiums; What are the challenges from the Municipality to implement an effective recycling program?
 - Reconociendo que lo que se esta construyendo en PR es los apartamentos y condominios; ¿Cuáles son los retos que confronta el Municipio para establecer un programa de reciclaje adecuado?
- Have you tried to enforce recycling policies on waste management companies?
 - ¿Han tratado de imponer politicas de reciclaje a las compañías privadas?
- How much waste is being put into the illegal landfills? How do you plan on controlling these illegal dumping areas?
 - ¿Cuanta basura se esta colocando en los vertederos clandestinos? ¿Hay un plan para controlarlo?
- Have you looked into building a recycling plant in Naguabo?
 - ¿Se ha pensado en instalar una planta de reciclaje en Naguabo?
- Do you think a 30% recycling rate is sufficient? Is it feasible?
 - ¿Piensa usted que un 30% de reciclaje es suficiente? ¿Se puede obtener?

Interview Summary

- The population of Naguabo is 23, 759 people as of the 2007 census.
- Naguabo has the second highest recycling rate on the Island.
- They are the first in recycling education programs on the Island.
- They have a 34.4 percent recycling rate that is based on the amount of garbage produced per person.
- Each year 10,216 pounds of recyclables are recycled in Naguabo.
- Naguabo is in a region of nine municipalities that all take their recycling to Caguas except for Naguabo. All recycling in Naguabo is taken to J.C. Reciclaje.
- J.C. Reciclaje is more successful with higher recycling rates and the facilities are closer so recycled goods can be taken there more often.
- J.C. is funded by committees and they do not have as much money as other recycling facilities, such as the one in Caguas.
- Naguabo is the only municipality in Puerto Rico that deals with compost, vegetable materials, and biodegradable materials.
- On a daily basis Sr. Rosario will go around the municipality and cut down trees. He then collects all the waste and grinds it into compost. This is provided to farmers and is just given away because it will end up taking space in landfills. By law all municipalities are supposed to do so but Naguabo is the only one that deals with composting.
- There are a total of 13 employees at this recycling facility. Funding comes from proposals and municipalities. Four of these employees are full time, four are paid through proposals, and five are paid through the municipality and are requested yearly.

- They have three trucks and one van that are provided by the Solid Waste Department and are designated for recycling only. There is one for cardboard, one for compost, and one for regular pick up.
- Every municipality is required by the Solid Waste Authority to have a yearly plan and a quarterly plan for recycling set up. There are fines if they do not comply.
- Naguabo is number one in public education for recycling education programs. Their education programs include public and private schools. They include special needs such as sign language.
- Recycling is picked up weekly in the schools in Naguabo. This collection program has been running for seven years.
- There is competition created within schools to motivate the students in a friendly way.
- There are fourteen neighborhoods in Naguabo; seven get their trash picked up and seven must drop their own trash off at drop-off sites.
- This recycling program does not generate any money; it saves money for the municipality. The philosophy of the town is to reduce costs.
- Drop off sites are volunteer based. People are not required to bring their recyclable goods to these sites.
- Sr. Rosario's opinion is that 35 percent is an obtainable goal for any municipality and 50 percent is good to reach for.
- Motivation and commitment are keys to having a successful recycling program but many officials get their positions for political reasons.
- Naguabo also plants trees to replace the ones they cut down which adds another arrow to the "recycling cycle".
- He also has a background in environmental science. One in three people on the Island managing recycling have an environmental science background.
- Sr. Rosario's goal is 50 percent and he will obtain this by developing a plan, asking other people and companies for help, and managing plastic recycling better.
- Since Sr. Rosario became coordinator in 2006 the recycling numbers doubled.
- The municipality has no plans for when the landfill closes.
- Private companies always pick up solid waste.
- In Naguabo recycling is a department of the municipality but usually it is a part of public works.
- Comerío is also run the same way. They have direct contact with Mayor on issues.
- Sr. Rosario's efforts to improve include adding four more employees, a new truck, and pick up in the neighborhoods that are currently having to drop off recycling. By 2010 he wants a 50 percent rate.
- Naguabo must apply and compete for Community Development money that is provided to municipalities by the government.

- Money granted to municipalities is dependent on the size and population. Large municipalities have assigned money and smaller ones must compete for the money.
- A recommendation he has to increase recycling rates is to implement a fee for NOT recycling.
- Legislation is an issue. Sr. Rosario believes that 75 percent of waste can be recycled.
- Conway runs the trash pick up in Naguabo.
- Sr. Rosario also began a program to educate the Condominium Association.
- It costs them \$150 every time the dumpster is emptied (this is a tipping fee).
- Sr. Rosario put up recycling bins in condos, picked it up weekly, and saved them money.
- Twenty-six illegal landfills exist in Naguabo. From one of these sixteen trash trucks were filled.
- Putting a recycling plant in Naguabo could cause competition for J.C. Reciclaje and so Sr. Rosario decided against it.
- The municipality does not guarantee approximately 20 percent of his budget.

Appendix D

Interview with Lelika I. Arias Pagán
Autoridad de Desperdicios Sólidos
Educatora Ambiental II
Edificio de Agencias Ambientales
Sector El Cinco
Monday, March 26, 2007 9:00 AM

- How much waste is currently being produced in the municipalities of Comerío , Guaynabo and Naguabo?
- How much of that waste is currently being recycled?
- Are there any recycling programs being run? How are they run?
- What are your plans regarding the landfill situation? Since landfills are being shut down and most are predicted to be closing within 5-10 years, how do you plan on managing the disposal of solid waste?
- How is waste management run? Are there private companies that are hired?
- What efforts are you currently making to improve recycling?
- Have you looked into alternatives to landfills? Incinerations?
- Have you considered beginning a recycling program to cut down on the amount of waste being deposited in the landfills?
- Why do you think recycling programs have failed on the Island?
- What types of public education programs are in place, if any?
- Have you tried to enforce recycling policies on waste management companies?
- How much waste is being put into the illegal landfills? How do you plan on controlling these illegal dumping areas?
- Have you looked into building a recycling plant on the Island? This would create jobs and recyclable goods would not have to be shipped off the Island.

Interview Summary

Guaynabo

- The first phase of the recycling plan was to set up all the houses in Guaynabo with recycling containers.
- Law 61 states that new housing developments must have a designated area for recycling.
- Municipalities that get their money from the government directly have the ability to create their own laws.
- Guaynabo is very rich so they were able to pass their own ordinance to the law.
- In the future Guaynabo hopes to take part of the sales tax and put it towards recycling.
- The recycling program began in summer 2003.

- The first phase included sixty-eight sectors. That is 29,275 residents and about 21,000 households.
- As of October 30, 2003, 10,700 tons of recycled materials had been picked up.
- The commercial side of recycling is not covered under law 61.
- Public education exists in twenty-six public schools and cultural centers.
- Private companies pick up the recyclable materials.
- Over one hundred thirty housing developments are currently recycling.
- There was 80 percent recycling in households as of December 2005.
- Violation fees are \$100 for first time, \$200 for second time, and \$300-500 after that.

In General

- Each municipality is provided with the machine to grind compost by the SWA.
- Each municipality has a coordinator/ educator who is in charge of about ten municipalities.
- According to the woman we interviewed, recycling success depends on the mayor and leadership; interest is needed even if they have money.
- Smaller municipalities do not have money to spend on disposal so they must recycle to save money.
- They have not fined anyone to this date, but are currently investigating the compost issue in each municipality.
- Representatives from the ADS are at landfills to monitor them.

Appendix E

Interview with Angel E. Salgado-Torrellas
Environmental Protection Agency (EPA)
Environmental Scientist
Environmental Management Branch
Thursday, March 29, 2007 10:00 AM

Interview with José C. Font
Deputy Director, CEPD
Caribbean Environmental Protection Division
Thursday, March 29, 2007 10:00 AM

Caribbean Environmental Protection Division
Centro Europa Bldg, Suite 417
1492 Ponce de León Ave., Stop 22
San Juan, PR

- What is the role of the EPA on the Island?
- How many employees work at the EPA and what resources does the EPA use?
- How does it work with the municipalities, if any?
- What do you feel are the major problems concerning the low recycling rates across the Island?
- Why and how was a rate of 35 percent recycling chosen? Do you feel this is still a reasonable recycling rate?
- What efforts are you currently making to improve recycling on the Island?
- How do you feel about the recycling laws on the Island? Are they sufficient to increase the rate of recycling to the desired level?
- Which aspects of the current recycling practices on the Island do you feel are have worked particularly well?
- Do you feel that most municipalities have thought about what they will do in the next five to ten years, when many of the current landfills are being projected to be shut down?
- Why do you think recycling programs have has taken so long to be implemented or fail on the Island?
- Why do you feel that certain programs across the Island are more successful than others?
- Do you feel recycling is taken seriously on the Island?
- Has the EPA tried to enforce recycling policies on waste management companies?
- What types of fines or penalties are given to municipalities or agencies that do not meet regulations?
- Could we get a listing of those municipalities or agencies that have received fines for violating regulations?
- How difficult is to prove a violation?

- Recognizing that the Island does not have the full cycle recycling program for all recyclable material, what could be some of the options for combating this problem?

Interview Summary

- The EPA does not deal directly with recycling. They deal with agency guidelines and proposals. Regulation is run by the SWA.
- There are about fifty-five employees at this branch. Region #2 including NY, PR, Virgin Islands. There is a coordinator in the Islands.
- Angel thinks the problems lie within the culture and personal attitudes of residents on the Island. The SWA has done public education for decades.
- There is approximately a 13 percent recycling rate currently.
- If there are operation problems or local community complaints involving landfills the EPA steps in. The regional office will inspect and make a decision on closing.
- There are currently ordering five landfill closings.
- Closings are based on environmental harm and are dependent on location. Most are not built with RECRA requirements.
- Landfills are owned by individual municipalities and have a hired coordinator to work with municipality. There are very few privately owned.
- The local government runs the solid waste management.
- The RECRA law was enacted by congress and states that municipal solid waste is specifically for local governments to handle.
- The EPA administers landfill closings but does not handle fines.
- EQB = Environmental Quality Board
- The EQB handles policy, enforcement, and education.
- Enforcement is handled by the EQB under a grant from the EPA.
- A 35 percent recycling rate is based upon the amount of material that is deemed recyclable but no studies have been done and it is just a target number.
- We will look into Caguas as a possible example of good recycling program.
- The EPA has few resources and must delegate programs to the state.

Appendix F

Interview with Lourdes E. Torres Romero
Coordinadora
Programa de Reciclaje
Municipio de Comerío
Tuesday, March 27, 2007 10:00 AM

P.O. Box 1108
Comerío, Puerto Rico 00782

- How much waste is currently being produced in Comerío ?
 - ¿Cuanta basura se produce en Comerío ?
- How much of that waste is currently being recycled?
 - ¿ Cuanta de esa basura se recicla?
- Are there any recycling programs being run? How are they run?
 - ¿Existe programas de reciclaje? ¿ Como los operan?
- What are your plans regarding the landfill situation? Since landfills are being shut down and most are predicted to be closing within 5-10 years, how do you plan on managing the disposal of solid waste?
 - ¿Cual es el plan con relacion a los vertederos? Reconociendo que estos seran cerrados en los proximos 5 a 10 años. ¿ Como van a manejar desperdicio de la basura?
- How is waste management run? Are there private companies that are hired?
 - ¿Como es el manejo de la basura? ¿ Tienen compañías privadas que son contratadas?
- What efforts are you currently making to improve recycling?
 - Actualmente que esfuerzos se estan tomando para mejorar el reciclaje
- Are there any public education programs in place?
 - ¿Tiene programas de educacion al publico que se esten proveyendo?
- Have you looked into alternatives to landfills?
 - ¿Han investigado en otra alternative a los vertederos?
- How much are you paying to dispose of the solid waste?
 - ¿ Cuanto estan pagando para disponer de la basura?
- How do you pay for it? What source of funds are utilize?
 - ¿Como cubren el costo de disponer de la basura? ¿Qué fondos se utilizan?
- If there is any recycling program, what are the costs associated with it and where is the funding coming from?
 - Si hay un programa de reciclaje; ¿Cuál es el costo de este y de donde viene el fondo para el pago de este?
- What materials is the Municipality able to recycle? And why?
 - ¿Que materials se estan reciclando? y ¿Por que?

- If not program available, Have you considered beginning a recycling program to cut down on the amount of waste being deposited in the landfills?
 - Si no hay programa disponible, ha pensado en comenzar un programa de reciclaje para contra restar la cantidad que se deposita en los vertederos?
- Why do you think recycling programs have has taken so long to be implemented or fail on the Island?
 - ¿Por que cree que los programas de reciclaje han tardado tanto en implantarse en la isla? o no han funcionado
- Recognizing that the new construction is walk-ups or condominiums; What are the challenges from the Municipality to implement an effective recycling program?
 - Reconociendo que lo que se esta construyendo en PR es los apartamentos y condominios; ¿Cuáles son los retos que confronta el Municipio para establecer un programa de reciclaje adecuado?
- Have you tried to enforce recycling policies on waste management companies?
 - ¿Han tratado de imponer politicas de reciclaje a las compañías privadas?
- How much waste is being put into the illegal landfills? How do you plan on controlling these illegal dumping areas?
 - ¿Cuanta basura se esta colocando en los vertederos clandestinos? ¿Hay un plan para controlarlo?
- Have you looked into building a recycling plant in Naguabo?
 - ¿Se ha pensado en instalar una planta de reciclaje en Naguabo?
- Do you think a 35 percent recycling rate is sufficient? Is it feasible?
 - ¿Piensa usted que un 35 de reciclaje es suficiente? ¿Se puede obtener?

Interview Summary

- There are 4,934 yards of waste produced in Comerío each month.
- There are 59,208 yards of waste produced in Comerío each year.
- $(2,936,290)/.68 = 4,318,073.5$ lbs of waste produced each year.
- Comerío has a 68 percent recycling rate.
- Each school, business, and home has recycle bins to place recyclables in.
- There are no private companies doing waste management in Comerío.
- They will be obtaining two compactors in the near future that will allow them to minimize the number of trips to the landfill. Also, they will be getting two new trucks.
- There are sixteen schools in Comerío and all contain a recycling program. Also, there is an orientation held at their office for education on recycling.
- It costs \$5.75 to dispose of one yard of waste and \$215 to take the truck to the landfill.
- $59,208 \text{ yards} * \$5.75 = \$340,000 * 68\% = \$231,503$ saved from recycling a year.
- She said she takes about 3 trucks a week. This is one hundred fifty-six a year.
- It costs \$215 to take truck to landfill. That is \$33,540 a year just to take trucks to the landfills.
- Total savings from recycling last year was approximately \$265,000.

- These savings will be increased further with the new compactors.
- They receive their funding from the municipality and the money they receive from recycling becomes company money.
- Glass: \$50 / ton
- Paper: \$20-\$35 / ton
- Aluminum: \$50 / ton
- News Paper: \$20/ ton
- Compost is given to farmers in Comerío.
- There is a lack of commitment from the municipalities.
- There was only one major illegal landfill in Comerío and they have been able to resolve the problem by finding who was dumping there.
- They have not looked into building a recycling plant in Comerío .

Appendix G

Interview with Emmanuel Rodriguez
Mechanical Engineer
Rubber Recycling and Manufacturing, Inc. (REMA)

Tuesday, April 10, 2007

- How many tires does REMA process a day? Or Year?
- Does REMA collect tires from the community or are the tires brought to them through another company?
- Does REMA receive tires for free or is there a cost for whoever brings them to REMA?
- How are tires collected by REMA?
- How much does it cost your customers to purchase the different types of crumb rubber produced from the tires?
- Does REMA receive any benefits from the municipality for the amount of space that they save in landfills? If so, how much? If not, has the company ever thought to ask?
- What is REMA's overall profit year-to-year?
- How many employees currently work at REMA?

Interview Summary

- REMA processes 10,000 tires per day; this is approximately 2.6 million tires each year.
- It is relatively inexpensive to run the plant from day to day as long as nothing breaks down. They could not give us an exact number.
- REMA is a company that was set up by the government of Puerto Rico.
- REMA does not do any pick up service for communities. Companies from all over the Island bring all the tires to REMA. They will also accept tires from any Puerto Rican residents that bring their tires to their facilities.
- REMA receives the tires for free and does not charge companies or residents for drop off.
- Crumb rubber produced from the tires is offered to customers on average at about seven cents per pound.
- REMA does not receive any benefits from the municipality for the amount of space that they save landfills. The company has never thought to ask the municipality for any benefits.
- REMA could not provide us with the information on their year-to-year profits.
- Currently there are twenty-three administrative employees at REMA.

- There is approximately one tire per person thrown away each year. However, in Puerto Rico, there are actually more cars than people so this means that there is closer to five million tires thrown away each year.
- It takes five hundred years for a tire to decompose in a landfill.
- There is an additional cost of \$1.65 added to the price of each tire when purchased by the customer for the cost to recycle that tire.
- REMA does not export any of its rubber.
- The recycled tires are used to construct:
 - Speed Bumps
 - Bases for some road side markers
 - Car barrier for parking lots
 - Used to fill in Turf on athletic fields
 - Can be mixed with concrete to make it stronger
 - Can be used to make stronger asphalt for roads

Appendix H

Interview with Guillermo Tous

CEO of IFCO

Tuesday, April 10, 2007

- How much plastic, glass, cardboard, etc, does IFCO process a day? Or Year?
- How are recyclable materials collected by IFCO?
- Does IFCO collect these recyclables directly from the community or are they brought from other companies?
- Does IFCO collect the recyclable materials for free or even pay whoever brings the materials to the plant?
- Does IFCO fully recycle all of the materials it collects?
- What happens to those materials that are not fully recycled here?
- What happens to those materials that are fully recycled here?
- Does IFCO receive any benefits from the municipality for the amount of space that they save in landfills? If so, how much? If not, has the company ever thought to ask?
- What is IFCO's overall profit year-to-year?
- How many employees currently work at IFCO?

Interview Summary

- IFCO processes five hundred tons of recyclable goods a day. This is approximately 20,000 tons per year.
- They pick up all of the recycled materials with their trucks from companies on the Island.
- They pick up the materials directly; however, they do not do any community pick-ups. It is strictly from companies.
- They used to pick up materials for free, but now there is a monthly fee for each of the companies that they pick up from.
- 98 percent of the materials they receive are recycled.
- The remaining 2 percent is taken to landfills.
- The majority is shipped overseas to Southeast Asia, some to Spain, and some to other European countries. It is not staying in Puerto Rico.
- IFCO does not receive any benefits from Municipalities.
- IFCO could not tell their yearly profit.
- There are currently one hundred ten employees working at IFCO.
- The plant is open and recycling twenty-four hours a day; however, it only receives 60 percent of the recyclables it could be processing.
- IFCO feels the problem with recycling lies with finding a way to collect all the materials, not with producing more recycling plants.

Appendix I

Interview questions for Condominiums

1. Condo Name: Ponorme Plaza

Location: El Senorid, Rio Piedras

2. Condo Name: Condominio Plaza Iunaculoda 1 and 2

Location: 1717 Sonturce, San Juan

Condo Association Interview Questions

Basic Information

- Nombre del Condominio (Name of Condominium):
- Dirección (Location):
- Número de unidades de vivienda (Number of Units):
- Que porcentaje es de alquiler vs. dueños (What percentage is owner occupied vs. renters):

Questions:

- ¿Cual es el nombre de la compañía que les recoje la basura?
 - What is the name of the trash company that currently picks up your trash?
- ¿Como se selecciono esta compañía?
 - How did you select this company?
- ¿Cuantas veces a la semana se recoje la basura?
 - How often is trash collected?
- ¿Como se desasen los residents de la basura?
 - How do the residents of the building have to dispose of their trash?
- ¿Tiene safacones en cada piso o tienen un contenedor grande en un area central del condominio?
 - Is there a bin on each floor or one large dumpster in a central location?
- ¿Cuantos contenedores tiene el condominio?
 - How many dumpsters does the building have for trash collection?
 - ¿Cual es el costo de remover la basura del edificio?
 - How much does waste removal cost for the entire building?
- ¿Como se cubre este gasto?
 - How is this paid for?
- ¿Que porcentaje representa este costo del presupuesto del condominio?
 - What percentage of the budget is trash collection?

- ¿Que porcentaje del mantenimiento del condominio? (En algunos condominios esto se cubre con otros ingresos como el alquiler de los techos para anuncios o antenas de omunicaciones)
 - What percentage of the condo fee is trash collection? (In some condominiums the condo association may bring some additional income by renting the air ways to signing companies or telecommunication)
- ¿Tiene el condominio algun tipo de reciclaje?
 - Is there any recycling in the building?
- ¿Ha pensado en el reciclaje para disminuir el costo del recojido de basura?
 - Have you considered recycling to cut back on the cost for trash pick up?
- ¿Consideraria usted un programa de reciclaje paralelo a su recojido de basura?
 - Would you be willing to try a recycling program in parallel with your trash pick up program?

Appendix J

Interview with Reynyer Cordova
Recycling Coordinator
Municipality of Guaynabo
Puerto Rico Waste Industries Corp.
Friday, April 20, 2007

- How much waste is currently being produced in Guaynabo?
 - ¿Cuanta basura se produce en Guaynabo?
- How much of that waste is currently being recycled?
 - ¿Cuanta de esa basura se recicla?
- Are there any recycling programs being run? How are they run?
 - ¿Existe programas de reciclaje? ¿Como los operan?
- What successes has Guaynabo had with recycling?
 - ¿Qué tipos de éxitos tienen Guaynabo tenía con reciclaje?
- What hardships has Guaynabo had with recycling?
 - ¿Qué tipo de dificultades tienen Guaynabo tenía con el reciclaje?
- What are your plans regarding the landfill situation? Since landfills are being shut down and most are predicted to be closing within five to ten years, how do you plan on managing the disposal of solid waste?
 - ¿Cual es el plan con relacion a los vertederos? Reconociendo que estos seran cerrados en los proximos cinco a diez años. ¿ Como van a manejar desperdicio de la basura?
- How is waste management run? Are there private companies that are hired?
 - ¿Como es el manejo de la basura? ¿ Tienen compañías privadas que son contratadas?
- What efforts are you currently making to improve recycling?
 - Actualmente que esfuerzos se estan tomando para mejorar el reciclaje
- Are there any public education programs in place?
 - ¿Tiene programas de educacion al publico que se esten proveyendo?
- Have you looked into alternatives to landfills?
 - ¿Han investigado en otra alternative a los vertederos?
- How much are you paying to dispose of the solid waste?
 - ¿ Cuanto estan pagando para disponer de la basura?
- How do you pay for it? What source of funds are utilized?
 - ¿Como cubren el costo de disponer de la basura? ¿Qué fondos se utilizan?
- What are the costs associated with the current recycling program and where is the funding coming from?
 - Si hay un programa de reciclaje; ¿Cuál es el costo de este y de donde viene el fondo para el pago de este?
- What materials is the Municipality able to recycle? And why?
 - ¿Que materials se estan reciclando? y ¿Por que?
- Why do you think recycling programs have taken so long to be implemented on the Island? And why are they failing?

- ¿Por que cree que los programas de reciclaje han tardado tanto en implantarse en la isla? o no han funcionado
- Recognizing that the new construction is walk-ups or condominiums; What are the challenges from the Municipality to implement an effective recycling program?
 - Reconociendo que lo que se esta construyendo en PR es los apartamentos y condominios; ¿Cuáles son los retos que confronta el Municipio para establecer un programa de reciclaje adecuado?
- Are there any recycling programs for condominiums and walk-ups in Guaynabo? If so, how are they run? If not, why?
 - ¿Hay cualquier programas de reciclaje para apartamentos y condominios? Si sí, ¿como los operan? Si no, ¿porque?
- Have you tried to enforce recycling policies on waste management companies?
 - ¿Han tratado de imponer politicas de reciclaje a las compañías privadas?
- How much waste is being put into the illegal landfills? How do you plan on controlling these illegal dumping areas?
 - ¿Cuanta basura se esta colocando en los vertederos clandestinos? ¿Hay un plan para controlarlo?
- Have you looked into building a recycling plant in Guaynabo?
 - ¿Se ha pensado en instalar una planta de reciclaje en Guaynabo?
- Do you think a 35 percent recycling rate is sufficient? Is it feasible?
 - ¿Piensa usted que un 35% de reciclaje es suficiente? ¿Se puede obtener?

Interview Summary

- Guaynabo is producing on average between one hundred forty and one hundred fifty-six tons of trash per day.
- They are recycling forty-five to fifty tons of trash per day, which means they have a recycling rate of approximately 32 percent.
- 90 percent of the residents have the option of an available recycling service.
- There are twenty-one condominiums in Guaynabo that have a recycling program.
 - The program in the condos is: there are two bins for trash and two bins for recyclable material (same type of bins for both). There is no cost for the residents to have the recycle bins picked up and there is a cost of \$64 each time one of the trash bins is picked up. Pick-ups are done two to three times per week.
- Guaynabo has been successful with providing the community with the proper services for recycling; however, they have not been able to successfully get all of the community to recycle.
- The Guaynabo landfill is scheduled to close within five months. The waste will then be brought to the landfill in Fajardo, which will greatly increase the cost of waste disposal because of the extra commuting between the municipality and the landfill in Fajardo.
- Guaynabo has two front loader trucks to pick up recyclables from condos, seven recycling trucks, and seven trucks for waste.

- There are education programs in the schools. They currently have a program with one of the universities that has sixty students each year work on ways to improve recycling in the municipality.
- There is going to be a new city ordinance going into effect in May (Number 37), which will require citizens to recycle. If recyclable goods are found in their waste bins they will be fined. This same ordinance also requires all condominiums to have a recycling plan that they must present to the Department of Recycling, article 5ta.
- There are twenty-two employees at the recycling plant and a total of two hundred twenty in the Department of Recycling for the municipality.
- They receive what are known as CBDG dollars from the government to fund the recycling program. Also, they get to keep half of the profit collected from recycling. The other half is given to the municipality.
- In 2006 Guaynabo was able to raise \$487,997 from recycling.
- Of the recycled material, newspapers make up approximately 64 percent.
- They sell their recyclables to IFCO, which also means that most of their recycled material is not staying on the Island.
- IFCO pays them fifteen cents/pound for newspapers;
- The bins used for pick up cost:
 - eight- yards \$1,800
 - six- yards \$1,400
 - three- yards \$1,200
- The recycling plant could process between fifty to sixty tons per day.
- It is currently processing between forty-five to fifty tons per day, 75 percent-100 percent of the capacity per day.

Appendix K

Condominium Results
April 23, 2007

Condo Name: Ponorme Plaza
Location: El Senorid, Rio Piedras
Number of Units: 197
Percentage Occupied by owners: 68 percent

- BFI is the company that picks up the condo's garbage.
- BFI was selected through proposals.
- Garbage is picked up three times per week.
- Each floor has its own trash can and staff from the condo will pick up each floors trash to bring to the dumpster.
- There is one eight- yard dumpster.
- They pay \$650 per month for trash removal.
- Condo fees assessed to each resident pay for the monthly bill.
- 4.12 percent of the budget is allocated to trash collection.
- There is newspaper and milk container recycling available in the condo.
- The condo has considered recycling to cut back on the amount of trash pick up.
- The current recycling program saves \$125 per month.

Condo Name: Condominio Plaza Iunaculoda 1 and 2
Location: 1717 Sonturce, San Juan
Number of Units: 192
Percentage Occupied by owners: 90 percent

- BFI is the company that picks up their garbage.
- BFI picks up the trash three times per week.
- Each floor has its own can for trash and the daily staff picks it up from each floor and brings it to the dumpster.
- They have four containers which are six- yard containers.
- They pay \$1,100 per month with an additional \$200 rental fee for a total of \$1,300 each month for trash removal.
- 3.62 percent of the budget is allocated for trash collection.
- There is no recycling in the building.
- They have not considered recycling as a way to reduce the cost of trash pick up.
- They would be willing to have a recycling program in parallel with trash pick up.

Appendix L

Municipalities

Añasco, Barranquitas, Cayey, Culebra, Hormigueros, Isabela, Jayuya, Juncos, Moca, Santa Isabel and Vieques each have a landfill located within their municipality. Each municipality's local Department of Public Works runs its own landfill. These eleven landfills provide disposal of waste for the surrounding twenty-two municipalities.

Landfill Technologies

Landfill Technologies is a local subcontract company that maintains the disposal of waste in nine local landfills (Aguadilla, Arecibo, Cabo Rojo, Carolina, Fajardo, Guaynabo, Toa Alta, Toa Baja and Yabucoa). These nine landfills provide waste disposal for the surrounding twenty-eight municipalities.

Waste Management

Humacao, Mayagüez and Peñuelas have landfills that are maintained by Waste Management. Waste Management is a widely known waste disposal service throughout the United States. These three landfills provide disposal for the surrounding five municipalities. Peñuelas is an industrial waste landfill and is only used by private industry and is not counted as a public waste disposal landfill. However, the Peñuelas landfill will be expanding and open to the surrounding municipalities in the next ten years.

BFI

Ponce and Salinas have landfills that are maintained by BFI. BFI, like Waste Management, is a widely known waste disposal service in the United States. These two landfills provide disposal of waste for the surrounding five municipalities.

AR Waste Disposal

The Vega Baja landfill is maintained by the AR Waste Disposal Company. The landfill provides disposal services for the surrounding four municipalities. The company charges \$7.75 for every cubic yard of waste.

Carlos Rental Equipment

The Guayama landfill is maintained by the Carlos Rental Equipment Company. The company services the Guayama landfill only. The company charges \$7.35 for every cubic yard of waste.

L & M Waste

Arroyo, Juana Diaz, and Yauco landfills are maintained by the L & M Waste Company. The company services the surrounding eleven landfills.

Prime Inc.

The Lajas landfill is maintained by the Prime Inc. Company. The company services the Lajas landfill only. The company charges \$6.00 for every cubic yard of waste.

Waste Disposal Management

The Florida landfill is maintained by the Waste Disposal Management Company. The company services the Florida landfill only. The company charges \$7.00 for every cubic yard of waste.

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