

Enhancing Urban Sustainability in Clearwater, Florida



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Introduction

In the summer of 2007, I was contacted by members of the Clearwater Environmental Advisory Board (EAB) to ascertain whether or not there was any interest on the part of the Department of Geography and the Environmental Science and Policy Program to partner on a review of how Clearwater can move ahead in green initiatives. The Board brought to my attention the Mayor's commitment to the Governor's initiative on climate change, the Council of Mayor's statement on climate protection, and the city's overall strong record on environmental issues, particularly storm water.

The timing was perfect. The University of South Florida was recently ranked as one of eight public universities in the United States by the Carnegie Foundation as "Engaged" with its community. Our Department, which includes Geography, Environmental Science and Policy, and Urban and Regional Planning undergraduate and graduate programs, is very active with community projects. Thus, this project is a perfect example of the type of partnerships that can exist between a university and a community.

I want to stress the importance of this project to the future of Florida. Our state is at a crossroads. The impacts of climate change are already being felt around the world. With much of our state at risk from sea level rise, we need to pay close attention to how we can make our state more sustainable.

In this technical report, you will find the work completed by thirteen graduate students over the course of one semester who were given the task of looking at Clearwater within the context of urban sustainability. Each student prepared three proposals for research that were shared with the EAB and some city employees for review. Comments were returned to me for review and I selected one project for each student.

The final reports of their work are divided into four sections. Part I focuses on where the City is in its green initiatives. Three of these four papers examine what the city has done, what needs to be done to achieve 'green city' status, and on the ideas of stakeholders. The fourth paper focuses on sustainability education within the city. The student who wrote this report also produced six short sustainability videos that will be seen on Seaview, Clearwater's public education channel.

Part II focuses on innovative new sustainability projects the city could undertake to move forward as a green city. Many cities across the country have done amazing things with urban sustainability and these projects provide some ideas for city leaders. Students examined the development of a solar energy park, innovative approaches to manage sewage, the development of community gardens, and an adopt-a pond program to promote storm water and ecosystem improvement.

Part III focuses on a perennial problem in urban sustainability—transportation. In this section, one paper examines various electronic car fleet alternatives, including low speed vehicles and hybrids; another paper examines how to reduce the amount of carbon

produced to get tourists from airports to the beaches; and the final paper focuses on how Clearwater can reduce cars in tourist areas through a bike rental program.

Finally, Part IV examines energy reduction and green buildings. One paper examines the City's use of electricity and programs that can be used to reduce energy consumption through an energy management system and the other paper looks at green buildings.

Each student was restricted in the amount they could write in this report (ten pages). So, you will see as you read through each report that there are referrals to appendices. I can assure you that the appendices provide a tremendous amount of bibliographic information and many valuable resources. If you received a paper copy of this report, the appendices and bibliographic materials are in the attached CD.

I am grateful for the opportunity to work with the City of Clearwater on this project. I am especially grateful for the assistance of so many city workers, citizens, and stakeholders. I want to thank the members of the City's Environmental Advisory Board for their advice and assistance on many aspects of this project. I particularly want to thank Mr. Ed Chesney, the City's Environmental Manager.

In closing, it is truly an inspiration to work with so many people in the city who believe in moving forward on urban sustainability. Clearwater can be a national leader in this area and I hope that this report is the start of a long-term partnership between the City of Clearwater and the University of South Florida.

Robert Brinkmann, Ph.D.
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Part I Green City Initiatives

Chapter 1

Inventorying the Sustainable Initiatives of City of Clearwater

Naimish Upadhyay

Executive Summary

The City of Clearwater has embarked on a journey to becoming a sustainable, ‘green’ city. At this point in time, it is of prime importance for the City and the community as a whole to know where they stand regarding their sustainable performance, and decide what they need to achieve in the future. Creating a comprehensive inventory of all sustainable initiatives undertaken by the City to date is the first step in this direction. Carrying out such an exercise has multiple benefits: the results help identify successes, shortcomings and possibilities for improvement. Additionally, an inventory will help the City move forward with the application procedure for the Florida Green Building Coalition, Inc.’s ‘Green City Certification’ and can serve as basis for a long term sustainability strategy for the future. The aim of this paper is to initialize the inventory process and outline its design and implementation stages. The paper also includes initial results from the cursory survey, points out some potential barriers to achieving the goals of sustainable development, and provides recommendations for the future.

Background and Project Overview

The concept of sustainability has become a key idea in national and international discussions following publication of the Brundtland Report by the World Commission on Environment and Development in 1987. It envisaged sustainable development as a means by which the global system would satisfy “the needs of the present without compromising the ability of future generations to meet their own needs” (Eaton and

others, 2007). More recently, sustainability has been the subject of renewed interest and debate in the context of the 2002 World Summit on Sustainable Development in Johannesburg, where the strapline “People, Planet, Prosperity” was adopted to reflect the requirement that sustainable development implies the balancing of economic and social development with environmental protection (Eaton and others, 2007). For the first time in history, there are as many people living in urban areas as outside of them and predictions by the United Nations estimate that by 2030 over 60% of all people will live in cities (UNCHS, 2001). Cities are also consuming three-quarters of the world's energy and causing three-quarters of global pollution (Rogers, 1998). Central to the sustainability debate must therefore be the increasing domination of cities and their hinterland regions (Egger, 2006).

In the absence of federal direction, states and cities across the United States are taking environmental stewardship into their own hands and undertaking many sustainable initiatives. One of the major initiatives is the U.S. Council of Mayors’ Climate Protection Agreement, which has been signed by six hundred mayors across the nation as of July 2007 (including the Mayor of Clearwater, Florida) and is the only climate protection agreement of its kind in this country (The United States Conference of Mayors, 2007). Furthermore, the Governor of the State of Florida has taken frontline position in the green movement by passing various executive orders addressing the problem of greenhouse gas emissions and global climate change (Governor of the State of Florida: Executive Orders Archives, 2007). Against this backdrop, the City of Clearwater, hereafter referred to as ‘the City’, has committed to strive for sustainability and address many issues associated with the U.S. Council of Mayors’ Climate Protection Agreement.

This project focuses on planning and implementing an inventory of all the sustainable initiatives undertaken by the City thus far. The entire work is done in context of the Governor's Executive Orders on climate change and the Mayor's commitments, with the Florida Green Building Coalition, Inc.'s, (FGBC) Green City Certification Application Tool being used as a guideline for inventory (Florida Green Building Coalition, undated). The work will proceed in collaboration with two other distinct projects: developing a Stakeholder Engagement Plan and the initial application work for FGBC's Green City Certification.

Sustainability Plan Development

A brief review of the sustainability path adopted by some of the more popular 'Green Cities' in the U.S. show that many have developed a well-defined strategy document at the onset of their efforts. Such a 'Roadmap to Sustainability' typically includes defining sustainability within the context of the city, their achievements so far, future goals and objectives with specific time-frames, strategies to meet these goals and means to evaluate their performance. The City of Clearwater has already undertaken multiple sustainability initiatives during the past few years across various administrative departments. Creating an inventory is not only a good stock-taking exercise at this juncture, but will also help the City recognize their achievements and design future strategies.

This inventory project was accomplished through accessing existing City databases and collecting pertinent information from various City departments. Some of the data is available on the official City website, but the majority if it was collected by means of department-specific questionnaires (see Appendix A). These questionnaires ask

for inputs on current and past sustainable practices, suggestions on potential actions and on ways to ‘green’ existing programs. The joint survey with two other projects also included department-specific checklists of ‘Green Initiatives’ as prescribed by the FGBC as well as a section for listing any external (non-City) stakeholders that might want to be involved in the process. The City departments were requested to supply relevant documentation in support to their claims on the surveys. Though outside the scope of this project, the data so obtained should be compiled into a single city-wide database and analyzed to gauge overall performance. An important finding would be the extent to which the City fulfills the FGBC criteria, and what more needs to be done in order to qualify for the Green City designation.

Sustainability Plan Implementation

The first step in the inventory process was to study the City government, its structure and various divisions/departments in order to get familiar with the administrative system and to design the surveys appropriately. The next step was preparing the survey, which contained detailed questionnaires for sixteen city divisions: Development and Neighborhood Services, Economic Development and Housing, Engineering (Environmental and Stormwater Management), Engineering (specifically related to Jolley Trolley), Fire Rescue and Police, Human Resources, Marine and Aviation, Parks and Recreation, Moccasin Lake Environmental Education Center, Planning, Public Communications, Public Services, Public Utilities, Solid Waste, Office of City Manager/Department Heads and Clearwater Gas Company. The FGBC’s criteria for Green City Certification were assimilated into these questionnaires. Care was taken to keep the survey format user-friendly and easy to understand, thereby requiring precise,

short answers in order to limit the respondents' time and assist with data integration. Thereafter, all the questionnaires were combined into a single document and sent electronically to the City Manager for distribution to individual departments. The expectation was that the questionnaires would be answered quickly and efficiently if distributed via the top-down official route. The respondents were given a week's time to return completed questionnaires owing to the time constraint imposed by the project completion deadline.

The time constraint imposed by the project deadline was a major barrier. Even though the project schedule allowed for proper design and dissemination of the questionnaires, there was not enough time to allow City personnel to respond. Therefore, the lack of responses limited the analysis of the data.

A major incentive for moving ahead with the remainder of the survey is that the creation of such an inventory provides the groundwork needed to obtain the FGBC certification for which the City has expressed interest. The results may also bring a sense of achievement and pride among all the City stakeholders. Additionally, the inventory information can be used for marketing purposes: for example, to 'sell' Clearwater as a 'green' holiday destination to potential tourists. The inventory project requires minimal funding, since it involves only the review, documentation and summarization of past and current sustainable programs and initiatives. The only major input required is the time that designated personnel in each department would need to collect, document and furnish the required data. Among the key players in the process are the City Manager and other upper-level administrative officials who may need to coordinate the efforts. This coordination will help all those involved to maintain focus, while assisting the heads of

each department in motivating their staff to perform the critical groundwork required for a successful inventory.

Results and Future Recommendations

Out of the sixteen City divisions that were sent the questionnaires, only six responded before the project deadline. These were the Human Resources, Engineering, Police, Solid Waste/General Services, Planning and the Public Utilities departments. Some of the major sustainable programs put into practice by these departments include a reclaimed water utility, use of water conservation devices, coastal cleanup program, flood plain restoration projects, use of LED traffic lights, recycling and reuse practices, exotic and invasive species control and creation of a wetland atlas. A full list of sustainable initiatives undertaken by each of these six departments is provided in Appendix B. The performance of the departments against the sustainability criteria as prescribed by the FGBC is provided in Appendix C.

A cursory view of the data obtained so far indicates that sustainable performance varies across the departments and the initiatives that have been undertaken so far, though commendable, seem uncoordinated and random. The results also indicate that the City, as a whole, lacks a dedicated, comprehensive policy on sustainability.

The implications of this exercise go far beyond the creation of a tabulated inventory document. It can be viewed as an opportunity for the City to take stock of its accomplishments, identify their deficiencies and to assist with decisions on future policies and actions. In addition, this ground-work will help the City move ahead with the application process for the FGBC's Green City Certification. The FGBC criteria can be used as a benchmark to assess the sustainability performance of the City. Achieving the

‘Gold’ Standard is a recommended goal for the City. The next steps would be to involve all the stakeholders and create a roadmap to sustainability - defining long-term goals, objectives, strategies and evaluation methodologies. Hopefully, this present exercise will work as a catalyst in motivating the City to become a truly sustainable community.

Chapter 2

Florida Green City Certification: Initial Assessment

Sarah Schlosser-Kelly

Executive Summary

Recognition for becoming one of only nine municipalities in the State of Florida to be certified “green” by the Florida Green Building Coalition is definitely something to be proud of (“FGBC”). Through examination of current city practices and extensive communication between city departments, it was determined that the City of Clearwater currently qualifies to receive the silver level certification. This paper aims to outline the purpose and direction needed to achieve the silver level certification. The major goals of this paper are to research the current standing of the City of Clearwater relative to certification standards and provide recommendations on future courses of action.

Project Overview

The primary goal of this project was to begin the research needed to achieve the Florida Green Building Coalition’s (FGBC) Green City Certification for the City of Clearwater, hereafter referred to as ‘the City’. The project also compared the City’s current efforts with the certification standards. This certification serves to gain recognition and publicity for the city along with increased internal communication, implementation of money saving practices, and efficient risk and asset management. Those entities awarded certification are setting an example by being outstanding environmental stewards. Through the certification, the FGBC hopes, “that successful local governments will create and enforce landscape codes that help preserve natural Florida ecosystems, conserve water, create pedestrian-friendly environments, and follow green policies throughout their own organization in everything from ball field

maintenance to in-house recycling” (*Designation Standard*, pg 7). The certification can also assist local governments in quantifying their impact of implementing green practices (i.e. gallons of water saved, tons of recycled materials, tons of carbon dioxide emissions).

The FGBC is a non-profit, membership-based organization “dedicated to improving the built environment” whose mission is "to provide a statewide Green Building program with environmental and economic benefits” (“FGBC”).

One of the major goals of the Florida Green Local Government Standard (FGLGS) is to bring together entities that are looking to incorporate green solutions, to not only local issues, but also statewide issues. This type of integration provides additional opportunities to increase energy efficiency, reduce pollution, and make improvements to the environment, while increasing the local government’s operational efficiency, providing better customer service, and expanding public acceptance. Specifically for the City, the implementation of this certification may increase eco-tourism, increase water quality, reduce landfill inputs, and lower government operating costs, among many other potential benefits.

The evaluation needed for the FGLGS certification examines the following broad categories: 1) internal environmental practices, 2) ordinances and incentives that encourage sustainable practices, and 3) internal and external environmental education. The certification looks to pull from existing programs that the City may be involved in along with presenting new ideas. Existing programs within the City include the Florida Main Street Designation and Tree City USA. Certification criteria that are outside of existing City programs include the development of a local Government Water Reduction Plan and the offering of incentives to local green business.

There are seven main steps to completing the certification process. They are as follows: 1) learn about the FGLGS; 2) designate an office, department, or individual as a Project Coordinator; 3) determine what criteria apply to the local government; 4) conduct a local government assessment review in cooperation with all applicable departments; 5) compile all information from the review to determine where the local government currently stands in relation to the standard; 6) schedule an implementation meeting to outline the path to certification; 7) submit the final application and all necessary documentation to the FGBC for evaluation (*Designation Standard*, pg 4).

The assessment for receiving the certification provides 19 categories under which criteria are listed (Appendix A). The categories are as follows: Administration, Agriculture and Extension Service, Building and Development, Economic Development and Tourism, Emergency Management and Public Safety, Energy Utility, Housing and Human Services, Human Resources, Information Services, Natural Resource Management/Environmental Protection, Parks and Recreation, Planning and Zoning, Ports and Marinas, Property Appraiser/Tax Collector, Public Transportation, Public Works and Engineering, School Board, Solid Waste, and Water and Wastewater. Eliminated from further examination are the extension service, the school board, and the property appraiser/tax collector offices since they operate outside of the City and are thus not applicable to the City's application. .

From this assessment, a point total value is calculated based on the number of practices/procedures that the City is currently doing (Appendix A). The total number of points achievable for the City is 291 (also referred to as the Maximum Applicable Points), of which, 0-20% must be achieved to be "Registered" as a Green City. This

designation requires that a filed statement of intent, along with the application, state that the City intends to achieve “Silver” certification within the next three years. Additionally, any “Registered” municipality must submit an annual report indicated the progress that has been made towards achieving the certification. Achieving “Silver” certification is receiving a total of 20-40% of 291 points, “Gold” is by receiving 41-60% of the maximum applicable points, and finally, “Platinum” certification is the City attaining 61-100% of the maximum applicable points. Thorough documentation is required for all the practices for which the City claims points. The *Florida Green Building Coalition, Inc. Green Local Governments Reference Guide* (Appendix B) provides examples of appropriate documentation.

Results of the Initial Assessment

This section of the paper, divided into the seventeen (17) categories by which examination of the City is performed, aims to determine where they currently stand in relation to the certification criteria. See the certification application in Appendix A for the list of the questions asked of each department.

Administration- In this category, only data applicable to the Planning Department were received, from which, four (4) out of fifty-nine (59) possible points (7%) were obtained by the provision of green building education to government staff and the maintenance of a group to coordinate current and future green activities.

Building and Development- Of a possible thirty-nine (39) points, only four (4) were obtained (10.3%) in this category. The City receiving one (1) point for each of the following: requiring mitigation of wetland habitats, enactment/enforcement of a tree

preservation/land-clearing ordinance, enactment of a landscaping ordinance for new construction, and the enactment of a septic system replacement ordinance.

Economic Development and Tourism- In this section, only data applicable to the Planning Department were received. Of a possible nine (9) points, two (2) points (22.2%) were received for obtaining the Florida Main Street designation and the development of a historic preservation ordinance.

Emergency Management and Public Safety- Of an applicable twelve (12) points, six (6) were received (50%), with two (2) points attributed to the use of green fleets.

Energy Utility (Clearwater Gas) – While no responses were received from this department, according to the City’s website, utility customers can pay their bill online. One (1) point was applied to the application for offering this service. Another point for their use of recycled bill envelopes gets this category 11.1% of the maximum applicable points.

Housing and Human Services- No responses were received. Under the assumption that no actions are being taken, zero (0) points were obtained in this section of the application.

Human Resources- Of a possible nine (9) points, only one (1) point was received (11.1%), which was for giving away re-usable water bottles during the Employee Health Fair.

Information Services- Replies for two of the seven questions were received in this section. Two (2) points for the development of environmental education on the City’s website/local television station and the enactment of local government policy requiring

that computers/ancillary equipment are off when not in use for a total of 28.6% of the maximum applicable points.

Natural Resource Management/Environmental Protection- Of the fifteen (15) points applicable in this category, thirteen (13) points (86.7%) were obtained. These points were achieved by a variety of activities including implementation of plans to remove exotic/nuisance species in public lands, maintaining membership with the Florida Local Environmental Resource Agencies, Inc. (FLERA), and the enactment of car wash standards.

Parks and Recreation- This department did not provide any responses, but according to the Blue Wave Campaign website, Clearwater maintains two Blue Wave Certified beaches, Clearwater City Beach and Sand Key Park Beach. For each Blue Wave beach, one (1) point is obtained, for a total of two (2) points (12.5%) in this category.

Planning and Zoning- Out of a possible fourteen (14) points, four (4) were obtained (28.6%). These points were for maintaining a pedestrian/bicycle coordinator on staff, encouraging mixed-use development, maintaining/reducing net impervious surface area, and the organization of green building seminars/training for staff and elected officials.

Ports and Marinas- No responses were received for this category, but according to the Florida Clean Marina website, the Clearwater Municipal Marina has been under this designation since 2000. For this, one (1) point was obtained, 25% of the maximum applicable points in this category.

Public Transportation – Even though the public transit system in the Clearwater area operates through Pinellas County, there are items within the public transportation category that apply to the City. These include the institution of bicycle and carpool commuter assistant programs. No information was received regarding these items; therefore, no points were obtained in this category.

Public Works and Engineering- A total of twenty-one (21) points were applicable to this section. Nine (9) points (42.9%) were received for practices including the use of LED traffic lights, street sweeping, and maintaining a certified arborist on the City staff.

Solid Waste- Out of a possible fifteen (15) points, eight (8) were received (53.3%). These points were obtained through various procedures including the development of a disaster management plan, provision of curbside recycling, and city wide chemical/hazardous waste collection.

Water and Wastewater- Out of a possible eighteen (18) points, nine (9) were received (50%). These points were obtained through a variety of activities including creation of a reclaimed water infrastructure system, the conduction of energy audits at treatment facilities, the water use rate structure being based on consumption, and implementation of low flow fixture rebates.

Overall, the City appears to be in good standing to receive the “Silver” FGLGS certification, achieving 67 of the 291 Maximum Applicable Points (23%) with their current use of green strategies. This is not the final standing of the City, being based only on the information received in the limited timeframe imposed by this project. Therefore, if this assessment is followed up with further research and there is increased city

department involvement more points may be received with the City's current sustainable activities.

Recommendations

If the City decides that they would prefer not to do any additional research and are happy with their standing as determined by this project, the City can submit the pre-application form (Appendix C) along with the minimum required deposit of \$500. Upon submittal, a coordinator from the FGBC will be assigned to the City for assistance with the final application process and questions during the compilation of the data required for submittal with the application. The *Florida Green Building Coalition, Inc. Green Local Governments Reference Guide* (Appendix B) provides suggestions for the type of documentation needed for each strategy for which points are claimed. Once this information is compiled and the final application form (Appendix D) is complete, it is submitted to the FGBC for a final decision on certification. This certification is good for a period of five years after which a new application must be submitted to retain certification.

If the City feels that some of their current practices deserve credit but are not touched upon in the application, they can submit a Standard Modification Form (Appendix E) along with the final application. A separate form must be submitted for each activity with an unlimited number of modification forms being allowed. The FGBC will review the form(s) and determine the amount of credit, if any, that will be awarded for the activities.

If the City of Clearwater decides that they would like to increase their rank to become a Gold Certified Local Government they will need an additional fifty-three (53)

points. Through further research into City activities and increased departmental participation, a portion of these points may be achievable through current City activities.

A total of thirty-five (35) additional points can be achieved by implementation of multiple community and staff education programs including, but not limited to, a green building awards program, use of informative billing (Clearwater Gas), posting of an air quality index on the web, hosting boating education classes, and the provision of information about alternative commuting on the web. Additional items by which certification points can be achieved are discussed in more detail in the *Florida Green Building Coalition, Inc. Green Local Governments Reference Guide* (Appendix B). The FGBC website provides invaluable information about the certification process and provides links to other websites for expended research. Furthermore, many professional journals have published articles on the topic of green cities and urban sustainability. Selections of these articles, which can be used for further research into sustainability, are presented in Appendix F. This list is by no means exhaustive.

Although the results of this initial assessment indicate that the City may qualify for the “Silver” FGLGS certification, many barriers to achieving the certification exist. Increased communication is needed between the project coordinator, the City mayor, and the departments/individuals responsible for providing the data requested. The financial and time commitments needed to complete the certification process may also prove to be barriers for success. A financial commitment from the City and possibly the community are needed for both the application fee and any new personnel that may be hired. The time required for compiling all the documentation can be extensive and, therefore, may require a City employee be dedicated to the process. The City may want to consider

hiring an upper-level intern or a temporary employee, just for this process. If the funding for such a person is unavailable, it may be possible to utilize multiple current employees by shifting their duties to allow for the time needed to complete the certification.

Additionally, it is recommended that a strict schedule be outlined and followed in order to streamline the process. Finally, a continued commitment to sustainability and maintaining the FGLGS certification are required. Since the certification is only valid for five years, the process will need to be repeated to maintain certification past the initial five years.

The information presented in this paper is more than just a means for obtaining recognition. It is a powerful tool that promotes education and awareness of sustainable practices. Only through continued communication and cooperation will the Green Local Government certification truly become a success. This is really just the beginning to a “greener” City of Clearwater and a more sustainable community.

Chapter 3

Stakeholder Engagement Report

Sandra Kling

Executive Summary

In climate policy debates, citizen involvement is necessary because the successful implementation of policy will require public consent and participation. Therefore, current decision-making on sustainability and climate policy requires the integration of stakeholder input into policy. This report presents a plan to engage key stakeholders in the City of Clearwater (Clearwater) and summarizes stakeholder engagement activities conducted to date.

Major stakeholders in Clearwater were identified and divided into two main groups: Internal and External Stakeholders. Internal stakeholders include Clearwater elected officials and government employees. External Stakeholders include residents, external government agencies, non-governmental organizations, and businesses within Clearwater.

Stakeholder engagement activities commenced in September 2007 and included conducting a focus group meeting and surveying residential citizens and business owners. Results of the focus group began to develop a vision of sustainability. The majority of the participants stated that Clearwater is moving away from sustainability in the areas of transportation, energy, the built environment, the natural environment, and food and water supplies and that Clearwater is slowly moving towards sustainability in waste management practices. Residents responding to the online surveys identified the major concerns facing Clearwater to include traffic congestion, unsustainable development, unsustainable population growth, and a lack of government response to these concerns.

Residents indicated that the best way the city can improve sustainability is to lead by example and to offer incentives to businesses and residences.

Clearwater should continue to engage both internal and external stakeholders to develop a clear vision of sustainability and an action plan that supports that vision.

Project Definition

Governmental agencies have learned the importance of involving the public in making environmental decisions (U.S. EPA, 2001; Hemmati, 2003; Durant et al, 2004; McPhail, 2002). In climate policy debates, citizen involvement is necessary because the successful implementation of policy will require public consent and participation (Kasemir, 2003). Therefore, current decision-making on sustainability and climate policy requires the integration of stakeholder input into policy.

The purpose of this stakeholder report is to present a plan to engage key stakeholders in Clearwater. The report contains a list of identified stakeholder groups in Clearwater and summarizes stakeholder engagement activities conducted to date.

Stakeholder Engagement Plan Development

In order to develop a stakeholder engagement plan, the key stakeholders affected by sustainability and climate policy were identified. Clearwater stakeholders can be divided into two main groups: Internal and External Stakeholders. Internal stakeholders include Clearwater elected officials and government employees. External Stakeholders include residents, external government agencies, non-governmental organizations, and businesses within Clearwater. The following section describes each key stakeholder group and the initial plan to engage each group.

Internal Stakeholders

Clearwater government is made up of elected officials and 24 city departments (City of Clearwater website, undated). Each department was evaluated based on their stated mission and current sustainability programs to determine their role in Clearwater's sustainability goals. All city departments and employees are considered key stakeholders in implementing citywide operational sustainability goals; however, selected departments are considered key stakeholders for specific departmental and/or community sustainability initiatives. Table 1 contains a compilation of the government departments, mission statements, and a rationale for inclusion on the stakeholder list.

As a key stakeholder group, internal stakeholders should be engaged through multiple approaches, including inventorying each department to determine current sustainability programs, surveying employees to determine their opinions regarding sustainability issues, providing educational training for employees, and conducting brainstorming sessions to determine appropriate solutions in achieving sustainability.

External Stakeholders

External stakeholders can be divided into the following key stakeholder groups: residential, non-governmental agencies, business, and external governmental agencies.

Residential

In 2006, the population of Clearwater was reported to be 107,742 residents (U.S. Census website, undated). Clearwater has been subdivided into seven regional neighborhood zones. Through the Clearwater's "Block-By-Block" Program, 56 neighborhood associations have been registered with the City. The engagement plan for residents should include multiple approaches that include online and telephone surveys,

focus group meetings, and in-depth working group meetings. Conducting preliminary focus group meetings with the neighborhood association leaders would be an appropriate first step to begin the engagement process throughout the city. In addition, public announcements and citywide online or telephone surveys would be an effective method to obtain residential input and, more importantly, to begin a dialogue with the public regarding sustainability issues.

External Governmental Agencies

Several county, regional, state, and federal government agencies could also be considered stakeholders, and a preliminary list of these agencies are identified in Table 2. These agencies are considered to be external stakeholders due to their regulatory oversight, guidance, educational mission, and funding opportunities. For example, the Pinellas Suncoast Transit Authority would be considered a key stakeholder in visioning a sustainable transportation policy. In addition, the Pinellas County School District could assist in disseminating an educational initiative. External government agencies should be invited as appropriate during the sustainability process.

Non-Governmental Organizations

Numerous non-governmental agencies (NGOs) exist in Clearwater that should be engaged during the sustainability process. Each stakeholder typically has a unique position regarding sustainability within Clearwater. An appropriate strategy to engage these groups is to hold stakeholder meetings with selected NGOs to ascertain their position, gather input on solutions, and determine if a mutual partnership would be appropriate. A preliminary listing of NGOs that serve Clearwater, including environmental, social, sectarian, and educational organizations, is included in Table 2.

Business

Clearwater has two Chambers of Commerce: the Regional Clearwater Chamber of Commerce, with over 1,700 members, and the Clearwater Beach Chamber of Commerce, with over 290 members. Engaging business should begin by inviting chamber members to complete a survey and attend stakeholder meetings. This can be accomplished by identifying major business sectors, such as restaurants, lodging, small retail stores, chain retail stores, professional services, service providers (for example, energy and fuel stations), and light industrial. Not all businesses are members of the Chamber of Commerce; therefore, additional attempts to invite participation should be made through media announcements and by referrals. A preliminary listing of business stakeholders are identified in Table 2.

Stakeholder Engagement Plan Implementation

Stakeholder engagement is required at all stages in the decision-making process. For this project, stakeholder engagement began in September 2007 and included conducting a focus group meeting, surveying, and interviewing both internal and external stakeholders. This section outlines the preliminary engagement activities conducted to date.

Internal Stakeholder Questionnaire

To begin engaging internal stakeholders (i.e., city employees), a written questionnaire was created and submitted to each department head. The questionnaire was designed to gather input on current sustainability programs, historic programs, and planned programs. In addition, each department was asked to provide input regarding potential sustainability initiatives. As of the publication of this report, only a few

departments have responded to the request. Once all the questionnaires are received, the questionnaires should be evaluated and follow-up interviews and meetings conducted. The information gathered from this phase should be summarized in a City-wide sustainability action plan.

Interview Summary

Specific organizations were identified for targeted interviewing in the previous section. As of the publication of this report, one key interview was conducted with the Pinellas County Bushnell Center for Urban Sustainability. The goal of the interview was to obtain information on Pinellas County's sustainability programs and to determine how the County and City of Clearwater could partner in future sustainability efforts. In summary, the County has experience in implementing a sustainability program and is willing to provide guidance to Clearwater. In addition, the County has suggested co-launching sustainability initiatives (e.g., green building ordinances). The interview record is included in Appendix A.

Business Survey

Anonymous online surveys were developed using www.surveymonkey.com to engage businesses in Clearwater. One online survey was emailed to businesses registered with both Chambers of Commerce. In addition, the "Innkeepers of Clearwater Beach" monthly meeting on October 17, 2007 was attended to gather stakeholder input from the hotel business sector, and the hotel group was invited to complete the hotel-specific survey. To date, one general business survey and five hotel surveys have been completed. A summary report of the completed business and hotel online surveys is included in Appendix B.

Residential Survey

An anonymous online survey was developed using www.surveymonkey.com to engage the citizens of Clearwater. The residential survey was emailed to over 100 residences identified from the neighborhood association member list and from the Clearwater's Citizens Academy Program. The purpose of the online survey was to determine residential concerns, behaviors, and future vision regarding sustainability. To date, 25 surveys have been completed. A summary report of the completed online surveys is included in Appendix B.

Focus Group Meeting

On November 7, 2007, a focus group meeting was conducted at the downtown Clearwater Library to begin a dialogue with the community regarding sustainability issues. Over 100 residents and targeted non-governmental organization representatives were invited to attend the meeting, of which 21 were present. A brief presentation on the topic of sustainability and climate change were provided to the participants, followed by a visioning exercise. A lack of a clear vision is one "blunder" that governments make in advancing sustainability (Doppelt, 2003). Participants provided their vision of a sustainable Clearwater, specifically in the following categories: transportation, energy, built environment, natural environment, food and water supply, and waste management. Participants were then asked to vote on whether they thought Clearwater is currently moving away from, stagnated, or moving towards sustainability. Participants provided a list of challenges or barriers that would affect the success of implementing a sustainability policy. Lastly, participants were asked to provide input on specific

initiatives they feel are important for Clearwater to advance. A summary report from the Focus Group meeting is included in Appendix C.

Key Findings

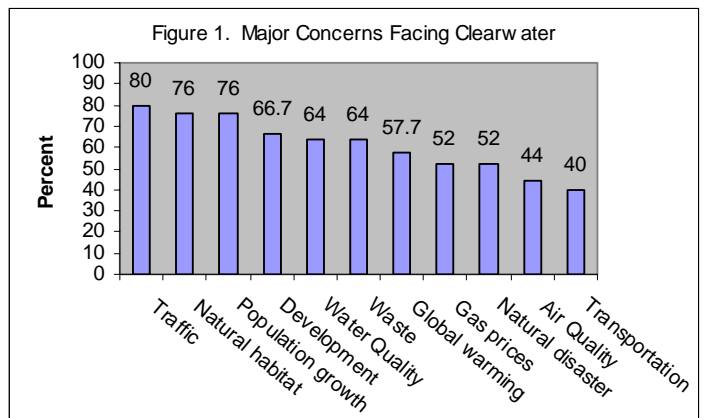
Review of online surveys indicates that participants think the three major concerns facing Clearwater are traffic congestion, a loss of natural habitat, and unsustainable population growth (Figure 1). Only two categories did not receive a majority response as a major concern, namely a lack of transportation and air quality.

When asked to rank these concerns, “loss of natural habitats” was listed most often, followed by unsustainable development and population growth. The majority of

participants in the survey agreed that neither government nor business is doing enough to address environmental issues and agreed that an environmental crisis will occur if society continues on the present course. A majority of participants

believe that the government should lead by example and offer incentives to residents and businesses to promote sustainable practices.

Focus group participants provided input on their vision of a sustainable Clearwater. The information provided is summarized below.



Category	Draft Vision of Sustainable Clearwater* (Summarized from comments gathered during meeting)
Transportation	Clearwater would have fewer automobiles and increase safe, affordable, and efficient multi-modal transportation options, to include rail, bus, bicycle, and water. The transportation system would be efficiently linked to the region.
Energy	Clearwater would utilize many clean energy sources, including solar, bio-fuels, tidal, nuclear, wind, and natural gas. Clearwater would depend less on oil and coal sources and more on clean energy, and energy efficiency would be maximized.

Category	Draft Vision of Sustainable Clearwater* (Summarized from comments gathered during meeting)
Built Environment	Clearwater would have attractive neighborhoods and commercial areas with mixed use. The built environment would use more natural construction materials that utilize natural cooling and heating.
Natural Environment	Clearwater would have more green space with more trees and natural, native habitats. Maintenance of the natural landscape will utilize organic fertilizers.
Life Support (Food and Water)	Clearwater would have more locally grown food and water. Water sources may include desalinization, rainwater, reclaimed water, and retention ponds.
Waste Management	Clearwater would have an efficient recycling system for business and residents with an emphasis on education.

*These statements were compiled for presentation purposes. The researcher recommends formalizing a Sustainability Vision during future stakeholder meetings.

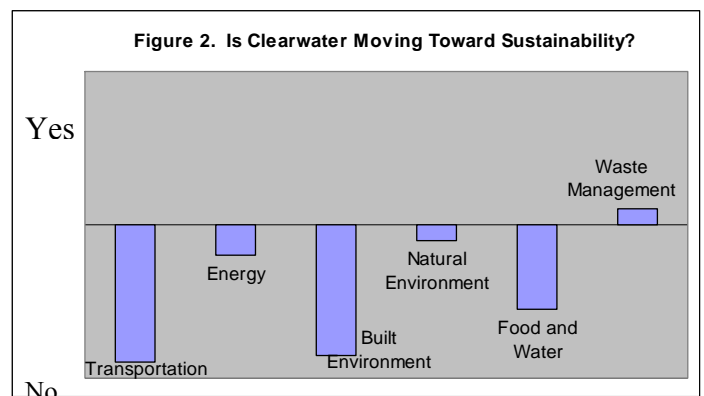
Participants voted on whether they thought Clearwater was moving away, stagnated, or moving towards sustainability. As shown in Figure 2, participants felt that Clearwater was moving away from sustainability in all categories except waste management. Transportation obtained the most votes, followed by the built environment for areas that are farthest from the vision of sustainability.

Lastly, participants were asked what barriers stand in the way of realizing the

vision. Participants' answers included greed, ignorance, over-development, unwillingness to change, and a lack of a clear written vision.

Recommendations

Based on preliminary survey data and the results from the focus group meeting, the following is recommended to continue internal and external stakeholder engagement to develop a sustainability action plan.



Internal Stakeholder Recommendations

1. Compile the remaining citywide questionnaires and upon analysis, conduct follow-up interviews and meetings.
2. Conduct anonymous on-line surveying with the purpose of measuring employee knowledge, behaviors, and opinions on a variety of sustainability issues. Anonymity would be used to encourage open and honest input from city employees.
3. Conduct initial and follow-up departmental meetings as well as department heads. The purpose of the meetings would be to develop a sustainability vision and determine appropriate actions to accomplish the vision. Working groups should meet regularly thereafter to monitor progress.
4. Summarize internal stakeholder progress into a formal report (i.e., questionnaires, surveys, and meetings). The summary of activities might be included as part of a City-wide sustainability action plan.
5. Encourage all departments and employees to provide innovative solutions to support sustainability. Ensure that all ideas are documented and analyzed. A variety of approaches would work here, including anonymous suggestion boxes and contests between departments.

External Stakeholder Recommendations

1. Conduct a statistically valid survey of residents and businesses to determine their sustainability knowledge, practices, and vision. This information should be used to calculate a baseline for which to measure progress towards sustainability. (Note: The survey conducted as part of this study was used for preliminary purposes only and is not statistically valid.)
2. Continue to interview key stakeholder groups; include non-governmental agencies, business sector groups, and external government agencies.
3. Conduct focus group meetings in each of the seven neighborhood zones to build consensus on a sustainability vision and formulate an action plan. Follow up meetings would be appropriate to monitor the effectiveness of the initiatives, as well as continue to brainstorm innovative solutions to improve sustainability.

In conclusion, Clearwater residents appear to have major concerns regarding sustainability and have indicated that society has been moving away from sustainability. Critical challenges exist as society transitions towards sustainable development, including linking policy with stakeholder participation (Swart, et al 2002). However, engaging stakeholders produces universally applicable, credible, and technically superior results in transitioning towards sustainability (Richards and Dickson, 2007).

Chapter 4

The Role of Education in the Goal of Sustainability

Barbara Stalbird

Executive Summary

The City of Clearwater and its residents are taking the first steps toward becoming a sustainable society. The consumer who selects a recycled paper product at the supermarket or who rejects a product because it is over-packaged is taking a positive step. The corporation that alters its manufacturing process to reduce waste and save energy is also taking positive action. This process of change is gathering momentum across the nation and around the world. Despite the encouraging trend toward sustainable living, however, an important fact remains: many Americans do not understand the concept of sustainable development.

Sustainability is a complex and multidimensional concept, which involves finding a balance between achieving environmental protection, economic progress, and sociopolitical equity (Wheeler and Beatley, 2006). The majority of citizens need more information about sustainability – what it is and what they can do to live more sustainably. It is possible that knowledge about solutions will grow as environmental problems continue to make news. However, the lack of knowledge could become a barrier to implementing solutions, especially if the public looks for a quick fix for issues like global warming (Curry, Ansolabehere, and Herzog, 2007). For many people, the desire to change is not the issue; they are ready to change their behavior but need the guidance and mechanisms to do so.

The City of Clearwater can use many different approaches to raise public awareness of sustainability. Lifelong education is a crucial tool for creating a common

understanding of this concept. This education should come from formal schooling, but it will also need to come from nonformal venues such as media, adult education programs, museum exhibits, conferences and workshops, and nature center programs; all of which can be initiated by the City. The goal is for citizens to become active participants in discussions about sustainable development within the City and in developing meaningful sustainable development strategies.

To begin the process of public education I have produced six short television segments for the City of Clearwater. They each highlight several ways that citizens can participate in creating a sustainable world. The information I presented is practical, easy to understand and cost effective. The topics covered include:

- ✓ Household products and energy conservation
- ✓ Native landscaping
- ✓ Transportation
- ✓ Green building
- ✓ Local food and produce
- ✓ Recycling

Project Definition

Local governments like Clearwater can be a significant catalyst of sustainability. They plan and control the very elements at stake – development, resource use, waste, energy consumption, partial regulations concerning production and land use control (Glass, 2002). They can influence sustainability because they influence the quality of life of their citizens. Furthermore, the scale of local government allows it to organize dialogue with citizens to define the values of the community.

Although previous environmental education efforts have resulted in successes, much remains to be done. A recent study conducted by the Massachusetts Institute of Technology measured public understanding of global warming. A number of questions were asked in both 2003 and 2006 regarding the source of carbon dioxide and technologies available to decrease carbon dioxide emissions into the atmosphere. In both 2003 and 2006, the average respondent answered just over half of the questions correctly. The 2006 survey did not show an increased understanding of sources of carbon dioxide or an increased awareness of the technologies available to address global warming. This suggests that the public continues to misunderstand – or are simply unaware of – some of the issues underlying action on global warming (Curry, Ansolabehere, and Herzog, 2007).

This survey, and others similar to it, reveals a significant need for increased knowledge of the environment and the ability to understand the interdependent relationships between the environment and the economy. The City of Clearwater is being proactive in its partnership with the University of South Florida to become sustainable. If they are to be successful, however, they will need the support and participation of their citizens. To obtain this, Clearwater will need an educated population who can make informed decisions. Citizens should understand that sustainable development is not an ideology or a goal, but an ongoing process; not a set of permanent answers, but a way of continually asking better questions.

Sustainable Plan Development

The President's Council on Sustainable Development identified education as an integral part of its long-term strategy for rebuilding communities and the country for the

21st century (PCSD, 1997). The City of Clearwater will need to formulate key objectives to reach the community through education efforts. Several examples of successful nonformal sustainability education efforts can be found in Appendix A. The Council on Sustainable Development recommends three objectives which underlie the goal of educating for sustainability.

First, Clearwater must ensure that awareness, knowledge, and understanding of sustainability become part of the mainstream consciousness. Also, there must be an in-depth understanding of the short and long term implications of decisions and choices. The citizens of Clearwater not only need to understand how natural systems work, they must also understand the interdependence of economic, social, political, and ecological conditions as it relates to their urban environment. Implementing the access of this information can be accomplished through various types of nonformal education. For example, Clearwater could host a sustainability series at various locations (i.e. the library, Moccasin Lake Nature Park, recreation centers). This series would highlight practical, useful information on how to change behaviors to live more sustainably. It would answer questions about what it takes to make a difference, and what citizens can do to have the biggest impact, without spending a fortune or making drastic lifestyle changes.

Secondly, a consensus must be reached through dialogue about sustainability. Dialogues must involve as many people and as many different viewpoints as possible. Stakeholders should work together to form an action agenda that is supported by the majority to ensure implementation. Continually involving new participants will widen the initial consensus. Implementation of such dialogue can range from town or neighborhood meetings to roundtable discussions, conferences and workshops, task forces, and

community and group “visioning” sessions. Electronic venues can also be used such as the internet, radio, television, feature articles, newspapers, etc.

Participants should be encouraged to visualize a sustainable world. They should be asked questions such as: What would a sustainable lifestyle be like? How can sustainability be achieved? What does a sustainable society mean? Since conditions vary from one community to another, what will be sustainable to one community may not be the best solution for another. Also, practices that are considered sustainable today may be seen as unsustainable in the future. Sustainability is a moving target, and as changes occur in technology and perspectives, our visions of a sustainable society must also change.

Lastly, the City of Clearwater must promote the skills, attitudes, motivation, and values that will redirect action to sustainable practices and produce the commitment to work individually and collectively toward a sustainable world. An understanding of the economic incentives that drive people’s decisions and the other values that affect decision making can help develop a sense of how values interact and how they can change behavior (PCSD, 1997).

Sustainable Plan Implementation

Implementation will depend largely on public outreach. Clearwater must foster in its citizens, the ability to recognize that environmental, economic, and social conditions are interconnected. Only then can a paradigm shift occur in society’s attitude toward the environment.

An effective approach to promoting sustainable practices is through a marketing and educational campaign. I have initiated this by producing 6 short video segments

about how to live more sustainably. Within each segment I gave citizens several suggestions on how to alter their everyday activities to reduce their impact on the natural environment. They provide information about:

- Ways to decrease energy consumption
- Non-toxic, environmentally friendly household products
- The benefits of native landscaping
- Ways to increase fuel efficiency and information about public transportation in Clearwater
- Where to buy local produce and why
- The benefits and objectives of green buildings
- What items to recycle and how to obtain further information on recycling

My primary objective in creating these videos was to keep the idea of sustainability in people's minds. The more often the public hears about sustainability, the more normal it will seem to them; therefore, changes that they make will not seem as drastic. Also, the more often the idea of sustainability is presented, the more likely it is to encourage a change in attitude to one of action and commitment.

Future Recommendations

Education can give people the tools, skills, and experience they need to understand, process, and use information about living sustainably. This education process must include a media campaign along with an education plan for residents, visitors, businesses, and City employees. The City of Clearwater will play an important role in empowering its citizens through media, adult education programs, conferences and workshops and nature center programs, as summarized in the table below:

Major Groups	Target Audience	Recommendations
Formal Education	Public and private K-12 St. Pete College-Clearwater campus Private Colleges	<ul style="list-style-type: none"> - Promote environmental education curriculum in schools. - Partner with local schools to advance sustainability initiatives
Nonformal Education	Residents Businesses Visitors and tourists	<ul style="list-style-type: none"> - Media campaign - Promote environmental education at parks, libraries, and nature centers - Adult education programs throughout the City - Conferences and workshops
Government	City employees	<ul style="list-style-type: none"> - Educate employees on sustainability issues through regular trainings - Train employees to take action at work - Showcase “lead-by-example” efforts to spread throughout the community

The City of Clearwater must support a media campaign to raise public awareness of sustainability, convey information on indicators of sustainable development, and encourage individuals to adopt sustainable practices in their daily lives. As indicators of sustainability are developed, the media should feature these “yardsticks” as part of their regular coverage. The Communications Department, in cooperation with nonprofit organizations, other departments and volunteers should include in their long term planning, educational efforts to reach the community through television, radio, computers, newspapers, and other printed materials. The programs should include specific examples of everyday actions that are sustainable. Easily understood information should be shared on a regular basis and it should include relevant measures to gauge societal progress towards sustainability.

The sustainability video segments developed as part of this project are a beginning step in providing these examples in easy to understand language. These videos should be used as part of a comprehensive marketing campaign to educate Clearwater’s

population. Additional efforts must be made to make this public awareness campaign successful. The video's that are already completed should be distributed to other venues (i.e. public radio). I would also recommend dedicating several interviews and stories about sustainability on the My Clearwater program. Educational publications will also be necessary. As an example, the City can provide checklists of several practical ways to contribute to a healthy Clearwater.

The City of Clearwater should utilize Moccasin Lake Nature Park as a resource for sustainability for its citizens and visitors. This was supported by the public, as evidenced by the results of the focus group meeting and preliminary surveying. The Park is already a working example of how to operate in a sustainable manner. With a little support, effort and funds it could be the headquarters of education for sustainability. The Park currently demonstrates solar energy, water conservation, native landscaping, green building, wildlife education and more. Educational information on sustainability should be exhibited throughout the Park. This would also be an ideal location for adult and youth education programs, visioning sessions, workshops, and conferences on sustainable living.

The City of Clearwater has a direct interest in educating their employees about sustainability. Employees who are trained in the principles of sustainability, for example, are in a position to slightly alter their daily habits in the workplace to conserve energy and minimize waste. One of the major goals to become certified as a Green Local Government from the Florida Green Building Coalition is to "Lead-by-example." By implementing green practices at work, the City will be in good standing with the

community for their environmental record, while at the same time reducing their economic costs.

At the community level, Clearwater would benefit from the development of partnerships among businesses, the nonprofit sector, and citizen groups to develop a shared vision for the future. A resource guide for potential partnerships has been provided in Appendix B. Educational information on sustainability has been very diverse in the past. While diversity of programs and information can be an asset, it can also be a weakness. Diversity sometimes results in duplication of efforts, lack of a shared vision, and deprivation of the strength that comes from a common voice (FFOF, 1996).

The overarching goal for the City of Clearwater is to instill the concepts of sustainability into the daily lives of their citizens. Current scientific information is more readily available than ever before. The fundamental question, however, is whether citizens will be able to understand how to use this information. Education is a tool that can ensure that technology and the capacity to use information are available to everyone.

How we meet the future is in our hands. Education about sustainability will provide Clearwater with the support and participation of their residents and visitors, enhancing the opportunity to create the future they want for a sustainable City.

Part II Innovative New Projects

Chapter 5

The Clearwater Solar Park

Margaret Embry

Executive Summary

Solar power is an important innovation used widely to provide a renewable, clean, reliable, and cost effective energy source. Aggregation of photovoltaic (PV) cells to create a PV system, or solar park, is one option available to harness energy from the sun. Solar energy is delivered free of charge as opposed to the economic and carbon costs of transporting conventional fuel. PV systems create no pollution and generate no waste products when operating. The PV modules, as explained further below, are based on a proven technology that has experienced little degradation in more than fifteen years of operation, more for a system that has no moving parts. Properly installed PV systems have the advantages of minimized periodic maintenance and unattended operation both of which reduce labor costs and travel expenses (economic and environmental). Finally, the advantages of PV systems offset their relatively high initial cost within a few years of operation. There are also state and federal incentives to help alleviate the upfront costs of installing and operating a solar park (DOE, undated).

A demonstration solar park is a viable option for the City of Clearwater to provide electricity to local homes and buildings. A PV system can be designed for easy expansion if Clearwater decides to create a solar park in phases. With a solar park operating in Clearwater, the city can become more sustainable by reducing carbon emissions drastically and having less reliance on fossil fuels. The city has a chance to become a model for other cities interested in becoming more sustainable. Through the

help of city officials, Progress Energy Florida, and other stakeholders, this project could become a reality for the city of Clearwater.

The following technical paper outlines feasibility and benefits of installing and operating a solar park in Clearwater along with resources that can be used to implement this project. The paper is organized into four sections: Project Definition, Sustainability Plan Development, Sustainability Plan Implementation, and Results and Future Recommendations.

Project Definition

Solar energy, or energy from the sun, is becoming a widespread renewable, reliable, and clean source of energy in the United States and throughout the world. Energy is harnessed from the sun through specific types of semiconducting materials exposed to sunlight which then release small amounts of electricity, a process known as the photoelectric effect. The photoelectric effect refers to the emission, or ejection, of electrons from the surface of a metal in response to light. It is the basic physical process in which a solar electric or photovoltaic (PV) cells convert sunlight to electricity. Specifically, PV cells are the basic building block of a PV system. An individual PV cell is usually quite small, typically producing about 1 or 2 watts of power. Connecting PV cells together to form larger units called modules or packs can boost the energy output of PV cells. Modules, in turn, can be connected to form even larger units called arrays, which can be interconnected to produce more power. By themselves, modules or arrays do not represent an entire PV system. Structures are needed to place the modules and arrays in orientation toward the sun, and components, including an inverter, that convert the direct-current electricity produced by modules and to alternate-current electricity.

Energy can also be stored in batteries for later use during low light days or at night. PV systems can be built with the ability to meet almost any electric power need from powering a water pump to powering a whole community through a grid-connected system (DOE, undated).

It is important to mention the effect of cloud cover on solar radiation and the energy output of a PV system as it is a common misnomer that energy cannot be produced on cloudy or low light days. While direct light, or radiation that comes straight from the sun without reflecting off of clouds, dust, the ground, or other objects, is the most efficient path to harness solar energy, diffuse light, or sunlight that is reflected off of clouds, the ground, or other objects can still produce solar radiation. Diffuse light has the slight disadvantage that it takes a longer path than a direct light ray to reach a module. With batteries in place to store energy for low light days and diffuse light still capable of creating solar radiation, cloud cover should not be an issue when producing energy from a PV system (DOE, undated).

Solar energy is an important innovation working to avoid further repercussions of climate change. Climate change has been the agenda of many city, state, and federal officials, including Florida Governor Charlie Crist. Governor Crist has recognized climate change as a problem and has since signed on to the U.S. Mayors Climate Protection Agreement. The Agreement specifically encourages the increase of the “use of clean, alternative energy by...advocating for the development of renewable energy sources...” (2005).

Clearwater can expect to see many benefits if a PV solar park project is implemented. Environmental benefits are sure to be seen, such as reduction of air

pollution, noise pollution, greenhouse gases, or hazardous waste. There is no need for liquids or gaseous fuels to be transported, further reducing pollution and the emission of greenhouse gases. Also, solar energy contributes to the nation's energy security, it helps to create jobs and strengthen the economy, it is a free and abundant energy source, and it decreases dependence on fossil fuels. Grid-connected solar energy that provides power for homes and businesses “reduces or avoids the necessity to build new transmission/distribution lines or upgrade existing ones, aids in meeting peak power needs, diversifies the range of energy sources in use and increase the reliability of the grid network, can be installed in small increments to match the load requirement of the customer, provides a potential revenue source in a diverse energy portfolio, assists in meeting renewable portfolio standards goals, and aids in off-setting or avoiding carbon emissions” (DOE, undated). The grid-connected system will allow the availability of solar energy to many in the city (depending on size of solar park) and will reduce local utility bills for businesses and residents. Also, the solar park will create an opportunity to promote education about solar energy. The park could be designed to welcome visitors and students and provide information about solar energy and PV systems.

Other communities in and outside of the United States have utilized solar energy through a solar park to provide electricity for surrounding buildings. Nellis Air Force Base in Nevada continues to construct a solar park (scheduled to be completed in December 2007) comprised of 70,000 panels over 140 acres (See Appendix A and B). This system will provide around 15 megawatts (MW) to generate thirty percent of the base's electricity needs. This park will significantly reduce the base's environmental footprint, reduce energy costs, reduce CO₂ emissions by 24,000 tons over thirty years,

and it complies with Nevada's Renewable Portfolio Standard. The reduction the base plans to see in CO₂ emissions is equivalent to removing over 186,000 cars from the road (SunPower Corp., undated).

By combining efforts to create a solar park in Clearwater with initiatives of other classmates, Clearwater could become an energy efficient and sustainable community. Some initiatives that could be considered to increase energy efficiency include Ms. Venner's energy consumption reduction plan, Mr. O'Connor's building guidelines plan-, and Mr. Noreika's reusable sludge plan at wastewater treatment facilities.

Sustainability Plan Development

As mentioned in the previous section, Clearwater can become more sustainable through the implementation of a PV solar park by reducing carbon emissions and providing a clean, renewable, abundant, and reliable energy source for businesses and residents. Clearwater could become a template for other cities committed to becoming more sustainable. This technical paper is designed to provide city officials in Clearwater with the information needed to plan, design, calculate cost and carbon dioxide reduction, and construct a solar park in Clearwater.

Since no site has been chosen for the Clearwater solar park, averages for energy output, cost, and reduction of carbon emissions are assumed. Once a site has been chosen and a technical design has been created for the solar park, the following numbers can be used to quantify the performance of each measure. Energy production from the typical solar PV array in Florida is approximately 4 kilowatt hours (kWh) / meter² (m²) / day. This means a typical solar panel covering one square meter of ground in Florida will produce 4 kWh of electricity per day. An inverter is needed for a utility-grid-connected

system and they are designed based on the electrical requirements and range in multiple capacity sizes. Typical single phase inverters can range from 1.5 kilowatts (kW) to 5 kW or more, depending on the application and design. Larger solar PV arrays can be designed for three phase applications and their capacity ranges may be much greater. The design engineer can determine the optimal installation based on cost, maintenance, and efficiency.

To illustrate this in a real world setting, Progress Energy Florida has a system that uses a 3.5 kW inverter, so it can be assumed that this size converter could be used in Clearwater. For a 3.5 kW inverter, 32.5 m² of solar panel coverage is needed assuming a ground mounted PV system takes 100 ft²/kW (could take more area depending on shading at the site). Most panels are about 1 m², so thirty-three panels would be needed. Shading occurs because the panels need to be angled up (tracking panels could also be used), therefore, more area to space the panels out is needed, around thirty percent (30%) more space than the panel area. With these calculations, land area will need to be 46.4 m² for each module. Therefore, each module will produce 130 kWh of electricity each day. To recap: one 3.5 kW inverter, thirty-three solar panels, and 46.4 m² of land area will produce 130 kWh/day based on the above parameters.

Progress Energy Florida conducted an end use metering study in 1998-1999. This research, coupled with billing data analysis, indicates the average residential customer in their service territory uses approximately 17,000 kWh / yr. Considering this average and if the system produced 130 kWh/day, then close to three houses could be powered through the system. Hopefully the system would be larger than the hypothetical scenario to power more houses and businesses. According to the Environmental Protection Agency (EPA), a PV array “with a surface area roughly the size of two football fields could produce 1000 kW of peak power” (2005). While there could be more energy produced than is needed, it is

ideal to include a backup storage system (battery) with the PV system to store power to be used during low light conditions or at night. The modules do not have to be placed together, leaving the option open for one large site or many smaller sites depending on site availability. Where the panels are placed will not affect the calculations, there just simply needs to be space.

A reasonable estimate for a typical solar PV array is \$10.00 per watt according to Progress Energy Florida. This price can vary based on the installation requirements and the size of the system. Subsidies will help support the project with a Federal tax credit of thirty percent (30%) and State rebate of \$4.00 per watt up to a total rebate of \$100,000. There are also other funding opportunities through the Department of Energy, Energy Efficiency and Renewable Energy Department, Solar Energies Technologies Program, the Environmental Protection Agency, and the Florida Department of Environmental Protection. MMA Renewable Ventures, LLC (website found in appendix), based in California, is also an option for private financing (this company financed the Nellis Air Force Base solar park). According to the EPA, “PV systems cost from \$6,000/kW to \$10,000/kW installed. The cost of a PV system depends on the system's size, equipment options and installation labor costs” (2005).

The national average of carbon dioxide (CO₂) reduction using a PV system, per the Department of Energy (DOE), is 1.53 lbs of CO₂ / kWh. The State of Florida is slightly below the national average at approximately 1.35 lbs of CO₂ / kWh. Using the 1.35 lbs CO₂ average and the hypothetical output from above, 130 kWh/day, Clearwater can expect to see a twelve ton reduction of CO₂ within the first year of operation. Assuming the system has a 20 – 25 year lifespan, Clearwater can expect to see a CO₂

reduction of 240 – 300 tons. Based on the project kW, the total project pounds or tons of CO₂ reduction can be estimated. Please keep in mind the above calculations are hypothetical.

Sustainability Plan Implementation

The first step in implementing a solar park project for Clearwater is to continue with a feasibility study, including collaboration with Progress Energy Florida or an outside contractor, contacting solar panel and inverter provider(s), evaluating available sites and assessing how many modules each site can house, and perhaps holding a stakeholder meeting to evaluate how the public is responding to this project. After a feasibility study has been completed, a site or sites needs to be chosen. With the site(s) chosen, it can be determined how many kWh/day will be produced along with the reduction in carbon emissions. The next step would be to design and build the project. This can be done with the help of Progress Energy Florida design engineers or an outside contractor, such as SunPower Corporation, and a PV system components provider. Progress Energy Florida has experience in designing, building, and operating PV arrays and is interested in collaborating on this project.

Barriers that may be encountered in the implementation phase of the project are upfront costs (economic and energy costs), installation problems, electronic equipment problems, and having the space to create a park(s) that can power many buildings. The high initial cost of a PV system is recovered through substantial fuel savings over the life of the system and lower utility bills. In terms of the energy payback time, or the time it takes for a PV system to generate the same amount of energy that it took to manufacture the system, energy is recovered in two to five years. Since a well-designed and

maintained PV system will operate for more than twenty years, and a system without moving parts will operate for close to thirty years, PV systems produce far more energy over their useful life than energy used to manufacture them. Most problems with the actual system occur because of poor or substandard system installation. Failed connections, insufficient wire size, and components not rated for the specific application are common problems associated with poor installation. The next most common cause of problems is the failure of the electronic parts, such as the controller, inverter, and protection components associated with poor installation. Batteries that store energy fail quickly if they are used outside their operating specification (DOE, undated). It appears that Clearwater has many city owned lots that could be suitable for PV arrays. This will be addressed further during the design phase.

Once a PV system is implemented and is operational, it will be important for the city of Clearwater to define goals and benchmarks to determine the success of the project. Obvious goals and benchmarks that could be established for measurement include target reduction of carbon emissions, energy output of the system and the number of buildings receiving electricity from the system. Once the assumed energy output is determined, these goals and benchmarks can be quantified.

Key roles and resources needed to continue research and implementation for this project will be through the city of Clearwater, Progress Energy Florida, and a private contractor if chosen. It will be important to keep the line of communication open with the residents of Clearwater and take into consideration their suggestions and concerns. Also, a provider for the equipment will need to be chosen. Progress Energy Florida suggests using the Florida Solar Energy Center (FSEC), the Florida Solar Energy

Industries Association (FlaSEIA), and the Florida Solar Energy Research & Education Foundation (FlaSEREF) to direct the city to a list of solar vendors (see websites in appendix).

Results and Future Recommendations

Key findings of this research indicate that Clearwater has an opportunity to build and operate an innovative and sustainable project that will provide electricity for local homes, businesses, and other buildings. Through this project, carbon emissions could be cut dramatically while Clearwater decreases their dependence on traditional fuel. This provides advantages to homeowners and business owners through lower utility costs and sets Clearwater up as a model of sustainability and innovation to other cities around the world. A PV system that is designed, installed, and maintained well will operate for more than twenty years, while the basic PV module that has no moving parts and can last more than thirty years as mentioned earlier (DOE, undated).

As mentioned in the sustainability plan implementation section, it is important to do further feasibility research, contact design engineers, equipment providers, and potential operators. Site(s) selection, energy output calculations, carbon emission reduction calculations, and number of buildings the solar park can power will all aid the city of Clearwater in its decision to implement a PV system project. If the project is implemented, the longevity of the system will provide Clearwater with a renewable energy source for years to come.

Chapter 6

The Clearwater Community Garden Initiative

Joshua Birky

Executive Summary

The idea of community gardens is not new, though the many benefits that they promote are just now being realized. Due to their role as a green space in an urban environment these gardens can bolster citywide economics by their positive effect on business, property value and tourism. These gardens also have the capability of improving the quality of water, air and soil in their area and also reducing the amount of environmental and economic damage that can be caused by pollution and storm water. Above all these gardens can have noticeable positive mental and physical health effects on all ages as well as making communities more safe and cohesive.

In order to create an effective community garden, stakeholder groups from all sectors of the community must be involved. A target group must also be identified and then catered to by choosing an appropriate location for the garden as well as the proper plot design, irrigation and maintenance features. Once the garden has been planned all legal and bylaw issues must be addressed and fundraising must be conducted with the ultimate goal of making the project at least profit neutral.

Finally we must realize that a garden is not truly a community garden unless it actually seeks to involve its community. The best way to achieve the involvement of those in the Clearwater area is to seek out possible groups that could act as resources for the garden's development and perhaps eventual expansion. If the Clearwater community as a whole can put people, resources and money behind this project, it has the potential to

spread beyond one simple location and turn into a network of community gardens that strengthen and enrich Clearwater's environment, economy and health.

Introduction

The city of Clearwater is no exception to the current trend of urbanization and currently seems to be balanced on a fulcrum where a slight push in either direction could snowball into either responsible sustainable development or typical "built-out" urbanization. In order to effectively push Clearwater towards a more sustainable future, the city should design and develop a community garden which represents and employs the ideas of sustainable development as well as fostering a spirit of community and environmental education. Rather than give a specified plan for an individual garden within the city of Clearwater, I plan instead to provide a flexible framework which can be used in the future as a resource and cornerstone to any community garden project in the city.

Why Garden?

Before we look at all the aspects that would be involved in developing a community garden in Clearwater, we should first put forth the motivation for such a project and ask ourselves "why garden?" Although there may be very obvious aesthetic and intangible reasons for developing a garden within the city there are also a number of compelling quantitative reasons in economic, environmental and health related areas. It is quite obvious that a project which can prove its economic merits will be looked upon more favorably than one which is not self sustaining. Community gardens, and more generally green spaces in an urban environment, have been proven as key components in positive economic movement. One of the main areas of community garden development

with economic implications is that of the effects of green spaces on property value.

According to numerous studies, it has been shown that an increase in the amount of urban green an area, including trees and foliage, has a significant impact on the property value of the adjacent and surrounding locations (Rodbell 1991, Altunkasa 2004).

Along with this, green spaces also act to improve the economic state of a city through ecological restoration and stabilization which improves the quality of soil, water and air and can prevent the possible costs associated with environmental degradation (Rodenburg 2002). Separate studies have also shown that urban green spaces can save money through storm water retention and purification (Giving Tree 2007). Along with all of these factors community gardens would also act to draw more citizens and tourists towards the community and thus give businesses in the area a positive push.

Obviously a patch of vibrant green growth in the middle of an urban setting has many positive environmental impacts; in fact so many that they would dwarf the scale of this report. Yet, it is still important that we quickly summarize some of the main benefits that a community garden would bring in order to show that such a project would, in fact, bring environmental progress to Clearwater. Besides the ability for a garden to mitigate pollution and regulate an ecosystem (as previously discussed) an urban green space also has the potential to increase the biodiversity of an area (Colding 2006). Basically by installing a community garden in Clearwater we would effectively be reducing water toxicity, improving soil quality, reducing flood severity, stabilizing ecosystems, improving air quality and sequestering carbon.

Though economic and environmental benefits are important byproducts of a community garden project, some of the most essential benefits come from what a garden

can do for the health of an individual and the community as a whole. For an individual gardens offer a place to get extensive physical activity and thus decrease the chance of many health problems. Along with this benefit green spaces in urban environments also offer mitigation for Attention Deficit Disorder (Fabor 2001), increases in self discipline in youth (Faber 2002), healthy mental development in children (Kuo 2004), stress relief (Wells 2003), and sustained health for the elderly (Takano 2002). From these examples we can see that the health benefits of green spaces are both universal (across all ages) and widespread (mental and physical).

Recognizing that the individuals alone are not what makes a community garden, but instead it is the interaction of these individual that are crucial, we then must evaluate the effects that such a garden would have on community health. Urban green spaces promote community health by making communities safer and giving communities a center for activity and congregation. The enhanced amount of safety comes from the fact that areas of green in urban settings have been shown to reduce crime rates (Kuo 2001), and reduce the amount of aggression individuals exhibit through the abatement of mental fatigue (Kuo 2001 (2)). Urban green spaces can also act as a place, or context, in which communities can define themselves (Sullivan 2004), and where communities can grow into vibrant healthy units (Coley 1997).

Before moving on with this report it is also worth noting that by developing a community garden in Clearwater the city would be moving one step closer to fulfilling many of its long term goals. Since one of the main movers for this project was Clearwater's involvement in the "U.S. Mayors Climate Protection Agreement" it is essential that we evaluate how the development of community gardens fulfills aspects of

this climate agreement. Primarily, this sort of green land development promotes a sustainable type of planning by preserving open space and introducing plants that will help in the sequestration of CO₂ – a main component of global warming. Less directly, a community garden will create a platform to educate citizens of the community about the importance of urban green spaces and their role in the mitigation of climate change. A community garden initiative would also fit into Florida's green local government standard. Community gardens are an important factor in a green local standard because they fulfill many of the requirements in areas such as economic and tourist development, environmental protection, parks and recreation, water and wastewater and natural resource management. Improvements in all of these areas would move Clearwater much closer to being considered a green city.

Implementation and Design

Now that we have gone over the many reasons for starting a community garden in Clearwater, it is essential that we next look at who the stakeholders would be. In other words we need to identify what groups within the community have some vested interest in a garden's development. Since a monumental amount of research has already been done by Sandra Kling on the specific stakeholders for the overall sustainability project in Clearwater, I will simply lay out some broad areas and general groups that should have an interest in a community garden project. These groups and their potential involvement in this project can be found in Appendix A.

After identifying the main groups of people who will be involved in the development and use of a community garden in Clearwater we must next briefly go over the main physical and ideological features of a community garden. The point of this

overview is to show all the possible options that the garden planners will need to consider and also to indicate what the results of these decisions may mean. Hopefully this will provide a flexible framework for the city of Clearwater to use as its base for development.

Once the decision has been made to build a community garden in Clearwater we must then come to a decision on the most basic features of the garden. The first step is finding the proper location for the garden (Appendix B). Some of the main factors in deciding on a location in Clearwater are the land's proximity to downtown Clearwater, bus routes and the Clearwater farmer's market.

After deciding on a location for the garden the next step is to figure out what size plots are desired and where they will be in relation to each other. The options in this area are pretty much endless but can be narrowed down to a few main sizes. Large individual plots (30 ft x 30 ft) are good for only the serious (commercial) growers or a large group (family) of casual growers; Medium plots (15 ft x 15 ft) are manageable for an individual with lots of spare time or an average sized family; and small plots (5 ft x 5 ft) are good for an individual or small family looking to garden as a hobby. The main principles that need to be followed are; to make sure you start small and build up and that you design the plots based on the type of prospective gardeners (Bartholomew 1981).

The idea of designing plots for prospective gardeners can also be translated into the style of the plots. One of the main examples of this would be the use of raised plot beds for the elderly and handicapped. The use of these raised beds would make gardening easier for those who have trouble bending over or getting down on their knees.

Another design style could be pre-tilled plots for young children, so that the initial aspect of growing is made easy.

Since the idea of designing for your growers has been mentioned so often we should now look at whom these potential growers are. The first option that can be explored is to create a garden that tries to cater to all groups. This sort of garden would have many different plot sizes and styles and would offer different kinds of assistance depending on the grower. This sort of garden, however, would be very resource intensive and thus may not be the best option. For this reason it may be wise to choose a certain group such as the elderly, low-income children, low-income families, schools, etc. and then base the garden features on that target group.

After developing the basic features of the community garden the next step is to make sure that the garden is able to function and become fruitful. In order for any growth to occur an efficient irrigation technique needs to be decided on in order to fit into Clearwater's climate and water availability. The most cost-effective irrigation system is a drip irrigation system because it provides water directly to the roots (Markels 2002). By also utilizing rain barrels along with a drip irrigation system a garden could become even more efficient at conserving water. However, if the construction and operation of this system is too daunting then a traditional "hose and spout" system could also work (though it would use up a good deal more water).

Besides irrigation, there are numerous other areas of garden up-keep that must be addressed such as pest control and soil quality. The proper control of these features is far too broad to address in this report but are still very important aspects of a garden. For

that reason when a garden is started the local county extension office should be contacted as well as any local resources (Appendix C).

Logistics and Challenges

With any large scale project there are always challenges that must be dealt with and the development of a community garden is no exception. Although Clearwater will almost certainly face some unique and unpredictable challenges there are a few expected areas that can be looked at prior to their occurrence. These problems will most often occur in areas dealing with legal issues and fundraising

Due to the fact that the land for this project would be city-owned many of the permit, insurance and other legal issues are made much more simplistic and thus not necessary for this report. The formation of bylaws, however, is an area of concern. A sample set of bylaws and other forms have been included in Appendix D and could be adjusted to fit the specific desires of a garden in Clearwater.

In many cases community gardens that are started without government assistance are funded out of the pockets of their members. Even though this can be considered a viable option, it is certainly not the only option. Since a project is much more appealing when it is either profit neutral or profit producing, it is important to look over ways to fund and maintain a community garden within Clearwater. The many ways of possible fundraising are laid out in Appendix E.

A key way to address all of these challenges, and gain information on community gardening in general, is by utilizing all of the resources that are available. These resources can come from the national, state and local level and I have laid out a few of these main resources in Appendix C of this report. An inventory of numerous local

groups interested in sustainability has also been compiled by Naimish Upadhyay and would be very helpful as a potential resource.

Clearwater Application

All of the information that we have discussed thus far can have a vague feel to it unless we have a direct plan of action and set of clear steps to follow. The first step will be identifying which location in Clearwater will be used and who the target audience will be. Once a location and group has been decided upon the next step is too look at local and national sources of funding and areas of local support. For Clearwater this means looking at stakeholders who have shown interest in the project such as “Natures Food Patch” in Clearwater or the downtown farmer’s market. It is also key that local educational and governmental resources are explored such as the Pinellas County extension office for advice, the Pinellas county correctional facility for labor and local colleges (USF campuses, University of Tampa, Eckerd College, etc.) for volunteer work, advice and design. Once enough public support and interest has been built it is then important to make sure that there are enough funds and materials by seeking out grants and donations from all areas, especially local growers and nurseries that are generally very generous with seed donations. After all of this has been completed the final step is to sign up members, form a community committee and produce bylaws which will govern the growth and maintenance of the gardens. Hopefully this initial project will inspire the formation of future gardens across the city that can eventually develop into an entire network of community gardens.

Chapter 7

Adopt-A-Pond

Michelle A. Harmeling

Executive Summary

Florida has had tremendous growth in the coastal areas, causing a decrease in wetlands that historically provided natural water treatment. This also led to an increase in impervious surfaces, and urban runoff. Management of stormwater has become a key issue regarding the quality of the City of Clearwater's natural resources. New rules, high rates of growth, and poor water quality have all led to improvements in stormwater management (Nisenson, 2005). Stormwater ponds which served Pinellas County previously had an Adopt-A-Pond program that was only available to unincorporated county areas, so a localized program is needed at the City level. The City has developed many capital improvement projects which primarily resulted in flood protection, but also added the benefit of stormwater quality improvement. Working with existing relationships between the City, County and citizen groups could provide the dual benefit of water quality improvement with aesthetic benefits, and community involvement with educational properties. A program with many options relating to improvements in aesthetics, education, and/or function would prove the most beneficial to a City with diverse groups that may choose to participate in the program. Keeping City costs low is of great importance to the current economy. There are many grant opportunities at the county, state, and federal level, as well as Non Governmental Organizations (NGO's) that are very interested in the improvement of the Tampa Bay watershed. The suggested program will also give the citizens of the City an opportunity to actively improve their water quality.

Project Definition

The United States Conference of Mayors has given the challenge at the city to become more sustainable through their Climate Protection Agreement. The City signed the agreement and is now examining operations for areas in need of sustainability improvements. In the 2007 Executive Order, stormwater ponds would be included in the section addressing land use and management policies that improve the long-term storage of carbon in Florida's biomass. In addition to water quality benefits, stormwater ponds also serve to provide plant establishment. According to the South West Florida Water Management District (SWFWMD):

“Stormwater contributes nine times more oxygen demanding substances to water bodies than point sources (industrial effluent discharges). Stormwater contributes approximately 80–95% of the heavy metals that reach Florida waters. Nutrient loads from stormwater runoff are comparable to those in to those in secondarily treated sewage effluent discharges. Restoration programs have demonstrated stormwater pollution can be reversed”.

Stormwater ponds offer a multitude of environmental benefits, whether they are done to minimum standards, or enhanced to their maximum potential. Their benefits from capturing sediment alone results in removal of metals, particles, organics, and the biological uptake by plants removes dissolved metals and nutrients (EPA, 1999) Also some types of ponds provide needed wetland habitat that can be utilized by waterfowl and amphibians.

According to City Public Works Administration stormwater policy (Section III):

“Lake/Pond maintenance shall be restricted to City owned systems or those portions of systems owned by the City only, and shall be limited to only those controls needed to satisfy an immediate problem, system operation, or to comply with provisions of agreement to remove silt and/or nuisance or exotic plant species where all appropriate licenses, permits, or exemptions have first been obtained. (The City) shall not be responsible for maintenance of private lakes or ponds (Clearwater pg. 3, 2006).”

The [United States Census Bureau](#), states that the City has a total area of 37.7mi, 25.3 mi of it is land and 12.4 mi of it (32.98%) is water, broken up into three main watersheds: Stevenson Creek, Alligator Creek, and Allen’s Creek. With such a large percentage of water that is not all under City ownership, a plan needs to be developed for all stormwater ponds to manage the resource. The City has many plans in order for flood control, but it will be up to citizen involvement to achieve successes in Non-Point Pollution control; primarily in their stormwater ponds. In a research study of urban area citizens it was shown that 94% agreed it would “be desirable to design and manage future stormwater control basins for fish and wildlife as well as for flood and sediment control if this were feasible from technical and economic standpoints” (Adams, 1984). As stated before, Pinellas County had a volunteer based Adopt-a-Pond program, but due to budgetary constraints the program was discontinued. Informational and guidance materials generated from these programs existence will be discussed later in this report. The intention is not to reinvent the wheel, but to apply these diverse programs at the City level.

Sustainable Plan Development

The City has several capital improvement projects for stormwater improvement. The goal of inspecting locations with the potential high risk of industrial runoff, such as retention and detention ponds, within the City, for pollutant discharge, was accomplished in the 2004//2005 period and all areas were in compliance. Some of the planned projects include Stevenson's Creek Estuary Restoration, coastal improvements, channel improvements, Coopers Point and Allen's Creek Drainage improvements. These improvements were included in the 2007 Budget Summary and there are completed projects such as Kapok Wetland Restoration Project and Glen Oaks Park. The 2008 city vision includes improvements to the Alligator Lake Wetland Creation and Stormwater Treatment project and the Alligator Creek Phase II implementation project to improve water quality in Tampa Bay (City Vision & Performance Measures, 2006). The City will have to first incorporate the proposal, later mentioned, into existing plans and focus the way the Adopt-A-Pond program would affect the watershed. Defining goals beyond stormwater quantity and quality to address invasive species, wildlife habitat and aesthetics would be needed to show measurable success. In order to have sustainable stormwater management, a project approach must be established toward all or many of the stormwater ponds, whether municipally owned or within a neighborhood. Also there are many State and Federal Grant opportunities that should properly amend the City budget, including the Pinellas County Environmental Fund and the partnerships with the Tampa Bay Estuary Program locally. Figure 1 shows the cost per kilogram to remove nitrogen and phosphorous based on projects that have received TMDL Water Quality

Restoration Grants (Livingston and Crane-Amores, 2005). This is an example of state dollars spent on these types of programs.

There is existing information that can serve as guiding principles for the program. First the SWFWMD has educational documents for the Stormwater Management System (SWMS), which can be dispersed to Neighborhood Associations. Also, Pinellas County Water Resources has many materials that can be used as guidelines for local project development such as *A Citizen's Guide to Lake and Pond Management*. There are many Florida programs in place that can serve as an initial model for the City to tailor to their needs. Hillsborough County, for example, has a Stormwater Management Section with more than 200 ponds that have been adopted from which Pinellas County modeled their program. "The Hillsborough County Stormwater program is a stepping stone by County government to initiate the improvement of stormwater quality (SWFWMD pg. 1, 2007)." The City of Lakeville, Minnesota also has a unique program that is set up to provide user related options to attract more program participants. From these examples, a blend can be created to be used at the unique local level rather than the unincorporated county-wide level. Since there is more concern initially with flood protection, the program may want to begin at an advisory and grant level, to focus City dollars toward capital improvements in flood protection.

Sustainability Plan Implementation

The Adopt-A-Pond program could be implemented at the City level through the stormwater division. By offering initial support toward pond retrofits, and development of a volunteer base for management, the program should prove to be sustainable. Volunteer efforts have proven successful in other City departments, as with the Adopt-a-

Park program. There are two broad options for implementation: providing an initial clean up effort by the City and the planting materials, which involves up-front budgetary constraints (that would later be balanced through volunteer maintenance labor); or provide only Staff expertise, educational materials, and applications for grant monies to perform the remediation activities. Using education and plantings would be the first step toward program development. “Educational efforts, whether signs associated with a structural retrofit project or statewide efforts such as Florida yards and Neighborhoods are essential in reducing [pointless personal pollution] and in gaining the support of citizens and elected officials for stormwater management programs (Livingston and Amores, pg. 4, 2003).” Also, creating vegetated buffers will show a water quality benefit beyond retention/detention alone, increasing vegetation also increased nutrient uptake of Nitrogen and Phosphorous. A central program option would be enhancement of the littoral shelf in stormwater ponds. See Figure 2 for explanation of this portion of a stormwater pond. The SWFWMD offers community education grants and the following is an excerpt from a Sarasota County project that was awarded \$4,834.00 in grant dollars:

Gillespie Pond Restoration Project

“Will restore the Gillespie pond by involving community and school volunteers in planting aquatic and shoreline trees. This planting project will help to minimize bank erosion, filter storm water that enters and exits the pond, improve wildlife habitat and educate the community about healthy ponds, watershed protection, and Florida-friendly landscape practices (SWFWMD, 2007).”

This example shows that initial costs can be kept low if the program is grant based and matched with staff hours toward oversight of these projects. The procedure

that is recommended is a blend from Pinellas County Adopt Your Pond program, the existing Clearwater Adopt-a-Park Program, and Adopt-A-Pond programs throughout the state and country: Through existing volunteer channels (e.g. Clearwater Adopt-A-Park), the City can form program working groups that can begin by assisting in approved activities requested by Neighborhood Association applicants. With guidance from City staff the program can provide the following options at the applicants request: Provide a one-time nuisance vegetation removal and disposal, provide the Florida native vegetation for planting, materials for trash removal and disposal, provide materials such as Barley straw to improve water aesthetics, and professional support in regards to environmental education (such as training citizens on frog monitoring, examination of pond buffers, and Hillsborough County's Pond Walk Program). This overall program would be most beneficial if it were tied to an agreement such as dedicating assistance on another applicant's pond, or a City pond (on a one time basis) or committing to hours of service on their existing pond.

Results and Future Recommendations

The City has made strong efforts in the area of stormwater management and improvement which has been shown in the existing water quality. Yet in order to be sustainable and keep up with the increase in urban runoff discharges, a program needs to be applied and managed by the City toward all stormwater features. There are many challenges associated with assessments, prioritization, and funding of stormwater pond projects. Using existing programs such as the Pinellas County Water Atlas <http://www.pinellas.wateratlas.usf.edu/> for citizen interaction and tracking of future projects can aid in the program organization, but also allow for citizen and County

involvement on the decision-making. Showing the economic benefits related to the savings in nutrient loadings and pursuing grant opportunities will safeguard the program from being cut. Approaching Home Owners Associations and Neighborhood Representatives first will cover a large number of privately owned ponds that would otherwise be left to the minimal standards of grassing alone. They have expressed an interest in more diverse and beneficial plantings, but just need the guidance. Also, advertising the program via utility bills would gather more volunteer interest. Informing the public of their impact toward water quality and providing a venue for active involvement can create more environmental citizens; thus extending to every aspect of sustainability including more efficient energy use, generation of less waste, and greener choices overall. With large amounts of community involvement, this program could serve as a stepping stone from work being done in community stormwater ponds, to the installation of rain gardens within individual lots. Rain gardens would be a shining example of a truly sustainable community as it would show citizen level interest in “recharging groundwater, maintaining natural hydrology, and absorbing and detaining pollutants carried in the stormwater” (Hager pg. 4, 2003). The Adopt-a-Pond Program would show the City’s commitment to go above and beyond minimum stormwater quality management, inspiring the citizens to do so as well.

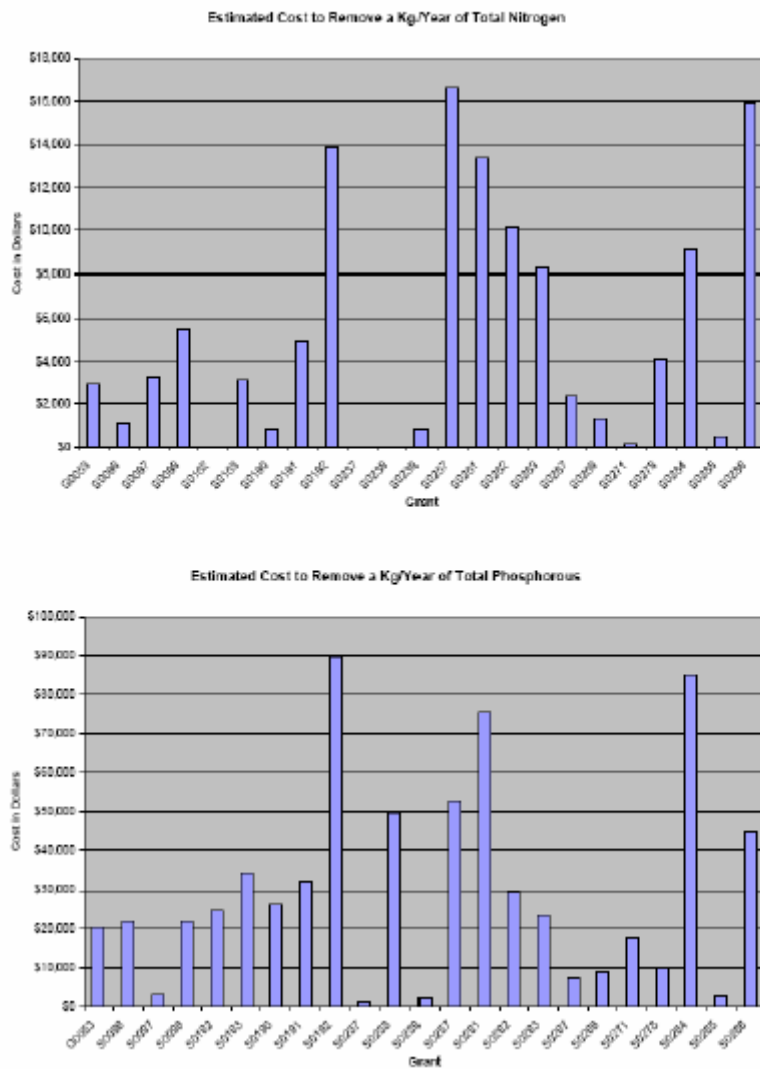


Figure 1. Cost per kilogram to remove nitrogen and phosphorous (TMDL grants).

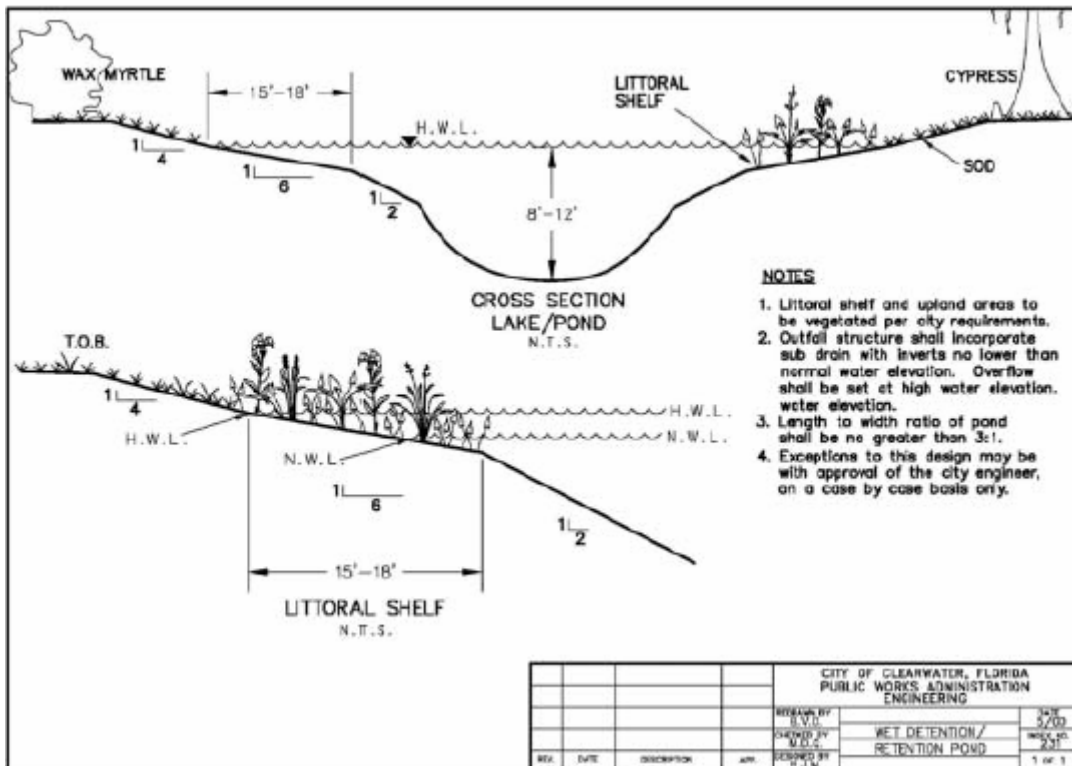


Figure 2. Littoral shelf location

Chapter 8

Sustainable Wastewater Residuals Treatment

Nick Noreika

Executive Summary

A biosolids treatment program is the focus of this paper. The benefits of converting a waste product to a sustainable resource will be looked at, and the feasibility examined.

Wastewater treatment facilities use natural biological methods to break down the components and clean the water. There are two main by-products of wastewater treatment: the treated effluent and the residuals (also known as biosolids or sludge). In Clearwater the treated effluent can be used as reclaimed water for various commercial and residential purposes. However, the residuals are hauled off to Hillsborough and Polk County to be land applied. As far as the sewage sludge (residuals), these biosolids are a valuable soil fertilizer because of their high organic content that plants need. The term residuals has gained popularity through recent years because of the changing perception that sludge is not just a waste product anymore.

Beneficial uses for sludge include application to land for farming and ranching operations. The non-beneficial methods of disposing of sludge are land filling and incineration. This type of sludge is referred to as Class B sludge, which is the type Clearwater wastewater treatment facilities generate. The City of Clearwater currently hauls off their sludge to Hillsborough and Polk County to be land applied. Residuals that meet very strict regulatory standards are considered Class A sludge; they go through extensive treatment, and can be used as commercial grade fertilizer.

Surface and land fill disposal pose problems with public acceptance and limitations on available space. Economic factors often influence the selection of a use or disposal option. Other factors include public acceptance, the availability of land to which residuals can be applied, and the degree of treatment that the residuals receive before leaving the wastewater treatment facility, (Smith, 1997).

Residuals application and treatment has been a common practice for almost 150 years, (National Resource Council, 1996). Wastewater and residual treatment are both natural solutions to converting a waste stream (sewage) to a practical resource (fertilizer). These benefits are well established, yet public perception today mainly considers the biosolids material as a waste, and not as a useful by-product. Through my research, I will discuss how the current Clearwater solution of land applying their residuals may not be the best way to go about obtaining treatment. The method of exporting the City's waste stream to other counties can lead to a negative public perception of the way Clearwater handles their residuals, along with the fact that obtaining Class A sludge treatment over Class B can be a lot more environmentally friendly and economically beneficial.

My report will conclude the long term costs outweighing the short term costs of establishing the proper equipment for such a treatment facility to come on line, making the City of Clearwater able to become environmentally sustainable.

Sustainable City

Ideally a wholly sustainable City's consumption of waste could be compared to a biological organism model in the way that it uses and generates resources. There would essentially be a circular metabolism where every output discharged by an organism would also become an input which, renewing and sustaining the continuity of the whole

living environment of which it is part. The whole web of life hangs together in a chain of mutual benefit through the flow of nutrients that pass from one organism to another. However the “metabolism of most modern cities is essentially linear, with resources being pumped through the urban system without much concern about their origin or about the destination of wastes, resulting in the discharge of vast amounts of waste products incompatible with natural systems. In urban management, inputs and outputs are considered as largely unconnected,” (Reader, 2007, p.125-6). The goods cities consume end up as waste or land fill material. This essentially non-circular metabolic system is not sustainable. This trend can be reversed if the outputs of a City can be made into beneficial inputs

Biosolids Treatment

Sewage sludge is generated during the treatment of sewage. This sludge contains nutrients that can be beneficial to plants; however it can also contain agents such as pathenogenic bacteria and parasites that can cause disease and attract vectors. If this sludge is untreated before land application or surface disposal there is a potential for direct or indirect exposure of humans to these agents. Therefore regulations require that before sludge can be land applied or used for any other form of “beneficial use” (EPA, 2003) the sludge must first be treated. In the United States the use and disposal of treated sludge (biosolids) is regulated under 40 CFR Part 503 which requires that sewage sludge be treated by a Class A treatment process, where pathogens are treated to a below detectable limit, or a Class B treatment process, where the sludge is unlikely to pose a threat to human health and environment under certain conditions (EPA, 2003). If Class B

biosolids are land applied, crop harvesting, animal grazing, and public access must be limited for a certain period of time and be closely monitored.

In the past, the City of Clearwater operated an RDP Envessel Pasteurization process at the Northeast Advanced Pollution Control Facility (APCF), which produced Class A biosolids from the sludge generated by the City's three APCFs. The sludge was then land applied. However, the City discontinued this process in 1998 after determining it was more cost effective to enter in to a long term contract with a contract operator to produce Class B biosolids, which are hauled to residual fields in Polk County and Hillsborough County for land application. Land application of biosolids is not very sustainable:

- The transport of biosolids from the City to the land application sites in other counties involve the emission of pollutants and usage of gasoline. As land application sites become more scarce, trucks will have to travel farther.
- Land – Not only is public awareness increasing resentment towards sludge fields, but a more prevalent long term problem is the fact that land is running out for this type of application process.

In addition to being unsustainable, it is important that the City be self reliant regarding residuals treatment. There is typically tremendous opposition to land application in communities where it occurs. A recent law suit in California has received a lot of attention in the residuals management industry. Orange County, California is dependant on Kern County to accept its residuals for land application. In November 2006, Kern County adopted an ordinance to ban the importation of biosoldis. The Kern County voters overwhelmingly (83%) voted for the ban on biosolids recycling in their

county, (Nebra, 2007). Neighbors argued that they should have the right to enjoy their home without be subjected to a neighboring residual treatment facility. The debate centered on the public's perception of living next to sludge material rather than a scientific debate about the actual hazards of the biosolids. Even though the residuals being shipped met the criteria for Class B biosolids land application, and there was no imminent hazard or danger to the public, the Kern County voters still wanted the ban. Their perception of the industry was the driving force for the lawsuit between the two government entities

The Court concluded that the outright ban of biosolids discriminates against interstate commerce, and Kern County lost the lawsuit. Out-of-county biosolids are considered commerce, and cannot be shut out of a county. Additionally, the Court did not find evidence that harm would occur to residents living near to the sludge fields, and it stated that the practice has been undertaken safely throughout the United States without indication of detrimental environmental or health impacts, (Nebra, 2007). Although the lawsuit was lost, it demonstrates the growing public discourse over the land application of Class B biosolids which could potentially lead to issues down the road.

Sustainable Development Plan and Implementation

A more sustainable plan for Clearwater would be for the City to treat its sludge to Class A standards, that is commercial grade for farming and agriculture. Although the sludge fields can be used by cattle ranchers to pasture their cows and grow hay, producing a commercial grade fertilizer would create a better and more useful product. This would also allow the City to avoid any potential issues that down the road with land application.

The initial costs of starting up a Class A residual treatment process will be the biggest factor. Proper planning and equipment purchasing is essential.

A meeting with Clearwater's Superintendent of Public Utilities, John Milligan, revealed a plan of action for what the City is currently, and planning on doing, regarding residuals treatment. Six years ago, Clearwater was hauling its sludge off to land fills. As mentioned above, this is a common practice for urbanized cities to do, which is very non-sustainable. Today, the City of Clearwater hauls off its sludge to be land applied, or sent to a land fill. To lighten the load of the actual hauling costs of trucking the sludge to the fields, the City invested in anaerobic digesters to reduce volatile solids in the sludge to reduce hauling costs. There are two digesters at the Marshall Wastewater Treatment Facility, and one at the Northeast Wastewater Treatment Facility. These digesters not only reduce the amount of volatile solids in the sludge, but can actually generate electricity in the process. The methane gas produced is a by-product of the residuals treatment, and 3500 cubic feet is produced every hour. This generates power for micro turbines, has so far given Clearwater an energy reduction of \$80-100 thousand dollar per year.

Clearwater did have a brief history with treating their sludge back in 1995 at the Northeast Facility. The process was a lime treatment process with is not efficient and literally a stinking process of residuals treatment. This type of treatment was messy, and treated with a high amount of lime to stabilize the sludge, which still had to be hauled away to residual fields. Overall, the plant was deemed too big of an expense, and went off line.

The plan currently on the table for Clearwater is to buy two dryers to treat and dry out their residuals. This type of advanced treatment yields Class A sludge. This method would dry sludge up to 90% solids, and the product would be hauled away to make fertilizer at fertilizer plants. The major barrier for this the \$14-15 million dollar price tag that goes with the equipment purchase for the capital project. A solution to lighten the expense load would be to have smaller, neighboring cities help contribute. The cities of Tarpon, Oldsmar and Dunedin could contribute towards the operations and maintenance costs of the equipment. Another way is if each smaller city were to pay per pound of what goes through the plant. This could be beneficial for a smaller quantity generator.

A concern John had with obtaining the Class A residual is the responsibility that comes with it. The difference between Class A and Class B residuals is huge. Class A is strictly regulated, and must meet strict guidelines before leaving the plant. This can be seen as a hindrance for most plant managers. The three hurdles for the City to get this plan off the ground are: 1 – Operations and maintenance costs, 2 – Start up capital costs for the initial purchase for the equipment, and 3 – Fuel costs.

To look at the incentives that can overcome these barriers, we'll look at each one of issues, and see specifically how each can be dealt with to move ahead with the project. First, the operations and maintenance (O&M) costs are varied because it depends on the frequency of machine usage. John's concern was for Clearwater to take on such a potentially huge O&M expenses for the City. The potentially high costs of repairs and/or downed equipment can be off-set by having the smaller surrounding cities of Tarpon, Oldsmar and Dunedin share expenses, in the meanwhile, ship their sludge to the Clearwater plant as well for Class A residual treatment. If neighboring cities can come to

the table as well with this part of the project, it would be a win-win situation for everyone. The second concern being addressed is the capitol project cost of \$14-15 million dollars for 4 years. John stressed the importance of such projects being done over a few years, rather than at one. If a huge project is taken up too quickly, it can have negative impacts on the taxpayers. This is to be avoided by all means; even if a great project idea is in the works, a time frame must be set to disperse the stress of the initial costs. The last issue mentioned is fuel costs. Unstable fuel costs can drive or crash markets and industries in our current economy. The dryers convert our waste product into a great resource, but it takes fuel to run the dryer stems that treat the residuals. A huge spike in fuel costs can cause extra expenses for the Class A process. If certain energy efficient dryers are purchased, they have capabilities of recirculating their energy, making them more efficient and less expensive to operate.

Results and Future Recommendations

Earlier, I mentioned the issues of basic sludge land fill and field application implications. Land filling is getting significantly more expensive. Basic land application is getting met with opposition from communities as was seen from the California county law suit. I think John Milligan said it best during our meeting, “Availability of land is what drives residual dryers to be purchased. We are running out of land.” Running out of land is an issue that will have to eventually be addressed, as with all wasting industries.

The bottom line for Clearwater tax payers is a benefit for purchasing the dryers. For the fiscal year of October 2006 through 2007, the current cost of hauling Class B sludge out of the City cost \$750,000. Estimation for running the fuel dryers to treat the

sludge, with fuel costs estimated at \$1.94 a gallon, the number came out to \$620,000. Clearwater can save potentially over \$100,000 a year by treating their sludge with this dryer method; all the while being sustainable and environmentally friendly. These costs can change however; rising fuel costs to operate this dryer system can become a huge negative factor for the City.

Looking towards the future, it can be an option left on the table to treat greater amounts of sludge from a growing population by making even bigger gains through the treatment process. The granulator method can be looked at if and when the Clearwater dryer treatment proves successful.

The neighboring City of Largo has a biosolids fertilizer plant which has been operating since 1991. A field meeting conducted with the Largo biosolids plant foreman, Craven Askew, went through the process of how regular wastewater sludge is treated and creates a Class A soil conditioner product. “The City of Largo Wastewater Biosolids Facility utilizes advanced heat-drying technology to produce marketable pelletized domestic waste residuals. The facility produces between 16 and 18 dry tons per day of Class A residuals that are sold for beneficial use as a soil conditioner. The finished product has very little odor, has a high nutrient value and is highly marketable. The finished product is sold to a private entity for resale to various agricultural interests throughout the United States. The final product is used directly as a soil conditioner and also is mixed with other ingredients for use as a fertilizer,” (Askew, 2004, p.). A diagram for the facility shows the sludge treatment process from start to finish, (Diagram 1). The end product of the Largo Biosolids Facility is a pelletized, granular residual that is sold and used as fertilizer. The plant currently sells the finished product for \$42.50 a ton to

the Centico Company, which has contracts with major fertilizer and agriculture companies throughout the U.S.

The major difference between what is being proposed for Clearwater regarding Largo's treatment process is the fact that a pelletizing train is not required to make commercial grade fertilizer. It is very useful to pelletize the residuals, and it makes a better product for agricultural use; however, at this stage of the plan for Clearwater is to treat the sludge with dryers and not put it through the pelletizing part of the process. This won't pull a profit for the City, since the end product will be picked up for free from a distributor.

If Clearwater were to put a biosolids processing plant into operation for the city, 100% of their waste stream from sewage sludge could be transformed into a fertilizer resource; hence, the current trend of the City's linear process urban production would be converted to a circular trend of input and output sustainability.

Part III Transportation

Chapter 9

Electric Vehicles in Clearwater

John Connaughton

Executive Summary

The subject of my study is how the city can reduce the generation of greenhouse gases produced there by cars and trucks. I first examine the benefits of low speed electric vehicles, or LSVs. This solution is attractive in terms of ecology and economics, but it is dependent upon a cultural and therefore political modification: it might require lowering speed limits on some roadways in Clearwater.

The conclusion of my study is that electric cars and trucks will eventually be the answer to the basic problem of greenhouse gas emissions, even if they are not LSVs. The problem is, affordable models of faster and fully electric vehicles do not exist yet. They will soon, but if Clearwater needed to replace vehicles today, and could not adopt the low speed solution, then the best solution I could present now would be a hybrid.

In doing this report I examined several dozens of internet sources, and my links are provided in the references for this chapter. As much as is possible the numbers cited herein come only from government web sites, most notably www.fueleconomy.gov, on the assumption those are the most objective and thorough. I avoided other sites unless they agreed with government sites. For distances I relied on Google Earth's measuring tools.

Fuel Alternatives: Ecology

From the ecological point of view any alternative to gasoline is better than gasoline. Appendix A shows that the typical mid-sized gasoline car on the road today

emits at least 8 tons of greenhouse gases in the course of an average year's 15,000 miles. Ethanol, natural gas, and hybrids are all notably better, and these could be adopted and used in the city right now with no more preparation than locating the nearest fuel supplier. Greenhouse gases from ethanol are about 80% of gasoline, and natural gas is about 67% of gasoline.

For absolute improvement, however, there is only electric. Electric does not produce any greenhouse gases at all, or only traces. Therefore replacing one gasoline car with an electric one cuts pollution by 8 tons or more per 15,000 miles driven.

Fuel Alternatives: Economics

If electricity is generated by solar, wind or water power, the raw resource is free (as well as clean) and there would be no comparison at all between electricity and other sources of automotive power. But most electricity today is generated from fossil fuels. When fossil fuels are the original energy source for both, gasoline arrives at the pump much more efficiently (82%) than electricity arrives at the outlet (52%). However, production and distribution do not matter, even ignoring the 'free' nature of renewable sources, because this is more than offset by performance at the end.

In a gasoline engine several things have to happen to get energy from a burning fuel converted into pressure turning the axles; in an electric car the axle can actually be the shaft in the motor. An electric thus, and in other ways, has significantly fewer moving parts. Because of this electric is about 75% efficient in converting stored energy into useful motion, compared to 20% for gasoline. At the point of use an electric motor approximately triples the productivity of a gasoline engine. (See appendix E.)

For the argument, say gasoline at the pump costs \$3.00 per gallon. At 30 mpg, 30 miles costs \$3.00, or 10 cents per mile. A gallon of gasoline contains power equal to 33.5 kilowatts worth of electricity. The current cost of kilowatt-hours is about \$.10 each (which is probably high, especially if one recharges at night). This means an electric car needs \$3.35 worth of electricity to match the power in a gallon of gas—but at three times the efficiency, you go 90 miles for that \$3.35, which means 3.7 cents per mile instead of 10. (See appendix A again for annual costs, and appendix C for fuel efficiency data.)

Other Technical Considerations

On top of the difference in fuel-to-action efficiency, any car that burns any fuel at all for even a moment (meaning hybrids too) needs a containment chamber for the fire and systems for conversion and exhaust, making them much heavier and more complex than an electric car, and therefore more expensive to build, purchase and maintain. Batteries might outweigh a full tank of gasoline, but overall the electric will still weigh less.

The life span of an electric motor is 30,000 hours. A gasoline engine driven 1,000,000 miles at an average speed of 50 mph has run only 20,000 hours, and it has probably needed a good amount of servicing along the way, while an electric did not.

As of now the weak point in electric cars is the battery. A hybrid Prius set on ‘EV’ (electric vehicle only) will run out of power in 10 or 11 miles because it draws on a single battery for locomotion; fully electric vehicles have greater range because they use grids of up to 20 batteries. Furthermore, however many there are, current batteries still

last for only 3 or 4 years—and batteries are expensive. The owner of an electric vehicle today may need to spend $20 \times \$100 = \$2,000$ every 3 or 4 years to replace them.

By comparison, the Department of Energy estimates a 4-year average routine maintenance cost for gasoline cars to be \$2,983. I do not have an item by item comparison on this, however. Both need tires, for example, and that might be included for the gasoline car but it is not for the electric. Therefore I allow that electric and gasoline maintenance may be an even match, at least for now.

I think, though, it will not be that way for long. As I edit in late November 2007, U.S. News & World Report reports that GM is closing in on a 300 lb. lithium ion battery that should extend range by 4 or 5 times the nickel metal hydride in a Prius, let alone the lead acid batteries that preceded that. I also expect that in the end fuel-cell technology will render all batteries obsolete, but I am not going there in this report except to note fuel-cells are intended to produce electricity, so that conversion from batteries at a later date should be a relatively focused and simple process.

If maintenance is a draw for now, and fuel costs run 3 to 1 in favor of electrics, and emissions are not even an argument, then it is time to start looking at electric vehicles.

Low Speed Vehicles (Lsvs)

For the technical reasons just described, and for reasons still to be discussed, LSVs are lightweight and inexpensive, typically \$9,000 - \$15,000. They win on purchase price as well as environmental cost and fuel economy. (Appendix E includes links to a number of different makes and models.) But what are they?

Federal Department of Transportation rules on this subject have existed only since 1998, when it became necessary for the public safety to separate smaller electric vehicles—specifically, golf carts—from sharing the same roads as faster, heavier vehicles. The result was the creation of the LSV category. The definition hinges largely on attaining speeds above 20 mph, which keeps golf carts out of this category. LSVs are supposed to be capped at 25 mph, but for technical reasons they are often--if not usually--capable of more; thus how and where they are allowed to be used defines them better than simple speed capability.

The federal rule drew upon the dozen or so states that already had rules for this, including Florida. Most of these, including Florida, allow LSVs on private and public roads where permitted by local government, or in self-contained retirement communities. Arizona took the approach that LSVs can be driven there on any road posted at 35 mph or lower.

Like other states that addressed the issue, Florida requires efficient brakes, reliable steering apparatus, safe tires, a rearview mirror, red reflectorized warning devices in front and rear, headlights, taillights, and brake lights. Notably, there is nothing in the rule about side impact panels or any meaningful bumpers—and therefore these vehicles would not pass a crash test. (This is another reason they are so lightweight.)

I could find no indication that automobile insurance companies have given LSVs any thought at all yet. I looked for quotes on-line and spoke at some length with a service representative at Progressive Insurance. They had never heard of these vehicles. So for now I assume that LSVs are treated as any other vehicle for insurance purposes; but for several reasons, most obviously speed, insurance on a LSV should cost far less.

Because they are only minimally equipped for safety, though, serious consideration needs be given to whether or not LSVs should be on the same roads as faster moving, heavier vehicles. The easy answer is that they should not. The next question, then, is a planning one: how much of the City of Clearwater could tolerate a speed limit of 35 mph on all traffic so that these vehicles would be reasonably safe?

Appendix B shows a map laying out the current speed limits in Clearwater. It is clear from that map that most of the road mileage in Clearwater is already at 35 or 30 mph. These speed zones are located largely in residential areas and in the island communities. Clearly LSVs would do well if they were used exclusively in these areas. The problem is getting from one such area to another one when they are not directly connected.

There are significant miles of roadway in Clearwater currently limited to 40 mph. These roads are problems for the LSVs where they divide the lower speed areas from each other. If these speed limits could be reduced by 5 mph, almost the entire city would then be capped at 35 mph. Very little would not be.

West of Route 19 only 6.13 miles of road are set above 40 mph, including 4.46 miles of Coachman, Drew and North Belcher roads, and 1.67 miles on The Memorial Causeway Bridge. These are all set at 45 mph. Perhaps the east end could be ignored; but the bridge looms in Clearwater's primary industry, and most obviously divides the lower speed areas. If the bridge could be reduced by 10 mph this entire plan would come together. (In driving the bridge's 1.67 miles, the difference between 45 mph and 35 mph is 38 seconds.)

I must note, however, the bridge is part of an evacuation route, and that makes this more than only a life-style issue. LSVs might be the only means of escape for some, but their presence on the bridge might also be the cause of chaos. This question needs professional consideration that I cannot provide.

Higher-Speed Electrics

At the other end of the scale, several new electric vehicles like the Tesla can out-perform all but the most powerful gasoline engines. The people behind the Tesla claim it can accelerate from zero to 60 mph in under 4 seconds, then cruise at 130 mph for up to 245 miles. They claim a fuel cost of 2 cents per mile and the equivalent of 135 mpg in efficiency. The first production run of this car sells for \$100,000, which could come down with volume; in the meantime it provides a glimpse into the future of electronic car technology.

On the more practical end—but still at \$42,000---from 1997 to 2003 Toyota sold a 100% electric SUV called the Rav-IV. It matched the speed and performance of any other SUV except for range, and it offered zero emissions and fuel efficiency equal to 111 mpg.

The electric Rav-IV was discontinued after 6 years, so something about it still wasn't economical. Or it may have had to do with California loosening an emissions standard the day before they closed it down, but I do not know that. My point is that the technology already exists, even the tooling and assembly line already exist, so full speed electrics could return as fast as demand rises as gas goes up, or legal standards tighten again.

Let me re-cap. We already know that electric is the only really good answer ecologically for personal transportation. We already know it is the least expensive type of fuel consumption. We know that except for batteries there is no comparison in maintenance costs. So what else is there?

Hybrids

The simplest way to deal with the subject of hybrids is to say a few things about the Toyota Prius. This car owns 40% of the hybrid market in the United States. It has been named Car of the Year in Japan (1997-98), in North America (2004) and in Europe (2005). It claims overall fuel mileage of 46 mpg, and its suggested retail price for 2007 was a low \$22,175. More than a million have been sold world-wide. It is used by local governments as police vehicles from Sweden to Ottawa to Laguna Beach, CA. It is also available now at many dealers within or around Clearwater, and it has a history of exemption from sales taxes (at least in Connecticut), federal income tax credits, and 10% discounts on insurance. If Clearwater were in the market to replace a sedan in its fleet right now, one would almost have to endorse this vehicle.

Nonetheless, half the time this vehicle is running on gasoline, and every 15,000 miles or so it has put 4 or 5 tons of greenhouse gas emissions into the air.

What Other Cities Are Doing Now

What cities are doing right now is buying the Toyota Prius. No-one thinks they can afford to wait for the perfect all-electric vehicle. There is something like a contest going on today in the United States, with cities competing to see who can get greenest, fastest. A website called Sustainlane currently ranks the top ten as follows; the

percentage shown for each is how much of their city fleets are powered by alternative fuels.

<u>Las Vegas, NV</u>	<u>63%</u>	<u>Denver, CO</u>	<u>31%</u>
<u>Honolulu, HI</u>	<u>51%</u>	<u>Phoenix, AZ</u>	<u>28%</u>
<u>Kansas City, MO</u>	<u>45%</u>	<u>Los Angeles, CA</u>	<u>25%</u>
<u>Albuquerque, NM</u>	<u>42%</u>	<u>Seattle, WA</u>	<u>25%</u>
<u>Dallas, TX</u>	<u>39%</u>	<u>Portland, OR</u>	<u>25%</u>

Albuquerque and Denver are on record as pursuing 100% greenness. In Albuquerque ethanol, electricity and biofuels are mandated for city buses, and hybrid cars are encouraged by getting free parking.

New York City is noteworthy. They bought 20 of the electric Toyota Rav-IV themselves and have in place major economic incentives to promote private investment in electrics and hybrids and other alternative fuels. The taxi medallions sold for alternative vehicle taxis there run at up to 33% less than for gasoline. The NYC Department of Transportation (NY DOT) will pay up to 80% of the incremental cost for new or converted medium- and heavy-duty natural gas, electric, dual-fuel (80% CNG), or hybrid electric vehicles. The New York City Private Fleet Alternative Fuel/Electric Vehicle Program gives out awards to help private sector fleets convert to alternative fuels. For examples:

- UPS was awarded \$746,888 to purchase ten (10) electric delivery vehicles for use in the Manhattan South delivery area.

- Coca-Cola Enterprises, Inc, was awarded \$124,237 to purchase five International Eaton hybrid-electric delivery trucks that operate out of their Bronx depot and service the five boroughs.

The money for these awards comes from Federal Department of Transportation Congestion Mitigation and Air Quality (CMAQ) funds distributed through NYSERDA to address air quality improvement strategies in the transportation sector. And finally, until December 31, 2010 New York state is giving a tax credit for the installation of clean fuel vehicle refueling infrastructure located in the state. The tax credit is equal to 50% of the cost of the infrastructure. (See Appendix D for more detail on NYC's programs.)

Quoting from ZAP's publicity release of March 29, 2007, the City of Richmond, CA, has joined them in launching a pilot fleet program to demonstrate ZAP electric trucks in a city fleet, the first fleet in the country to incorporate all-electric city-trucks. ZAP calls the XEBRA sedan and truck "city-cars," an electric car design for inner city driving up to 40 MPH. XEBRA is manufactured through a strategic partnership with a Chinese auto manufacturer and available through ZAP's authorized dealers at a price of about \$10,000. (Note the speed—almost only a LSV. I assume these avoid the higher speed limit streets.)

Implementation Ideas For Clearwater

1. Clearwater can work with the state and the county to look at sales taxes, which Connecticut waives on purchases of hybrids.
2. It can work with the state DMV to set graduated fee rates based in part on fuel usage.

3. It can look at reduced license (medallion) fees for electric or hybrid taxicabs.
4. It can consider free parking for obvious electrics or hybrids.
5. It can explore the federal and state agencies which would support such efforts financially.
6. It can explore the LSV idea with adjacent towns and cities.
7. It can promote electric vehicle rentals by rental companies, and electric shuttle service by local hotels, via tax considerations. It could also bring consumer pressure to bear here by offering consumer incentives, like local hotel discounts if they show they rented a hybrid.
8. It can look at partnerships with electric utilities for the development of convenient, credit-card operated charging stations in public parking facilities or even with metered street parking; such convenience for citizens could only encourage private use of electrics.
9. Clearwater could explore a partnership with 'Zip-Cars,' a national rental operation in major cities that rents vehicles out for just a few hours at a time and at a fairly low cost. A fleet of inexpensive electric vehicles might prove a very strong economic model here.
10. Clearwater could buy an electric or hybrid vehicle the next time one of the town's fleet needs to be replaced, and track that vehicle's expenses and performance for the sake of learning more.

Chapter 10

Sustainable Options for Travelers to Clearwater

Johan Gonzalez

Executive Summary

For the fall semester of 2007 Dr. Robert Brinkmann, Chair of the Geography Department at the University of South Florida, conceived a course outline meant to complement ‘greening’ efforts being made by the city of Clearwater, Florida. This project is the work of one of the students taking that course.

The subject of this project is transportation systems used to get here by visiting tourists and winter residents. This project is related to two other USF projects focusing on transportation, one about electric vehicles and other fuel alternatives, and the second on bicycle use within the city. These however are more about what can be done once a person is in the city, as opposed to how one gets there.

Clearwater is a city that is strongly affected, economically and socially, by tourism with a significant percentage of the population here is seasonal due to our attractive beaches and climate. However, the transportation systems our visitors use to get here adversely affect the quality of life in Clearwater for everyone.

The goal of this project is to identify the transportation systems that travelers use now to come to the area, and identify alternatives that are more sustainable. The pros and cons to these alternatives will be presented followed by an implementation strategy for their adoption.

The city has recognized the need for multimodal transportation in its plans for development, and has made the first step in considering sustainable options. The city, as well as other stakeholders such as shuttle operators, can adopt alternative options with

financial and research assistance from outside as well as internal sources. This would serve to improve the lifestyles of both residents and visitors and make the city a sustainable community and tourism destination

Project Definition

The scope of the project is to identify the options of that travelers chose to get to Clearwater from the major airport in the area, and to identify the economic, social, and environmental impacts those options might have on the city. Alternatives that could help reduce the impact of tourism on the city shall be presented. This would include a study of the strengths and weaknesses of alternative transportation options, as well as suggestions for making the acceptance of these options more feasible.

The project involves several elements of sustainable transportation. In the first place it might be useful to define what sustainability is. The most basic definition is from the Brundtland Report (1987): Sustainable development “*meets the needs of the present without compromising the ability of future generations to meet their own needs*”¹. In terms of transportation the Environmental Directorate of the OECD defines environmentally sustainable transportation as, “*transportation that does not endanger public health or ecosystems and that meets needs for access consistent with (a) use of renewable resources that are below their rates of regeneration, and (b) use of non-renewable resources below the rates of development of renewable substitutes.*”² This definition is relevant to the project in that it mentions renewable alternatives to petroleum, which will be considered later.

¹ Sustainable Transportation and TDM. Online TDM Encyclopedia <http://www.vtpi.org/tdm/tdm67.htm>

² Sustainable Transportation and TDM. Online TDM Encyclopedia <http://www.vtpi.org/tdm/tdm67.htm>

There are several impacts that transportation can have on the environment which are of concern to the city. One of the major concerns today is the depletion of non renewable resources such as gasoline and diesel. The burning of fossil fuels also contributes to air and water pollution, which can affect the city's tourist trade. It also affects the city's efforts in terms of greening itself in that climate change has shown to be linked to human contributions of green house gases.

The economic consequences of transportation are also significant. There are the more obvious costs on the building of facilities such as highways as well as concurrent costs to increase access to urban and suburban areas. Traffic congestion due to the increased automobile usage also has economic costs due to increased fuel usage. One of the major concerns of consumers today is the rising cost of gasoline. (This may actually help sustainability efforts, in that it almost forces people to consider alternative means of transportation.

Benefits

There are several benefits to be gained from understanding how tourists traveling to Clearwater impact the environment through their transportation choices. By addressing this source of potential green house emissions, this study can help the city contribute to the international movement of adaptation to climate change. If it leads to the adoption of fuel efficient vehicles and alternative fuels, it will reduce the consumption of petroleum citywide. New developments can be designed with more sustainable transit options, and of themselves become a draw for residents and tourists.

Sustainable Plan Development

The need for more sustainable transit options begins with a review of the data gathered on options for travel to the city. Different alternatives will be assessed with examples of success stories to better explain the possibility of adoption.

The major data sources on travelers from the airport to Clearwater were gathered from two surveys. The first is the Tampa International Airport Survey (See Appendix 1). This survey though not specific to the area of Clearwater in general was instrumental in revealing the fact that travelers in the airport tended to be either picked up (36.4%) or were using private vehicle (19.5%). The use of rental cars (36.9%) was also relevant to sustainable development in Clearwater, for several reasons. The survey shows that the major users of transportation from the airport are private or small car users³. It also emphasizes that any sustainable transit approaches by the city government should include rental car companies as prime stakeholders.

The second source was the St. Petersburg/Clearwater Area Convention and Business Bureau⁴. The website that is operated by this organization had a number of important surveys that were related to the specifics of travelers to Clearwater. In the 2006 annual visitor profile, the number of travelers who deplaned from Tampa International numbered approximately seventy-two thousand compared to twenty thousand from Orlando international⁵. The number of visitors who used rental cars annually was also significant (fifty three thousand).

The rental car companies at the airports offer a number of vehicle choices to travelers, including fuel efficient models as well as those with low efficiency. Some

³ Tampa transit survey Pg 16 http://www.tampaairport.com/ground_transportation/transit_survey.pdf

⁴ St. Petersburg/Clearwater Area Convention & Visitors Bureau website <http://www.pinellasevb.com/>

⁵ pg 19 <http://www.pinellasevb.com/statistics/Pinellas%20Annual%202006.pdf>

companies did offer some alternative vehicle types. An example would be The Dollar Rental Company, which offers a hybrid Nissan Altima⁶. Alamo also offers a number of hybrids, including the Toyota Prius and Camry⁷. A number of rental car companies, in fact, are now aware of and working to improve the greenhouse gas emissions problem as it relates to rental cars⁸.

These options have several environmental problems. The major problem would be the emissions that fossil fuelled cars emit. These include major green house gases such as carbon dioxide which contribute to global warming as well as other gases that are detrimental to human health. The other major concern will be congestion on the major roadways to Clearwater especially during the peak tourist season during the winter. Therefore sustainable options should seek to reduce emissions as well as lessen traffic on the roads.

Alternatives

Light rail is a form of transport that uses electric rail cars on private roads. This mode of transport should be considered an option for bringing travelers from the airport to the city and its tourist destinations.

Advantages

Light rail can provide a higher capacity service than buses or shuttles approximately 100 persons per car or 150 per train⁹. They also are less polluting in that

⁶ Dollar Rental Company undated <http://ww2.dollar.com/Cars/FindACar.aspx>

⁷ Alamo car rental undated <http://www.alamo.com/>

⁸ http://aboutus.enterprise.com/file/162/Customer_Cabon_Offsets_Oct07.pdf

⁹ http://www.sfecstudy.com/other_transportation.html

they give off zero emissions at the point of use. Passenger comfort can be superior to other forms of mass transit. This can enhance the image of using light rail encouraging greater ridership. The costs to passengers are also much less than renting a car. Light rail can also reduce congestion on major roadways by reducing the number of commuters from the airport.

Disadvantages

The major disadvantage would be costs on construction and implementation. Capital cost can be high (between 3 and 25 million dollars)¹⁰. The infrastructure required will occupy significant urban space and may require modifications to existing traffic flows. Cost of construction will be naturally reduced due to the topography of Florida (flat) especially in the light that there is no need for underground construction. Speed can be a concern with the average being between 15 to 25 miles/hour with a top speed of 65 mile/hour. This however can be ideal if the rail is constructed along scenic areas such as Tampa bay where tourist would most likely visit during their stay.

The airport has considered a small light rail project in conjunction with the City of St. Petersburg¹¹. This should be replicated in Clearwater with the system running along the scenic Courtney Campbell Causeway. It also serves create a vital linkage with an important shareholder in tourism as well as provide travelers with further incentive to use light rail.

Shuttle usage was also a concern, although it does not have as significant an impact on fuel usage as private cars do, according to the surveys. Shuttles can reduce the

¹⁰ http://www.sfeccstudy.com/other_transportation.html

¹¹ <http://www.heraldtribune.com/article/20071102/NEWS/711020396/-1/RSS01>

impact on the environment through the sharing of rides by travelers to their destination. The sustainability of shuttles can be further enhanced by using alternative fuels or even going completely electric. There are several benefits to conversion

Benefits

The most important is the reduction of emissions. Shuttles tend to make several trips a day the reduction benefits can be compounded. They can also help shuttle operators reduce operational and maintenance costs as these vehicles are more efficient than their petroleum counterparts. The public relation perception of alternative fuel vehicles are extremely positive as they are cleaner and quieter than conventional vehicles.

Disadvantages

The major disadvantage would be costs of implementation. Typically buses using natural gas or ethanol cost \$60,000 more than conventional vehicles. This is in addition to the new infrastructure needed such as fuelling station and storage. However this can be mitigated through grant programs from the Federal Transit Administration as well as excise taxes such as an alternative fuel infrastructure tax credit. One example would be Section 1342 of the Energy Policy Act of 2005¹². It provides a tax credit equal to 30% of the cost of alternative refueling property. Qualifying alternative fuels are natural gas, propane, hydrogen, E85, or biodiesel mixtures of B20 or more.

Another program is the Clean Cities initiative. According to the Guide to alternative fuel transportation in Florida by the Clean Fuel Florida advisory Board (2003), Clean Cities is

¹² http://www.eere.energy.gov/afdc/progs/view_ind_fed.php/afdc/351/0

a U.S. DOE nationwide initiative, begun in 1994, to encourage the use of alternative fuels, infrastructure and vehicles through grassroots groups in designated areas throughout the country. The program is a voluntary, locally based government and industry partnership to mobilize local stakeholders in the effort to expand the use of alternatives to gasoline and diesel fuel. The program seeks to improve the quality of life by using clean domestic fuels for transportation. This program can aid in infrastructural implementation of alternative fuels. Portland, Oregon has a program using a mix of alternative fuels, and that city is considering conversion to hybrid buses¹³. The experience of The Salt Lake City international airport was also successful in term of working with shuttle companies and offering incentives.¹⁴ This suggests that with suitable partnership and incentives, a sustainable alternative to private automobile use from airports can be achieved.

Transit buses were not popular choices for travelers to get to Clearwater. However, as an alternative to private cars, public transportation can be less damaging to the environment. They can also serve as means of transit from transit stations of intercity systems such as light rail. The City of Clearwater is served by a number of routes of the Pinellas Suncoast Transit Authority. The most significant to Clearwater, in terms of tourism, would be the Suncoast trolley (<http://www.psta.net/beachtrolley.htm>) and the Jolley Trolley (<http://www.thejolleytrolley.com/>). Both these trolley services operate between the Cities of Clearwater and St. Petersburg on a regular daily schedule. The continuous operation of these vehicles, as well as their accessibility to popular tourist

¹³ http://www.eere.energy.gov/afdc/progs/ddown_exp.php/SHUTL/159

¹⁴ http://www.eere.energy.gov/afdc/progs/ddown_exp.php/SHUTL/7

areas, makes them prime candidates for consideration in sustainable transit options as electrical buses.

The experience of the Greater New Haven Transit District (GNHTD) in Connecticut is one success story¹⁵. They began operating four Ebus -22-foot, fully electric trolley replica vehicles in 2002. The most positive aspects of the switch were the reduction of emissions in the immediate area as well as a reduction in fuel consumption.

Sustainability Plan implementation

The first step would be construction of a light rail network from the Tampa international airport. This will be accomplished through funding from the Clean cities initiative as well as funding from the Federal Transit authority. The airport also has a vested interest in a light rail project as it would reduce congestion to and from the airport and could provide additional funds for construction. The initial cost borne by the city would be recouped through funding sources as well as the user fees once the system is fully operational (7 to 15 dollars per trip). These systems would run along the major route from the airport to the Courtney Campbell causeway. This is the significant link between Tampa and Clearwater and completely above ground eliminating the need for underground sections. This would reduce cost per mile significantly.

Shuttle usage can offer significant savings in terms of fuel consumption as well as emissions due to increase in number of passengers. These reductions can be further enhanced with conversion of shuttle fleets to either use alternative fuels or completely electric. A mix of both can be used with electric shuttles being used for relatively short

¹⁵ http://www.eere.energy.gov/afdc/progs/ddownload_exp.php/SHUTL/72

trips. Infrastructure cost though significant will be reduced through incentives such as tax credits.

The city of Clearwater must actively engage the rental car companies to encourage passengers to choose hybrids as their mode of transport. This can be accomplished by giving financial incentives such as free parking at popular sites or reduced hotel rates for passengers using sustainable rental vehicles within the city the public image of rental car companies will be enhanced by such a program.

Results and future recommendations

The data reviewed suggested that travelers mainly use either private transportation or rental cars in arriving from the Tampa International Airport. These options were not sustainable as they contribute significantly to petroleum usages and air pollution. The sustainable transportation options such as electric light rail from the air port to Clearwater as well as shuttles and rental vehicles using alternative fuels and engines will help reduce the negative effects of travel to the city. The main disadvantage (costs of implementation) can be reduced through aid from programs offered by the Federal Transit authority and clean cities program among others..

The first recommendation would be to educate travelers about sustainable options before they arrive in the city. This can be done through the My Clearwater website as well as through travel agencies. A clear listing of options should be presented as well as any incentives for choosing to use them.

Involvement of the hospitality industry must be a necessary component of any sustainability project involving tourists. A second recommendation would be the hosting

of green conventions for business travelers. This would make regular travelers aware of the city initiatives for sustainability as well as provide an opportunity to showcase any environmental business programs the city may have to offer. It also gives hoteliers incentives to adopt technologies such as electric vehicles in their business plans.

Chapter 11

A Bicycle Sharing Program for the City of Clearwater: Getting People Out of Their Cars and Into a Greener City

Danielle Sobczak

Executive Summary

Creating a sustainable community involves developing in a way that increases resident's quality of life while protecting the natural environment. In other words, sustainable communities increase economic and community well-being in ways that promotes healthy environments (Hubbard, undated). It involves the efficient use of resources, meeting local needs through the efficient use of those resources, protection and enhancing in an equitable manner community quality of life and creating new businesses that provide services or products that protect or restore the environment (Hubbard, undated). Designing a sustainable transportation system is an important component in developing a sustainable community. A sustainable transportation system minimizes carbon dioxide emissions, reduces air pollution, promotes physical fitness, reduces noise pollution and provides a healthier and greener image for the community.

Developing policies and providing transportation infrastructure that promotes the use of bicycles is an important component of developing a sustainable transportation system. The City of Clearwater has recognized this and is taking important steps to promote bicycle use through various infrastructure projects and educational campaigns outlined in *Shifting Gears: Bicycle and Pedestrian Master Plan City of Clearwater 2006*. A bicycle sharing program, gaining popularity throughout the United States and across Europe, may compliment the City's current efforts to create a more sustainable transportation system.

Project Definition

Currently, residents and visitors rely heavily on the use of personal automobiles to navigate the City of Clearwater. This results in traffic congestion, increased air pollution and the image that the city is unsafe for pedestrians. Modifying the City of Clearwater's current transportation system is important and necessary in the city's quest to create a greener image and more sustainable community. A bicycle sharing program is an innovative and environmentally friendly transportation program that also promotes health through exercise, reduces annual transportation costs for participants, reduces traffic congestion, and reduces air pollution and carbon emissions thus creating a more sustainable transportation system and environment. This paper will demonstrate, using Paris as a model, how a bicycle sharing program in the City of Clearwater may compliment the city's current Bicycle and Pedestrian Master Plan and get people out of their cars and into a greener city.

There are several ways cities can provide bicycles to their residents and visitors through bicycle sharing programs. The "first generation" bicycle sharing programs are unregulated programs where a city simply releases bicycles into the community for anyone to use (Gordon, p. 2007). There is no charge for the use of the bicycles and the bicycles are typically painted an identifying color (2007). However, this program is plagued with problems, most commonly bicycle vandalism and theft (2007). Other programs, often referred to as "next generation programs" include deposit programs where "a small cash deposit releases the bike from a locked terminal" and can only be retrieved by returning the bicycle to another terminal (Wikipedia, undated). Unfortunately, this program is also plagued with theft problems because the deposit

amount is only a fraction of the cost of the bicycle and therefore there is no true incentive to return the bike (Wikipedia, undated). Membership programs have fewer problems with theft (Wikipedia, undated). These programs are designed where “bicycles are kept either at volunteer-run hubs or at self service terminals” and “individuals registered with the program identify themselves with their membership card” allowing them to check out a bicycle (Wikipedia, undated). The membership creates a sense of responsibility thus reducing bicycle vandalism and theft (Wikipedia, undated). Another common program involves the long-term checkout of bicycles (Wikipedia, undated). This program allows bicycles to be given “free of charge, for a refundable deposit, or sold at a reduced price” and are “assigned to one person” for an extended period of time (undated). The most common disadvantage of this program is “the much lower using frequency” (undated).

Finally, the “third generation” of bike-sharing programs are “high-tech” featuring “electronic payment, tracking and locking systems” (Gordon, 2007). These programs are often the product of public-private partnerships where cities have signed contracts with private advertising agencies that supply the city with bicycles for no charge and also provide the maintenance for the bicycles (Wikipedia, undated). In return the cities allow the agencies to advertise on the bicycles directly or in various locations throughout the city for no costs (Wikipedia, undated). These programs have proven more successful and have successfully combated the theft and low usage problems plaguing most of the other programs. As a result, this program may prove most useful for the City of Clearwater. The following section will use Paris’ Velib’ program as a model for a successful bicycle sharing program that has the potential to be implemented in the City of Clearwater. Of course Paris and Clearwater are extremely different in numerous ways. However, Paris

seems to be the leader in this type of program and therefore serves as an excellent model. In addition, with any community bike program local variations should always be considered and adapted to accordingly.

Sustainable Plan Development

On July 15, 2007, “the City of Paris launched a new self-service bicycle” program appropriately named Velib’, a “combination of the French words velo (bicycle) and liberte (liberty)” (Velib’, undated). Paris’ program has been described as “the most ambitious in the world” (Bennhold, 2007). The overall goals of the program include pollution reduction and to reduce “damage caused by intense use of cars, and also to limit the emission of green house gases” (Velib’, undated). Furthermore, the city aims to transform their current transportation system by drastically reducing the use of cars and increasing the use of bicycles (undated). Positive consequences of this change in transportation include healthier residents, improved quality of life and a greener image for the city.

Paris’ program features 24 hour self-service bicycle terminals (Shown in Appendix 1, Figure 1) where users can take a bike from one terminal and return it to another (undated). In addition, the terminals have computers allowing users to “obtain one-day and seven-day subscriptions,” recharge accounts, obtain terminal location information and view their account information (undated). The bicycle terminals are strategically located around the city “to serve centers of interest” (undated). The bicycles (Shown in Appendix 1, Figure 2), costing around 1,300 dollars apiece (Anderson, 2007), are designed for “durability, safety and comfort” (pristine planet,

2007) and are painted a soft grey to blend “harmoniously into the urban environment” (Velib’, undated). In addition, the bicycles are equipped with an electronic tracking device that substantially deters theft. Computers at the bicycle terminals assess the maintenance needs of the bikes. The costs to rent the bicycles are relatively cheap and affordable to most. For instance, the first 30 minutes are free, the next 30 minutes will cost \$1.30, \$2.60 will be charged for the next 30 minutes and \$5.20 will be charged for the fourth-half hour of use and every 30 minutes after that (Anderson, 2007). The rising rate helps promote the swift return of the bicycles.

Paris’ program is a public-private partnership with the company JCDecaux (2007). JCDecaux is responsible for providing all of the bikes, building the pickup/drop-off stations, covering start-up costs and employing the individuals necessary to operate the program (2007). All of the revenue from the program will go directly to the city and JCDecaux will pay Paris an annual fee (2007). In exchange the company will receive “exclusive control over 1,628 city owned billboards” (2007). Additionally, the company is responsible for maintenance of the bicycles and terminals. To further increase the sustainability of the program the company has developed some innovative maintenance techniques. For example, “control of the bikes will be carried out with 20 clean natural gas vehicles” and “the maintenance staff will travel around using 130 electrically assisted bikes” (Velib’, undated). Furthermore, the most common maintenance required is washing the bicycles and this is accomplished using “rain water recovered from JCDecaux sites” (Velib’, undated). The bicycles are also “99% recyclable” and the company has “set up a recycling network for worn bike tires” (Velib’, undated). To date

the largest complaint with the program is that often in certain areas all of the racks are occupied in the terminals making returning a bicycle difficult (Anderson, 2007).

It seems that Paris' bicycle sharing program would compliment Clearwater's current sustainability efforts and Bicycle and Pedestrian Master Plan. For instance, the Master Plan outlines the city's vision stating:

The City of Clearwater seeks to increase overall mobility and wellness by providing an integrated non-motorized network of bicycle and pedestrian facilities throughout the City for the purpose of recreation, conservation, education, transportation and economic development

A bike sharing program would bring in bike rental revenue that could be used to further enhance the city's transportation infrastructure and support the city's vision. In addition, bike sharing programs are known to reduce traffic. For instance, the mayor in Lyon, France claims, traffic has been reduced by four percent since the implementation of their bike sharing program (Anderson, 2007). A bike sharing program also has the potential to reduce air pollution, improve parking, and enhance the city's image as a greener, quieter more relaxed place to live and visit (2007). More importantly, a bicycle sharing program may help reduce carbon emissions. Again the deputy mayor of Lyon, France reports that "the cities 3,000 rental bikes have logged about 10 million miles—saving an estimated 3,000 tons of carbon dioxide from being spewed into the air" (Anderson, 2007). Furthermore, Cambridge reports that vehicles may emit between 280 to 430 grams of carbon dioxide per mile where as using a bicycle emits no carbon dioxide (Cambridge, undated). There are also practical benefits to bicycle sharing programs. For example, in Paris a recent study analyzed various trips around the city comparing "a car,

bike, taxi and walking, and the bikes were always the fastest” (Anderson, 2007). Using bicycles as the main mode of transport also saves money. For instance, AAA reports that “car ownership ranks as the second highest living expense” and “the average yearly cost of car ownership is \$8, 431” (Community Cycling Center, Undated). This cost is significantly higher than the costs to participate in the bicycle sharing program described above.

Sustainability Implementation Plan

The key to getting people out of their cars and onto a bicycle is to make it easy for them and making it the popular thing to do. The City of Clearwater already has transportation infrastructure modifications underway that will undoubtedly promote the use of bicycles. For instance, there are approximately 14 miles of existing multi-use trails and the City plans to add an additional 5.2 miles outlined in their Master Plan. In addition to these modifications, the City is actively promoting education and safety programs as well as campaigns to encourage bicycle use. The City has already conducted studies looking at bicycle use characteristics and has developed a model for prioritization of projects. In other words, the City’s efforts in creating a friendlier biking atmosphere will be useful and may even serve as a model to implement the proposed bicycle sharing program.

As with any community project it is important to obtain community input from stakeholders representing the diversity within the community. Community participation may be accomplished through interviews, focus groups, workshops and surveys. Through this process’ project goals, priorities, timelines and concerns may be established

and addressed. More specifically, location of bicycle terminals may be identified and strategies to avoid user complaints developed. Furthermore, potential partnerships may be identified through the stakeholder process. These partnerships may include local businesses and the tourism industry that is so prominent in Clearwater. As mentioned in the Paris model the public-private partnership was imperative to their bike sharing program because the private company provided all of the start-up costs, bicycles, terminals, necessary personnel and maintenance of the program in return for advertising privileges. Therefore, the City of Clearwater should make establishing partnerships a top priority in implementing a bicycle sharing program of their own. Getting people to use the bicycles will most likely pose the largest challenge and their use will serve as the clearest marker of success. The City can use educational programs and advertising to promote the programs use. These programs would compliment the current programs already in place that are described in the City's Master Bicycle and Pedestrian Plan. It seems a bicycle sharing program would be a perfect compliment to this waterfront community and will help sustain the qualities that make it such an attractive community to live in and visit.

Results and Future Recommendations

"Not everything that can be counted counts, and not everything that counts can be counted."

— Albert Einstein

Measuring the success of sustainability initiatives is often difficult. In the case of the proposed bicycle sharing program success can be measured in terms of use. The City may be able to gage the potential success of the project through obtaining public input

through the stakeholder process described above. The potential for success can be maximized through careful planning and educational outreach. The City of Clearwater has the opportunity to become a leader in sustainable transportation with the implementation of its own bicycle sharing program.



Figure 1. Example of a Velib' Terminal (Velib, undated)



Figure 2. Example of Velib Bicycle (Velib, undated)

Part IV Energy and Buildings

Chapter 12

Energy Management

Ifetayo Venner

Executive Summary

As a signatory to the Mayor's Climate Change Agreement, the City of Clearwater is required to strive to meet or exceed Kyoto protocol targets for reducing global warming in its own operations and communities. Under the Kyoto protocol, developed countries are required to reduce greenhouse gas emissions by an average of 5% below 1990 levels at a minimum (United Nations, 1998). As energy use in the United States has steadily risen, so too has the amount of greenhouse gases in the atmosphere. It is clear that to reduce energy related emissions the consumption of energy from fossil fuels will need to be reduced.

Currently the most cost effective way to reduce greenhouse gases is to reduce overall energy consumption. The City can do much to promote energy efficiency among its constituents through education, tax incentives, building code changes among other things. However, this would be more effective if the City set the example by instituting these measures within its own operations.

Discussions with staff indicate that there is some progress towards becoming more energy efficient and the City is moving in the right direction. However, there is no clear policy on energy efficiency, coordination or directive from the higher levels of the City. This means that the full potential for energy savings is not being realized. To engage as many employees as possible and to maximize savings the City should develop an energy management program. This paper presents the key constituents for a successful energy management program.

The Case for Energy Management

As a signatory to the Mayor's Climate Change Agreement, the City of Clearwater is required to strive to meet or exceed Kyoto protocol targets for reducing global warming in its own operations and communities. Under the Kyoto protocol, developed countries are required to reduce greenhouse gas emissions by an average of 5% below 1990 levels at a minimum (United Nations, 1998). Most of the man made greenhouse gases in the United States come from burning fossil fuels for energy use; of these, carbon dioxide is the most significant. As energy use in the United States has steadily risen, so too has the amount of greenhouse gases in the atmosphere. Figure 1 shows the energy consumption and carbon dioxide (CO₂) gas emissions in the US from 1949 through 2006. It is clear that to reduce energy related emissions the consumption of energy from fossil fuels will need to be reduced.

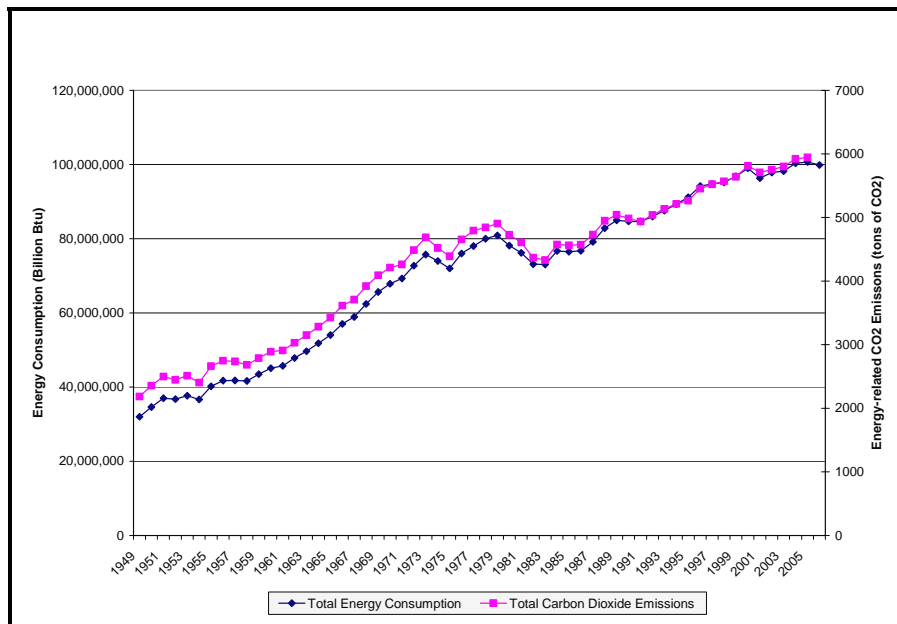


Figure 1. United States Total Energy Consumption and Energy-Related CO₂ Emissions
(Department of Energy, undated)

Among the actions identified in the Mayor's agreement to reduce emissions due to energy consumption are to promote the use of clean, alternative energy and to make energy efficiency a priority. Clean, alternative energy sources of energy are an alternative to burning fossil fuels and will in the future be critical to reducing the consumption of greenhouse gas generating fuels. Solar energy, for example, could potentially be key in a state with as many sunshine days as Florida. The City should do what it can to promote the development and use of alternative energy sources where possible.

However, currently these alternatives are not cost effective and viable for large scale use. For the time being the most efficient way to reduce greenhouse gases is to reduce overall energy consumption. The City can do much to promote energy efficiency among its constituents through education, tax incentives, building code changes among other things. However, this would be more effective if the City set the example by instituting these measures within its own operations. Residents and business would respond to the City's commitment and see that it is possible.

Current Practice

The City is made up of several departments. Discussions with staff in General Services and Public Utilities, as well a general City Of Clearwater website investigation, indicate that there is some progress towards becoming more energy efficient. Some examples are:

- Replacement of older inefficient HVAC equipment
- Installation of electronic temperature control systems
- Gradual replacement of existing lighting to more efficient types

- Specification of efficient lighting products for construction and renovation projects
- The use of natural gas for heating, space and water, when applicable.
- Replacement of process air blowers and change to more efficient diffusers at the Marshall Street Advanced Wastewater Treatment Facility.
- Piloting of more energy efficient motors at the City wastewater treatment plants

These projects show that the City is moving in the right direction. Some of the staff are committed to saving energy and realize that it can be cost effective and even produce cost savings. However, there is no clear policy on energy efficiency, coordination or directive from the higher levels of the City. This means that the full potential for energy savings is not being realized. To engage as many employees as possible and to maximize savings the City should develop an energy management program with defined goals, employee education and management backing.

Developing a Successful Energy Management Program

A City energy management program will require several components to be successful. Much of it is outlined in the Figure 2, a guideline established by ENERGY STAR, a joint program of the Environmental Protection Agency and the Department of Energy, set up to help organizations save money and protect the environment through energy efficient policies and practices.



Figure 2. Guidelines for Energy Management (ENERGY STAR, undated)

Management Commitment

For an energy management program to be a success, and to engage as many people as possible, commitment from the top levels of the City is critical. Money should be set aside to fund the program and from the Mayor on down through the ranks it should be clear that this is a critical goal. It is critical that the program launch be well publicized within the City and that commitment from the highest levels of the City is demonstrated. Communication could be in the form of memos/email to all of the staff from the Mayor, posters and/or an article in a newsletter. Details of the program could be made to management of the various departments who could then communicate the detail to their employees through meetings etc where necessary.

Management Coordination

Ideally someone should be designated with responsibility for energy management, reporting to the City Manager. This may not be possible with the limited budget of the City. However, the City should establish an energy management committee comprised of representatives from the various City departments, as well as stakeholders in the community with relevant expertise. There should be a representative from each department that affects energy use (eg. General Facilities, Engineering, Public Utilities), the Office of Management Budget, the Clearwater Gas System and Progress Energy. This team would initially be charged with developing a formal energy policy, developing strategies and a plan to implement them, identifying barriers and procedures to overcome them, and communication with employees. As the program progresses it would be responsible for evaluating proposals, monitoring and reporting progress and branching out into new areas.

According to ENERGY STAR (ENERGY STAR, undated), to be successful and energy policy should:

- State a clear, measurable objective
- Establish accountability
- Allow for the policy to be evaluated and updated as needs and priorities change
- Set and promote goals, linking them to the overall financial and environmental goals

Establish Goals and Accountability

Since the overall goal is to reduce energy, the goal should also be measurable. There should be an overall goal, goals for individual departments and sub-units and goals for processes. Goals should have clear, obligatory deadlines, and be achievable. Managers of the various departments should have input in determining goals and be held accountable for achieving them. Some examples of goals are:

- Reduce overall City/department/equipment/process energy use by a certain percentage or amount
- Reduce greenhouse gas production by a certain percentage or amount
- Gain a certain number of additional points related to energy towards achieving a higher Florida Green Building status, a LEED certification for a building
- Performance against a certain benchmark such as another similarly sized City.

Establish a baseline

Before any program begins the City should assess the current overall energy use and the energy use of the individual departments to establish a baseline which is critical for determining trends, success in meeting goals and identifying areas with potential for improvement. A complete assessment of what is currently being done should also be performed to identify successful projects, opportunities and problems.

Create an action plan

Once the general policy is created and goals identified, an action plan should be established to implement the goals. This should be updated annually to reflect achievements and changing priorities, needs and technologies. The action plan should:

- Evaluate the past performance
- Identify current energy use and short term and long term goals for the City as a whole and the various departments
- Set timelines for the achieving the goals
- Establish a system to track and monitor success
- Identify critical people and roles
- Identify resources

Establish criteria for identifying and approving projects

Some of the criteria for identifying savings and projects could be

- Is the equipment/process needed?
- Can the equipment be used more efficiently or the process made more efficient?
- Can the same purpose be accomplished using less energy by some other equipment or process
- Would new, more efficient equipment be more cost effective
- If the project must prove to be profitable the criteria must be determined such as a payback period or a particular return on investment.

Engage Employees

For the program to be successful everyone in the City needs to be involved. Some critical factors that will contribute to the success are:

- Employees should know why the program is necessary and what the goals are.
- Employees should know that they are critical to the program's success, how they can contribute and what is expected of them. They should be educated as to how their activities (at work and at home) affect energy use and impact the environment.
- Early success is critical to gaining support and enthusiasm. Management should start out with some programs with the most chance of success and publicize them.
- The energy management team could put out its separate newsletter detailing goals, programs and successes.
- Individual departments could also form teams responsible for implementing and championing the program.
- Employees could be rewarded through publicity, letters, or even gift cards or monetary rewards especially if a suggestion has led to large savings.
- Workshops/training with staff

Evaluate Progress

Once the action plan is implemented energy consumption should continuously be measured and compared to goals established for each department. This energy savings could then be converted to greenhouse gases. Data such as energy, monetary and

emissions savings and return on investment are critical to justifying the need for and success of the program and to make corrective action if necessary. It also can be used to sets a good example when City moves forward with trying to get its residents to and business to establish their own energy efficiency measures.

Conclusion

If the City adopts an energy management program following the guidelines outlined above, it should be able to improve energy efficiency further, reducing greenhouse gases and saving money in the process.

Chapter 13

Sustainable Building Initiatives in Clearwater, FL

Jack O'Connor

Executive Summary

This study report begins by identifying the challenges and opportunities faced by the City of Clearwater in connection with the emerging practices of sustainable or green building development. The costs and benefits of this approach are discussed in some detail. While the issues discussed are seemingly specific to the City, they are representative of much a larger national and global trend. Included in the discussion are references to other venues and how they have used public policy initiatives to further their community objectives. The free market and private enterprise have also waded into the idea pool, while technical organizations have undertaken a wide range of studies and the cost/benefit models are evolving almost daily.

Sustainability and green design have become a part of a larger global debate. Climate change, specifically humankind's potential to adversely impact the earth, is a topic to which green design and construction play a part. Energy, water, and related resource consumption/conservation are all themes central to sustainability. This has been an interesting and rewarding study. The initial results provide a necessary platform to support further research and evaluation.

Project Definition

In accordance with the city of Clearwater's mission to become a more sustainable community, this project specifically deals with current environmental efficiency issues with Clearwater's buildings. This study examines what role Clearwater's current building

regulations play, if any, in creating and maintaining sustainable offices, retail spaces, hotels, apartment complexes, and other types of buildings. This project will examine various factors that are taken into consideration by cities when analyzing a building's sustainability. These include, but are not limited to: building materials, energy consumption, and waste output. The widespread use of air conditioning in Florida is an unavoidable reality. However, there are numerous steps that can be taken to maintain current service level standards while reducing the amount of overall consumption.

Sustainability has become a global area of concern. For example, the California Integrated Waste Management Board states that commercial and residential buildings account for one-sixth of the world's fresh water withdrawals, one-quarter of its wood harvest, and two-fifths of its material and energy flows. The creation of more sustainable buildings is an opportunity to use resources efficiently while creating healthier buildings that improve human function, build a better environment, and provide for improvement of traditional cost/benefit ratios.

Sustainable buildings, more commonly referred to as "green buildings," are structures designed, built, renovated, operated, or reused in an ecological and resource-efficient manner. Green buildings are utilized to meet certain objectives such as protecting occupant health, improving employee productivity, using energy, water, and other resources more efficiently, and reducing the overall impact to the environment.

Sustainable Plan Development

From an economic standpoint, green buildings have traditionally cost more to design and construct. However, evidence suggests that green buildings also generate substantial savings, primarily through lower operating costs over the life cycle of the facility. For example, *The Tampa Tribune*'s Russell Ray recently wrote an article about Verizon's upcoming use of solar power to run the equipment that makes telecommunications possible in the Tampa Bay area. Verizon has recently completed the installation of 140 solar panels at its central office building in Carrollwood. According to Russell Ray's article, the savings would be very significant, and the \$300,000 upfront cost of the project would be completely recoupable (Ray, *Tampa Tribune*, 2007).

Currently, the Leadership in Energy and Environmental Design (LEED) Green Building Rating System has been established to accurately gauge a building's level of sustainability. LEED projects are independently certified as including a pre-determined number of energy-efficient and environment-conscious elements into design and construction. LEED Certification can be difficult to achieve, but several newer buildings, utilizing cutting-edge sustainable technology are setting a tremendous example. For example, the largest and most energy efficient LEED building in the state of New Mexico, the Jefferson Green office complex in Albuquerque, is one of the few buildings in the world to achieve a double LEED Gold Certification (Jefferson Green pamphlet, 2007).

LEED's point-based rating system is organized into six categories (Sustainable Sites, Water Efficiency, Energy and Atmosphere, Materials and Resources, Indoor Environmental Quality, and Innovation and Design Process) which contain credits and

prerequisites. A project must achieve all seven prerequisites in order to attain any level of LEED certification. The prerequisites include Erosion and Sedimentation Control, Fundamental Building Systems Commissioning, Minimum Energy Performance, CFC Reduction in HVAC&R Equipment, Storage and Collection of Recyclables, Minimum IAQ Performance, Environmental Tobacco Smoke Control (Jefferson Green pamphlet, 2007).

One of Florida's newest and most environmentally-friendly buildings is already located on Clearwater Beach. The Sand Pearl Resort has recently been considered for LEED certification by the US Green Building Council. This hotel and resort is one of the first of its kind, and is already considered to be a leader among other resorts in energy efficiency and environmental design.

The Sand Pearl Resort has taken several innovative steps to ensure quality conservation. For example, in the area of climate control, they have replaced the traditional Freon cooling system through using the building's own water supply. A state-of-the-art chiller system provides high efficiency cooling, using only about 70% of the energy required for other cooling methods. The indoor air quality is subsequently improved by utilizing the chilled water plant to supply the hotel's interior spaces with pre-conditioned air (Sand Pearl information pamphlet, 2007).

The Sand Pearl's conservation efforts were underway from the beginning of its design and construction. Approximately 24 million pounds (12,000 tons, to be exact) of materials were reintroduced into the manufacturing process instead of being tossed away into landfills. That meant that over 65% of "normal" construction demolition waste was recycled, providing wood, concrete, plastic, gypsum, and metal for use in other

construction projects which is enough building material for 80 new 2,000-square foot homes (Sand Pearl information pamphlet, 2007).

Sustainable Plan Implementation

An example of “green legislation” in an area of the state in close proximity to Clearwater is currently taking place in Sarasota County. The Sarasota Green Building Program Resolution, part of a county-wide program popularly known as “Sustainable Sarasota,” was first implemented in March of 2005. This resolution was designed “to provide the Sarasota Community with a certification-based ‘green building’ program.” This ordinance encourages the county to design and construct sustainable, energy-efficient buildings through the compliance of new county buildings. It also encourages voluntary green building in private development through incentive-based programs.

To promote energy efficient construction, this ordinance provides a great deal of incentives for building new energy-efficient homes, such as: fast-track permitting for building permits, and a 50% reduction in the building permit fee with a maximum of \$1,000 per building, but no person or organization shall receive more than \$5,000 in permit fee refunds (Romero and Hostetler, 2007).

The Sarasota County government also provides marketing incentives, including erection of building signs at the site, placing participants on the city website, and press releases. Finally, the Board of County Commissioners offers a Green Building Award to recognize one participant each year that demonstrates commitment to the program. An independent third party must certify buildings in order to retain such benefits. Standards

for development certification are compliant with the Florida Green Building Coalition and the U.S. Green Building Council (Romero and Hostetler, 2007).

In addition to the green building program in Sarasota County, similar programs have been adopted in other Florida communities, including the city of Gainesville and Miami-Dade County. Outside of Florida, notable green building programs across the country have been started in Frisco, TX; Boulder, CO; and Arlington County, VA (Romero and Hostetler, 2007).

In a fascinating article for the Massachusetts Technology Collaborative entitled *Green Building Costs and Financial Benefits*, Gregory H. Kats analyzes the various economic aspects of green building. Kats acknowledges the fact that green buildings are commonly perceived to be significantly more expensive than conventional buildings and often not justified on the basis of cost. Kats even references an early 2003 article in the New York Times entitled “Not Building Green Is Called a Matter of Economics.”

However, Kats is quick to point out that, in many cases, green buildings are both environmentally and fiscally responsible alternatives. He goes on to explain that the average premium for green buildings is slightly less than 2%, or \$3-5 per square foot, substantially lower than is commonly perceived. The majority of this cost is due to the increased architectural and engineering (A&E) design time, modeling costs, and time necessary to integrate sustainable building practices into projects. Generally speaking, the earlier these green building features are incorporated into the design process, the lower the cost will be. Green buildings are known for providing financial benefits that conventional buildings do not. These benefits include energy and water savings, reduced

waste, improved indoor environmental quality, greater employee comfort/productivity, reduced employee health costs, and lower operations and maintenance costs (Kats, 2003).

Energy, in particular, is a substantial and widely recognized cost of building operations. Consumption can be easily reduced through energy efficiency and through other related measures that are part of green building design. For example, Kats' article goes on to reveal that green buildings, when compared to conventional buildings, are on average 25 to 30% more energy efficient, characterized by even lower electricity peak consumption, more likely to generate renewable energy on-site, and more likely to purchase grid power generated from renewable energy sources.

In addition to energy, green building offers benefits in both health and productivity for all parties involved. Every year, hundreds of billions of dollars are spent on health and productivity costs imposed by poor indoor environmental quality in commercial buildings. This is not particularly surprising, as people spend about 90% of their time indoors, and the concentration of pollutants indoors is typically higher than outdoors, sometimes by as much as 10 or even 100 times (Kats, 2003).

The relationship between worker comfort/productivity and building design/operation is very complicated. There are numerous studies, reports, and articles that find significantly reduced illness symptoms, reduced absenteeism, and increases in perceived productivity with employees in buildings with cleaner indoor environments. Green buildings are not only 25-30% more energy efficient, on average, but are known to generate much lower emissions. The measures that are often taken to ensure these lower emissions include better siting (e.g., avoiding locating air intakes next to outlets, such as parking garages, and avoiding recirculation), and building better material source controls

(including paying the required amount of attention to storage). Certified and Silver-level green buildings achieved 55% and Gold level LEED buildings achieved 88% of possible LEED credits for use of the following: less toxic materials, low-emitting adhesives and sealants, paints, carpets, composite woods, and indoor chemical and pollutant source control. Green buildings offer generally improved thermal comfort and better ventilation, especially in buildings that use underfloor air for space conditioning (Kats, 2003).

Increased efficiency of construction materials is yet another benefit of building green. Green buildings utilize reused and recycled materials, zero or low gassing of harmful air emissions, zero or low toxicity, sustainably harvested materials, high recyclability, durability, longevity, and local production. Through using dimensional planning and other material efficiency strategies, the amount of building materials needed are reduced, as is construction costs. For example, designing rooms on 4-foot multiples conform to standard-sized wallboard and plywood sheets (CIWMB, 2007).

Water efficiency is a very important characteristic of sustainable buildings. Green buildings are often designed for dual plumbing to use recycled water for toilet flushing or a gray water system that recovers rainwater or other non-potable water for site irrigation. Wastewater is greatly minimized by using ultra low-flush toilets, low-flow shower heads, and other water conserving fixtures. Other measures that can be taken to ensure a greater level of water efficiency include installing point-of-use hot water heating systems for more distant locations, using a water budget approach that schedule irrigation, metering the landscape separately from buildings, using micro-irrigation (which excludes sprinklers and high-pressure sprayers) to supply water in non-turf areas, and using state-of-the-art irrigation controllers and self-closing nozzles on hoses (CIWMB, 2007).

The issue of cost is an ever-present concern to developers and city leaders alike whenever extra measures are undertaken to pursue an ecologically-friendly environment. While there seems to be a general consensus on the environmental and social benefits of green building, there is a consistent concern, both within and outside the green building community, over the lack of accurate and thorough financial and economic information. Sustainable buildings generally incur a “green premium” above the costs of standard construction, although studies such as those of Kats point to a significant reduction in this capital outlay “premium.” However, there is virtually no dispute that green buildings provide an array of financial and environmental benefits that conventional buildings do not. These benefits, such as energy savings, should be looked at through a life cycle cost methodology, not just evaluated in terms of initial costs. From a life cycle savings standpoint, savings resulting from investment in sustainable design and construction dramatically exceed any additional upfront costs (CIWMB, 2007).

It is generally recognized that conventional buildings consume a large portion of water, wood, energy, and other resources used in the economy. Green buildings provide a potentially promising way to help address a range of challenges facing the state of Florida, such as: the high cost of electric power, worsening electric grid constraints (with associated power quality and availability problems), pending water shortage and waste disposal issues, continued state and federal pressure to cut criteria pollutants, growing concern over the cost of global warming, the rising incidence of allergies and asthma (especially in children), the health and productivity of workers, the effect of the physical school environment on children’s abilities to learn, and increasing expenses of maintaining and operating state facilities over time.

Results and Future Recommendations

The benefits to green building include a great deal of cost savings from reduced energy, water, and waste; lower operations and maintenance costs; as well as enhanced occupant productivity and health. According to a survey done in the state of California, the total financial benefits of green buildings are over ten times the average initial investment required to design and construct a green building. Energy savings alone exceed the average increased cost associated with building green (ciwmb.ca.gov – Executive Summary).

Additionally, the relatively large impact of productivity and health gains reflects the fact that the direct and indirect cost of employees is far larger than the cost of construction or energy. Consequently, even small changes in productivity and health translate into large financial benefits. Despite data limitations and the need for additional research in various areas, it is clear that building green is cost-effective and makes financial sense.

The City of Clearwater would be well-advised to consider legislation that would provide incentives for the future use of sustainable design and construction. Currently, the city's building regulations offer no apparent guidelines or incentives for building green (see Appendix C). I propose that the City of Clearwater use the guidelines set forth in Sarasota County's Resolution No. 2005-048 (see Appendix B), and develop legislation that would allow for financial incentives for building developers in Clearwater who pursue LEED certification for future construction projects.

By following in the lead of the city of Gainesville and Sarasota County, Clearwater will find itself in a rare and highly enviable position to set itself aside from a majority of communities not just within the state of Florida, but across the entire country. Creating new building regulations designed to encourage more sustainable construction and operations would not only be environmentally beneficial and fiscally responsible, but could also attract a tremendous amount of favorable publicity towards the city. Clearwater, after all, relies on the tourism a great deal as a valuable source of income.

In a world where the environment is one of the most pressing issues, waterfront communities such as Clearwater are most often looked at as having a critically important impact on our planet's ecology. This is an opportunity for the City of Clearwater to take a position of leadership among Florida's cities in what will certainly come to define how cities are planned and constructed in the future. By utilizing green building practices, Clearwater has a chance to be one of a select few cities in the world that set the standard for intelligent, creative, and responsible development.

Final Summary

Robert Brinkmann

These papers represent a body of work that mark a significant moment in the sustainability of Florida. The graduate students provided many suggestions for urban sustainability that were designed specifically for Clearwater. The work demonstrates that Clearwater has already done many things to promote urban sustainability including the development of a bicycle and pedestrian master plan, an environmental education center, and the conversion of traffic lights to LED technology. Indeed, so much has been done that the city is likely to gain ‘silver’ status if it were to apply for green city status from the Florida Green Building Coalition.

The students also explored the strength of support for sustainability efforts among stakeholders in the City of Clearwater. The city has very strong links with community groups. Many members of the community participated in a stakeholder meeting where they provided input on how the city can move ahead with sustainability. The ideas they came up with were very helpful and demonstrate that there is widespread support for sustainability initiatives within the city. Indeed, there is also support within other groups including the Clearwater Beach Innkeepers Association, the Clearwater Regional Chamber of Commerce, the Clearwater Beach Chamber of Commerce, and the Clearwater Audubon Society.

Many cities have distinguished themselves with innovative sustainability projects. For example, the City of Milwaukee, Wisconsin is known for its comprehensive watershed management, the City of Portland, Oregon is known for its comprehensive energy plan, and the City of Cleveland is known for its EcoVillage program. These illustrate the reality and practicality of urban sustainability. The City of Clearwater has

the opportunity to become a leader in Florida in urban sustainability by taking bold moves. Several examples were presented in this report for review, and the students identified willing private and public partners ready to assist with implementation. For example, one idea presented is the development of a solar park. This idea has some traction in that Progress Energy is interested in moving forward with assisting the city in the development of this idea.

Transportation is also an interesting issue within the City. Several ideas were presented and each provides opportunities for future research and discussion. With Clearwater's unique road network and seasonal residents, there are opportunities and problems. Nevertheless, a focus on bicycle transportation, airport to hotel transportation, and electric fleet vehicles could make a difference.

Finally, there are many practical moves the city could make with energy and green building. There is no doubt that the city can save money through the development of green buildings and through an integrated energy management system. There are opportunities to change building codes and to rethink how the city moves forward with redevelopment.

We urge that the city continue its progress in sustainability. **We believe that the cost savings brought about through conservation would support the hiring of a sustainability officer.** Indeed, this is a trend seen in many cities. For example, the City of Dunedin recently hired a sustainability officer in charge of its sustainability initiatives.

The University of South Florida will continue its partnership with the City. Three students in this class have expressed a desire to continue their work and develop master's

theses around their topics. We hope that this document and the future work done by students and faculty will be useful to the citizens of the City of Clearwater.