

1. Summary

Humboldt State University is striving to meet its sustainability goals through a series of campus wide projects. One of these goals is to reduce the amount of waste the campus generates. Currently a food waste diversion pilot study is being conducted in conjunction with the Humboldt Waste Management Authority to estimate feedstock for a proposed municipal anaerobic digester. This paper examines the possibility of including bathroom paper towels in addition to the food waste. We conducted our own pilot study to determine: mass and volume of paper towels generated, behavior change through participation in project, and logistics for future study. From the data we estimate a mass of 30,000 pounds or 15 tons and a volume of 8,000 cubic feet with a 75% reduction in the amount of contamination. Even though these are rough estimates they support future investigation into paper towel waste diversion.

2. Introduction

Humboldt State University is becoming more aware of its waste. Currently we dispose roughly 900 tons of waste a year, some of which can be diverted from the landfill to meet Assembly Bill 341's requirement of 75% diversion by year 2020. To meet that goal, HSU is aggressively looking for more ways to reduce, reuse, and recycle. This project is intended to create a possible solution for diverting additional waste from the landfill in order to meet this goal.

At the moment, HSU diverts its waste through various campus-wide projects. The Campus "Waste Reduction Recycling and Awareness Program" or WRRAP, oversees the recycling of glass, aluminum, plastic, paper and cardboard. In addition, they have a small-scale demonstration composting site, an electronic waste recycling program, and the "Reusable Office Supply Exchange Facility" (R.O.S.E).

HSU's Sustainability Department is responsible for implementing campus-wide sustainability initiatives. Currently they have teamed up with Humboldt Waste Management Authority's (HWMA) to conduct a food waste pilot study. As an early adopter, they will be collecting food waste from two main cafeterias to determine the mass and volume generated on campus. The data will help as HWMA is preparing to bring a municipal anaerobic digester online as early as January 2012. They suggested looking into paper towel waste to complement the food waste pilot study.

Anaerobic digestion is the decomposition of organic matter by microorganisms in an oxygen free (anaerobic) environment, creating biogas, residual solids and liquids (Bohn, et al., 24, 51) The biogas will be used to power the actual digesting plant, thereby reducing HWMA's dependence on electricity and their Greenhouse Gas Emissions (GHG's). The residual solids and liquids are nutrient-rich and valuable soil amendments, with the possibility of providing an additional source of revenue for the facility (Bohn, et al, 52).

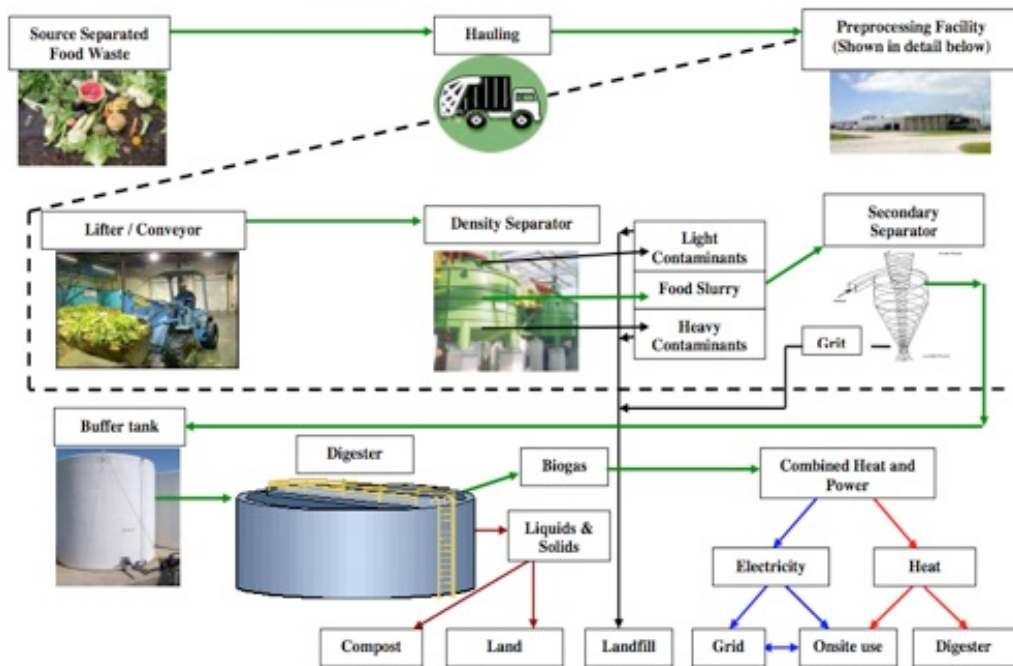


Figure 1: “Process Flow Diagram for a food waste digester. Green arrows are organic material flow, the black arrows follow contaminant flows, and the brown, blue and red arrows show end products (Bohn, et al. 71).”

This paper will background research into the subject, the goals and objectives, methods to meet the objectives, and results from sampling and experiments. In addition it will include our opinions along with a planning document for future study. We hope that students and campus staff will be able to use this to someday implement a campus-wide paper towel waste diversion program.

3.0 Background Research

3.1 Landfills

In 2010, the Environmental Protection Agency estimated the generation of just less than 250 million tons of municipal solid waste (US EPA, 2010 c). Historically, the amount of waste generated per capita has increased with the amount of consumer goods entering the marketplace. More consumer goods mean more packaging and unwanted items in the waste stream. Although recently the amount of waste disposed per capita has decreased from 5.1 lbs/person/day in 2008 to 4.5 lbs/person/day in 2009, mainly due to the most recent economic recession (CalRecycle, 2009). Still, landfills are decreasing in number while waste is still being generated. From 1991 to 2000, the number of landfills in California decreased from 340 to 146 (O’Connell, Kim A. “Sorry Landfill Closed”). Humboldt County’s, Cummings Road Landfill located on Pine Hill in Eureka, CA was capped and closed at 1,825,212 tons of waste in 2000 (Bohn, Juliette. “LMOP Project Expo 2010”). Consequently, all waste generated is now trucked an average of 187 miles (380 miles round trip) out of county to the Dry Creek Landfill in White City, Oregon or to the Anderson Landfill outside of Redding, CA (See Figure 2: Bohn et al,

3). The cost of transportation in Diesel fuel and the external costs in GHG's are significant. Roughly 100,000 tons of waste is transported out of Humboldt County per year, generating 4,484 Metric Tons in GHG's (Bohn et al, 4, 10). Landfills themselves are a source of Greenhouse Gas emissions, which include Carbon Dioxide (CO₂), Methane (CH₄), and Nitrous Oxide (N₂O). Most of these GHG emissions are produced from organic material breaking down under anaerobic conditions, while other forms of solid waste do not produce GHG's because they are not composed of carbon (US EPA, 2009b). Paper towels are included as a type of "organic waste", making them a viable target for GHG reduction. It is understood that GHG emissions are the main contributors to climate change and are the subject of international focus on prevention and remediation (e.g. Kyoto Protocol).

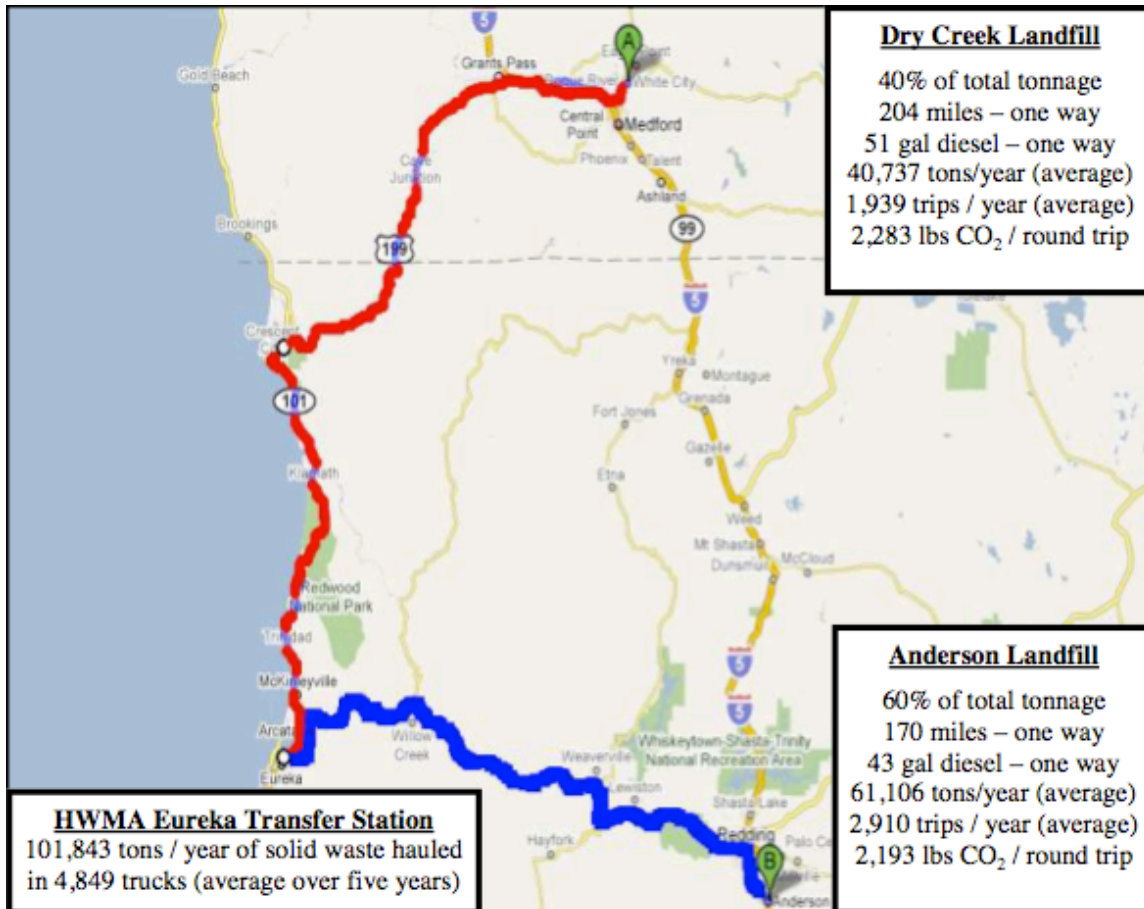


Figure 2: This map shows Humboldt County's solid waste disposal routes. Map source: Google Maps (Bohn et al, 3).

3.2 Waste Reduction Policy

In response to the growing waste and pollution problem, US Congress passed the Solid Waste Disposal Act in 1965, forming much of the framework for states disposal laws and setting minimum safety requirements for landfills (US EPA, 2011d). The Resource Conservation and Recovery Act (RCRA) passed in 1976, in order to provide a more comprehensive national waste management strategy. The established goals were to “ensure that wastes are managed in a manner that protects human health and the environment; reduce or eliminate, as expeditiously as possible, the amount of waste generated, including hazardous waste; and to conserve energy and natural resources through waste recycling and recovery (US EPA, 2002e). The Environmental Protection Agency (EPA, est. 1970) eventually gained authority over the national waste management strategy. The first decade of this act (1976-1986) mainly focused on hazardous waste management and disposal and it wasn't until the late 1980's and early 1990's, that the EPA began to focus on recycling and source reduction measures.

The US EPA mandated recycling and resource conservation goals to the states environmental divisions. The state of California has implemented a variety of policies targeting different components of the waste stream and different types of generators in order to reduce its waste. The first legislative policy formed was SB 5: Solid Waste Management and Resource Recovery Act of 1972, shifted the responsibility of establishing a “Solid Waste Management and Resource Recovery Policy” to each individual county. This shift gave rise to the California Beverage Container Recycling and Litter Reduction Act (AB 2020) of 1986 provided the public with a financial incentive to recycle their bottles and cans. It imposed a redemption fee, called CRV, on all beverage containers (\$0.10 for >24 oz. and \$0.05 <24 oz.) bought and sold in California. This program has been extremely successful, increasing California's recycling rate from 52% in 1988 to 82% in 2010 (Container Recycling Institute. 2010).

The strongest measure coming out of the state legislature, effecting how waste is handled in California, was AB 939: The Integrated Waste Management Act. It established the Integrated Waste Management Board, now CalRecycle, which is responsible for establishing Integrated Waste Management Plan's, and requiring each county to set-up task forces to coordinate and develop City Source Reduction and Recycling Elements (SRRE's). Each city had to submit to the County the following by July 1, 1991: A waste characterization study; source reduction plan; existing recycling, composting and solid waste capacity; education and public information; funding information; information on special waste handling such as asbestos, sewage, sludge, etc.; and information on household hazardous waste. The counties were also responsible for developing a siting element for specifying areas for transformation (composting) or disposal sites. It also determined strict regulations and permits for landfill operators. The main component of this bill was the attainment by each city and county to reduce their waste by January 1, 2000 by 50% through “source reduction, recycling, and composting (CalRecycle, 2011).” The funding for the implementation of Integrated Waste Management Plans and new recycling, composting and education programs was provided by the allowance of local jurisdictions' to impose fees at local landfills per tonnage of solid waste (CalRecycle, 2011). After AB 939, local cities and counties in California had an economic incentive to reduce waste going to landfills because the fines were steep, up to \$10,000 per day for failing to

implement Integrated Waste Management Plans or not meeting the 50% diversion goals. In Humboldt County there are still four jurisdictions that have yet to reach the 50% target (Bohn et al., 3).

Most recently California's state legislature passed AB 341, an amendment to AB 939. It increases the 50% diversion goal mandate to 75% by the year 2020. By January 1, 2014, the Department of Resources Recycling and Recovery (CalRecycle) is required to provide a report to the legislature stating strategies to achieve the 75% goal. By increasing the diversion percentage goal, California is striving towards a "zero-waste" future, which is a vision of creating little to no waste at a 90% diversion rate or greater (Sierra Club, 2009). This requires more drastic measures in the forms of source reduction, recycling and composting. Much has been done in the forms of recycling by providing education, increased access, and opening new markets for more materials. But there is still much to do, especially in the form of composting, which has the potential to drastically reduce and reuse California's waste in an environmentally friendly and profitable manner.

The Humboldt County General Plan 2020 ascribes to the 75% waste diversion goal and has policies in place that support increased source reduction, including WM-P1: Implementation of Waste Management Programs. Section a through c of this policy state the intention of achieving the "maximum reduction possible in volume and weight of material requiring landfill disposal through regional diversion efforts and expansion of existing programs as well as the creation of new programs targeting more recyclables and organics (Humboldt County Planning Commission, 10-4)". This is why HWMA, a joint powers authority responsible for managing and tracking Humboldt Counties waste, is moving forward with the implementation of a new form of waste management through anaerobic digestion. HSU's Strategic Plan 2009 states that "waste reduction initiatives" will be one of the strategies used to obtain a goal of HSU becoming a "model of environmental and sustainable building practices (HSU 2009, Table 16: pg. 182)."

3.3 Greenhouse Gas Policy

Global climate change has become one of the biggest threats to our planet. Its impacts are being experienced throughout the world, with extreme weather events and patterns changing our community structure and environment. Scientists from the International Panel on Climate Change (IPCC) predicted that the effects of climate change, warming oceans and melting glaciers, would cause sea levels to rise 7 to 23 inches by the year 2100 (IPCC, 2007).

On October 5, 2009, President Obama signed an Executive Order directing the Interagency Climate Change Adaptation Task Force to develop a report with recommendations for how the Federal Government can strengthen policies and programs to better prepare the Nation to adapt to the impacts of climate change (Council on Environmental Quality, 2011). According to the IPCC, the waste sector contributes less than 5% of global GHG emissions, with landfill methane emissions being the largest component (IPCC, 2007).

In 2006, California passed AB 32: Global Warming Solutions Act. This requires the State of California to begin monitoring and regulating GHG emissions. By Dec 31, 2020 California's GHG emissions need to be at 1990 levels (California Air Resources Board, 2006). In 2007, the

Humboldt County Board of supervisors unanimously adopted the ICLEI Cities for Climate Protection Program Greenhouse Gas Reduction Plan and currently the Redwood Coast Energy Authority is completing the first countywide GHG Inventory (Redwood Alliance, 2011). This is one of five steps or “milestones” that the Humboldt County Board of Supervisors adopted in Resolution 07-88 towards a county climate change leadership strategy (Humboldt County Board of Supervisors, 2007). Humboldt State University has pledged to follow the states lead and also cap its own GHG levels at 1990 levels by 2020 (Humboldt State University, 2011). Reducing the amount of waste HSU generates will help HSU attain its GHG reduction goal.

3.4 Social Marketing

The success of many environmental programs is dependent on the participation of the audience influenced by its changes. This is largely in part because it often requires a fundamental change in the way a person behaves. Because of this there is a crucial role for social sciences in these problems because “they are all caused by human behavior, and can be reversed by human behavior” (Oskamp, 2000). There have been many approaches to support these changes from education, incentives, and social marketing.

Early research into the field suggested that a lack of education or knowledge on the subject was the greatest barrier to successfully influencing sustainable behavior change (Marcell, 2004). This simple model assumes that environmental awareness and concern stems from a linear progression of environmental knowledge leading to pro-environmental behavior (Kollmuss, 2002).



Figure. 3 Early models of pro-environmental behavior. (Burgess et al. 1998)

Unfortunately these models were proven wrong as research showed that an increase in knowledge and awareness did not lead to a sustainable pro-environmental behavior. There are more complex factors such as social norms, altruism, personal perceptions, beliefs, and attitudes affecting our individual and collective behavior (Marcell, 2004).

Blake (1999) describes the *Value-Action Gap* by constraints created from individuality, responsibility, and practicality barriers. Individual barriers lie within our attitude and temperament and have the greatest impact on our environmental concern. He explains responsibility barriers as those created primarily by our efficacy or lotus of control. Without hope or belief in a reason to change there is little motivation to change behavior. Lastly he examines practicality as a barrier. This is largely created from external factor such as lack of time, money, information, or supporting infrastructure.

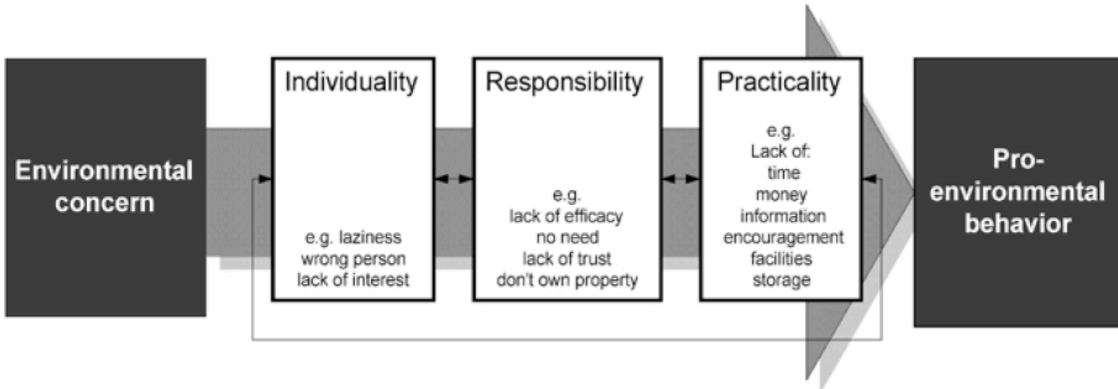


Figure. 4 Barriers between environmental concern and action. (Blake, 1999)

A more comprehensive model was presented by Kolluss and Agyeman (2002) as they tried to tackle the gap between environmental knowledge and awareness and pro-environmental behavior. Their model incorporates four major factors influencing our behavior. At the core lies our environmental consciousness, which is shaped by internal and external factors. Constraining these are obstacles or barriers to behavior.

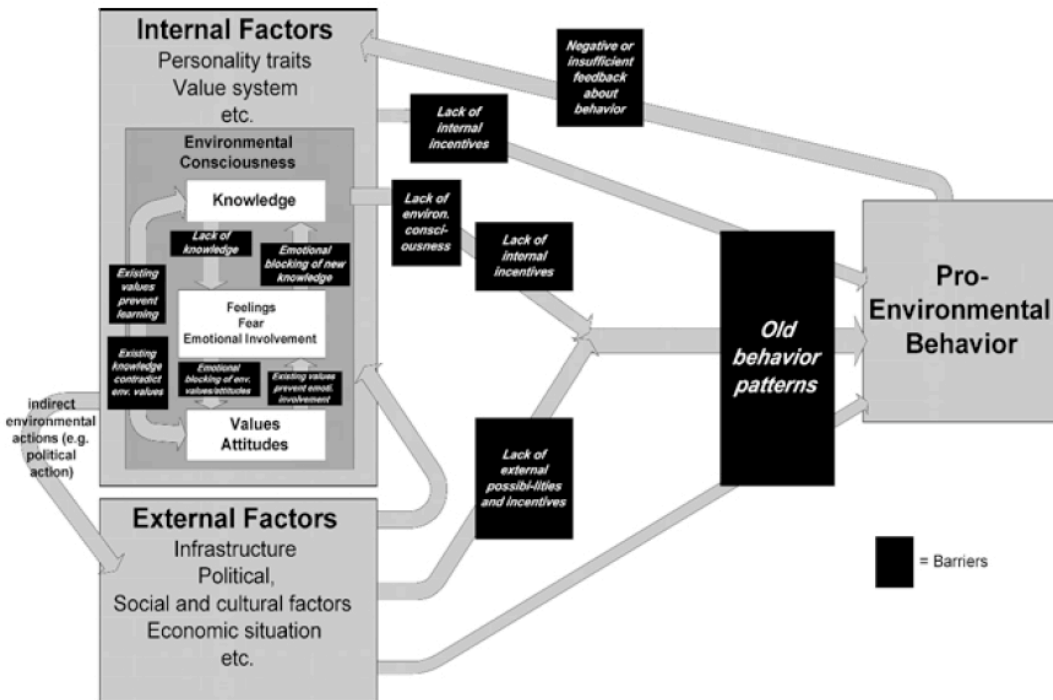


Figure. 5 Model of Pro-Environmental Behavior (Kollmuss and Agyeman, 2002)

They view our environmental consciousness as made up by our environmental knowledge, values, attitudes, and emotional involvement. Our personality traits and broader personal values further shape our behavior. External factors such as a supportive infrastructure, politics, and social and cultural norms also influence us as we finally are faced with both internal and external barriers. Although simplistic this model serves as a way to clarify and categorize factors influencing pro-environmental behavior.

One successful method of creating sustainable pro-environmental behavior is social marketing. It has been applied for more than three decades in the field of public health, political marketing, and environmental protection (Smith, 2011). The basis of a social marketing program involves market research into planning, pricing, communication, distribution, and evaluation much like a commercial marketing model. The premise is to create a situation where the audience chooses to change their behavior rather than to educate, direct, and regulate it (Marcell, 2004). It seeks to create benefits and reduce barriers that matter to specific audiences, while providing a sense of increased societal benefit (Smith, 2011). In a sense we become social entrepreneurs or a person who changes the performance capacity of society. It implies responsibility not only on society but also on the social entrepreneur (Gershon, 2009)

4.0 Goals & Objectives

4.1 Strategic Goal

Our overarching strategic goal is to simply reduce the amount of waste being generated on campus and transported long distances to the landfill. This will in turn, reduce the GHG emissions associated with HSU and hopefully complement the future food waste-composting program being studied. Many stakeholders, including HSU, the campus Sustainability Department, WRAAP, and HWMA, share this goal.

4.2 Programmatic Goals

In order to meet our strategic goal, we need to implement several programmatic goals or objectives. The following is a comprehensive list of what these goals are in chronological order:

1. Develop and maintain relationships with all stakeholders.
2. Research existing policy framework and determine if paper towels can be legally composted in the county.
3. Research similar programs at other colleges.
4. Research the type and brand of paper towels currently being used on campus and determine if they are an efficient feedstock for an anaerobic digester.
5. Observe custodians during work and discuss issues and troubleshoot obstacles pertaining to collection methods.
6. Perform a baseline study of current paper towel waste generation in a random sample of bathrooms on campus to determine estimates of volume and weight.
7. Perform a behavior change study to determine how well students are informed and can comply with a possible bathroom towel waste-composting program.
8. Compile an organized planning document for future students to use to implement the actual paper towel waste composting program in the future

4.3 Objectives

To gain support for our project we would like to prove that it could be successful by achieving a 70% decrease in contamination in our paper towel collection bins.

If our group compiles a detailed synthesis on current policy and existing programs, we will have a solid background of waste diversion allowing us to develop our own project. After completing the waste characterization study, we will be able to quantify a volume/weight of paper towels currently being generated on campus. This data will be provided to HWMA as a potential feedstock to their anaerobic digester. By minimizing additional workload to custodial service, we can increase our chances of their participation. If we can prove that custodians and students will be on board with changing existing behaviors, then we can sell this program to administration and plant operations. If all of these objectives are met, it should allow us to write a comprehensive planning document, leading to a reduction in solid waste transported to the landfill.

5.0 Methods

5.1 Brainstorming Solutions

An important step in problem solving is generating solutions that would meet your goals and objectives. Our group used the team idea mapping method and generated up to 42 different possible solutions that could help us to meet our strategic goal. We applied logical, cost, sanitation, and participation filters to narrow them down. The following is a simple break down and examples of these filters:

a. Logical Constraints:

Some of the proposed alternatives were rather absurd and would only occur in a different reality. An example of a few:

- Make paper towel parachutes
- Make paper towel muumuus
- Ship to Space

b. Cost Constraints:

Our second filter removed several alternatives that wouldn't have been economically feasible. An example of a few:

- Shipping to another country
- Use to soak up oil at oil spill disasters
- Process into printing paper for the North Coast Journal

c. Sanitary Constraints:

Our third filter applied issues of sanitation and removed several other alternatives. An example of a few:

- Have janitors reuse for cleaning
- Implement a cloth towel dispenser
- Transport to locker rooms for reuse as towels

d. **Participation Constraints:**

Our fourth filter applied the logistics of gaining cooperation from our collaborating stakeholders, namely the Sustainability Department and Plant Operations. An example of a few that were removed at this point were:

- Remove paper towels from the bathrooms
- Composting on campus
- Create bedding for marijuana plants in local grow houses

5.2 Final Four Solutions

From all of our alternative solutions we ended up with four viable solutions. More research had to be done to determine which one would be more feasible. The following is a summary of research on each possible solution.

a. Electric Hand Dryers

In 2010, HSU received a HEIF (Humboldt Energy Independence Fund) grant funding the installment of two (each) Dyson Airblade hand dryers in both the men and women's bathrooms on the first floor of the Library on campus. The original grant stated that they can save HSU up to \$63,000 per year on paper towels and reduce 120,00 kg of CO₂ per year (HEIF, 2009). It was observed on campus that there still exist paper towel dispensers in the library bathrooms and according to the head custodian at Plant Operations, paper towel waste in these bathrooms has actually increased due to the increasing size of incoming classes (Goodeyon, Ed. 20 Oct 2011). The initial cost barrier is \$1,200 each (HEIF, 2009), and that doesn't include maintenance or the cost of electricity. A 2009 cost-benefit environmental study by the University of British Columbia on hand dryers found that although they are more environmentally friendly than paper towels in terms of carbon dioxide emissions, they consume 10 times more energy (Gyenge et al. 29). Additionally hand dryers proved to be inferior in terms of bacterial removal from users' hands, by generally increasing bacteria anywhere from 88% to 358% for jet-air dryers (Gyenge et al., 29). This could explain why the library bathrooms still have paper towels as well as the fact that some people simply don't approve of hand dryers for a variety of reasons.

b. Compressed Paper Logs

Compressing unused paper into logs is not only feasible, but it is already practiced on a smaller, more rural scale. Simple compression devices can be purchased several ways, including online. Amazon sells an easy to use (roughly) \$35.00 compressor. (Amazon.com.UK). However, this is not feasible on the large-scale volume that we experience here at HSU, for the volume we receive is too large for such small-scale compression.

c. Burning Paper Towels

Incineration of mixed paper waste with an energy generation component is one of the most economical alternatives to landfills and is a potential solution to reducing HSU's solid waste

contribution to landfills (Ucuncu, 1993). Currently the 18 MW steam power plant in Fairhaven, CA burns 250,000 tons of woody biomass annually (Association, 2011). This incineration capacity can easily accommodate any volume the campus produces in a given year. But unlike woody biomass the energy output from a paper towel is significantly less than that of a wood chip. In an interview with Bob Marino, the General Manager of the DG Fairhaven plant, he mentioned, “the plant could easily burn the paper towels. They just wouldn’t generate the heat required to run the plant at their current rate.” In addition he added, “In a windy environment, such as the North Spit, keeping refuse derived fuels, such as mixed paper from becoming litter is pretty difficult.” (Marino, 2011) We took a walk around and saw how the biomass is transported into the boilers. Mixing paper towels into the biomass piles or creating a unique system to feed the paper towels both do not seem like viable solutions.

d. Anaerobic Digestion

After analyzing all possible alternatives related to our goals, our group chose our top choice to be implementing a paper towel waste-composting program. Largely in part because of HWMA’s future anaerobic digester, the HSU Food Waste Pilot Study, and the high amount of paper towel waste we personally observed in the bathrooms on campus.

5.3 Strengths, Weaknesses, Obstacles, and Threats (SWOT)

The next step in developing our solution was to evaluate our group's strengths and weaknesses. Internal analysis helped us identify irregularities, limitations and opportunities affecting the project. External analysis revealed how we might be perceived or influences that may influence our group.

The purpose is to reveal positive forces that work together and potential problems that need to be addressed. The following is a list of internal and external SWOTs.

| | Internal | External |
|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Strengths | <p>Strong work ethic</p> <p>Prior existing relationship with custodial staff</p> <p>Passion for the project</p> <p>Connections with waste management</p> | <p>Affiliation with similar diversion program (Recycling and Campus Compost)</p> <p>Support from community, peers, County and local government officials</p> <p>Strong volunteer group</p> <p>Similar programs on other campuses</p> <p>Doesn't require much additional work for custodians</p> |
| Weaknesses | <p>Limited time for data collection/ Social Marketing</p> <p>Funding</p> <p>Individual ability to participate in project</p> | <p>Transportation of food waste off campus still not addressed</p> <p>Unionized custodial labor</p> |
| Obstacles | <p>Heavy work load pertaining to other classes</p> <p>Lack of knowledge on the subject</p> <p>Managing time and meeting deadlines</p> <p>Ability to design a affective social marketing program</p> | <p>Gaining approval from County Health Department, Office of Sustainability, and Facility Management</p> <p>Acquiring infrastructure needs (bins, bags, gloves etc.)</p> |
| Threats | <p>Unexpected personnel changes</p> | <p>Immediate project disapproval</p> <p>Labor disputes from custodial staff</p> |

Table 1: SWOT Chart

5.4 Unintended Consequences

The solution we choose may generate some positive or negative unintended consequences. It is important to recognize this issue and incorporate ways to identify them. Some factors influencing consequences are complexity in a project, human nature, ignorance, immediate interests, values and beliefs. The following is a list of foreseeable unintended consequences.

Negative:

- Upsetting the custodial union, management, and staff.
- Creating a program that generates more GHG's than it offsets.
- Creating an economic burden on an already strapped budget.
- Confusing the campus populace with an ambiguous program.
- Generating too much feedstock for the proposed anaerobic digester to handle.
- Reducing or eliminating campus employment.

Positive:

- Reinforcing the recycling program.
- Inspiring similar programs on campus and in other institutions.
- Gaining a better understanding of the campus culture and behaviors.

5.5 Implementation

a. Summary of meetings and communications with Collaborators/Stakeholders: (See Appendix B for full notes):

| Date | Who | Key Points |
|---------|----------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 9/13/11 | Morgan King Sustainability and Waste Coordinator | <ul style="list-style-type: none"> • Initial Scoping of our project |
| 9/22/11 | Juliette Bohn Program Analyst (HWMA) Sara Mosser Food Waste Diversion Program Analyst (HWMA) | <ul style="list-style-type: none"> • Overview of HWMA's Food Waste Diversion Program • Outlined the HSU's Food Waste Diversion Pilot Study • Discussed important elements of conducting a paper towel waste pilot study |
| 9/26/11 | HSU Food Waste Pilot Study Group Meeting | <ul style="list-style-type: none"> • Stakeholder Meeting with all collaborators on Food Waste Diversion Pilot Study • HSU Director of Sustainability stressed importance of implement "Behavioral Change" mechanisms to implement diversion |
| 9/28/11 | Robert Holmes CalRecycle: Compliance and Enforcement Division | <ul style="list-style-type: none"> • Anaerobic digestion facilities are subject to the Compostable Materials Handling Operations and Facilities Regulatory Requirements that can be found in the California Code of Regulations, Title 14, Division 7, Chapter 3.2. |
| 9/29/11 | Carolyn Hawkins Solid Waste Land Supervisor with | <ul style="list-style-type: none"> • Technical definitions of medical and hazardous waste, which are prohibited from anaerobic digestion. |

| | | |
|----------|---------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| | County Department of Environmental Health | <ul style="list-style-type: none"> • Collection of paper towel waste would not violate county codes. |
| 10/27/11 | Ed Goodeyon HSU Facilities Services Manager | <ul style="list-style-type: none"> • Information on custodians job description and work hours. • Data on type and consumption of paper products. |
| 11/3/11 | Norton Mitchell UC Berkeley Facilities Manager | <ul style="list-style-type: none"> • Outlined the current paper towel waste diversion program at Unit 1 Dormitories at UC Berkeley. • Stressed importance of collaborating with custodial staff. • Mentioned that contamination will always be an issue. |
| 11/15/11 | Johanna Young Residential Sustainability Program Volunteer | <ul style="list-style-type: none"> • Created first bathroom paper towel compost pilot study. • Outlined social marketing program. • Stressed collaboration. |
| 11/23/11 | Claire Evans Lead Coordinator UC Berkeley Cal Compost | <ul style="list-style-type: none"> • Outlined the current paper towel compost program on campus. • Greatest challenge was financial. • Knowledge on the subject, social marketing, and collaboration are key. |

Table 2: Summary of Correspondence (Appendix B1-B8)

b. Gaining Voluntary Participation from Custodial Staff

The custodial staff is unionized under the California School Employees Association, Unit 5. Seeking participatory action on behalf of the custodial staff was a tentative issue, on what their current contract dictates specific allowable variances in the custodial routine. Facilities Services Manager, Ed Goodeyon, informed us that dividing recyclable material and storing them in separate waste bins were currently included in the job description. Nevertheless, the legality of the issue was but a minor concern; Future consideration of this project would inevitably depend on the exclusive labor conducted by the custodians. Furthermore, progressive pay grade increases ceased in early 2002, so convincing a somewhat disgruntled group to perform additional duties with no extra incentive was challenging to say the least.

We were fortunate enough to have an existing relationship with one of the custodians working in Science building A. Josh Koerschgen was our original point of contact for the custodial community with whom we arranged a few casual meetings before we contacted Ed Goodeyon. He provided insight into the current mentality of the staff and gave us suggested techniques on how to approach them. This proved crucial not only in the beginning stages of the project, but will also be important in all future collaboration. In addition he provided information pertaining to each individual custodian’s collection routines and varying schedules.

One helpful suggestion was offering additional incentives for those who volunteered; such as a complimentary barbecue, or even the possibility of rewarding some of the monetary savings to the custodial budget. The ladder of course would require extensive administration involvement that was well beyond the scope of our abilities in a single given semester.

Ultimately, we needed to approach the custodial staff requesting a favor and not demanding a

change in routine for the convenience of our study. Also, that this is a feasibility study, therefore only a temporary adjustment would be required.

When we finally scheduled our meeting with a majority of the custodial staff, even given our prior established rapport with the group, we were faced with immediate skepticism and doubt concerning their involvement and were bombarded with a volley of questions about additional duties. With the approval of the custodial shift-manager, Charles Batini, we were granted access to the lavatory facilities with the promise to conduct the bulk of the collection/separation ourselves. In the end we acquired seven initial volunteers and their respective buildings, more than enough workload for the two students conducting this portion of the project. During the data collection our establishment rapport with the custodial staff strengthened and new friendships created. We believe this to be the key element to the project and should be carefully considered by those who wish to continue this project.

5.6 Campus Pilot Study

One of the most crucial components to our project is the paper towel waste diversion pilot study. It not only provided important data but also will serve as a template for future work. From the study we hoped to determine an estimate on the amount of paper towels generated on campus, the level of contamination in our bathroom waste bins, and research basic methods for campus participation. We outlined our study in 6 steps with specifics (Appendix A4).



Figure 6: Developing a research methodology.

a. Planning

One heaviest constraint that needed addressing was the limited amount of time to conduct a pilot study. This required us to create a planning document to help organize and manage tasks and deadlines. A rough timeline was created and later revised with more specific assignments and deliverables. This system created accountability and maintained a steady workflow.

b. Research

Research into similar or existing projects was the next step. We learned of two California college campuses that are running successful paper towel waste diversion programs.

UC Berkeley

UC Berkeley's paper towel composting program began as a Residential Sustainability student project in 2009. They conducted a pilot restroom paper towel-composting program in two campus buildings, which resulted in a 90% diversion, generating 325 pounds of paper. The study involved a several weeks of social marketing. It also incorporated signs to promote awareness within the restrooms.

The success of the program prompted a full-scale operation though out the Unit 1 dormitories consisting of 4 high-rise buildings. This program utilized a short educational video that plays on a 30-second loop at the freshmen check in center and can be view on YouTube (Paper Towel Composting in Residence Halls at UC Berkeley!, 2010).

The student group Compost Alliance, housed under the Campus Recycling and Refuse Services, later initiated a continuation of the program in all dining facilities and cafes. The Cal Dining facilities along with several buildings on campus had already implemented a food waste-composting program(UC Berkeley, 2010). With a pre-established food waste collection site, the addition of paper towels became a complementary addition.

Currently a third party private company called Recology collects the food and paper towel compost and transports it to East Bay Municipal Utility District (EBMUD). Their food waste pilot study began in 2007 and has been growing strong accepting food waste from neighboring restaurants.

Santa Clara State University

A paper towel-composting program has also been implemented in their gymnasium and restrooms. This includes food waste as well (Santa Clara University. 2011.)

c. Design

The pilot study was designed to meet several objectives. First, it had to be conducted in a way that did not disturb the existing routine the custodial staff followed. To ensure this, preliminary observations looking at routines, the mass and volume of paper towels collected, timing, equipment used, and traditions or norms were done. The bathrooms sampled were based on voluntary participation by the custodial staff (See Appendix A3).

Secondly the study needed to be completed within the semester. This time constraint limited the types of social marketing methods that could be used. To meet our objectives and constraints we divided the study into to phases. Baseline data was collected for one week. The second week informational signs were hung promoting awareness of the project. (See Appendix A1-A2).

Lastly our design needed to be manageable with the amount of people able to assist in the study. This limited the number of restrooms that could be sampled in an evening. Two people (preferably male and female) are needed to carry this out.

d. Promote

Establishing relationships with involved authorities requires a certain degree of preparation; after conducting extensive research on existing projects and policies involving waste management/separation, designing a detailed pilot study with methodologies, and doing so with a predetermined timeline we were armed with enough information to promote this project to all affiliated parties.

e. Implement

The pilot study implementation required a two-week commitment with an average of 2.5 hours a night.

We met with participating custodians at the pre-determined time with all of our equipment. (See Appendix A4) Almost every bathroom in participating buildings was sampled during the baseline and behavior change collection period. All necessary measurement and observations were recorded.

f. Innovate

The last step in developing our pilot study was being flexible and adaptive. Based on feedback from the custodial staff we made adjustments to the schedule we followed in our sampling. Some custodians preferred an earlier sampling while others later.

The number of bathrooms changed during the project as well. This was largely in part to vandalism and theft of signs. This reinforces the idea of maintaining the largest feasible sample a group can handle.

Being able to adapt to a changing research group will also be important. Committing to 4 weeks of research is not realistic. A rotating pair of researchers is probably a better way to handle the workload.

6.0 RESULTS

6.1 Data Collection:

Baseline Data Collection:

Baseline data consisted of a 4-day collection period and 132 bathrooms from 7 different buildings between the dates of 11/07/2011 and 11/10/2011. A total of 247.8 lbs of paper towels were collected. We measured 29.6 lbs of contamination mixed in with the paper towels, for a total waste mass of 277.4 pounds. Between the seven buildings we collected 24.7 full bags of paper

towels at 2.7 cubic feet per bag; that's 66.69 cubic feet of paper towels collect on the first week(See Appendix A5).

Behavior Change Data Collection

The behavior change data sampled a total of 129 bathrooms in 7 buildings between the 11/29 and 12/2. A total of 168.1 pounds of paper towels were collected. We measured 6.7 pounds of contamination mixed in with the paper towels. Our bins marked “everything else” contained 26.3 pounds of waste. In total, 201.1 pounds were removed from the sample bathrooms. A total of 16 full bags at 2.7 cubic feet per bag for a total of 43.2 cubic feet of paper towels. Observations of contamination and “everything else” bins were noted (See Appendix A6).

6.2 Analysis

Over an eight-day period a total of 478.5 pounds of waste was removed from the sample bathrooms. Our baseline data averaged 1.9 pounds of paper towels and 0.2 pounds of contamination per bathroom. This was smaller in our behavior change sampling at 1.3 pounds of paper towels and 0.05 pounds per bathroom. This data shows a 120% difference or a 75% decrease in contamination.

Assuming 120 bathrooms on campus, we can extrapolate the average of 1.6 pounds of paper towel mass per bathroom for a total of 192 pounds generated in one day. This equates to 29,952 pounds or 15 tons of paper towels per semester.

We calculate an average of 10 pounds per full bag. This represents a total of 2,995 full bags of paper towels. At conservative estimate of 2.7 cubic feet of compressed paper towels per bag this equates to a volume of 8,086.5 cubic feet. This volume of paper towels alone requires 2.7 waste hauling trucks.

Using our data to calculate possible GHG offsets and reductions in disposal fees, we came up with a reduction of roughly 2,260 kg CO₂/year and a savings of \$2,250 a year. Current disposal costs of HSU are around \$135,216 per year with a GHG equivalent of 37,725 kg CO₂/year (See Appendix A6). These numbers are conservative because they do not account for the large amount of volume of uncompressed paper towels.

7.0 Discussion

7.1 Weakness in study

Time was a very limiting factor in our study. Before we could even begin to consider measuring volume and mass, we needed to gain approval from the Office of Sustainability, Humboldt County Environmental Health, the Facilities Manager, the custodial staff, and Dr. Richard Hansis. After having accomplished said approvals, we were left with just a few weeks to conduct the study. The study itself was also a very time consuming entity, with only two students committed to the research, data collection ranged between 2-4 hours a night. Additionally, the deadline for the report was the day after the final night of paper towel collection, leaving just a few hours of analysis before submission.

We believe that an adequate duration and sample size of data collection far supersedes that in

which we provided. Perhaps an entire semester including weekends, special events such as football games, and holidays are required to supply a more accurate representation for HSU's paper towel content. Also an increase in sample size is recommended for a more complete statistical analysis. We were only able to acquire 32 out of the assumed 120 bathrooms located on HSU. This would require a larger work force with a longer time allowance than we were able to attain.

The device we used to measure mass was a standard, inexpensive bathroom body weight scale with a high margin of error. With contamination levels averaging a pound per building, it was nearly impossible to obtain accurate readings with this simple scale. We recommend using a hanging spring scale with accuracy up to one hundredth of a pound.

Lastly, the social marketing portion of our project that we implemented was limited to signs posted in the bathrooms next to the waste bins. These signs were merely temporary, laminated, color coordinated pieces of paper held aloft by strips of 14-day painters tape. This left the study vulnerable to sign removal and vandalism, which we experienced at multiple collection sites. Future signage needs be on a more permanent basis and should be harder to remove by the casual passer-by.

In the November 30, 2011 issue of the campus newspaper "The Lumberjack", the second day of our behavioral change pilot study (Poor, K. 2). This could have boosted participation from students and faculty on campus. Although this was rather serendipitous, it could be employed as a social marketing tool in the future.

7.2 What we learned

Of the many lessons garnered from this study, we found that establishing communications and building relationships with people and organizations are paramount. A good example of this would be that of the custodial staff; without their support and being allowed to conduct this study in their respective areas-of-responsibility, we would not have been able to pursue this experiment at all.

Accuracy and precision are important when measuring paper towels and especially contamination, given that large amounts of volume do not necessarily mean a high measurement of mass.

Effective signage is key to communicate your message. We used only temporary signs that we held to the wall by 14-day painters tape, however we experienced a 120% difference in behavior change. With a more permanent sign/education system even higher results can be expected.

A large amount of time, labor, and commitment is required for this study. Two students spent an average of 2.5 hours each collection night, for 8 nights (does not include sign posting and removal), additionally a week of preliminary observation was conducted by a student for an hour each night the week prior to data collection. That's a total of 45 hours just on collecting paper towels.

We also learned that, with communicating with a wide variety of people and organizations, there would always be “naysayers”, which are those who don’t initially agree with the proposed project or its methodologies. But we also found that brainstorming with them can help provide new, out-of-the-box ideas that were not originally included in the study.

7.3 Successes

Our project had numerous successes. Our biggest success was conducting a rudimentary pilot study allowing us to evaluate some of the issues necessary to continue this project in the future.

Another success was the creation of interest and support from different collaborators forming a project network. We feel that these relationships are very important and should be maintained to ensure future participation.

We were also successful in reaching out to our friends and peers for help. Much of the data sampling would have been very difficult without the help of our volunteers for whom we are grateful to.

And of course we feel successful in conducting a study that met our objective of reducing contamination in the paper towel bins by 70%. This proves that there is hope that students can make a difference and support a paper towel waste diversion program.

8.0 Outlines for Future Adopters (See Appendix A7)

8.1 Phase Two: Re-Analysis and Adjustment

The planning document will serve as a guide for another group to continue next semester. The time sensitive nature of this project will require an additional semester for several reasons. Detailed transportation and collection logistics need to be thoroughly outlined during the second stage of progression in this project. A more robust sampling of the campus' paper towel waste will be needed to better estimate the volume of paper towels that will be sent to the proposed anaerobic digester. This will also impact the current transportation schedule and thusly, logistics on pickup schedules and coordination with 3rd party transportation will need to be squared away. More research must be done on social marketing measures to ensure behavioral change mechanisms are in place prior to the actual implementation of this composting program. In addition, HWMA expressed an interest in determining if the paper towels HSU currently uses are adequate for composting in an anaerobic digester. While we did learn that there are two types of paper towels used in campus bathrooms, one made of sugar cane (bagasse) and the other from 100% recycled paper fiber, further study into how these materials digest and break down will be needed to ensure they are fit for diversion (Meyer, J. 2011).

The second phase will continue to outline established resources, data collected, and additional work to complete. In addition, changes to methods will be outlined for future consideration. The second-phase group will be responsible for maintaining strong relationships with interested parties and collaborators. The idea is to build a seamless bridge between a student group and the office of Sustainability.

8.2 Phase Three: Rollout

The last phase will be the transition from student group to the office of Sustainability. By this time there should be a good level of communication between all interested parties and a concrete commitment to the project.

The project will begin before the semester begins, roughly two weeks prior. Changes to waste transportation will be negotiated with Arcata Garbage using supporting data from phase two sampling. The custodial staff will be educated on the campus zero-waste commitment and given the empowerment to participate through incentive programs. All bathrooms will be fitted with smaller landfill wastebaskets and appropriate signage in preparation for incoming students.

The first week of school will focus on education through freshman orientation, tabling, articles in the lumberjack and PSA's on the radio. The main objective is to create social responsibility through community awareness.

Lastly there will be a monitoring program employed looking at the level of participation among students and collection strategies. A measure of the amount of contamination will indicate a level of behavioral change and allow for changes in social marketing strategies. Adjustments to

collection schedules will also need to be made as participation changes along with troubleshooting of any other obstacles that come up.

The last step is to continually document and evaluate in preparation for institutionalization. Random waste characterization studies should be performed throughout the year and quarterly reports submitted to the Office of Sustainability and campus administration on the projects progress and success. Once institutionalized, the program should be promoted on a local and national scale so other student groups and universities can learn from this example.

9.0 Conclusion

Paper towels are an untapped component of HSU's waste stream that could be diverted to make energy. Our project narrowed in on this "low-hanging fruit", in order to aid HSU on its path towards sustainability. By reducing its waste, HSU meets state and local policy initiatives, and incurs the benefits of reduced disposal costs. It also can enjoy the opportunity to become apart of a larger picture towards reducing Humboldt Counties dependence on out-of-area landfills and in providing a new local energy source. Our project paved the way towards meeting our target of composting paper towels through a collaborative process. We developed relationships with stakeholders that provided invaluable insight on our project and their maintenance will be crucial for the final phase of implementation. We set reasonable goals and clear objectives on how to meet them, which helped us succeed. There is much more work to be done for this project to come to fruition and this planning document is a first step towards attaining our final goal of an actual paper towel waste composting program.

Sources Cited

- Amazon.com.UK. (n.d.). "Eko-Mania Paper Log Maker." Web. 25 Oct. 2011
- Association, B. P. (2011). *EWP Renewable Corporation*. Web. 25 Oct 2011.
- Blake, J. (1999). Overcoming the 'Value-Action Gap' in Environmental Policy: Tensions Between National Policy and Local Experience, *Local Environment*, 4(3), p.p. 257-278.
- Bohn, Juliette. "LMOP Project Expo 2010." *Landfill Methane Outreach Program*. 2010. Web. 30 Nov. 2011.
- Burgess, J., Harrison, C., Filius, P. (1998). Environmental Communication and the Cultural Politics of Environmental Citizenship, *Environmental Planning. A*, 30, pp. 1445-1460.
- CalRecycle. History of California Solid Waste Law, 1985-1989. 26 Aug 2011. Web 5 Dec 2011.
- (CARB) California Air Resources Board. "AB 32: California Global Warming Solutions Act." 2006. Web. 30 Nov. 2011.
- Container Recycling Institute. "Bottle Bill Resource Guide: California." *Program Success*. 7 Nov. 2011. Web. 30. Nov. 2011.
- Council on Environmental Quality. 2011. "Climate Change Adaption Task Force." Web. 10 Dec 2011.
- Gershon, David. (2009) *Social Change 2.0 A Blueprint For Reinventing The World*. High Point publishing, West Hurley, NY.
- Goodeyon, Ed. Humboldt State University Facility Services Manager. Personal Communication. 20 Oct. 2011.
- Gyeng, Dr. Christina, et al. "Sustainability Recommendation Report-An Investigation into the Sustainable Attributes of Three Hand Drying Methods: Paper Towels, Cloth Towels, and Hand Dryer." *UBC Social, Ecological Economic Development Studies (SEEDS) Student Reports*. Nov. 2009.
- Hawkins, Carolyn. Humboldt County Department of Environmental Health. *Solid Waste Land Use Supervisor*. Personal Communication. 29 Sep. 2011.
- Holmes, Robert. Compliance and Enforcement Division. *CalRecycle*. Personal Communication. 28 Sep. 2011.
- Humboldt County Board of Supervisors. 2007. "Resolution No. 07-88: Establishing County Climate Change Leadership Strategy." Web. 10 Dec 2011.

- Humboldt County Planning Commission. "Section 10.5: Waste Management." *Humboldt County General Plan*. 10-4. 23 June 2011. Web. 2 Dec. 2011.
- (HSU) Humboldt State University. "HSU Named a Princetown Review Green College." *Now*. 20 Apr. 2011. Web. 2 Dec. 2011.
- (HSU) Humboldt State University. "The Green Scene: Sustainability Matters at HSU." *Campus Operations*. 2011. Web. 30 Nov. 2011.
- (IPCC) International Panel on Climate Change. 2007. "Fourth Assessment Report: Climate Change 2007." Web. 5 Dec 2011.
- Kerr, Dana. "EB MUD Turns Food Scraps into Electricity." *Oakland North*. 10 Nov. 2010. Web. 3 Dec. 2011.
- Kollmuss, Anja., Agyeman, Julian. (2002) Mind the Gap: why do people act environmentally and what are the barriers to pro-environmental behavior?, *Environmental Education Research*, 8(3), pp. 239-260.
- Marcell, Kristin., Agyeman, Julian., Rappaport, Ann. (2004) Cooling the Campus, Experiences from a pilot study to reduce electricity use at Tufts University, USA, using social marketing methods. *International Journal of Sustainability*. 5(2). pp. 169-189.
- Marino, Bob. DG Fairhaven General Manager. Personal Communication. 25 Oct 2011.
- Mitchell, Norton. UC Berkeley Facilities Manager, Unit 1 Dormitories. Personal Communication. 3 Nov. 2011.
- Meyer, Jeff. Sales Representative. Mendes Supply Company, Eureka, CA. Personal Communication. 4 Dec 2011
- National Geographic. African Elephant. *Animals*. 2011. Web 3 Dec. 2011.
- O'Connell, Kim A. "Sorry, Landfill Closed." *Waste Age*. 1 July 2001. Web. 30 Nov. 2011.
- Oskamp, Stuart. Psychological Contributions to Achieving an Ecological Sustainable Future for Humanity. *Journal of Social Issues*. 56(3). p.p. 373-390.
- Paper Towel Composting at Residence Halls at UC Berkeley! [Video]. (2010). Retrieved 7 December 2011 from <http://www.youtube.com/watch?v=cn8zLXucugE>
- Poor, Kaci. "Want to be in a Study? Visit a Campus Bathroom." 30 Nov 2011.
- Redwood Alliance. "Climate Action." 2011. Web. 2 Dec. 2011.
- Sierra Club. 2009. Zero Waste: Policies and Advisories. Web 1 Dec 2011.

Santa Clara University. "Can you Compost Paper Towels?" Sustainability at SCU. 2011. Web. 2 Dec. 2011.

Comet, TC. Personal Communication. 15 Sep. 2011.

UC Berkeley. "Composting at UC Berkeley." My Little Green Book. 2010. Web. 2 Dec. 2011.

Ucuncu, A. *Energy Recover From*. Durham, North Carolina 27706: Department of Civil and Environmental Engineering Duke University. 1993. Print.

(US EPA) U.S. Environmental Protection Agency (2009b). Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2007. EPA 430-R-09-004.

(US EPA) U.S. Environmental Protection Agency (2010 c). Municipal Solid Waste Generation, Recycling and Disposal in the United States: Facts and Figures 2010. Web 7 Dec 2011.

(US EPA). U.S. Environmental Protection Agency (2011d). History of RCRA. Web 6 Dec 2011

(US EPA) U.S. Environmental Protection Agency(2002 e). "25 Years of RCRA: Building on Our Past to Protect our Future." April 2002. Web. 30 Nov. 2011.

UKgreenstamp. "How to Use the Newspaper Log Maker." 6 June 2009. Web. 25 Oct 2011.

Wallace, Bob. "US Landfill Exposure-The Big Picture, WIH Resource Group." *WIH Resource Group*. Waste Management, Recycling and Logistical Solutions. 13 Jan. 2010. Web. 30 Nov. 2011.

Appendix

A1: Pilot Study Bathroom Signs

Let's Make a Difference!

Compost your paper towels.

It's Easy...



bins = **Paper Towels
Only**



bins = **Everything
Else**

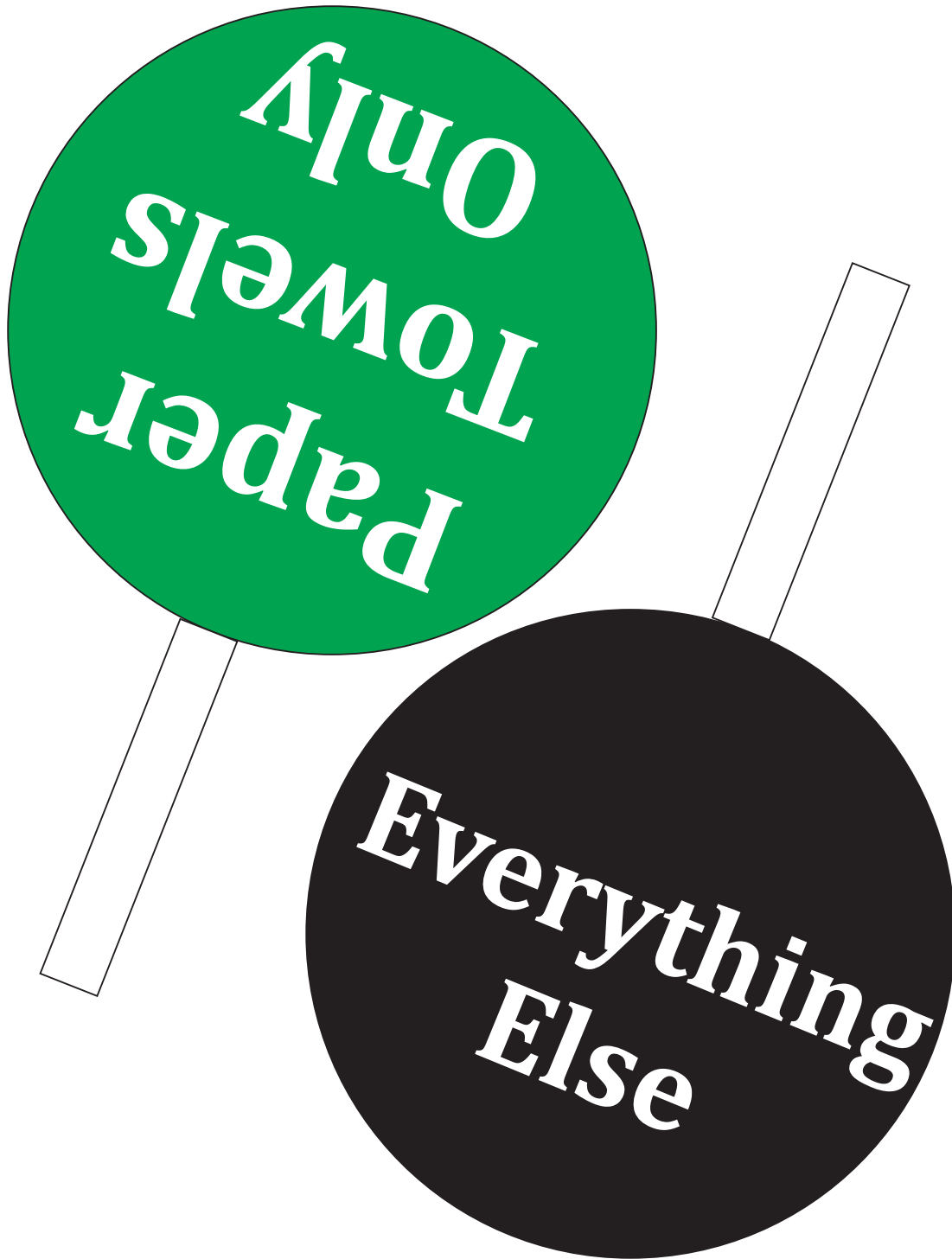
HSU generates almost 20 tons of paper towels every year.

We then truck it hundreds of miles to a landfill.

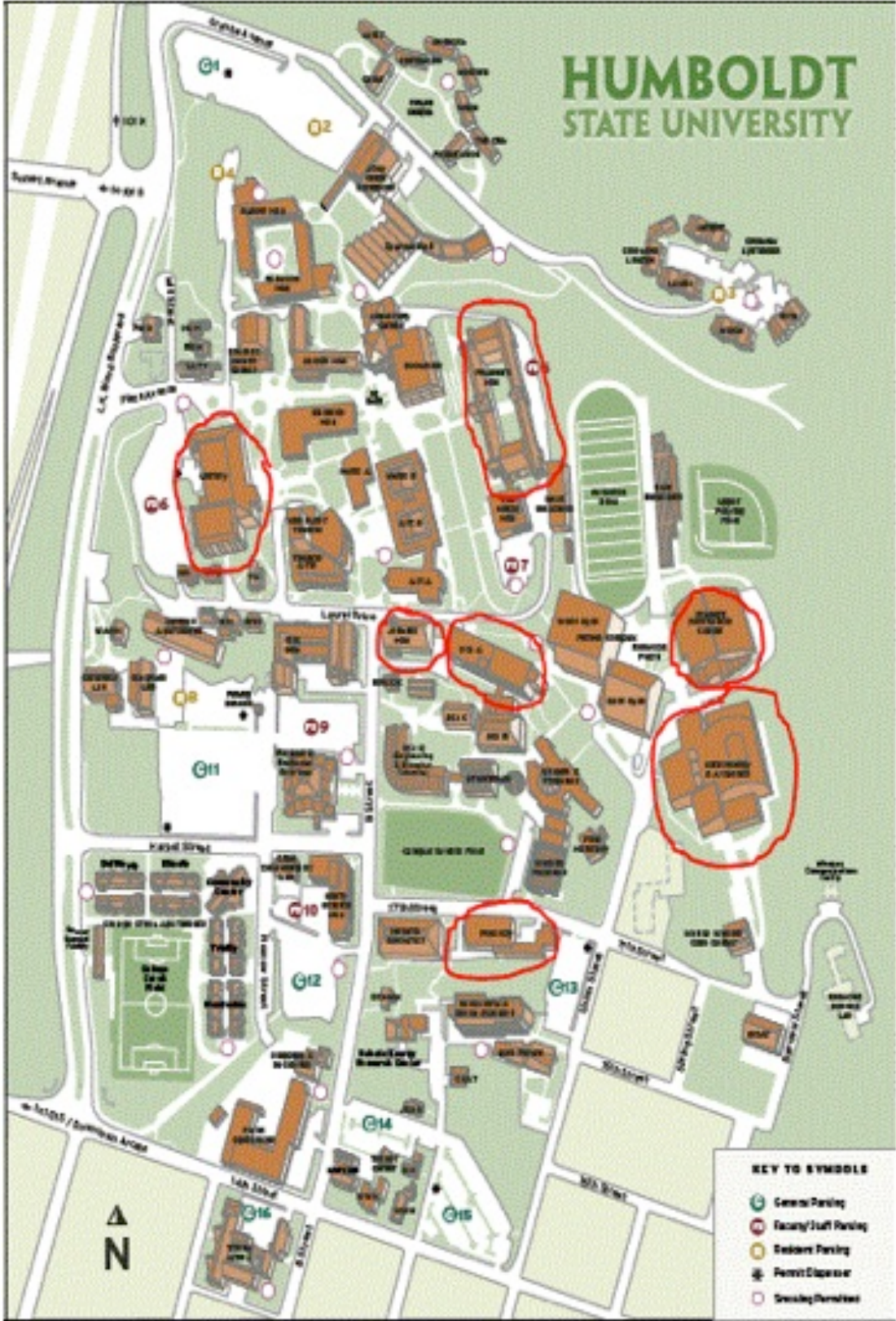
But if we can separate our paper towels from other trash, we can create energy, soil, and reduce our carbon footprint, right in our own backyard!

HSU can make a difference!

A2: Bin Dot Signage



A3: Campus Map with sample buildings



A4: List of Materials

- **33 gallon plastic barrel**
- **Plastic trash bags**
- **Rubber Glove**
- **Pen/paper**
- **Standard bathroom scale**
- **20 plastic bins**
- **Signs and tape**
- **Camera**
- **Volunteers**

A5: GHG Emissions and Disposal of Paper Towels

GHG Emission Calculations

93 lbs CO₂/per ton waste hauled to landfill (Juliette Bohn, 2011)

2.7 trucks * 20 tons waste * 93 lbs CO₂/ton waste = 5,022 lbs Co₂

*calculated from our study

0.45 kg/1 lb

5,022 lb*0.45kg/1lb=2,260kg CO₂/year

Total Waste 2010 = 901.44 tons

901.44 * 93 lbs Co₂/Ton =83,833.92 lbs Co₂/ton

83,833.92*0.45kg/lb = 37,725.264 kg CO₂/year

Disposal Fees

901.44 tons * \$150/ton = \$135,216 year

15 tons * \$150/ton = \$2,250/ton

*calculated from our study

Appendix A6: Phase 2 and 3

1. Phase 2: Re-Analysis and Adjustment
 - A. Maintain Established Relationships
 - I. Plant Operations/Custodial Staff
 - Possible incentive options to garner support (BBQ, Pizza & Beer)
 - II. Office of Sustainability
 - III. HWMA
 - IV. Humboldt County of Environmental Health
 - V. Mentorship from original student group
 - B. Continued Sample Study
 - I. Larger workforce
 - II. Longer duration of sample study (4 weeks)
 - III. Larger sample size (40+ bathrooms)
 - C. Equipment
 - I. Hanging Spring Scale: in Kg/ gram units.
 - II. More bins, bags, gloves
 - D. Further Research
 - I. Types of paper towels used: Adequate for anaerobic digester
 - II. Bio-Bags
 - III. Funding: grant opportunities
 - IV. Social Marketing
 - E. Transportation Logistics
 - I. Identify centralized collection locations
 - II. Work out 3rd party pickup methods
 - III. Negotiations between HSU and Hauler (Arcata Garbage Company)
 - F. Implementing Social Marketing and Behavioral Change
 - I. Conduct Surveys
 - II. Tabling in the Quad
 - III. Educational Video
 - IV. Freshman Orientation
 - V. Media: Radio, Newspaper, Facebook/Twitter
 - VI. Signage
 - VII. Update Appropedia page
 - G. Meet all Logistical Parameters mentioned above
 - I. Gaining HSU administrative approval with signed agreement
 - H. Re-evaluate Phase Three feasibility

2. Phase Three: Project Implementation

- A. Continue Social Marketing: 2 weeks before semester begins (HOP)
- B. Transition responsibility from Students to Office of Sustainability
- C. Monitor Program
 - I. Occasional waste sampling
 - II. Troubleshoot any unforeseen obstacles
- D. Document results
 - I. Quarterly reports to Administration
 - II. Evaluation
- E. Promote Program
 - I. Other universities
 - II. HSU website
 - III. Newspaper

Appendix B1-B6

B1: Paper Towel Compost Project and Humboldt Waste Management Authority Meeting 9/22/2011

Attendance:

Juliette Bohn
Sarah Mosser
Shannon Townsend
Aaron Gallo
Joel Bisson

Opened with a brief discussion about the Environmental Science 410 Practicum Assignment.

- Develop a plan of study and implement a change.
- Project needs to be completed by the end of the semester (11 weeks)

Juliette shared an overview of the pilot program in place.

- Permitting complete.
- Working with City of Eureka for support.
- Securing financing.
- Rolled out the pilot program with 50 early adopters including HSU as a big partner. Plan to conduct 1 year of food waste collection to quantify potential collection amounts and identify contamination issues.
- Request for Proposal to come.
- Dealing with issues of odor, rats, and liquids.
- Studying efficient ways to add to collection route in the future.
- Possible additional collection site off Westhaven Rd in Arcata.

Joel pitched our idea of including paper towels collected from HSU campus into the compost system.

Project Goal:

- Reduce the amount of solid waste transported to Medford landfill.
- Collaborate with food waste digestion pilot program to optimize collection strategies.

Future research:

- Call other composting facilities
- Contact other schools who are currently composting paper towels. Eg. UC Berkeley.
- Cal Recycle – Juliette can provide a contact.
- County Health Dept. to determine legality and possible solutions.
- Collection system:
 - Meet with HSU custodial services and observe how they collect waste around campus. I believe the word is “SCHWOOPING”.
 - Brainstorm on alternatives to plastic bags.

Actions:

- Meet with County Health contact and see if we can move forward with this.
- Get information on paper towels from vendor.
- Continue requesting information from similar programs at other schools.
- Get a person to do the statistical analysis.
- Set up a timeline for actions and deliverables.
- Develop a methodology for the study:
 - How much paper does the campus consume?
 - What percentage makes into the waste basket?
 - What percentage of the waste is contamination?
 - What percentage of the total solid waste will paper towel diversion make up?

Aaron suggested working closely with custodial staff to work out ideas of collection system and sampling.

- He has several contacts and can arrange a meeting.

Shannon has contacts with the Sanoma County waste management and can get information on their compost program.

Sarah mentioned incorporating GIS into the study to aid in the collection analysis.

- Goal: to stream paper towel waste to food collection sites.
- The inclusion would aid in liquids in the collection vessels.
- Map all bathrooms, handwashing stations, paper towel dispensers.
- Information on paper towel quantities will also aid in the transportation timing.

Aaron brought up the possibilities of internships with HWMA.

Joliette expressed interest.

The possibility of incorporating a HEIF program to either conduct the work we propose or handle the social marketing on campus was brought up.

Joliette said it was important to coordinate our projects and try to work them into one proposal.

Sarah stressed the importance of determining scope with our project and suggested writing a planning document rather than focusing on implementing the project.

- The project can be completed by another Practicum class, campus group, or the Sustainability Department.
- Important to “draw a line” around our project.

Future meeting:

Wraap meeting or at the tipping scales to see the food waste come in.

B2: 9/26 WRAAP meeting

Attendance:

Juliette Bohn

Sara Mosser

Morgan King

TC Comet

Joel Bisson

Eddy Ankler

- Depot Manager

Elmer Llamas

- Researching compostable products eg. Cups, gloves, bags, etc.
- He may be a good resource to find alternative paper towels.

Ashley Durant

- Depot recycling coordinator
- Aids in advertisement and education

Erin and Juliene (jls190@humboldt.edu)

- RESU club aims to promote renewable energy
- Looking for a project to promote to HEIF
- Has data from hand dryer study which includes paper use for comparison

Nicole

- Writing a comprehensive document to aid other schools, communities in implementing food waste diversion
- Her work was considered to be very valuable

TC mentioned Ed Goodion (custodial director / manager)

He was concerned that the county would not approve the collection of paper towels from restrooms.

Secondly he feels that even if we do get them on board a pilot program would have to be approved by the custodial department and plant operations. We would basically have to sell the fact that we can promote behavioral changes before the school is willing to change existing bathroom waste collection. He suggested doing the research or finding someone in Behavioral Sciences to help us.

Opportunities for money

HEIF

Peace, Prosperity, P grant

Need Waste Characterization Study

B3: Holmes, Robert Robert.Holmes@calrecycle.ca.gov

Sep 28 ___ to Shannon, Joel, Aaron

Shannon, Aaron, and Joel,

Here are a few nuggets of information that should be of some help to you, I hope.

Anaerobic digestion facilities are currently subject to the Compostable Materials Handling Operations and Facilities Regulatory Requirements found in California Code of Regulations, Title 14, Division 7, Chapter 3.1. [_HYPERLINK
"http://www.calrecycle.ca.gov/Laws/Regulations/Title14/#Chapter3_1" __http://www.calrecycle.ca.gov/Laws/Regulations/Title14/#Chapter3_1_](http://www.calrecycle.ca.gov/Laws/Regulations/Title14/#Chapter3_1)

Pursuant to section 17855.2 of these regulations, there are 3 types of waste that are prohibited from compostable material facilities:

1. Unprocessed mammalian tissue, except when from the food service industry, grocery stores, or residential food scrap collection, or when for research purposes
2. Medical waste
3. Hazardous waste

If the paper towel waste is not subject to one or more of these prohibitions, then it would be an allowable feedstock. Even mixed solid waste from the municipal waste stream is an acceptable feedstock if doesn't contain any of the prohibited waste (it typically does not).

The last two listed waste types are not defined in the compostable materials regulations but the meaning is commonly understood to be consistent with the following definitions:

“Medical waste” means waste regulated pursuant to the Medical Waste Management Act, Part 14 (commencing with Section 117600) of Division 104 of the Health and Safety Code.

“Hazardous waste” means any waste which, under Article 1, Chapter 11, Division 4.5 (§66261.3 et seq.) of Title 14, California Code of Regulations, is required to be managed according to Division 4.5 of Title 14, California Code of Regulations.

After you determine that the waste is an acceptable feedstock, the next step would be to determine what type of permit is necessary. The compostable materials regulations contain a tiered permitting system. In brief, where a facility fits within the tiered system depends on the type and amount of waste received. County Environmental Health would be good to talk to about this if you need more detail.

Finally, the compostable materials regulations contain requirements for pathogen reduction, including sampling on the back end to verify reduction is achieved.

Good luck with your project. Let me know if you have any other questions.

Robert Holmes | California Department of Resources Recycling and Recovery | Compliance & Enforcement Division | 1001 I Street Sacramento, CA | P.O. Box 4025 Sacramento, CA 95812 | (: [_HYPERLINK "tel:916.341.6376"__916.341.6376_|](tel:916.341.6376) 7: [_HYPERLINK "tel:916.319.7403"__916.319.7403_|](tel:916.319.7403) *: [_HYPERLINK "mailto:Loan.Feher@CalRecycle.ca.gov"__Robert.Holmes@CalRecycle.ca.gov](mailto:Loan.Feher@CalRecycle.ca.gov)

B4: Environmental Health Dept. Meeting

9/29/2011

Attendance:

Carolyn Hawkins

Aaron Gallo

Shannon Townsend

Joel Bisson

Introductions:

- Brief background on our assignment
- Carolyn shared her role as a Solid Waste LEA/Land Use Supervisor
- Peter Esko (Senior)
 - Three branched dept.
 - Haz mat., business plans, and emergency preparedness.
 - Consumer protection, food facility inspection, vector control, pool and spa.
 - Solid waste and Land use.
- They regulate all three facilities of HWMA

Information gained:

- CalRecycle follows state regulations and req. full compostable handling permit
 - HWMA needs to apply
 - The county will be permitting the digester after a 1 year application period following CEQA documentation.
- Dept. Health Services – in Sacramento enforce regulations of health issues.
 - The definition of medical waste is very clear.
 - “sharps, lances, dripping fluids” would be examples.
 - Issues like mucus or dried blood are not considered medical waste.
- She said the project as a planning document is very “do-able” in addition she mentioned that an implementation will require the campus to detail the operation but feels that it also is very “do-able”
 - Our intent is not subject to any regulatory constraints.
- Need to consider collection, transport, and storage.
 - Must minimize the waste becoming liter in collection, transit, and storage.
- Consider incorporating:
 - Education
 - Inspection – system for systematic screening. Sample method or continuous is another question. Could be done at the custodial level, at the food waste collection site, or at HWMA.
 - Important to find the ratio of food to paper towel waste and consider the optimal levels.

- HWMA has to submit a Proposal application for notification for research. This will allow them to collect food waste without a permit with the understanding that this will provide useful data. Sec. 178.62.
- Title 14 Code of Regulations
 - Div. 7 – Chapter 3.1 Articles 1-9
 - Regulations that govern all aspects of composting
- It would be a good idea to use students to do the collection to relieve the possible extra work on custodial service.

Action Plans:

Meet with custodial service manager. Make appointment ASAP.

Get in touch with CalBerkeley Sustainability Department.

Continue Research on our aspect of the project.

Shannon – policy

Aaron – collection

Joel – Behavioral

B5: 10/27 Meeting notes with Ed Goodeyon

Began with an overall project description

- Food waste program
- Paper towel compost program

Stats

1. About 40 cases “boxes” per month are consumed – this doesn’t include housing.
2. 80% of the paper towels are used in bathrooms.

We mentioned that we would like to meet with custodial staff to find volunteers.

Ed mentioned a behavioral study that was done in the NR building

- moved recycling to one place with all the recycling options in one location.
- He said there will always be some resistance.

Putting an additional waste basket may be harder in the older buildings with smaller bathrooms.

Heavily used restrooms include: Founders, BSS, Seimens, Library,SBS.

Sorting

- Eventhough recycling any aluminum or plastics is in the custodial staff job description, he said he realistically can’t ask them to sort through waste.
- The ave sq footage of floor space a janitor cleans is 35,000. This is up from 25,000. To add more tasks such as sorting will result in resistance.
- Unionized work does not allow student groups to go in and take work away from custodial staff.

Ed said most of the staff should be willing to help us out.

Study Methods

- Limit the study to 4-5 buildings.
- Shifts are from 5pm – 1 am.
- Need to be flexible w/ staff.
- Should ask for volunteers.

Collection Logistics

- Arcata garbage collects from 21 sites around the campus.
- Liner bags are change as needed. With all the contents being dumped into a single collection bag that ends up in the dumpster.
- Bio-bags could be a possibility.

H1M1

- Cross contamination fear
- Lead to bins near door to collect paper towels used to open doors.
- Hand sanitizers installed.

The department has looking for ways to “go green”

B6: 11/03/2011 Phone interview with Norton Mitchell

In attendance:

Aaron Gallo

Joel Bisson

Norton Mitchell

Introductions and overview of the call given.

Norton Mitchell has been the Facilities Manager for Unit 1 Dormitories at UC Berkeley for 4 years.

He likes to create a living experience for students” providing lots of services to make the transition.

The Paper Towel Composting started as a student project. When he heard about the idea he wanted to “Figure out ways to encourage an idea and get it done.”

The Student ‘s name is Joanna ?

In designing a program like this you need to consider the future. Things that may come down the line.

It’s important to motivate the custodial staff. One way is to have personal conversations with staff to understand their points of view.

The program started small only focusing on the 1st floor of the building. It took months to get off the ground. Grant money was used to help with costs. They soon realized they needed other people to push the idea for them. It is important to build collaboration and support from many interested groups.

It was definitely and incremental battle with small gains that has grown significantly.

It is really important to do all you homework. You need to be able to answer hard questions for people in advance. This aids in speeding up the process.

Timing is really important. It would be more effective if it was rolled out in the spring. They used a YOUTube quality clip on a 30 sec. loop in the freshman check in area. It forced people to at least watch it twice a week. Use people in the video that other people know.

In working with the custodial staff you want to provide the resources to minimize their effort.

Don’t try to make this perfect. Any initial start to a new program will need tweaking. More importantly you need to build support.

Social Marketing – Appeal to one’s pride and ego. Signs were made and put in every bathroom.

He has a list of vendors that provide them with the compostable towels and bio-compostable trash bags.

The UC waste management group picks up all the food waste and paper towel compost. MWF. Initially they picked up 3 yard dumpsters 1-2 times a week. Now they come 5 times a week for a 4 yard dumpster. Amine is the Waste management person.

There were no bureaucratic challenges. They did their homework and put together a solid plan. He mentioned that the UC Chancellor is in support of minimizing waste on campuses. This directive trickles down the ladder.

Contamination is an issue. It is inevitable and is an opportunity for education. You can empower the custodial staff to make their own decisions on how to handle contamination. They can throw it out of pull the contamination.

It is important that the custodial staff mentions when there is a lot of contamination. Community is the best form of education and creates social responsibility.

B7: 11/15/11 Phone Interview with Joanna Young from UC Berkeley Office of Sustainability

1 volunteer : Resident Sustainability Program

- Speaker on waste reduction
- Inspired, why not done?

Cal Dining 1st Floor:

- 1 building pilot- 8 floors
- Tabled for 1 week: 2 weeks before implementation
- Random Timing (mid-semester)

The amount of space available was a determined issue in the early onset by campus facilities:
Used pictures to prove there was enough space

3 signs:

- 1 paper towel only “please no food”
- 1 “This is Trash”
- 3rd sign promoting awareness

Writing on fliers: Questions asked

Custodians:

- small scale
- educated staff

*Claire Evans: gone through tons of administrative procedures. Lots of signage

UC Berkeley

- Grant \$\$ - used to get bio bags
- Commercially procured

Other schools/other buildings adopted

Contamination:

It will always vary

- Adoption was really quick
- Find a place that’s always just paper towels

Help: Norton and friend

Budget created

B8:11/23 Phone Meeting with Claire Evans

East Bay Municipal Utility District

Recology – Oakland

Super Senior:
Sustainability and building and composting
Try composting on?

Compost Alliance: funded by grant – who?

All dining facilities and café's

Main Challenge: financial

Campus Recycling and Refuse Services:
Contract to vendors:
Recycling
Food Scraps (Recology) EXPENSIVE
* More buildings would do it if not for its costs

Critical mass can be met to make it in-house w/ own truck

Compostable bags (Green):
Bio-tuf tested/compact: (\$0.50-\$1.00/bag)
Regular bags: (\$0.05-\$0.10/bag)

In restrooms: clear white liner tipped by custodians into a big bin
Concerns with weight issues. They use light containers

Ways around custodial staff:
Have a solid relationship (Having on inside)
Being sensitive – “This is the project we want to do, how can we make this happen.”
Excess amounts of trash bins (unnecessary) eliminated bins to make it easier for staff.
Meet with custodians and keep informed.

Vendor provides totes or dumpsters
By weight:
Paper
Food
Landfill
Recyclable

Education:

Email with newsletter
Kick off event
Post in restrooms/kitchenettes
Contact info
Send students around to talk with students when the system is installed
QR Code
Website

Logistics:
Slim jim bins
3 paid student coordinators (stipend)
1 volunteer coordinator
(5-10) volunteers
Have under Campus Recycling and Refuse Services

In the beginning it's a cost to university and its difficult to get support: hesitation
Thinking out every single thing they might have issue with (do your homework)
Think about how this will happen financially
Act confident