California State University
Northridge

CSUN INSTITUTE FOR SUSTAINABILITY:
A Focus on Kitchen and Green Waste

MBA Field Study Experience Graduate Project

CALIFORNIA STATE UNITVERSITY, NORTHRIDGE

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Any opinions, findings and conclusions or recommendations expressed in this publication are those of the authors and do not necessarily reflect the views of California State University, Northridge, the College of Business and Economics or the faculty thereof.

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I. EXECUTIVE SUMMARY

Sustainability and reducing environmental impact rests at the forefront of business, education, and government decisions. Recent laws and regulations, social trends, and public scrutiny created the need for organizations to reevaluate day-to-day and future business decisions in order to ramp-up waste reduction efforts and develop socially responsible operations. Taking a proactive approach to this situation, California State University Northridge developed the Institute for Sustainability to ensure the University follows best practices in sustainability and reducing its carbon footprint. Recent advancements in technology provided the opportunity for organizations to divert green and food waste from landfills, and reduce their environmental impact. This report's objective is to analyze CSUN's current green and kitchen waste disposal program, which includes food waste, lawn trimmings, leaf, mulch, etc., and recommend alternatives that ideally serve two functions: (1) improve the sustainability of CSUN and its impact on the environment and (2) reduce its costs for waste disposal.

Currently, CSUN pays Consolidated Disposal Service and Allied Waste to remove its green and food waste. CSUN pays $6K and $36K per year to remove its yard and food waste, respectively. However, Dr. Helen Cox, Director of the Institute for Sustainability, and others associated with the University question if more sustainable and efficient methods of waste disposal exist.

An analysis of similar California higher education institutions revealed an industry containing wide variation between depths of food waste recycling programs. Some campuses are currently developing sustainability projects, while others implemented programs years ago. Recent growth in sustainability departments and university cooperatives show an increasing awareness of food waste recycling practices. Campuses obtained public and private funding to

finance new projects. In terms of food waste schools typically partner with third party corporations to compost food waste off-site.

Although many universities utilize third party composters, several food and yard waste recycling options exists including in-vessel composting, on-site pulping, worm farms, and grease to energy conversion. Viable alternatives include:

1. **The Vegawatt System**: a device used to convert kitchen grease to energy.
2. **The Rocket**: an in-vessel machine used to seal and expedite composting.
3. **Vermiculture**: a process involving red worms used to digest food waste creating usable output.
4. **Open Windrow**: turning exposed mounds of organic material to slowly for compost (green waste only)
5. **Third-Party Composting**: paying professionals to haul separated kitchen waste and compost at a designated facility.

Cost benefit analysis and time series calculation revealed multiple options for CSUN to consider, which reduce expenses and improve the University's sustainability. Two projects yielded the highest rank on NPV calculations and multi-dimensional scorecards. CSUN can implement in-vessel composting and waste vegetable oil (WVO) conversion simultaneously using relatively low initial capital investment. Other options lacked ability to include food waste, involved high initial investment, and threatened campus atmosphere with odor and vermin. Of the two recommendations, the Vegawatt requires little maintenance and operation, and the Rocket program could function with help from Associated Students. Students could integrate the Rocket with compost tea and provide fertilizing material. Both recommendations

exhibit feasible options projected to reduce expense, create productive output, and improve landfill diversion.

Successful implementation of a food and green waste recycling program would likely advance the University's social and economic efforts. The improvement to campus operations would reduce the University's carbon footprint. These socially responsible practices may also generate positive feedback and enhance the university's reputation and business model. The two recommendations in particular, maximize productivity and output using core competencies and current resources found on CSUN's campus. Each option reduces expenses and waste while providing nutrients for existing landscape. Both projects promote self-sustaining operations and increased awareness of environment-friendly best practices in-line with the Sustainability Institute's mission.

II. INTRODUCTION TO CSUN INSTITUTE FOR SUSTAINABILITY

The Institute for Sustainability is a division of the California State University, Northridge designed to educate and promote conservation and sustainability. The mission of the Institute for Sustainability is:

> *To promote, facilitate, and develop educational, research, and University and community programs related to sustainability. The Institute serves as an umbrella organization across all the Colleges of the University on issues related to sustainability and is committed to serving our campus community, especially our students, faculty, and the broader community served by the University. With respect to sustainability, the Institute is committed to increasing interdisciplinary and cross-functional communication, education, and research among the faculty of the Colleges*. (http://www.CSUN'sustainability.org/about)

Figure 1 – Photo Montage of CSUN's Green Practices
Note: Taken from CSUN's website

While still in its infant stage, the Institute made several strides to promote sustainability among students, faculty, and campus visitors. It includes a dedicated staff constantly examining alternative methods to improve the facility and has sponsored many student and community events including trash clean up, Earth Day, and Los Angeles River Cleanup Day.

III. INDUSTRY ANALYSIS

i. Industry Profile

CSUN operates primarily in an industry comprised of accredited, public 4-year Universities in California. In addition to government funding and endowments, these Universities obtain a large portion of revenue from tuition and enrollment fees. Students have a choice in where they attend school, therefore CSUN faces additional competition from private schools within the region and globally. Possible substitutes include non-accredited universities, trade schools, community colleges, and internet-based education. After acceptance, students typically decide where to enroll based on features including: programs offered, location, design, aesthetics, and reputation. Focusing on certain unique features creates a competitive advantage and point of differentiation.

CSUN belongs to the state-wide education system titled California State University (CSU). This organization includes 412,000 students, and 23 campuses (http://www.calstate.edu). Another public higher education organization is University of California (UC) which includes 10 campuses and over 191,000 students. For comparison purposes, this study is limited to universities with on-campus housing and dining. The U.S department of Education's Institute of Educational Sciences National center for Education Statistics states that California contains over 124 accredited 4-year universities offering bachelor's and advanced degrees with on-campus housing (http://nces.ed.gov/collegenavigator/).

In recent years, the industry underwent a recent shift towards more socially responsible practices. Recent trends show an increased allocation of funds toward reducing universities' environmental impact. Universities' curriculums shifted to mirror corporate trends of improving

sustainable practices. As organizations created sustainability departments, the demand for this education increased. The CSU website states:

> *The CSU has focused resources on increasing the generation and use of green energy as well as environmental design in new campus buildings. These efforts have helped the CSU to minimize a potential increase in its carbon footprint due to growing enrollment and technology usage. With California employment in the Energy sector growing 63 percent from 1995 to2008, the CSU is providing a platform for the future leaders of the green economy*. (http://www. calstate.edu)

Although most Cal State Schools adopted recycling programs, programs vary heavily across the Universities. Several lack programs to divert green waste and kitchen waste recycling from landfills. **Figures 2** shows the annual tons of green waste recycled per year by sampled campuses. **Figure 3** displays the tonnage recycled in proportion to the size of each campus.

Figure 2 - Green Waste Tons per Year for Select Universities
Note: From data collected during site surveys interviews with campus staff

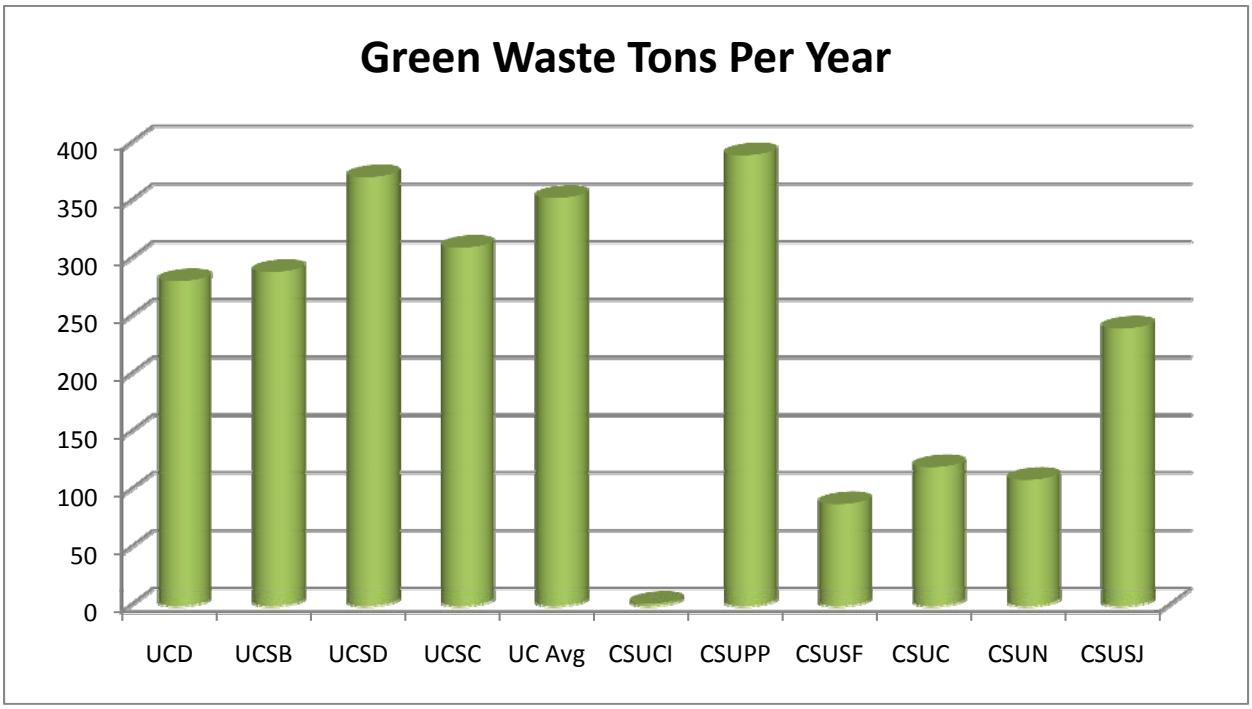
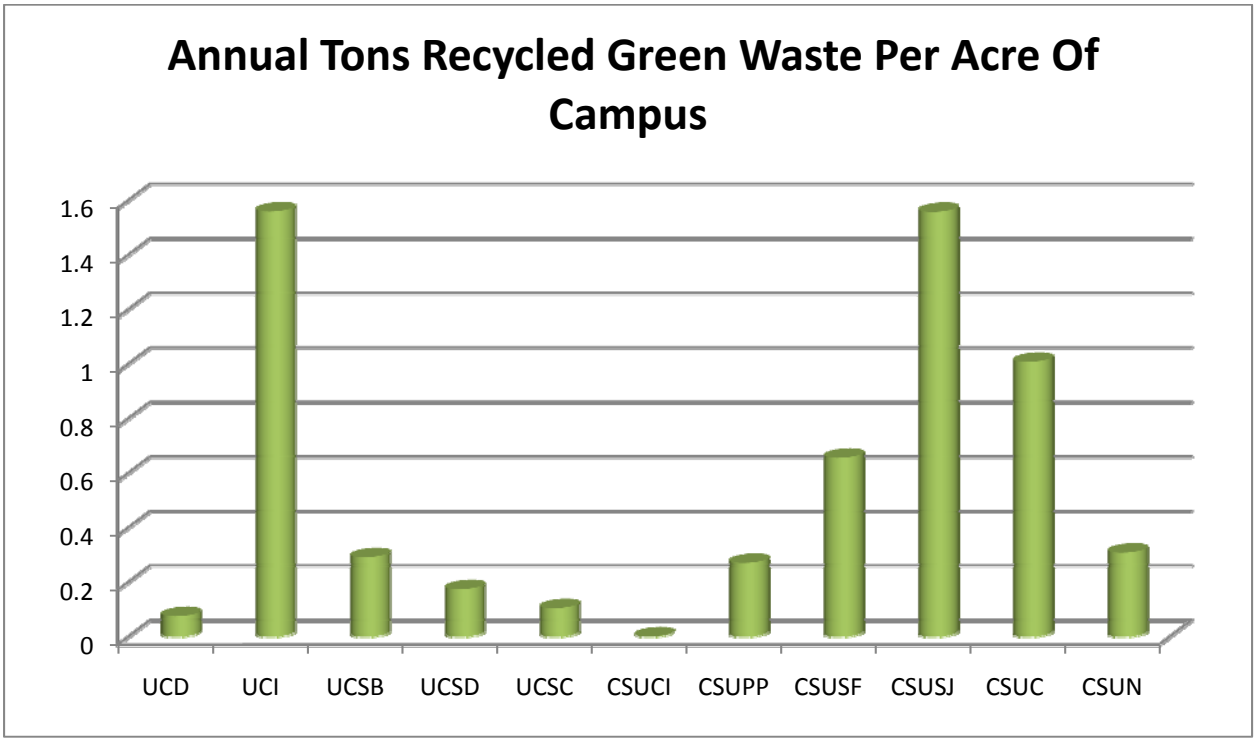


Figure 3 - Annual Tons Recycled Green Waste per Acre of Campus

Note: From data collected during site surveys interviews with campus staff compared to campus acreage data from www.calstate.edu and campus official websites.



The 10 schools included in the UC system adopted organization-wide mandates to reach optimum diversion levels. In 2003, the UC Regents implemented the Policy on Sustainable practices for each campus to adopt. The policy was updated in January 2006, March 2007, and March 2008. Recent amendments included the addition of a section on sustainable food services. The policy employed aggressive diversion goals: By 2008, divert 50 percent of waste from landfill, by 2012 divert 75 percent of waste from landfill, and achieve "zero waste" by 2020. A large portion of this diversion objective is food waste. Currently most UC Schools serve between 10,000 and 20,000 meals per day. These meals are served through a combination of University owned dining halls and leased food service restaurants. (http://www.universityofcalifornia.edu/ sustainability/goals.html).

The research and surveying performed in this study indicated food and green waste programs vary widely across many California universities. Results indicated scattered California State Universities with operational food waste recycling programs, and the Cal State University organization lacked any written mandate for incorporated schools. Most schools instead follow municipal guidelines established by the California Integrated Waste Management Board. State legislation requires large state facilities to reduce solid waste. Most schools contacted report sustainability practices according to the SB1016 State-wide guidelines and continue to utilize the AB75 policy.

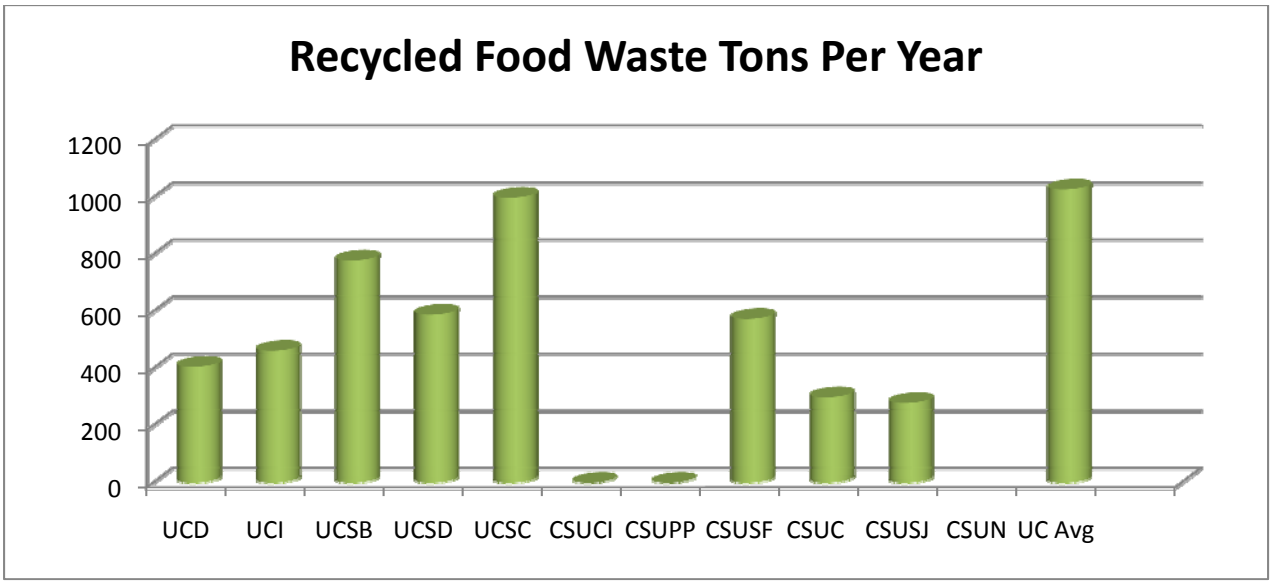
Research revealed that CSU Channel Islands currently recycles green waste, but currently commingles food waste with landfill-bound refuge. After making primary contact, California Polytechnic University, Pomona staff members revealed the campus recycles 390 tons of green waste per year, but fails to separate food waste from dining hall refuge. Both campuses are currently evaluating resources and capabilities and plan to implement programs in the near future. CSU Chico and CSU San Francisco both separate food waste from all on-campus dining facilities. The food is transported by the hauler to Recology where it composts the waste at a commercial transfer station. Recology services the majority of regions in Northern California. Recology composts food waste from both campuses and sells the final product to wine vineyards in Sonoma and Napa Valley. Recology's website describes the users it supplies compost to as: "We combine our decades of experience and technical expertise to provide farmers, landscapers and contractors with custom compost blends made from a wide range of materials" (http://www.recology.com/services.htm). CSU San Francisco contains one dining hall and 14 on campus cafes. In 2009, the University partnered with Recology to successfully recycle 575 tons of food

waste. Caitlin Steele, a CSUSF facilities management employee, stated that University staff expects recent year's totals to increase significantly.

Pursuant to the Regents' action of July 2003, the UC system implemented a "Policy on Green Building Design and Clean Energy Standards" in June 2004. Since that date six additional policy sections were added, and the expanded Policy is known as "UC Policy on Sustainable Practices". The current version of the Policy can be accessed at: http://www.universityofcalifornia.edu/sustainability/documents/policy_sustain_prac.pdf.

Since implementation of this policy, UC sustainability departments have expanded. University of California campuses have demonstrated an aware and conscious culture. Nine out of ten campuses employed food waste and other green waste recycling programs. Statistics and data on these programs are published with high publicity and transparency. The sustainable food-service portion of the UC policy went into effect in September 2009. University dining services on each campus submitted action plans with campus-specific goals in late 2009. Goals were classified into categories of sustainable food purchasing, sustainable facility operations, educational and training programs, and community outreach programs.

Figure 4 - Recycled Food Waste Tons per Year
Note: From data collected during site surveys interviews with campus staff



For publication in its 2010 magazine and website, Sierra Magazine published its rankings of the top 100 "coolest school's" in the nation. This list ranks environment-friendly programs on college campuses across the nation. Sierra sent 11-page questionnaires to over 900 colleges and universities. The survey asked each school to detail its sustainability efforts. Schools were graded on weighted categories including efficiency, food, transportation, waste, administration, financial investment, and "other"; 163 universities responded to the survey. Eight UC schools and one CSU campus made the list. UC Irvine is approaching the top rank on the 2010 list in sixth place with an overall score of 84.4. UC Santa Cruz reached 11th at 82, UC san Diego at 15th with 81.6, UC Davis was 16th with 81.2, UC Los Angeles ranked 25th with 77.6, UC Berkeley was 32nd with 76.3, UC Merced was 39th with 73.3, UC Santa Barbara at 44th with 72.2, and Cal State University San Francisco ranked 69th with a total score of 66.3 (www.sierraclub.org/sierra /20100 9/coolschools/all rankings.aspx).

The sustainability segment within California's higher education institutions typically promotes shared ideas and collaboration. The CSU system partnered with the University of California and the California Community Colleges (CCC) to hold the 9th Annual UC/CSU/CCC Sustainability Conference 2010. This conference sold out, drawing more than 1000 participants (http://laccd.lentinidesign.com). In 2010, the conference was held at the Los Angeles Trade-Technical College. The event gathered campus engineers, university architects, students, faculty, and operations staff from campuses around the state. Over $900 in prizes were given to innovative student ideas. CSUN was recognized for its best practices in the water efficiency category.

Another industry coalition is the Association for Advancement of Sustainability in Higher Education (AASHE). Its mission describes an organization created to promote sustainable knowledge within the industry:

> *AASHE's mission is to empower higher education to lead the sustainability transformation. We do this by providing resources, professional development, and a network of support to enable institutions of higher education to model and advance sustainability in everything they do, from governance and operations to education and research.* (http://www.aashe.org/about/aashe-mission-vision-goals)

Among many services, AASHE provides research, presents awards, and supplies the Sustainability Tracking, Assessment & Rating System (STARS), a campus sustainability rating tool projected to be used by at least 500 diverse colleges and universities. AASHE promotes an understanding of the social, economic, and environmental impact of sustainability awareness.

Although the industry environment lacks a competitive nature, several external forces may impact decisions within the sustainability segment. Showing leadership in sustainability can offer CSUN a positive reputation and competitive advantage as the University seeks

productive students, exceptional faculty, future endowments, private funding, and research grants.

ii. Threat of New Entrants

For new private or public universities to join the industry, a high level of capital is required. Each university offers unique programs with skilled and specialized faculty with an established business model and defined brand and logo. Industry players must meet stringent requirements to attain accreditation. For these reasons, the threat of new entrants joining the industry is low.

iii. Threat of Substitutes

Substitutes include trade schools, non-accredited universities, internet-based learning, and not attending college. There are minimal to no direct substitutes to a formal education from an accredited university. With the development of the internet, students have increased options of earning degrees from accredited universities without the need for a physical campus. Although options are increasing, the threat of substitutes remains low.

iv. Buyer Power

Given the staggering number of universities across the globe, potential new students, the buyers, face many different options for education. Students can apply to private and public universities in any state and incur minimal switching costs. Increasing tuition prices have created a price sensitive market. These forces are offset by the large number of students relative to the number of universities within the industry. Buyer power is moderate.

v. Supplier Power

Considering the suppliers of the industry: private investors, government endowments, and labor, the industry contains high supplier power. Universities are unable to substitute inputs

easily. Professors and specialized labor forces are unique and differentiated. In addition, universities within the industry lack many potential sources of funding. Supplier power is relatively high.

Although the California public university system lacks intense rivalry and competition in the traditional corporate sense, the buyer and supplier powers create demands on schools' performances. In an industry where the business is extremely important to buyers and suppliers, every segment of a campus' operation is scrutinized. Sustainability is becoming a core value of all participants in the industry. Students and faculty wish to associate themselves with an environmentally-friendly campus. Trends indicate that new students and hiring corporations' value sustainability education. Many universities are developing programs promoting the awareness of these concepts.

vi. Notable and Unique practices among Industry Participants

*Based on content received from interviews and primary sources.

a. 100% of UCI's green waste is composted, totaling 2,147 tons per year. Rainbow transfer station works with UCI to bag the mulch and sell to 99cent retail stores.

b. UCI purchased a fleet of biodiesel & alternative fuel vehicles to haul over 11,000 tons of solid waste per year. Hauling is performed in-house, which saves money and allows the university to sell services to private dormitories.

c. UCSB implemented a "trayless" dining program, which reduced food waste by 50%, saving money on food costs and freeing up funds to purchase more sustainable food. UCSB's compost was geo-tested revealing material high in micro-nutrients.

d. In September 2009, UCSC converted dinning common compactors to food compactors equipped with "Slim Jim" automated loaders and in-house facilities crew now hauls to a compost facility in Marina, CA.

e. UCSC lines dining hall trash cans with "bio-bags" to facilitate composting. UCSC recently reached over 1,000 tons composted annually.

f. Chico State and San Francisco State separate food waste, which is professionally composted and sold to wineries in Napa and Sonoma, CA.

g. Stanford University collects food and compostable material separately from other garbage. The material is then taken to an offsite compost facility (an independent company which only services Stanford), which turns it into a new soil product. Stanford also uses compostable "serviceware" (e.g., napkins, pizza boxes, etc.). (http://bgm.stanford.edu/sites/all/lbreshared/files/bgm/files/shared/file/pssi_pdfs/food_waste_specifications.pdf)

h. According to Tom Corpus, Recycling Coordinator at SMCC, Santa Monica City College purchased a vermiculture machine called Vermitech, which utilizes worms to turn certain food waste into high-grade compost. In addition, SMCC employs Crown Disposal to compost other green material. The compost then goes to Bakersfield grape vineyards (T. Corpus, personal communication, March 23, 2011).

IV. ANALYSIS OF THE EXTERNAL ENVIRONMENT

i. Funding Opportunities

a. Government Grants for Sustainability

UC Davis and UC Irvine are both receiving grants from the California Department of Conservation to further develop the sustainability programs in the amount of $200,000. Anne Krieghoff, Manager, Solid Waste and Recycling Services for UCI, said her grant was $200,000 for the general commingle project. This was for refurbishing a hauling truck, marketing and educational material, new bins, etc. The University applied for the grant at CalRecycle, formerly CalGrant. Additional source of funding for sustainability programs are provided by the Integrated Waste Management Board (A. Krieghoff, personal communication, April 18, 2011). CSUN should take advantage of the potential government grants promoting sustainability practices. However, due to expected California budget cuts, it is possible that these grants may not be available in the future.

Other recent grants include:

- UC Merced, UC Davis, UC Irvine and UC San Diego campuses all received "Renewable Energy Secure Communities" grants from the California Energy Commission to develop utilization of mixed renewable energy technologies in an integrated, sustainable and optimal manner (Committee on Grounds and Buildings, 2011).

- Los Angeles campus received a $20 million grant from the L.A. Department of Water and Power to use the campus as a living laboratory for research on creating a smart grid.

- Students at the Riverside campus passed a student fee referendum to provide approximately $90,000 in annual funding for campus sustainability projects.

- Students at the San Diego campus collaborated with the Environmental, Health and Safety department to reduce water consumption on campus through an "Aquaholics" educational program.

- The San Diego campus received $33 million in grants, incentives and private sector contributions for research and deployments for expanding the award-winning efforts to use the campus

More information on obtaining grants:

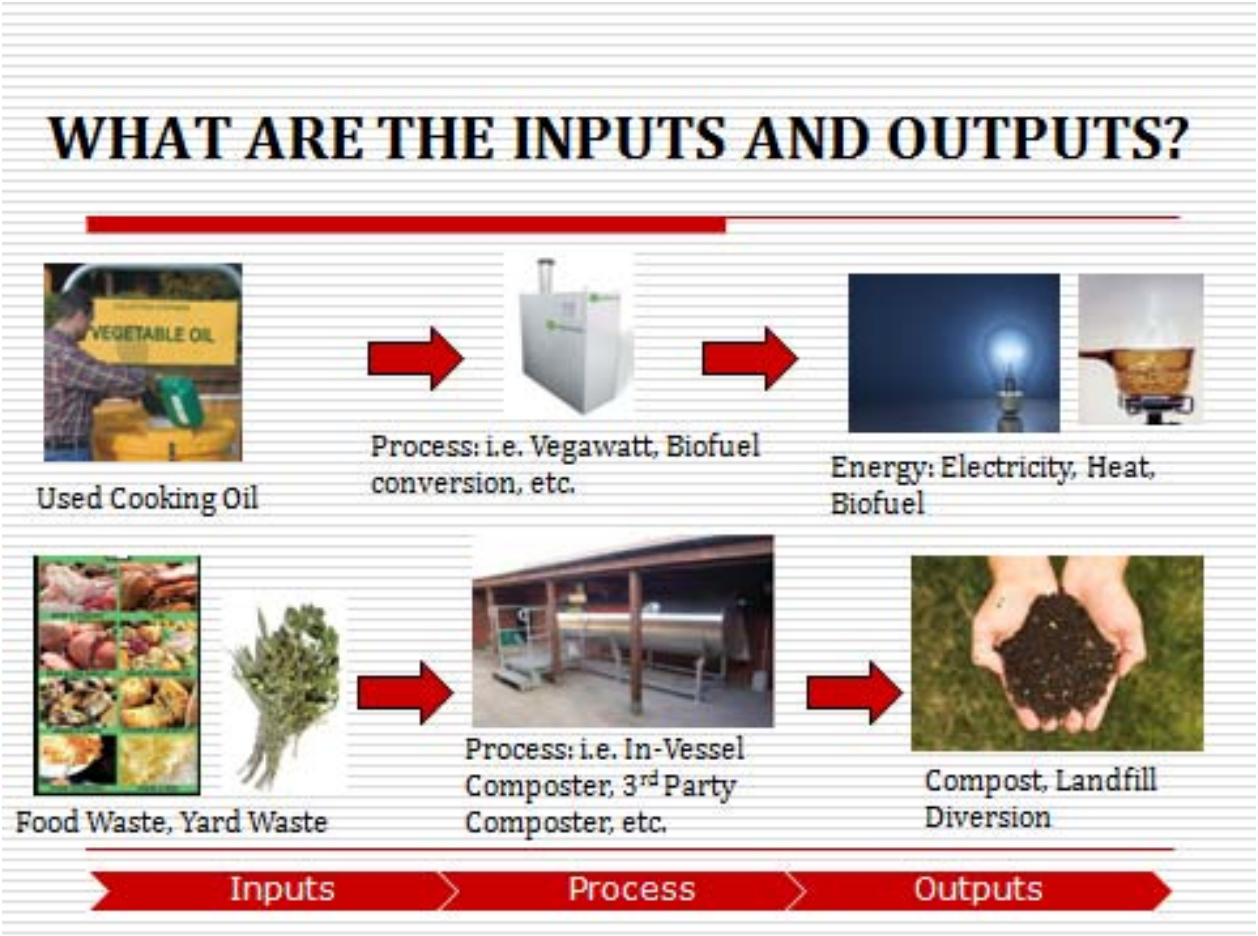
- http://www.conservation.ca.gov/index/Pages/qh_grants.aspx – grants from the California Department of Conservation

- http://www.calrecycle.ca.gov/Organics/Food/Funding/default.htm – available federal, state or regional loans, grants, or contracts

- https://energycenter.org/index.php/incentive-programs/self-generation-incentive-program/faqs – 30% federal tax credit and an accelerated depreciation schedule for renewable technologies

ii. Operational Opportunities

Several processes exist to facilitate green and kitchen waste diversion and recycling. Each method involves converting waste to usable output. The following options involve inputs including landscape trimmings (green waste), food scraps (kitchen waste), or fryer oil. Each process converts the input or a combination of several into mulch, compost, or energy. Each option also diverts these inputs from reaching unproductive refuge landfills.


WHAT ARE THE INPUTS AND OUTPUTS?
VEGETABLE OIL
Used Cooking Oil
Process: i.e. Vegawatt, Biofuel conversion, etc.
Energy: Electricity, Heat, Biofuel
Food Waste, Yard Waste
Process: i.e. In-Vessel Composter, 3rd Party Composter, etc.
Compost, Landfill Diversion
Inputs
Process
Outputs

a. The Rocket Composter

Figure 5 - Rocket A900, Third Largest of Four Available Sizes
Note: From www.tidyplanet.co.uk

The Rocket is an in-vessel composter that allows on-site treatment of organic waste including cooked and uncooked meat and fish, cooked and uncooked fruit and vegetables, garden waste, and animal waste (including some types of animal bedding). The Rocket creates usable compost from organic waste in two weeks as opposed to a typical compost pile which takes several months to produce compost, which is CSUN's current method. This compost can be used instead of fertilizer which will reduce costs and pollution of groundwater. The Rocket requires a mix of 50% wood chips to provide the carbon needed to the mixture, as food waste is very high in nitrogen. The wood chips also add mass to the compost which allows the rotating shaft within the composter to aerate the mixture properly. The campus itself provides a large amount of wood chips. Should the campus not provide enough wood chips, tree surgeons or landscape gardeners can provide the needed wood chips for free as they are considered waste. The Rocket maintains an internal temperature of 140 °F to ensure that pathogens in the food waste are killed. The entire process is continuous; as waste is fed into the Rocket, it forces compost through an outlet on the bottom. The Rocket requires only a standard single-phase 240-

volt power supply (26 kWh per week), 15 to 20 minutes of labor per day, and must be housed under cover on a solid non-porous surface (http://www.natradinghouse.com/solutions.php). The Rocket A700 can process 370 gallons of mixed waste per week, 180 gallons of food waste per week, and 555 gallons of food waste per week when used with a waste pulper.

The Rocket A900 would be more appropriate for the amount of waste CSUN produces and can handle 925 gallons of mixed waste per week, 460 gallons of food waste per week, and 1,385 gallons of food waste per week when used with a waste pulper. According to CSUN's Associate Director of Campus Dining Betsy Corrigan, the University already owns a waste pulper; this could be used in conjunction with the Rocket to further increase efficiency. The A900 is 13.1 feet long, 3.3 feet wide, 5.3 feet high, and has an empty weight of 1100lbs. The Rocket is in use in campuses across Europe as well as in the U.S. The costs are $33,050 for an A700 Rocket and $48,400 for an A900 Rocket (http://www.tidyplanet.co.uk/food-wastecomposters).

Benefits

- Substantially reduces food waste disposal costs
- Reduces or eliminates fertilizer costs
- Reduces or eliminates fertilizer contamination of groundwater
- Immediate treatment eradicates vermin problems and pest control costs
- Eliminates trash-related odors (Rocket is odorless)
- Eliminates the need for garbage bags and other non-biodegradable products use to dispose food waste
- Reduces greenhouse gas emissions coming from rotten food in landfills (methane)
- Contributes to the decrease of number of waste collection vehicles on streets and highways which emit CO_2
- Low power requirements (26kWh per week)

Drawbacks

- Initial total expenditure of $48,400 *(A900 composter $45,900, shipping [From port of Los Angeles to Northridge CA] $1,200, Rocket installation costs and training $1,300)*

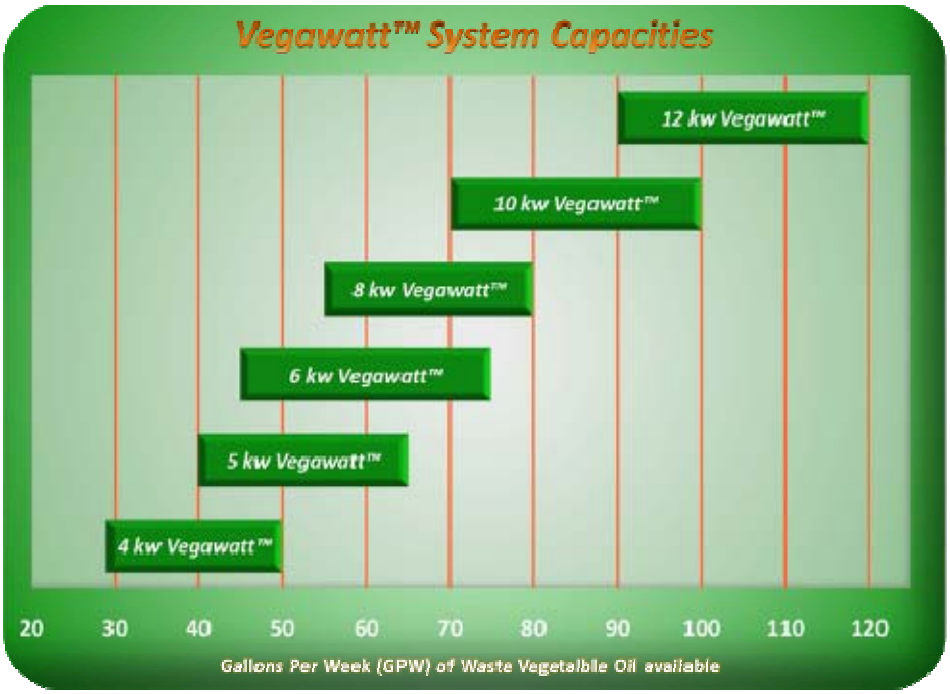
b. The Vegawatt

Currently, Western Imperial picks up used fryer oil from the CSUN campus for free. The Vegawatt is system about the size of a refrigerator and converts used fryer oil into power. The unit is placed outside a building and hooks up through one electrical cable to the electric system. A Vegawatt system typically provides 10-25% of the electricity required by a restaurant and comes in six available sizes. The system also produces heat and there is a hot water feed and returns system. In addition to the electrical power the system produces, a CSUN hot water heater would not have to work as hard because water can be partially heated by the system. The system integrates electrically in the same way as a solar electric panel, making local licensing and permitting simple. Units are adaptable; they can tie into an automated oil change system or accommodate a 10-gallon stock pot. The cooking oil undergoes a patented four-stage cleaning process that creates an extremely clean fuel while using no additional energy input. The Vegawatt is cleaner than converting fryer oil to biodiesel; biodiesel requires using caustic chemicals and fossil fuel products (usually methanol and lye) and produces glycerol, a byproduct that needs to be removed. Converting used oil to electricity with the Vegawatt is a much simpler and straight-forward process than converting oil to biodiesel, which could then only be used to run diesel motors. The Vegawatt requires no additional chemical feed stocks, produces no byproducts, is non-flammable, and is non-toxic. The system comes in six available sizes. Based on the amount of oil CSUN produces, the 4 kWh Vegawatt

Figure 6 - Vegawatt
Note: From www.vegawatt.com

system would be most appropriate. The 4 kWh system has a list price of $25,800 (http://www.vegawatt.com).

Figure 7 - The Six Available Vegawatt Sizes and their Weekly Oil Converting Capacities
Note: From www.vegawatt.com



Benefits

- Substantial cost savings on electricity
- Extends the life of hot water heaters
- Eliminates transportation to and from the campus by Western Imperial, which produces air pollution

Drawbacks

- Initial expenditure of $25,800

c. Vermiculture

Vermiculture is the creation of compost using a specific species of worm called "red worms" (http://earth911.com/news/2007/04/02/composting-with-worms). Worms eat organic waste and create rich compost called "worm castings". Commercially available vermiculture bins can be used to house the worms. Approximately one square foot of surface area is required per pound of food waste per week and the depth of each container should be eight to 16 inches. The bins have many small holes in the bottom which are required for ventilation and drainage. Initially, moist shredded newspaper with a small amount of sand or soil must be used as bedding for the worms, after which organic waste can be added. Worm bins must be kept out of hot sun and heavy rain and between temperatures of 40-80 degrees F (http://www.cityfarmer.org/wormcomp61.html). The organic waste mixture must also be kept moist by spraying with water every other day or so, but it must become not overly wet or the worms will die.

Figure 8 - Vermiculture Bin
Note: From www.composters.com

The worms will eat vegetable scraps, egg shells, coffee grounds, fruit and vegetable peels, and bread. Materials that cannot be converted to compost by worms are meat, fish, dairy products, or anything that is oily, greasy, salty, or acidic (http://www.squidoo.com/worms). After 2.5 to 4 months, the compost can be separated from the worms. This can be done manually or by pushing the compost to one side of the bin and adding new organic waste to the other side,

after which the worms will migrate over to the new food source and the compost can be removed.

Benefits

- Reduces fertilizer costs
- Reduces waste disposal costs
- Reduces contamination of groundwater due to less use of chemical fertilizer
- Relatively inexpensive

Drawbacks

- Worms cannot digest a wide variety of food waste
- Worms require specific temperature and humidity
- Overfeeding/overwatering may produce unpleasant odor
- Impractical amount of bins required
- Impractical amount of maintenance required

d. Vermitech

Figure 9 – Vermitech
Note: From www.smc.edu/recycling

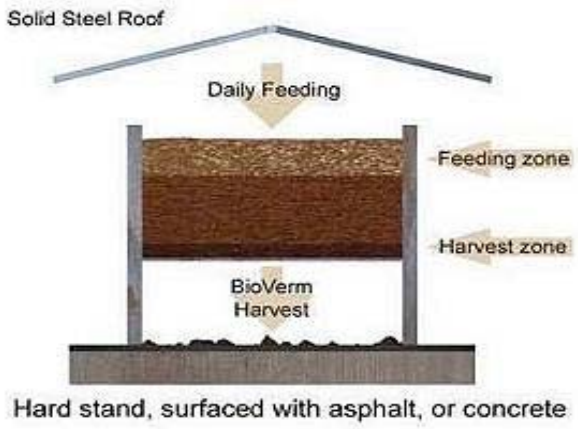


Figure 10 – Vermitech Process
Note: From www.vermitech.com

Vermitech is a proprietary large-scale vermiculture system. The core of the technology is an open-top reactor vessel (bed) in which the worms are housed. The beds can be up to 40m long. A controlled blend of bio-solids is fed to the surface of the bed on a regular basis. The worms consume the waste in-and-around the top region producing compost. Preparing the waste to make it worm accessible has required the development of mix formulae, mixing systems and

mechanisms for spreading the material onto the surface of the bed. The compost is removed from the base of the bed, using equipment developed by Vermitech that "cuts" the bottom layer from the bed via a specialist bed base design and deposits it upon a conveyor belt. This occurs on a time frequency basis and the depth of cut is controlled via an adjustable cutting head. Santa Monica City College purchased a Vermitech in 2002 for $80,000 (http://www.vermitech.com).

Benefits

- Reduces fertilizer costs
- Reduces waste disposal costs
- Reduces contamination of groundwater due to less use of chemical fertilizer
- Easier to harvest compost than traditional vermiculture

Drawbacks

- Initial expenditure of at least $80,000
- Worms cannot digest a wide variety of food waste
- Worms require specific temperature and humidity
- Overfeeding/overwatering may produce unpleasant odor
- Impractical amount of bins required
- Impractical amount of maintenance required

e. Compost Tea

Figure 11 – Compost Tea Brewer
Note: From www.CompostTea.com

Figure 12 - Tractor Mounted Sprayer
Note: From www.compostwerks.com

Compost tea is a solution made by soaking or steeping compost in water. The resulting solution is applied to the soil to provide nutrients to lawns and improve root systems (http://www.dep.state.pa.us/dep/deputate/airwaste/wm/recycle/tea/tea1.htm). The longer the root system of grass and other plants is, the less watering they require. Compost tea brewers create the solution after compost and water has been added. Brewers also have filters that remove chlorine from the water, as chlorine will kill the beneficial microorganisms in the compost tea. A tractor or truck mounted sprayer can then be used to spray the solution on the lawns. Compost tea brewers come in sizes from 85 gallons to 200 gallons and cost from $2,400 to $3,700 (http://www.compostwerks.com). Tractor and truck mounted sprayers from compostwerks.com come in sizes from 50 gallons to 300 gallons and cost from $2,600 to $4,600.

Compost tea can also be produced on a small scale basis which may be more appropriate from an educational/culture-changing perspective. With this scalable approach, an organization could pilot the use of compost tea without a large investment to determine if it is an effective fertilizer for operations. All of the materials can be bought off-the-shelf for a very small investment. See **Appendix E** for material lists and instructions on how to make compost tea on a small scale.

Benefits

- Reduces fertilizer costs
- Reduces contamination of groundwater due to less use of chemical fertilizer
- Lawns require less watering due to improves root systems

Drawbacks

- Initial expenditure of $5,000 to $8,300
- Requires compost (cannot use raw food or green waste)
- A method CSUN landscape maintenance already uses called “grasscycling”, whereby grass clippings are recycled into the lawn is cheaper, more efficient, and has similar effects such as reduced watering requirements

f. Open Windrow

An open windrow is a long low mound of organic waste in an outside area that is turned or mixed every few days (a closed windrow is within a facility) (http://www.britannica.com/facts/5/593314/open-windrow-composting-as-discussed-in-environmental-works-civil-engineering). Turning is required to aerate the mixture and to distribute moisture and the heat generated by the composting process. This method of composting could be used in the same area as CSUN's current compost heaps. Open windrow composting produces usable compost in approximately five to 12 weeks, which is quicker than compost heaps produce (http://www.donarbon.com/open-windrowcomposting). Only green waste (***NO food waste***) can be used in open windrows, as food waste would attract vermin. Windrow turners come in many sizes, a small turner such as the one shown has a total cost of $18,375 (http://www.turnandscreen.com/content/mighty-mike-compost-turner).

Figure 13 - Mighty Mike Windrow Turner
Note: From www.turnandscreen.com

Benefits

- Initial expenditure of $18,375 *($15,550 for turner, $1,975 for required water sprayer attachment, approximately $550 shipping from Oregon)*
- Reduces fertilizer costs
- Reduces contamination of groundwater due to less use of chemical fertilizer
- Produces compost more quickly than the compost heaps CSUN currently uses

Drawbacks

- May produce strong odor
- Cannot be used with food waste due to vermin problems

g. Waste Pulper

Waste pulpers are used to process a wide range of solid wastes, primarily food waste. Waste pulpers grind up organic matter, such as food scraps, cardboard, and paper, with water and then extract most of the moisture to produce a dry, organic pulp. Waste pulpers are available in capacities ranging from 250 to 4,000 lbs./hr. and can reduce the volume of wastes by up to 70 to 85% (depending on the type of pulper used). This can reduce waste, transportation and disposal costs (http://www.p2sustainabilitylibrary.mil/p2_opportunity_handbook/7_III_9.html). The dry pulp that is produced is often in a form that can be used for composting. The combination of a waste pulper with a system like the Rocket composter will significantly increase the capacity of the Rocket. Waste pulpers can cost from $13,000 to $40,000, however, CSUN already has a waste pulper. According to CSUN's Associate Director of Campus Dining Betsy Corrigan, the pulper has not been in use recently due to the system not being able to handle straws and chopsticks, the system produced a strong odor, and a good deal of maintenance was required. Ms. Corrigan states that she is currently attempting to reestablish use of the waste pulper.

Figure 14 - Waste Pulper
Note: From www.meiko.us

Benefits

- Reduces fertilizer costs
- Reduces waste disposal costs
- Reduces contamination of groundwater due to less use of chemical fertilizer
- Increases capacity of the Rocket

- CSUN already owns one

Drawbacks

- Cannot handle straws or chopsticks
- May produce strong odor
- Requires significant maintenance

h. Third-Party Composter

Figure 15 - Roll-Off Bin Being Placed by a Truck
Note: From www.wikipedia.org/wiki/Roll-off_(dumpster)

Companies such as Crown Disposal provide off-site composting for various campuses. Crown Disposal uses a "single stream" system in which all waste is collected from the campus and then sorted for recyclables and organic waste at Crown's own facility. Waste from trash cans is dumped into 40 yard roll-off bins and is collected by trucks sent by Crown. Pepperdine has general waste bins, as well as cafeteria bins, in which only food waste and cardboard is dumped. According to grounds manager James Lockhart, Crown collects two 40-yard general trash bins twice a week and a single 40-yard bin with cafeteria waste six times a week for Pepperdine. Crown charges $300 for collection of each bin. Pepperdine can ask for compost

whenever they want and Crown will bring it for free. Mr. Lockhart said that the gardeners do not use the Crown compost for everything, as they have certain plants and flowers that require a specialized mix. However, CSUN may not be as particular about its compost needs. Peter Duby, coordinator for the Center for Sustainability at Pepperdine, explained that Crown is able to recycle or compost 78% of all the trash they collect from Pepperdine. Crown does not compost at its Sun Valley headquarters; it transports the composts approximately 100 miles to Bakersfield, Crown's composting site. This causes a negative impact on the environment due to the increased pollution caused by hauling the waste long distances.

Benefits

- Reduces or eliminates fertilizer costs
- Reduces or eliminates contamination of groundwater due to less use of chemical fertilizer
- No initial large cost expenditure required

Drawbacks

- Large trucks transport waste and compost back and forth between CSUN and Bakersfield frequently, causing a negative impact on air pollution

i. Associated Student Association (ASA)

Another excellent opportunity is that CSUN's Associated Students has the ability to coordinate students for free to support sustainability projects. CSUN Institute for Sustainability needs to partner with the ASA for many future projects. The partnership will capitalize on (1) cutting costs with the free labor attained by the students and (2) promote the Institute's current and future ventures, raise awareness for sustainability practices, and inform student, faculty, and staff, of the program's mission. For more information see the ASA website: http://www.csunas.org/about/index.php.

iii. Threats

There are several possible threats to CSUN's sustainability program. If CSUN has a poorly functioning sustainability program, for instance, this may provide negative publicity for the University due to the campus not being environmentally friendly. Such press may come in the form of state or federal audit or journalist inquiry.

Problems may exist with the implementation of the program. Initial expenditures or maintenance costs could exceed the budget. A lack of proper management could lead to wasting resources invested in the sustainability program. Management must be on board with the program and be aware of added responsibilities.

Local and state government regulations on conservation and waste requirements must be met. State and federal legislation regarding recycling, sustainability, and other "green" efforts in both the private and public sectors will likely become more stringent in the future. It is important that CSUN maintains the capabilities to keep up with, and hopefully exceed future legislation to conserve resources.

Strong and unpleasant odors may be associated with some forms of composting, including the open windrow composting. California law states that commercial composters must not emit unpleasant odors. (http://www.green.ca.gov/EPP/Grounds/compost.htm#laws). Odors may lead to violations of city and state ordinances, and create a general nuisance for students and visitors. Open windrows, if used, should be placed away from residential areas, offices, and classrooms.

California State University budget trends reflect a recent history of reduction. Campuses may face more difficulty getting money for a sustainability program than in past years. It may

also mean that government grants for sustainability provide less money, or some grants may soon be discontinued.

New technology developments within the "green" industry are rapidly changing. Shortly after new sustainability measures are implemented, new technology, services, or ideas may arise. This could leave CSUN with a substantial investment in outdated equipment.

The sustainment of internal capabilities and possible loss of key staff creates another threat. In cost models, projections for the utilization of student employment are included. Eventually, these students will graduate. CSUN must face the threat of losing internal resources and capabilities each year with regards to the sustainability program.

Seasonality and weather effects must also be considered. Certain methods of composting, such as vermiculture, do not tolerate rain or hot sun, as mentioned. Certain campus restaurants close for the summer while others remain open, causing variation in food waste input into the composting system and modifying scheduling and output. The sustainability implementation will need customization around seasonality.

iv. Pest Analysis

Examining the external environment reveals crucial factors to consider when determining most feasible options for CSUN's sustainability program. Analysis of political, environmental, social, and technological factors indicate several laws and regulations, socio-cultural trends, and advancement in technology that must be addressed before determining the best course of action for CSUN.

a. Political

Since the early 1990s, politicians have attempted to persuade businesses and state agencies, such as California State Universities, to focus on alternative options to their current

operations to reduce environmental impact and aid in a sustainable future. From regulations related to making and selling compost to grants provided to universities focusing on sustainability and energy conservation, lawmakers have attempted to minimize the carbon footprint left by businesses and organizations.

Legal issues related to making and selling compost or biofuel have been addressed by politicians. Public Contract Code (PCC) section 12203 maintains that state agencies, including California State Universities, must ensure that at least 50 percent spent on compost and mulch product must be spent on the minimum content requirements set forth by PCC section 12209 (http://www.green.ca.gov/EPP/Grounds/compost.htm#laws). In addition, commercial composters are required to meet certain regulatory requirements related to public health and safety. Certain aspects that must be considered to stay in compliance are (1) the compost needs to have a pleasant aroma, students and the surrounding neighborhood must not be able to detect the compost, (2) the carbon to nitrogen ratio needs to be less than 20%, and (3) the acceptable pH value of the finished compost must remain between 5.5 and 8.0 pH, neither to acidic or alkaline. Furthermore, according to Title 14, Chapter 3.1, Article 2, California mandates that any special handling of compostable material must obtain a Compostable Materials Facility Permit (http://www.calrecycle.ca.gov/Laws/Regulations/Title14/ch31.htm). However, it is important to note that Article 2 states exclusions to the regulation, two of which are important to CSUN's facilities. A permit is not required if the within-vessel's capacity is less than 50 cubic yards. The Rocket A900 only has a 3.5 cubic yard capacity, thus CSUN would not be required to obtain a permit. Second exclusion of importance is if there is 500 cubic yards or less of compostable material on-site at one time a permit is not required.

Over the last 20 years, Congress has passed laws and regulations directly related to green and food waste in California that is important to consider for CSUN's sustainability program. The most influential bill pertaining to green waste is the Integrated Waste Management Act passed in 1989. This law required 25% diversion of state's waste from landfills by 1995, and 50% diversion by 2000 (Warner, 1996). Given the 50% mandated diversion required by the Integrated Waste Management Act, municipalities have used green waste for Alternative Covering at landfills, which is credited toward the required diversion (http://www.cawrecycles.org/issues/adc). In order to reduce the odors and risk to public health, landfill operators are required to cover the waste at the end of every day. In place of dirt, operators have turned to green waste products to fulfill this covering, which is referred to as Alternative Daily Covering (ADC). Californians Against Waste do not have a problem with using green waste for ADC, but are concerned with municipalities receiving credit. Currently, the same green waste that receives credit toward the mandated 50% diversion for ADC is used for the production of advancement in biofuels and green power, which is only considered as disposal (Martin, 2009). A new bill that was recently introduced addresses some of these concerns by the Californians Against Waste. The bill will phase out recycling credit at landfills within the next 7 years, charge a state fee for green waste disposal as landfill cover, and use the money to promote composting and environmentally-friendly energy production (Olney, 2008).

Along with new bills and regulations introduced to promote productive green and food waste utilization, factors to consider are city restrictions due to unsightly machinery or smells coming from food and green waste handling methods. In California, composters must have a pleasant aroma and consistent throughout (http://www.green.ca.gov/EPP/Grounds/compost.htm#laws). If a composting method is utilized by CSUN's Sustainability Department, whether it is

the Rocket or worm farming, it must remain conscience of the city restrictions and compost heap.

Although there are laws and regulations mandating what state agencies and business must do to stay compliant, the government has provided incentives to increase sustainability programs and energy conservation, especially among the academic community. For example, grants received by University of California, Davis and University of California, Irvine from the Department of Conservation to facilitate a growing focus on sustainability.

b. Economical

The economic factors are crucial to CSUN's desire to achieve a more sustainable campus and recent events directly impact this ability. CSUN's budget cuts and California's budget deficit are of major concern. Governor Jerry Brown's new budget proposal cuts $500 million from California State Universities (Abou-Diwan, 2011). Given this information, CSUN will face decisions on which programs to fund and cut. The question for CSUN, along with many other universities, is determining the level of priority for a sustainability program. Current investments in composting machinery, although eventually showing financial savings, may not be in CSUN's current budget. In addition to the state budget cuts, an expected $12.5 billion in cuts are expected for government spending and programs. These cut backs may directly impact the Department of Conservation and any grants it provides universities to promote sustainability programs. The grants received by both UCI and UC Davis may no longer be available for universities. In addition, in April 2011, federal government approved spending cuts of approximately $38 billion for the U.S. budget, $500 million pertaining directly to higher education (Rucker, 2011). The budget cuts of both the state and federal have the potential to limit the amount of grants and opportunities to expand on current or future programs. The

advantage programs, such as CSUN's sustainability program, have are the dedication the government has placed on conservation (e.g., Integrated Waste Management Act).

c. Socio-cultural

Over the last decade, there has been a growing trend toward a "green" movement. The importance of conservation, energy efficiency, recycling, and reducing one's carbon footprint have become increasingly popular among businesses, government policies, and individuals. An overarching trend for campuses to become more sustainable has emerged. In fact, many campuses and campus-like facilities have a long-term goal of 0% waste, or 100% sustainable. As of 2010, more than 1,000 university chancellors and presidents, through pledges, dedicated their institution toward a sustainable future (Bezbatchenko, 2010). Many universities recognized the need for a focus on a sustainable future. This drive and dedication may present an opportunity for campuses, such as CSUN, to work together and achieve this goal for sustainability. In addition to the growing movement to decrease business's environmental impact, growing concern exists among college students about society's impact on the environment. In 2007, youth activists around the country were increasing in size, with a green business school network of 130 chapters and 570 schools participating in Campus Climate Change (Green, 2007). As the growing concern and commitment from college students increases, CSUN's dedication to sustainability may provide leverage over other universities.

d. Technological

In regards to green and food waste, the technology to improve composting and sustainability is constantly improving. Significant advancement in composting and sustainability occurred in recent years. This advancement is evident in composting machinery design, such as the Rocket and Vegawatt Systems. In addition, researchers have explored alternative

technologies to composting machinery. One example of vermiculture utilizes worms to break down waste.

New technology and alternatives are continuously explored in hopes of discovering more efficient use for green and kitchen waste. Green Waste Technologies, a New Jersey start-up firm, is researching a new method for composting food. The firm is exploring the possibility of utilizing black soldier fly larvae to break food waste into oil and protein stocks (Worthington, 2011).

V. INTERNAL ANALYSIS

California State University, Northridge resides on 356 acres, including more than 40,000 students and faculty. CSUN Institute for Sustainability, the campus, and the members involved provide strengths and weaknesses for future development of the program. The current weaknesses of CSUN are easy to overcome, and present the potential to become strengths. By focusing on the strengths and improving weaknesses, the desire to become a leader in sustainability is a realistic goal.

i. Strengths

CSUN's quest to improve its sustainability department and methods of waste disposal is supported by the University's strengths. From the size of the campus to the current application in process to the dedicated staff focused on conservation, California State University, Northridge is ready to become a leader in waste disposal and energy conservation.

CSUN Institute for Sustainability exhibits a strong devotion toward a renewable future and reducing impact on the environment. Its chief strength is the faculty and team, which will provide the necessary resources allowing CSUN to become a leader in sustainability. There are ample resources devoted to the sustainability program and reducing the University's carbon

footprint. Researching CSUN's sustainability program provided contacts with faculty and staff, such as Dr. Helen Cox, James Logsdon, Randal Thomson, Betsy Corrigan, and Cynthia Signett; all displaying an overwhelming dedication to improving the sustainability program. Dr. Helen Cox is Director of the Institute for Sustainability and has a strong desire to improve CSUN's carbon footprint. James Logsdon and Randal Thomson, current and former head of CSUN's maintenance department, respectively, have indicated an openness and passion to improve the University's green waste. The efforts and dedication of these men and women provide CSUN Institute for Sustainability an opportunity to become a leader in sustainability.

Along with a dedicated core group of faculty and staff, CSUN already implemented steps to reduce its waste disposal. The University is currently using alternative methods to reduce green waste. Presently, CSUN utilizes the "grasscycling" method to help reduce fertilizer and water requirements. "Grasscycling" decomposes quickly and reduces fertilizer requirement by approximately 20 percent (Hartin & Henry, 2001). In addition, "grasscycling" has the potential to reduce the need for mowing time and disposal costs. According to James Logsdon, CSUN produces 0% grass clipping waste excluding short periods due to heavy rains. In addition, CSUN has invested in a fuel cell which significantly reduces heat and electricity costs and also demonstrates its devotion to becoming more sustainable.

Figure 16 - California State University, Northridge's Fuel Cell
Note: Photograph taken April 1, 2011

CSUN's campus presents a strength for the sustainability department. Initially well designed, the campus allows for future implementations of waste programs. For example, the campus is a manageable 356 acres with 225 maintenance acres. Its size and waste production provide more options than other universities that do not produce as much food and waste production. In addition, CSUN has over 3,800 trees with several planter beds, hedges, and vast lawn. The open design allows for future alterations and improvements to improve sustainability. Furthermore, to help manage the campus, CSUN owns a fleet of transportation carts, street sweepers, and bull dozers, among others. Among its fleet of vehicles, CSUN owns a wood chipper. Wood chips have multiple uses including the ability to create a supply of wood chips sufficient to mix with food waste to create high-quality compost.

CSUN Institute for Sustainability promotes several events aimed at conservation and sustainability. Students have events, such as Earth Fair, organized picks and trash clean up, to promote awareness around sustainability and green technology. Other events supported by the Institute for Sustainability are the 8th Annual AltBuild Expo and volunteer events, such as Los Angeles River Cleanup Day. Furthermore, with its continued desire to grow the sustainability program and students awareness, CSUN is introducing into the curriculum a minor in

sustainability. This will give students the opportunity to understand and become active in sustainability for the campus and the environment.

The University has also made strong strides to promoting and being actively involved in a sustainable future. Developed by the U.S. Green Building Council, Leadership in Energy and Environmental Design (LEED) provides green building certifications based on metrics such as energy saving, water efficiency, and emissions reduction, among others (Daly, 2010). CSUN has already focused on improving the efficiency of its building standards. Recently, it was awarded LEED certifications for two major constructions, Performing Arts building and Student Recreation Center. Rigorous certification process must be passed to be awarded this honor – Performing Arts building and Student Recreation Center received silver and gold, respectively.

ii. Weaknesses

While CSUN Institute for Sustainability exhibits the desire and the people in place to become a leader in the industry, it must consider several weaknesses. Currently, CSUN pays $6,090 per year to Consolidated for green waste removal and another $36,112 per year to Allied Waste (Bills & Kuhn, 2010) to have food waste removed. Several options exist to not only save the University money on waste removal, but provide a more eco-friendly answer. Composting alternatives, such as the Vegawatt or windrow system, provide a cost-saving, environmentally-friendly option to paying a company to haul the waste away.

Another weakness is CSUN's budget size. Budget cutbacks with the University and state may prevent the funding necessary for the Sustainability Department to invest in compost machinery to enhance the program. Cynthia Signett, Recycling Coordinator for Associated Students with CSUN, stated: "at this point in time or the near future, this (budget for AS to operate a composting machine) is not factored into our plans and budget. Please check out our

feasibility study for more information – we are in process of finding funding sources and then hope to build out from there. It is taking longer than we thought with this economy! After that, we can look at systems to compost – again, with the cooperation of other entities on campus".

While the devotion to improve the program is apparent, the lack of a sustainability program focusing on kitchen and green waste compared to other local universities is a weakness. Universities, such as University of California, Irvine, Santa Monica City College, among others, have a more advanced and sustainable program. Focusing on universities in California, such as San Jose State University, CSUN's program is not comparable.

The University campus's potential is a strength, but its current gardens and maintenance activities hinder the progress of the Sustainability Department. CSUN currently has an extremely unimpressive campus garden:

Figure 17 - CSUN Campus Garden & Surrounding Areas
Note: Photographs taken April 1, 2011

However, since these pictures were taken, Randy Thompson improved the overall quality of the campus gardens. CSUN currently dumps its chipped waste in an unsightly pile near the softball fields and tennis courts. It takes a long time, approximately 2 to 3 months, for the waste to turn to mulch, until then it remains in an unsightly area of the campus (see **Appendix A** for pictorial examples). Though CSUN has these wood chip waste, it still purchases some shredded bark to enhance the look of the campus.

Furthermore, CSUN's grounds manager claims there is a lack of space for certain large-scale composting projects. This limits the possible projects and composting machinery that can be used for the campus. CSUN currently gives away used fryer oil. In addition, the company that removes the oil is located relatively far away causing the release of additional CO_2 emissions generated during the hauling process.

VI. MARKETING STATEGY

A common thread found in all current campus composting programs is marketing. Administrators of the program continually stress the importance of signage, promotional material, instructional media, and branding when implementing any recycling program. Many of the marketing efforts encourage students to adapt the recycling principles needed to successfully

separate trash at the end-user level. For example signs are created to educate students which trash can accept certain materials. Often trash cans are color coded for food, comingled recyclables, and general waste. Many campuses dining halls place a list of acceptable items above each trash can.

In additional to the educational material, campuses include motivational messages. These are marketing campaigns focused on spreading an echo-friendly mindset. These messages promote socially responsible ideas. Slogans like “Zero Waste” and “Save Our Planet” encourage socially responsible practices. This type of performance marketing addresses broader concerns about the ethical, social, and environmental effects of student’s behavior. In Marketing Management, Kottler and Keller (2009) describe a category within performance marketing labeled social responsibility marketing where: “The effects of marketing clearly extend beyond the company and the customer to society as a whole. Marketers must carefully consider their role in broader terms, and the ethical, environmental, legal, and social context of their activities” (p. 26).

In additional to the educational, and performance marketing many schools have created brand images and slogans. Universities with established composting programs even developed brands specific to the composting program. For example, The Associated Students at California State University of Chico created a logo for their organization and attached a mascot like drawing of a composting worm and slogan at the end of their presentations and packets.

Figure 18 - Marketing Example 2
Note: From www.aschico.com/recycle

Organized marketing efforts help create a general awareness and productive in-group. Through effective marketing programs students learn to participate and realize the social impact of their efforts. These programs create an environmentally conscious culture and facilitate successful implementation of recycling programs.

VII. KEY STRATEGIC ISSUES

The key strategic issue facing the Institute for Sustainability is how CSUN will alter current green and food waste disposal methods to create a more self-sustaining campus. Complimentary to this issue and equally as paramount is how CSUN will drive a culture change to keep these methods in place in the long run. Will it need to purchase new equipment to facilitate this effort? If so, how will the institute justify investments?

VIII. FINANCIAL ANALYSIS

i. Vegawatt System

The 4 kWh Vegawatt system was quoted at $25,800 with an estimated $3,000 in freight charges (See **Appendix H** for full quote and other figures used in this analysis). For the purpose of NPV calculation, the freight charge is included in the investment, bringing the total investment for this particular technology to $28,800. Research shows that this machine can be depreciated using a MACRS schedule (Center for Sustainable Energy – California). The Vegawatt Corporation has performed a detailed cost analysis for CSUN, factoring in the amount of electricity as well as gas savings measured in therms (because Vegawatt also produces hot water). Vegawatt's estimate for the value of CSUN's waste vegetable oil (WVO) is $2.79 per gallon (CSUN's gallons WVO per month as listed in **Appendix I** was provided to Vegawatt). Currently, CSUN is giving this oil away for free to Western Imperial which converts the oil to biofuel and generates profit from it. According to Jim Logsdon, CSUN Grounds Manager, CSUN's cost per kWh is $0.125; however, Vegawatt used a $0.18 per kWh for electricity and $0.87 per therm of natural gas in its calculations based on averages for California. **Table 1** uses the $2.79 value per gallon calculated by Vegawatt and CSUN's CY 2009 actual gallons (2,347) of WVO to compute the savings revenue from the use of Vegawatt ($6,458 per year).

Figure 19 - Vegawatt
Note From www.vegawatt.com

Table 1 – Vegawatt Income Statement
Note: Value of Oil from Appendix H; Estimated Qty per year from Appendix I

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Approx value of Oil with Vegawatt[1] (see analysis)	2.79	2.79	2.79	2.79	2.79	2.79	2.79	2.79
Estimated gallons per year[2]	2,347.00	2,347.00	2,347.00	2,347.00	2,347.00	2,347.00	2,347.00	2,347.00
Savings Revenue $	6,548.13	6,548.13	6,548.13	6,548.13	6,548.13	6,548.13	6,548.13	6,548.13
Total Revenues $	**6,548.13**	**6,548.13**	**6,548.13**	**6,548.13**	**6,548.13**	**6,548.13**	**6,548.13**	**6,548.13**
AS Student Worker [3]	936.00	936.00	936.00	936.00	936.00	936.00	936.00	936.00
Total Usage Costs	**936.00**	**936.00**	**936.00**	**936.00**	**936.00**	**936.00**	**936.00**	**936.00**
Depreciation	4,118.40	7,056.00	5,040.00	3,600.00	2,563.20	2,563.20	2,563.20	1,296.00
Income Before Taxes $	1,493.73	(1,443.87)	572.13	2,012.13	3,048.93	3,048.93	3,048.93	4,316.13
Tax (No Tax)								
Net Income $	**1,493.73**	**(1,443.87)**	**572.13**	**2,012.13**	**3,048.93**	**3,048.93**	**3,048.93**	**4,316.13**

[1]Calculated by Vegawatt
[2]2009 Data from B. Corrigan
[3]Assumes (1) AS Student worker 2 days per week, 1 hour per day

In addition to the Vegawatt's costs of operation (which is already deducted from the value of the WVO), the cost of one Associated Student worker, two days per week for one hour per day at $9/hr. was factored into the income statement. This employee would transport the WVO from the various kitchens around CSUN, to the Vegawatt. Since nothing is being sold, there is no applicable tax – just a cost savings from a heat (therms) and electricity (kWh) standpoint.

The yearly savings as a result of purchasing the Vegawatt amount to $5,612. **Table 2** displays the savings revenues, operating costs, depreciation, and cash flow for an 8 year span.

Table 2 – Vegawatt Cash Flow

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Revenues		6,548.13	6,548.13	6,548.13	6,548.13	6,548.13	6,548.13	6,548.13	6,548.13
Operating Costs		936.00	936.00	936.00	936.00	936.00	936.00	936.00	936.00
Operating Margin		5,612.13	5,612.13	5,612.13	5,612.13	5,612.13	5,612.13	5,612.13	5,612.13
Depreciation		4,118.40	7,056.00	5,040.00	3,600.00	2,563.20	2,563.20	2,563.20	1,296.00
Taxes		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Net Profit		1,493.73	(1,443.87)	572.13	2,012.13	3,048.93	3,048.93	3,048.93	4,316.13
OCF (add back depreciation)	0.00	5,612.13	5,612.13	5,612.13	5,612.13	5,612.13	5,612.13	5,612.13	5,612.13
Total CF from Investment	(28,800.00)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
IATCF	**(28,800.00)**	**5,612.13**	**5,612.13**	**5,612.13**	**5,612.13**	**5,612.13**	**5,612.13**	**5,612.13**	**5,612.13**

Looking at the cash flow statement in **Table 2**, the payback period for this machine is approximately 5.13 years. Vegawatt computed a payback period of about one year less than this because it did not factor in the cost of a CSUN employee operating the machine. Using a cost of capital of 5%, which is indicative of a rate that CSUN would use, the NPV for this project is calculated to be $7,472. **Table 3** shows the NPV at from cost of capital rates varying from 1% to 10%, the latter being the most conservative approach. In all situations, the NPV is positive; therefore, the project should be accepted.

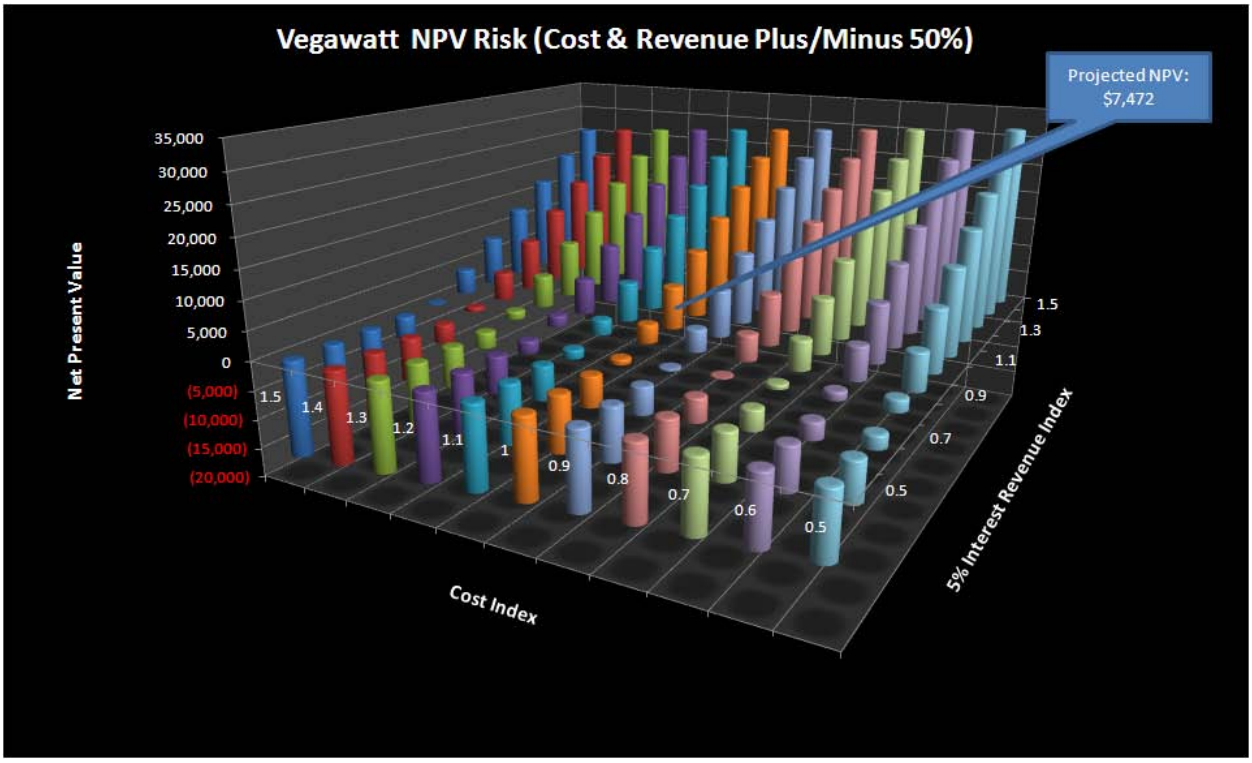
Table 3 – Vegawatt NPV at Cost of Capital 1% to 10%

	Cost of Capital	NPV
Less conservative	1.0%	$14,142
	2.0%	$12,312
	3.0%	$10,595
	4.0%	$8,985
	5.0%	$7,472
	6.0%	$6,050
	7.0%	$4,712
	8.0%	$3,451
	9.0%	$2,262
More conservative	10.0%	$1,140

The risk involved with this project lies in the projections. For example, what happens if (1) the cost of labor increases or if (2) CSUN does not generate the projected amount of WVO to achieve the yearly projected savings? On the other hand, if the price of gas were to increase,

CSUN's WVO would become more valuable. **Figure 20** is a graphical representation of these different scenarios.

Figure 20 – Vegawatt NPV Risk



The center of the table shows the most likely NPV of $7,472. If the revenue index (x-axis so-to-speak) increases by a factor of 1.5 for example, this means that CSUN is generating more WVO and saving more by using the Vegawatt, thus the NPV is valued higher at $28,633. In addition, the payback period would be reduced. On the other hand, if CSUN only generates half the WVO that is projected, the NPV would be valued at ($13,084) unfavorable. It is unlikely that CSUN will generate much less WVO than in previous years, therefore, the risk of this project is minimal. It is likely, however, that CSUN can obtain more oil (e.g., from the community through advertising, etc.), therefore, the NPV of this project has a higher probability of increasing rather than decreasing.

Overall, the Vegawatt project in the most likely scenario has a positive NPV of $7,472, a payback period of 5.13 years, an IRR of 11.1%, and a profitability index of 1.26. These figures suggest that the Vegawatt is an acceptable project.

ii. Rocket A900

NATH Sustainable Solutions quoted the Rocket A900 at $45,900. Freight charge to CSUN is $1,200 and installation costs/training is another $1,300 (See **Appendix G** for full quote and other figures, i.e. capacity that are used in this analysis; See **Appendix F** for conversions). In addition, CSUN will need to purchase approximately 100 food disposal bins at a total cost of $2,000 (**Appendix A**) for collecting food waste around campus. The last investment that needs to be made for the A900 is approximately $1,500 for the construction of a tarp or wooden overhang to protect it (*rough estimate*). This brings the total investment cost for NPV calculation to $51,900. Like the Vegawatt, the Rocket uses a 7-year MACRS depreciation schedule, and a 5% cost of capital is assumed.

Figure 21 – Rocket A900
Note: From Rocket Quote in Appendix G

Table 4 is a detailed income statement for the Rocket A900 composter. The compost revenue is derived from a primary source. RotoTillerGuy.com has offered the going rate of $10/per cubic yard in the event CSUN produces compost using the A900 (See **Appendix A** for contact info).

Table 4 – Rocket A900 Income Statement

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9
Compost Revenue ($)/cubic yard[1]	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
Estimated Quantity (Cubic yards)[1]	136.50	136.50	136.50	136.50	136.50	136.50	136.50	136.50	136.50
Compost Revenue $	1,365.00	1,365.00	1,365.00	1,365.00	1,365.00	1,365.00	1,365.00	1,365.00	1,365.00
Total Revenues $	**1,365.00**	**1,365.00**	**1,365.00**	**1,365.00**	**1,365.00**	**1,365.00**	**1,365.00**	**1,365.00**	**1,365.00**
Power Usage Costs $[2]	195.00	195.00	195.00	195.00	195.00	195.00	195.00	195.00	195.00
AS Student Worker $[3]	4,212.00	4,212.00	4,212.00	4,212.00	4,212.00	4,212.00	4,212.00	4,212.00	4,212.00
Savings on Waste Removal $[4]	(1,076.05)	(1,076.05)	(1,076.05)	(1,076.05)	(1,076.05)	(1,076.05)	(1,076.05)	(1,076.05)	(1,076.05)
Savings on Fertilizer Cost $[5]	(500.00)	(500.00)	(500.00)	(500.00)	(500.00)	(500.00)	(500.00)	(500.00)	(500.00)
Total Usage Costs $	**2,830.95**	**2,830.95**	**2,830.95**	**2,830.95**	**2,830.95**	**2,830.95**	**2,830.95**	**2,830.95**	**2,830.95**
Depreciation $	7,421.70	12,715.50	9,082.50	6,487.50	4,619.10	4,619.10	4,619.10	2,335.50	
Income Before Taxes $	(8,887.65)	(14,181.45)	(10,548.45)	(7,953.45)	(6,085.05)	(6,085.05)	(6,085.05)	(3,801.45)	(1,465.95)
Tax @38% $	(3,377.31)	(5,388.95)	(4,008.41)	(3,022.31)	(2,312.32)	(2,312.32)	(2,312.32)	(1,444.55)	(557.06)
Net Income $	**(5,510.34)**	**(8,792.50)**	**(6,540.04)**	**(4,931.14)**	**(3,772.73)**	**(3,772.73)**	**(3,772.73)**	**(2,356.90)**	**(908.89)**

[1]Rocket A900 is capable of producing 3.5 cubic yds of compost per week. Assuming CSUN can sell at $10 per cubic yd
[2]Assumes 12.5 cents/kWh X 30 kWh per week X 52 Weeks
[3]Assumes (1) AS Student worker 5 days per week, 4 hours per day (or (2) Student workers 5 days per week, 2 hours per day) for 3/4 of the year
[4]CSUN's Average cost per cubic yard of food & Yard waste removal 50/50 split is $7.85. The Rocket will reduce this by 137 cubic yards, so 137 X $7.85 = $1076
[5]Assumes Compost Tea will save 25 bags of fertilizer per year @ $20 per bag

The amount of compost this company purchases from CSUN may vary, however, the NPV model assumes CSUN will sell all of the compost it produces. It is also assumed that the Rocket A900 will only be operating for ¾ of the year due to breaks, etc. According to the specifications, the Rocket A900 is capable of producing 136.5 cubic yards of compost per year when running ¾ of the year. At $10 per cubic yard, this is only $1,365 of compost revenue per year; however, an estimated $500 per year will be saved in fertilizer costs. Another $1,076 will be saved on waste removal because CSUN will no longer have to pay for the 137 cubic yards that the Rocket composts. [CSUN's average cost per cubic yard of food & yard waste removal 50/50 split is $7.85 (See **Appendix D** for quantities & associated cost & **Appendix F** for conversions). The Rocket will reduce this by 137 cubic yards, so 137 X $7.85 = $1076] See **Table 5**.

Table 5 – The Rocket: Savings on Waste Removal
Note: See Appendix D and F for Quantities and Conversion factors.
Total Cubic yards based on Rocket A900 (from Quote in Appendix G)

Rocket A900 - Handling Capacity
& Expected Cost Savings/yr

	Cubic Yds	Cost
Food Waste	68.5	$310.11
Yard Trimmings	68.5	$765.95
Totals	137	$1,076.05

There are two continuous costs associated with the Rocket: Labor costs and power costs. From a labor perspective, one (1) Associated Student employee, working 5 days per week, 4 hours per day (or (2) employees working 5 days per week, 2 hours per day) for ¾ of the year will cost about $4,212 at a rate of $9 per hour. From an energy perspective, CSUN's cost per kWh is 12.5 cents. The Rocket A900 requires current at all times and uses 30 kWh per week. This comes to $195 per year which is about as much as a refrigerator would cost. Taxes are estimated at 38% on sales of the compost.

Considering all revenue, expenses, and savings on expenses as a result of this project as they are stated above, it is determined that the Rocket would run at a net loss (**See Table 4**), and therefore, the NPV is negative $46,273 (assuming a 19 year life), which suggests this is not an acceptable project from a financial perspective.

iii. Alternate Scenario for the Rocket A900

Because one of CSUN's strengths is its devoted students and faculty, it would be possible to enlist volunteers to collect compostable waste and operate the A900. In this scenario, the labor cost would be zero. In addition, the estimate for savings on fertilizer cost per year may vary as well. **Table 6** shows the income statement for the Rocket if labor costs were zero and fertilizer savings were 5 times the original estimate of $500 per year, or $2,500. Note that net

income from year 9 thru year 19 remains at $2,943 because the Rocket is fully depreciated at year 8.

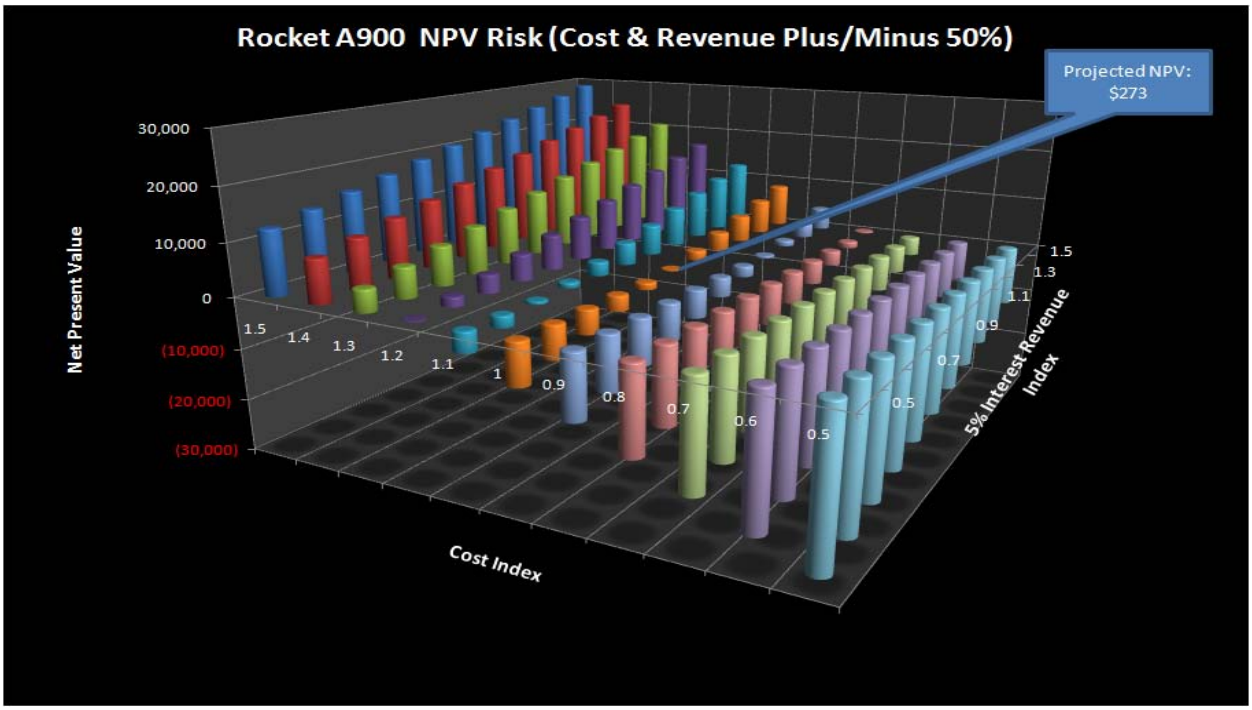
Table 6 – Rocket A900 Income Statement (Scenario 2)

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9
Compost Revenue ($)/cubic yard[1]	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00	10.00
Estimated Quantity (Cubic yards)[1]	136.50	136.50	136.50	136.50	136.50	136.50	136.50	136.50	136.50
Compost Revenue $	1,365.00	1,365.00	1,365.00	1,365.00	1,365.00	1,365.00	1,365.00	1,365.00	1,365.00
Total Revenues $	**1,365.00**	**1,365.00**	**1,365.00**	**1,365.00**	**1,365.00**	**1,365.00**	**1,365.00**	**1,365.00**	**1,365.00**
Power Usage Costs $[2]	195.00	195.00	195.00	195.00	195.00	195.00	195.00	195.00	195.00
AS Student Worker $[3]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Savings on Waste Removal $[4]	(1,076.05)	(1,076.05)	(1,076.05)	(1,076.05)	(1,076.05)	(1,076.05)	(1,076.05)	(1,076.05)	(1,076.05)
Savings on Fertilizer Cost $[5]	(2,500.00)	(2,500.00)	(2,500.00)	(2,500.00)	(2,500.00)	(2,500.00)	(2,500.00)	(2,500.00)	(2,500.00)
Total Usage Costs $	**(3,381.05)**	**(3,381.05)**	**(3,381.05)**	**(3,381.05)**	**(3,381.05)**	**(3,381.05)**	**(3,381.05)**	**(3,381.05)**	**(3,381.05)**
Depreciation $	7,421.70	12,715.50	9,082.50	6,487.50	4,619.10	4,619.10	4,619.10	2,335.50	
Income Before Taxes $	(2,675.65)	(7,969.45)	(4,336.45)	(1,741.45)	126.95	126.95	126.95	2,410.55	4,746.05
Tax @38% $	(1,016.75)	(3,028.39)	(1,647.85)	(661.75)	48.24	48.24	48.24	916.01	1,803.50
Net Income $	**(1,658.90)**	**(4,941.06)**	**(2,688.60)**	**(1,079.70)**	**78.71**	**78.71**	**78.71**	**1,494.54**	**2,942.55**

[1]Rocket A900 is capable of producing 3.5 cubic yds of compost per week. Assuming CSUN can sell at $10 per cubic yd
[2]Assumes 12.5 cents/kWh X 30 kWh per week X 52 Weeks
[3]Assumes AS coordinates volunteers at no cost
[4]CSUN's Average cost per cubic yard of food & Yard waste removal 50/50 split is $7.85. The Rocket will reduce this by 137 cubic yards, so 137 X $7.85 = $1076
[5]Assumes Compost Tea will save 125 bags of fertilizer per year @ $20 per bag

In this scenario, the NPV is $273, with a payback period of almost 11 years. Since the NPV is positive, this is an acceptable project given the assumptions made. Financial risk, however, is high. **Figure 22** details the cost index vs. the revenue index. If either factor varies by 0.1 times, the NPV of the project would be negative, and thus not acceptable.

Figure 22 – Rocket A900 Cost & Revenue Risk



iv. Vermitech

The Vermitech is expensive. According to Tom Corpus, Recycling Coordinator at Santa Monica City College, the system was purchased for $80,000 in 2002. Although an actual quote was not received from Vermitech, it is assumed that it will cost no less than $80,000. Tom Corpus also estimated an additional $50,000 in costs per year to cover electricity, etc. In addition, six students that are paid $8.10 per hour (subsidized through a Federal work study program so SMCC only pays 25%) are needed for its operation. For CSUN, this cost will be zero as it will be assumed that volunteers will see to

Figure 23 – Vermitech
Note: From www.smc.edu/recycling

its operation. Revenue assumptions and quantity of compost produced will be the same as for the Rocket: $10 per cubic yard of compost and 137 cubic yards per year output.

Even with student volunteers operating the Vermitech for zero cost, the project has a negative NPV and will cost CSUN approximately $28K every year even after it is fully depreciated. **Figure 9** shows the cash flow for the Vermitech. Note that from year 9 through year 19, the cash flow remains -$27,937.

Table 7 – Vermitech Cash Flow Statement

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9
Revenues		1,365.00	1,365.00	1,365.00	1,365.00	1,365.00	1,365.00	1,365.00	1,365.00	1,365.00
Operating Costs		46,423.95	46,423.95	46,423.95	46,423.95	46,423.95	46,423.95	46,423.95	46,423.95	46,423.95
Operating Margin		(45,058.95)	(45,058.95)	(45,058.95)	(45,058.95)	(45,058.95)	(45,058.95)	(45,058.95)	(45,058.95)	(45,058.95)
Depreciation		11,440.00	19,600.00	14,000.00	10,000.00	7,120.00	7,120.00	7,120.00	3,600.00	0.00
Taxes		(21,469.60)	(24,570.40)	(22,442.40)	(20,922.40)	(19,828.00)	(19,828.00)	(19,828.00)	(18,490.40)	(17,122.40)
Net Profit		(35,029.35)	(40,088.55)	(36,616.55)	(34,136.55)	(32,350.95)	(32,350.95)	(32,350.95)	(30,168.55)	(27,936.55)
OCF (add back depreciation)	0.00	(23,589.35)	(20,488.55)	(22,616.55)	(24,136.55)	(25,230.95)	(25,230.95)	(25,230.95)	(26,568.55)	(27,936.55)
Total CF from Investment	(80,000.00)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
IATCF	**(80,000.00)**	**(23,589.35)**	**(20,488.55)**	**(22,616.55)**	**(24,136.55)**	**(25,230.95)**	**(25,230.95)**	**(25,230.95)**	**(26,568.55)**	**(27,936.55)**

From a financial perspective, the Vermitech is not an acceptable project. Its initial investment is high, its NPV is negative, and it does not have a payback period because it incurs a continuous loss year after year.

v. Mighty Mike Windrow

The Mighty Mike Windrow system requires an initial expenditure of $18,375 ($15,550 for turner, $1,975 for required water sprayer attachment, and approximately $550 shipping from Oregon). Because windrow systems do not compost food waste, the savings on waste removal is higher than the Rocket, or

Figure 24 – Mighty Mike Windrow
Note: From www.manure2compost.com

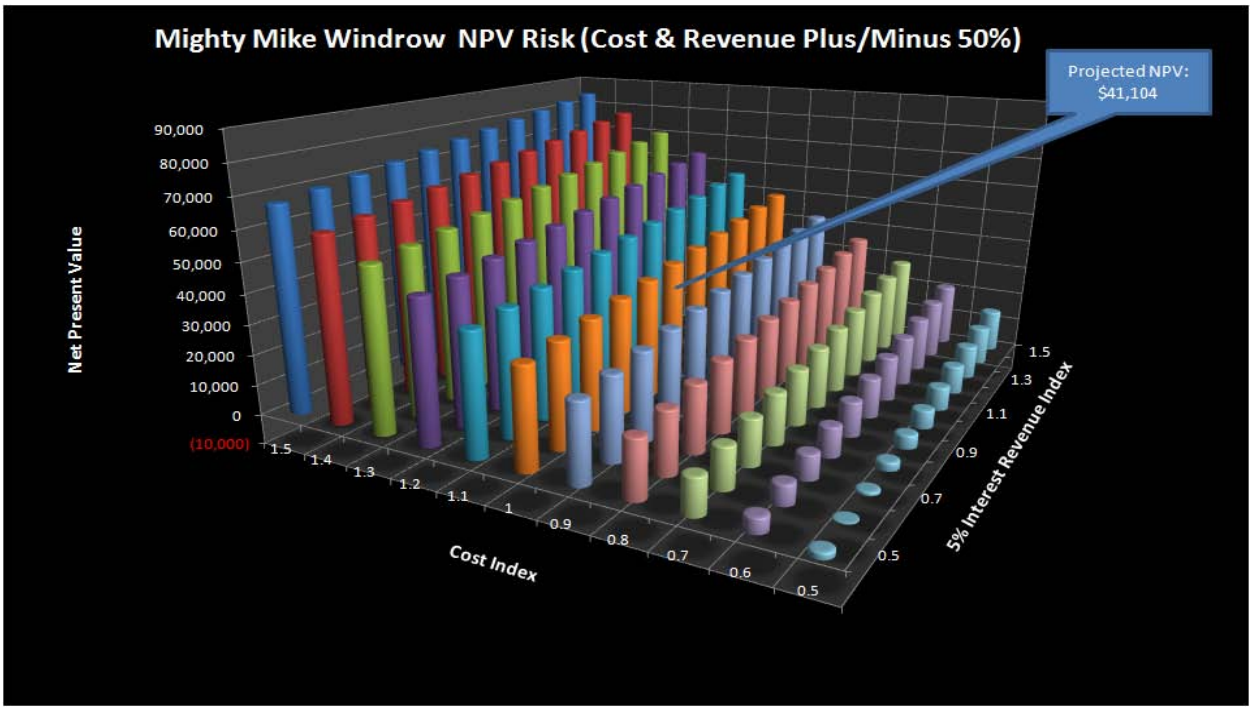
vermiculture due to the higher cost of yard waste ($11.1 per cubic yard) compared to the cost of food waste ($4.53 per cubic yard). In addition, the Mighty Mike Windrow system allows all of CSUN's green waste to be utilized, therefore, cutting the entire cost of green waste removal. From a labor cost perspective, labor is very minimal. For financial purposes, it is assumed that one employee at $9/hr., 1 day per week, 2 hrs. per day, for ¾ of the year is needed to operate Mighty Mike. Based on these assumptions, **Table 8** shows the Mighty Mike Windrow has a positive cash flow stream for every year. Note that the windrow system is fully depreciated by year 8, however, cash flow continues to year 19 (additional years not shown but are included in NPV calculations) as 19 years is the estimated life of this project.

Table 8 – Mighty Mike Windrow Cash Flow Statement
Note: Revenue assumption is the same as for Rocket A900

	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9
Revenues		1,365.00	1,365.00	1,365.00	1,365.00	1,365.00	1,365.00	1,365.00	1,365.00	1,365.00
Operating Costs		(5,788.12)	(5,788.12)	(5,788.12)	(5,788.12)	(5,788.12)	(5,788.12)	(5,788.12)	(5,788.12)	(5,788.12)
Operating Margin		7,153.12	7,153.12	7,153.12	7,153.12	7,153.12	7,153.12	7,153.12	7,153.12	7,153.12
Depreciation		2,627.63	4,501.88	3,215.63	2,296.88	1,635.38	1,635.38	1,635.38	826.88	0.00
Taxes		1,719.69	1,007.47	1,496.25	1,845.37	2,096.74	2,096.74	2,096.74	2,403.97	2,718.19
Net Profit		2,805.81	1,643.77	2,441.25	3,010.87	3,421.00	3,421.00	3,421.00	3,922.27	4,434.93
OCF (add back depreciation)	0.00	5,433.43	6,145.65	5,656.87	5,307.75	5,056.38	5,056.38	5,056.38	4,749.15	4,434.93
Total CF from Investment	(18,375.00)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
IATCF	**(18,375.00)**	**5,433.43**	**6,145.65**	**5,656.87**	**5,307.75**	**5,056.38**	**5,056.38**	**5,056.38**	**4,749.15**	**4,434.93**

From a risk standpoint, the Mighty Mike is relatively safe, given the assumptions are accurate. The NPV for 19 years of operation is $41,104, the payback period is 3.26 years, and the IRR is almost 29% for this project. **Figure 25** shows the revenue and cost index breakdown which displays little risk with fluctuating revenues and costs. Overall, the Mighty Mike Windrow is an acceptable project.

Figure 25 – Mighty Mike Windrow Cost & Revenue Risk



vi. Third-Party Composting

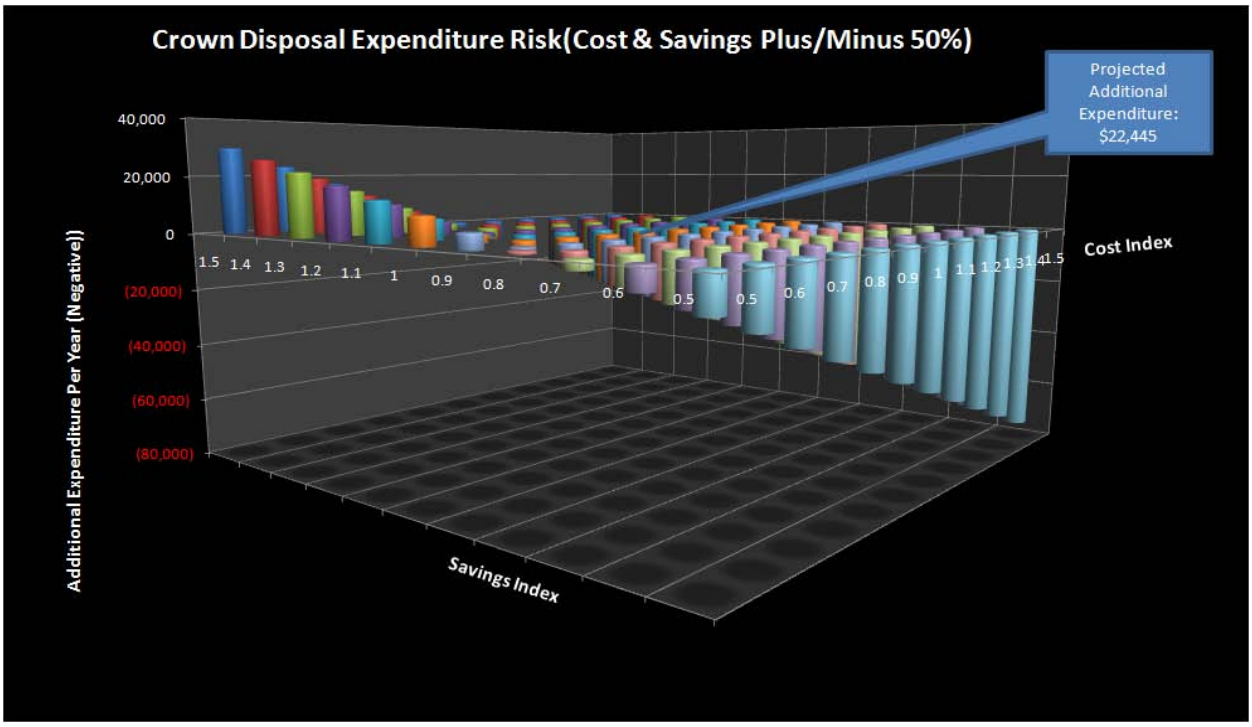
Third-party composting requires no initial investment on CSUN's behalf. Financial analysis will simply look at what CSUN is currently paying versus what it would pay a third party to compost its waste. Because Crown Disposal is the closest third-party composter to CSUN, cost is based on the $300 it charges for a 40 yard haul. This information was gathered from a primary source – based on what Pepperdine University currently pays Crown. **Appendix D** shows CSUN's green waste and food waste quantities and current removal costs by month. On an annual basis, CSUN currently spends $6,090 removing its 109 tons (approximately 871 cubic yards) of green waste and $34,261 removing its 7,568 cubic yards of food waste. When converted into 40 cubic yard truckloads, CSUN would need about 211 hauls per year to handle its green waste. **Table 9** shows that at $300 per haul, this equates to $63,296, which is about $22,945 more than CSUN is currently spending.

Table 9 – Estimated Additional Expenditure When Using Crown Disposal

Costs		
Estimated truckloads per year of green waste (40 yard hauls)		21.79
Estimated truckloads per year of Food waste (40 yard hauls)		189.20
Total Hauls		**210.99**
Total Cost at $300 per Haul	**$**	**63,295.80**
Savings		
No longer use Consolidated for Green Waste	$	6,090.12
No longer use Allied for food waste	$	34,260.99
Fertilizer savings	$	500.00
Total Savings	**$**	**40,851.11**
Net expenditure		
Net additional expenditure per year	**$**	**(22,444.69)**

It is estimated that an additional $500 per year will be saved in fertilizer costs, bringing CSUN's total savings per year to $40,851. This means that in the most likely scenario when using a third-party composter such as Crown Disposal, CSUN will be paying an additional $22,445 per year. **Figure 26** shows CSUN's net expenditure risk distribution. This is important because it shows that small differences in cost can make the difference between CSUN spending more than it currently does, or the same. For example, if CSUN were to spend the same as it currently does on waste removal, it would have to negotiate the hauling cost using Crown Disposal down to 90% of the scenario in **Table 9** and achieve a savings (fertilizer, etc.) of 1.4 times.

Figure 26 – Crown Disposal Expenditure Risk (Service Cost vs. Savings to CSUN)



vii. Financial Summary

Table 10 summarizes the financial projections of all the feasible options. The different investments range from $21K to $80K with payback periods ranging from 3 to 11 years. Note that the operating costs in this table do not reflect savings from current waste removal and fertilizer.

Table 10 - Financial Summary

	Initial Investment	Payback Period	NPV	IRR	Operating Costs per Year[1]
Vegawatt	$28,800	5 years	$7,472	11%	$936
Rocket A900 In-Vessel Composter	$51,900	11 years	$273	5%	$195
Vermitech	$80,000	N/A	($392,017)	N/A	$50,000
Mighty Mike Windrow	$20,910	3 years	$41,104	29%	$802
Third Party Composter (Crown Disposal)	$0	N/A	N/A	N/A	$63,296

[1]Vegawatt & Mighty Mike assume student employees @$9/hr. Rocket & Vermitech assume AS volunteers at no cost

IX. RECOMMENDATIONS

California State University, Northridge recognized the need to improve the University's sustainability and environmental impact. Current social-trends, advancements in technology, and a growing "green" movement have provided CSUN with the opportunity to explore options to improve the sustainability of the campus and increase the awareness around the subject.

From an industry perspective, all of the major options above alleviate buyer power to some degree by putting CSUN on the map as being on the cutting edge of sustainability. A remaining issue is how CSUN will permanently instill a culture change in students and faculty to achieve long-term success. The best way to achieve this is by involving them in the process. For mainly this reason, Third-Party Composting, though it is the least hassle and has a high probability of success, is not recommended. CSUN needs to set an example and will not achieve this having its waste hauled off and composted behind closed doors. CSUN has set an example in basic recycling and shown dedication by investments such as its fuel cell, however, there are no current or future plans to improve the University's food and green waste.

Table 10 is the matrix of all the major viable options or solutions to handling CSUN's green and food waste that would make CSUN more sustainable. Each major advantage is ranked from 1 to 10, 1 being less important and 10 being more important. The scale is negative for the disadvantages. For the final scoring, the positive advantage numbers and the negative disadvantage numbers are summed up.

Table 11 – Recommendations Matrix

Opportunity /Solution	Major Advantages (1 thru 10 rank)	Major Disadvantages (-1 thru -10 rank)	Recommendation / Score
Rocket A900 (In-Vessel System)	•Can take food and green waste (10) •Scalable, i.e. buy another if there is too much waste or use with pulper for higher output (8) •Compost can be used to save on fertilizer costs; compost tea can be made as complimentary product (5) •Unique technology that would set CSUN apart from most schools (10)	•Coordination & management required for operation (-10) •Initial expenditure of $48.4K (-5) •May still have to pay for some green waste removal until the flow of operation is perfected (-5)	•Score: 13 •**Recommend.** The A900 is not only a good solution to reducing green / food waste, but will also provide education to students that will lead to positive culture change
Vegawatt	•Can make profit with all of CSUNs oil (10) •Payback period of only 5 years; possibly sooner depending on oil output (7) •Produces electricity and heat (8) •Positive NPV with larger upside risk than downside risk (5) •Requires little operation expense (9)	•Initial expenditure of $25.8K (-3)	•Score: 36. •**Recommend.** Vegawatt is a must-have.
Vermitech	•Produces higher-grade compost (5) •Unique technology that would set CSUN apart from most schools (10)	•Very expensive to purchase and operate ($80K +) (-10) •Does not accept wide variety of food waste (-10)	•Score: -5 •Vermitech is not practical due to high costs and low functionality
Open Windrow	•Could handle all of CSUNs green waste (10) •Relatively inexpensive, Positive NPV (5)	•Cannot handle any food waste due to vermin problems (-10) •May produce strong odors (-8)	•Score: -3 •Do not recommend due to low functionality
Third party composting	•Least hassle – sorting , etc, is done at facility (10) •Third party will take all food and green waste (10) •Third party will supply CSUN with compost it makes (5)	•Will cost CSUN at least $22K more per year than its current waste arrangements (-8) •Carbon footprint impact from transportation trucks (-10) •This solution is not very hands-on (i.e. will not educate students like an on-site system would (-7)	•Score: 0 •Score of zero suggest this is neither a great opportunity or a bad one. Recommendation given to higher scoring option

After analyzing our findings and measuring the overal effectiveness of each viable option, the Vegawatt and Rocket A900 scored the highest and will provide CSUN the best option to improve its sustainability department and provide the school with a competitive advantage.

Current operations involve CSUN giving its fryer oil to Western Imperial. The Vegawatt will provide the opportunity to continue recycling this waste while making a profit. In addition, with only an initial investment of $28,800, the ability to produce electricty and heat, and immediate revenue savings for the University of $6,458 per year, the Vegawatt's payback period is only 5 years with the possiblity of an earlier return on its investment depending on the oil input. In addtion, the Vegawatt's four-stage cleaning process with no energy output allows for

minimal operating expenses, which will aid in cost savings. Including operation costs and depreciation of the equipment, CSUN can expect to see a yearly savings of $5,612 within the first year. As explained in the financial analysis, the positive NPV with larger upside risks out way the risks associated with the "what ifs" of the investment.

Cost savings and an early return on its investment is an important aspect for CSUN in deciding the future operations to improve its environmental impact; however, the mission is not simply cost related, but improving the sustainability of the University. The Vegawatt not only saves CSUN $5,612 per year, but its process is cleaner than converting fryer oil to biodiesel. Converting fryer oil to biodiesel requires the use of caustic chemicals and fossil fuel products, which is arguably counterproductive to the goal of a sustainable future. The added benefit from the use of the Vegawatt is the elimination of air pollution caused by the continued transportation to and from the campus by Western Imperial. Furthermore, the Vegawatt's much simpler process of converting oil will help save on campus heating and electicity.

Our findings and recommendations also include the use of the Rocket A900. This in-vessel composter provides CSUN with the ability to manage its green and food waste on-site, as opposed to utilizing the services of Consolidated and Allied. The purchase of the Rocket A900 gives CSUN the option to adjust for heavier waste input, allowing for student and campus growth, by either purchasing an additional Rocket or employing CSUN's pulper that is currently not in operation. The Rocket A900 will also save the University on fertilizer costs – compost tea, a simple process (see **Appendix E**), can be made as a complimentary product to reduce the need for fertilizer and water. CSUN's introduction of the sustainability minor offered to students in Fall of 2011 will provide a great tool for the required operations of both the Rocket A900 and compost tea.

The financial analysis of the Rocket A900 illustrates two scenarios, one providing a positive NPV and another demonstrating a negative NPV. The scenario that provides a positive NPV for the Rocket requires no labor costs. This can be achieved based on the dedication of students and faculty volunteers to collect the compostable waste and operate the Rocket A900. Under this scenario, with the savings incurred from zero labor costs and reduced use of fertilizer, the NPV is $273 with a payback period of approximately 11 years with an initial investment of $51,900.

The worst case scenario for the Rocket involves labor costs of approximately $4,212 per year based on $9 per hour. Given the labor and power costs, the revenue generated from the compost, and savings on expenses (e.g., fertilizer costs), the Rocket incurs a net yearly loss and a negative NPV of only $46,273. Even with a (maximum) yearly loss of $8,793 (See year 2 of **Table 4**), this worst case scenario for the Rocket is still thousands less than the next viable option of third-party composting, which increases CSUN's waste removal costs by $22K per year. Additionally, Tim Fry, the general manager of Crown has proven to be extremely difficult to contact. This could mean that Crown has reached capacity, thus is now turning away prospective clients. More research is needed, however, to come to this conclusion.

It is important to refer back to CSUN Institute for Sustainability's mission: "To promote, facilitate, and develop educational, research, and University and community programs related to sustainability…" (http://www.CSUN'sustainability.org/about). While the Rocket A900 has an increased risk with labor costs, it provides CSUN with an innovative technology that would set the University apart from many other schools that are currently leading the industry in sustainability practices. The ultimate goal of CSUN Institute for Sustainability is to improve the University's environmental impact, which the Rocket A900 accomplishes. A commitment to

improving the sustainability practices may result in minor costs, but the overall impact far outweighs the minimal costs.

Financial analysis of the Mighty Mike Windrow showed a NPV of $41,104 and an acceptable project for investments. However, when measuring the potential success of the Windrow, it scored a zero. There are three main reasons why this investment, while showing the highest NPV of any potential projects, is not recommended to help improve CSUN's sustainability. (1) The Windrow cannot handle food waste due to the possibility of attracting vermin. Food waste is major contributor to the waste produced at CSUN, and arguably the more important aspect to reduce to improve the University's sustainability. (2) The Windrow requires an open area and produces a large mound of compound heap. This reduces the attractiveness of the campus, which is already a current weakness of the University. Finally, (3) the Windrow produces an odor. Not only is the unsightly smell a deterrent for the students, it may pose public health concerns. Cost savings cannot be the sole motivator for future investments in sustainable practices. The main goal of this report is: *improve the sustainability of CSUN and its impact on the environment*, a secondary importance is future cost savings.

Along with the purchase of the Vegawatt System and the Rocket A900, CSUN's current sustainability operations must remain a focus, as well. The continued use of the "grasscycling" technique, which will reduce the green waste, need for fertilizer, and water is important to continue. In addition, promotions of events, such as Earth Day, trash clean up, and L.A. River Cleanup Day, are critical for CSUN to continue in order to raise awareness of the importance of a sustainable campus and future. Furthermore, government grants and funding opportunities for sustainability programs, similar to the grants received by UCI and UC Davis, must be researched and applied for to help alleviate any future costs.

X. IMPLEMENTATION PLAN

1. Memorandum of Understanding (MOU) – Management Buy-in

An appropriate first step for CSUN to take is to create a Memo Of Understanding (MOU) among the three principle stakeholders for the organic solution quest: TUC (the university corporation, who supplies the food pre- and post-consumer waste), AS (Associated Student, and Recycling in particular), and PPM (Physical Plant Management, who supplies all yard waste and could potentially gain from a compost to grounds program). Without some initial buy in by these three – and perhaps the president of the institution – there can be no complete and accurate sharing of detailed, in depth information to form a meaningful and insightful assessment of CSUN's products, costs, and desires/outcomes for this sustainability project. This will help alleviate CSUN's lack of management of these types of projects in the past (using coffee grinds to fertilize rose beds). This document should contain a project overview, objectives, general approach, contractual aspects, schedules, resource requirements, required personnel, evaluation methods, and a list of potential problems that could arise. A dedicated project champion, such as Helen Cox, assigned to initiate action and keep the process fluid. This role would ensure proper communication and expectations exist between the organizations.

2. Attempt to obtain state, government, private grants

Before any sustainability technology is purchased, all grant opportunities should be exhausted. The forms on the following websites should be completed:

- http://www.conservation.ca.gov/index/Pages/qh_grants.aspx – grants from the California Department of Conservation
- http://www.calrecycle.ca.gov/Organics/Food/Funding/default.htm – available federal, state or regional loans, grants, or contracts

- https://energycenter.org/index.php/incentive-programs/self-generation-incentive-program/faqs – 30% federal tax credit and an accelerated depreciation schedule for renewable technologies

Additionally, Federal work study sustainability programs should be pursued which can pay for up to 75% of student labor costs. In order to cover every last possibility of obtaining external funding, CSUN should contact the "green" private donors who can be found on this website: http://www.calrecycle.ca.gov/Organics/Food/Funding/default.htm

3. Insert prospective projects into CSUN's budget for projects

CSUN operates on a very tight budget finalized the year before. If external sources of funding do not materialize, or prove insufficient, the Institute for Sustainability must prepare to use its own budget and coordinate with AS and TUC to supplement shortfalls. Projects are submitted for AS review each fall, therefore, it is assumed the earliest complete funding can be obtained is in September/October. The campus quality fee is a possible source of funding that should be tapped. This takes into consideration long-term sustainability of equipment, maintenance, location, personnel and budget resources.

4. Purchase Vegawatt

Because no detailed waste audit is needed for the Vegawatt, CSUN should purchase this item first. Minimal staff is needed; however, as part of this implementation step, current job descriptions may need modification to include transferring used fryer oil to the Vegawatt and subsequent operation. Initially, a PPM crew member should pick up the used oil from locations outside various dining halls. As the process becomes more refined and budget for an AS student employee opens up, this responsibility can then be assumed by the new employee.

5. Detailed food and green waste audit

Before CSUN purchases the Rocket A900, a detailed food and green waste audit should be performed to more accurately estimate quantities of compostable material. This will help better predict labor costs, i.e. how much time per day an employee or multiple employees spend collecting waste, transporting it to the Rocket, etc. Derek Tabak at Ecco Technologies should be contacted. CSUN could use his company to perform this detailed audit as it boasts many years of experience in the industry and is dedicated to sustainability.

6. Marketing

Students should construct flyers and other promotional activities. AS demonstrated abilities to arrange these projects in past efforts. The plan should consist of pictures of food and other green waste that can be composted and other promotional material as stated in the Marketing section. At this time, a few pilot food separation bins such as the Home Depot bins in **Appendix A** should be purchased and placed outside major dining halls. The pictures and other explanatory material can be taped to the outside of these bins. After a few weeks, progress of food waste separation will be monitored and recorded before more bins and the Rocket A900 are purchased. Buying the equipment to become sustainable is only half the battle. If the program is to continue and flourish, marketing is the enzyme that will drive a cultural change among students, faculty, and the community.

Figure 27 – Compostable vs. Non-Compostable Items
Note: From Appendix G – Rocket Quote

7. Purchase Rocket A900

The lead time for the purchase and installation of the Rocket is 12-14 weeks; therefore early thought should be given to its purchase. This is a pilot machine and is not anticipated that it can handle all of CSUN's food waste immediately; however, until funding permits and the pilot program claims victory, this is the best option for beginning a sustainability project. Because the Rocket needs a bulking agent, CSUN's PPM department will provide wood chips or mulch created from the chipper (See **Appendix A** for pictures of the chipper).

8. Appropriately staff Operations

Staff must be in place for anticipation of operating the Rocket and using the compost around campus. In fall of 2011, CSUN is providing students the option to minor in sustainability. To obtain the necessary staff to operate the Rocket and collect the compost, offering a work study program through the sustainability minor will provide the volunteers needed and alleviate the labor costs associated with operating and maintaining the composting machinery – it will also promote awareness and provide students a hands-on opportunity with the process. Additionally, contact with potential buyers of compost such as therototillerguy.com should be made to facilitate arrangements.

9. Implement other minor options

After successful operations of the Vegawatt and Rocket, complimentary options can be implemented. From an educational (and even cost savings) perspective, compost tea can be produced using the compost from the Rocket. Compost tea can then be used as potent fertilizer for the garden, etc., thus improving CSUN's image by being home to flourishing, all-natural (non-toxic) landscapes. See **Appendix E** for instructions on making compost tea on a small/experimental scale.

10. Monitor progress, costs, etc.

The operation of the Vegawatt and Rocket A900 must be monitored so that any adjustments can be made as required. For example, if PPM finds that the compost can be used for much more landscaping than initially estimated and one Rocket is not enough to handle all CSUN's green waste, the purchase of a second Rocket may be feasible. Additionally, if used with a food pulper, the Rockets capacity can be increased. So investing some money into fixing CSUN's current broken pulper or purchasing a new pulper may be necessary. In addition, it must be verified that CSUN is receiving the 30% tax credit for purchasing sustainability technology. Also, the power and heat output of the Vegawatt should be examined as well. If CSUN is not using it to full capacity, reaching out to the community for additional fryer oil could be beneficial.

As a backup plan, in case the operation of the Rocket and Vegawatt experience difficulties, Derek Tabak at Ecco Technologies (outside consultant) can be contacted at: **(310) 617-1081**. His company has many years of experience in green projects and can help get the program back on track.

11. Expand Sustainability projects

Once success is perceived with the major options, thought should be given to expanding into other sustainability projects. These may include activities such as increasing compost tea production or purchasing small vermiculture bins for education and experimentation. Additionally, if compost tea is a success, thought can be given into expanding machinery on a larger scale (such as larger compost tea equipment as in **Figure 11**, and the tractor mounted sprayer in **Figure 12**) in order to produce more. Once the major sustainability efforts are underway, more attention can be paid to the finer details of sustainability. For example, CSUN

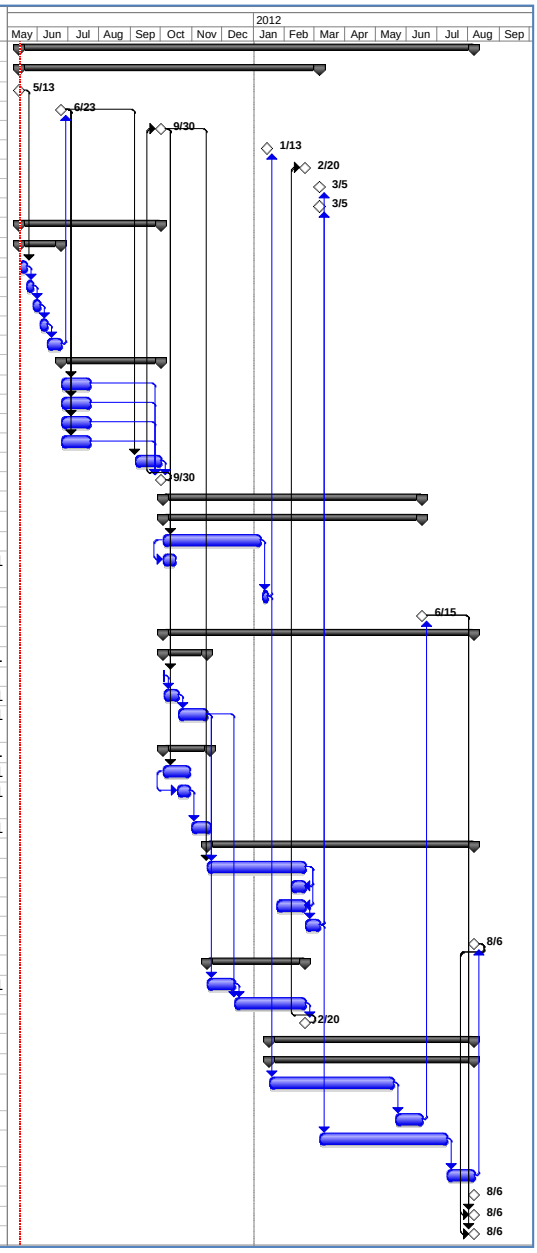
can adopt compostable dining utensils similar to Stanford's program, or start procuring the "bio-bags" that UCSC uses, which are also compostable.

XI. TIMELINE FOR IMPLEMENTATION

The following example timeline has been constructed in Microsoft Project and will be provided to the Institute for Sustainability electronically on the flash drive along with an electronic version of this paper and PowerPoint presentation. The MS Project file can be used and modified as necessary to ensure this sustainability project is kept on schedule and costs are controlled. Each task can be resource-loaded with Persons responsible, and those responsible employees should review the durations of their prospective tasks so that the project has their buy-in. Logic (predecessors and successors) has been added to the schedule so that if certain dates change, others will flow out respectively. Current critical path lies with obtaining senior management buy-in and obtaining funding. See **Figure 28**.

Figure 28 – Green Projects Implementation Timeline

ID	Task Name	% Complete	Duration	Start	Finish
1	**CSUN GREEN WASTE IMPLEMENTATION PLAN**	**0%**	**322 days**	**5/13/11**	**8/6/12**
2	**Key Milestones**	**0%**	**212 days**	**5/13/11**	**3/5/12**
3	Begin Project	0%	0 days	5/13/11	5/13/11
4	Obtain Signed MOU	0%	0 days	6/23/11	6/23/11
5	Obtain Funding	0%	0 days	9/30/11	9/30/11
6	Vegawatt Operational	0%	0 days	1/13/12	1/13/12
7	Staffing for Rocket A900 Complete	0%	0 days	2/20/12	2/20/12
8	Rocket A900 Operational	0%	0 days	3/5/12	3/5/12
9	Green Waste Implementation Complete	0%	0 days	3/5/12	3/5/12
10	**Management Activity**	**0%**	**101 days**	**5/13/11**	**9/30/11**
11	**Management Buy-In**	**0%**	**30 days**	**5/13/11**	**6/23/11**
12	Draft the Memorandum of Agreement	0%	5 days	5/13/11	5/19/11
13	Institution for Sustainability Sign-off	0%	5 days	5/20/11	5/26/11
14	PPM Sign-off	0%	5 days	5/27/11	6/2/11
15	AS Sign-off	0%	5 days	6/3/11	6/9/11
16	University President Sign-off	0%	10 days	6/10/11	6/23/11
17	**Obtain Grants / Sources of Funding**	**0%**	**71 days**	**6/24/11**	**9/30/11**
18	Federal	0%	20 days	6/24/11	7/21/11
19	State	0%	20 days	6/24/11	7/21/11
20	Other/Private	0%	20 days	6/24/11	7/21/11
21	Work Study Funding/Approval	0%	20 days	6/24/11	7/21/11
22	Insert Green Waste Project into CSUN Budget	0%	20 days	9/5/11	9/30/11
23	All Funding Avenues Explored	0%	0 days	9/30/11	9/30/11
24	**Vegawatt Activity**	**0%**	**185 days**	**10/3/11**	**6/15/12**
25	**Vegawatt Procurement and Installation**	**0%**	**185 days**	**10/3/11**	**6/15/12**
26	Place order (12-14 weeks ARO)	0%	70 days	10/3/11	1/6/12
27	Modify Current Job Descriptions (Food Services, PPM, or AS)	0%	10 days	10/3/11	10/14/11
28	Install Vegawatt	0%	5 days	1/9/12	1/13/12
29	Implement Changes to Vegawatt Staffing, etc.	0%	0 days	6/15/12	6/15/12
30	**Rocket A900 Activity**	**0%**	**221 days**	**10/3/11**	**8/6/12**
31	**Detailed Food & Green Waste Audit**	**0%**	**31 days**	**10/3/11**	**11/14/11**
32	Contact Ecco Technologies	0%	1 day	10/3/11	10/3/11
33	Request for Quote - Detailed Waste Audit	0%	10 days	10/4/11	10/17/11
34	Review Results of Audit and Adjust Plan As Necessary	0%	20 days	10/18/11	11/14/11
35	**Marketing Campaign**	**0%**	**35 days**	**10/3/11**	**11/18/11**
36	AS Constructs Flyers and Other Promotional Material	0%	20 days	10/3/11	10/28/11
37	Purchase Pilot Food Waste Bins and Place them at Strategic Locations	0%	10 days	10/17/11	10/28/11
38	Monitor Food Waste	0%	15 days	10/31/11	11/18/11
39	**Rocket A900 Procurement and Installation**	**0%**	**190 days**	**11/15/11**	**8/6/12**
40	Place order (12-14 weeks ARO)	0%	70 days	11/15/11	2/20/12
41	Determine Final Location For Rocket	0%	10 days	2/7/12	2/20/12
42	Build Tarp, If Necessary	0%	20 days	1/24/12	2/20/12
43	Install Rocket	0%	10 days	2/21/12	3/5/12
44	Implement Changes to Vegawatt Staffing, etc.	0%	0 days	8/6/12	8/6/12
45	**Staffing for Composting Operations**	**0%**	**70 days**	**11/15/11**	**2/20/12**
46	Create Job Outline	0%	20 days	11/15/11	12/12/11
47	Place Requisition for Student work	0%	50 days	12/13/11	2/20/12
48	Hire if Necessary, Otherwise Modify Current Jobs	0%	0 days	2/20/12	2/20/12
49	**Misc. Activity**	**0%**	**146 days**	**1/16/12**	**8/6/12**
50	**Monitoring**	**0%**	**146 days**	**1/16/12**	**8/6/12**
51	Begin Monitoring electricity & heat savings, Oil consumption, etc	0%	90 days	1/16/12	5/18/12
52	Implement Changes to Staffing, etc.	0%	20 days	5/21/12	6/15/12
53	Begin Monitoring Quantities of waste, Compost output, etc.	0%	90 days	3/6/12	7/9/12
54	Implement Changes to Staffing, etc.	0%	20 days	7/10/12	8/6/12
55	**Implement Minor Options**	**0%**	**0 days**	**8/6/12**	**8/6/12**
56	Composte tea	0%	0 days	8/6/12	8/6/12
57	Vermiculture	0%	0 days	8/6/12	8/6/12



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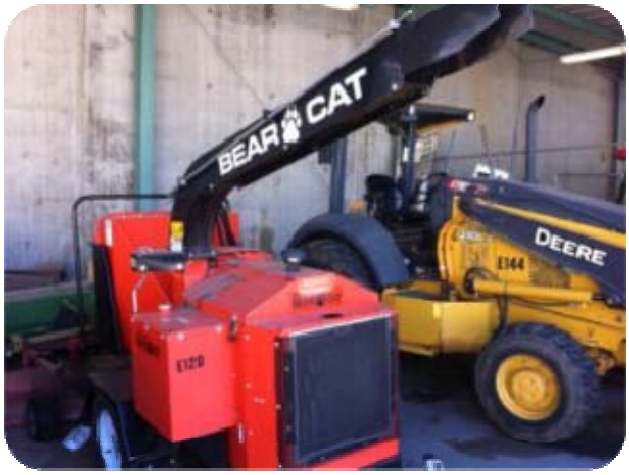
APPENDICES

APPENDIX A: SWOT Analysis

Strengths

- A lot of resources devoted to the sustainability program and reducing the University's carbon footprint (e.g., Dr. Helen Cox, James Logsdon, Randal Thomson, Betsy Corrigan, Cynthia Signett)
- CSUN is currently using alternative methods to reduce waste
    - Utilizes the "grasscycling" method to reduce fertilizer and water requirements
        - According to Jim Logsdon, CSUN produces 0% grass clipping waste excluding short periods due to heavy rains
- A well designed campus to allow for future implementations of waste programs
    - A manageable size
- CSUN's Performing Arts and Student Recreation Center received silver and gold LEED certifications for construction, respectively.
- CSUN owns a wood chipper. Wood chips have multiple uses including the ability to create a supply of wood chips sufficient to mix with food waste to create high-quality compost



- CSUN has invested in a fuel cell which has significantly reduced heating and electricity costs and also demonstrates its devotion to becoming more sustainable:

- CSUN has over 3,800 trees, 225 maintenance acres (356 acres total). In addition, CSUN has planter beds, hedges, vast lawns
- Students have events such as organized picks, trash clean up, etc.
- CSUN owns a fleet of transportation carts, street sweepers, bull dozers, etc.

Weaknesses

- Currently paying $6,090 per year to Consolidated for its green waste removal.
- Currently paying $36,112 per year to Allied Waste to have its food waste removed
- Budget size for the program
- Lack of sustainability program focusing on green and kitchen waste compared to other local universities (e.g., UCI, Santa Monica City College, etc.)
- CSUN currently has a very unimpressive campus garden:

- CSUN currently dumps its chipped waste in an unsightly pile near the softball fields and tennis courts. It takes a long time (2-3 months) for this to turn to mulch.

- Even though CSUN has this chipped waste, it still purchases some shredded bark to obtain a certain look.
- Grounds manager claims there is a lack of space for certain large-scale composting projects
- CSUN is currently giving away its fryer oil. In addition, the company that removes the oil is located relatively far away, thus more CO_2 emissions are generated in this process
- Quote from Cynthia Signett, (Recycling Coordinator, Associated Students): "At this point in time or the near future, this (budget for AS to operate a composting machine) is not factored into our plans and budget. Please check out our feasibility study for more information – we are in process of finding funding sources and then hope to build out from there. It is taking longer than we thought with this economy! After that, we can look at systems to compost – again, with the cooperation of other entities on campus".

Opportunities

- Government grants for sustainability programs
  - UC Davis and UCI received $200,000 grant from the Department of Conservation
- Possible creation of jobs
- Selling compost to stores like 99 Cent stores

- Selling compost on Craigslist to the community would reduce transportation costs
- Local companies such as http://www.rototillerguy.com/ could purchase compost from CSUN. This company has agreed to purchase CSUN compost for $10/cubic yard. Phone contact info: 818-209-4967. Initial contact has been made.
- The Rocket – utilizes food and green waste.
    - Odorless
    - The in-vessel can accommodate nearly any type of organic waste – meat, animal manure, bio solids, and food scrapes
    - Can fit in confined areas
    - Can be used year-round
    - Ability to compost in as little as two weeks
- The VF-2000 series manual bagging system is a heavy-duty belt system designed to handle products such as mulch, bark, peat moss, compost, and soils. From a long-range perspective, this machine could provide CSUN with the capability to bag and store its compost. Cost is approximately $100K including freight, installation, and optional heat sealer. Contact info: Huguette Gagnon gagh@premiertech.com

- The Vegawatt – utilizes used fryer oil and converts it to heat and electricity
    - 30% Tax credit for the purchase of energy technology such as the Vegawatt
- Process fryer oil onsite into biofuel which could be used to power equipment or sold
- Worm Farming (vermiculture)
    - Use the output for fertilizer
    - Worm farms can handle up to 650 lbs. of food waste per day, however, no meats

- Vermitech
    - Large-scale proprietary vermiculture system
- Using a third-party to produce compost for CSUN from its green waste and food waste
    - Crown Composting
        - Tim Fry can be contacted at 818-504-1409 (direct line). Mr. Fry is the general manager of Crown and is the only employee with the authority to take on additional contracts.
- Compost is selling on Craigslist for a price that would support our NPV calculations
- Continued use of "grasscycling"
- Compost Tea
    - Creates healthier plants that drive the roots further into the ground, which ultimately results in less water usage
    - Relatively inexpensive (we provide demo in our presentation)
- Associated Students (AS) recycles
    - Coffee grounds used to fertilize rose beds
        - Originally terminated due lack of management
    - Associated Students could be utilized to pick up food waste, deliver to composting site on campus, and to bag compost
- Pulper
    - Handle food waste
        - Drawbacks – process smells, could not handle straws and chopsticks, requires a lot of maintenance, and requires water
- CSUN can utilize its fryer Oil – selling or using 2347 gallons per year
    - Currently Western Imperial provides containers & picks up oil. There are better ways of dealing with the oil onsite. CSUN can purchase equipment to convert the oil to biofuel. Then use biofuel engines. This would be a multistep process and a longer-term sustainability goal.
- Utilizing food waste for fertilization
- Labor for program implemented
    - Cheap student labor (approximately $9/hr.)
    - Federal work study allows CSUN to only pay 25% of student's cost
- Possible financial incentives (or credit?) for students to come up with cost cutting waste solutions
    - Harvard currently utilizes this program
- Networking with local universities – CSUCI and Pierce Community College – for future cost cutting programs and partnerships
- Ability to draw from multiple areas for funding on projects
- Open Windrow Composting
- Multiple areas that can be closed off can be used for housing an in-vessel compost system. See below gated-off area conveniently located near a CSUN tram stop. All that would need to be provided for the Rocket is a tarp and a more robust platform

- This area adjacent to a wind vane and weather monitoring system as well as CSUN's current mulch pile can be used for a more complex composting system. In addition, the AS Feasibility Study suggests there may be room at the recycling center.

- CSUN has many areas that need fertilizer such as this one:

- CSUN has over 2000 trash cans
- Composting collection bins reduce smells (carbon filters in them) and could provide a means for separating compostable food waste from non-compostable food and other waste. CSUN would need approximately 385 of the bins listed below to handle the 925 gallons capacity that the rocket A900 is capable of producing. Because composting at CSUN is a discovery process, it is not recommended CSUN purchase this quantity to start. Possible purchase of 100 to start would cost approximately $2,000 (www.homedepot.com)

Exaco Trading Co. ECO Kitchen Compost Collector

Model # ECO 2000 Internet # 100672911

★★★★★ 4.6/5 Reviews (8) Write a Review

$19.98 /EA-Each

Free Shipping

- Visual Waste Audit Report from page 20 of the AS recycling feasibility shows that up to 50% of materials in CSUN's trash cans is compostable

	Cardboard	Compostables	Mixed Paper	Newspaper	Beverage Containers	Milk Cartons	Film Plastic	Poly Plates	Cups	Yard Waste	Textiles	Trash
University Club	25%	50%	10%		2%							13%
Satellite Student Union	2%	30%	2%		1%	10%	50%					5%
Dorms Bldg 12		1%			40%		5%	10%	15%	10%		19%
Dorms Bldg 12	1%	5%	3%		2%		15%		5%		8%	61%
Dorms Bldg 12	1%	2%	30%	1%	2%		40%			10%		14%
Oviatt Library			40%		30%		15%					15%

- The following was taken from the AS Feasibility Study ~ Allied Waste: services 29 of the University Corporation, University Student Union trash containers located throughout campus. Locations of the trash containers on campus include:
    - 4 – three yard bins at the University Student Union serviced six days a week
    - 3 – three yard bins at the Satellite Student Union serviced six days a week
    - 11 – three yard bins at various food service locations as part of the University Corporation
    - 3 - four yard bins at the Sierra Center serviced five days a week
    - 4 - four yard bins and 1 - three yard bin at the Matador Bookstore Building serviced five days a week
    - 1 - 4 yard bin and 1 - three yard bin at the Arbor Court serviced five days a week
    - 1 - three yard bin at the University Club serviced five days a week

Threats

- Bad publicity for a lack of sustainability program
- Process not implemented properly
    - Budget exceeded
    - Lack of management
- Local and government regulations on conservation and waste requirements
- Legislative changes regarding sustainability
- Some forms of composting yield an undesirable smell
- California State University budgets are being cut

- Local stores may not be willing to sell CSUN compost. For example, an Osh store manager as well as Osh Corporate spokesperson both said they would refuse to accept compost if CSUN were to sell it.

- Outdated equipment, services, ideas after implementation due to rapidly changing technology
- Maintaining internal capabilities after losing key student staff due to graduation
- Customization of the sustainability program to take into account seasonality and weather effects

APPENDIX B: PORTER'S FIVE FORCES Analysis

Threat of New Entrants – LOW

- High levels of capital is required for public or private universities
- Defined brand and established business model, certain accreditation requirements, and unique programs with skilled and specialized faculty

Bargaining Power of Suppliers – HIGH

- Suppliers include private investors, government endowments, and labor
- Universities cannot substitute inputs easily
    - Professors and specialized labor force are unique

Bargaining Power of Buyers – MODERATE

- Countless number of private and public universities worldwide that people can choose
- Minimal switching costs from applying at several university ~ only application costs incurred
- Many new college students are price sensitive which plays a role
    - Large number of applicants offset this factor

Threat of Substitutes – LOW

- Trade schools and non-accredited universities
- Internet-based learning (e.g., University of Phoenix)
- People not attending

APPENDIX C: PEST Analysis

Political

- Legal issues related to making and selling compost or biofuel
    - Public Contract Code (PCC) section 12203 – state agencies, including California State Universities, must ensure that at least 50 percent spent on compost and mulch product must be spent on the minimum content requirements set forth by PCC section 12209.
    - In California, commercial composters are required to meet certain regulatory requirements related to public health and safety.
        - Compost should have pleasant aroma
        - Carbon to nitrogen ratio needs to be less than 20
        - Acceptable pH value of finished compost must be between 5.5 and 8.0 pH
    - Title 14, Chapter 3.1, Article 2
        - "All compostable materials handling activities must obtain a Compostable Materials Handling Facility Permit"
        - Within-vessels (e.g., the Rocket) with less than 50 cubic yard capacity are excluded.
        - 500 cubic yards or less of compostable material on-site at one time is excluded from obtaining a permit.
- Laws and regulations related to green and food waste in California
    - Integrated Waste Management Act – required 25% diversion of the state's waste from landfills by 1995, and 50% diversion by 2000.
    - Municipalities that use green waste for Alternative Daily Covering at landfills are credited toward the mandated 50% diversion
        - Same green waste is used for the production of advancement in biofuels and green power, only counted as disposal.
    - New bill recently introduced:
        - Phase out recycling credit at landfills over next 7 yrs.
        - Charge state fee for green waste disposal as landfill cover
        - Use the money to promote composting and environment-friendly energy production
- City restrictions due to unsightly machinery or smells coming from food and green waste handling methods
    - Commercial composters must have a pleasant aroma and consistent throughout.
- Government programs promoting sustainability departments and energy conservation
    - UC Davis and UCI received $200,000 grants from the Department of Conservation to facilitate a growing focus on sustainability.

Economical

- CSUN's budget cuts and California's budget deficit
    - Governor Jerry Brown's new state budget proposal cuts $500 million from California State Universities
    - An expected $12.5 billion in cuts are expected for government spending and programs

        - This may affect the Department of Conservation and any grants it provides universities for sustainability programs.
- New Federal budget passed in April 2011 cuts nearly $500 million for higher education.

Socio-cultural

- Overarching trend for campuses to become more sustainable. In fact, many campuses and campus-like facilities have a long-term goal of 0% waste, or 100% sustainable.
    - Many universities have recognized the need for a focus on a sustainable future.
    - As of 2010, more than 1,000 university chancellors and presidents, among others, through pledges, have dedicated their institutions toward a sustainable futures
- Campuses may be willing to work together to achieve sustainability goals
- Growing number of youth activists groups concerned about environmental impact.
    - 2007: A green business school network with over 130 chapters and 570 schools committing to participating in the Campus Climate Challenge.

Technological

- Much advancement in composting and sustainability has occurred.
    - Examples: the Rocket, Vegawatt, vermiculture, etc.
    - Continuously looking for new improved technology
        - Green Waste Technologies are researching the use of black soldier fly larvae to compost food waste

APPENDIX D: CSUN's Green & Food Waste Quantity and Cost

	2010 Green Waste Tonnage	Cost	Food Waste Yards*	Cost
Jan	11.34	$712.56	1093.33	$2,141.00
Feb	8.54	$505.11	1093.33	$3,873.00
Mar	8.97	$518.30	1093.33	$3,867.00
Apr	13.35	$774.23	261.33	$3,886.00
May	3.87	$240.28	261.33	$2,816.00
Jun	11.23	$830.74	261.33	$1,225.00
Jul	6.89	$366.70	1093.33	$1,226.99
Aug	5.55	$326.50	1093.33	$1,342.00
Sep	9.66	$449.80	1093.33	$3,919.00
Oct	9.73	$451.90	74.67	$3,926.00
Nov	4.76	$222.80	74.67	$3,945.00
Dec	15.04	$691.20	74.67	$2,094.00
Total	**108.93**	**$6,090.12**	**7568.00**	**$34,260.99**

- Monthly green waste figures provided by Jim Lodgsdon (PPM); Quarterly food waste yards provided by Betsy Corrigan (Food Services) and level-loaded for monthly analysis
- Some conversions used in the financial section were calculated using **Appendix F**

APPENDIX E: How to Make Compost Tea

1. Purchase supplies (about $25):
    - 1 – 5 gallon bucket
    - 1 gallon compost
    - 1 aquarium pump
    - 1 – 3 way aquarium gang valve
    - 4 gallons of water
    - 4 feet of aquarium hose
    - Unsulfured molasses

2. Cut off 3 sections of aquarium hose long enough to span from the gang valve hanging on the side of the bucket all the way to the bottom of the bucket (about 1 ft. sections)

3. Cut one more section of hose that will span from the aquarium pump to the gang valve

4. Add compost, covering the 3 tube ends

5. Add water. Note that if you are using tap water, the chlorine may kill beneficial bacteria so run the pump and let the chlorine evaporate for an hour before adding water to compost

6. Add 1 ounce of the unsulfured molasses. This provides food to the microorganisms

7. Turn on the aquarium pump and leave the mixture for 2 or 3 days, stirring occasionally

8. Your compost tea is done. Apply to garden or grass areas using a trombone sprayer or equivalent

APPENDIX F: Waste Conversions

Category	Material (u=uncompacted, c=compacted & baled)	Volume	Estimated Weight (in pounds/lbs.)
High-grade paper	**Computer Paper**		
	Uncompacted, stacked	1 cubic yard	655
	Compacted, baled	1 cubic yard	1,310
	1 case	2,800 sheets	42
	White Ledger		
	(u) stacked/(c) stacked	1 cubic yard	375-465/755-925
	(u) crumpled/(c) crumpled	1 cubic yard	110-205/325
	20# bond ream; 8 1/2X 11	1 ream=500 sheets	5
	20# bond ream; 8 1/2X 14	1 ream=500 sheets	6.4
	White ledger pads	1 case=72 pads	38
	Tab Cards		
	Uncompacted	1 cubic yard	605
	Compacted/baled	1 cubic yard	1,215-1,350
Low-grade paper	**Cardboard (Corrugated)**		
	Uncompacted	1 cubic yard	50-150
	Compacted	1 cubic yard	300-500
	Baled	1 cubic yard	700-1,100
	Newspaper		
	Uncompacted	1 cubic yard	360-505
	Compacted/baled	1 cubic yard	720-1,000
	Compacted	3.33 cubic yards=1 ton	2,000
	12 inch stack	--	35
Other Paper	**Miscellaneous Paper**		
	Yellow legal pads	1 case=72 pads	38
	Colored message pads	1 carton=144 pads	22
	Self-carbon forms: 8 1/2X11	1 ream=500 sheets	50
	Mixed Ledger/Office Paper		
	Flat (u/c)	1 cubic yard	380/755
	Crumpled (u/c)	1 cubic yard	110/755
Glass	**Refillable Whole Bottles**		
	Refillable beer bottles	1 case=24 bottles	14
	Refillable soft drink bottles	1 case=24 bottles	22

	Bottles:		
	Whole	1 cubic yard	500-700
	Semi-crushed	1 cubic yard	1,000-1,800
	Crushed (mechanically)	1 cubic yard	1,800-2,700
	Uncrushed to manually broken	55 gallon drum	300
	Whole	1 grocery bag	16
Plastic	**PET (soda bottles)**		
	Whole bottles (u)	1 cubic yard	30-40
	Whole bottles (u)	66.67 cubic yards=1 ton	2,000
	Whole bottles (c)	1 cubic yard	515
	Whole bottles, (c)	gaylord box	40-53
	Baled	30" X 62"	500-550
	Granulated	gaylord box	700-750
	8 bottles (2-liter size)	--	1
	HDPE (dairy/milk jug)		
	Whole (u)	1 cubic yard	24
	Whole (u)	80.0 cubic yards=1 ton	2,000
	Whole (c)	1 cubic yard	270
	Baled	1 cubic yard	400-500
	HDPE (mixed)		
	Baled	32" X 60"	900
	Granulated	semi-load	42,000
	Odd Plastics		
	Uncompacted	1 cubic yard	50
	Compacted/baled	1 cubic yard	400-700
	Mixed PET and HDPE (dairy)		
	Whole, uncompacted	1 cubic yard	32
Metals	**Aluminum (cans)**		
	Whole	1 cubic yard	50-75
	Whole	27.03 yards=1 ton	2,000
	Compacted (manually)	1 cubic yard	250-430
		8 cubic yards=1 ton	2,000
	Uncompacted	1 full grocery bag	1.5
		1 case=24 cans	0.9

	Leaves, vacuumed	1 cubic yard	350
	Grass clippings (uncompacted)	1 cubic yard	350-450
		4.95 cubic yards=1 ton	2,000
	Grass clippings (compacted)	1 cubic yard	550-1,500
	Finished compost	1 cubic yard	600
	Scrap Wood		
	Pallets	-	30-100 (40 average)
	Wood chips	1 cubic yard	500
	Food Waste		
	Solid/Liquid fats	55-gallon drum	400-410
		4.85 drums=1 ton	2,000
Other Materials	**Tires**		
	Car	1 tire	12-20
	Truck	1 tire	60-100
	Oil (used motor oil)	1 gallon	7
		285.71 gallons=1 ton	2,000

Sources: 1) South Carolina Department of Health and Environmental Control, Office of Solid Waste Reduction and Recycling for sharing this information from the 1998 edition, Start A Recycling Program: A Guide to Developing A Recycling Program For Your Business Or Organization. Portions of this table were originally taken from the US Environmental Protection Agency's "Business Guide for Reducing Solid Waste." EPA/530-K-92-004, November 1993. 2) Arizona Department of Environmental Quality, Arizona Small Business Reduce, Reuse and Recycle Guide, 1992. Original information obtained from the New Jersey Department of Environmental Protection Office of Recycling-1989.

APPENDIX G: Quote for Rocket A700 and A900

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March 31 2011

Elliott Richards
Cal State University Northridge
18111 Nordhoff St,
Northridge, CA 91330

Ref: Q-0015-11

Dear Elliott,

We have structured a preliminary proposal whereby Cal State University Northridge (CSUN), will be able to see first-hand how our proven technology can help your university become sustainable when treating food waste. We want to help contribute to your ability to stop paying expensive food waste removal costs, reduce hundreds of tons of food waste that we send every year to the landfills as well as to reduce CO_2 emissions. In addition, the Rocket composter is an ideal educational tool for CSUN.

As you required, we are quoting an A900 and an A700 Rocket composter. We recommend performing a food waste audit in volume. The capacity of the Rocket® is calculated in gallons. When converting metric tons to gallons there could be significant margin of error, and therefore a food waste audit to obtain a volume measurement is ideal.

The A900 Rocket® composter has a capacity to treat 460 gallons of food waste per week (925 of mixed waste, food waste plus wood chips during a 7 day feeding schedule). The Rocket® composter runs at 85% capacity in order to allow for peaks in your operation. Our technology requires a bulking agent, in this case wood chips, which accounts for 50% of the total capacity of any Rocket®. The adequate mix is 50% of food waste and 50% of wood chips.

The A700 Rocket® composter has a capacity to treat 180 gallons of food waste per week (370 of mixed waste, food waste plus wood chips during a 7 day feeding schedule). The Rocket® composter runs at 85% capacity in order to allow for peaks in your operation. Our technology requires a bulking agent, in this case wood chips, which accounts for 50% of the total capacity of any Rocket®. The adequate mix is 50% of food waste and 50% of wood chips.

All Rocket® composters of different scale are manufactured in the same design. All models have an angled cylinder with a steel shaft inside. The shaft has angled blades attached and is turned by a gearbox. The machine is insulated and encased in a stainless steel protective cover. The Rocket® composter has an electrical control unit which is visible at the inlet end of the machine. The majority of the machine is manufactured from the highest-grade stainless steel for durability and to meet our quality manufacturing standards. There are no moving parts outside the machine. Very little noise can be heard when the machine is running for approximately one minute every hour. The Rocket® composter is designed to be located inside or outside. When locating the Rocket® composter outside we require being undercover, a simple roof will work.

The latest Rocket® composter technology uses a low power motor to reduce the power consumption and running costs. All machines require a small amount of electricity to introduce additional heat into the Rocket® composter at the start of the process, via a thermostatically controlled low power heating system. This assists meeting ABPR and similar regulations in the UK. The running cost varies

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depending on the ambient temperature and the type of waste material being processed. All Rocket® composters are powered from a one phase 240 Volts socket or from a one phase 120 Volts socket when using a power converter and require a covered location when situated outside.

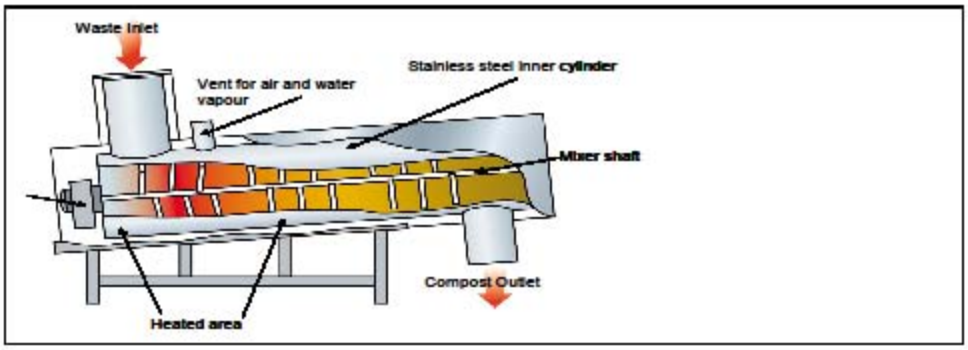
The Rocket® composter is designed to compost all food waste including meat and fish, but in order to do that you need to provide the machine with the right feedstock. The simplest way to do this is using a mix of equal volumes of food waste and wood chips (50%/50%). We recommend using wood chips for the following reasons:

1.- Provides much needed carbon to the composting mass, as food waste is often very high in Nitrogen.

2.- Gives the composting mass good structure inside the Rocket® composter which helps the shaft aerate the mix correctly.

3.- Generally free, as wood chips are considered a waste product. If it is not something that you produce on site we can assist you with finding a tree surgeon or landscape gardener in your area who can provide the wood chips.

Food Waste and wood chips (material) are fed into the machine via the inlet hopper on the top of the machine. Once the material enters the Rocket® composter the whole process is fully automated with the shaft programmed to turn at regular intervals to aerate the mass and move it through the vessel.



As the material works its way through the vessel it passes through various stages of the composting process where temperatures of 140 F plus are reached, making sure that all pathogens that may be present due to the inclusion of meat and fish are destroyed. The majority of heat generated is achieved due to the activity of the microbes in the Rocket® composter; however there is also an external, thermostatically controlled heat blanket that ensures the appropriate temperatures are maintained throughout the composting process. The whole process is continuous. As food waste is fed into the Rocket® composter it forces material further through the machine and the compost is disposed through the outlet on the bottom of the Rocket® composter.

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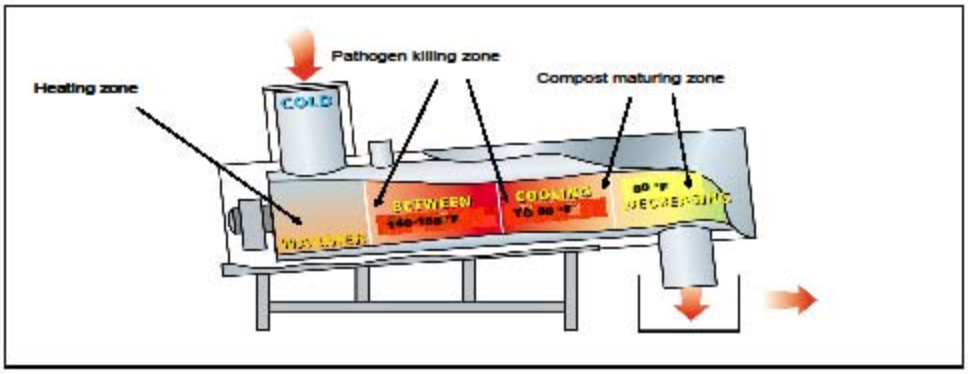

Main attributes of the Rocket® composter:

- Dramatically reduces food waste disposal costs. (Refer to exhibit A)
- Reduces transportation costs and carbon dioxide emissions (CO_2).
- Immediate treatment eradicates vermin problems and pest control costs.
- Eliminates trash-related odors.
- Eliminates the need for garbage bags and other non biodegradable products use to dispose food waste. (Refer to exhibit A)
- Avoids greenhouse gas emissions coming from rotten food in landfills (Methane).
- Removes trash bins from the streets and sidewalks maintaining them clean.
- Contributes to the decrease of number of waste collection vehicles on streets and highways which emit CO_2.
- Allows compost to go back to its origins thus closing the loop of recycling.

Please find the basic terms for the Rocket®.

A900 Rocket® Composter (FOB port of Los Angeles) (1)		$45,900
A900 Shipping (From port of Los Angeles to Northridge CA) (2)		$1,200
A900 Rocket Installation costs and training (3)		$1,300
Total		$48,400

(1) Temperature datalogger included. Prices do not include applicable taxes and Power Converter (120 volts – 220 volts).
(2) Shipping costs include delivery to a loading dock. There will be an additional charge for any additional maneuvering and for not delivering to a loading dock. The client is responsible for transporting the unit to the final destination where installation will take place.
(3) Installation & training has to take place on the same day, otherwise additional costs will be charge. It is require providing a 220 volts 50 Hertz outlet to connect the system (wiring is not included).

A700 Rocket® Composter (FOB port of Los Angeles) (1)		$30,900
A700 Shipping (From port of Los Angeles to Northridge CA) (2)		$850
A700 Rocket Installation costs and training (3)		$1,300
Total		$33,050

(1) Temperature datalogger included. Prices do not include applicable taxes and Power Converter (120 volts – 220 volts).
(2) Shipping costs include delivery to a loading dock. There will be an additional charge for any additional maneuvering and for not delivering to a loading dock. The client is responsible for transporting the unit to the final destination where installation will take place.
(3) Installation & training has to take place on the same day, otherwise additional costs will be charge. It is require providing a 220 volts 50 Hertz outlet to connect the system (wiring is not included).

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You can eliminate your food waste removal costs for life, reduce your CO_2 foot print, avoid contributing to the increased production of methane and leachate in landfill and save energy as the food waste does not have to travel many miles to landfill. We can truly close the loop of recycling using compost made from your food waste in garden beds and for landscaping on the same property where waste is generated!

Education is a core element to our company; we firmly believe that to take care of our environment, we need to contribute educating young people. Our solution, the Rocket® composter has been use at educational institutions as a tool to teach the students sustainability among other subjects. Education is an important part where we all should work together for the development of our future sustainability leaders. We believe that this is the ideal way to change our actual behavior towards the environment.

Payment Terms		50% down payment upon receipt of purchase order. Balance payable upon notification of shipment from the manufacturing facility.
Validity		The quote is valid for 30 days from the issue date.
Delivery		Delivery time of 12-14 weeks from receipt of purchase order and sign agreement with Advance Acceptance or from deposit of 50% down payment
Exclusions		Non standard work during installation of Rocket®

We are offering you the ideal solution to stop paying expensive food waste removal costs. You can invest in the Rocket composter which will save you money but the most important aspect is the educational component. Cal State University Northridge, an institution committed to education will be affording its students, faculty and staff the opportunity to learn about composting, resource management, energy savings, landfill diversion, carbon reduction, greenhouse gases, among other subjects, an essential part of a sustainability program.

Please contact me with any questions. We look forward to working with Cal State University Northridge on this important project.

Sincerely,

Gerardo Soto

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Appendix A

The food & oil waste challenge – The last piece of the recycling puzzle



In the United States each year we generate 31.7 million tons of food waste which represents 12.5% of the total waste stream. Only 2.6% of that food waste does not end up in landfills. The larger environmental damage happens after the consumption stage, where millions of tons of food waste are sent to landfills. Rotten food accounts for 34% of all methane emissions which is 20 times more damaging to the environment than CO_2. Using cutting edge sustainable solutions we divert many tons of food waste from going to landfills, therefore avoiding methane emissions and leachate contamination into the US water stream. Compost and other clean by-products go back to their origins, thus closing the recycling loop. Treating food & oil waste on site contributes to decreasing the number of collection vehicles on US streets and highways, which in turn, reduces significant energy consumption and CO_2.

We generate about 2.9 billion gallons of oil waste every year in the United States of which the majority is disposed at a landfill or treated at a bio fuel or rendering site. It is important to keep in mind that this figure goes back to 2000. If we were to use that oil waste to replace the energetically equivalent amount of petroleum, almost 1% of US oil consumption could be offset. We can take advantage of the oil waste to create energy and heat onsite generating thousands of megawatts and BTU's every year.

There is little to no awareness of the damage caused when sending food waste to landfills. We are missing a big opportunity to recover nutrients from food waste that would be otherwise lost when sent to landfills and to generate electricity and heat from oil waste that otherwise would be lost at a biodiesel or rendering site. Among all recycling process (cardboard, plastic, glass, etc) onsite composting is the only natural way of recycling which does not generate CO_2, it does not require significant power to transform a new product and does not emit potential harmful by-products.

Bio-diesel production utilizes Methanol (a petroleum product) and Lye (Sodium Hydroxide, a hazardous caustic agent) to convert vegetable oil into a fuel similar to diesel fuel. Up to 25% of a bio-diesel batch is converted to glycerine. While glycerine is a common food sweetener, the glycerine produced from the biodiesel process is contaminated with methanol and lye, and must be disposed of as a hazardous waste, usually by burning. It is not financially feasible to remove the methanol and lye components from the glycerine to satisfactory levels, where the glycerine would be considered a food-grade product.

If you are able to recycle food and oil waste onsite you can become ZERO WASTE – it is the missing link!

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Appendix B

Economics of the Rocket® composter

Every food operation is different having many different variables involved, therefore it is difficult to calculate hard numbers for all the savings that the Rocket® composter could potentially achieve. The following are some of the savings that a typical food operation shall be able to achieve under normal circumstances:

- Reduces food waste disposal costs significantly
- Reduces compost costs for green areas
- Reduces pest control costs
- Additional Savings
  - Cleaning garbage dumpsters
  - Reduction of garbage bags
  - Reduction of other cleaning products
- Value creation from being Green. It is challenging to quantify but definitely creates value among stockholders, stakeholders and employees.

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Appendix C

Rocket© A900

Size:	13.1 ft long, 3.3 ft width, 5.3 ft high
Capacity:	925 gal of mixed waste per week 460 gal of food waste per week 1,385 gal of food waste per week when used with waste pulper (macerator and dewaterer)
Power Costs:	Approximately 30kWh per week
Power Req:	Single phase 240 Volt or 120 v when use with power converter.
Weight (Empty):	1,100 Pounds
Outside Site	Needs a covered location

Rocket© A700

Size:	9.9 ft long, 3 ft width, 4.6 ft high
Capacity:	370 gal of mixed waste per week 180 gal of food waste per week 555 gal of food waste per week when used with waste pulper (macerator and dewaterer)
Power Costs:	Approximately 26kWh per week
Power Req:	Single phase 240 Volt or 120 v when use with power converter
Weight (Empty):	660 Pounds
Site Outside	Needs a covered location

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APPENDIX H: Quote for Vegawatt

vegawatt
ON-SITE WASTE
VEGETABLE OIL GENERATORS

April 4, 2011 [via email]

Elliott Richards
California State University Northridge
18111 Nordhoff Street
Northridge, CA 91330

Elliott,

As you discussed with Gerardo Soto, I have attached a worksheet that exhibits the projected performance and payback for a Vegawatt 4 kW system at your Northridge campus. This sheet will allow you to see what the monthly and annual financial savings would be with varying amounts of waste vegetable oil (WVO) available per week at your location relative to *average* California utility rates. I have provided a projection based upon your annualized availability of 44 gallons per week of WVO.

Here is a brief synopsis of the Vegawatt 4 kW system:

The Vegawatt co-generation system supplements a foodservice facility's electric and gas utilities, reducing your energy costs by producing electricity and hot water as it operates using your waste vegetable oil as its fuel. The gas savings come from hot water produced (through the use of an included heat exchanger) by the Vegawatt. You can see on the worksheet that with 34 gallons per week (gpw) of WVO the Vegawatt will run for about 103 hours each week, and for as much as 152 hours with a supply of 50 gpw.

Your summary is as follows:

Using a recent California average cost of $0.18 per kWh for electricity, a Demand charge of $6.78 per kW, a cost of $0.87 per therm of natural gas, and an annualized available supply of 44 gpw of WVO we project that the *annual savings* at *this year's* average energy prices would be about $6,200 and provide you with a value of about $2.79 per gallon of WVO. This projection shows a payback[1] of about 4.1 years, (an actual cash savings of $525.00 each month) *before* any additional state, local or utility based incentives, rebates or credits, far surpassing wind or solar systems that could provide this quantity of power 24 hours per day. *Should you supplement your WVO availability from another source by as little as 11 gpw you would reduce your payback to only 3.3 years.*

In addition, users of Vegawatt cogeneration systems can achieve a number of other environmental and financial benefits:

- Increase the Green branding opportunities for your business
- Elimination of waste oil hauling costs and hassles
- Elimination of odors, pests and mess associated with WVO storage
- Reduction of the carbon footprint associated with your operation
- Environmentally better than biodiesel
- Eligibility for LEED points
- Earn 20 Green Restaurant Association points

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Should you have any questions please feel free to give me a call and I can walk you through the worksheet at your convenience.

Sincerely,

Benton Prentice
Vice President of Sales and Marketing

[1]A 4 kW Vegawatt system's current unit price is $25,800. *There may be additional state, local or utility company incentives that can further reduce your payback.*

Your estimated payback will shorten as energy prices rise. As your volume of WVO increases, your Vegawatt system will also operate more hours per week, increasing its clean energy output and your ultimate benefit and shortening your payback. The above price does not include shipping or installation. Estimated shipping to California is about $3,000.

4 KW Vegawatt System - Detailed Savings Analysis

Customer: Cal State University-Northridge	April 4, 2011
Location: Northridge, CA	
Contact: Elliott Richards	
Phone:	
E-mail:	

Customer Specific Data		
Electric energy cost (from your electric bill)	$ 0.180	per kWh
Demand charge (from your electric bill)	$ 6.78	per kW
Water heating fuel	Natural Gas	
Natural gas cost (from your gas bill)	$ 0.87	per therm

List Price	$	25,800
Incentives:		
Federal †	$	-
State	$	-
County	$	-
City	$	-
Electrical Utility		
Gas Utility	$	-
Your System Cost	$	25,800

Financial Benefits	Weekly Waste Vegetable Oil Gallons							
	34		42		50		44	
Monthly								
Weekly run time (hours)	103	61%	127	76%	152	90%	133	79%
Electricity Generated (kWh)	1786	$ 321	2206	$ 397	2626	$ 473	2311	$ 416
Demand Reduction (kW)	4.0	$ 27	4.0	$ 27	4.0	$ 27	4.0	$ 27
Hot Water Produced (therms)	73	$ 63	90	$ 78	107	$ 93	94	$ 82
TOTAL MONTHLY SAVINGS		$ 412		$ 502		$ 593		$ 525
PROJECTED ANNUAL SAVINGS		$ 4,940		$ 6,026		$ 7,112		$ 6,298

Notes:

The approximate value of your oil with a Vegawatt system is $ 2.79 per gallon.
This system can provide you a payback on system cost in 4.1 years,
and is based upon your cooking oil disposal of 44 gallons per week.

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APPENDIX I: Waste Vegetable Oil (WVO) by Location by Month

FRYER OIL BY LOCATION (GALLONS)

	THE PUB	THE SIERRA CENTER	RESIDENT DINING FACILITY	THE CLUB	THE ARBOR	BURGER KING	TOTAL	
Dec-08	56	80	23	0	30	0	189	
Jan-09	9	30	0	10	90	80	219	
Feb-09	109	0	0	0	50	0	159	
Mar-09	0	0	0	0	0	0	0	
Apr-09	16	75	24	15	9	75	214	
May-09	0	0	0	0	0	0	0	
Jun-09	59	58	29	0	56	149	351	
Jul-09	0	0	0	0	0	0	0	
Aug-09	0	0	0	0	0	0	0	
Sep-09	75	100	75	0	75	200	525	
Oct-09	0	0	0	0	0	0	0	
Nov-09	154	66	174	0	148	148	690	Avg/Mo
	478	**409**	**325**	**25**	**458**	**652**	**2347**	**196**

Note: From B. Corrigan, Manager of Food Services