

# The Sustainable University

EN 103 Fall Semester 2007  
Clark University, Worcester, MA U.S.A.  
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## Introduction

This final report is a collaborative effort detailing the work of 21 undergraduate students at Clark University enrolled in EN 103: The Sustainable University in the fall of 2007. This course explored both the theory and practice of sustainability and sustainable development by examining the role of the university in promoting a transition toward sustainability. In addition to reading and writing about the challenges of sustainability and the role of the university in promoting sustainable practices in society, the students in this course have engaged directly with the challenges associated with promoting sustainable behavior and fostering institutional and social change through team projects right here on the Clark campus. This final report is a culmination and summary of the seven team projects that students developed this semester.

Of these seven team projects (three students in each team), two teams chose to focus on recycling: one team focused on recycling infrastructure improvements and the other on recycling education and the wastestream. Another team concentrated on promoting sustainable transportation at Clark, and another provided recommendations on developing a plan for Clark to move toward climate neutrality. Two teams investigated renewable energy: one, the installation of solar panels and the other, the expansion of Clark's Renewable Energy Credit (REC) program. The seventh team chronicled the efforts of efforts of this class to be a paperless course and analyzed the potential for paper-use reduction strategies at Clark. Throughout the semester, all reading and written requirements for the course were assigned, conducted, and evaluated electronically – no printing of hardcopies was necessary.

Throughout the semester, Sustainable University students benefited greatly from an expanded teaching staff; in addition to my role as faculty instructor for the course, Carlos Marin, a Clark Ph.D. student, served as a valuable teaching assistant (TA), and Amber Huffstickler, a Clark undergraduate who took the course in the Fall 2006, served as a resourceful Peer Learning Assistant (PLA). In addition Dave Schmidt, Clark's Sustainability Coordinator, was integrally involved in the class and team projects. Students also benefited from several visitors to the class including: Jim Collins, Clark's Chief Financial Officer; Tom Wall, Associate Director of Physical Plant; Joe Sarkis, Professor of Management; and Paul Bottis, Director of Physical Plant. Additionally, input from and connections with members of the Sustainability Task Force, Physical Plant Staff, and the Clark administration (particularly Provost David Angel) were critical to the success of the students' projects. We extend appreciation to all these people who have contributed to the success of this course and the students' efforts throughout the semester.

Throughout the semester, students in this class have read quite extensively the work of David Orr and others who have expanded on the notion the impact of learning at institutes of higher education does not only occur in classrooms but throughout the campus community and space. Students have been exposed to and engaged with ideas that the university's policies and community priorities, as well as buildings and campus operations, all play a role in the education of students, and have a broader impact on society. We have explored how institutions of higher education have unique potential to catalyze and/or accelerate the transition to sustainability. The focus on the university provides a lens for students to examine how the myriad of decisions with environmental

consequences are made at institutions with complex structures. This situated students in a context for considering the broad role of education in sustainable development within a framework with personal, direct connections to the challenges of promoting sustainability. We took several local field-trips around the Clark campus as a complement to the theoretical foundations of sustainability we explored in class. These included visits to Clark's recycling center on Hawthorne Street, the Clark co-generation power plant located in Jonas Clark Hall, several of the local urban gardens within walking distance of the Clark campus, the Artichoke Food Co-op on Main Street, and the newly certified Gold LEED certified Lasry Biology building on campus.

In addition to the progress that students made this semester in their teamwork, a series of valuable class discussions has resulted in recommendations of future student projects. One of these recommendations is a future initiative or team project focused on drawing attention to and the promotion of more sustainable diets and food options on campus. The environmental impact of our food choices is not regularly considered in many of our daily dietary decisions, and students in this class feel that this is an area with a large potential future impact. Another recommended project involves making the case for expanding sustainability education at Clark to all Clark undergraduates. One proposal discussed by the students is the idea of having a "sustainability perspective" to ensure that all students graduating from Clark leave with some awareness of the increasingly urgent sustainability challenges facing society. Another recommended area for future advancement includes expanding the staffing and budget in support of sustainability initiatives at Clark – although Clark has a sustainability coordinator, many other schools have a sustainability department, or at the very least, an office with more than one person committed to coordinating institutional initiatives in the sustainability realm. Expanding Clark's sustainability initiatives in a way that is consistent with meeting Clark's signing of the American College and University Presidents Climate Commitment is likely to require a larger institutional commitment to this area than is currently in place. Through their team projects, students in this class learned about the challenges and complexities of implementing new initiatives, and gained an appreciation for how the level and type of established institutional commitments play such a critical role in making changes to the status quo.

Working with these students throughout the semester, and with Carlos and Amber as teaching staff, has been a pleasure. I am proud of the progress that these students have made. They have worked hard and accomplished a great deal as they struggled with the challenges of promoting environmental sustainability at the individual, institutional, and societal level. This final report provides details on each team project completed throughout the semester, but several of these initiatives will continue to be developed and implemented by these students and others on campus beyond this semester; for up-to-date information about any of these initiatives please get in touch with me, any of the students, or Dave Schmidt, Clark's Sustainability Coordinator.

Thank you!

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The Sustainable University, Fall 2007

## **Managing Environmental Sustainability in Institutions of Higher Education in the United States: Assessing How Clark University Compares**

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The concept of sustainability encompasses ideas, aspirations, and values that inspire public and private organizations to become better stewards of the environment, to promote positive economic growth, and to insist on social justice (EPA, 2007). However, this paper primarily focuses on the environmental aspects of sustainability, with particular attention given to how its various manifestations are managed at colleges and universities in the United States. These institutions of higher education, including Clark University, have initiated myriad actions aimed at becoming more environmentally sustainable (Parent, 2007; EPA, 2006). At the same time, they are only just beginning to adopt environmental management systems (EMSs) (C2E2, 2006), or systems designed as a framework for understanding an organization's environmental impact, complying with environmental regulations, and implementing proactive pollution prevention strategies (EPA, 2001). Ultimately, this paper recommends Clark University take the steps necessary to develop and implement an EMS, in order to ensure continued success in all current and future environmental sustainability initiatives.

### **Introduction**

Sustainability is defined broadly as development that meets the needs of the present, without compromising the ability of future generations to meet their needs (Brundtland, 1987). Continuing with a broad scope, sustainability is said to be based upon three basic elements: economic issues, sociopolitical issues, and environmental issues (Holdren, 2007). Therefore, one might say that sustainability rests upon a three-legged stool, with each of its three basic elements representing an indispensable supporting leg (Holdren, 2007). This concept of sustainability encompasses ideas, aspirations, and values that inspire public and private organizations to become better stewards of the environment, to promote positive economic growth, and to insist on social justice (EPA, 2007). Additionally, the principles of sustainability can stimulate technological innovation, advance competitiveness, and improve our quality of life (EPA, 2007). While it is important to remember sustainability encapsulates much more than simply environmental issues, this paper is primarily focused on the environmental aspects of sustainability.

Said focus is, by no means, an attempt to establish environmental sustainability as higher in priority than economic or sociopolitical sustainability. It is simply the element of sustainability I am most interested in studying at this time. Of particular interest is the current state of how colleges and universities (henceforth synonymous with institutions of higher education) in the United States manage issues of environmental sustainability

on their campuses. The fact that colleges and universities are analogues of small cities (EPA, 2001) makes studying their collective management of environmental sustainability practical, due to its potential to be useful for a wider audience.

## **Background**

### Environmental Sustainability in Higher Education

#### *Opportunity*

According to the Environmental Protection Agency (EPA) (2006), the greatest opportunities for institutions of higher education to become more environmentally sustainable are reducing air emissions, managing and minimizing waste, conserving water, and improving water quality.

#### *Practicality*

In addition to the existence of opportunities for institutions of higher education to become more environmentally sustainable, there are a number of practical reasons why these institutions have begun and will likely continue taking the actions needed to reduce their environmental impacts. Generally, many of these reasons include potential for monetary savings, potential to enhance institutional reputation, and the chance to do something that is morally right (Parent, 2007). For instance, in pursuit of monetary savings, a college or university might install motion-sensing indoor lighting, the idea being that the lights will automatically be switched off when not in use. This action is particularly prudent if one considers the fact that, while sometimes erratic, energy prices have been steadily increasing since the 1990s, a trend that is only expected to continue in the medium and long term (EIA, 2007). Additionally, in pursuit of higher caliber students and research funds, a college or university might develop a Sustainability Science major into its curriculum. Finally, in pursuit of adherence to environmentally sound morals, a college or university might decide to only purchase, sell, and support products that are recyclable or biodegradable.

#### *Areas of Action*

Many colleges and universities are committed to reducing air emissions resulting from fleet vehicles and energy use on campus. Some campuses have developed energy conservation projects and commuting programs to decrease energy needs, while others have switched their campus fleets to compressed natural gas or biodiesel, a cleaner-burning alternative to diesel made from vegetable oil. These institutions of higher education have recognized the environmental benefits of 'green' buildings and are currently being hailed as a leading sector in this area, due to the fact it they account for approximately 51 of the 342 Leadership in Energy and Environmental Design (LEED)-certified new buildings in the United States. As colleges, universities, and others continue to construct green buildings, and new technologies and practices are proven effective, the overall costs of green construction are expected to decline, which should make green buildings more common in the future. (EPA, 2006)

Colleges and universities are using tools such as target goals and management plans to reduce the generation of hazardous and solid wastes and to increase recycling on

their campuses (EPA, 2006). Solid wastes from colleges and universities include common recyclables, such as cans, glass, cardboard, and office paper, and compostables, such as food scraps, animal bedding, landscape refuse, and trash. An increasing number of colleges and universities are reducing their solid waste volumes through recycling. (EPA, 2006)

With its student residences, athletic facilities, landscaping, research laboratories, and other activities, a typical college or university can use millions of gallons of water each year. With such a large volume of annual usage, even a small improvement in the efficiency of water use can translate into many gallons of water conserved. Water conservation efforts on campuses often include activities such as increasing awareness of wasteful practices, using stormwater for landscaping, and implementing more efficient methods of heating and cooling buildings. Stormwater discharges from colleges and universities can affect the quantity and quality of water that must be handled downstream. To reduce stormwater runoff and pollution, strategies such as buildings with vegetated or turf roofs and parking areas with porous pavements that have been built, enabling enhanced infiltration and groundwater recharge, rather than runoff. (EPA, 2006)

Signing a declaration, such as the American College and University Presidents Climate Commitment, or releasing a policy are two of the preconditions that help ensure the successful completion of many of the aforementioned actions. Signing a declaration or releasing a policy has three functions. Firstly, they galvanize attention; secondly, they act as excellent directives for the steps required to achieve sustainability; and thirdly, they assign a university's progress and commitment to achieving sustainability to the scrutiny of the international public, academic, and corporate arena. It is this scrutiny that can make a university accountable, and it is critical that proponents of sustainability focus on this task. (Bekessy et al, 2007).

#### *Area of Inaction*

Institutions of higher education have only become interested in environmental management systems (EMSs) relatively recently, as has been evident in their limited participation in the range of EMS programs offered for college and university campuses (C2E2, 2006). An EMS is a framework for understanding an organization's environmental impact, complying with environmental regulations, and implementing proactive pollution prevention strategies (EPA, 2001). An EMS is not a checklist completed once per year to review compliance, a one-time project, or jargon for a policy statement; instead it initiates a continual cycle of planning, doing, reviewing, and improving the processes and actions associated with the organization's environmental management (EPA, 2001). Two elements that are most critical to the success of the EMS are the EMS Manager and EMS Team.

The manager is an employee appointed by the college or university's administration and is responsible for initiating and leading EMS implementation (EPA, 2001). Said individual may direct the department responsible for environmental matters or may report to the individual charged with such responsibility (EPA, 2001). The team is the core group of people comprised of college and university staff (e.g., facilities, maintenance), faculty, students, department heads, and administrators responsible for day-to-day EMS activities (EPA, 2001). Broad representation is critical to EMS success (EPA, 2001). While many colleges and universities have indicated they are developing or

have an interest in developing an EMS, these efforts are clearly only in their infancy; due to the fact that the vast majority of colleges and universities that report having an EMS in place also report having initiated them during the period between 2000 and 2005 (C2E2, 2006).

### Environmental Sustainability at Clark University

#### *Historic Actions*

Having juxtaposed a number actions of colleges and universities have taken to positively contribute to environmental sustainability with the major action these institutions have failed to take, the focus shifts to the case of environmental sustainability at Clark University. The logical beginning of Clark's involvement in environmental initiatives dates back to the 1971-1972 academic year when Science, Technology, and Society (STS) – a precursor to the current Environmental Science and Global Environmental Studies – became an academic program on campus (DeCarolis et al, 2000). Motivated by a decade of high energy prices in the 1970s, a partnership of students and a federal grant from the United States Department of Energy, the university installed a cogeneration plant in 1982 (CUES Task Force, 2007). The plant's primary functions are to produce electricity via the combustion of diesel fuel or natural gas and provide heat – the waste heat that is captured from the engine – that is utilized for space heating in the winter months (DeCarolis et al, 2000). Additionally, during that same time period, the university physical plant managed to more than halve the primary energy intensity of the campus by fixing missing and/or broken heating and lighting controls (DeCarolis et al, 2000).

A recycling program was established at Clark in 1990 by undergraduate students Matt Most '92 and Dan Kallin '92. It officially began full-time operations during the 1991-1992 academic year. Over the years, the recycling program has expanded in order to better serve the needs of the university. (Clark University, 2007a)

In 1995, shortly after establishing recycling on campus, Clark became a signatory of the Talloires Declaration (AULFS, 1996). Pronounced Tal-Whar, the declaration was composed in 1990 at an international conference in Talloires, France, and was the first official statement made by university administrators of a commitment to environmental sustainability in higher education (AULFS, 2001). In substance, the Talloires Declaration is a ten-point action plan for incorporating sustainability and environmental literacy in teaching, research, operations and outreach at colleges and universities (AULFS, 2001). It has been signed by over 350 university presidents and chancellors in over 40 countries (AULFS, 2001).

#### *Current Actions*

More recently, progress toward the goal of increased energy efficiency has been made, in part, by way of a lighting efficiency program offered by National Grid, the local electricity provider. The program has allowed Clark's physical plant to introduce the newest generation of energy efficient lighting in two residence halls, the athletic center, the cafeteria, and a handful of academic buildings. It has also provided the incentive to compile a lighting inventory for the remainder of the campus, in order to take further advantage of National Grid's lighting efficiency rebate program. In addition to this,

physical plant replaced a 40-year-old chiller in the Goddard Library with a more efficient model, made steam-line and trap repairs at several campus locations to reduce steam loss, and installed air-lock doorways in some campus buildings to reduce heat loss. Further progress toward energy efficiency has been made by following the previously-mentioned LEED building standards in the construction of the Lasry Center for Bioscience and Blackstone Hall. The Lasry building has been awarded Gold LEED certification. Blackstone has not yet been rated but it is anticipated that it will perform at a similar level to Lasry. (CUES Task Force, 2007)

The university has also acted to make its recycling program more efficient. With this goal in mind, Katrina Rideout '00, MA '01, was hired in 2004 as Clark's first staff member dedicated to recycling and conservation issues on campus (Clark University, 2007a). Rideout, whose position was a part-time contract position, oversaw the recycling program and promoted recycling, reuse, and waste reduction within the Clark community (Clark University, 2007a). In July 2006, Dave Schmidt '04, was hired as Rideout's successor. In addition to making the position a full-time Clark employee with benefits, Schmidt has been charged with the coordination and expansion of recycling, energy conservation, and other issues of environmental sustainability on campus (Clark University, 2007a). Currently the recycling program is managed year-round by Schmidt and is staffed by work/study students during the academic year and by a skeleton crew of non-work/study student employees during the summer recess (Clark University, 2007b).

The commitment to environmentally motivated social action displayed in 1990 by Most and Kallin has been carried on at Clark, partly by the Clark Sustainability Initiative (CSI), an environmentally minded student group on campus. With Josh Hilsdon '06 taking the lead, CSI designed the Choose Renewable Energy program aimed at signing students up to offset the electricity they use at Clark with the purchase of Renewable Energy Credits (RECs). In the fall of 2005, Hilsdon and fellow CSI members collaborated with Provost David Angel and Residential Life and Housing to set up an optional fee to be added to students' housing bills. This strategy would allow students to participate at their own discretion, instead of creating a University wide fee. The final number of students who participated in the first CRE was 344, for a total of \$10,320 of RECs purchased. (CUES Task Force, 2007)

Such student action was also evident in the submission of a proposal to Clark's Administration to establish a program to compost food and other biodegradable waste from the cafeteria. The proposal was developed and submitted in spring of 2006 by Amanda Lee '09, Dominic Pascarelli '08, Vera Simon-Nobes '09, and Lia Volat '09. The proposal was submitted for consideration to the newly-established Clark University Environmental Sustainability (CUES) Task Force (discussed below). After approximately one-and-a-half semesters of further research and deliberation, the task force recommended that the university pursue composting, at least for the near term, a bit differently than outlined in the original proposal. Citing outstanding site location and logistical issues involved with making composting an on-campus activity, the university has contracted to have its food and other biodegradable waste from the Higgins University Center – the building in which the cafeteria is housed – hauled to a commercial composting facility for processing and sale. (CUES Task Force, 2007)

As mentioned above, in the spring of 2006, Clark University President John Bassett formally launched the Clark University Environmental Sustainability (CUES)

Task Force (Bassett, 2006). The mission of the task force is to promote environmental sustainability at Clark. The task force proposes to achieve this mission by 1) increasing awareness of environmental and sustainability issues on campus, 2) researching environmental impacts of University activities along with options for improvement, 3) developing recommendations for the President and appropriate University committees on actions and policies to improve the environmental sustainability of the University, and 4) coordinating activities related to environmental sustainability of the University (Bassett, 2006). The task force released the first annual Environmental Sustainability Report at the beginning of the 2007-2008 academic year.

The sentiment conveyed in the university's signing of the Talloires Declaration was carried on in June 2007, when President John Bassett signed the university on to the American College and University Presidents Climate Commitment. The core goal of this commitment is to stimulate signatories to adopt different measures aimed at becoming climate neutral, or net zero emitters of greenhouse gasses. Before signing on to the commitment, the university acknowledged that making progress toward this goal will not be easy and will require a willingness on the part of all members of the Clark community to make this a priority for years to come. (CUES Task Force, 2007)

### *Area of Inaction*

While Clark University has in the past and continues to take actions aimed at improving environmental sustainability, it does not have an EMS. As mentioned above an EMS is a framework for understanding an organization's environmental impact, complying with environmental regulations, and implementing proactive pollution prevention strategies (EPA, 2001). An EMS is not a checklist completed once per year to review compliance, a one-time project, or jargon for a policy statement; instead it initiates a continual cycle of planning, doing, reviewing, and improving the processes and actions associated with the organization's environmental management (EPA, 2001). Currently, Clark University has not made public any plans its senior managers might have for developing or implementing an EMS. Additionally, my current position as a member of the CUES Task Force would inform me of any such plans prior to them being made public.

### **Process**

#### **Goals**

The goals of this project turned out to be relatively straightforward. The first was to determine what the current state of environmental sustainability management is at colleges and universities in the United States. The basic idea behind this goal was to broadly consider the environmentally sustainable actions these institutions are taking and take a look at whether individual institutions had established plans to manage all of these actions simultaneously. The second was to determine the current state of environmental sustainability management at Clark University. Much like the idea behind the first goal, the idea behind this goal was to broadly consider the environmentally sustainable actions Clark University has taken and determine whether the university has a plan in place to simultaneously manage these actions. The third was to make my research as useful as possible to the university by making recommendations based on my findings and

presenting them to the Clark's Administration. The basic idea behind this goal is my preference for conducting research in such a way that makes it useful, rather than having the end product simply tucked away in a filing cabinet, recycled, or deleted from my hard drive.

### Literature Review

Toward the end of realizing the project's stated goals, a review of the relevant literature was conducted. Having no substantive previous knowledge on the topic of environmental sustainability management at colleges and universities, it was recommended I first search the business operations and business management literature. Many of these sources turned me on to literature more closely related to the topic of this paper. As the focus narrowed to Clark University, it was necessary to meet with representatives from the administration and staff whose knowledge and experience would supplement the literature available through the university's web site.

### Interviews

The two university representatives I formally met with were Campus Sustainability Coordinator David Schmidt and Provost David Angel. The meeting with Schmidt occurred on September 25, 2007 at the Gates House, located on the campus of Clark University. The meeting with Angel followed on October 5, 2007 in the university's Geography Building.

### Challenges and Reassessments

As previously mentioned, the goals of this paper turned out to be relatively straightforward. This, however, came to pass only after meeting David Angel. Prior to that meeting, there was one goal in addition to the three mentioned above. That goal was to provide detailed case studies on between two and four colleges or universities that Clark regards as peers or aspirants. In the time between the two meetings, it became clear that the very act of choosing two to four such institutions would be far more time consuming than I originally had thought. This was mainly due to the fact that the criteria Clark uses to determine peer and aspirant schools – mainly dealing with admissions overlap and faculty compensation (Himmelberger, 2007) – include no variables even remotely related to sustainability management issues. Because of this, it was clear that the case studies would need to be cut out due to time constraints.

### Results

The nature of the meeting with Dave Schmidt, Clark's Campus Sustainability Coordinator, was less of a data collecting endeavor and more of a brainstorming session. The one bit of data I hoped to and did collect, was an answer to whether or not any research similar to this had been, was underway, or was planned for Clark. He indicated that none had been done, was underway, or was planned. In addition this, Schmidt pointed me toward the International Journal of Sustainability in Higher Education and recommended I speak with Joe Sarkis, a Management professor at Clark, regarding business operations and business management literature that dealt with the management of environmental sustainability. Lastly, Schmidt recommended I meet with Clark's senior

managers in order to be ascertain what, if any, behind-the-scenes actions they had taken with regard to Clark's environmental sustainability. (Schmidt, 2007)

The meeting with David Angel, Clark's Provost, was geared much more toward data gathering. There were two questions in particular that the meeting addressed. The first question was one concerning inter-institutional comparisons. Provost Angel confirmed that case studies based on colleges or universities that had been chosen from Clark's peer or aspirant groups were not likely – based on the same reasoning mentioned above – to be highly generalizable when used for the purpose of comparing environmental sustainability management (Angel, 2007).

The second question was one concerning institutional commitment to environmental sustainability. In answering this question, Provost Angel stated that the senior managers of the university – including himself – had devoted what he deemed a significant amount of time to issues of environmental sustainability at Clark over the last 3-4 years. He indicated that their focus had been primarily on energy efficiency measures and that to meet the requirements of the American College and University Presidents Climate Commitment additional actions would need to be taken. The three broad categories of actions he specified were integrating environmental sustainability into the core decision-making criteria for (1) capital and financial planning, (2) institutional policy-making, and (3) behavioral norms expected of administrators, faculty, staff, and students. (Angel, 2007)

In addition to this, Provost Angel stated his belief that Clark University's commitment to environmental sustainability at the senior management level is, while not an explicit part of the university's mission statement or academic and financial plan, implicit in these two documents. Angel went further and indicated that the academic and financial plan would be edited to more explicitly commit to environmental sustainability in the next 2-3 years, when the document undergoes a comprehensive rewrite. (Angel, 2007)

## **Conclusions**

### **Recommendations for Clark University**

The primary recommendation of this paper is that Clark University develops and implements an environmental management system (EMS). This recommendation is made to President John Bassett and the CUES Task Force. The basis of the recommendation is threefold, consisting of a review of the relevant literature, personal experience as a member of the CUES Task Force, and analysis of data gathered in an interview with Clark University Provost David Angel. It is anticipated that it will be considered by the CUES Task Force. As documented above, the literature focused on environmental sustainability in higher education has identified adoption of environmental management systems as a key deficiency in the efforts of colleges and universities to efficiently work toward environmental sustainability. Since Clark University does not currently have an EMS or plans to develop one, it too is deficient in this regard. Based Clark's commitment to becoming more environmentally sustainable and the benefits of an EMS (discussed below) the university should view its most pressing need with regard to environmental sustainability as the development and implementation of an EMS.

Implementation of an EMS has a wide range of benefits for a college or university. Institutions of higher education are analogous of small cities encompassing myriad activities within the borders of their campus. Therefore, these institutions must grapple with a wide range of issues focused on environmental sustainability. Much of the time, these issues concern the protection of the college or university and its surrounding community and compliance with local and federal environmental regulations. However, unlike the typical governmental unit, most colleges and universities have no central authority coordinating environmental practices. For this reason, many of the internal environmental practices of these institutions differ from department to department. An EMS, if implemented properly, can improve communications, establish responsibilities, training, and methods to address environmental issues – including environmental sustainability – and achieve the campuses environmental goals. (EPA, 2001)

As mentioned above, the two most critical elements to ensuring successful implementation of an EMS are the EMS Team and the EMS Manager. The EMS Team is the core group of people comprised of college and university staff, faculty, students, department heads, and administrators responsible for day-to-day EMS activities (EPA, 2001). The CUES Task Force seems to meet the criteria for being an EMS Team, based upon the fact that its members currently include staff, faculty, students, and administrators, and, perhaps more importantly, the task force's current mission is not in conflict with what it would be expected to do if it were charged with being the EMS Team.

The EMS Manager is an employee appointed by the college or university's administration and is the one responsible for initiating and leading EMS implementation (EPA, 2001). Said individual may direct the department responsible for environmental matters or may report to the individual charged with such responsibility (EPA, 2001). Currently, there is no obvious way to fill this position with an already-existing Clark University employee. Since there is not one single department that is responsible for environmental matters, the university administration cannot simply appoint the head of that department. This also effectively eliminates the possibility of appointing another individual who reports to the head of whichever department is responsible for environmental matters. An option whose benefits would go far beyond filling the short term need of filling the position of EMS Manager is creating the position of Sustainability Program Director.

This would be a non-faculty position suitable for an individual with both educational and practical experience as well as background in environmental sustainability. The individual should also possess a background managing projects and facilitating collaboration in an interdisciplinary university setting. The primary responsibilities of the Sustainability Program Director would include leadership and management of existing programs, including the campus recycling program and energy efficiency improvements mentioned above as well as developing new initiatives. The Sustainability Program Director would be a logical choice as chair of the CUES Task Force as well as EMS Manager and would ensure the continued success of current and future environmental sustainability initiatives that Clark is committed to. (Stephens, 2007; AASHE, 2007b)

### Next Steps

The most logical next step is for the above recommendations to be reviewed and evaluated by the CUES Task Force. Given that the task force has already convened its final meeting of the Fall 2007 semester, this review and evaluation will need to wait until the beginning of the Fall 2008 semester. Being that the task force has a substantive amount of work ahead of it with regard to actions it must recommend in keeping with the American College and University Presidents Climate Commitment, it would be prudent to consider the recommendations of this report as soon as possible. Finally, individuals or groups with questions, comments, or suggestions regarding the aforementioned recommendations, should contact the author of this report by e-mail: [dpascarelli@clarku.edu](mailto:dpascarelli@clarku.edu).

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## **Advising the Sustainability Task Force on Achieving Climate Neutrality at Clark**

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Because of the high impact of greenhouse gas emissions, many colleges and universities in the United States have agreed to commit to neutralizing greenhouse gas emissions on campus. This project aims to provide the Clark administration with recommendations to facilitate the achievement of the American College and University President's Climate Commitment. The project analyzes potential practices that Clark could pursue on its way to becoming climate neutral. The implementation of these practices could help Clark reach the major goal of the Commitment, which is to reduce emissions by 80% by the year 2050. Currently, Clark has a tremendous opportunity to do so and must work effectively to meet the President's Climate Commitment and promote sustainability around Worcester and throughout the higher education sector.

### **Introduction**

Global climate change is a serious issue that has come to the forefront as the rise in the Earth's global average temperature has been linked to greenhouse gases produced by human behavior (IPCC, 2007). According to the Environmental Protection Agency (2007), the principle greenhouse gases linked to climate change include carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), nitrous oxide (N<sub>2</sub>O) and fluorinated gases, including hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride. The agency attributes the following anthropogenic activities to the gases. Carbon dioxide production is attributable to the burning of fossil fuels, wood, and other materials and also to certain chemical reactions, such as the manufacturing of cement. Methane is generated from the production and transport of coal, oil and natural gas, as well as by livestock and the decay of wastes. Nitrous oxide also results from agricultural activities, but also during industrial activities and the burning of fossil fuels and wastes. The fluorinated gases, are powerful synthetic gases that come from a multitude of industrial practices (EPA 2007).

Climate change, or the variations in weather over long periods of time, refers to the natural fluctuation in the Earth's global climate and regional climate over time. In recent years, the climate has been changing at a quicker pace than ever before. In a sample of average yearly temperatures from the Civil War to the present, the hottest year was 2005 (Gore, 2006). If global climate change is allowed to continue at its current pace, drastic repercussions will be seen on local and global scales. Globally, the rising of seawater temperature threatens glacial melting, which could result in worldwide flooding (The Environmental Health Center, 1994). Other threats include more severe storms and inclement weather conditions, uncomfortably high air temperatures and destabilization of world climate. Together these changes could contribute to forced displacement of peoples, species displacement, increased risk of illnesses and severe weather events. The

threat of malaria will increase, as the vector by which it travels will have an expanded habitat due to the geographic shift of warmer climates (Clean Water Fund 2007).

Locally, The Massachusetts coastline will see rising sea level, increased threats to public health and the loss of our regions unique fall foliage, winter skiing opportunities, maple syrup production and a serious decline in lobster and cod populations (Dutzik et al, 2007). This would negatively impact the local economy, not only because of the huge loss of tourism, but also the net loss of goods. Although the state has taken important steps to reduce emissions, we must adopt a climate neutral policy to avoid these horrible impacts.

To combat these changes, climate neutrality, or zero net greenhouse gas emissions, is a strategy that is rapidly gaining support. Climate neutrality is the goal of offsetting or significantly reducing greenhouse gas emission produced from a variety of energy consuming activities (Clean Air-Cool Planet 2005). Climate neutrality can be a goal of individuals as well as institutions of any size. The first step to achieving climate neutrality is to calculate emissions by conducting a large-scale inventory, which shows where improvement is most needed. The second step is reduction, which includes changing behaviors and technologies to lower overall emissions. Thirdly, offsetting emissions by purchasing carbon credits can be used to account for the remaining emissions. Carbon credits balance carbon dioxide released into the atmosphere from burning fossil fuels with renewable energy that creates a similar amount of harmless energy (Johansen, 2006). Carbon credits offer an easy way to take responsibility for ones greenhouse gas footprint and offer hope for the future. Specifically, as Clean Air-Cool Planet (2007) reports, most Americans can completely offset their personal emissions for less than one hundred dollars a year. Climate neutrality, specifically carbon neutrality, is the key to halting climate change and guaranteeing a sustainable future. It is vital that institutions of higher education take this opportunity as leaders in the community to achieve carbon neutrality.

In response to the global climate crisis, the international community developed the Kyoto Protocol, implemented in 1997, and is currently working on developing the post-Kyoto international climate regime. On December 15, 2007, nearly 200 countries met in Bali to follow up on the application of the Kyoto Protocol and to strengthen international climate change efforts. The decisions made seek to address consequences of climate change, reducing greenhouse gas emissions, and strategies to widely deploy green technologies, as well as financing these measures (UNFCCC 2007). On a smaller scale, individual nations, states, cities and towns are developing their own climate mitigation initiatives. At the level of institutions of higher education, collaboration on the part of EcoAmerica, Second Nature and Association for the Advancement of Sustainability in Higher Education has developed the American College and University President's Climate Commitment. The commitment represents a nationwide effort in the United States, on the part of colleges and universities, to combat global climate change by becoming climate neutral institutions.

Outside of higher education, commitments in other sectors are taking hold. In 2000, the Cities for Climate Protection Program was created by the International Council for Local Environmental Initiatives, an international association of local governments. The program commits local governments to adopt policies and implement measures that will lead to a reduction in greenhouse gases and environmental sustainability. So far,

Pittsburg, Boston, Nashua and Portland have joined on. Through the guidance of the commitment, Boston has become the first city in the nation to adopt a green building policy for all new large, private construction to meet LEED certification (Zezima 2006). Additionally Nashua, New Hampshire's extremely successful Green Task Force recently kicked off a new anti-idling campaign to end unnecessary running of vehicle engines (CA-CP 2007). Uniformly, these cities are spreading awareness throughout their communities and encouraging citizens to recognize sustainability in their everyday lives.

## **Background**

### History of Energy-Climate Initiatives at Clark University

As the general public becomes more aware about global climate change as a truth and not a theory, both political and community action have become major forces in developing strategies. In addition, colleges and universities have come to the forefront in research and action on climate change and sustainable development. Clark University has been active in climate research and sustainable development since 1971 when students and faculty from the Science, Technology and Society Program began to monitor the University's energy use (DeCarolis, 2000). Since then, much progress has been made at Clark and other colleges and universities as schools continue to work towards carbon neutrality.

At Clark, successes in energy conservation projects have varied over the years. Beginning in the 1970s, increasing fuels prices and an increased social awareness in environmental concerns sparked Clark's interest in energy efficiency (DeCarolis, 2000). Culminating this period of concern was the installment of Clark's cogeneration facility which was originally designed to use the byproducts of energy production to heat buildings. Unfortunately the efficiency of this technology has declined over time and currently the waste heat recovery system is in need of updating to maximize efficiency.

More recently, Clark has seen the formation of several influential forces on campus including the Clark Sustainability Initiative (CSI) in 2005, Clark Energy Awareness Program in 2006, and the Sustainability Task Force in 2006. These student-faculty collaborated forces, geared towards sustainability issues, have helped to raise awareness and implement new behaviors on campus. A major accomplishment of CSI includes the student Renewable Energy Credit (REC) program; a program that allows Clark students to contribute to the school's purchase of renewable energy credits. CSI also took control of Clark's future actions by instigating the signing of the President's Climate Commitment, an extremely important step in guiding the school to achieve climate neutrality under a specific timeline. Aside from specific accomplishments, CSI and the Energy Awareness Program have helped immensely with overall knowledge of sustainability and its importance on campus, from events and campaigns to just tabling in the university center talking to people about the issues. (Schmidt, 2007, personal communication)

Other successes at Clark have included the revamping of the recycling program by Katrina Rideout during the 2004-2005 school years, which resulted in increased awareness and increased number of items of recycled on campus. A comprehensive "carbon footprint" analysis was also conducted in 2005 by Dave Schmidt to help those working on sustainability issues understand how far Clark is from climate neutrality.

More concrete actions have included the integration of composting in the cafeteria, informal commitment by the school to energy star products, adherence to LEED building requirements in new projects, introduction of reusable coffee cups and utensils into the Bistro, and more focus on sustainability through new classes and guest lecturers.

Despite all of the efforts of students and some faculty, the reality of Clark's progress in the area of campus climate neutrality rests on the fact that these types of decisions are based on maintenance costs and efficiency and not greenhouse gas emissions (Schmidt, 2007, Meeting On Campus Sustainability). Regardless, Clark has signed the President's Climate Commitment and has made a commitment to consider emissions of carbon and other greenhouse gases in all decision-making and must begin working towards climate neutrality.

#### American College and University President's Climate Commitment

Beginning in 2006, the American College and University President's Climate Commitment was created to address global warming and its potential for disastrous social, economic, ecological and adverse health effects (ACUPCC 2007). By promoting climate neutrality as a strategy, the commitment offers a tangible way to halt the process of global warming. According to the Commitment, within the first two years two or more of the following seven "tangible actions" must be initiated (ACUPCC, 2007): "Green-building policy, energy star procurement policy, air travel offsetting, provision of public transportation, green power production or purchasing, climate-friendly investing, and waste minimization". The next step is to organize a climate action plan, outlining target dates and milestones (ACUPCC, 2007). Specific actions should be outlined as well as mechanisms that will be used to track progress.

By using the ACUPCC as a guide, this project seeks to inform the Clark Sustainability Task Force's process on creating the climate neutrality plan. By providing specific recommendations for action and goals our team hopes to contribute to Clark's initial planning process for achieving climate neutrality. The following document includes methods we used to collect data, significant findings, and lastly recommendations for the Sustainability Task Force.

#### Process

During the course of this project, we conducted both primary and secondary research. Primary research included personal correspondents, email correspondents, and phone correspondents. Secondary research included the Internet and library bibliographic materials. After significant research we realized our findings fit into three broad categories: education and outreach, energy-use reduction, and energy production. By dividing information into these categories, collection was much more organized and analysis much simpler.

#### Education and Outreach

We looked to other schools as examples for research on education and outreach related to the President's Climate Commitment objectives. By referencing websites and news articles reporting actions on campuses nationwide we attempted to gather effective methods for education and outreach. We also contacted people we identified as key

informants on campus sustainability, including administrators, faculty and students. The Kasperon Library was also a major source of helpful reading materials for this section.

Using the information provided from other schools, we discussed the possibility of implementation of these strategies at Clark. By focusing on schools in our area, on a scale of Worcester to New England, we determined school's success by frequency of outreach programs and level of student awareness. Awareness was measured by the existence of student groups for sustainability and their presence on campus. Specifically Harvard Green Campus Initiative, Kyoto Now at Cornell, New York Sustainability Coalition a team of New York Colleges and Universities, and Sustainable Bates were used as references. News articles, especially those featured in on-campus publications, played a major role in this section by displaying the degree of public interest on these campuses; allowing us to gauge how the actions would fit at Clark.

### Energy-Use Reduction

The investigation of energy reduction on campus began with a look into how and where Clark is using energy on campus. We then brainstormed ideas for energy reduction from successes at other schools as well as from our own previous knowledge. Internet and book research on energy reducing technologies were also an integral part of the process, from where we got many of our core ideas. Motion sensors for dorm lighting, Vending Misers, alternative faucets for hot water, green roofs and updated heating policies were the technologies we explored. To determine feasibility we consulted costs and benefits of the technologies and compared them to our perceived budget.

### Energy Production

Our study on energy source began with the discussion of all possible alternative sources of energy. We explored solar, hydro, geothermal, wind, and surplus though cogeneration. Through general internet and book research we discovered key costs and benefits of each technology and began to understand feasibility. Interviews with Jim Collins, Dave Schmidt and Tom Wall played an integral role in this portion of the research as their insight and opinions strongly guided our focus and conclusions. By contacting individual providers of each technology we examined costs and time-tables of installation and payback. The tour of the cogeneration plant also provided a sense of urgency for updating the plant and unveiled the potential efficiency of this type of system.

## **Results**

### Education and Awareness

We found that the most successful schools, in terms of student awareness and participation in sustainability events were those that had specific groups and clubs designed to promote sustainability. Those mostly student run, but backed by faculty were the most successful, rather than those dominated by students. Some of the more successful groups included the Environmental Business Club at Indiana University, the Harvard Green Campus Initiative at Harvard University, the Greening Program Committee at Green Mountain College, and the Committee on Environmental

Sustainability at Oberlin College. These groups all include an effective mix of faculty, staff and students and in some way have all been successful at communicating progress on the President's Climate Commitment. In fact, at Oberlin College, one of the obligations of the Committee on Environmental Sustainability is to work with the school to publicize sustainability actions on campus and progress of the climate action plan developed after signing the commitment (AASHE 2006).

Educational and awareness programs ranged from presentations to competitions, including the nationwide Recycle Mania contest, MIT's cooking oil conversion project and Cornell's holiday break initiative. Although no post-contest behaviors were officially recorded, the Recycle Mania committee strongly argues that the contest instills awareness about recycling, and believes recycling will stay at an increase at participating schools even after the contest is over (Recycle Mania 2006). The cooking oil conversion project also helped raise awareness and educated students about the feasibility of bio-fuels for university vehicles. Lastly, the holiday break initiative at Cornell utilized a 13-day holiday break period to turn off all personal appliances in the dorms. The initiative ended up saving the school \$75,000 in such a short time (citation). We found that programs and events that received considerable publicity before and after were the most successful in creating awareness and concern on campuses. Few programs dealt with the promotion of the President's Climate Commitment, and no schools reported announcement ceremonies or progress update public events, including Clark. Instead, schools with a high level of student awareness on the commitment used school newspapers and website to distribute the information. Awareness events remained targeted at sustainability in general.

### Energy–Use Reduction

In the energy reduction category we found that occupancy sensors for dorm lighting would enable us to reduce wasteful lighting at night for a reasonable cost. At University of Indiana, motion sensor installation in just two dorms is projected to save the school \$35,000 over the next ten years (Lunde 2007). Vending Misers, when used properly, can eliminate wasteful powering of vending machines. We found that Clark has Vending Misers on all Coca Cola vending machines; however, many were not installed properly or were in need of repair. If used properly and effectively, vending misers have a payback of about 1-2 years and save nearly half the electricity that a constantly running machine uses (Tufts Climate Initiative). Low-flow devices were also determined to be an effective way to cut the amount of water and energy used to heat water (citation!!). Low-flow toilets use a maximum of 1.6 gallons of water per flush compared with about 3.5 gallons of water used by a standard toilet. Low-flow shower heads use about 2½ gallons of water per minute compared to between four and five gallons per minute used by conventional heads. Low-flow faucet aerators can cut the water usage of faucets by as much as 40% from 4 gallons per minute to 2½ (Toolbase 2007).

Heating issues, including thermostat access and function, also need to be addressed as an immeasurable amount of energy is wasted through unnecessary heating of the dorms. Upgrading dorm heating systems would be extremely effective, especially equipping individual floors or even rooms with digital thermostats. Unfortunately no monies exist for this type of large-scale revamping. Although such a project would be

extremely beneficial, project such as upgrading the cogeneration plants and large-scale solar implementation have first priority.

Green roofs, designed to capture excess heat from buildings and utilize surface area for carbon offsetting were another idea considered for Clark. It turned out the roofs on Clark's campus would not be feasible sites. According to Tom Wall, the roofs of the older buildings on campus are not structurally sound enough to carry much more weight (cite). Determining which buildings could handle the extra soil, water and vegetation weight would not be an ineffective use of money, as hiring an engineer to do this type of analysis on the buildings would be quite costly.

### Energy Production

We found solar to be the most plausible option for Clark, based on geographic location, immediate landscape and funding capabilities. At the start of our project, Geothermal, Wind Power and Solar Power clean energy technologies were completely ruled out based on financial barriers (Jim Collins, Personal Communication, 10/19/2007). As we looked further into the issue we found that geothermal resources, most commonly used to heat building, are available in our immediate area but not financially feasible (Tom Wall, Personal Communication, 11/09/2007). We found that wind generated energy is also not feasible solely based on location and lack of open space. Implementing wind power requires a constant supply of 25-30 mph winds to the wind turbine and because of trees and buildings in the city landscape of Worcester our site is unsuitable (WSUEEP, 2007). Rooftop solar installation was ruled out by both financial barriers and by the questionable structural integrity of older Clark buildings (Tom Wall, Personal Communication, 11/09/2007).

However, freestanding, installation on auxiliary lighting around campus, and rooftop installation on newer buildings remained feasible. According to Warren Wilson spokesperson, small solar lights for outdoor lighting are "easy to install, cost effective, and eliminate the need to run further underground cable while showcasing the utility of solar lighting and minimizing pollution" (Huie 2007). The average cost for this type of product ranges between \$100 and \$200, but is highly effective. One brand, Solar Cynergy claims that their product can run for days on a single day of weak sunlight and that their \$100 light will last for up to 25 years (Morrison 2007). Around campus incredible savings could be seen with this type of investment, with a high average payback of 3 to 5 years, making the technology well within Clark's means.

### Conclusion

#### Education and Outreach

In terms of education and outreach, Clark already offers many opportunities to learn about climate neutrality. Unfortunately the events are often not publicized well; even when they are publicized there is little incentive for students and faculty who are not already interested to attend. Additionally, little focus has been placed specifically on the President's Climate Commitment and neither an official announcement of the signing of the Commitment or any public follow-up have occurred. In order to make the subject of climate neutrality appealing to a wider audience, Clark needs to work on making sustainability issues "cool." Worldwide, environmental issues are gaining momentum and

sustainability practices are becoming more popular. Clark should follow this example and make sustainability “the thing to do” on campus, with a strong focus on climate neutrality as the solution to a changing climate.

One way to encourage climate neutral behavior on campus is to involve both the faculty and administration. Together the two could be very influential in setting an example for the rest of the community to follow. Recommendations should be made to the faculty and administration regarding these ideas. Professors should require papers to be double sided when turned in, just like they require certain font sizes and spacing. This would set a standard for paper use reduction in the academic sphere. Additionally, if professors were motivated enough, they could also convert all of their classes into paperless classes. Although this demands more work on the professors’ part, it has proven to save large amounts of paper. One class could save up to or more than 8,000 pages, equivalent to one tree (Paperless Class Group Presentation, 12/10/2007). It would also be beneficial to encourage faculty to purchase Energy Star appliances for their personal offices. Though most of the university’s appliances are Energy Star, faculty members’ use of their own personal devices is excluded from the university’s energy standards. On a different note, a renewable energy credit campaign for faculty and staff, similar to the student opt-in program is a promising way to encourage this part of the Clark community to participate in climate neutrality initiatives. Not only will their dirty energy be offset but also it will be done so locally. Since students may be strongly encouraged to purchase Renewable Energy Credits in the near future, it seems fitting that the faculty also purchase them. This will help offset the dirty energy they use on campus with the production of clean energy nearby.

As far as students go, on-campus residents should be given opportunities in their daily lives to improve their climate impact. Even students who were very conscious of their energy use at home sometimes become less aware of it when there are no direct effects on them and their family. Since tuition does not rise when a student leaves their computer and lights on or blasts the heat while the windows are open, there is often a disconnect between doing those things and the environmental and monetary consequences. Installing water meters and reporting energy usage for heating in dorm common rooms or kitchens should absolutely be considered. With these metering systems competitions between dorms could be set-up and would raise awareness and encourage students to use less water. Another area where competition could be used to increase sustainable activities is with recycling. An inter-dorm competition would encourage students to recycle their trash instead of throwing it away and of course would be an excellent way to incorporate recycling guidelines.

Another way to promote climate neutrality in daily life at Clark is to add compost bins into dorm kitchens. This would cut down on the amount of trash generated from dorms and involve students in the educational experience of composting. There could even be plants in the dorm kitchens and common rooms as a reminder that nature should be a part of our lives, even though we live in the midst of a city. In order for all of these changes to take place and be continued, Residential Life and Housing needs to be a part of the process. Resident Advisors should be required to hold activities having to do with climate neutrality and could potentially be in charge of the water and composting competitions.

Improvements can be made outside of the residence halls as well. A “Sustainability Tip of the Week” should be projected in the dining hall. This would remind the Clark community that there are many small ways in which individuals can make a difference in Clark’s ecological footprint. Re-establishing a product regulation committee that decides which companies Clark is allowed to support would be a responsible choice for Clark to make. Knowing what types of activities you are supporting through your purchases is extremely important, and could be very positive in terms of climate neutrality. The committee would ensure that Clark did not support companies that pollute superfluously, use unnecessarily large amounts of packaging, or harm the environment in other ways, and would drop those that did. If done right, this type of committee would be immensely popular among students at Clark, many of whom are social and environmental activists. This could be a great opportunity to promote dialogue about climate neutrality and making informed choices that are consistent with beliefs.

The last and possibly most important way to educate the Clark community is by integrating climate neutrality into week one. Presenting the Climate Commitment as an important governing policy will help orient new students towards more climate neutral behavior. By introducing them right away to the progress being made towards climate neutrality at Clark, new students will regard the school as a motivated, concerned entity and will be inclined to respect new policies and technologies added throughout their education. That way, every incoming class will know the basics; such as how to recycle, why it is important to conserve energy, and how to minimize waste production. During week one, reusable, canvas shopping bags could be given out to all first year students with the idea that they will use these bags to carry books and other necessities purchased at the bookstore.

The sooner the Clark community is educated about the problems and solutions involving climate neutrality on campus, the closer we are to becoming carbon neutral. The key is addressing the Climate Commitment and the soon to come climate action plan as a governing policy in Clark’s decisions, with a strong emphasis on keeping all decisions and actions public.

### Energy-Use Reduction

Our findings on energy-use reduction strategies suggest that reducing water flow by installing alternative faucets to reduce water flow would benefit Clark tremendously. Many people consume both hot and cold water at alarming rates. Water consumption averages 200 and 300 liters per day per person in the United States (U.S. Department of Energy, 2007). By using low flow systems, Clark could see a significant difference in water usage. Educating those who are not aware of their impact on water usage could also reduce intake. Monitors or screens serve as a device to display the amount of water that is depleted daily. If individuals see the consumption rates, they will be more conscious and likely to care about the affects.

Installing motion sensors, also known as occupancy sensors in academic buildings and dormitories will reduce electricity costs and carbon emission impacts. From our experience as residents in Clark dorms, lights are left on twenty-four hours a day, seven days a week in most dorms. Occupancy sensors detect when someone is around and have a set time—normally 10 to 15 minutes—to shut off automatically. Sensors enable

us to go about our day-to-day activities normally, without worrying about excessive, sometimes unnecessary electricity usage.

Another source of poor energy management is campus heating. Policies need to be established to reduce unnecessary energy consumption. “It gets so hot in the dorms, I no longer have to wear a blanket at night!” states Priyanka Kapur, a student at Clark University, “At times, I try to avoid my room because of the heat” (Priyanka Kapur, Personal Communication, 11/19/2007). Lowering the thermostats by a few degrees Fahrenheit will do no harm to the students. Plus, sweatshirts are the perfect alternative as they release no carbon dioxide.

Electronics are also top consumers of energy. Students often leave monitors and printers on for long periods of time, while little effort is required to shut them off. Holiday breaks are a crucial time for individuals to be aware of their impact on the environment even when he or she is not physically present on campus. On a related note, improving Vending Misers on Clark’s campus has a guaranteed payback and will significantly reduce energy use. Currently, there are misers installed all around campus, most of which are not even being used correctly. Some were discovered to be unplugged completely, which is not effective or beneficial. Blinking lights on the miser indicate that there is a problem and the machine needs maintained; however, many devices go for days without being attended to. To remedy this situation, Physical Plant should check and providing maintenance to all existing Vending Misers. A monthly follow-up monitoring plan would ensure the efficiency of these machines on campus.

### Energy Production

In a larger context Clark should start planning for major renovations to the current energy infrastructure. In accomplishing the goals of the Commitment, two major areas in need of adjustment are clear: the cogeneration plant and the university’s energy source. The cogeneration plant, located in the basement of Jonas Clark Hall essentially creates thermal energy by capturing the excess heat from the production of electricity. Unfortunately since its installation in 1982, the waste-heat boiler has become less efficient as it ages, decreasing the amount of steam captured, thus making the whole system much less efficient. Updating the cogeneration plant would restore its economic and energy benefits, and would allow the university to continue producing a percentage of its thermal energy without emitting any carbon directly.

To fully achieve climate neutrality, Clark should actively explore replacing its energy source, specifically shifting to a system more reliant on solar energy. Currently the potential of the sun remains untapped; the total amount of energy radiating from the sun has the ability to provide more than 10,000 times the annual global energy consumption (Greenpeace 2005). In addition, solar cell technology is rapidly advancing as more and more investors are climbing on board. Just this month Google, the leader in internet search announced its new project that will invest millions of dollars into developing a cheaper and more readily available solar cell (Liedtke 2007). Additionally the state of Massachusetts offers millions of dollars each year in incentives and rebates for small- and large-scale solar projects. Essentially solar is not as out of reach as we once thought and it is seeming more feasible each day.

If we are going to be successful, Clark’s long-term climate action plan must revolve around conversion to solar power and additional electricity generation from a

well maintained and updated cogeneration plant. Making this shift could cut costs and emissions dramatically so that Clark could easily afford carbon offsets. In addition, a serious multi-stakeholder emphasis needs to be placed on education and outreach focusing mainly on energy reduction in daily campus life. Together, these changes in the school's behavior have the potential to set an example for the community of Worcester and help to promote sustainability in the higher education sector.

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## **Solar Panel Installation on Clark's Campus**

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The small community of Clark University's campus provides the opportunity to set the foundations of utilizing renewable energy. As the Advancing Renewable Energy Team; we have looked at various renewable energies, focusing on solar power. Conducting extensive research and studying of what other universities and colleges have done, we looked at the possibility of bringing Solar Photovoltaic Cells onto campus. We have contacted several solar panel installation companies and had a consultation with the New England Solar store, located in Auburn, coordinating with Clark University's Physical Plant Assistant Director Tom Wall. In the end, we have decided that the installations of the Solar Heat Panels are the best way for Clark to make its first step towards renewable energy.

### **Introduction**

Climate change is one of the major challenges currently facing society (IPCC, 2007). Issues concerning global warming have been around for years, however entering the 21st century the scientific evidence has become more conclusive and the consequences harder to ignore (Johansen, 2006). According to specialists in the field, if carbon dioxide emissions are not limited, by the 21st century the surface temperature may rise from 1.4° to 5.8° (depending on the assumptions made). A rise of this magnitude will not only create more climate extremes, including floods, droughts, but as well as significant disturbances to agriculture and natural ecosystems (Boyle, 2004). To avoid or lessen such dramatic outcomes, it is critical to look at the potential of shifting the world's energy sources away from fossil fuel and toward renewable energy sources.

Under the Intergovernmental Panel on Climate Change standards, climate change is defined as a, "change in the state of the climate that can be identified by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer (IPCC, 2007)." The increase of green house gas emissions perpetuates the global atmospheric changes. Since 1970, there has been a 70% increase in green house gases emissions, releasing carbon dioxide, methane, nitrous oxide and halocarbons into the atmosphere due to human activity (IPCC, 2007). According to the IPCC's 2007 Fourth Assessment Report, it is "highly likely" that anthropogenic warming has altered physical and biological systems (IPCC, 2007). At the alarming rate of change, human activity must be curtailed in order to prevent devastating atmospheric conditions.

The optimal renewable energy source is one that does not pose the threat of being depleted after continued use and does not emit hazardous or polluting emissions (Boyle, 2004). Renewable sources of energy technology include biomass, solar, wind,

geothermal, ocean energy and hydrogen, many of which have already gained commercial value. The demand for renewable energy, however, is driven as much by consumer demands for cleaner energy as it is for consumer demands for convenience, cost efficiency and flexibility (Grübler, McDonald, 1998).

In the last few years, solar power has become one of the most common sources of renewable energy as the pressure for cleaner energy increases. Worldwide, many countries have been developing more efficient and affordable ways to harness the sun's energy to fuel today's power needs. Japan has increased production to 290 mega watts (MW) in 2005 and reduced costs by 8% (Kammen, 2006). Germany by 2006 has installed seven times the amount of photovoltaic (PV) cells than the U. S. due to political pressures to reduce greenhouse gas emissions (ACORE, 2007). In the U. S., solar energy is only one-thirtieth of the one percent of all electric generation even though solar is the most abundant renewable energy in the U.S. (ACORE, 2007). Studies show that solar energy can provide 110 GW of new annual power needs by 2016, reducing natural gas imports by forty percent, increase jobs by 260,000, and save consumers over \$110 billion in energy savings (ACORE, 2007).

Solar power, especially photovoltaic cells has become increasingly popular as a way to reduce the carbon footprint for many higher education institutions due to their direct utilization of the sun and simple installation systems. Pierce College in California exhibited a \$4.98 million project, mainly being funded by outside state and private institutions, where a 191-kilowatt solar PV system along with a 360-kilowatt micro turbine cogenerator was installed. The California Public Utility Commission supplied an incentive by providing \$2 million; California Energy Commission gave a \$1.3 million low interest loan, and a 15 year contract with Chevron Energy Solutions to pay for the project where Pierce used the revenue to pay off the balance. The main motivation for the project was to reduce both the energy cost and greenhouse gas emissions. It also provided a back up power supply and was installed over the parking lot providing shade and energy. (Putman, 2006)

Clark University does not yet rely on renewable energy as an energy source on campus, but recent history shows how the university is moving toward a greener campus. The University has recently begun evaluating its greenhouse gas emissions (Schmidt, 2007) and has been setting up new programs to support renewable energy such as the North American Renewable Energy Credit. For example, in 1996 the faculty at Clark established a course called Energy and the Campus set up to renew and evaluate the energy used on campus (DeCarolis et al 2000). More recently, Clark University has linked up with the Choose Renewable Energy Program, which allows students to buy Renewable Energy Credits (RECs) at a cost of \$30. In the case of Clark, this money is sent to help aid the New England Wind fund which finances wind energy projects.

Another large-scale group that Clark has gotten involved with is Clean Air Cool Planet, a non-profit organization dedicated to finding ways to stop Global Warming (Clean-Air Cool Planet, 2007). With the help of this organization, Clark was able to produce a Greenhouse Gas Inventory spanning the last three years of campus gas emissions. This inventory brings Clark University closer to the next step which is to continue to try and reduce emissions, but also start to look at fuel switching and more renewable energy projects (Schmidt, 2007).

This project aims to fulfill the steps that are required to apply for the small renewable energy initiative rebate from the Massachusetts Technology Cooperative for the installation of solar panels on Clark's campus. This would be a step towards renewable energy on campus, becoming the most advantageous step towards reducing our emissions of green house gases. While the purchasing of energy credits is beneficial, the installation of solar panels would put Clark at the forefront of becoming a truly sustainable university.

## **Background**

There are three different ways to utilize the sun for energy, Photovoltaic cells, Solar Heating, and Passive Heating. Photovoltaic Cells (PV) is the direct way to generate electricity. Two sheets of dissimilar semi-conducting sheets ("p" for the positive charge due to the small amounts of impurity that is added to make the sheet deficient of free electrons (negatively charged atoms); and "n" for the negative charge due to small amounts of impurities that are added to give the sheet a surplus of electrons) are placed together to create an electrical field. In the sun's rays there are photons which are tiny particles of energy that would reverse the charges of the sheets creating a reversed electrical field. When incoming photons enter the field, the electrons in the junction are stimulated to "jump" into the conduction band, creating a flow of electrons to the n-region thus creating an electrical current. (Boyle, 2004)

Solar Heating Panels are another way to utilize the sun in a more direct way. Panels with water running through various pipes along the sheet are circulated and heated directly by the sun. The heated water then is collected and circulated through the facility. Passive Solar Heating takes advantage of the feature of the house itself. This would be to reduce the heating costs. An example is having large areas of glass facing the south to maximize the amount of sunlight that would enter in the winter. Also heavy building materials such as concrete and bricks are used to store the heat in the house.

The implementation of renewable energy is becoming a more prevalent on campus. As of 2006 over 200 colleges and universities in the United States purchased renewable energy or created renewable energy structures on site (Putnam, 2006). Because college campuses are communities within themselves, they provide the ideal environment for the groundwork of renewable energy. Clark University has reason to start to make major steps toward installing renewable energy sources on campus.

President Bassett's signing of the American College & University Presidents Climate Commitment calls for the institution to create a development structure plan within two months of signing the pledge (ACUPCC, 2007). This provides a more President Bassett signed the commitment on June 14, 2007 and as for the plans to implement the "green" goals, our suggestions would prove beneficial (Clark University, 2007). An action plan is required of the commitment after two years of signing (ACUPCC, 2007). President Bassett was quoted saying, "For many years Clark has been fully committed to having all economic development take place within environmentally sustainable parameters" (Clark University, 2007).

Along with purchasing renewable energy credits, the plan should weigh the many benefits of onsite installation of renewable energy, which will only increase the climate

neutrality of the campus and reduce the fossil-fuel needs of the campus. Solar panels enable economic development within the sustainable parameters. Even though feasibility studies for solar panels have at Clark have been done before, the obstacle facing the

University is finding the financial assistance to fund such an economically significant project. Massachusetts Technology Collaborative is Massachusetts's development agency for the installation of renewable energies such as wind and solar. Projects undertaken by the MTC are partially funded through the Renewable Energy Trust which has been put in place to financially assist either individuals, businesses or nonprofits, communities or other groups into moving towards renewable energy.

The Small Renewable Initiative (SRI) is the application based program under the MTC that provides rebates for 10 kW energy installation projects. The Small Renewables Initiative doles out approximately \$3.6 million a year in rebates for projects such as the installation of a photovoltaic system (Small Renewables Initiative). The Small Renewables Energy application will be completed to the best of our group's ability with the help of faculty and administrations. It has to include information on the renewable energy system including specifications, worksheets, and cost worksheets. One of the other requirements to complete the application is the authorized applicants' signature and a completed acceptance form. The main purpose of the application is to determine if the project is feasible both system wise and economically, and to determine whether or not it is supported by the authorities funding it.

The installation of solar panels provides a simple solution for the introduction of renewable energy on Clark's campus. Fortunately, Aside from the environmental advantages of Clark installing renewable energy structures on campus, there are quite a few monetary advantages as well. Since solar energy reduces the use of fossil fuels, the increasing price of fuel will no longer be a major concern for supplying the campus with a sufficient amount of power (Putnam, 2006). Living in the "fossil fuel economy", the cost of fuel is only going to increase as the supply becomes scarce (Droege, 2002). The scarcer the resource, the more expensive it will be to purchase. Although there may be a high upfront cost for the installation of solar panels, they are considered worthwhile investments that will lead to an overall savings.

The installation of solar panels in Massachusetts can generate a payback within as little as five years and comes with a five-year warranty for the system along with a twenty-year warranty for the modules (Guide to Solar Electricity, 2007).

The most recent installation of PV cells in a higher education institution is at Harvard Business School on the roof of their fitness center, Shad Hall. It is Harvard University's first renewable energy project and is the second-largest installation, 36 kilowatts, of its kind in the Boston area. The PV cell project is projected to supplant the emissions of about 75,000 pounds of carbon monoxide annually. The Massachusetts Technology Collaborative (MTC) has provided a \$143,500 grant and the rest was an interest free loan from the Harvard University Green Initiative. (Powell, 2006).

## **Process**

In moving towards a more sustainable campus the focus of our project was to concentrate on the installation of structures to reduce Clark's carbon emissions. Rather

than focusing on the ample strategies that could aid in the carbon reduction, our team focused our efforts on technology that the Massachusetts Technology Collaborative awards grants for. The cost of installing renewable energy on campus is the primary obstacle. The main goal of the project was to find a renewable energy technology that could be implemented on Clark's campus, while relieving the often-expensive initial costs of such a project.

The initial step of the project was to fully understand the Small Initiatives Grant from the Massachusetts Technology Collaborative. The grant announcement suggests that a variety of different types of technologies could be supported by the MTC, including the installation of small-scale photovoltaic solar panel systems, methane gas generators, and wind turbines. We have researched various renewable technologies and with Clark's infrastructure, we have decided that the best would be to focus on solar energy. Methane generation and wind power but due to the large structural changes that are needed, they were ruled out.

In regards to the MTC's Small Renewable Initiatives Grant our group has begun drafting the application. The application requires extensive details on the campus' energy consumption and costs, so we have been working with Tom Wall, Assistant Director of Physical Plant. Thomas provided us with all the information we needed to cover the energy consumption section of the grant. Our meetings with Tom Wall were very helpful and demonstrated to us the inner workings and costs of Clark's utilities. During this process we improved our understanding of the benefits both environmentally and economically that the installation of solar panels or other alternative energy technologies could provide.

The first communication of Clark's administration was made to Jim Collins of the Sustainability Task Force. Via email Collins advised us to explore the Sustainability Task Force and use it as an instrument to explore Sustainable Energy practices. Noting that the specifics of the proposal are very important our research should be a thorough focus on beginning stages of implementing renewable structures. Cost effectiveness is a huge factor in whether or not solar panels are installed at Clark, which is why seeking grants, and other ways of funding has been crucial in this process.

In order to secure the stability of our project the group had to make sure that once monetary funds are collected the institutional decision makers on such a project would accept the installation. Early on we knew it would be important to contact those at physical plant. It was during our meeting with Paul Botis and Thomas Wall that the installation of solar panels emerged as an obvious choice for the environmental sustainability of Clark's Campus. The main problem however was the economic cost and the payback time. The photovoltaic system happens to be one of the more expensive solar installations because the main material that is used in PV cells is silicon. The marketing demand for silicon is high and competitive due to the use of silicon in computer chips. Under the Small Initiatives Grant the system size is a require 10kW maximum. A projected at such magnitude has an initial cost averaging \$90,000.

Understanding the high cost of such a project, outside means are needed to be secured. The Small Initiatives Grant only awards up to \$50,000 dollars in aid and even that number varies according to the project. Massachusetts also offers a set of tax rebates for projects that will aid in the environmental sustainability within the state. The whole cost however would not be met. It was here that we met with another Sustainable

University group working on the climate neutrality of Clark's campus. It was during the meeting that the difficulty to obtain grants for the simple science of solar panels is straightforward. It was here that the Green School Initiative was mentioned

The grant only allows for one structure to be awarded monetary support from the Massachusetts Technology Collaborative. The grants varied according to the project. A methane gas generator would call for a feasibility study, while the solar panels are now a generally accepted science, thus the money is for the direct installation. The methane gas generator seemed to include more intriguing science and was an overall more exciting choice. After weeks attempting to understand the exact science and cost effectiveness of the generator we thought it in Clark's best interest to invest in the photovoltaic solar panel system. Within Clark's campus the methane generator would not be an appropriate fit. Once settled on solar energy it was time to once again concentrate on the MTC grant application.

After contacting Kelly Brown, the Small Renewable Initiative Project Administrator at the MTC, she offered advice on the MTC rebate application. Hiring a contractor proved to be one of the loftier tasks of the application. Along with a necessary site consultation, a drafted design plan must also be submitted. A contractor would also help calculate the costs and determine what rebate we would be given from the MTC. Depending upon the project the MTC will give rebates of up to \$50,000.

The Small Initiatives Grant requires a visual component for the solar installations. A site evaluation and pictures must be provided in order to designate the specific location of the possible structure. Once again with the services of Thomas Wall we were able to go on a roof top site search. In searching for the perfect location it was important to find a roof that could support the solar panel structure, along with the foot traffic for the maintenance of the panels. Other specifications include the size of the roof, the position towards the sun, along with the shading of trees. With the current expansion of the Goddard Library the group thought that it might prove to be a feasible location. Unfortunately the roof proved to be unsuitable. Upon further surveying it was decided that the rooftop of the University Center, above the cafeteria would provide an ideal location. The sturdy foundation has great exposure to the sun with little shading from trees making it an optimal location.

For further information and research on solar energy the group went to a solar panel seminar at the Central New England Solar store. The seminar provided most of the general information we had researched about photovoltaic systems as well as detailed specifics of the efficiency of the panels and the process for the proper installation. It was here that we met Peter Slota, the owner and primary installer. Along with the other components the grant application requires an on site consultation and development/design plan. The CNE store will provide such information for a fee of \$70; fortunately for us Peter Slota agreed to a consultation and waived the fee.

On December 14, 2007 Peter Slota, Tom Wall, and our group had arranged for an initial consultation. It was during the meeting that we were able to discuss specific logistics in regard to installation at Clark. Prior to the meeting our research had been fairly generalized and inapplicable. Unfortunately due to snow conditions we were unable to survey the roof tops for an overall evaluation, but other important factors were brought to our attention that had been unforeseen. The shading of the designated structure appeared to be unfit for the solar PV cell installation. With minimal options on

campus, Peter Slota suggests the possible use of solar heating panels. More compact in size, the panels are currently a less expensive option that would work well in the designated area. With 1/3 of Clark's water use coming from the dining hall, the solar heating panels seem to be a feasible solution.

Our main obstacle was to focus our research and goals. The Massachusetts Technology Collaborative grant allowed for flexibility in the structures that had potential for installation. Solar panels were most definitely on our list of priorities, but we had taken an interest in more exciting forms of energy conservation mechanisms. It took almost half the semester to focus in and create a concrete plan for the suggesting of solar panels, along with filling out the small initiatives grant from the MTC. It seemed we to rely on others for a large portion of the project. The response time appeared to be one of our largest obstacles. While we feel as though our project was most definitely involved, overall I think we wanted something more hands on, than research.

## **Results**

Our Renewable Energy Installation team focused more on gathering the necessary data and engaging in dialogue that proved beneficial to our aim. In regards to our research the majority of the information we collected will enable the initial steps for the installation of PV cells on Clark's campus. Working off of Thomas Wall's recommendations, we have decided the ideal place for solar power installation at Clark University would be on top of Stoddard Hall. It is an older building but as one can see from the beams on the ceiling of the cafeteria, the roof is stable and its location gives it better sun exposure than most buildings on campus. Stoddard Hall also produces a lot of compost so it already has some attributes of a green building.

After our solar consultation as a group we decided that our findings would not be the best economical and logistical solution. Unfortunately our semester's work did not yield a product. However, we have learned from our trial and errors and plan to move forward with our project. Our setbacks have only inspired the group members to become more invested in the project and to see it followed through. Now that the initial cost has been reduced with the less expensive technology of solar heating, we hope to receive greater support from the administration.

At the meeting with the CNE Solar Store owner Peter Slota, we have been suggested to contact National Grid and also mayoral office for more funding and rebates to further help the economic costs of the Solar Heat Panels.

## **Conclusion**

Our next step as a group is to complete the site evaluation so we can complete the piece of the MTC application. Rather than trying to complete the entire grant application, which is not feasible or even possible for us to do without administrative power, we plan on completing as much as we can and presenting it to the Sustainability Task Force for them to follow through with. Also there will be more research done on Solar Heat Panels being that we have only scratched the surface on this particular technology. Another step

that needs to be done is contacting National Grid and the mayoral office to see if we are able to receive a rebate or overall economic assistance. Due to our high interest in bringing renewable energies to Clark University, our team is going to continue in this process even though our course is ending this semester.

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## **Greening Transportation at Clark University**

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Ashley Trull

Transportation contributes a third of all greenhouse gas emissions in the United States, yet at Clark University policies have not been established to reduce transportation-related emissions. This project involved researching alternative, more sustainable transportation options that have the potential to benefit Clark University economically, as well as environmentally. This project reviews programs that may be implementable at Clark University, including a ride sharing program and a bike sharing system. With a grant to initiate the ride sharing program GoLoco, Clark is already well on its way to improving its system of transportation. Other recommendations include additional consideration in a bike sharing system, adding more bike racks, and using alternative fuels. One product of this project is a recommended method of collecting data in order to complete calculations of carbon emissions from vehicles at Clark to be included in Clark's greenhouse gas inventory. Finally, we propose for consideration the hiring of a sustainable transportation coordinator on campus to facilitate transportation changes.

### **Introduction**

Human burning of fossil fuels is releasing greenhouse gases to the atmosphere that are increasing global average temperature and threatening the stability of the Earth's climate (IPCC Working Group I, 2007). Climate change has become the largest and most difficult environmental problem of our time, causing widespread concern about how to reduce greenhouse gas emissions and advance sustainability measures that will allow conditions and resources to sustain human life as we know it.

Transportation is one of the leading sectors contributing to global warming pollution. It contributes to global warming through the use of fossil fuels and the resulting release of primarily carbon dioxide, as well as methane, nitrous oxide, and chlorofluorocarbons. In fact, transportation is only second to power plants as a source of U.S. carbon emissions with a share of over 30 percent (U.S. Environmental Protection Agency, 2003). Dependence on fossil fuels to power vehicles is unsustainable as well as highly detrimental to the environment. The United States is highly dependent on automobiles as a form of transportation. Transportation in the U.S. emitted an estimated of 1,958.6 million metric tons of carbon dioxide, or 33 percent of the total energy-related carbon emissions in the US (Energy Information Administration, 2006). Also in 2005, there were 247,421,120 registered vehicles in the United States (Bureau of Transportation Statistics, 2005). Furthermore, in 1995, "there were nearly 600 cars per 1,000 people...or roughly 1.6 cars per household, and there were more cars than licensed drivers" (International Energy Agency, 2000). This reliance on automobiles increases our dependence on and demand for fossil fuels, particularly liquid fossil fuels including

diesel fuel and gasoline. The burning of these liquid fossil fuels for transportation is having a detrimental impact on our climate.

The mobility that transportation systems provides is valuable to society. According to research done by the Organization for Economic Cooperation and Development (OECD), transportation has been a major vehicle of progress as, “[i]t has helped expand intellectual horizons,” and travel has become a comfortable, commonplace lifestyle in OECD countries. Also transportation and mobility has been associated with “democratization and material prosperity” because ownership of an automobile gives people freedom to move and is even seen as a token passage into adulthood (OECD, 2002).

In order for the Clark community to improve the sustainability of Clark’s transportation system, the freedom to move around must be made available in other forms that will reduce the use of fossil fuels. For this reason, our Sustainable University course team decided to focus on thinking about alternative forms of transportation that will reduce the carbon footprint associated with transportation on the Clark campus. Here at Clark University, there are over 1,678 registered cars on campus this year owned by students, faculty, and staff (Melanson, 2007). This number accounts only for cars used on campus that are registered for certain parking lots and does not account for other gas-powered vehicles that may be used on campus, which are also contributing to the overall carbon emissions of our university.

The overarching goal of our team project was to evaluate the transportation system on campus and explore alternatives that might reduce Clark’s transportation carbon footprint by reducing the Clark community’s reliance on cars. After exploring a variety of preliminary options, we decided to focus on three specific goals that we could accomplish in one semester: (1) the introduction of a bike sharing program, (2) the implementation of a ride-sharing program on campus, and (3) the research of alternative fuels and vehicles for the campus fleet.

## **Background**

In the Sustainable University final reports from the 2005 and 2006 fall semesters, there were no research projects regarding transportation at Clark. There also has not been any inventory on greenhouse gas emissions from transportation on campus. Recently, the Clark University Environmental Sustainability Task Force completed an inventory on the main sources of greenhouse gas emissions from steam heat boilers, the cogeneration plant, and power plants that generate Clark’s electricity (Environmental Sustainability Task Force, 2007); the emissions from transportation were not included (Schmidt, 2007, personal communication). An inventory on the emissions associated with transportation would be helpful so that knowledge of the amount of carbon and other emissions will spark incentives to change the ways of transportation on campus. In addition, the inclusion of transportation in the Clark greenhouse gas inventory is a requirement for meeting the American College and University President Climate Commitment (American College and University Presidents Climate Commitment, 2007).

Although Clark’s Campus Sustainability Coordinator, Dave Schmidt has been involved in considering a few transportation programs and ideas, including how to promote bicycle use on campus and discussions about two car-sharing programs

(Schmidt, 2007, personal communication), there is no single person at Clark who is responsible for transportation planning at Clark. Parking permits and the escort service are managed by the campus police and the vehicle fleet is managed by physical plant.

The two car-sharing program ideas are GoLoco and Zipcar. GoLoco is “a service that helps people and communities create their own personal public transportation service” (GoLoco, 2007). GoLoco provides a place online, so people can communicate, in order to find others who are traveling to the same place. GoLoco reduces CO<sub>2</sub> emissions, traffic congestion, and the amount of parked cars. GoLoco is also great for networking and it encourages coworkers to travel together. This service calculates CO<sub>2</sub> emissions and it allows drivers to charge passengers for rides. GoLoco is very intriguing because it is free to sign up, since it is a Facebook application (GoLoco, 2007). On the other hand, the other car sharing program, Zipcar is not free to sign-up. There is a membership fee for Zipcar and it includes gas and insurance. Then the members are charged by the day or by the hour for using the Zipcars. Zipcar is the largest car sharing program in the world, and there are Zipcar providers in more than thirty-five cities, including Boston, Chicago, New York, London, San Francisco, Toronto, Washington D.C., and Vancouver. There are more than 120,000 members and more than 3,500 Zipcars. Zipcar is now even larger, since on October 31, 2007, Zipcar and another car sharing program, Flexcar, emerged (Griffith, 2007). All in all, GoLoco is great for people who are interested in sharing rides with other people, while Zipcar is great if one would like to use a car from time to time, without having to own one.

Next we provide some background and context related to each of our three goals.

#### Bike-Sharing programs

One form of sustainable transportation that some campuses have implemented is bike sharing programs. At the Massachusetts Institute of Technology, a bike sharing program, called TechBike that uses a swipe-card system was implemented in 2004 by students (Brown, 2005). This program at MIT used cheap bicycles from police bike auctions and thrift stores, and the program benefited from donations from alumni, faculty, staff, and the community. The student leader of this program, Atif Qadir, also received a grant from the MIT IDEAS competition in the Spring of 2004 (Brown, 2005). Once the bikes were collected, they were painted and designed in the same way, in an attempt to keep track of the bikes and to prevent theft (Qadir, 2004).

TechBike runs throughout the school year, except during November to March. This program makes it very convenient for members to find bikes, since locations of available bikes are shown on a website. This program is also convenient for the college student, since it is cheap. If the bike is used less than two hours then it is free, but if it is over two hours, then there is a fee of one dollar. The bikes can also be used overnight for five dollars (Qadir, 2004). TechBike has been successfully running and flourishing since 2004, so this offers hope to our team that it is feasible to implement a bike sharing program at Clark.

Currently in Worcester there is a non-profit program called “Earn-A-Bike.” This system provides incentive for people to use bikes by giving away donated bicycles after completing educational training describing how to repair and maintain a bike and also

volunteering five hours towards the programs operation. Earn- A-Bike has been successfully running in Worcester for over a year.

### Ride-Sharing Program

Ride-sharing programs are another alternative transportation strategy that can be implemented on college campuses.

In March of 2007, the Worcester UniverCity Partnership, which is a nonprofit coalition of different organizations that deals with the colleges in and around Worcester, Massachusetts (Carriere), did a survey about how college students in Worcester travel and how they would travel if certain programs were offered to them (Labadorf, 2007). Part of the survey was dedicated to Zipcars. Zipcars are appealing since it is estimated that each Zipcar eliminates the need for seven to fourteen cars on a campus (Robertson, 2007). Out of the 1,300 students who answered the survey, 843 students (65.9%) “stated that they would consider subscribing to the service [Zipcars] in general” (Labadorf, 2007). However, the percentages of students who would use the Zipcars were not as high. 29.1% said they would use Zipcar five or more times per a month, 14% said they would use it about four times a month, 20.8% said about three times, 22.6% said about two times, and 13.6% said they would use it zero to one time a month. Even though there are not a high percentage of students who would often use this service, 55.3% said they would sign up for Zipcar if it was at their college.

Zipcars could be successful on campuses, but from the survey, it was found that a Consortium Shuttle appealed the most to students, especially if it ran during the weekend. The shuttle would be paid by the Worcester Consortium of Colleges, which is made up of thirteen different colleges in the area, and it would take students to certain spots in the city. 81.6% of the students who took the survey said that they would use the shuttle and 25.8% said they would use it five or more times a month. The Consortium Shuttle would drive to destinations, like the train station, clubs, other Worcester colleges, and the Blackstone Valley Mall. The shuttle is a great form of ride sharing, since students would use the shuttle, instead of individually driving their cars to desired destinations. Also, if there was a Consortium Shuttle, this could be an incentive for students to not bring cars on campus. The shuttle is an option for college students in Worcester and according to the survey, they are more apt to use the shuttle than using and paying for Zipcar.

At Holy Cross there are two Zipcars, a Toyota hybrid and a Ford Escape. The student rate is \$35 a year and then there is an additional fee of \$8 per hour. There are only forty-five students signed up as Zipcar members at Holy Cross, a campus of 2,817 students (College of Holy Cross, 2007), but there is hope that the program will grow as it becomes more known to students and prospective students. Less than 25% of the members are currently using the Zipcars. Holy Cross hoped that at least 50% of the members would use their membership, since the expenses it cost to implement Zipcar need to be paid (Robertson, 2007). At the University of North Carolina, faculty and students over twenty-one years old can use the Zipcar program, and the members only have to pay \$20 a year, without any other fees. There is enthusiasm to use this program, since twenty dollars is much cheaper than the average of \$7,000 a year it costs to own a vehicle (Rainforest Action Network, 2007). Zipcars are also used at Brown University, Rutgers University, and the University of Massachusetts in Boston (Rainforest Action Network, 2007).

### Alternative Fuels/Vehicles

Many colleges are implementing cleaner fuels and cleaner vehicles in order to reduce greenhouse gas emissions to help mitigate global warming. For example, Oregon State University uses six Toyota Prius hybrids and twelve flexible-fuel automobiles (Rainforest Action Network, 7), which are powered by either gasoline or a mixture of 85% ethanol (U.S. Department of Energy). Another university that uses hybrid vehicles is the University of Minnesota. The University of Minnesota has a total of twenty-eight hybrids, including twelve 2007 Toyota Priuses (Rainforest Action Network, 6). Besides using hybrids and flexible-fuel automobiles, other universities, like the University of Michigan, has a vanpooling program for commuters and they offer free bus passes for the faculty and staff (Rainforest Action Network, 6). These strides made by these various universities are proof that campuses can offer more sustainable ways of transportation.

### Process

#### Bike-Sharing Program

One of our goals is to promote bike-use on campus by exploring the implementation of a bike sharing program and by trying to get more bike racks on campus. The first step to reach this goal was to take inventory of the number of bike racks on campus and the number of bikes each rack can hold. We did this inventory to be able to demonstrate the need for more bike racks.

We also put up a survey for two weeks on *Student Digest* about interest in bikes and a bike sharing program. The survey consisted of the following questions: “do you like bikes,” “would you use a bike sharing program if one was implemented,” “if you had a bike would you use it over a car to drive to specific places,” “do you have a bike on campus,” and “if yes to the previous question, are you able to lock it up on a rack, and if not, then where do you usually have trouble.” The answers to these questions were intended to prove that there is a need for more bike racks, especially in the residence halls, and that there is interest for a bike sharing program on campus.

After we gathered all of this information, we talked to Kevin Forti, the Assistant Director of Residential Life and Housing, about the bike rack problem and the bike sharing program idea. Our team had a meeting with Kevin Forti to discuss with him the need for more bike racks, especially in the residence halls. We showed him pictures of the full racks and the bikes that had no place to be locked. For example, in Wright Hall, there were eight bikes in the room that had no spot to be locked on the rack because all six spots were already used. In other residence halls, the bike racks were exactly full, which indicates that students may keep their bike in their rooms, because there were no more spots. During the meeting Kevin expressed that one reason the racks in the residence halls are full could be because students only store their bikes on the rack and don't use them— he mentioned that he rarely sees pupils riding their bikes (Forti, 2007). At the conclusions of our meeting, after seeing the pictures and knowing the facts about the number of bike racks on campus, Kevin said that he will look further into the bike rack situation (Forti, 2007).

### Ride-Sharing Program

A second goal is to help make transportation at Clark more sustainable is to bring a ride-sharing program to Clark – we were particularly interested in Zipcar. We first talked to Dave Schmidt, who is the Campus Sustainability Coordinator, regarding the Zipcar program and he mentioned that there is great interest for Zipcar on the Clark campus (Schmidt, 2007). Mike McKenna of Student Leadership and Programming Activities is also quite interested in having Zipcars on campus (McKenna, 2007) and President Bassett mentioned that the Consortium has been trying to lead the Zipcar initiative (Bassett, 2007). So we learned that there is already a process occurring to initiate Zipcars, and Dave Schmidt had recently attended a meeting with people from Worcester, the Consortium, and other colleges that use Zipcars (Schmidt, 2007).

Jack Foley, the Vice President of Government and Community Affairs and Campus Services, said that the Zipcar program is very interested in flourishing in Worcester and it is already in full swing at Holy Cross, therefore he wanted to meet with Adam Brophy, who is the Director of Zipcar, about implementing Zipcar at Clark (Foley, 2007). Our team then tried to set up a meeting with Adam Brophy, but unfortunately, we were not successful in communicating with him; a meeting never occurred. Since our team was not communicating well with Adam Brophy, we e-mailed Kathy Robertson, who implemented Zipcar at Holy Cross. She gave us information about Zipcars in general and Zipcars at Holy Cross, but not specific steps on how to start Zipcar at Clark. She only stated, “Basically, the decision to utilize Zipcars [at Holy Cross] was a long time in the making and the result of a convergence of different agendas and programs” (Robertson, 2007). Our team e-mailed her back for specific steps or suggestions, but we never received a reply. We then tried to contact Jack to see if we could meet with him in order to discuss the e-mail from Kathy Robertson and what to do next since we couldn’t contact Adam Brophy, but the reply did not have a direct response. At this point, our team realized that we needed to find another approach, since our previous attempts were not successful nor making any progress.

In trying to establish a ride sharing program, we came across two programs which have shown much success. GoLoco is a program in which people post where they are planning to drive to and if they have room for someone who needs a ride to the same location. We are in contact with a representative from the program who is trying to make more universities aware of the benefits of this program. “If 1,000 people post three trips each year, there will be this amazing new way for people to share rides. You would be able to go on GoLoco and get a ride to almost anywhere! Students benefit by reducing their travel costs and spending more quality time with friends. The earth benefits by lower greenhouse gas emissions” (Chase, 2007). This program would reduce the amount of cars and lessen the congestion, while providing students and faculty with free rides.

Dave Schmidt had mentioned that he was willing to work with Mark Chase, the Transportation Program Director for GoLoco to bring GoLoco to Clark University, especially when Chase mentioned the opportunity for a pilot grant to start up the program in late September. After applying for this grant we looked into other ride sharing programs which had been implemented at other schools.

In addition to Zipcar and GoLoco, during our team research we came across another ride-sharing program with potential at Clark – using the facebook carpool application. With 95% of college students using Facebook, (Zimmer. 2007) this is a

good tool to engage college students. The Carpool application allows students, faculty, and staff (anyone with a Facebook account) to post if they need a ride or are able to offer a ride somewhere. This ride sharing service allows people to charge money, if they choose, to help alleviate financial pressures on which college students are well aware of. By having this program run through Facebook, users are allowed to view their driver or passengers profile before they dedicate themselves to anything. The system allows users to search and find rides within their university network as well as in other locations, with over 20,000 users already in North America and the numbers rapidly increasing. Implementing this program merely takes promotion and can create a huge incentive for users to meet new people, save money, and be more energy efficient (Zimmer, 2007). After finding this program while attending Power Shift in early November (a national youth summit regarding issues of global warming), we found it extremely easy to start up. By creating a group titled "Clark Carpool" and inviting people to join in adding the application, the word spread rather quickly. We sent a message to all those in the Facebook group inviting them to post if they wanted to offer a ride or needed a ride before Thanksgiving break, which seemed necessary for promotional purposes.

Potential problems with these two programs include a lack of publicity, support, and participation. In order for one of these to be successful, a lot of time and effort will be needed to publicize the program and gain participants. We may need information sessions, brochures, fliers, a website, and media collaboration within the Clark community to gain enough support for a ride sharing program to become successful.

#### Alternative Fuels/Vehicles

In order to work on the Alternative Fuel facet of our project, we started by doing research about possible alternatives to gas-powered vehicles. We found in our research that there were multiple possibilities including electric, hybrids, biodiesel, waste-vegetable oil, liquefied petroleum gas, natural gas, and alcohol fuels (ethanol). All of these varieties provide solutions to reducing carbon emissions by using a different fuel source, although many of them have other negative impacts or are not easily accessible at this point in time. Our main focus was on biodiesel as an alternative fuel because of its increasing accessibility and feasibility.

After doing some basic background research, we looked into where it would be possible to use alternative fuels on campus. We found that none of the vehicles on campus can be powered by alternative fuels at present, but six maintenance vehicles on campus run on diesel and can therefore be converted to biodiesel (see Results for further detail).

Next we decided to do an analysis on how much money is being spent on gasoline fuel for the vehicles on campus. We targeted the major departments and sectors of transportation and vehicle use on campus to get a general idea of what is being spent on fuel at Clark. We gathered information from Erick Theimke (Athletic Van Manager) about the event vans used by the Athletic department. We received data that shows the amount spent on each of the three vans, at each fill-up (See Results section). From there, we also collected data from Mike McKenna, the Student Leadership and Programming Director, about the Student Council van shuttle. We wanted to find out how much money is spent per week on gasoline in order to run the shuttle. Also, we collected data about the Escort vans and how much is spent per week to fill up their tanks. We collected data from

Physical Plant about the amount of gas used to power the maintenance trucks, vehicles, and machinery. Lastly, we spoke to Paul Coute about the purchase of vehicles and consideration for buying alternative vehicles or using alternative fuels.

**Results**

For our project, our team tried to collect a wide range of data to get a better idea of what the transportation situation currently is at Clark and what the needs of the students are. First, we collected data about general transportation information to try to get a grasp on how students transport themselves and where they most often need transportation.

**Vehicle Reliance on Campus**

We found that there are about 1,678 parking stickers already distributed, and this is only half way through the year. That number is expected to rise at the beginning of the Spring 2008 semester. Also, this number only includes faculty, staff, and students who have registered vehicles on campus parked in one of the 10 commuter lots or in the parking garage, meaning that even more cars are probably used on campus.

**Bike-Sharing Program**

One of our targeted data sets was the bike environment at Clark. We tried to get a feeling about if people often use bikes or if there were the resources to start a bike-sharing program here at Clark. We developed and publicized a bike survey on *Student Digest*. Although our survey was not completely thorough or widely taken (only 16 students participated) we found that all respondents liked bikes and 85% said they would use a bike sharing program if it were implemented (see Table 1). Another interesting point was that of the 8 respondents who said they had a bike on campus already, 6 of those said they were unable to lock it up on a bike rack (Table 1).

**Table 1: Bike Survey**

Question	Yes	No	Sometimes
Do you like bikes?	14	0	0
Would you use a bike sharing program if one was implemented?	12	2	0
If you had a bike would you use it over a car to drive to specific places?	13	1	0
Do you have a bike on campus?	8	6	0
If yes to the previous question, are you able to lock it up on a rack?	2	6	2

**Additional Comments:**

**Mentioned trouble spots where bike racks would full up:** Dana Hall and Wright Hall  
**Mentioned needed places:** Dana Commons, Traina Art Center, and Blackstone Residence Hall

Our survey definitely provided some interesting results despite its limited nature; however we recognize that it was not as complete as it could have been. Some flaws of the survey were that it was not publicized enough, respondents were completely voluntary (and the survey took enough time/effort to be unappealing to many), and there may have been a bias in that students who feel strongly about bikes would be more inclined to respond to the survey. The survey is just a starting point and will hopefully be continued and expanded in a more effective manner.

The next step for our bike-sharing program analysis was to further investigate if there are enough bike racks on campus for students to safely lock up their bikes and to support a bike sharing program. We found that there were bike racks in every residence hall on campus, except for the newly built Blackstone Hall (see Table 2). There is a “bike room” in the basement of Blackstone, but the room can only be opened by a R.A. and with the use of an elevator. Out of the 8 other residence halls on campus, 5 had bike racks that were full or over-full (see Images in Appendix 1). Of the other buildings on campus that were part of the inventory, only 5 out of 13 have bike racks (see Table 2). There are also no bike racks along Woodland Street, where many classes are held inside the various Houses. In total, there are 14 bike racks on campus that are made to hold about 114 bikes.

**Table 2: Bike Rack Inventory**  
**Bike Racks at Clark University**

Location at Clark	Number of Bikes that the Racks Hold
Wright Hall	6
Bullock Hall	6
Dana Hall	9
Ruth Dodd Hall	9
Maywood Hall	9
Hughes Hall	9
Sanford Hall	8
Johnson Hall	8
Blackstone Residence Hall	0
Goddard Library	6
Higgins University Center	6
Jonas Clark Hall	6
Kneller Athletic Center	8
Dolan Athletic Center	8
Atwood	0
Jefferson Academic Center	0
Dana Commons	0
Little Theatre Center	0
Traina Center for the Arts	0
Arthur M. Sackler Sciences Center	0
Woodland Street Houses	0
Kasperson Library	0

**Total Number of Bike Racks: 14**

**Total Number of Bikes that can be Locked on all 14 Racks: 114**

### Ride-Sharing Program

For the ride-sharing portion of our project, we ran a pilot program for a carpooling program on Facebook to see if it would be successful among students at Clark. Within the first week of publicizing, circulating, and networking the problem, over 70 students had joined. After about 3 weeks, there were over 150 members. This growth occurred with very little publicity or promotion and just happened through the natural networking that occurs on Facebook.

Also, in conjunction with our project, Dave Schmidt, the Sustainability Coordinator on campus, applied for a grant from GoLoco being offered to three schools in Massachusetts. On November 28, we received notice that Clark had been awarded the grant for the implementation of a GoLoco ride-sharing program at Clark. This is something that will be beneficial next semester, outside the realm of what we are working on in this class, but still very helpful in achieving the goals of our project in the future.

### Current Transportation Evaluation & Alternative Fuel/Vehicles

For our project, we also collected data to investigate the possibility of using alternative fuel on campus. We began by first collecting data about Clark's main fleet of vehicles. We found that there is one Student Council shuttle van, two Clark Escort vans, three Event vans (used mostly for sporting events), and a large variety of vehicles used by Physical Plant for campus maintenance. We found that out of all the vehicles, 6 of the maintenance vehicles were the only ones with potential for being converted to alternative fuel (biodiesel). We continued to gather information about the different vehicles, how often they are used, and how much is spent on fueling them. The purpose of this data collection is to analyze how money is spent on transportation at Clark and if it is spent efficiently on transportation that is well-utilized by Clark students.

The Student Council shuttle vans are used on weekends for shuttling students back and forth between local malls and campus on Friday and Saturday nights. On Friday nights the van makes about seven round trips to Solomon Pond Mall (11.4 miles from school). The average van averages 43 riders per night for the Solomon Pond shuttle. On Saturday nights the van makes seven round trips to Blackstone Mall (6.5 miles away), and averages 43 riders per night. Also, the van can be rented out by students for other events. An average of \$280 per month is spent on fueling the student council van in order to run the shuttle on Friday and Saturday nights (McKenna, 2007). It is clear that this service is relatively popular with students, but due to high mileage traveled (about 1,000 miles per month) a more efficient fuel source would be beneficial.

For our project, we also collected data about the Clark Escort vans, a service that runs 2-3 shuttle vans to take students anywhere within a quarter mile radius every day between the hours of 4 pm and 4 am. To get an idea about the use and costs of Clark Escort University Police provided us data from a 2-week period in November with rough estimates of utilization, riders, and gas costs. The data showed that an average of 230 students use the Escort service per evening, averaging about 1-2 students per service call. Also about \$560 is spent per week to fuel the Escort vans (Peter Murray and Diane McCarthy, see Appendix for further information). Our evaluation of the Escort system is

that it seems to be widely used, and thus could benefit from greater fuel efficiency or alternative fuel source. Also, the efficiency of the program itself could be improved by encouraging carpools to destinations, so it is not just 1 student riding at a time. One of the suggestions made by University police staff was that a more efficient method of shuttling students to popular destinations (such as the super market) in larger groups. Furthermore, another criticism about the Escort Service that came up in the analysis of our results was that the service only goes with a quarter of a mile of the campus, which is a distance easily traveled by walking or biking. There is a greater need for automobiles when traveling farther than a quarter mile and Clark Escort does not meet that need for students, which is a reason for reliance on personal vehicles on campus.

Another service offered to students is a shuttle, the vehicle being a school bus, to Boston and Providence, each once a month. The shuttle to Boston is very popular and in the months of October and November, 34 and 27 students took the bus, respectively. On the other hand, only three students utilized the shuttle to Providence in November (McKenna). Due to the turnout, a smaller or more efficient vehicle might be considered for this shuttle.

The three Event vans are managed by the athletic department and used primarily for transport to and from athletic events. Students can rent out the vans when needed for this use. The vans are fueled up about once a week, costing an average of \$39.45 per fill. About \$375 is spent per month fueling these vehicles (see Table 3).

**Table 3: Event Van Fueling Costs – Fall ‘07**

Van 1 (GSOM)		Van 2 (Green)		Van 3 (White)	
Date	Cost	Date	Cost	Date	Cost
17-Aug	42.51	17-Aug	\$66.21	17-Aug	\$47.23
22-Aug	72.39	22-Aug	\$52.23	7-Sep	\$40.40
12-Sep	36.02	12-Sep	\$65.62	19-Sep	\$19.92
26-Sep	62.4	19-Sep	\$10.87	26-Sep	\$19.24
3-Oct	32.06	26-Sep	\$29.06	3-Oct	\$26.48
10-Oct	26.01	5-Oct	\$38.57	10-Oct	\$22.18
17-Oct	65.98	17-Oct	\$50.00	17-Oct	\$29.59
24-Oct	73.09	24-Oct	\$51.89	31-Oct	\$23.62
7-Nov	52.98	31-Oct	\$32.88		
		7-Nov	\$35.69		
<b>Total</b>	<b>\$463.44</b>	<b>Total:</b>	<b>\$228.66</b>	<b>Total:</b>	<b>\$433.02</b>
<b>Grand total for approx. 3 month period:</b>					<b>\$1,125.12</b>

Physical Plant on campus has a large fleet of vehicles that include 6 pick-up trucks that run on gas, 3 small golf cart vehicles (gas), a large variety of mowing equipment (gas), 1 diesel truck, 1 New Holland Skid Steer (diesel), 1 Mitsubishi Cab-over dump truck (diesel), and 3 grounds tractors (diesel). Between all of these vehicles,

Physical Plant spends, or is at least budgeted to spend, \$12,000 per year on fuel (Paul Bottis and David Caputo). This averages out to about \$1,000 per month since maintenance is continued even when school is out of session in the summer. There is potential for biodiesel use in the 6 vehicles that currently run on diesel, but it would require investment in conversion parts for the vehicles and equipment to produce the fuel if it were to be produced on campus. There is also potential to use waste vegetable oil from the campus cafeteria to produce biofuels, but that would require investment in a filtration system to remove food particles from the waste oil. (Caputo, see Appendix 3 for further information). Each of these options has potential to save Clark a lot of money on fuel costs but would require further professional assessment as well as upfront capital investments.

To summarize the data we collected, between the 3 transportation departments we investigated (and there are definitely more departments using vehicles on campuses that have not been factored in), Clark spends at least \$3,995 per month on using conventional fuels to power the vehicles on campus. Over one entire school year this amounts to over \$31,160.

### **Conclusion**

After working on this project all semester, we are now at the beginning stages of actually implementing change in Clark's transportation options. Since Clark does not have any extensive transportation records, we have struggled to find much statistical information regarding its transportation usage. Transportation usage accounts for 31% of the carbon emissions in the United States, but was excluded from Clark's Sustainability Report. By signing the Presidents Climate Commitment, a more green transportation system should have been one of the immediate major projects taken into consideration. We are still in the progress of developing a bike sharing program, which will promote on-campus living and be relatively cheap to implement. Also we recently received a grant from GoLoco allowing us to implement and promote a ride sharing system on campus, but this is only the beginning. Below is a list of projects we strongly recommend which will be beneficial in creating a transportation system that will save thousands of dollars for the school and will eliminate greenhouse gas emissions from transportation.

### **Recommendations**

- Explore options of hiring a Transportation Coordinator to keep track of the vehicles being used, the frequency in their usage, greenhouse gas emissions associated with transportation, and generating innovative ways to keep costs of fueling vehicles as low as possible. This initial investment would have a quick economic feedback in savings associated with enforcing better methods of fuel efficiency allowing a reasonable salary to be available for the position.
- Keep parking records of decals issued each year, distinguishing between commuters, staff, faculty, and students, where students are from, and what their car's approximate fuel efficiency is in order to calculate greenhouse gas emissions more precisely.
- Sign a commitment that the next fleet of vehicles purchased by Clark will be hybrid or at least more fuel efficient (should average at least 40 mpg)

- Produce bio-diesel from cafeteria waste to use for maintenance vehicles, which currently operate on diesel
- Add additional bike racks, especially in the residence halls
- Collaborate with Earn-A- Bike to implement a bike-sharing program. Possibly using a Clark Identification swipe system to rent out the bikes from a central location, such as the University Center, would be successful. This would be a possible opportunity to establish a work study program.
- Offer a reduced price to park or have a reserved spot for people participating in ride sharing systems

We hope that our project is just the starting point of reforming transportation at Clark to more green methods that reduce our greenhouse gas emissions. Between the three goals we worked on and the recommendations we provided, we have laid a basic groundwork for sustainable transportation to grow and move further. So, Clark, what are we waiting for?

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**Appendices**

1. Pictures of bike racks in residence halls on campus



**Maywood Hall**



**Dana Hall**



**Hughes Hall**



**Wright Hall**



**Sanford Hall**



**Bullock Hall**



**Dodd Hall**

## 2. E-mail correspondence with Clark University Police-Escort Service

Subject: Escort Questions

Tue, Nov 20, 2007 at 3:50 PM

Daily Calls:

Sunday-Wednesday

4-10: 125/150 calls which translates to about 150-175 people

10-4: 60/80 calls which translates to about 60-70 people

Thursday & Friday

4-10: 125/150 calls which translates to about 125-150 people

10-4: 80-100 calls which translates to about 85-105 people

Saturday

4-10: 75-100 calls which translates to about 85-105 people

10-4: 75-100 calls which translates to about 85-105 people

Weekly Totals:

4-10: 1050 people

10-4: 575 people

Gas Prices:

Van 1- Roughly 35 dollars a night (depends on how busy, how cold, etc)

Van 2- Roughly 30 dollars a night (Again, depends on how busy, how cold, etc)

Van 3(which only does 4:30-8:30)- 15 dollars a night

Weekly Total for Gas: 560 dollars

The Escort boundary, as long as anyone can remember, has been 1/4 of a mile around campus. This distance is reevaluated depending on the needs of Clark students. For example, after the student body expressed its wish to be able to grocery shop at Shaw's Market, Escort accommodated and allowed escorts to Webster Square. The same is true of CVS pharmacy on

Park Ave. Also, escort changed its policy regarding picking up and dropping off students at bars within the allotted radius.

Although Escort attempts accommodating the Clark Community, there are some areas that need repairing. For example, instead of 300 to 400 different calls a week to Price Chopper, designating certain times, in a similar fashion to the Consortium Bus, would eliminate a great deal of frustration students express with this service. A huge complaint with Escort is inaccurate E.T.A.'s (which stand for an estimated time of arrival), but with two vans going back and forth between Price Chopper 50 times a night (not to mention taking into consideration external pressures such as traffic or in-climate weather) it is hard to be accurate 100% of the time.

I hope this information helps you in thinking of ways to improve Clark's escort service.  
Peter Murray

Appendix 3: Interview with David Caputo about Biodiesel on campus

*-How many vehicles have potential for biodiesel?*

David: There are 6 vehicles or pieces of equipment used for transportation, or landscape maintenance: a Ford f350 Superduty pick-up, New Holland Skid Steer, Ford front end loader tractor, John Deere front end loader tractor, Kubota lawn tractor, and a Mitsubishi cab-over dump truck. The school also has a 9-cylinder engine that they use in the cogeneration plant that I think runs off of waste oil and other fuels I think about the multi fuel, but that would also be able to burn bio fuel.

*-What have you thought about doing or started doing?*

David: I have been researching and going to seminars on bio fuel and biodiesel. I have also talked with upper management about possible conversions.

*-Do you think biodiesel is feasible for Clark?*

David: I really don't know if bio diesel is feasible for Clark. Bio diesel is more expensive to make. You have to purchase the corn, peanut, soy, etc. oil as well as the diesel fuel. Then, depending on the mix you add the two together to give you the mix. Most common ones made are b5, b10, and b20 but other mixtures have been produced. What you can do, but it is not recommended for a proper mix, is just to add the two together and stir or shake it in the mixing drum. It is recommended for proper mixing to be put into a proper mixing vessel and allowed to sit for a period of time and mixed through a certain process.

A few of downfalls of biodiesel or straight bio fuel are that it will gel up (clog the filters and injection ports) at higher temps than straight diesel. You have to keep the fuel warm and you will also lose some power as it is not able to push as much snow and how much you lose is all dependent on that piece of equipment.

I know you are not working on the heating part but you can also use it for your heating system. It does burn hotter so again it is more expensive to burn a mix but straight bio is cheaper and you can get a special pump and nozzle made just for biodiesel.

*-Would it be possible to use waste oil/grease from the cafeteria to power any vehicles or use as any sort of fuel on campus? Does it come close to being a good (reliable, sufficient, etc) source of fuel? And can you make 'biodiesel' out of that or is that 'biofuel'?*

David: If there is no diesel in the fuel than it is biofuel if there is a mix of diesel and bio than it is biodiesel. Waste oil/grease can be used but it is not really the best source to use because of the impurities from the food being cooked in it. You would have to put the waste grease/oil through a process of filtration heating and filtering the waste several times to get out the food particles and even at the end there is still impurities at the end process that will affect the fuel. It is still usable but not as good as virgin oils.

## **Improving Clark's Recycling Infrastructure**

Hallie Westermann  
Dominic Pascarelli  
Cameron Miller

Recycling is an integral aspect of solid waste management. One of the most crucial criterion to an efficient recycling program is adequate infrastructure. This project seeks to improve the existing recycling program at Clark University through infrastructural improvements to the program, namely the quantity and location of paper and container recycling bins. Through an inventory of campus, we documented where additional recycling bins are needed and evaluated ways to improve the efficiency of collection and participation through communication with various members of the Clark community. The inventory process proved to us that recycling is a complicated practice and achieving success requires improvements in many areas, including the provision of ample bins to encourage more participation on campus.

### **Introduction**

Waste management has not always played a prominent role in the everyday thinking of the human population. Drivers such as technological advance, increasing levels of affluence, and increased population growth have caused the amount of waste that is produced to skyrocket to a point where deliberate management of its various streams is necessary. The goal of managing liquid, hazardous, and solid waste has created large industries that the modern world depends on to function properly. Recycling, as part of solid waste management, has always been a poster-child of the sustainability movement (Acunzo et al., 2005).

Although one's lifestyle cannot be considered sustainable if she simply recycles, the act of recycling does provide the environmental, social, and economic benefits associated with reducing waste. These benefits stem from the fact that solid waste is most commonly disposed of through burial in a landfill or by incineration. Decomposition of trash in landfills releases both greenhouse gasses and leachate, a liquid made toxic by percolating through trash (US EPA, 2007). Incineration of trash releases greenhouse gasses, particulate matter—ash, and pollutes landfills with the remaining residue. While advances in technology have lessened the environmental impact of these methods, they remain sources of air and water pollution, making them environmentally, socially, and economically costly (CUES Task Force, 2007). Viewed in the aforementioned manner, recycling is an investment and, in the longer term, can only be profitable for the earth its inhabitants (Acunzo et al., 2005).

Our team was motivated to improve the efficiency and functionality of Clark's program through infrastructural and educational changes which can help the University reduce costs and more effectively reduce our waste stream. The goal of this project is to improve the existing recycling program at Clark University through infrastructural improvements. We aim to evaluate the quantity and location of paper and container

recycling bins and based on this make recommendations to the University for ways of improving the recycling program. Through this project, we also aim to implement a structure for communicating with custodial staff to organize a procedural training of university physical plant staff in the implementation, collections and development of a successful recycling program. This report aims to provide the following: the necessary context in support of recycling, the current status of institutional recycling at Clark and other universities, and what changes Clark can make to its program.

## **Background**

### **Waste and Recycling**

In 1960, Americans generated 88.1 million tons of trash per year; by 2000 that figure had risen to 232 million tons (Cohen, 2006). Additionally, in that time, the personal increase in trash production rose from 2.7 pounds per person per day to 4.5 (Cohen 2006). The problems associated with waste are most pronounced in places with high population densities, often urban settings (Melosi, 2005). Clark, as a university within a large urban area, absorbs the impact of trash which flows inward from countless sources—food services, the mailroom, and the purchases of Clark students to name a few. While recyclable solid waste is only one type of trash, how we treat this waste is of great importance to the environment. Too often, waste is sent to landfills, brimming with unsorted recyclable material, or exported to landfills in other states. In the case of Clark's waste, it is sent to the Wheelabrator incineration plant in Millbury, which uses the energy from produced by incineration to generate electricity.

Recycling saves energy and virgin materials, particularly in the cases of aluminum and glass, which incur no loss in quality of product, despite the number of times they have been recycled (Bureau of National Affairs 1990). Additionally, recycling reduces the amount of virgin materials needed to produce consumer goods. In the case of paper, 17 trees are needed per ton of paper (BNA 1990). Considering the Institutes of higher education can play an integral role in influencing a global trend toward better recycling practices.

### **The National Approach to College Recycling**

Most colleges and universities now have some sort of recycling program, but effective and exemplary programs take careful attention to maintain. Examples of several universities are mentioned below to detail how specific issues are dealt with and what conditions are necessary for a recycling program to run smoothly and efficiently. These examples can provide Clark with models on which to base the actions we choose to take in improving our recycling program.

#### *University of Colorado at Boulder*

University of Colorado at Boulder, UCLA, and Washington University conducted a national survey of colleges and universities in 1990 and determined that about 78% had "fairly well established" recycling programs, while many of the remaining 22% have at least a small volunteer program. Jack DeBell is student-turned-organizer of Boulder's program and notes that student involvement and pressure are main forces behind recycling programs in higher education. Since Clark's program has always been student-

run, student involvement and pressure has always been an integral part of recycling here. Using the power of the student voice has and continues to be challenging in reaching administration for needed funding and support. DeBell of CU sees the need for recycling to be an integral part of the educational experience. The CU Solid Waste Task Force was formed on Earth Day in 1990 by a variety of well informed stakeholders that included students. The task force deemed 5 areas of integral importance to a successful recycling program: procedural training; collections; processing; marketing; and program development.

Debate continues on the issue of making recycling programs student-run or making them a part of traditional waste management run by the physical plant at many schools (Keniry 1995). It is necessary to have the professional staff for a full fledged, sophisticated operation, but student involvement and input is also necessary to publicize. Thus, a partnership between facilities staff and students has been deemed necessary based on studies of various universities' programs.

The trend in colleges is toward facilities staff control of recycling programs, but many schools choose to pay for off-campus collection companies. Negotiation, custodial involvement in the planning process, and custodial incentives are all very important characteristics of CU's program as DeBell notes. CU has translated recycling brochures into Spanish and Hmong (languages many custodians there speak, which also applies, at least with Spanish, here at Clark). CU also launched a "multicultural campaign" which expressed appreciation for custodial involvement in the recycling program (Keniry 1995).

Custodians reported at Illinois Wesleyan University that certain faculty and administration members were not recycling, but that they did not feel comfortable approaching them about their lack of compliance. The ReduceReuseRecycle (RRR) Committee responded by creating a monitoring system composed of volunteer staff members who would act as liaisons between "residents" and custodial staff. In trying to identify locations for recycling bins, members of Illinois Wesleyan's RRR Committee surveyed with custodians each campus building, asking about content of garbage, seeking input for a better system. They hosted a breakfast for custodians when the new recycling program was implemented to get feedback on the effectiveness of the new system (Jahiel and Harper 2004). The systems at both CU Boulder and Illinois Wesleyan effectively engaged custodial staff, creating a system with integrated waste management and collection.

Implementing sound infrastructure is of great importance in sustaining a successful university recycling program. CU designed special recycling collection carts, distributed 10,000 desk side recycling containers, and purchased three recycling trucks at the inception of the program. To aid in the effectiveness of this infrastructure, specifically the recycling bins, DeBell integrated code-compliance provisions into the campus master plan for recycling. This included appropriate sites for bins and square footage of bins; now architects have to include recycling in their designs (Keniry 1995).

Clark recently completed the new LEED certified Blackstone Hall which has recycling infrastructure built into the design. Additionally, President Bassett just signed the President's Climate Commitment, putting into writing the university's commitment to promoting sustainable actions including an improved recycling program.

In the development of a successful recycling program, a shared vision of the program is necessary among all stakeholders: the students, physical plant, the

administration etc. Illinois Wesleyan experienced resistance from the administration when they attempted to implement recycling bins in prominent places on campus. This remained an issue even though it was well known that convenience is one of the most important factors affecting the efficacy of recycling programs. Prominently displayed recycling bins display a hard-to-miss symbolic commitment to “environmental stewardship” on a campus. Students in favor of prominent bins around campus insisted that to prospective students, the *lack* of recycling bins would be more of an eyesore than the presence of them (Jahiel and Harper 2004).

Team member Hallie interviewed students from colleges and universities across the country to gain perspective about specific recycling initiatives taking place currently, at institutions of similar size to Clark in various cities and states. Two colleges are listed below as examples.

#### *Babson College*

Lillian Cullen is a senior at Babson College, a premier business college in Wellesley Massachusetts with an undergraduate population of just under 2,000. At Babson, residence hall suites are provided with special trash bins, placed next to the trash in the kitchen with slots for container recycling. All dorm room on campus there are separate bins provided for trash and paper. Administrative and academic offices each have two bins, emptied weekly. The most interesting part of Babson’s recycling infrastructure was that every classroom is equipped with a trashcan, a paper recycling receptacle, and a bottles/cans receptacle (Personal Communication Lillian Cullen, student, Babson College). Babson aims this academic year to increase their recycling rate to 20%, up from 11% in 2005 (Babson College 2007).

#### *Carleton College*

At Carleton College in Northfield, Minnesota, (which also has an undergraduate population of 1,750 students) a single-stream recycling program has been recently initiated and seems to be successful. Single stream recycling programs allow users to mix newspaper, magazines, phone books, plastic beverage bottles, milk jugs, glass bottles and jars, cereal boxes and other clean and dry cardboard in one bin. Blue, trash sized recycling receptacles with labels letting you know what is accepted are all over campus. One very effective tool used to aid in recycling is a huge poster on display at a campus snack bar that has actual cups, napkins, and compostable silverware taped directly to it to clearly let students know acceptable and unacceptable items (Personal Communication, Anna Cooley, student Carleton College). So far the new system has been successful and will most likely lead to the university’s goal of increasing the recovery of recycled materials by 30% and reduce the energy required for collection over the long run. Like Clark and the University of Puget Sound, Carleton College also recently signed onto the President’s Climate Commitment (Carleton College Facilities Management 2007).

Clark can learn from these varied examples of other American universities when considering their recycling options as a small liberal arts university. Each school has taken a slightly different approach to recycling and each has shown success in increasing their recycling percentage. There is a wealth of knowledge on the topic of how to run a successful university recycling program from which Clark can learn how best to confront the present issues of infrastructure, funding, and collection.

### The History of Recycling at Clark

Clark University's recycling program was initiated by two undergraduate students, Matt Most '92 and Dan Kallin '92, who officially began part-time operation in September of 1990, with full-time operations beginning during the 1991-1992 academic year (Clark University 2007b). The program briefly operated out of the few rooms in the basement of Goddard Library; in 1992 it was moved to its current location at 5 Hawthorne Street (Clark University 2007b).

Since its inception the recycling program has expanded in order to meet the needs of an expanding campus and student body. This expansion included the installation of a new loading dock in February 1993 and the expansion of the list of accepted materials to include scrap metal, plastic, cardboard, glass, and paper of all types (Clark University 2007b). Members of the program's staff dedicated space to reusable goods, collecting used books, office supplies, Styrofoam packing peanuts, and other items for use by the Clark community (Clark University 2007b). Unfortunately, a need for additional space forced the elimination of the reuse room (Clark University 2007b). Further expansion of the program was made possible in 1997, when a vertical down stroke bailer was installed for use in bailing cardboard, plastics, and shredded paper (Clark University 2007b). However, the same year all paper recycling containers were removed from residential buildings, due to the fact that residents were using them for trash. Three years later, in response to a new state law, the staff members began separating cathode ray tubes (CRTs) – found in computer monitors and televisions – from scrap metal for recycling as a separate commodity (Clark University 2007b).

With the goal of improved efficiency, the University changed recycling service providers in 2001 from E.L. Harvey & Sons of Westborough, Massachusetts to the Institutional Recycling Network, a New Hampshire-based cooperative (Clark University 2007b). This switch eliminated the need to sort paper by grade (newspaper, copy paper, glossy paper, and so on), enabling operations to become more streamlined (Clark University 2007b).

Another action aimed at improving efficiency was the January 2004 hire of Katrina Rideout '00, MA '01, Clark's first staff member dedicated to recycling and conservation issues on campus (Clark University 2007b). Rideout, whose position was based on a part-time contract, oversaw the recycling program and promoted recycling, reuse, and waste reduction within the Clark community (Clark University 2007b). In August 2004, she brought paper recycling back to residence halls and houses, though she found contamination to be persistent in several locations. Another of Rideout's initiatives was to partner the campus recycling program with the non-profit organization Dump and Run in the spring of 2003 (Clark University 2007a). The partnership allowed for the collection of usable items from students during the end-of-the-year move-out process. In Spring of 2005, volunteers collected an estimated 13 tons of usable items from students in residence halls and houses held two yard sales to benefit participating student groups and local charities (Clark University 2007a). In July 2006, Clark hired Dave Schmidt '04 as Rideout's successor. In addition to making the position a full-time Clark employee with benefits, Schmidt has been charged with the coordination and expansion of recycling, energy conservation, and other issues of sustainability on campus (Clark University 2007b). Currently, Schmidt manages the recycling program year-round by Schmidt with a staff of work/study students during the

academic year and by a skeleton crew of non-work/study student employees during the summer recess (Clark University 2007c). The Physical Plant staff is also an integral part of ensuring consistency in the collection of recycled materials, particularly during the winter recess.

During the Fall 2005 Semester, several students in the first-ever Sustainable University class designed a research project that focused on the University recycling program. These students identified a need to increase the visibility of recycling on campus and, subsequently, established it as a goal of their project (Sustainable University 2005). The group also determined that the recycling program does not receive enough financial support from Clark (Sustainable University 2005). A particularly interesting finding was that Clark students, at that time, were generally interested in recycling, but the infrastructure enabling them to do so was lacking (Sustainable University 2005).

The following are the recommendations the 2005 group made, based on its research. First, secure a moderate financial commitment of funds from the University. This would include money for a full-time, continuing recycling coordinator; money for standardizing collection bins and any additional bins that might be needed to do so; and money for the creation of a part-time recycling coordinator position, much like the organizational structure of the University mailroom. Second, institutionalize a requirement for Residential Life and Housing to spend time educating Residential Advisors about bin placement and recycling practices in order to encourage residents to use them and to prevent students from misusing them. Third, allot a more adequate space to house the program. (Sustainable University 2005).

Despite the recommendations outlined above, one can see that little progress has been made since the first Sustainable University made its recommendations almost three years ago. Thus far, the progress that has been made is in the form of creating the full-time Campus Sustainability Coordinator position, currently filled by Dave Schmidt, '04. There also seems to be less of a mystery surrounding the question of budgeting for the recycling program. Currently, the University budgets the Campus Sustainability Coordinator's salary and fringe benefits (salaries are not public information at Clark University), work/study wages and non-work/study wages in the aggregate amount of \$9400, \$3000 for miscellaneous expenses, the total trash removal budget of \$63,050, and reimbursements made by individual residence houses to cover their portion of trash removal (Collins personal communication).

Unfortunately, there has been little additional progress toward meeting the recommendations of the first Sustainable University report. Proof of this is that a full two years later, three actions identified by the Clark University Environmental Sustainability (CUES) Task Force as so-called next steps for the recycling program are to increase the ease and availability of recycling by supplying a recycling bin near each trash bin, develop a policy for new construction to include space for recycling bins in floor layouts, and expand education efforts on waste reduction and recycling (CUES Task Force 2007).

## **Process**

In the beginning stages of our project, our team considered the different approaches to improve recycling at Clark. There are two teams working on different aspects of this improvement. Our team chose to seek infrastructural improvements in the

program, while the other team is focusing its efforts on recycling awareness and education. In order to effectively document the current strengths and weaknesses of Clark's recycling program, we decided to explore the campus—all its buildings and grounds—to get a first-hand account of the program's current status. Our goal has been to gather both quantitative and qualitative data about Clark's recycling program, in order to make recommendations to Physical Plant. It is our hope that such recommendations will lead to implementation of lasting, consistent, system-wide changes to improve the effectiveness of the program. Realizing the necessity of a comprehensive survey, we devised a plan to take a recycling bin inventory around campus, counting the bins in public spaces and learning about the effectiveness of recycling in offices and classrooms.

An initial meeting with Campus Sustainability Coordinator Dave Schmidt allowed us to evaluate the current status of the recycling system. First, we listed, counted, and divided the buildings and grounds of the campus among our team. Hallie created our original spreadsheet, providing fields for various aspects of our search: presence of container and paper bins, their placement, labeling, and room for additional comments. The spreadsheet expanded and adapted to meet our changing informational needs. Additional meetings with Dave Schmidt and the creator of Clark's recycling program, Matthew Most, focused our efforts further. Unbeknownst to us at the beginning of our project, another inventory had been taken, somewhat unsuccessfully, during the 2006-2007 academic year. During our November 5 class presentation, Kate Del Vecchio, an employee of the Clark Recycling Center, informed us of this document. After locating and reviewing this document, we made certain changes to our spreadsheet to gather a more holistic picture of the program, adding a field for proximity of receptacles to trash bins in an effort to understand how convenience encourages good recycling practice.

Team member Hallie began researching recycling programs at other schools of varying sizes to gain perspective on the different campus recycling methods across the country. Understanding where Clark lies in comparison to other institutions helped us in adapting our goals to coincide realistically with the limitations we face in terms of budget, staffing, infrastructure, and education.

Our team faced certain challenges in the process of conducting our inventory. Through the process of data collection, each member of our team has experienced how some people react defensively when questioned about recycling or conservation efforts. Many of the students and faculty who we questioned about their recycling concerns answered with guarded responses, as though it was our intention to make them feel guilty for not recycling on every occasion. When we encountered this, we tried to elicit accurate responses with an assurance that we were there with the intention of improving the current system. We are also busy students who juggle academic work with jobs, sports, and other commitments. Our team also faced the challenge of finding common discretionary time to meet and discuss our progress. Teamwork is an effort very distinct from individual effort, as it places a shared responsibility on each team member, a concern for the partial success of another's efforts. In addition to weekly face to face meetings we communicated extensively through e-mail, as well as several features of Blackboard and telephones.

## **Results**

### **Quantitative Results**

Attached as an Appendix is our team's campus inventory of recycling bins, which details the location, labeling and proximity to trash bins of paper and container receptacles.

### **Qualitative Results**

In addition to this quantitative data, we collected qualitative data from students, faculty, and staff. The qualitative data consists of personal responses regarding the effectiveness and comprehensiveness of Clark's current recycling program.

Dianne Rocheleau, a professor of Geography at Clark, responded strongly when asked about the recycling infrastructure in the Geography department. Rocheleau has no bins for paper or containers in her office and must use a small blue bin (labeled "Newspaper Only!") in the central office for her recycling, which she notes "fills up way too fast!" Rocheleau noticed that all of the professors in the geography hallway offices in Jefferson Academic Center use only a small paper bin in the office and a makeshift container bin, converted from an old metal trash bin. However, Professor Colin Polsky, who has an office across the hall from Professor Rocheleau, has personal bins for both trash and recycling; the custodial staff empties these daily. "They come and get it every night as far as I know, though who knows if it all gets thrown away into one trash bag," noted Professor Polsky. This common mistrust with the custodial staff surfaced frequently during our inventory. In the Academic Advising office a secretary noted, "I am not always careful where I throw things because I am not sure if the custodians put it all in the same bag at the end of the day." Likewise, in the Foreign Languages office, the secretary questioned the efforts of the custodian who picks up the trash and recycling. "He has been told how to properly do it in the past, but between you and me, I am not sure if he actually puts the paper and containers in the recycling bins."

Conversely, the custodians reported a general lack of student recycling efforts in the residence halls. Two custodians from, respectively, a freshman and a mixed-class dorm, expressed their frustration as students this year make less effort to recycle properly. One custodian reported "paper, plastic, cardboard, and sandwiches all in the same blue bin". These custodians thought that the students fail to recycle properly because the paper and container bins have unsatisfactory labeling and students do not receive proper recycling education. "They need to be taught," noted one custodian. Consistent with the students' experience, custodians reported that they received no real training about recycling at Clark. Superiors instructed them to bring all recycled material downstairs to the front entrances of the residence hall, where the recycling team would collect the material and complete the process.

Another common response found during the inventory was the problem of the disappearing bins. Many office personnel commented that their bins tended to disappear and reappear from semester to semester. In the Alumni Affairs office, one staff member noted that the office had asked for more bins from the recycling center and had received a few, but that they still lack several desk-side bins. Faculty and staff also complained that there was not enough room for the bins under desks in offices. There was often only

room for one bin, either recycling or trash, next to desks, and it was more often than not a trash bin.

A senior living in an on-campus apartment at 13 Beaver street complained that her apartment has only one paper receptacle for both the second and third floor stairwells and two large receptacles on the ground floor: one for containers, one for paper. "They seem like they are never collected and are always overflowing!" she noted. These apartments have full kitchens, none of which are equipped with container or paper receptacles within the apartments. "It makes it really annoying to recycle cans and bottles we use for cooking when the container for them is on the first floor. We have made up our own system," she said, pointing to an overflowing heap next to the refrigerator, "with a cardboard box."

Jim Collins, Chief Financial Officer, also cleared some things up for us concerning the status of the recycling budget. Currently, the University budgets the Campus Sustainability Coordinator's salary and fringe benefits (salaries are not public information at Clark University), work/study wages and non-work/study wages in the aggregate amount of \$9400, \$3000 for miscellaneous expenses, the total trash removal budget of \$63,050, and reimbursements made by individual residence houses to cover their portion of trash removal (Collins, personal communication).

## **Conclusion**

Our goal for this project was to evaluate the infrastructural needs of the current recycling program at Clark, which we did through our inventory. In learning about these needs, we were able to see where the program needs to improve. To address the issues we encountered around campus while conducting our inventory, we noted several areas where the recycling program can develop and increase its efficiency. These suggestions are based not only on our personal experiences during the collection of data, but also through researching other schools, speaking with physical plant staff, and browsing catalogues of waste management supplies.

First, a training or short workshop/dialogue with custodians should be conducted by Physical Plant. The purpose of this meeting, which would be short, casual, and informative, would be to gain an understanding of how much the custodial staff knows about the recycling process at Clark. Engaging in a dialogue about their concerns, suggestions, and opinions on the current state of a process in which they have a big part, will make them feel appreciated for their efforts as well as educate them about areas where they may need to improve, demonstrating the importance and cost-effectiveness of recycling. This training could help to build trust between the faculty and student bodies and the custodial staff, a concern raised several times during our inventory.

Second, we suggest implementing the kinds of recycling bins that are present in the Blackstone suites to all of the suite and apartment living spaces on campus. This would include the eight suites each in Hughes, Dana, and Johnson Halls, all of Maywood Hall, and all of the on-campus apartments. The bins in Blackstone Hall are similar to the City of Worcester curbside bins, but smaller and more convenient for en-suite or apartment living, especially when a kitchen is present. The cost of buying around 100 of these bins to outfit every kitchen or suite would be roughly \$2,000.

Acquiring more desk-side paper bins for offices on campus is a necessity. Through our inventory we were able to see the inconsistency in what offices use for desk-side recycling, from grey bins, to blue bins, to cardboard boxes. We also found locations with no bins at all. If physical plant purchased more desk-side bins (\$9.80/ dozen blue bins in Rubbermaid catalogue), then sent an e-mail to all departments advertising their availability, then departments or individuals could respond with their requests. Physical Plant could then distribute bins according to the reported need. In the Rubbermaid catalog we browsed, which offered a wide variety of recycling and trash bins, one bin stood out. It was a space-saver model in which a blue desk side paper bin was tucked inside a larger rectangle grey trash bin. This solves two problems: the space issue in many of the offices, and the idea of keeping trash and recycling bins directly next to each other at all times. A phase-in of these types of bins across the campus' administrative and faculty offices would also provide a much more consistent means of recycling for the Clark community.

In a meeting with Physical Plant employee Gregg Janda, we discussed a phase-in of the quad-style bins that are present in the University Center. These bins which are made by Midpoint come in a variety of sizes—quad, triple, and double bins, and cost around \$2,000 per unit. Phasing these in, a few buildings at a time, would provide a more consistent and aesthetically pleasing recycling image for the university. The phase-in of these bins could not be done alone, but would need to be done in conjunction with implementing some of the other suggestions we provide, especially increasing the amount of desk-side bins, as these larger bins are more suited for high traffic, visible, and central locations.

Additionally, outdoor recycling bins would provide Clark with a strong image to support their commitment to the environment. We determined that installing about 10 bins would be appropriate on Clark's campus. Installing outdoor bins around campus would hopefully greatly decrease the amount of soda cans and water bottles that get tossed in the trash as students walk by from the UC to their dorms. Midpoint also sells a variety of attractive outdoor recycling bins that are covered to protect the contents. These range from single bins with labels that can be changed to suit an individual's needs, to three unit bins with receptacles for trash, containers, and paper. These bins are made out of 100% recycled milk jugs, and while they are expensive, appear to be very durable and are attractive. One issue we determined with these bins would be the placement. They are best suited for sitting on level ground, so current locations of outdoor bins may need to be reassessed and possibly shifted slightly to enable these larger bins to fit. A thorough analysis of locations with exact dimensions of the chosen bins would be necessary.

Our project detailed the shortcomings and potential of our current multi-stream system, but in doing so brought light to other kinds of systems that could work more effectively and save the university money in the long run, such as single stream recycling. Single stream recycling is when all recyclables- bottles, cans, paper, cardboard, are all tossed in the same bin and then taken away to be sorted off campus. This method of recycling needs to be further researched as a very viable and attractive option to completely re-work the entire recycling system. It has shown success at other schools for its convenience, which increases the total percentage of waste that is recycled and diverts more waste from landfills.

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## **Recycling at Clark: System-wide Change**

Callista Perry  
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*“Recycling is a good idea. It always was. For thousands of years individuals and enterprises have recycled goods to save materials or lower costs” (Alexander, 1993).*

Recycling is a vital step institutions can take to reduce waste and save money. Clark University’s recycling program, although present, ought to be strengthened in order to better serve the environment and the students, while also providing economic benefits for the University. Clark can improve our recycling system by increasing education of the student body about recycling’s importance, availability, and procedures. To facilitate recycling education, we created a slide-show to be shown at Week One orientation (Appendix A), so that all incoming Clark students will be educated on these points. Furthermore, we designed uniform signs to accompany all on-campus recycling bins to better assist Clark students and staff.(Appendix B). Our team also investigated a switch to single-stream recycling, which is a viable option for improving the capture rate of recyclable materials. Clark’s current membership in the Institutional Recycling Network (IRN) prevents Clark from making the shift towards the increasingly popular single-stream system. The implementation of new recycling bin signage, a recycling educational component to Week One, and single-stream recycling would result in a greener university.

### **Introduction**

There are many ways in which Clark University can become more sustainable. One of the most visible and possibly most accessible and interactive ways is through recycling. Recycling has always been a positive and popular way for individuals and enterprises to save materials and lower costs (Alexander, 1993). The United States saw a revival of recycling as a form of waste disposal in the 1980s. Originally viewed as a grassroots movement towards source reduction and against overconsumption, the solid waste management community shifted towards a more inclusive perspective on recycling as a method to conserve resources and generate less waste (Melosi, 2005). Indeed, recycling enjoys a long and established history, and has the good fortune of being one of the most familiar greening efforts of which people know. On university campuses and at Clark specifically, recycling is a direct way to involve the student body, staff, and faculty in the shift towards sustainability, while also being a relatively effective greening process itself.

Although source reduction (less production of a material, like paper – the “reduce” part of “reduce-reuse-recycle”) is the optimal way to decrease greenhouse gas emissions and waste, recycling has similar effects. “Greenhouse Gas Emissions from

Municipal Waste Management: Draft Working Paper” (Environmental Protection Agency, 1997), explains recycled material as being material that is used in place of virgin materials in the manufacturing process, instead of being disposed of and managed as waste (Environmental Protection Agency, 1997). As is noted in the paper, the recycling of paper products reduces greenhouse gas emissions by resulting in forest carbon sequestration (trees are left alive and carbon stays sequestered in them), which has the effect of reducing greenhouse gas emissions (Environmental Protection Agency, 1997). Overall, the EPA found that recycling has lower greenhouse gas emissions than all other waste management options studied in the report, except for source reduction (Environmental Protection Agency, 1997).

In the broadest sense, the goal of our project was to improve the recycling program at Clark University. In order to achieve this goal we considered three major steps that may be taken to increase the capture rate and efficiency of the recycling program. The first of these steps, or sub-goals, was the analysis of Clark’s current policies concerning the collecting, sorting, and processing of recyclable materials. Secondly, in order to increase the capture rate of recyclable material, people must recycle; thus, we constructed educational programs and signs describing recycling guidelines and restrictions. Finally, we charged ourselves with the task of investigating the possibility of implementing a single-stream recycling collection system in place of Clark’s current recycling program.

## **Background**

### Challenges of Campus Recycling Programs

Despite the public’s relatively warm reception to recycling, there are technical, economic, political and social challenges that any recycling program faces (Environmental Health Center, 1993). University campus recycling programs are not exempt from dealing with these challenges. Even when faced with such obstacles, however, small liberal arts colleges can effect successful institutional change (Bartlett & Chase, 2004).

In *Ecodemia* (1995), Julian Keniry devotes a chapter to an examination of the recycling program at The University of Colorado at Boulder. Jack DeBell, the recycling coordinator at CU at the time of publishing, tells the story of CU’s comprehensive recycling system and provides insight for University recycling programs everywhere – the do’s and don’t’s of on-campus recycling. Despite the fact that CU’s program has come tremendously far – at the time of publishing, DeBell had incorporated code-compliance stipulations (such as the appropriate sites and square footage for recycling receptacles) into the campus master plan (Keniry, 1995) – challenges still remain. With regard to who should be running the recycling program – the students or the staff – DeBell promotes “Institutionalization Without Disenfranchisement” (Keniry, 1995) and speaks of keeping the best aspects of both the energetic, student-run programs and the efficiency of physical plant-run programs by forming a partnership (Keniry, 1995). Elsewhere, other colleges and universities are taking steps – sometimes through student initiatives and sometimes through administrative incentives – to incorporate recycling into on-campus life.

### Clark's Recycling Program

Two Clark students founded the recycling program at Clark University in the early 1990's (Clark University, 2007). This is a rather late start to a necessary program compared with other small liberal arts colleges, including Macalester College in Saint Paul, MN and Lewis & Clark College in Portland, Oregon. Students at each of these schools implemented recycling programs in the 1970's and have continued to improve environmental practices each year (Pascoe and Ullmer, 2000, Lewis & Clark College 2006). Evergreen State College is a leading "green" school and their website exemplifies the success of their recycling program. There is a detailed list of what can and cannot be recycled under each category of recyclable materials on the page. Evergreen College also provides information on the history and importance of recycling in the United States (Evergreen State College, 2007).

Clark, similar to these colleges, recognizes the obvious importance and benefits of recycling, and thus has established a program that can receive praise, as well as criticism. Like many colleges and universities, Clark works with a recycling contracting business that is separate from the school itself. Although Clark students, hired by Physical Plant as part of the Clark work study program, collect all the recyclables and complete the sorting of materials, the University depends on the Institutional Recycling Network (IRN) to actually recycle and reuse our materials (Clark University, 2007).

Currently, the IRN picks up and processes Clark University's recycling. In addition to a five hundred dollar membership fee to receive the IRN's services, Clark pays a transportation fee and a loading fee each time the IRN picks up recyclables. The IRN collects baled cardboard and plastics from Clark about once a month, and paper about once every ten weeks. The IRN also collects and processes what is called "universal waste" as needed. This includes fluorescent light bulbs, batteries, and ballasts. Depending on the values of these commodities picked up by the IRN, Clark either receives money from the IRN, or is required to pay the IRN additional fees based on the market value of the material being recycled. These market values, called commodity charges, are provided by The Official Board Markets: The Yellow Sheet, a weekly periodical filled with news and prices of recyclable commodities. Some commodity charges are positive, meaning that Clark receives money back from the IRN, and others are negative, meaning that Clark pays the IRN additional money. Typically, commodities with positive charges are high value products such as precious metals. Items with negative commodity charges include paper, plastic, and scrap metal. These commodity charges determine what materials are cost-effective for Clark to recycle. For example, narrow neck bottles are recycled differently than non-tapered bottles and incur a negative commodity charge, so it is not cost-effective for Clark to recycle non-tapered plastics. The items that have proved cost-effective for Clark to recycle include paper, cardboard, metal, #1 and #2 plastics, and universal waste products. All the commodities Clark recycles, with the exception of scrap metal – including cans, which go to a private contractor, Beaupre – are collected and processed of by the IRN (K. Rideout, personal communication, October 15, 2007).

The IRN was created in 1999 as a service for colleges, businesses, independent schools, hospitals, and other organizations seeking to improve their recycling systems. The IRN's member institutions each pay a yearly membership fee that provides them with access to the network's programs. The membership fees vary from \$250- \$500;

colleges pay \$500 per year. The IRN operates solely on the revenue garnered from these membership fees and the profits from the sale of recycled, re-usable goods. The IRN transports the materials, which are comprised of a wide variety of items including everything from paper products to bed mattresses, before marketing the re-sellable products and recycling all the other materials that cannot be sold. The destination of the recycled materials varies, depending upon the buyer of the recycled commodities. The IRN accepts a wide array of materials including paper, cardboard, electronics, fluorescent light bulbs, batteries, metals, mattresses, construction waste, bottles, cans, cell phones, and even mercury-containing wastes. If a member institution wants a specific item recycled, it is the IRN's policy to determine a means of reusing or recycling the item (Institutional Recycling Network, 2007). However, Clark University, along with all other IRN member institutions, must determine whether it is cost effective to recycle a particular material. Many materials, such as non-tapered bottles, have been deemed to be too costly for Clark University to recycle, producing a limited scope of recycled materials.

Beyond the narrow scope of products that Clark recycles, there are other contributing factors that decrease the amount of materials that are actually recycled. One of these factors is education. On the Clark campus, it is assumed that the student body will read the signs or visit the Clark web site in order to discover what materials can and cannot be recycled. However, this is not a realistic expectation. Every day students throw bottles into the waste bins and apple cores into the paper receptacles. There are many recycling guidelines students do not know about, such as the inability to recycle half filled bottles, pizza boxes, non-tapered bottles, and paper that has been soiled by food or beverage residues. Juniata College in Huntingdon, PA, attributes the success of their self-established recycling program to education (PDEPP, 1999). A seminar on recycling is held for freshman orientation; if a program at Clark University was added to Week One, all incoming freshman (as well as transfer and graduate students new to Clark University) would be equipped with the basic knowledge needed to make responsible recycling decisions. In addition to basic educational value, a Week One recycling seminar could spark increased student interest in recycling. Students can learn about proper recycling practices and use their acquired knowledge to be future leaders in the rapidly expanding field of recycling (Keniry, 1995). This incorporation of education could also encourage a more intensive program concerning environmental issues, which is a key point in the President's Climate Commitment (ACUPCC, 2007).

## **Process**

In order to analyze Clark's current recycling program and its effectiveness, we first conducted basic research, using Clark's web-site, and proceeded to contact Katrina Rideout, currently an employee of the IRN who previously spent eight years working at the Clark Recycling Center. Katrina Rideout was able to provide us with information (see "Background"), about what materials are recycled, what costs are incurred, how often recycling is done, and how the IRN and Clark work together.

Following the initial assessment of Clark's recycling system, we had a meeting with Dave Schmidt on November 19<sup>th</sup> concerning other possible options for recycling programs. Dave Schmidt suggested that we investigate the costs and benefits of single-

stream recycling as well as other contractors capable of processing a single stream collection system. After researching single-stream recycling, and determining that it would most likely prove beneficial to Clark University's recycling program, we took Dave Schmidt's advice and contacted two contractors: Waste Management (Clark's current contracted "hauler" of waste) and Casella Waste. Waste Management referred us to Mark Evans, at Casella Waste, who provided us with basic information about Casella's single-stream recycling program, leading us to the conclusion that Clark University would benefit from considering making the switch to a single-stream recycling service. Included in the information provided by Mark Evans was a list of materials Casella Waste's single-stream recycling program includes (Appendix C).

To achieve our second goal of increasing the capture rate through the help of proper education we created a PowerPoint presentation to be shown at Week One, Clark's week-long orientation program for new students, in hopes that incoming freshman, transfer students, and graduate students will receive correct information concerning what materials can and cannot be recycled.

We are now currently establishing communication with Jason Zelesky to make sure this video and PowerPoint will be incorporated into Week One. In addition to developing a slideshow and PowerPoint we created clear, informative signs that list what can and cannot be recycled and communicate which receptacles collect which recyclables. We intend to propose that these signs are hung above all recycling receptacles so there will be uniform signage around campus resulting in a clarity of message and an increase in common recycling knowledge at Clark.

The final step we had hoped to take to complete our goals was the execution of a current trash audit. We wished to perform a trash audit to determine how much "trash" was getting thrown away that could in fact be recycled. After reviewing the data from a 2005 trash audit (Appendix D) and the "Trash and Recycling for SU" (Appendix E) document supplied by Dave Schmidt, we realized that our plan to collect the trash on our respective floors of our residence halls and sort it into only waste and recyclable materials was impractical, because we would be unable to compare the data with that of previous records. Additionally, the "Trash and Recycling for SU" document provided us with data about Clark's recycling for fiscal years 2002-2006, making an additional audit unnecessary. Due to the apparent irrelevance of the data we would have collected, coupled with our inability to contact Greg Janda and schedule a time and place to conduct an effective audit, we realized that our energies would be better utilized elsewhere. Accordingly, we elected to discontinue the audit that we originally intended to conduct.

The collapse of our plan was one of the numerous challenges our team experienced throughout the semester. Once our original idea for the trash audit proved impractical, we accordingly revised our plan of action to analyze Clark's waste-stream. Communication with external sources was another challenge we faced. Because we could not simply collect the necessary information and research from books and web sites, we needed to make contact with individuals and organizations including Dave Schmidt, Waste Management, Casella Waste, and Katrina Rideout. This involved a high level of communicative coordination among numerous, disconnected parties, which at times proved difficult.

In addition to external communication and research challenges, our team also experienced internal challenges. Working in a team was in and of itself a challenge and

proved to be a learning experience. Communication and consensus proved difficult at times, especially during the process of scheduling meeting times and writing specific documents. Because everyone has different ideas and different academic and personal commitments, our team found achieving compromise and even establishing dialogue to be arduous. The degree to which we were challenged was compounded by irresponsible communication, including a lack of punctual responsiveness to e-mails and phone calls.

## **Results**

### **Current Status of Clark's Recycling Program**

The results we got concerning Clark's current recycling process came directly from Katrina Rideout. Katrina was able to provide us with information concerning Clark's connection with the Institutional Recycling Network, as previously detailed in the "background" section.

### **Improved Education about Recycling at Clark University**

We met with Dave Schmidt to determine how we could best improve the Clark recycling program at this time. We received some strong suggestions and found new direction for our project. According to Dave, the PowerPoint presentation that we prepared is an excellent, interactive way to educate incoming first-year, transfer, and graduate students about what can and cannot be recycled at Clark. Dave also suggested that we research the costs and benefits of single stream recycling and work towards determining whether or not the shift towards a system of single stream recycling would make sense for Clark University.

### **Potential Switch to Single Waste Stream Collection System at Clark**

A shift to a single-stream recycling collection system at Clark was one potential change to the management of Clark's wastestream that we explored. Single-stream collection systems entail single, multi-material recycling receptacles in which all recyclable materials are collected. In practice, single-stream recycling makes recycling easier for the participant since no separation of recyclables into separate containers (i.e. paper, plastic, glass, etc.) is required. Additionally, single-stream recycling facilitates increased ease of vehicle collection, since only one truck (into which all recyclables are dumped) is necessary (D. Schmidt, personal communication, November 19, 2007). We investigated single-stream recycling and explored the costs and benefits of a potential shift to single-stream for Clark.

Generally, when the switch is made to single-stream collection, many recycling benefits are experienced, including an increased volume of recovered materials, a higher diversion rate of materials from landfills and incinerators, increased recycling participation, and reduced collection costs (Kinsella & Gertman, 2007). In addition, a single-stream collection system tends to yield a higher capture rate of recyclable materials and increases the participatory convenience of recycling for the average person (Goodman & Associates, 2006).

But single stream collection systems do not come without a price – one that is often paid by recycled product manufacturers at the other end of the recycling food chain.

Some costs associated with single-stream recycling systems are an increased prevalence of glass breakage during collection and processing, a decline in feedstock (material about to be recycled into new, useful items) quality due to an increased rate of contaminated recyclables, and an increase in the amount of processing residuals generated at single-stream materials recovery facilities (MRFs) (Minnesota Pollution Control Agency, 2007). Single stream collection systems can also result in less recovered paper stock due to an increase in the amount of paper collected that is unsuitable for recycling; a higher rate of loss of recoverable product (due to contamination or non-recyclable materials mixed in with the recyclables) including glass, paper, and plastics; and increased processing costs incurred by the necessary investment in more sophisticated separation equipment (Goodman & Associates, 2006).

For a private institution like Clark University, many of the costs of single-stream recycling do not directly impact the effectiveness of a single stream collection system on campus. Concerns such as higher costs for MRFs and a lower quality of feedstock have little bearing on the immediate success of Clark's recycling program – essentially, the higher Clark's capture rate, the better for Clark.

According to the 2005 trash audit performed at Clark, nearly half (44.8%) of the trash collected was made up of recyclable materials (recyclable bottles and cans, recyclable plastics, cardboard and boxboard, and mixed recyclable paper). Mixed recyclable paper made up the largest percentage of the trash collected that was actually recyclable, at 24.6% (Trash Audit Results, 2005). As the auditors concluded from the data, perhaps the most obvious result of the trash audit is that Clark, as a campus, needs to put more effort into recycling paper (Trash Audit Results, 2005) (Appendix D). A move to a single-stream collection system on campus might be an effective tactic to increase the recyclable paper capture rate.

Other higher education institutions, some of comparable size and scope to Clark, have already successfully made the transition to single-stream recycling. One such school, Carleton College in Minnesota, announced the switch to single stream recycling at the beginning of the 2007-08 school year, crediting the single-stream collection with both the recovery of up to 30 percent more recyclable materials and a reduction in energy usage during the collection process due to a "one route one truck" system (Carleton College Office of Media and Public Relations, 2007). Carleton, with a student body size comparable to that of Clark, is taking the lead on making the switch to single-stream recycling among Minnesota schools. Closer to home but with a student body roughly four times that of Clark, UMASS Dartmouth has also elected to employ single-stream recycling because the increased ease and convenience of single-stream recycling for participants (Housing Facilities Operations & Services, 2007). Other schools, including Williams College in Williamstown, Massachusetts, have not yet made the transition to single-stream recycling but are very interested in making the switch and are trying to move in that direction (M. Goodwin, personal communication, December 8, 2007).

Because there has been success on campuses similar to that of Clark, we pursued the gathering of information concerning single-stream recycling options here at Clark University. After contacting Waste Management, we were directed to Mark Evans at Casella Waste. Waste Management currently sends all of their single-stream recycling to Casella Waste in Auburn, Massachusetts for processing. Mark Evans highly recommended that Clark University seriously consider making the switch to single

stream recycling, noting that it is “recycling made easy.” Upon making a switch to single-stream recycling, recycling would not need to be sorted at the recycling center, students would be able to put all recycling in the same bin, and more materials could be recycled. Evans noted that juice cartons, yogurt containers, and food and beverage containers marked 1-7 may all be recycled through single-stream recycling (Appendix C).

## **Conclusion**

Although we were unable to conduct an effective trash audit this year, as we had originally planned, the results of previous trash audits suggest that we can greatly increase the capture rate of recyclable materials at Clark University. An increased capture rate will improve Clark’s recycling program. To improve the system, and see increased capture rates, we have explored the possibility of required recycling education, as well as the option of making the shift to a system of single-stream recycling.

To fill the need for increased recycling education at Clark University, we created an informative slide show to be presented at Week One to educate new students (Appendix A). This slideshow includes information concerning the importance of recycling, where to recycle, and what to recycle. Through effective use of photographs, bulleted lists, and a creative and humorous display of the information, the proposed Week One slideshow will educate and entertain the incoming Clark students. To ensure the inclusion of this slide show in the Week One program, we have contacted Mike McKenna and will continue our communication with him and with the Week One planning committee to emphasize the value of adding the slideshow to Week One Orientation.

To reinforce correct recycling practices, we have designed clear, functional signs communicating Clark University’s recycling guidelines (Appendix B). It is our recommendation that these signs be posted above every recycling bin to establish a uniform, campus-wide message. We will make the recommendation to Residence Life and Housing to get the signs posted in residence halls. We will also contact Dave Schmidt to communicate this recommendation for sign posting in other on-campus facilities such as the Higgins University Center, and all other on-campus buildings.

To further improve the recycling program at Clark University, we recommend further investigation of single-stream recycling as a viable option. We recommend this exploration because single-stream recycling has been effectively implemented at a growing number of colleges, typically increases the capture rate, requires less time and sorting of materials, and allows for a wider range of accepted items,

These recommendations and created documents, if considered and implemented properly, ought to lead to an increased capture rate of recyclable materials; thereby, improving the Clark recycling program. In order to determine and quantify progress, a recycling and trash audit, similar to that detailed in “Trash and Recycling for SU,” must be conducted after all proposed measures have been implemented. If the results of this future audit show an increase in the percentage of Clark’s waste stream that is comprised of recyclable materials, then it can be presumed that our recommendations were successful.

However, before a new audit is conducted, our proposed methods must first be implemented, which could prove challenging. The incorporation of the slide show into

the Week One program is currently becoming a reality as our team maintains communication with Mike McKenna and the Week One planning committee. The posting of the newly designed signs should be easy to accomplish via the Residence Life and Housing office and Dave Schmidt. However, the proposal for further research of single-stream recycling could potentially be neglected. This recommendation would require an immense collaborative effort involving many offices and representatives from both within the Clark community and from the external waste management community, including financial affairs representatives, private contractors, and members of the recycling center. This recommendation would most likely be positively received by the task force, and would possibly require a group of students charged with the task executing the necessary further research. More research concerning the financial costs and benefits of single-stream recycling is necessary, as well as research of specific private contractors, such as Casella Waste, before a conclusion can be reached regarding the benefits and logistical feasibility of a switch to single-stream recycling at Clark. It is our hope that these recommendations be positively received and acted upon, thus improving the recycling program at Clark University.

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## **Promoting Renewable Energy Investments at Clark University: Renewable Energy Credits on Campus**

Sara Greenberg  
Maggie Small  
Jess Whitney

In the Sustainable University class our group chose to take on the Renewable Energy Credit (REC) purchasing program and institutionalize it on campus. We felt as though projects such as these fizzle out with the incoming and graduating of various students and it is very important to make this happen. Our goal is to establish a permanent process for continuing the purchasing of RECs at Clark. In order to accomplish this goal various processes were involved. First we talked to a variety of people on campus to establish a background of the REC program at Clark University and then we tabled in the University Center to sign students up for the opt-in program. Finally, we met with Provost Angel to discuss options for creating a mandatory or opt-out program at Clark in order to institutionalize our project. The purpose of this project was to have an institutionalized process of signing students up for this REC program by creating a new Massachusetts Technology Collaborative (MTC) partnership. However, at the end of the semester a more beneficial program for Clark University was brought to light; the MTC, Clean Energy Choice-On Campus program. This program goes further than the REC program by providing clean energy projects on campus as well as in the greater community.

### **Introduction**

One important issue that the present generation faces is the environmental degradation caused by human practices, more specifically the burning of fossil fuels. Releasing carbon dioxide into the atmosphere to produce energy and fuels causes average global temperatures to increase. Consequences include extreme weather patterns as well as increased spread of diseases (IPPC Assessment Report, 2007). This vast problem requires immediate attention and one successful way to prevent this environmental problem from mounting is to support and implement renewable energy technologies.

The burning of fossil fuels that releases carbon into our atmosphere causes a thickening of the carbon dioxide blanket that encompasses the earth. This increases the natural greenhouse effect causing global temperature to rise. Carbon dioxide represents over 70% of all anthropogenic greenhouse emissions and fossil fuel combustion accounts for over 80% of anthropogenic carbon dioxide emissions (World Energy Council, 2000). Thus, renewable energy technologies are a way to mitigate carbon dioxide emissions because their energy sources do not rely on releasing carbon dioxide into the air (Elliott 2003). Renewable energy sources include wind, solar, nuclear, wave, tidal and hydroelectric power. All of these technologies use “fuels” that are carbon neutral and do not release carbon dioxide in large amounts into the short term carbon cycle. Renewable

Energy Credits are one specific way to invest in these renewable technologies and mitigate climate change and improve air pollution.

However, there are many barriers to the deployment of renewable energy technologies. Many political, social and economic factors prevent renewables from entering the market and every facet of society. Major resistance seems to lie in opposition to changing the foundation of how society operates and altering a long standing energy infrastructure. One way to overcome technological deployment barriers is to invest in renewable energy projects such as buying renewable energy credits (REC). The purchase of RECs represents an offset of dirty fuel and enters a fund from which wind farms, for example, are built.

At Clark University, the purchasing of such credits has existed since last year and requires no major technological or infrastructure changes. In the Sustainable University class, our team project focused on strengthening the existing REC program at Clark by (1) raising awareness about and participation in the program, and (2) to institutionalize the program to ensure its continued success. Our group chose to strengthen the REC program at Clark because it's an important way to help the University reach its president's climate commitments. It's also important to us to continue to allow students to show their support for green energy technologies.

## **Background**

In this section we outline where electricity in New England comes from and how Renewable Energy Credits are a good way to contribute to the effort for clean energy. After this we discuss Clark's process in creating a Renewable Energy Program and where the project was at as of September 2007.

### Electricity Generation in New England

Electricity in New England is generated by products that have high emissions and high dependency on foreign markets that diminish our security (New England Wind Fund, 2007). On a national level, electricity generation is the number one source of industrial air pollution (New England Wind Fund, 2007). On average New England's electricity is generated by using 30% natural gas, 28% nuclear, 17% coal, 11% oil, 8% large hydropower, 2% trash-to-energy, 1% wood, gas and municipal solid waste, and less than 1% wind, solar and BioMass (New England Wind Fund, 2007). Even though in the past decade New England has constructed new power plants that generate electricity using natural gas which consume less fossil fuels therefore producing less emissions, the market for such products is constantly increasing (ISO New England, 2007). While supporters advocate the benefits of natural gas, it still emits 117,000 Pounds per Billion Btu of carbon dioxide compared to 208,000 Pounds per Billion Btu of carbon dioxide from coal; there is not a sufficient amount of reduction needed to stabilize our climate crisis (NaturalGas.org, 2004).

Developing new sources of energy is urgently needed for the security of our economy and health of our citizens. Wind power is an excellent resource of renewable energy but because they face large up front costs, construction is slow. Another difficulty is that with the current government policies, dirty energy sources are given huge tax subsidies that allow faster development and extraction of fuel (New England

Wind Fund, 2007). The cost of building a renewable energy facility is high (compared to fossil fuels) relative to the amount of electricity it can produce (Schmidt, 2007).

#### The Renewable Energy Credits Program

In order to fund the availability of these resources programs such as Renewable Energy Credits have been created to produce more clean energy being added to the grid. For each kilowatt hour of electricity generated by a renewable energy facility one REC is produced (Schmidt, 2007). When renewable energy is placed on the grid, the actual energy is still sold at market price. By buying renewable energy credits we can neutralize the difference in the cost of producing renewable energy and the market price for energy (Hilsdon, 2006).

One way to get involved with Renewable Energy Credits in Massachusetts and other parts of New England is through Mass Energy's New England Wind Fund. After over twenty-four years of experience as a non-profit organization with a mission to make energy more affordable and sustainable, Mass Energy formed this program in the summer of 2006 to create more wind power in New England (New England Wind Fund, 2007). The typical home in New England uses about 1 MWh of electricity in two months (New England Wind Fund, 2007). Mass Energy's New England Wind Fund expects that for every fifty dollars contributed, at least one megawatt-hour (MWh) of electricity will be generated by a wind facility connected to the New England grid (New England Wind Fund, 2007). This amount is equivalent to 1,102 pounds of carbon dioxide offset (Cohen-Rosenthal, 2005).

Along with the contribution to the New England Wind Fund, Mass Energy participates with a program of the Massachusetts Technology Collaborative called Clean Energy Choice (New England Wind Fund, 2007). When you make a contribution to NEWF, your payment is matched with two grants, each equal to 100% of your payment, by the Massachusetts Technology Collaborative (New England Wind Fund, 2007). One of these grants is used to finance clean energy goods and services to your local community while the other help's fund clean energy projects that benefit the state's low-income residents (New England Wind Fund, 2007). The implementation of these grants can already be shown in the purchase of solar panels on public schools in Boston, Northampton, and Shrewsbury (Massachusetts Technology Collaborative, 2006). Clark University could play an imperative role in the installation of more solar panels and other renewable energy sources in Massachusetts.

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### History of REC Program at Clark

Starting in 2004 Clark University students started to become interested in purchasing energy from renewable sources. In the spring of 2004 a group of students from Clark's Sustainability Insinuative or CSI organized a poll of the student body to try and figure out if students would be in support of paying for Renewable Energy Credits. Students showed that they would be willing to pay an additional \$30 fee. The donation was calculated by multiplying the cost per kilowatt hour (\$.02) by the number of hours used by students per year (500). With the support of the student body, CSI met with Provost David Angel and Director of Physical Plant Paul Bottis. They discussed measures for going about charging the students and began meeting with four different renewable energy marketers to try and find the best fit for Clark. After considering their options Clark chose to work with Massachusetts Energy Consumer Alliance because it would allow Clark to work with the Massachusetts Technological Collaborative's (MTC) clean energy choice program. The MTC provides a double match grant program making each donation a total of \$90 instead of \$30.

In the spring of 2005, CSI launched a tabling campaign trying to raise student support for the possibility of adding an additional charge of \$3 to the student activity fee (Sustainability Task Force). This fee of \$3 was to go to the purchase of renewable energy credits. On February 16, 2005, the question was posed to the student body in the form of a student council referendum. The voted passed by 65% of the students who voted, voted in favor of the additional charge (Sustainability Task Force). Due to the way in which voting regulation were organized the referendum was not passed because the majority of the student body was needed in order for the charge to be added.

In the fall of 2005, with the failure to pass the referendum, CSI changed plans and collaborated with Residential Life and Housing or RLH to design an opt-in program allowing students to voluntarily choose to pay for renewable energy. In the spring of 2006, CSI tabled at the housing lottery, signing up a total of 344 students or \$10,320 (Sustainability Task Force). The check was presented to Mass Energy Consumer Alliance during Campus Sustainability Day on October 23, 2006.

After seeing student willingness to optionally sign up for Renewable Energy Credits, CSI posed another referendum question to the students asking if they would be willing to change the program from opt-in to opt-out. This time it passed with the majority of the student body that voted.

With the continuing support for renewable energy credits and the change in views that students have at Clark. In June of 2007, President Basset signed the American Colleges and Universities President's Climate Commitment. The commitment is designed to help Colleges and Universities organize plans to make their campus more sustainable.

### **Process**

In order to measure success in our Renewable Energy Program project, we established four main goals throughout the semester. First, in order to understand where Clark was in terms of Renewable Energy Credits, we wanted to establish a solid background of how RECs were developed at Clark. This would include conversations with people such as Dave Schmidt and Zo Tobi. A second goal was to outreach to the Clark community in order to mobilize individuals to sign up for Renewable Energy

Credits. This involved tabling in the University Center with a computer for people to sign up immediately, starting a Facebook group about Renewable Energy Credits, hosting a table at Sustainable University Day to inform the community about Renewable Energy Credits and meeting with Clark Sustainability Initiative to combine our efforts with theirs. The third goal was to institutionalize the REC program at Clark University. This required most importantly meeting with Provost David Angel to discuss REC's options and to find out what the University's stance on the issue was. The final goal was to go beyond the Clark community and reaching out to the Worcester Consortium schools to promote their involvement in buying Renewable Energy Credits. Our last goal involved meeting with the Task Force to see what Clark's actions toward carbon neutrality were going to be, to be able to bring ideas to the larger community. Also, in order to outreach with the greater Worcester Community, meeting with the Regional Environmental Council and Chris Noonan from Worcester State, would allow for a sharing of ideas and base of support for continuing the Renewable Energy Credits Program at Clark and in Worcester. However, we only wanted to ambitiously tackle this last goal if we successfully implemented and institutionalized REC programs at Clark. We wanted to have a solid foundation and example at Clark to be able to approach other schools and mobilize them by showing what Clark did and how it was successful in order to show that it would be successful for another school.

#### Understanding REC background and History at Clark

In order to accomplish our first goal, we had conversations with Dave Schmidt and Zo Tobi. Dave Schmidt is the Campus Sustainability Coordinator. Through out the semester we have worked with Dave to gather background information of what has been done in the past four to five years towards establishing the REC program. Dave has helped in providing ideas about who to speak with, such as Janna Cohen-Rosenthal, who works with Massachusetts Energy. She helped us to understand which fund the REC donations go into and which projects they support. Dave informed us of important meetings such as the Clark University Environmental Sustainability Task Force meetings. This was informative to see how our REC project could fit into the president's climate commitment. Dave was also an integral part in helping to manage online sign ups by creating and maintaining the website. We met with Dave early in the semester and he was able to provide background about Clark and what had been done up to this point to try and institutionalize the REC program.

Zo Tobi is a senior at Clark University and one of the people interested in changing the way Clark students think in terms of sustainability. Zo Tobi helped modify the way in which people signed up for RECs by transitioning from paper sign ups to online sign ups. He also worked hard to recruit people to sign up through tabling in the University Center and at Housing Lottery as well as conducting general educational outreach activities. Zo was in email contact with one of our representatives and was able to provide a very detailed background whilst providing ideas about how to continue this project successfully in the future. Zo attended the meeting with Provost Angel and his continued support and information has been very helpful. As a student who has been involved with RECs for more than a year, he is a firm foundation of the student voice on campus.

In order to gain some background specifics about Mass Energy, the company we're involved with in donating the REC generated money, we talked to Janna Cohen-Rosenthal. She is the Marketing and Communications Coordinator at Mass Energy. Dave Schmidt and Janna met with us and she was able to explain where the money goes once it is donated and why the purchasing of renewable energy credits is so important. Janna said that the MTC has two years to decide how best to spend the money and then eight years to build the actual wind farms. She explained how Mass Energy is working on two different wind farm projects, one in Worcester and one up on the North Shore. Janna has been a helpful resource in our understanding of the Renewable Energy Credits.

### Enhancing Student Support of RECs

Our second goal for this semester was to gain student support of Renewable Energy Credits and continue to outreach to the Clark Community. One of our strategies to accomplish this goal was to table in the University Center. We tabled during lunch and dinner for one to two hour blocks at a time, on multiple occasions. During this time we were able to sign up 179 students for the Renewable Energy Program. This effort was to show our persistence regarding the program and the continual support from the student body. Another strategy to continue education and outreach efforts was to create a Facebook group where students can sign up for the program on their own time. Within the group there is information regarding Renewable Energy Credits and a link to the "Choose Renewable Energy Program" website where students can quickly and easily sign up. In this day and age of technology, Facebook was a good outlet to make many people aware of our project for anyone who hadn't passed us as we tabled in the University Center. In preparation for the future, Amber helped us receive permission to set up a table during the housing lottery for students to sign up for RECs. This effort will be organized outside Residential Life and Housing where both our group and CSI will be responsible for the implementation and will help continue the student body's contribution to the program.

### Institutionalizing the REC program

In order to accomplish our third goal of institutionalizing this program, we met with Provost Angel on October 30, 2007, to discuss making the Renewable Energy Program at Clark opt-out. During this meeting he proposed three options for Clark University and the REC program. First, he talked about creating a more robust program which would continue the opt-in atmosphere. This program would be University run and would therefore make implementations like RECs, imbedded into institutional ownership. Second, he proposed the idea we brought to the meeting regarding making RECs an opt-out program that would appear on a student bill each semester. The opt-out function would be some kind of box to check or number to call in order to opt-out. In the past the University has been averse to adding on fees to an already large tuition bill. Other complications include concerns about making an institutional expectation saying, "You have to do it," ethical problems, and why not be able to do this for others issues like the genocide in Sudan or AIDS in Africa. Lastly, Provost Angel talked about making RECs part of the tuition with no opt-out option. This option is a way for the University to start committing to the Presidents Climate Commitment and within that, they need a program to help off-set emissions. Currently, ideas for meeting the Presidents Climate

Commitment are to work with energy conservation and waste management. Off-setting emissions can be used to make up for the rest of the commitment that the University may not be able to achieve.

After discussing the possibilities, the Provost continued by stating his personal proposal that he believes will be best for the University and its students. He believes that we should create a mixture between the first and third proposal. Clark needs to assume their own responsibilities and not place them solely on the students. By creating such a program, the institution would be held responsible but the students would also be allowed to make personal statements by participating in the program. Provost Angel discussed how the REC program will make up for a small amount of the millions of dollars needed in reevaluation of the University to reach the Climate Commitment and that focusing students to pay extra money is not fair. Instead, he believes that the institution itself needs to make sustainability a primary issue and prove this through their actions. A year ago, he was pushing for an opt-out program but the more he thought about it, the more he believes there are better ways to address these issues. The University itself needs to take responsibilities instead of tacking them on to the student's bills. In exchange, he believes that the institution can affect change by making the program widely visible and using their current resources to tackle the same issues presented in the program. He spoke of the University spending money in different ways and changing their priorities.

Ending the meeting, the Provost left us with an expected timetable. He told us that he could have the program institutionalized within 60-70 days where a sub-committee of faculty, undergrads, and graduate students would be able to tackle the program head on.

#### Outreach to Worcester Consortium

In order to begin on our fourth goal, to reach out to the Worcester Consortium, we went to Task Force meetings in order to gain a better understanding for what Clark was doing to become carbon neutral. These meetings would help us build a foundation in order to help other schools and provide ideas of what we were working on and what was a possibility at a Consortium school. Throughout the semester a representative from our team has attended the four Clark Sustainability Task Force meetings. The Task Force is made up of the provost, faculty members and staff from the various different parts of Clark. The Presidents Climate Commitment states that by November 14, 2007 Clark had to sign on to completing two of the possible seven options for making the campus more sustainable. The goal of the Task Force this fall has been deciding what the best options would be. After debating and categorizing the Task Force proposed to try and complete; established a policy stating that when purchasing new appliances to try and buy energy star equipment, climate-friendly investing, waste minimization and a green building policy for any new construction. By attending the Task Force meeting we have been able to understand Clarks view point on sustainability and what is going on. Also an option that the Task Force did not feel would be efficient to try and accomplish at this time was green power purchase and production which tied directly into our project. Important members of the Clark faculty are on the Task Force and it was important that they see our commitment to try and make changes.

Another way to be involved with the Consortium schools was to keep in contact with Chris Noonan, a student at Worcester State. Unfortunately institutionalizing a REC

program at Clark has been taking a long time and will most likely not be considered successful until the beginning of the spring semester. Thus, we did not want to pursue outreach to the other schools believing that in order to make effective change at other schools, we need to first have a stable example to work with at Clark University. We met with Chris Noonan on October 23<sup>rd</sup> and discussed his communication with faculty and staff from the Consortium schools. An overall consensus which he received from each school was that if such a program were to be established, it would have to be inspired from the student body (Noonan, 2007, personal communication). With this new agenda of working bottom-up, we have begun research and communication with other student run environmental organizations on other campuses. Besides involving Consortium schools in the REC program, we have done research and communication with other student run environmental organizations on other campuses. According to each Worcester Consortium school's websites, only Assumption College, the College of Holy Cross, Worcester State College, WPI, and Clark University have such programs. After discovering that we have extended our communications to each group to see what types of projects they are working on and some of their past accomplishments.

Assumption College has a campus group called the Environmental Club. This group works to create a more environmentally conscious community where its main focus has been on recycling. Currently, the group has created a campus-wide book drive where the books will be distributed throughout the country to improve literacy and reduce land fills (Paolucci, 2007, personal communication). To improve efficiency on campus, the group has also created a survey to get an idea of how environmentally conscious their campus is and to help determine where they want to turn their attention next (Paolucci, 2007, personal communication). Along with these efforts the club has also organized the Assumption Earth Day Clean Up, taken a tour of their waste removal company's plant, and worked with Holy Cross's "Eco Action" to collaborate their ideas.

In reference to Holy Cross, another Worcester Consortium environmental club is their Environmental Concerns Organization or Eco Action. This club is dedicated to promoting conversation through education and local action. Along with their Eco Action group, Holy Cross also has a Student Alliance for the Advancement of Alternative Fuels and Energy (SAAAFE).

The third school which participates in environmental activity is Worcester State College. Worcester State's Environmental Advocacy Group was formed three years ago and since then they have taken site visits to a recycling factory, a solar manufacturer, and a coal plant while advocating for renewable energy installment and for the president to sign the Presidents Climate Commitment (Noonan, 2007, personal communication).

Lastly, WPI has an on campus group called, "Global Awareness of Environmental Activity of GAEA. Due to insufficient modes of communication presented by the club, we have been unable to converse but hope that they are continuing their goals through effective activism.

## **Results**

Our first goal was to gain an understanding for the level of support for Renewable Energy Credits at Clark. Our results showed that Clark students were very supportive of paying an extra \$30 to support a Wind Farm Project within the state of Massachusetts in

order to offset some of their dormitory dirty energy consumption. In addition, the administration supported the idea of having students pay to fund renewable energy within the state.

Our second goal was to mobilize support through outreach and education as well as signing students up to purchase RECs. In total this semester we were able to sign up 179 students who agreed to purchase Renewable Energy Credits to offset their dirty carbon emissions from using energy in their dorm. This number is in addition to the hundreds of students that signed up in previous years and continue to donate the \$30. In an outreach and educational effort to inform more people about our project, the Facebook group that we created currently boasts 117 members.

Our third goal was to institutionalize a mandatory sign up of RECs. We met with Provost Angel and discovered that the administration did not support a mandatory or opt-out program. As an institution the Provost was only able to offer us the institutionalizing of a robust opt-in program which would be run and overseen by a permanent faculty or staff member. This program would include students and faculty who wanted to raise awareness and funds to support clean energy projects such as the Wind Farms through Massachusetts Energy. This program was to have a committee developed by the end of the semester so it could be permanent and established by the beginning of January 2008.

However, during one of the Task Force meetings, MTC proposed a new "Clean Energy Choice-On Campus Program for Clark and other Massachusetts institutions of higher education (Gustavo, 2007). This program is almost identical to the one Clark is currently participating in except the double match grant is divided into thirds (Gustavo, 2007). The double matched grant goes towards the installation of solar, wind or other energy rated projects at the college or university, local clean energy projects, and clean energy projects that benefit low income residents throughout Massachusetts (Gustavo, 2007). The grant for the university or college itself requires the collaboration of students and administration. The administration is responsible for organizing how the money will be donated and collected from the students (Gustavo, 2007). This may include the continuation of online registration or possibility an option added to the bill. They are also responsible for utilizing the grant money quickly and efficiently (promptly) to fund clean electricity generation projects on campus (Gustavo, 2007). The students are responsible for generating awareness about clean energy on campus and to communicate with the administration about the most effective and efficient ways of running the program (Gustavo, 2007). Each of these responsibilities will be facilitated through members of the MTC program (Gustavo, 2007). Along with this, MTC will provide materials such as brochures to help promote the program (Gustavo, 2007). The new program that MTC is proposing helps fill the void that REC's could not and provides us with funding for renewable energy projects on-campus to help meet the climate commitment.

Our fourth and final goal was to reach out to the greater Worcester community, in specific the Worcester Consortium schools. Our goal was to know which schools in the Consortium have a similar program to purchase Renewable Energy Credits. In addition, we wanted to establish Clark as an example of a successful institutionalization of such an opt-in program in order to mobilize other schools to adopt a similar program. The Consortium schools with environmental advocacy groups included Assumption College, the College of Holy Cross, Worcester State College, and WPI. Out of these only Worcester State College has made progress on the installation of a Renewable Energy

Credits Program. As of early December, 2007, Worcester State received approval to implement Renewable Energy Credits at their school and have been endorsed by the Student Government (Noonan, personal communication, 2007). In regards to the other schools, Chris Noonan has been finding bureaucratic and political road blocks that have been prolonging schools administration's to further such an idea.

## **Conclusions**

Through out our process we talked with many individuals at Clark in order to learn what had been done up to this point. We met with Provost Angel to discuss the University's support for the REC program. We also tabled in the University center to show students continued to support this endeavor. We contacted the other schools in the consortium to gain an understanding for what they were doing in their attempt to bring sustainability to their campuses.

These goals were overall successful as we saw the University support our REC program by deciding to institutionalize it. We did not want this program to lose support or people to run it when students lost interest. Even though we initially were pursuing an opt-out program, our group was satisfied with a robust but institutionalized opt-in program. This meant that the administration would have faculty, staff and students pursue this campaign each year, promoting the routinely purchasing of these credits.

After going through the political gateways of the University, we discovered the only feasible option for institutionalizing Renewable Energy Credits on campus was to accept a robust opt-in program. Provost David Angel expressed concern over creating a mandatory or opt-out program that students had an obligation to pay. This seemed morally at odds with what the University's values should be. The institution should not be telling students what to personally support and add extra fees onto an already high tuition bill. Such an investment should be voluntary showing a personal choice or should come from University funds as a step towards carbon neutrality and fulfilling the President's Climate Commitment. In addition Renewable Energy Credits provide a comparatively small amount of money and they only offset the carbon we produce whereas the University has to invest in changing the infrastructure of the campus to support renewable technologies and efficiency within the University. This becomes an interesting discourse on the ethics involved in the level of responsibility individuals should bear versus the institution.

After actively pursuing this project and working towards institutionalizing Renewable Energy Credits, our group came to an agreement that the responsibility of renewable energy should be initiated by the University. The students' roles should only be to show support for renewable energy and any such endeavors. Renewable Energy Credits should still be promoted and invested in, but the greater role lays with the University. Provost Angel agreed, saying that money for renewable energy technologies should come from University revenue rather than students' pockets.

After this new MTC program came to light at a Task Force meeting, it seemed like a better investment for the University to commit to. Our future recommendations would be institutionalizing this new MTC program. This program allows both students and faculty to make donation to fund renewable energy projects. Unlike the regular REC program, this program gives money back to Clark University to fund renewable

technology projects. This program is extremely advantageous because it directly benefits Clark University and the greater Worcester community. We recommend that the University continue to raise awareness for Renewable Energy Credits as well as this new MTC partnership. It's important for students to be constantly aware of the beneficial environmental projects their school is involved with.

Through out the semester, we have been successful in keeping the issue of Renewable Energy Credits important on campus. Without our persistence the project might have been considered low priority, leaving Clark one step farther away from meeting it's climate commitment. To keep on this path towards climate commitment, Clark should install MTC's Clean Energy Choice-On Campus Program. This partnership will help Clark reduce its carbon footprint as well as provide a cash flow into the University for projects such as the installation of solar panels.

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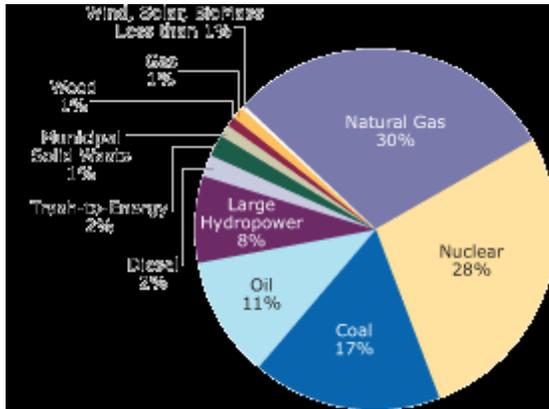
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**Appendix**

Figure 1.1—Pie chart breaking down the forms that energy comes from



(In case you can not read the text with a black background it reads: Wind, Solar, BioMass Less than 1%, Gas 1%, Wood 1%, Municipal Solid Waste 1%, Trash-to-energy 2%, Diesel 2%, respectively) (New England Wind Fund, 2007).

## **The Paperless Course as a Paper Reduction Tool: Clark University**

Jenna Perschka

Amanda Addeo

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### **Introduction**

Global warming, climate change, sustainability. These three words are entering daily conversations more often as these topics frequent news headlines. Along with these conversations, the role of humans is inevitably introduced. Humans are the reason, but could also be the solution in preventing further climate issues. Every day, more people in the general public become aware of global warming issues, and in turn, seek for simple measures that they can make. Typically suggestions follow along the lines of the change of a light bulb. After all, if every American home were to switch one incandescent light bulb with a compact fluorescent bulb, it would prevent the equivalent greenhouse gas emissions of more than 800,000 cars, in addition to saving enough energy to light more than 3 million homes for a year (U.S. EPA). Recycling, too, is a small enough commitment to make. However, outside of those small suggestions, individual change always comes in the form of much bigger and more expensive solutions—for example, the addition of solar panels onto your home, or the purchase of a hybrid vehicle. But what about paper?

Why is it important to use less paper? Printing on a slim-lined sheet of crisp, white paper hardly seems like a significant contribution to pollution. But how many times a day does the typical person print something? How much paper junk mail do you receive? Is the daily paper delivered to you or do you pick one up on the way into work every day? How many rolls of toilet paper, paper towels, or tissue boxes fill the home of every American family? And after it is all said and done, how much of this paper is actually recycled?

On a global scale, the world produces more than 300 million tons of paper annually (RCA). In the United States only fifty percent of this paper has a chance of being recycled (RCA). More than forty percent of the U.S. municipal solid waste stream is comprised of paper products—the single largest component (RCA). Furthermore, an average U.S. office employee generates approximately 9,999 sheets of paper annually (RCA). Those 300 million tons of paper translates into a loss of nearly 30 million forested acres (approximately the size of the state of Pennsylvania) each and every year. Of those 30 million acres, nine percent are old growth forests (RCA).

Colleges and universities are especially responsible for mass paper consumption. On a daily basis mass amounts of paper are used—professors hand out notes to students, students hand in exams, papers, and other assignments. Students also frequently print out readings for class for portability and ease of taking notes. Outside of the classroom but still on campus, different departments, including admissions offices and marketing constantly send paper mail to prospective and admitted students, families of students, and alumni and friends of the university.

In the classroom, one measure in curbing paper use is the implementation of a paperless course. This project examines the use of a paperless course—EN 103: The Sustainable University—in efforts to address paper use at Clark University. Ultimately,

the goal of the project is to reduce paper-use on the Clark campus, through increasing awareness of current use, and making suggestions for reduction.

## **Background**

Until 1990, no recycling program existed on the Clark campus. Two students, Matt Most '92 and Dan Kallin '92, changed this by placing bins for paper collection throughout residence halls and offices. Now, a more structured program exists as part of the Physical Plant office. However, paper recycling is still an area that can use a lot of improvement. Recent focus on reducing paper waste at Clark comes after multiple sustainability meetings between student-led groups such as the Clark Sustainability Initiative (CSI) and faculty meetings in the Sustainability Task Force. The focus has now shifted from paper recycling to paper reduction.

An audit completed by the Clark Recycling Center in 2006—which accepts a wide variety of paper wastes including mixed office paper, junk mail, books, notebooks, newspapers, magazines, corrugated cardboard, and box board—showed that 24.6% of the trash on campus was paper that could have been recycled (Clark University, 2007). This does not include the 4.3% of cardboard that was also not being recycled (Clark University, 2007). This means that almost one-third of the trash on campus is composed of paper than can be recycled. In spite of the great bulk that paper represents in Clark's waste, no previous campaign has been carried out in order to reduce its consumption.

Clark's Internet and Technology Services (ITS) has a number of networked-printers on campus which students can use, at no cost. At least two of these printers are widely used: one of these printers is in the Goddard Library, the other in the student computer lab in Jonas Clark. Both printers are set at a double-sided default. The monthly average for the Goddard printer is 27,000 sheets of paper (Brooks, 2007, personal communication). The printer in Jonas Clark, however, has a monthly average of 127,000 sheets per month (Brooks, 2007, personal communication). This brings the monthly average of these two printers alone, to roughly 154,000 sheets. Additionally, there are two other printers in the library which are frequently used by students—however, because the printers are not networked, monthly averages are unknown. These numbers also exclude all department-used printers, and personal printers in students' rooms. However, the project assumes that students are more likely to use campus printers because of: lack of fees and an endless supply of paper and ink.

Given that one tree makes approximately 8,333.3 sheets of papers, 720 trees are required to supply Clark with printer/copy paper for one year (Clark University, 2007). Again, this figure does not take into account printing done on student printers, nor does it calculate paper used for note-taking, or paper in the form of textbooks.

In the Fall of 2007, in an effort to reduce paper consumption, Professor Jennie Stephens, director of Environmental Science and Policy, decided to test the feasibility of a paperless course at Clark. EN 103: The Sustainable University, is a typical thirteen week course with a total of twenty-one undergraduate students. The online tool *Blackboard* was used extensively throughout the class.

*Blackboard* offers a range of capabilities for the professor and students (Wulf, 2004). For instance, from the online program a professor can post assignments and grades, give feedback on student work, and generate discussion boards for the students to

participate. Students can access articles and information posted by the professor, submit work, and complete reviews of peer work. Professors and students can also utilize file exchanges to share information.

The course was documented and analyzed for its effectiveness by three undergraduates in the course. Calculations were done to tally the amount of paper saved and a student survey was created to gain feedback from students. Teachers were also surveyed. All of this was done to assess the feasibility of implementing paperless courses on the Clark campus.

## **Process**

The first step in determining the effectiveness of the class was calculating how many sheets of paper were saved in the Sustainable University course. To do this, the amount of pages in posted readings was counted and multiplied by 24. Twenty-four includes both teaching staff and students, as it was expected that the teaching staff would also need a copy of the readings. The total number of pages from assignments was also counted—including the number of reading responses, number of peer reviews, activity logs and team meeting notes. The consumption of electricity used from each student reading on a computer was considered, but ultimately excluded. There is undoubtedly some additional energy used because of the increase of computer reliance, however, the team completing the course assessment decided to limit the scope of the analysis to the paper-use reduction aspects. Additionally, because so many student computers are left on regardless of use, the team felt comfortable omitting this part of the impact.

The next step in the process was the completion of an anonymous survey by all students in the class. The survey was composed of open and closed – ended questions and was kept anonymous so that students could feel comfortable giving honest answers. Please see Appendix A for the complete survey used.

The survey was designed for multiple reasons. Primarily, the anonymity of the survey was designed to determine whether or not students were printing the readings outside of class, which would defeat the purpose of the class being paperless. Another goal of the survey was to get student feedback about whether or not they felt the benefits of the class outweighed the disadvantages.

In addition to the student survey, the team designed a survey for faculty members of the course. The responses of the teaching staff are intended to provide information relevant to the faculty perspective on the organization and execution of the paperless course. The responses included an analysis of the challenges of conducting a paperless course as well as suggestions for students and faculty, which will hopefully serve to mitigate such difficulties (Appendix D).

Finally, throughout the project, Clark Internet and Technology Services was contacted in order to gather appropriate estimates on student printing at the university. Justin Brooks, Clark IT, was able to provide monthly averages for printing/copy information in some of the school's main buildings. The information collected from Clark IT is discussed in detail in the previous Background section of this paper.

## **Results**

When tallying the number of pages from student readings and various other assignments (which excludes final papers), the total saved paper in the class is approximately 7,700 sheets. However, when an additional calculation was done to include printing Professor Stephens' power points for each student, the total was closer to 9,200. Many students shared that some of their professors print out their power points for students, which was why the later calculation was done.

The anonymous survey showed that approximately 75% felt that the environmental benefits of the class outweighed the personal inconveniences of the class. Less than half of the class printed readings, and of that percentage, only one student printed the readings more than four times (See Appendix B for complete survey results).

Optional student comments on the survey varied. One student explained that the reason they printed a reading was because they were going home for the weekend, and had no internet access there. Another student suggested that many of the teachers are at fault for wasteful printing, posting readings on blackboard or power points, but still suggesting that students print them. Other students expressed ideas for other ways of reducing paper use on campus, and would like to see recycled paper replace virgin printing paper on campus.

## **Conclusion**

The results from Professor Stephen's paperless course experiment suggest that more paperless courses are feasible at Clark and other colleges and universities. While there are some inconveniences from online reading, there are solutions for some of these problems (i.e. reduce eye straining by dimming the computer screen).

Based on the assessment of the class, this project team suggests that all faculty, staff, and students are made aware of the huge paper consumption at Clark, including the associated problems with paper production. The team also suggests that purchases of virgin paper on campus be changed to recycled. Penn State implemented a policy requiring all recycled paper on campus over ten years ago (PSU, 1995). The next step of this project is testing the paperless course in various other classrooms on campus. Proper *Blackboard* training for teaching staff should be offered to ensure better success of the implementation. Ultimately, reduced paper consumption at Clark, and various other colleges and universities, is the primary goal. A reduction of paper-use at the college level could save a huge amount of paper (approximately one tree for every paperless class) from being consumed. Steps can be taken and transitions made to ensure success of paperless course and other paper-reduction methods.

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## Appendices

### 1. Survey Completed by Class

The environmental benefits of the paperless class outweigh the personal inconveniences caused by the class.

- Agree, Disagree, Unsure

I would enjoy taking another paperless class.

- Agree, Disagree, Unsure

When reading online, I find it harder to focus or retain information.

- Agree, Disagree, Unsure

Blackboard is generally user-friendly.

- Agree, Disagree, Unsure

If I have a problem with Blackboard, there is a teaching staff available to help me.

- Agree, Disagree, Unsure

Taking a paperless class has made me more conscious of my paper-use outside of The Sustainable University.

- Agree, Disagree, Unsure

Have you ever personally printed a reading assignment for the class?

- Yes, No

If yes, how many times have you printed a reading assignment?

- 1 time, 2 times, 3 times, 4+ times

Do you use paper to take notes in class?

- Yes, No

If yes, is the paper virgin or recycled?

- Virgin, Recycled, Unsure

## 2. Survey Results

The environmental benefits of the paperless class outweigh the personal inconveniences caused by the class.

Agree: 14 = 73.7%

Disagree: 0

Unsure: 5 = 26.3%

I would enjoy taking another paperless class.

Agree: 9 = 47.4%

Disagree: 3 = 15.7%

Unsure: 7 = 36.8%

When reading online, I find it harder to focus or retain information.

Agree: 10 = 52.6%

Disagree: 4 = 21.1%

Unsure: 5 = 26.3%

Blackboard is generally user-friendly.

Agree: 14 = 73.7%

Disagree: 3 = 15.7%

Unsure: 2 = 10.5%

If I have a problem with Blackboard, there is a teaching staff available to help me.

Agree: 12 = 63.2%

Disagree: 3 = 15.7%

Unsure: 4 = 21.1%

Taking a paperless class has made me more conscious of my paper-use outside of The Sustainable University.

Agree: 18 = 94.7%

Disagree: 1 = 5.3%

Unsure: 0

Have you ever personally printed a reading assignment for the class?

Yes: 7 = 36.8%

No: 12 = 63.2%

If yes, how many times have you printed a reading assignment?

1 time: 2 = 10.5%

2 times: 2 = 10.5%

3 times: 2 = 10.5%

4+ times: 1 = 5.3%

Do you use paper to take notes in class?

Yes: 11 = 57.9%

No: 8 = 42.1%

If yes, is the paper virgin or recycled?

Virgin: 8 = 42.1%

Recycled: 2 = 10.5%

Unsure: 1 = 5.3%

### **3. Survey Completed by Teaching Staff**

Are there presently any efforts at Clark University to encourage faculty members to convert their courses to paperless?

What anxieties might faculty members have about going paperless?

What sequence did you follow in creating your paperless course?

What, if any, were the difficulties of establishing a paperless course?

What, if any, are the resources available to faculty members who wish to have a paperless course but struggle with the technology portion of doing so?

Are you satisfied with the progress of your paperless course?

How have students responded to having a paperless course?

With a paperless course, what do you feel is most challenging to students? To members of the teaching staff?

What, if any, changes might you consider making to your paperless course?

What might help faculty members to better adjust to going paperless if they choose to do so?

What might ease the adjustment of students taking a paperless course?

#### **4. Teaching Survey Results (Jennie Stephens)**

**Are there presently any efforts at Clark University to encourage faculty members to convert their courses to paperless?**

No, not that I know of. I have not heard anything even about paper-use reduction efforts for faculty in their teaching.

**What anxieties might faculty members have about going paperless?**

I sent out an email to the IDCE faculty (~16 faculty) this summer suggesting that faculty consider electronic submission of papers and assignments. I got two responses from faculty who are absolutely against reading papers online. One faculty member said that she does not think that online readings of papers get the same level of attention. She thought that hard copies are a must. Another faculty member was strongly opposed because she does not like “track changes” and she does not want to spend more time sitting at her computer. Another faculty member expressed concern about her eyes with all the time it takes staring at a computer screen.

**What sequence did you follow in creating your paperless course?**

Last year I taught this same course and it was not “paperless.” I printed handouts occasionally and I asked students to hand in hard copies of their papers. And actually it was feedback from some students in last year’s class that made me realize that I didn’t have to do that and I could require all electronic submissions. Then I did a little thinking and reading about what it would take. Then I decided to go paperless. It has been great from my perspective.

**What, if any, were the difficulties of establishing a paperless course?**

The only challenge was figuring out the legal implications. I wanted to post all the readings as PDFs on blackboard but to do that I had to find out whether that was legal. Apparently it is OK the first time, but if I am teaching this course over and over and I am always posting the same readings this will violate copyright law. I think this is clarified in the “fair-use” law?

**What, if any, are the resources available to faculty members who wish to have a paperless course but struggle with the technology portion of doing so?**

ITS is available to help with blackboard. They are quite helpful to faculty in this regard. That is the only resource that I can think of. I didn’t find much in my internet search of “paperless” class. That is why I think that you/we should write something up on this and publish it.

**Are you satisfied with the progress of your paperless course?**

Yes, I think it has gone very well. I have been reading online with the students. It actually simplifies my life having everything in my computer.

**How have students responded to having a paperless course?**

From what I can tell from the students in our class, it seems to be working OK. Because students realize that this is an experiment and they recognize the value in this experiment

due to the nature of the course, I haven't heard any real opposition to it. But I imagine in other courses that might be different.

**With a paperless course, what do you feel is most challenging to students? To members of the teaching staff?**

For students I imagine it is reading the pdf articles online. For the teaching staff probably the same. I find that the submission and response of written work online has worked really well.

**What, if any, changes might you consider making to your paperless course?**

Not sure yet. But I am going to try to make all my courses paperless.

**What might help faculty members to better adjust to going paperless if they choose to do so?**

I think we should develop a one-page set of guidelines – and maybe not calling it a “paperless course” but calling it “paper-use reduction strategies for college teaching” I think the case needs to be made on how and why this matters –because I think many will think that this inconvenience is not worth it.

**What might ease the adjustment of students taking a paperless course?**

I think explaining to students why. Making the case and justifying the decision to reduce paper-use. As I said in the previous statement, maybe the focus should not be on “going paperless” but reducing paper use in coursework. This will allow those students who it really doesn't work for to go ahead and print when necessary, but I think if faculty make a big deal about paper use reduction efforts, many students will make changes in their habits.