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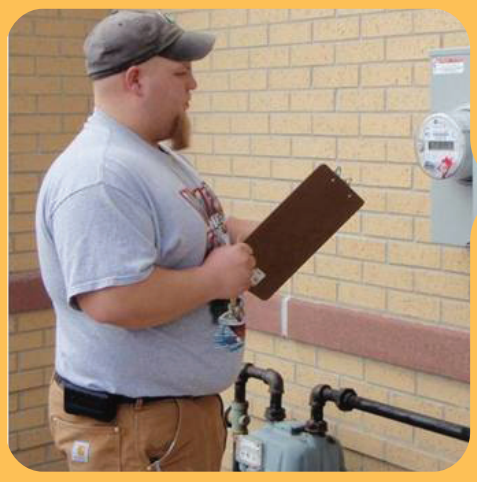

Action Plan for Climate Neutrality and Sustainability at the U of M, Crookston

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6/30/10

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BACKGROUND

On 9 July 2004, the University of Minnesota Board of Regent's passed an official policy on Sustainability and Energy Efficiency (Appendix A.) The policy committed the University to, "incorporating sustainability into its teaching, research, and outreach, and the operations that support them." Guiding principles were identified as well as implementation guidelines. On 2 April 2008, President Robert Bruininks charged a Sustainability Goals and Outcomes Committee to facilitate this policy by:

• Recommending University-wide sustainability goals aligning to the policy guiding principles: leadership, modeling, operational improvements, energy efficiency, research, and education and outreach
• Drafting performance measures and appropriate mechanisms for measuring and reporting progress both in operational units and across the University as a whole
• Supporting each campus's development of campus-wide, ongoing sustainability committees to ensure implementation of the Regents policy.

The committee completed its report in September of 2009 (O'Brien and Swackhamer 2009) and identified the following goal areas:

Leadership and Modeling

Goal 1: Be a national leader and pioneering model for sustainability and energy efficient operations among large public research land-grant institutions
Goal 2: Actively advance the transition to a sustainable world economy through research, teaching, outreach, and operations
Goal 3: Inspire and influence the community, nation, and world through innovative sustainable research and practices
Goal 4: Make significant continuous achievements toward sustainability goals and commitments
Goal 5: Embrace an organizational culture and individual decisions that support an inclusive, engaged, active, and sustainable healthy community
Goal 6: Meet all regulatory requirements and support the development of future regulations and policies through technical review, academic study, and practical experience

Operational Improvements

Goal 1: Plan, program, design, construct, and operate University of Minnesota facilities throughout their life cycle to provide restorative impacts to the natural environment and a healthy indoor environment for the University community
Goal 2: Integrate environmental, economic, and social priorities into purchasing and contract decisions
Goal 3: Use lower impact transportation alternatives that increase fuel efficiency, provide more sustainable fuel options, and help reduce the miles traveled on campus, to campus, and as part of the University of Minnesota enterprise
Goal 4: Manage resources for their highest end use by reducing consumption, minimizing waste, and strongly supporting the reuse and highest value recycling of unwanted materials

Energy Efficiency

Goal 1: Reduce energy use
Goal 2: Engage the University of Minnesota community in energy conservation
Goal 3: Pursue climate neutrality and energy efficient operations across the University of Minnesota
Goal 4: Adopt energy-related financial policies which enable the University of Minnesota to be socially, environmentally, and fiscally informed

Goal 5: Contribute to the development of progressive state and federal energy policies

Research

Goal 1: To advance sustainability, nurture cross-disciplinary collaboration and sharing of ideas and perspectives within and beyond the University
Goal 2: To advance sustainability, promote civically engaged, socially informed, and community responsive research and scholarship
Goal 3: To advance sustainability, instill sustainability principles in the research culture of the University of Minnesota; all levels of University leadership should embrace sustainability as a core pillar of the University's mission
Goal 4: To advance sustainability, eliminate institutional barriers and disincentives to interdisciplinary and collaborative sustainability research
Goal 5: To advance sustainability, transform the University of Minnesota into a living laboratory for sustainability

Education and Outreach

Goal 1: Capture the land-grant mission: Sustainability is part of the educational or campus experience of each and every University of Minnesota student
Goal 2: Integrate service learning into the undergraduate and graduate experience, linking students, faculty, University of Minnesota Extension, and community partners
Goal 3: Create and implement curricula and educational programs that address the interface of environment, society, and economy
Goal 4: Develop outreach programs for sustainability education of working professionals in the public and private sector

Communication

Goal 1: Create opportunity for dialogue to discuss global and local sustainability challenges, opportunities available, and the work of the University to advance sustainability
Goal 2: Develop and implement marketing/promotion efforts to engage those who may not be aware of sustainability-focused education, outreach, and research opportunities
Goal 3: Develop and maintain a transparent data management information system to enable decisions utilizing environmental, economic, and social factors

On 8 January of 2008, President Bruininks signed the American College and University Presidents' Climate Commitment which required signatories to complete a campus report on greenhouse gas emissions by 15 May of 2009 and a Climate Action Plan for each campus within 2 years of signing the agreement, or January of 2010 for the University of Minnesota, Crookston. This report constitutes the campus Climate Action Plan for the Crookston campus as well as addressing general aspects of a campus Sustainability Plan. There are 10 sections to this report and most of the preceding goal areas are addressed in each section.

EXECUTIVE SUMMARY

Action Plan for Climate Neutrality and Sustainability at the University of Minnesota, Crookston

The beginning Heightened concern about the environment and the role of the University of Minnesota was cast in a spotlight with the first Earth Day observance on 22 April 1970. Some level of interdisciplinary attention began at that time but was somewhat inconsistent and became dispersed in various programs and departments amongst the various campuses over time. It lacked a unified focus and in general, "sustainability," as a holistic concept was used little at the outset. On 9 July 2004, the University Board of Regent's passed the Sustainability and Energy Efficiency Policy to incorporate sustainability into its teaching, research, and outreach. On 8 January of 2008, President Robert Bruininks signed the American College and University Presidents' Climate Commitment which required a report on greenhouse gas emissions by 15 May of 2009 and a Climate Action Plan for achieving climate neutrality for each campus within 2 years of signing the agreement. Further, on 2 April 2008, President Bruininks charged a Sustainability Goals and Outcomes Committee to develop an implementation plan for the 2004 Regent's policy. The Action Plan presented here is an outgrowth of these beginnings.

The process University of Minnesota, Crookston (UMC) Chancellor, Charles Casey, established a campus-wide Sustainability Committee with various working groups to provide direction to sustainability efforts in the fall of 2008. Meanwhile, UMC students came together in an historic, cohesive way to form the Crookston Students for Sustainable Development (CSSD) which provided an education and action forum which greatly elevated the sustainability awareness of the student body. The U of MN Center for Sustainable Building Research was engaged in the summer of 2009 to guide the development of this Action Plan and coordinated a series of campus workshops to inform and engage the UMC campus community towards sustainability and the goals and objectives of *climate neutrality*; a term which previously held little meaning to the campus at large. As in strategic planning, the *process* of informing, engaging, and empowering participants is as important as the *final plan*. Linda Kingery, Executive Director of the Northwest Regional Sustainable Development Partnership, played an indispensable support role throughout this process.

The progress UMC students through the CSSD forum developed a mission statement, hosted several speakers, adopted a "green fee" to support a part-time student sustainability assistant, and encouraged action which led to the planned residence hall (now Evergreen Hall) being constructed according to LEED standards. Chancellor Casey established the Center for Sustainability in July of 2009 to provide more identity to campus sustainability initiatives. Fortuitously, a revision of the Campus Master Plan was underway and will now contain sustainability design considerations. In the summer of 2009, UMC was the successful applicant of the Otter Tail Energy Challenge Program; a unique partnership between an educational institution and a power company to cooperatively strive towards enhanced energy efficiency. The success of that application was strengthened by demonstrated student initiatives and the institutional commitment toward sustainability. That partnership supports and adds impetus to this Action Plan.

The plan This resulting Action Plan is a road map or a long-term strategic plan of sorts with the end goal of achieving climate neutrality* by 2030. The various sustainability strategies and recommendations identified

herein will contribute towards achieving that goal. Strategies are categorized into 10 sections in this report but content-wise, contain the essence of the 6 goal areas of the U of MN Systemwide Sustainability Goals and Outcomes Report of September 2009 (O'Brien and Swackhamer); Leadership and Modeling, Operational Improvements, Energy Efficiency, Research, Education and Outreach, and Communication.

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* "*Climate neutrality is defined as having no net greenhouse gas (GHG) emissions, to be achieved by eliminating net GHG emissions, or by minimizing GHG emissions as much as possible, and using carbon offsets or other measures to mitigate the remaining emissions*." (From: American College and University Presidents' Climate Commitment. http://www.presidentsclimatecommitment.org/)

Recommendations

Energy. Since energy is the common denominator which drives the production of greenhouse gases and global climate change, naturally the focus of this Action Plan uses energy as a reference point in evaluating actions. Energy conservation is the low-hanging fruit and should always be step 1 whether it be behavioral modification strategies or infrastructure retrofits/new construction. Capital improvements have to be balanced with appropriate management programs though in order to be effective over the long term. A building by building focus is needed but within a campus-wide context. To meet requirements of climate neutrality, a transition from non-renewable to renewable fuels is recommended with geothermal assisted heat pumps powered by electricity generated by wind turbines as the primary strategy.

Local foods. A greater understanding of the value of locally produced food is needed by Sodexo (the local food vendor) and the campus community as to the carbon footprint, relationship to health, and the economic impact on the local economy.

Water and landscape management. A nutrient/stormwater management plan is being implemented in the livestock area of the UTOC complex. A more comprehensive campus stormwater management plan is under development. Still needed is a sustainable landscape management plan which addresses the energy dimensions of maintaining present land covers with recommendations for alternative, low maintenance landscapes. The latter plans could be combined.

Transportation. Although only 1 mile from the edge of Crookston, UMC is a rural campus, and necessitates some means of vehicular transportation, particularly during inclement weather. There is currently limited bus service. Carpooling can be encouraged and transitioning the University Fleet vehicles to more fuel efficient models, such as hybrids, can make a substantial difference.

Curriculum. One sustainability related major, *Biofuels and renewable energy technology*, is in place, *Environmental Science* has just been approved by the Board of Regents, and a minor in *Sustainability* and a major in *Sustainable Facilities Management* are in progress. Also, four long-standing, programs within Natural Resources are based on sustainable resource use as an operating principle. As the campus transitions towards more applications of sustainability principles, it will function as an institutional case study of sustainability which will inform many campus programs and courses.

Recycling and Waste Management. Accommodations (containers and pick-up programs) are in place for recycling paper, beverage containers, and metals, but more can be done regarding source reduction. Incorporating comprehensive waste management goals within the campus culture is happening incrementally but continual education and emphasis are needed. The campus was a recent participant in the national, *Recylemania* initiative.

Research. The potential for faculty and undergraduate student research related to sustainability and climate neutrality is largely untapped on the UMC campus but the research questions, opportunities, and funding potentials are numerous. The campus, undergraduate research support fund (UROC) is often undersubscribed.

Communication and outreach. Outreach or extending information to those who can apply it, is a hallmark function of the University of Minnesota as the land grant university as well as a tenant of sustainability since inception in the early 1970's. Climate action plans are new in the U.S. and particularly in northwest Minnesota. Communicating about this action plan and progress towards its implementation can be newsworthy and informative to students, faculty, and staff involved in developing press releases and presentations as well as the receiving audiences. Further, since climate action plans are a system-wide activity, the opportunity exist to connect this effort to other campus' activities within the University.

Connections and conversations. A number of outside sustainability speakers have been featured on the UMC campus or accessed remotely; many of national and international prominence. The information relayed and connections made with these resource specialists can elevate the awareness of the campus community, increase opportunities for UMC faculty and staff to partner with others on collaborative grants, and contribute towards culture change. But how can this process be made more efficient and networks made more viable? Websites and blogs are possibilities. How can the Crookston campus and the University at large become a more effective, "learning and innovative organization?" (Senge, 1995).

Culture and process. Serious implementation of an action plan to achieve Climate Neutrality is no small matter and requires a culture change. Societies tend to respond more readily to *events* (9-11, Pearl Harbor, Gulf Oil Spill, and Cayuga River catching fire in 1968) but climate change is a *process* where participants need to be "reasoned" into implementation. How is buy-in achieved, how do participants believe that the issue is of consequence, how do they perceive that the issue affects them or their descendants, and are they convinced that individual recommended actions will make a difference? From an institutional perspective, when sustainability is included as a priority in campus Strategic Planning and Master Planning documents, this sends a powerful message to the campus community. Recommended approaches include; 1) riding the wave of external changes happening in society, 2) integrate sustainability to efforts already important to the campus community, 3) foster the internal changes one step at a time, and 4) creating an innovative and creative campus community where all are included and all can participate. This Action Plan is best viewed as a living document and will be updated annually to reflect changes in technology, attitudes and priorities of the campus community, financial resources, and unforeseen challenges and opportunities.

The journey towards a more sustainable, energy efficient, and climate neutral campus of the University of Minnesota at Crookston has begun. The goal is about the future, and the future is forever.

Daniel Svedarsky, Director - Center for Sustainability 12 June 2010

INTRODUCTION

Global climate change is somewhat incomprehensible in its science and overwhelming in its impacts. In the 21st century we as a civilization are confronted with changes that are seemingly beyond our control, yet, these problems are very much within our capability to solve. The solutions to this problem will benefit us as individuals, organizations, nations, and as a world community. These solutions are within the financial capability of each of us. In many ways the appropriate response to climate change is more a design problem than an insurmountable structural problem. By addressing climate change, we will conduct our current business differently in the future; more in concert with operating principles of the natural world around us and upon which we depend. In most cases, this change will not inconvenience us. The change will in fact facilitate new opportunities to reduce waste, create new integrative management systems, and operate with a renewed sense of commitment to the new paradigm that we will have developed.

It is timely that this report comes on the heels of the U.N. Conference on Climate Change staged in Copenhagen, Denmark from December 6- 19, 2009. Delegates and heads of state from around the world gathered to discuss the breadth of the issues and how to craft preventative and adaptation strategies. That most significant environmental gathering provides a global context for the local action outlined here. We must strive to be proactive rather than reactive. We must adapt what fits within the context of local resources and the community consciousness with an eye to the future so we can, in the words of Wayne Gretsky, "Skate to where the puck is going to be!"

The future will require changes in how we do business because some of our present modes of operation will not be viable in 10 or 20 years. Actions like increasing energy efficiency, shifting to renewable energy, and reducing waste and pollution are not only good for the environment but are good business as well since they save money. The University of Minnesota, Crookston (UMC), because it is a learning and teaching institution as well as a leader in northwestern Minnesota, is the ideal organization to lead in developing and communicating this new paradigm to our students and regional communities. Universities are a microcosm of society where creative ideas are to be developed and demonstrated as we prepare students to be leaders in an increasingly diverse and resource-constrained environment. It is important to outline some operating principles to guide our efforts.

The following principles, developed in Wingspread, Wisconsin, are a good model for UMC to adopt. The Wingspread Principles[1] are an outgrowth of the National Leadership Summit on Energy and Climate Change, held at the Johnson Foundation's Wingspread Conference Center in June 2006.

Wingspread Principles on the U.S. Response to Global Warming[1]:

Great nations rise to great challenges. Today, no challenge is more critical than global climate change. It reaches to the core of humanity's relationship with the Earth. It tests our capacity to make intelligent changes in our economy, policies and behaviors in the interest of all people and all generations.

- **Urgency:** Global warming is real and it is happening now. Every year that we delay action to reduce emissions makes the problem more painful and more expensive - and makes the unavoidable consequences more severe. Leaders in government, business, labor, religion and the other elements of civil society must rally the American people to action.

[1] http://summits.ncat.org/energy_climate/question.php

- **Effective Action:** The U.S. must set enforceable limits on greenhouse gas (GHG) emissions to significantly reduce them within the next 10 years, and should work with other nations to achieve a global reduction in absolute GHG emissions of 60 - 80% below 1990 levels by midcentury. Experience proves that voluntary measures alone cannot solve the problem. Aggressive government action, including mandates based on sound science, is imperative and must be implemented now.

- **Consistency and Continuity of Purpose:** Climate stabilization requires sustained action over several decades to achieve deep cuts in greenhouse gas emissions throughout the economy. With its frequent changes of leadership and priorities, however, the American political system does not lend itself to long term commitments. Leaders in both government and civil society must shape policies and institutions that ensure sustained climate protection.

- **Opportunity:** Mitigating and adapting to global warming offer the opportunity to create a new energy economy that is cleaner, cheaper, healthier and more secure. We must awaken America 's entrepreneurial spirit to capture this opportunity.

- **Predictability:** Measures that signal investors, corporate decision makers and consumers of the certainty of future reductions are essential to change the economy.

- **Flexibility:** Deep cuts in greenhouse gas emissions demand and will drive innovation. Our economy will innovate most efficiently if it is given the flexibility to achieve ambitious goals through a variety of means, including market based incentives and/or trading.

- **Everyone Plays:** Measures to stabilize the climate must change the behaviors of business, industry, agriculture, government, workers and consumers. All sectors and the public must be engaged in changing both infrastructure and social norms.

- **Multiple Benefits:** Actions to stabilize, mitigate or adapt to global warming should be considered alongside other environmental, economic and social imperatives that can act synergistically to produce multiple benefits - for example, "smart growth" practices that conserve forests and farmland while reducing the use of transportation fuels. Many actions to stabilize climate offer local, regional and national, as well as global, benefits.

- **Accurate Market Signals:** The true and full societal costs of greenhouse gas emissions, now often externalized, should be reflected in the price of goods and services to help consumers make more informed choices and to drive business innovation. Policymakers should eliminate perverse incentives that distort market signals and exacerbate global warming.

- **Prudent Preparation:** Mounting climatic changes already are adversely affecting public health and safety as well as America 's forests, water resources, and fish and wildlife habitat[2]. As the nation works to prevent the most extreme impacts of global warming, we also must adapt to the changes already underway and prepare for more.

- **International Solutions:** U.S. government and civil society must act now to reduce their own greenhouse gas emissions, regardless of the actions of other nations. Because greenhouse gas emissions and the

[2] http://www.usda.gov/wps/portal/!ut/p/_s.7_0_A/7_0_1OB?contentidonly=true&contentid=2009/12/0611.xml and, http://www.usda.gov/img/content/EffectsofClimateChangeonUSEcosystem.pdf

effects of climate change are global, however, the ultimate solutions also must be global. The U.S. must reengage constructively in the international process.

- **Fairness:** We must strive for solutions that are fair among people, nations and generations.

In accordance with the above principles and the goal areas of the U of MN system wide Goals and Outcomes Report (O'Brien and Zwackhamer 2009) , the University of Minnesota, Crookston is making the commitment to reduce its net carbon emissions to zero by the year 2030.

1 ENERGY

Background and Current Efforts at Crookston:

One of the first significant energy-related initiatives for the Crookston campus was a campus energy audit conducted in the summer of 2005 by Fabian Pommier entitled, Energy audit and recommendations for energy efficiency and renewable energy (Pommier 2005).

Pommier was an exchange student from France where gasoline was about $ 5.50 at the time so energy was very much a concern for him. His study was funded by the Institute for Renewable Energy and the Environment (IREE) of the University of Minnesota and the Northwest Regional Sustainable Development Partnership. His rather thorough, 126-page report was the first attempt to compile a campus-wide view of energy use and recommend steps to improve efficiencies and conservation.

Two campus landscaping interns in the summer of 2005 focused on steps to improve the sustainability of landscaping practices by recommending no-mow and minimum maintenance procedures. Finally, native prairie and forest vegetation was established in the Nature Nook that summer to mark the beginning of using native vegetation on campus for carbon sequestration. A sustainability seminar series was held in 2005-06 which included a program on wind energy potentials. A comprehensive Sustainable Development Conference was staged in the fall of 2005.

In 2008, the McKinstry Company completed, A Carbon Footprint for the University of Minnesota, Crookston, report, (McKinstry2008), and 2009, University of Minnesota, Crookston Energy Audit (McKinstry2009).

In the summer of 2009, UMC was the successful recipient of an Energy Challenge partnership launched by Otter Tail Power Company. This is a unique partnership between a university and a power company to work toward energy use reduction through infrastructure improvement and behavioral modification. As part of the program implementation, Otter Tail is supporting external energy auditing, installation of energy use meters, energy use and infrastructure consulting, student worker cost-sharing, and public relations efforts. Otter Tail is assisting to support a change in the overall energy use culture at UMC. Not only are faculty and students a key part of this change but custodians and maintenance staff, in particular, are a crucial link between proposed changes in energy use and their actual implementation. These individuals play a key role in whether a building is functioning properly (as intended and designed) or if it is losing energy in unnecessary ways. Proper upkeep of HVAC systems, making sure lights and electric devices (computers) are turned off when not in use, assisting with proper recycling, monitoring ventilation-openings, and closing windows as necessary are all ways which allow buildings to function energy efficiently.

There are two example of new construction on campus which emphasizes energy efficiency; Evergreen Hall, a LEED-certified residence hall dedicated in the fall of 2009, and a new maintenance facility at the Northwest Research and Outreach Center that has a geothermal-assisted heating system. Evergreen Hall was constructed to LEED standards largely as a result of a student led, $8,000 CERTS grant in 2008 (“LEEDing Crookston to a Sustainable Future.”).

A Crookston Alternative Energy Working Group was launched in the spring of 2009 to address alternative energy strategies for the greater community. This campus and community group is chaired by the Crookston mayor and includes members of the Regional Development Commission, former head of the Crookston Water Department and now city Councilman, Otter Tail Power Company representatives, county government, an organic farmer/ school board member, and campus leaders.

Lastly, in August of 2009, UMC was awarded an 11-month GreenCorps Energy Conservation Specialist position that will conclude at the end of August of 2010. The inaugural program is administered by the MN Pollution Control Agency and Chris Waltz, was hired for the position. Waltz is a 2009 UMC graduate who was a very effective student leader in energy conservation and sustainability initiatives as well as leading the efforts for the new residence hall to be constructed to LEED standards. Waltz was the primary author of an $ 11,000 CERTS grant to promote building energy efficiency measures and conduct a feasibility study of a campus methane digester ("Crookston Students Paving a Green Path," December 2009).

Alternative Energy Production:

There have also been recent discussions of alternative energy production on campus. The feasibility of wind power has been explored in a general way by several groups and individuals (David Demuth, personal communication). The opportunity to have on-site wind turbines are somewhat limited by the airport flight paths. Because the campus is located only three miles from this airport, it was thought that large wind turbines were not an option to be located on campus. Off-site wind energy, or small scale wind generators could be considered. Biomass is another possible option for renewable energy. There is a modest opportunity to use animal waste for methane since the campus has many animals that live directly on the campus that is not common on many colleges. A precedent for use of manure for a methane generator can be found on the St. Paul campus. The prospects for development of energy from biomass would complement the Biofuels and Renewable Energy major on campus.

Campus Building Energy and Carbon Emissions:

In order for UMC to effectively transition to a climate neutral campus, it will first have to work towards aggressive energy conservation goals. Secondly, existing energy production will have to be de-carbonized over time. Both of these strategies can work in concert and reduce the timeframe to UMC achieving climate neutrality.

The use of heating, cooling, and electrical energy produces the highest levels of CO_2 on the Crookston Campus (not considering amounts related to food.). It amounts to nearly 10,800 tons of CO_2 per year. This is close to 9 tons per year per student for the 1,200 students attending the college. The average American produces 20 tons of CO_2 each year through their day-to-day activities.

Where is the carbon?

The University of Minnesota, Crookston campus emits about 17,000 tons of carbon in a variety of ways (Figure 1). The greatest sources are the burning of coal for heating buildings and the electrical energy from the local utility. These two energy systems together constitute over 87% of the carbon emissions. Although these two energy systems are robust in terms of carbon intensity, their conversion to non-carbon energy sources is currently technologically available and easily accomplished without reducing the quality of life for the campus inhabitants. The other 13% of the carbon emissions are more difficult to convert to non-carbon sources. Reducing the 7% transportation energy will be the most difficult for a rural campus. The need to commute to and from campus in personal vehicles is very ingrained for most of staff and faculty as well as the students, but there are some options for alternative transportation. The conversion of the 6% carbon emissions from water and wastewater will have to be coordinated with the city's water and wastewater systems. In most cases, these carbon emissions will be difficult to substitute in the near future. The solid waste stream accounts for 1-3% of the total carbon emissions of the campus. In the case of solid waste, many alternatives can be developed to reduce emissions with source reduction as a first step. Composting organic waste, recycling cardboard, paper and other organic materials such as wood or wood fibers will also reduce CO_2 emissions. Metal and glass recycling will reduce off-campus CO_2 emissions.

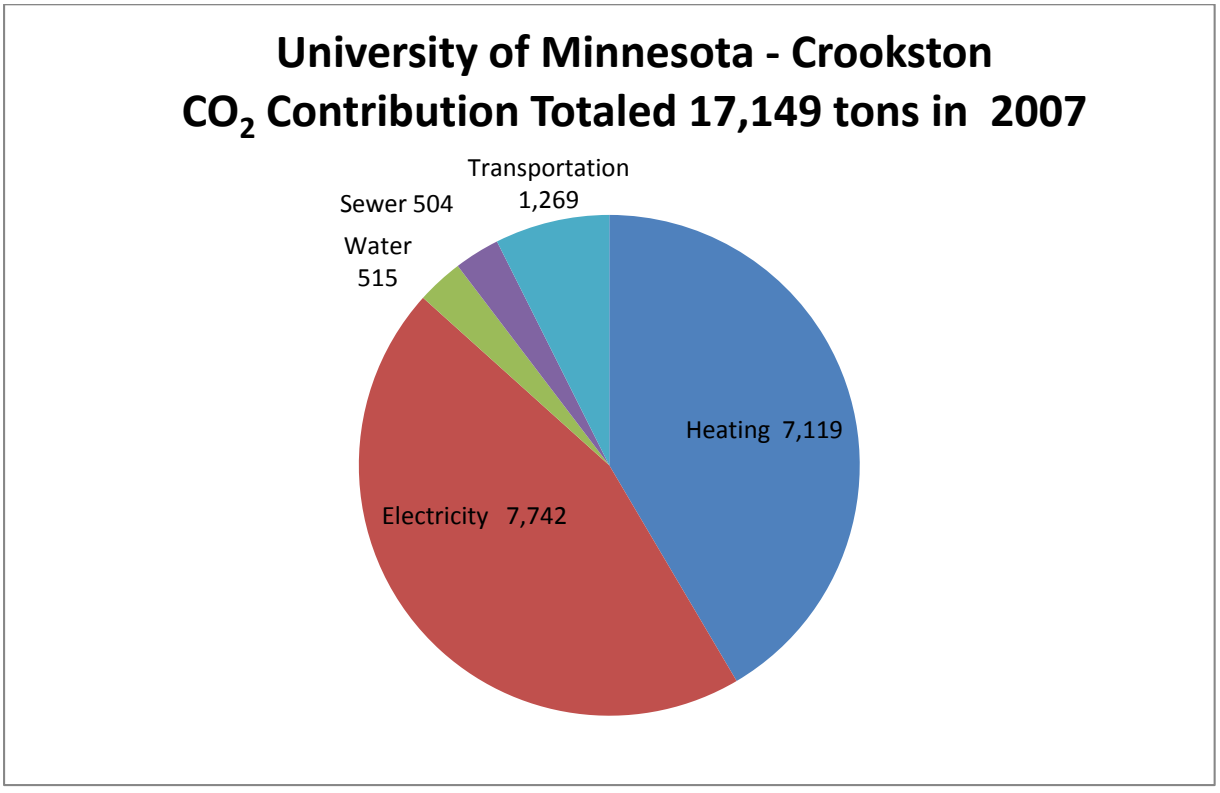


Figure 1. Sources of CO_2 generated at the University of Minnesota, Crookston in 2007 (McKinstry Report).

Heating – 7,119 tons of CO_2/year
Electricity – 7,742 tons of CO_2/year
Vehicles – 1,269 tons of CO_2/year

Water - 515 tons of CO_2/year
Wastewater - 504 tons of CO_2/year
Solid Waste - (data unavailable at this time, 1-3% is an estimate)

The University of Minnesota, Crookston Campus produces approximately 16,000 tons of CO_2/year. A portion of the carbon dioxide, calculated at **1,080.30 tons of CO_2/year,** can be sequestered on lands that the University of Minnesota, Crookston and the Northwest Research and Outreach Center own.

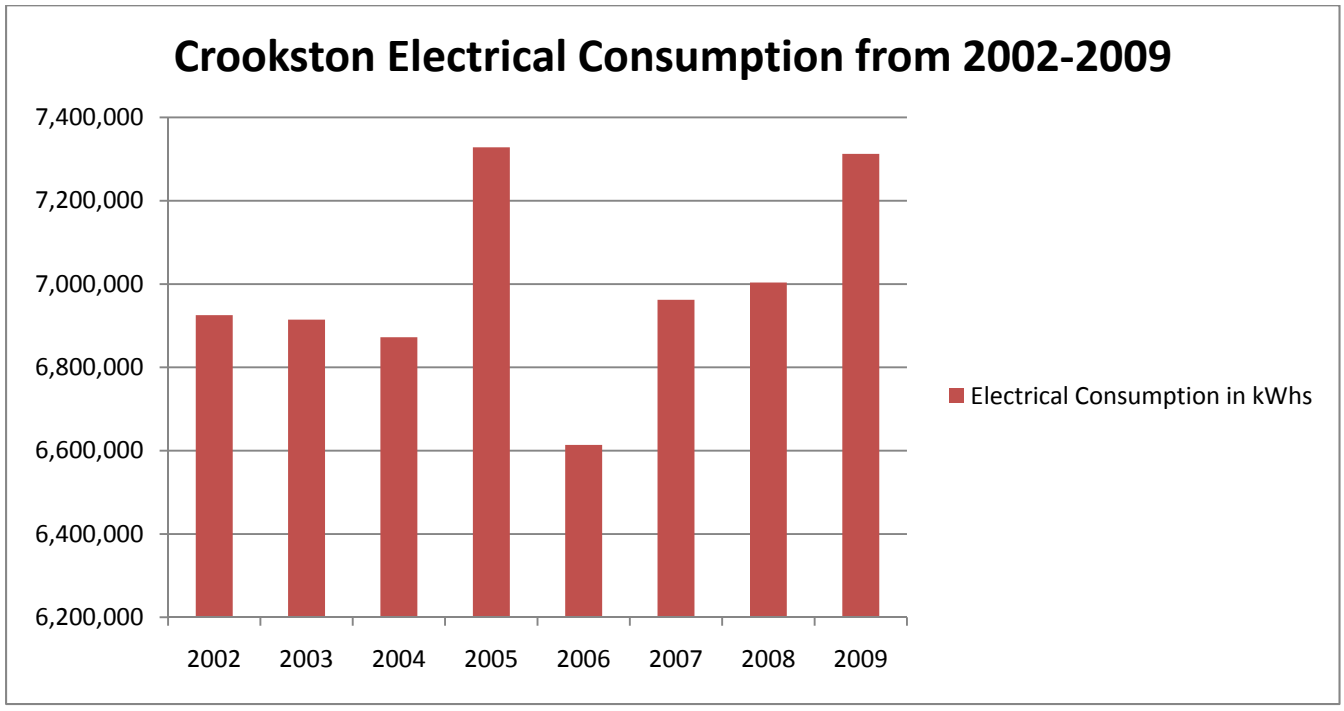


Figure 2. Approximate electrical consumption (kWhs) at the University of Minnesota, Crookston from 2002 to 2009 (McKinstry Report).

Note: The fluctuation in the electrical consumption is more reflective of the number of students on campus rather than other considerations

A. ENERGY CONSERVATION (goal of 50% REDUCTION of existing energy use)

To convert the UMC campus to a renewable energy system in the future to attain the goals of climate neutrality, first, a 50% reduction in energy use will have to be accomplished. Although this goal may seem outside the realm of possibilities, private sector building management companies have already been able to accomplish this. Currently, a 50-year old office building in downtown Minneapolis reduced it total energy consumption by 50% over a three-year period through aggressive energy management. This goal not only saves money, it will also demonstrate leadership in an area that is extremely cost effective and is often an overlooked method of energy conservation. This reduction in energy use is not intended to reduce occupant comfort or the quality of the indoor air but only to attain maximum energy efficiency. Occupant comfort will remain the top priority of the campus, balanced with energy efficiency.

Capital Improvements:

Conservation is known in the building industry as the most cost-effective means to save energy but this knowledge has been sparingly implemented. There are two trains of thought about energy conservation in existing buildings. One method is the replacement of older technologies with newer ones. This strategy upgrades building systems in order to get greater efficiencies of the newer systems. Employing this strategy usually requires that buildings go through a re-commissioning process where older systems are evaluated according to a payback schedule. The systems with the shortest time period for paybacks, are usually implemented. Lighting, mechanical controls, and sensors are usually included in the list of items to be replaced. This is one strategy that Otter Tail Power is currently pursuing at UMC. In addition, individual building metering of heating, cooling, and electrical usage should also be installed. Presently there are limited ways of accurately measuring energy use savings achieved therefore it is impossible to determine the efficacy of building energy improvements. It is estimated that energy savings of 15%-25% can be achieved with capital replacement strategies. This method usually can bring the operational costs of a building down over a few years, but, if there isn't an aggressive energy management strategy in place, the efficiency of these improvements will decline over time and energy usage will rise again. Therefore, a good capital improvement program has to be coupled with a good energy management program which brings us to the next method of energy conservation.

Energy Management:

Energy management is a second method that can be employed that is not often effectively used. Some campuses have energy management plans that measure the amount of energy a building uses over the course of a year and determines whether that is too much. The key question being "is the building using the correct amount of energy or the amount of energy for its intended use?" This is a difficult and complicated question to answer. The correct application of an energy management system could save an additional 25-30% and attain the 50% reduction that is essential to meeting a baseline for conversion to renewable energy.

The first step and the quickest way to determine if a building is performing within its building energy code guidelines is to register it with the State of Minnesota B3 Benchmarking program located at http://www.mnbenchmarking.com/. This program is able to determine whether a building is using energy within the energy standards of the energy code of Minnesota. By inputting key energy data, the program will readily display which buildings are using more than expected. However, this method will require that each of the University's buildings be separately metered for steam and electrical energy use.

After a preliminary building energy assessment is completed for the campus buildings, an energy baseline is established. From this baseline, a new 50% energy reduction baseline can be established on each of the buildings and for the campus in general. There might be more opportunities in some of the buildings to be more aggressive in energy conservation and in others it might be more difficult. However, it is the total energy reduction for the entire campus that is the goal.

The second step in the energy management plan is to look at each of the individual buildings to determine which systems within the building are the largest energy users. For each of these systems, an evaluation is made to see if these systems are using the "correct" or appropriate amount of energy for the users' comfort. By looking at run times and energy consumption, it can be determined if the system is operating as efficiently as possible.

This evaluation can be conducted employing temporary energy meters placed on each of the systems over a set period of time. This establishes the key large energy users. There might be four to five in each building depending on the complexity of the mechanical and electrical systems. When these systems are operating at their maximum efficiency the run times are the next issues.

The third step is examining the run times of the electrical and mechanical equipment. Once the equipment is tuned to its minimum energy use, then it is the run time that is the key indicator of energy use. This is the area where there is a negotiation between the occupant's needs and the ability of the building systems to efficiently provide for those needs. Obvious energy savings opportunities are to reduce the run time when there are no occupants. Buildings can be heated and flushed between or before the hours they are needed. And finally, the minimum amount of heat and ventilation should be used to provide the desired level of room comfort.

Although the preceding steps seem common sense, customer complaints can change the run time of systems that increase energy use without increasing comfort. It is the intent of the college to meet the needs of the occupant but often times it is accomplished in a unsystematic and energy consumptive manner. This management system requires careful recurring system checks and check-ins with occupants to assure that the energy parameters have not changed from semester to semester. This management system requires ongoing repeating of the steps outlined above. Often, energy management is seen as a one-time fix and then it is assumed nothing changes from season to season or semester to semester.

Green Buildings:

Evergreen Hall is the Crookston campus's first LEED certified building and the first LEED certified residence hall in the U of M system. Although this was an important first step, in terms of energy conservation, more needs to be accomplished. New buildings present the greatest opportunity for energy conservation. Mechanical and electrical systems can be designed to use the minimum amount of energy and contain sensors to alert energy managers when these systems are running outside established parameters. Building envelopes should be maximized in terms of energy efficiency. New buildings should be required to follow the Minnesota Sustainable Building 2030 program. This program establishes an energy standard for each type of building space according to climate zone and building usage. These energy standards are presented in Btus/sqft/yr. Building designers are required to design to this energy standard and energy managers are required to manage the building energy use according to this standard. These energy standards present aggressive and verifiable goals both for the designer and the building operator. In most cases energy standards ask for a 50-60% reduction in energy use from comparable buildings. All energy standards for Sustainable Building can be found at www.mn2030@umn.edu

B. ENERGY PRODUCTION

The production of campus energy is the second part of attaining a climate neutrality goal. It is essential that the existing energy systems be de-carbonized as much as possible. In most cases, this means switching of energy sources to less carbonized sources. A gradual migration from coal to natural gas and/or to wind, geothermal, and solar is proposed to take place over the next few years. There will always be a need for the natural gas/propane backup and therefore clean energy sources will have to produce more during their peak times to offset the carbon dioxide from the burning of natural gas.

Non-renewable Energy:

Currently UMC is predominately fueled by coal. Although coal is abundant in the U.S., its combustion causes significant environmental effects. UMC burns about 3,266 tons of coal annually but produces 7,100 tons of CO_2 emissions. One way of visualizing this information is that in an average year, these emissions would cover the entire campus to a height of 26 feet. During a 4-year baccalaureate degree period, the height of the carbon dioxide would be over 100 feet high. The weight of the CO_2 would crush the campus structures if Crookston would retain its current environmental emissions over a 4-year period on its campus. However, UMC and other CO_2 producers are able to diffuse the CO_2 emissions into the air above them and they are carried with the wind currents to other locations in a less dense and toxic state.

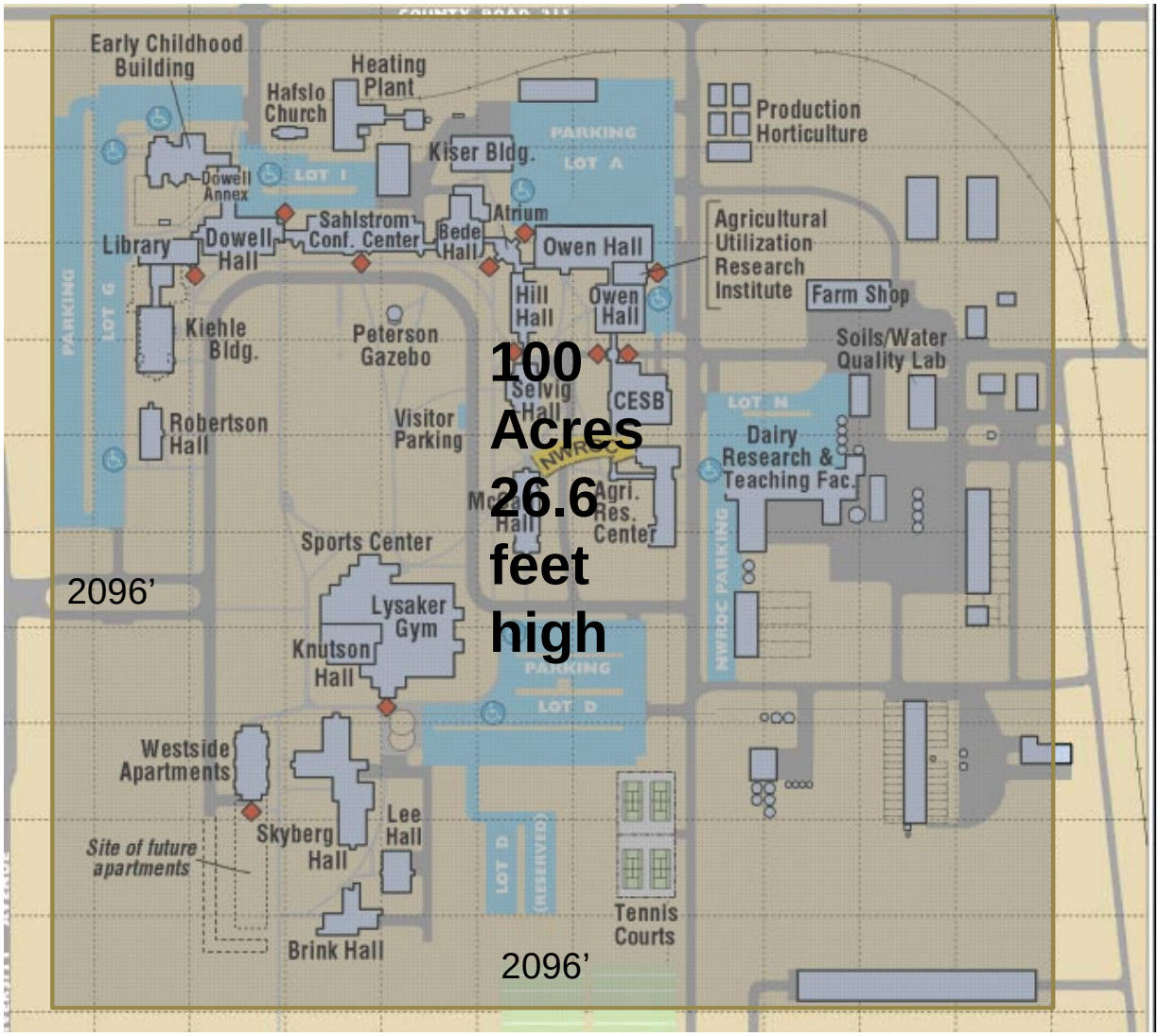


Figure 3. Approximate yearly production of CO_2 relative to the UMC campus.

Although diffusion of coal emissions in the past has been an effective strategy for individual producers, the combined effect results in producing climate change for the world. Although the detrimental effects of climate

change will be manifested differently throughout the world, the responsibility for reducing emissions falls directly on each of the producers of the emissions. It is the responsibility of an institution of higher learning such as UMC to its students to apply cutting edge technology in pursuing options to the detrimental environmental effects of coal combustion. This report envisioning UMC's path to climate neutrality marks a proactive effort to address potential impacts of climate change in a responsible way. Often it is the cost of alternative fuels that is the stumbling block for change. Crookston is a small institution dependent on student tuition for survival, and its ability to take on additional costs for world-wide environmental concerns is limited. However, the total cost of the fuel system should be considered before making a decision.

Energy Cost Comparison

Currently the annual cost of coal only for Crookston is about $158,000 per year. According to the National Research Council's Report, Hidden Costs of Energy: Unpriced Consequences of Energy Production and Use in 2010, the environmental costs of each kWh of energy is about 7.5 cents for coal-fired production. The study states:

"*Despite the many benefits of energy, most of which are reflected in energy market prices, the production, distribution, and use of energy causes negative effects. Many of these negative effects are not reflected in energy market prices. The Hidden Costs of Energy defines and evaluates key external costs and benefits that are associated with the production, distribution, and use of energy, but are not reflected in market prices. The damage estimates presented are substantial and reflect damages from air pollution associated with electricity generation, motor vehicle transportation, and heat generation. The book also considers other effects not quantified in dollar amounts, such as damages from climate change, effects of some air pollutants such as mercury, and risks to national security.*"

If this cost is applied to the current heating plant the indirect cost of the plant would be $1,340,000. If UMC is willing to include the total cost of burning coal it would be closer to $2,205,000 per year rather than the $675,000 or about 4 times higher than the cost that Crookston is paying now (See Table 1).

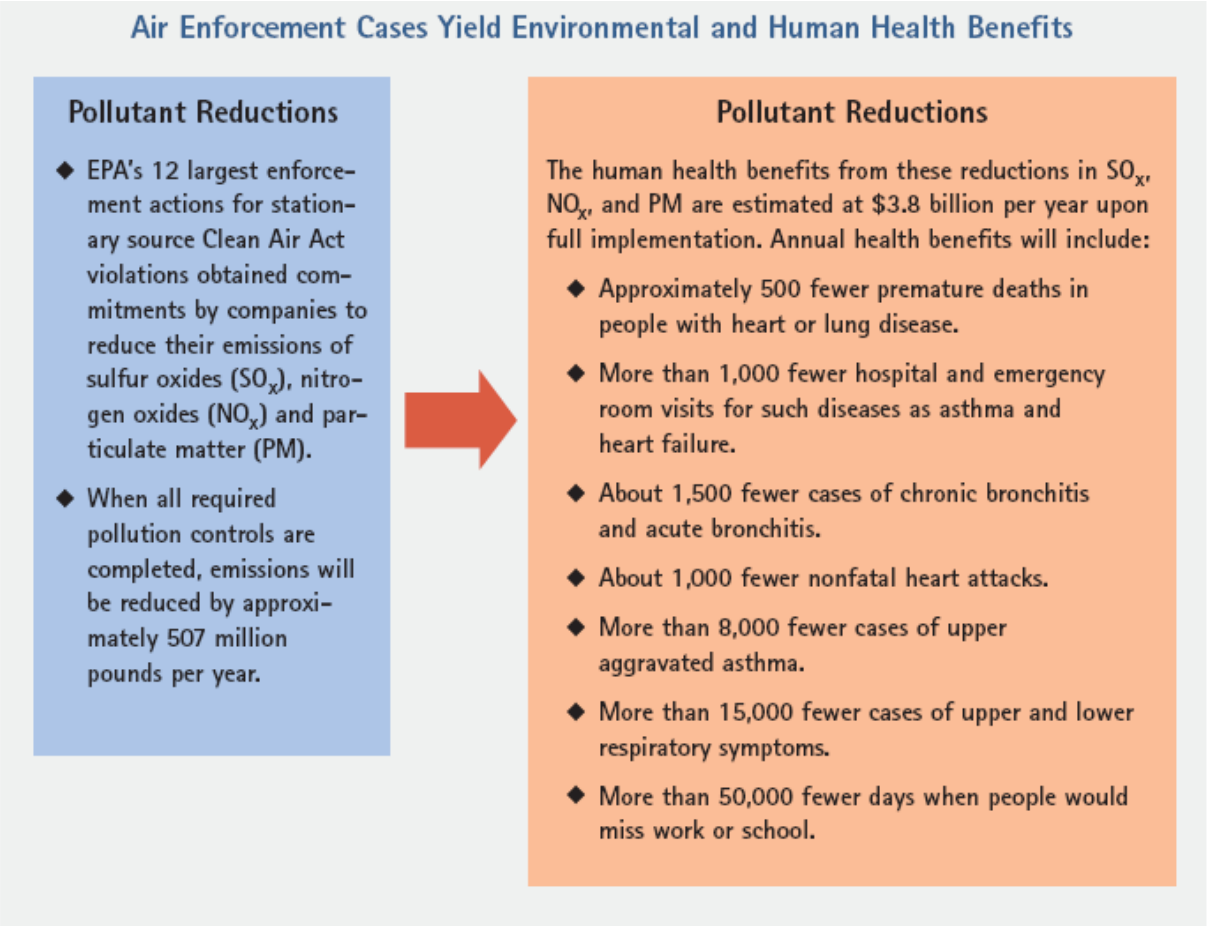
Table 1. Current costs of using coal-fired boiler for heating

1) Cost of fuel for a season	$143,192.52 (2007-2008) $172,761.16 (2008-2009) Average $ 158,000
2) Labor costs/season	Around $210,000 without overtime or holiday pay included
3) Environmental costs/season	$1,265.71 (MPCA – Annual air emissions Fee) $1,537.50 (NOVA – Air Monitoring) Coal testing ($ 40.00 per load)2007-08 = $5,160, 08-09= 4,880, average = $ 5,020 Plant performance testing done in 2008 and to be repeated every 10 years. $ 14, 565 /10years = $ 1,456 per year
4) Annual maintenance for a season	$300,000.00 (estimate, may include more than boiler/heating)
Annual operating costs:	**~$670,802**

Estimated potential pollution cost: $1,340,000.*

Total annual cost for operation of a coal-fired heating plant including environmental costs: $2,010,802

- This is the cost of the externalities of UMC burning coal or cost that others besides UMC bear. For example, EPA estimated in its FY 2007 OECA Accomplishments Reports of May 2008 that its top 12 FY 2007 civil air enforcement cases will result in $3.8 billion in health benefits annually from the consent decrees requiring plants to install new technology. Of those top 12 air cases, half of them (78 percent by emissions) were New Source Review cases against coal fired power plants. That's 500 fewer premature deaths, 1,000 emergency room visits, 1,500 cases of bronchitis, 1,000 non-fatal heart attacks, 8,000 cases of aggravated asthma, and 50,000 days of missed school avoided each year from 2007 cases alone.



Data source: Integrated Compliance Information System (ICIS), October 13, 2007; Office of Air and Radiation's BenMAP model.

One-time construction costs for boiler and coal-handling upgrades conducted in 2006.

$1,101,384.00 (May 2006 – November 2006 – Wrigley Mechanical)
$1,967.339.03 (May 2006 – November 2006 – Marcy Construction)
$724,235.10 (Stanley Consultants – October 2006)
$13,500 (Northern Technologies)

Total Capital Construction Cost in 2006: ~$3.8 million

Table 2. Projected costs of using natural gas-fired plant for heating

1) Anticipated cost of fuel (interruptible) for a season	$443,909
2) Anticipated cost of labor for a season (low pressure steam)	$140,000 (2/3 of the high pressure steam)
3) Anticipated environmental cost for a season	$0 (it is assumed that natural gas will not exceed the EPA emission limits
4) Anticipated annual maintenance for a season	$150,000 (it is assumed that the new plant will require less annual maintenance)
5) Anticipated other annual costs	$0 (it is assumed that no annual testing will be required)
6) Estimated potential pollution cost	$6,700

Estimated annual cost for operating a natural gas-fired heating plant: $733,909*

*Craig Petter, U.S. Energy Services, Inc., 605 North Highway 169, Suite 1200 Plymouth, MN 55441, www.usenergyservices.com

The annual pollution cost of natural gas is unknown at this time but it is a cleaner fuel than coal as the following data (Table 3.) indicate, however it is not pollution free.

POLLUTANT	NATURAL GAS	COAL
Carbon dioxide	117,000	208,000
Carbon monoxide	40	208
Nitrogen oxides	92	457
Sulfur dioxide	1	2,591
Particulates	7	2,744
Mercury	0.000	0.016

(Energy information agency 1998) Natural gas issues and trends.

Table 3. Comparative fossil fuel emission levels between coal and natural gas in lbs per Billion Btu's of energy input

Let us look at the annual operating cost of converting to natural gas. If the same amount of energy is generated by combusting interruptible natural gas, the annual cost would be approximately $733,909. The estimated potential environmental costs of natural gas are significantly smaller, about $6,700 for a total cost of $740,609 or about 3 times less than the total cost of a coal system. If UMC is willing to take full responsibility for its emissions from energy combustion for heating, it would be substantially cheaper to convert to natural gas.

The emissions from combusting coal are estimated to be around 7,200 tons of CO_2 annually. The emissions from combusting natural gas for the same about of heating energy would be about 3,576 tons of CO_2 or a 50% reduction. A renewable source of energy would reduce this emission load even more.

Renewable Energy Strategies

Wind

Perhaps the most cost effective alternative electrical energy source in the Crookston area is wind. Minnesota contains some of the best wind resources in the U.S. Even without subsidies, wind often represents the lowest cost option for the production of electrical energy. The low cost of wind energy has surpassed that of coal. In the last twenty years the cost of wind has decreased by a factor of ten. In 1990, the cost of a kWh of wind was 40 cents and in 2000 it was close to 4 cents. The cost of energy from larger electrical output wind turbines used in utility-interconnected or wind farm applications dropped from more than $1.00 per kilowatt-hour (kWh) in 1978 to under $0.05 per kWh in 1998, and is projected to plummet to $0.025 per kWh when new large wind plants come on line in 2001 and 2002 (Dodge, 2001-2006). Today, there are many wind farms in the Midwest that are being constructed for purely economic reasons.

Wind could provide up to 70% of the electrical energy needed on the campus with one large scale turbine assuming an electricity demand of 7,111,312 kWh and a generating capacity of 1.6 MW. If for some reason this turbine could not be located close to campus because of the airport, UMC could consider the purchase of a small parcel of land close to the campus to locate the wind turbine and connect it to the campus energy systems. Skip Carlson contacted both the Crookston Airport Manager and the Minnesota Department of Transportation - FAA and learned that there is a possibility of a variance to the airport restrictions on the far

southeastern corner of the university property. However, wind energy is variable and other energy sources are needed as a supplement.

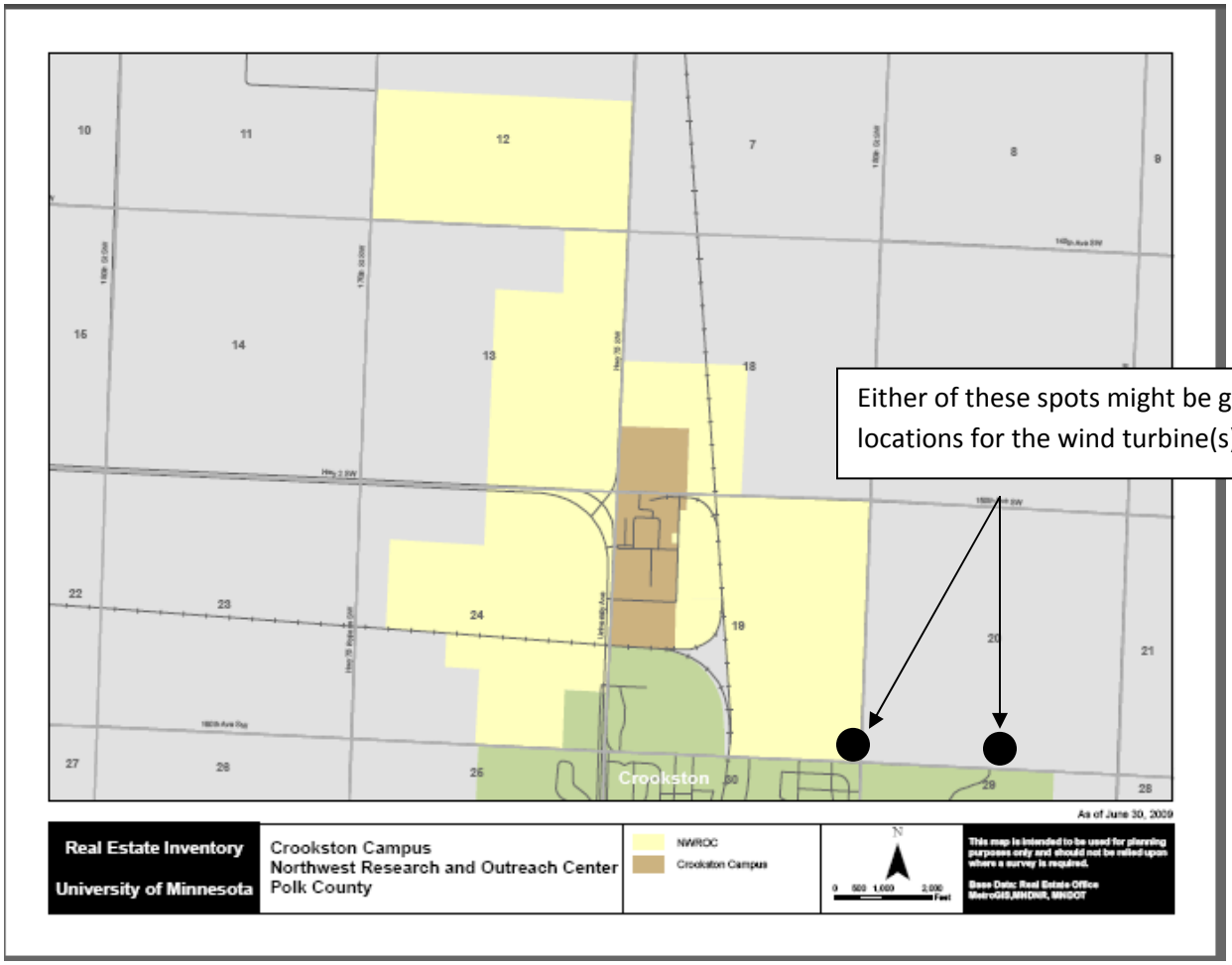


Figure 4. Location of U of MN land and possible sites for wind turbine.

Solar

A good complement to wind energy is solar energy. Generally, solar energy is the highest when wind is lowest and vice-a-versa. Wind energy is the highest in the change of seasons-spring and fall. Solar on the other hand is most abundant during the summer and winter months. Skip Carlson estimated that solar could provide about 20% of the campus energy demand. Although solar energy is a developing technology, there has been significant progress in reducing the cost per kilowatt. There are new technologies that combine photovoltaic cells (for the production of electricity) with solar thermal cells (for the production of heat energy) and increase the efficiency of both. In European countries, solar is a fast advancing technology. Even in Germany where the solar resource is only 1/3 of the resource in Crookston, there is significant progress in the development and implementation of solar photovoltaic cells. This technology should be looked at seriously for Crookston.

Mark Jenner (2006) authored a fairly comprehensive systems approach to viewing biofuels for a community in his Biotown, USA, sourcebook. He uses the town of Reynolds, Indiana as an example. Figure 5 is a useful graphic within which one can plug in whatever feedstock is available in a local community.

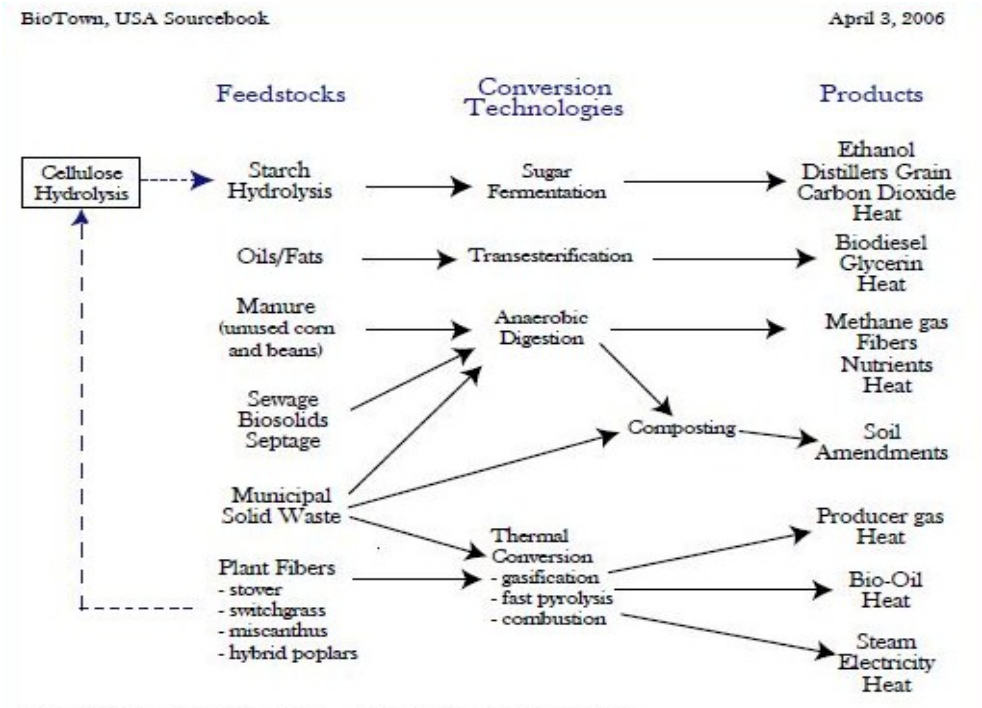


Figure 5. Systems illustration of biofuel production methods. (From, Jenner, M. 2006. BioTown USA.)

Biomass is a possibility to supplement the campus' heating and cooling needs. The University of Minnesota, Morris is currently planning to implement a biomass-fired boiler to produce steam for both winter heating and summer cooling using corn stover as a feedstock. The coal-fired boiler at UMC could be retro-fitted to use biofuels or a mixture thereof. Some preliminary work was done in the past using wood chips mixed with coal but the results were not positive according to Wendell Johnson (personal communication), a since retired biology professor who has worked extensively with biofuels in the area, especially hybrid poplar. At this point, the major impediments to using biofuels in the UMC boiler system seems to be related to feedstocks and are as follows:

Biofuel supply and homogeneity are a challenge. There is an insufficient supply of one product that is close by and transportation is a major cost determinant to use other sources. Brush and/or hybrid poplar plantations are some distance away and it is unlikely that the high value soils of the Red River Valley would be dedicated to growing a consistent supply of biofuels. Coal, in contrast, is a very homogenous fuel source.

- Agricultural residues from corn, sunflowers, and small grains could be available but contain nutrients (especially potassium) and are of value as soil amendments thus affecting their price and predictable availability.
- In Wendell Johnson's view, gasification of biofuels is the future, at least in this part of Minnesota and in this setting. This could merit further evaluation to produce a product that could be combusted in a gas-fired boiler. There is also a sugar beet processing plant at the south edge of Crookston adjacent to the sewage treatment plant. There could be a potential to produce methane from these facilities but these

are located at a distance of about three miles and this could affect the feasibility of collaboration with UMC.

Geothermal

Geothermal is another alternative energy source. Using the heat of the earth, geothermal efficiency can reach in the range of 300-400%. Powered with renewable energy, geo-thermal can be a good back-up source when the campus transitions from natural gas. Geothermal wells can be located under parking lots and roads where they can be easily accessed.

Campus Climate Neutral Energy Considerations:

Currently the University of Minnesota, Crookston uses both coal-fired boilers for heating and electricity from the local utility (Otter Tail Power Company) for electrical energy. The source of energy for Otter Tail Power Company is also largely from coal resources. Both sources of energy are very carbon intensive and are prime creators of CO_2, a contributor to climate change. Combining both the heating and electrical energy, Crookston uses about 71 billion btus per year (Figure 6).

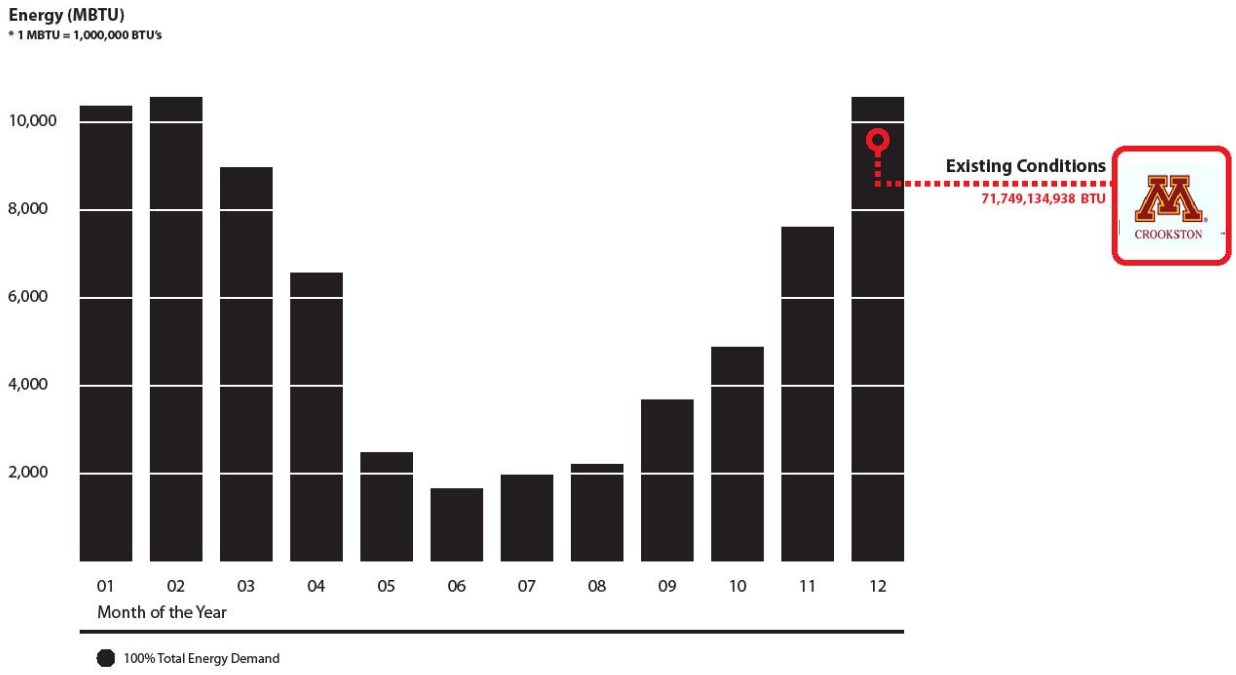


***Figure* 6: Total annual energy use of UMC in Btus, including electrical and heating (Skip Carlson's energy report for UMC, December 2009).**

As Figure 6 depicts, there is a significant variation in energy demand between the summer and winter months due to the severe winters and the relatively mild summers. Most (~80%)of the heating energy is used during the seven months of January, February, March, April, October, November and December.

Otter Tail Power Company has made a commitment through the Energy Challenge Grant to help UMC reduce its energy consumption by 15% within the next 2 years by increasing use efficiency and behavior modification. This program will offer incentives to faculty, staff and students for participating in energy reduction (Figure 7). A 15% reduction is a good start but more energy conservation is required to convert to a non-carbon intensive energy system. The additional 35% in reductions will have to be accomplished through comprehensive energy management. Both building efficiencies and run time management will have to be employed to their fullest potential.

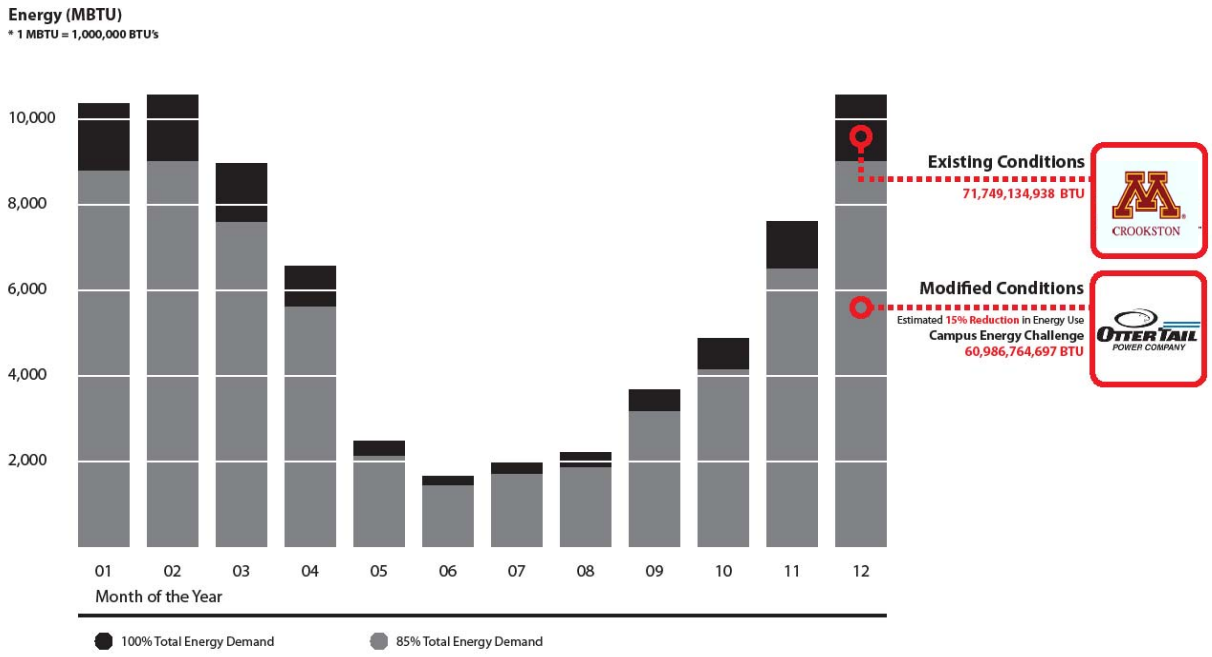


Figure 7. Estimated reduction in energy use resulting from implementing the Otter Tail Power Energy Challenge program (Skip Carlson's energy report for UMC, December 2009).

Sustainable Energy Efficient Operation

Buildings contain many devices that consume energy and each is installed for the purpose of serving some specific need (e.g., provide heat, light, etc.). These needs vary hourly with changes in weather and occupancy, daily with changes in weekday versus weekend occupancy, seasonally with changes in weather, and they also vary significantly when there is a change in the tenants who occupy the building. The key to sustainable building operations is to establish and maintain the "minimum energy operating state" while attaining customer comfort and acceptable indoor air quality during each of these time periods.

There are two factors that influence the amount of energy mechanical and electrical equipment use within a building: 1) The efficiency of the equipment and 2) the run time of that equipment. Both attributes can be managed to ensure the "minimum energy operating state." Efficiency of equipment can be maintained by establishing the minimum energy baseline during operations and then monitoring this periodically to assure that the equipment is within normal running efficiency. Run time for equipment can only be managed by

systematically adjusting equipment schedules to match the functions of the building and seasonal weather conditions. Management of both the efficiency and run times are essential in sustainable energy-efficient operations.

Few energy-consuming devices need to operate continuously at a constant rate. Most are equipped with some method of manual or automatic control intended to achieve a coincidence between actual operation and the "minimum energy operating state." These control methods often fail to reach their full potential through inappropriate manual operation, malfunctions, or improper settings of automatic controls. In spite of these challenges, the minimum operating state is a highly desirable goal to strive for. The goal of building operation is to continually operate each energy-consuming device or system so it consumes only as much energy as required to satisfy necessary needs. The effort expended in managing each device should be in proportion to the amount of energy consumed, with the most effort focused on the big energy users. To achieve this goal, the building management/operating team must acquire documentation that shows which energy-consuming devices or systems are the most significant, and provide an approximation of their annual energy use. They must then institute an on-going process of periodically verifying that each significant energy consumer is operating efficiently. This verification should consist of (a) verifying the necessity of the current needs served, (b) determining what optimal operating pattern will serve the needs at the least consumption of energy, (c) measure the current actual operating patterns and (d) take remedial action when a comparison of the actual operation and the optimal operation detects excess energy use. The frequency of this verification of operating efficiency is determined by each device's potential to consume excess energy.

The experience of practitioners in the field of energy efficient operation as well as numerous studies shows that buildings operated under this process consume 10-30% less energy than if operated under more typical procedures. Therefore, a 50% energy reduction is attainable and desirable but it will require innovative energy management procedures to be consistently implemented.

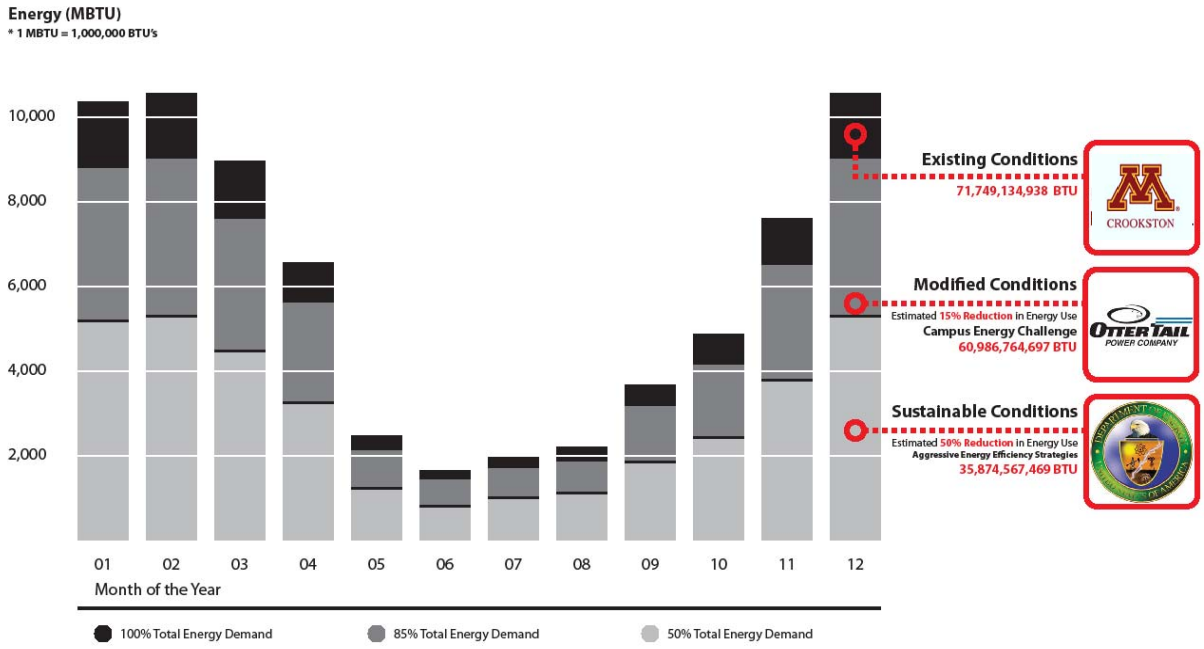


Figure 8. Estimated 50% reduction in energy use resulting from implementing the Otter Tail Power Energy Challenge program and additional changes in infrastructure, management, and behavior modification (Skip Carlson's energy report for UMC, December 2009).

ALTERNATIVE ENERGY SOURCES - WIND

Minnesota is fortunate to be located in a very windy part of the nation and UMC is equally fortunate to be located in the one of the windiest parts of Minnesota (Figure 9). The land located from Minnesota to Texas is called the "Saudi Arabia" of wind *("Great Plains are the Saudi Arabia of wind Investments in renewable energy may be a partial solution to our economic woes" Daniel Gross, Slate.com Published: Monday, Financial Post, June 29, 2009 and* Michael Donough in Cradle to Cradle). More wind blows in this corridor more than any other place in the U.S. As most people know who live in or frequent Crookston, the wind blows almost all the time; there are very few days without wind.

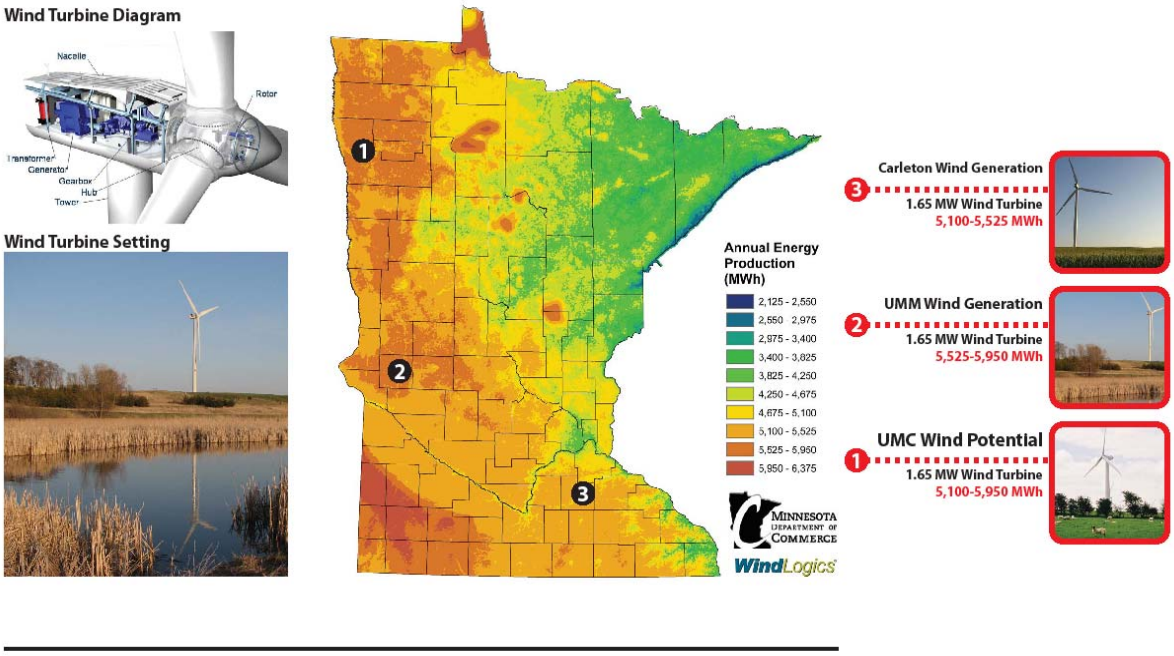


Figure 9. Estimated annual wind energy production in MWh for the State of Minnesota (Skip Carlson's energy report for UMC, December 2009).

The wind in Minnesota is strongest during the change of seasons, when spring and winter arrive in March and November (Figure 9). Wind turbine technology has improved so much in the last ten years that in most cases in Minnesota, wind will be the lowest cost electrical choice per kWh. Wind turbines have become bigger and more efficient and are sized to be around 2.0 Megawatts. A 1.6 Megawatt wind turbine would supply about 60% of the 50% reduction in the total energy needs of the Crookston Campus.

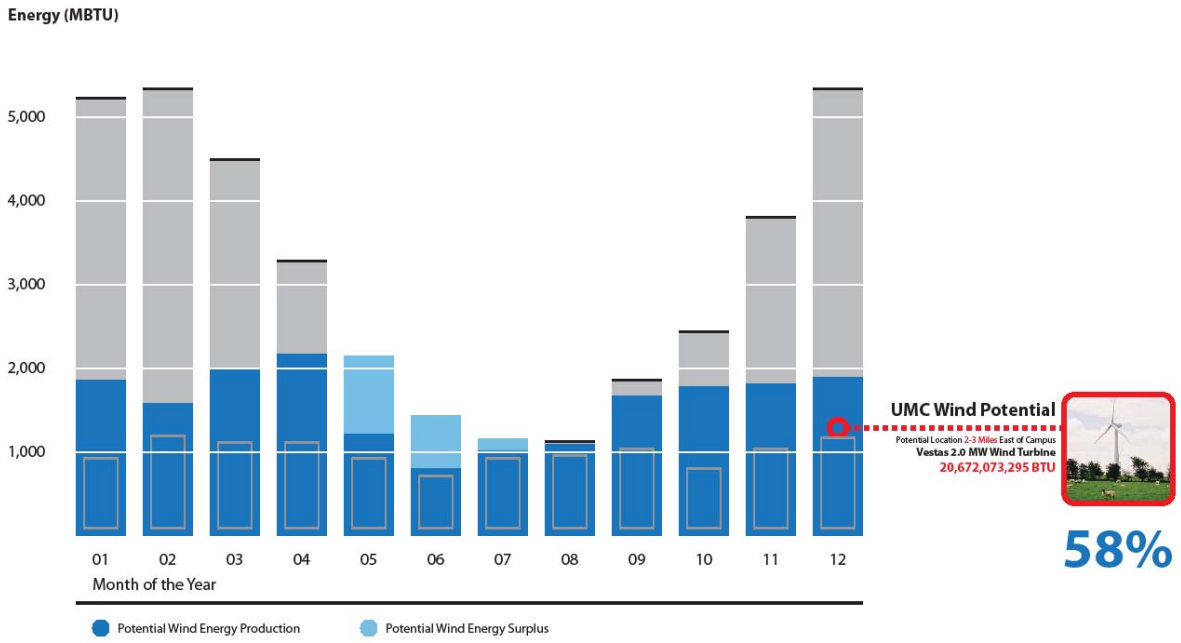


Figure 10. Seasonal distribution of electrical production by a 1.6 MW wind turbine at UMC (Skip Carlson's energy report for UMC, December 2009).

ALTERNATIVE ENERGY SOURCES - SOLAR

In the Midwest, when the wind is not blowing, the sun is usually shining. Solar energy is a nice complement to wind in Crookston. Solar energy is most abundant in the summer months when the wind power is the lowest. However, solar is still undergoing development and the cost per kWh is not competitive with wind. It is anticipated that the economy of scale in manufacturing solar and technological improvements in the next few years will bring this price competitive with wind. The alternative should not be dismissed so readily. In Germany, where sunlight is only 1/3 of the amount that Crookston receives, the solar industry is very robust and solar collectors can be seen on almost every new building.

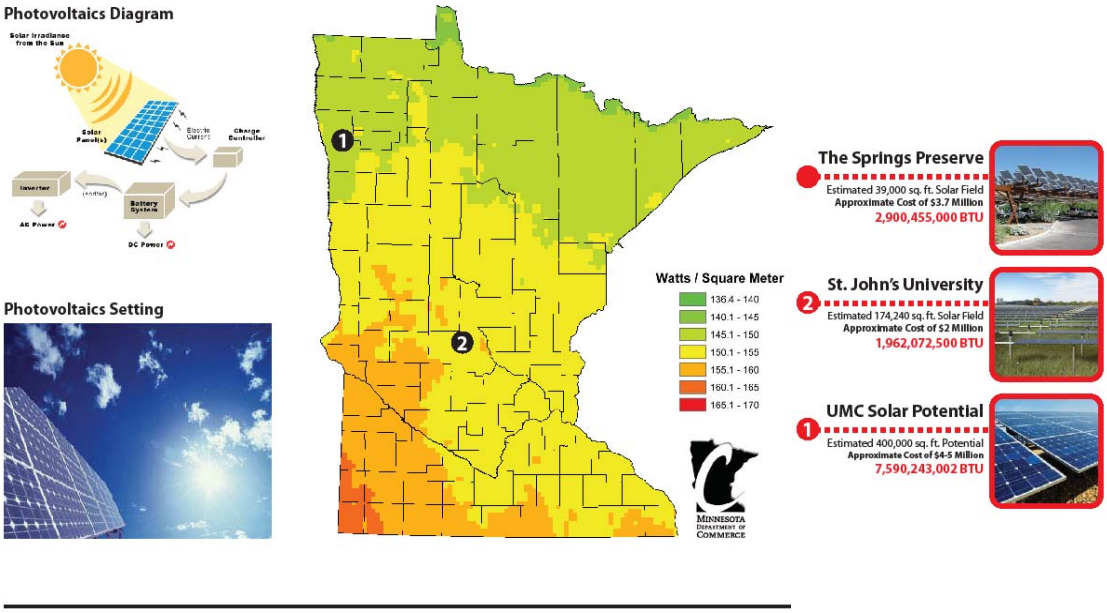


Figure 11. Geographical distribution of solar power potential in Minnesota - Minnesota Department of Commerce, Skip Carlson's energy Report for UMC, December 2009

Solar is a more expensive alternative than wind in Minnesota. With the same investment as a wind turbine, solar will only supply about 21 percent of the total energy needs of the campus. (Skip Carlson Energy Report for UMC, December 2009)

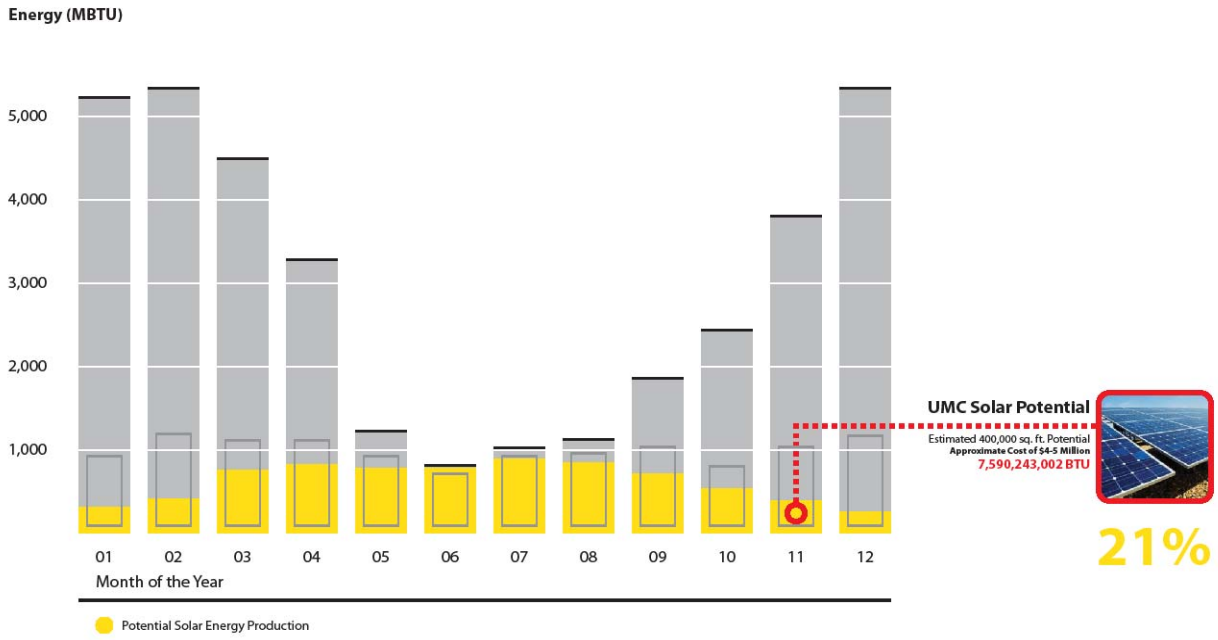


Figure 12. Seasonal projection of solar power potential at Crookston, Minnesota (Skip Carlson's energy report for UMC, December 2009).

ALTERNATIVE ENERGY SOURCES - METHANE

Another source of energy near the Crookston campus is animal waste. There is considerable research in the conversion of animal manure into biogas. The manure is simply collected in a biodigester and methane and solids are the resultant of anaerobic decomposition. Large dairy farms have experimented with this technology to supplement their energy needs. Professor Philip Goodrich on the Saint Paul campus of the U of MN has evaluated down-sized biodigestors for smaller farms.

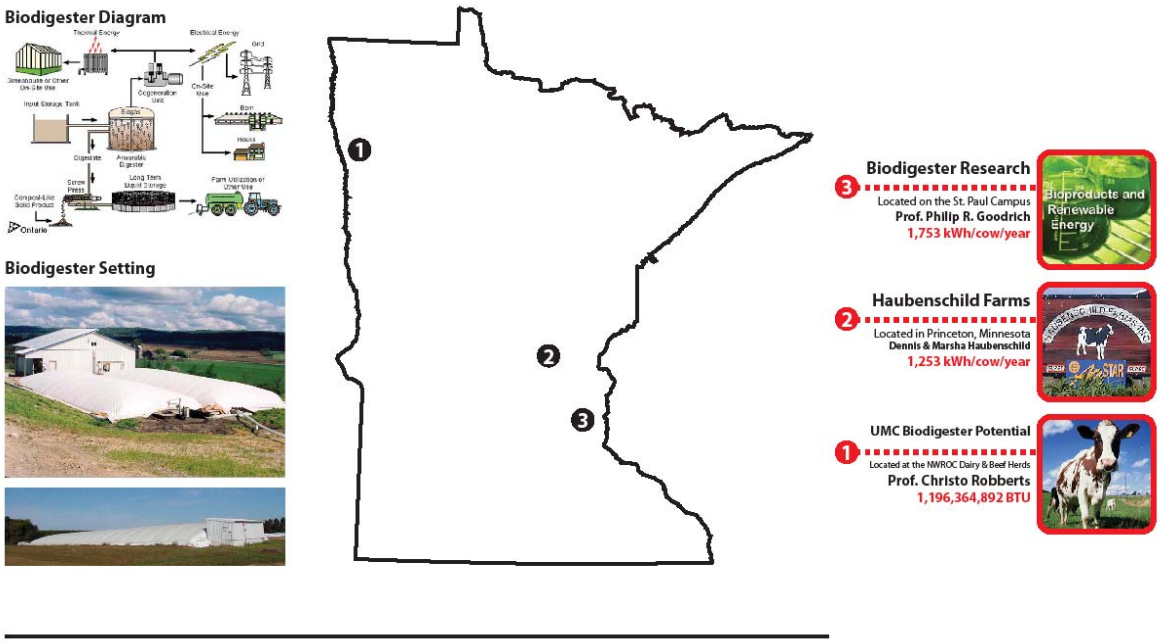


Figure 13. Schematic concept of a methane digester and location of operating and proposed systems in Minnesota (Skip Carlson's energy report for UMC, December 2009).

Because the amount of animal waste produced by the campus livestock is small, the resultant bio-gas is relatively small; about 3% when compared to the total energy needs of the campus. If this option is to become viable, additional animal waste would have to be transported to the campus. Although this energy source is rather small, the campus is already collecting and disposing of this waste and it would be a small step to use it in a biodigester.

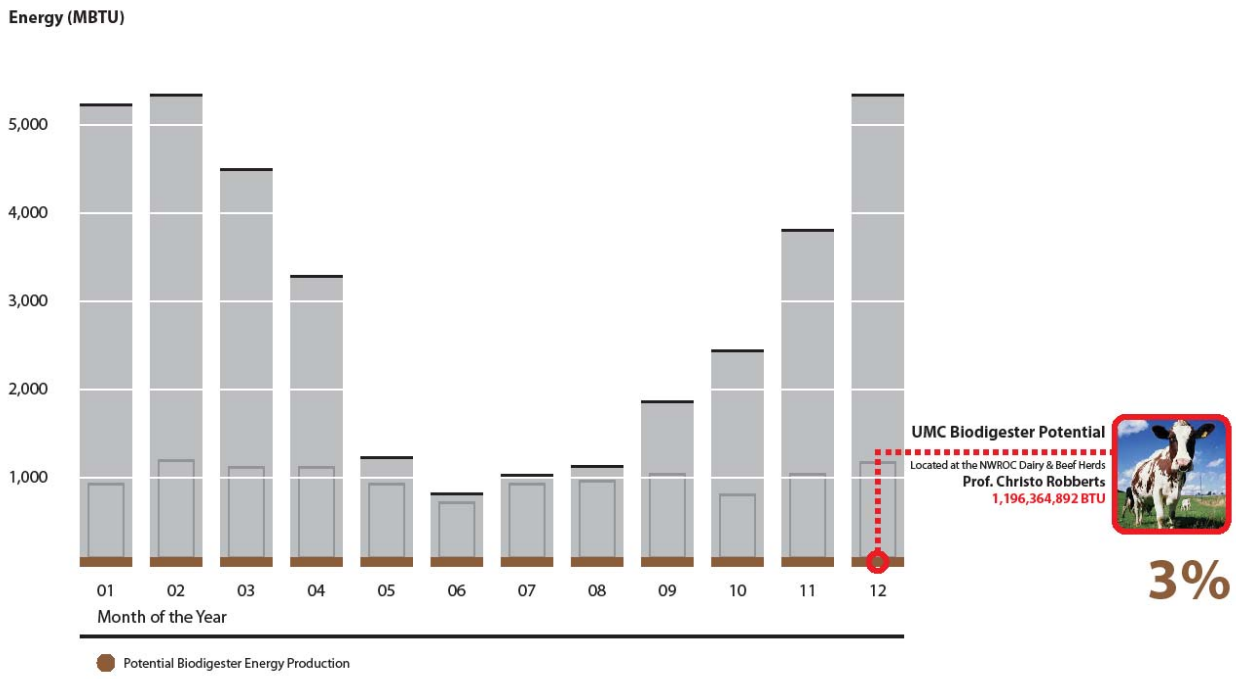


Figure 14. Projected energy potential from animal generated methane at Crookston, Minnesota (Skip Carlson's energy report for UMC, December 2009).

ALTERNATIVE ENERGY SOURCES - GEOTHERMAL

The last abundant source of energy available to the Crookston campus is the ground. The earth is a huge heat sink and stays relatively stable in its temperature. Usually the ground temperature is 55 degrees ^{o}F, six feet below the surface. This constant temperature creates a versatile heat sink for heating and cooling energy. Geothermal heat pump technology is the most efficient method of extracting from and injecting heat into the ground. In fact, geothermal heat pump systems are around 400% efficient. (Earth-energy systems intended for ground-water or open-system applications have heating COP ratings ranging from 3.6 to 5.2, and cooling EER ratings between 16.2 and 31.1 (Natural Resource Canada, December 2009). This means that an energy load can be cut by 75%.

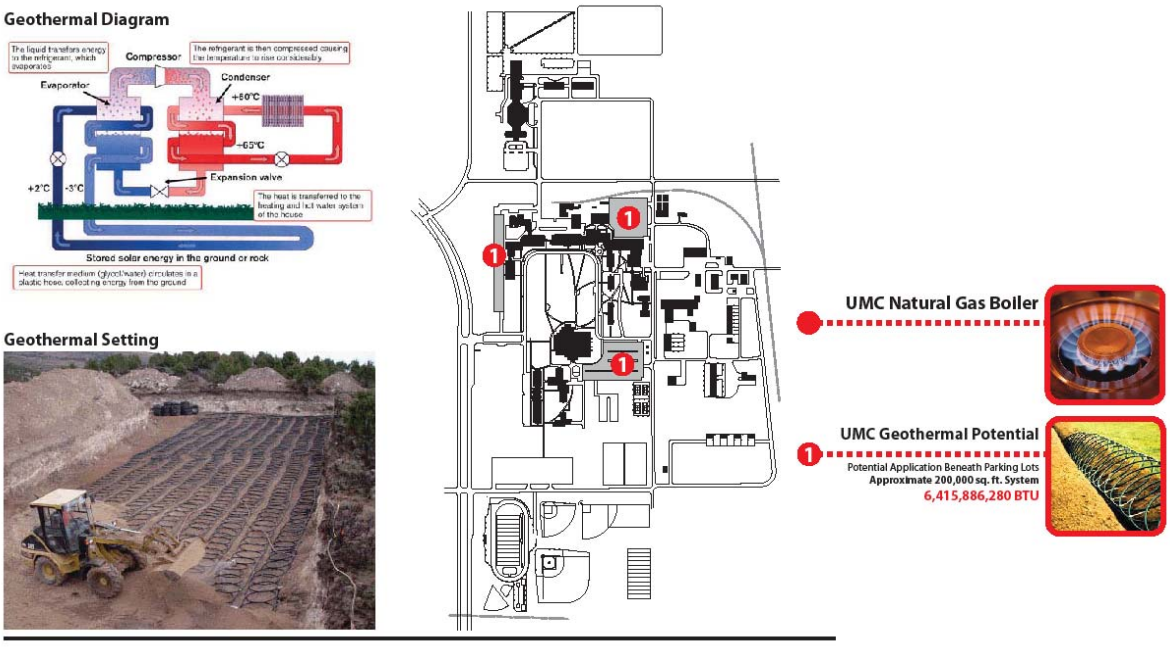


Figure 15. Schematic of a geothermal assisted heat pump system and possible locations of source fields (Skip Carlson's energy report for UMC, December 2009).

A geothermal heat pump system is based on similar heat exchange principles as a refrigerator but far more efficient. With a refrigerator, the heat exchanges with the air around it, whereas a geothermal heat pump system uses an underground heat exchange field or wells instead of air. Since the buildings are all owned by the same entity, a common exchange field can be used to reduce the size of the field due to redundancy. In our initial research, a geothermal heat pump system was an energy source used only to supplement wind, solar and bio-digester energy. It was needed to supply only 18% of the energy needs in the cooler periods of the year (Figure 16) .

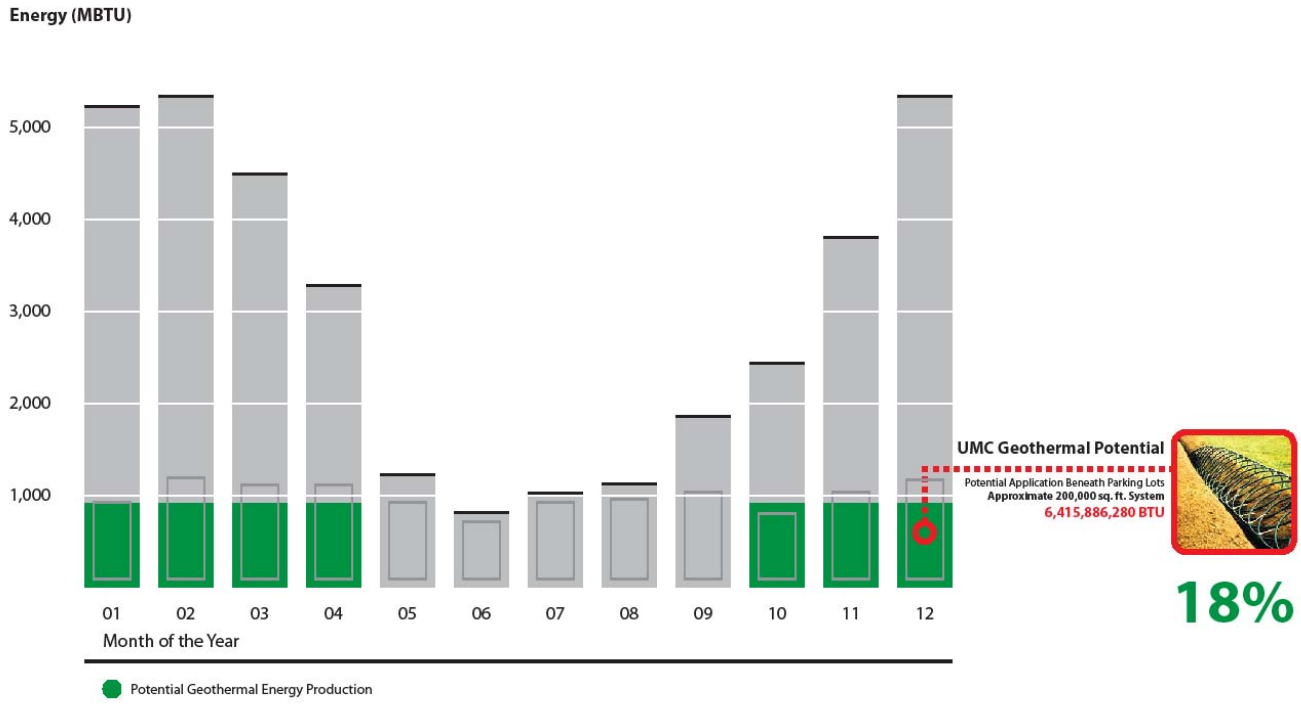


Figure 16. Projected contributions of a geothermal assisted heat pump system to supplement other energy sources at the University of Minnesota, Crookston (Skip Carlson's energy report for UMC, December 2009).

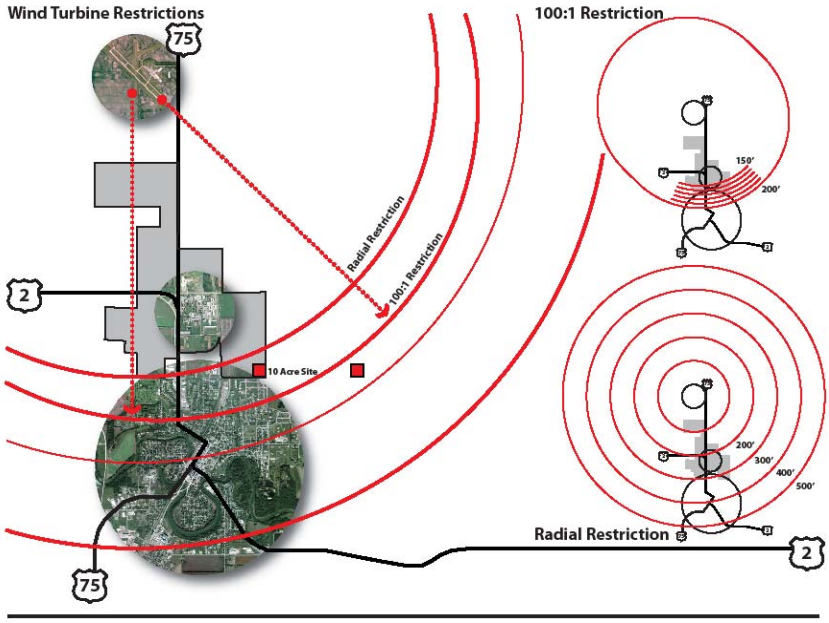


Figure 17. Possible locations of a wind turbine relative to the Crookston airport (Skip Carlson's energy report for UMC, December 2009).

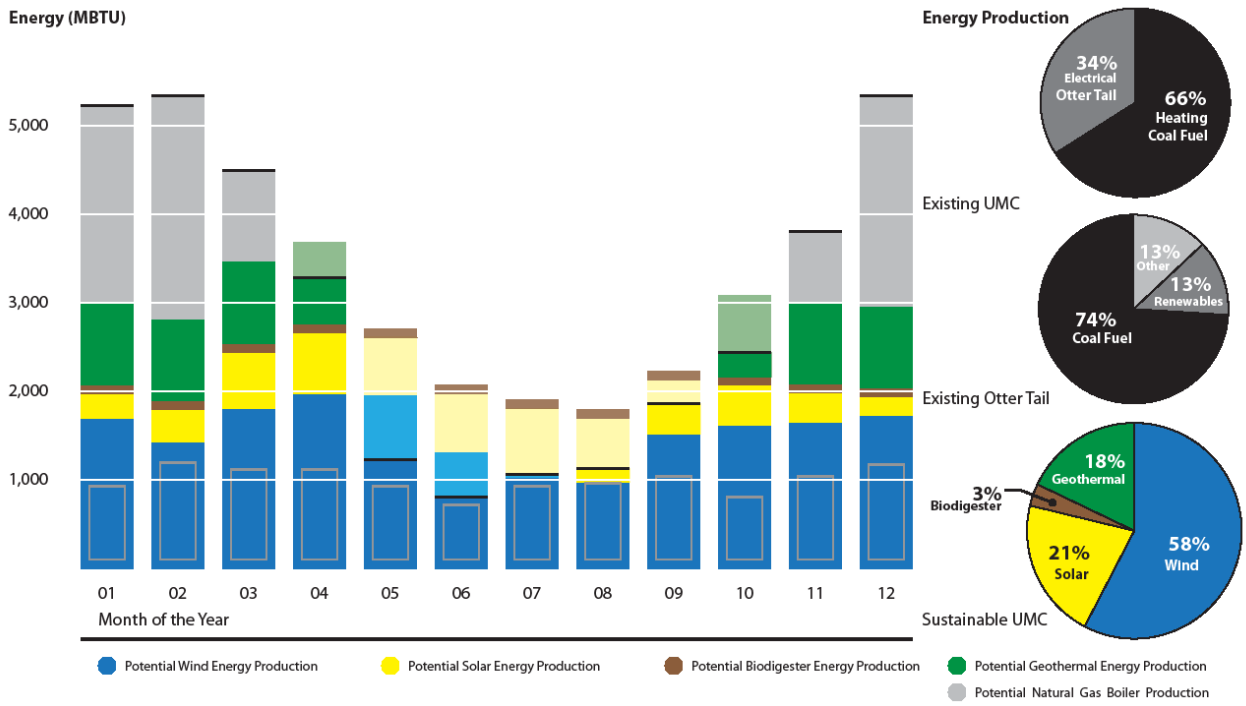


Figure 18. Energy source scenarios for the University of Minnesota, Crookston, Scenario 1 (Skip Carlson's energy report for UMC, December 2009).

Crookston Climate Neutrality Plan

Initially, a variety of alternative energy systems were considered to supplement the campus energy supply such as ; 58% wind, 21% solar, 3% biodigester and 18% geothermal (Figure 18). However in the final analysis, the suggestion is to use only wind and geothermal heat pump systems. The geothermal system would provide the bulk of the heating and cooling energy loads and a wind turbine would provide the majority of the electrical energy load. This combination of systems would be highly efficient, climate neutral, and provide stability to the campus energy needs. The efficiency of the geothermal heat pump system will vary little from year to year and the wind energy, with the help of net metering, will provide a steady and abundant flow of electrical energy for the campus.

The following diagram (Figure 19.) depicts the final configuration of climate neutral heating, cooling, and electrical energy of the Crookston Campus. The heating and cooling energy for the campus will be produced by geothermal ground source heat pumps using a common field for heat exchange. This common field could be a horizontal field located either under the central green space, under 3 different parking lots or under the horse paddock, or other locations as yet determined (Figure 20.). A common exchange field will reduce the total amount required because of redundancy.

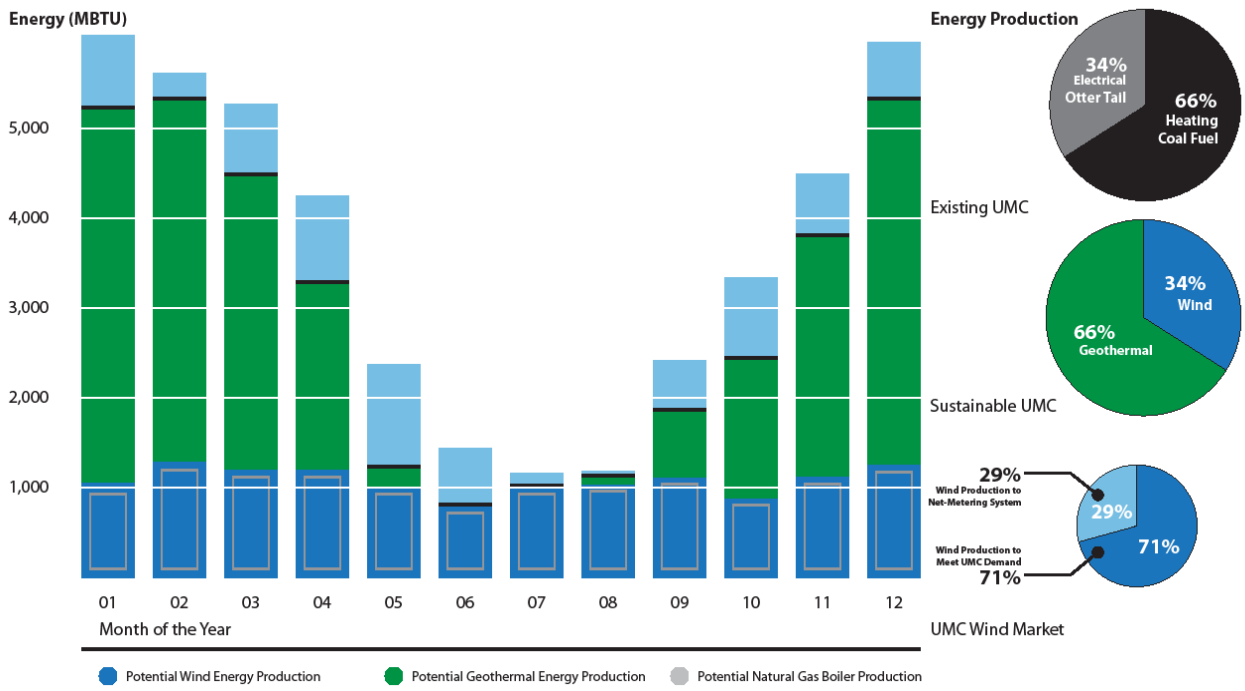


Figure 19. Energy source scenarios for the University of Minnesota, Crookston, Scenario 2 (Skip Carlson's energy report for UMC, December 2009).

In order to attain climate neutrality, electrical energy could come from a new 2.0 Megawatt wind turbine. There has been discussion about possibly locating a wind turbine on campus but this has some limitations because of the municipal airport located north of campus. However, after further research, it was determined that a wind turbine could be located on the far southeastern portion of the campus (Figure 17). If the campus location is not suitable or not allowed by the FAA, then an alternative location could be purchased just to the east of the preferred one.

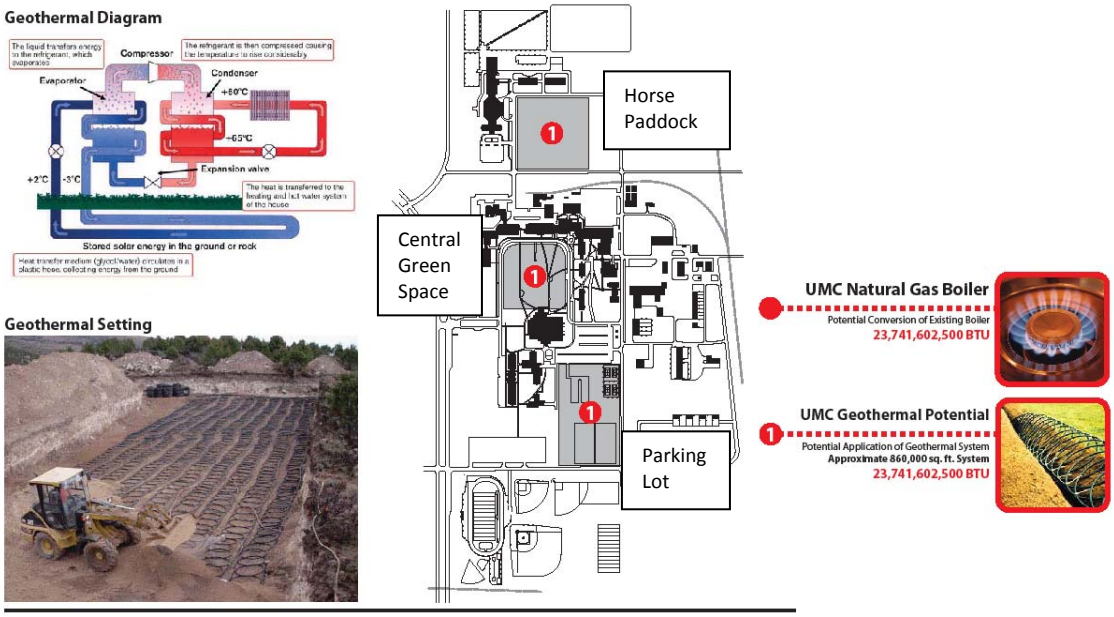


Figure 20. Possible location of geothermal heat exchange fields at University of Minnesota, Crookston (Skip Carlson's energy report for UMC, December 2009).

The electrical energy for the geothermal ground source heat pumps will be produced by a wind turbine situated on the southeast portion of the campus. Although the wind source will be variable, a 2.0 Megawatt wind turbine will provide the total amount of all necessary electrical energy for electrical loads (heat pumps, lighting, and plug loads) needed by the campus for an average year by using the existing power grid as a battery. This can be accomplished by net metering the campus. Net metering will create the ability for the campus to sell power to the utility when the wind turbine is producing a surplus for the campus and buy from the utility when the wind turbine isn't producing enough for the campus. It is anticipated that the total cost from the buying and selling of power over a year's time will be zero. In other words, the campus will produce as much power as it needs over a year's time. Otter Tail Power Company will tentatively consider net metering the campus if the electrical energy from the wind turbine is initially passed through the campus. This is a similar arrangement that Xcel Energy has with St. Olaf College. It is anticipated that a very small amount of energy will have to be net metered therefore it will have very little effect on the total electrical system of the community.

Are geothermal heat pumps feasible for the Crookston campus?

Powering the heating and cooling system of a campus by a ground source heat pump is not a new idea. In 2009, Ball State University started a program to convert the heating and cooling of their campus buildings from coal-fired plants to ground source heat pumps over a 10-year period. At the February 2009 meeting, the University's Board of Trustees approved a proposal that set in motion a phased replacement of the plant's four existing coal-fired stoker boilers through a complete transition of the University's central heating and cooling system to one employing geothermal fields and energy centers to service more than 40 buildings on campus. According to Tom Kinghorn, Vice President of Business Affairs and Treasurer (personal communication), taking the current coal

boilers offline will save the University a half-million dollars per boiler annually in operational costs, resulting in savings of $2 million a year when the project is completed. A similar comparative analysis could be conducted for UMC.

According to a December 2008 report from the Oak Ridge National Laboratory (2008), 600,000 geothermal heat pumps have been installed in the United States. These geothermal heat pump systems have efficiencies greater than 100%; some can reach 400% efficiency. A 400% efficient heat pump system will reduce heating and air conditioning energy by 75% or one-fourth of the current energy load. However, in order to employ geothermal heat pumps in buildings, their existing heating system must be a hydronic system or a hot water heat system. Currently 60% of the square footage of UMC is heated with steam converted to a hot water heating system within the building. These hot water heating systems can easily be converted to a heat pump system. About 26% of the square footage is still using steam heat throughout the building and 70% of these steam-served buildings were built before 1940. These buildings will have to be converted to hot water heat before a heat pump system can be installed. The 26% comprises eight buildings that will have to have substantial mechanical renovation before a heat pump system can be used. Also there are two buildings that are heated and cooled with electrical energy and two buildings that are heated with gas. All four of these buildings will have to undergo substantial mechanical renovation before a heat pump system could be utilized.

Geothermal heat pump systems are very feasible for UMC, because 60% of the space is readily available to be converted to a heat pump system. This heat pump system is anticipated to save 75% of heating and cooling energy. If just the buildings that are easily converted to the heat pump system were connected, the energy savings would be close to $260,000 per year. These savings would help pay for the conversion of the remaining 12 buildings to accommodate a geothermal heat pump system. Most of the larger buildings and newer buildings are already served with hot water heat. The older steam energy served buildings would probably require upgrading because of the inefficient system and would give the college an opportunity to convert to hot water heating. Another advantage of a geothermal heat pump system is the ability to heat and cool with the same efficiency. Therefore, all current buildings that are cooled with DX units: window air conditioners, split systems and chillers could be converted to the heat pump system and reduce the energy loads substantially. Also, if the college were to extend classes into the summer months, additional buildings could be cooled at a reasonable cost and additional buildings could be added to the common system. Not only will energy costs be reduced but the ability to add additional capacity is inherent to the geothermal heat pump system. Since the heat pump system requires electrical energy, the most cost effective way of producing electrical energy in the Crookston area is by a wind turbine. When a wind turbine replaces the utility produced electrical energy, then the campus will be climate neutral for heating and cooling energy.

The following is a tentative schedule for conversion of the campus to a geothermal heat pump system:

Year One and Two:
Designing and estimating the geothermal heat pump system for the campus – 2 years.

Year Three:
Installation of the common heat pump exchange field – over one summer.

Year Four and Five:
Installation of a 2.0 Megawatt Wind Turbine – One year planning, 18-month delivery, 6-month installation and interconnection with the campus.

Year Six to Twenty:
Installation of individual heat pump systems- 13 buildings with hot water heat – 2 months each
8 building with steam heat – 6 months each
2 buildings with electric heat – 6 month each
2 buildings with gas heat – 6 month each
9 buildings with no heat
34 total buildings on campus

Over a 15-year period, two of the campus buildings can be converted each year.

Climate Neutrality could be reached as early as year 2030

The first step in converting a campus to climate neutrality is a careful assessment of the various design options. It seems that a geothermal heat pump system might be the most economical and feasible way for the conversion of UMC, but a careful design study should be commissioned. Once it is determined that this is the direction the campus would like to go, then a more detailed implementation plan can be created. Otter Tail Power Company has offered $550 for every ton of geothermal heat pump energy installed. It is estimated that there will be the need for close to 328 tons. Each ton is estimated to cost around $4,000 and the Otter Tail Power Company is willing to subsidize the cost $550/ton for a total of $190,000 or 14% of the cost per ton to the college, which would be $3,450.

Table 4. Estimated cost for UMC to convert to primarily geothermal and wind systems.

1-2.0 megawatt wind turbine	3.5 million
Geothermal System with exchange field (328 tons at $3,450/tons-current use)	1.2 million
Geothermal System with exchange field (164 tons at $3,450/tons-50% reduction)	.6 million
Conversion of 12 buildings to hot water heat (200,000 sqft)@ $50/sqft	1.0 million
Total estimate	5.1 to 5.7 million
Contingency	1.5 million
Total cost estimate of conversion*	**7.2 million-high**
	6.6 million-low

*a careful engineering estimate should be commissioned to more accurately assess these costs.

The improvement costs for the conversion to a geothermal heat system over a 20-year bonded project of 6 million dollars, at 4% interest is about **$450,000/year.**

The annual energy cost of the campus is $590,000. There would be a 75% savings of the current energy cost resulting from the conversion to a geothermal heat pump system totaling **$442,000/year.**

These two numbers are very close. These numbers represent only the dollar costs of energy and not the possible reduction in labor and environmental costs from the conversion of coal to a geothermal heat pump system. When the future environmental and maintenance costs are factored in, the geothermal heat pump system is the

lowest of the life cycle cost. Therefore it is recommended that the University of Minnesota, Crookston plan a conversion to a geothermal heat pump system.

Conclusion:

Crookston has a very good option to convert to carbon free heating, cooling, and electrical power in the next twenty years and attain climate neutrality by 2030. The geothermal heat pump systems would provide the campus's heating and cooling needs at greater efficiency than present systems. The geothermal heat pump systems are so efficient it is anticipated that one 2.0 Megawatt wind turbine could provide the electrical power for the heat pump system and the other annual electrical needs of the campus.

The timing of the conversion to an entire geothermal heat pump system and wind-powered electrical system will depend on funding. Although more expensive, the campus could consider the conversion from coal to natural gas heating but this conversion will only reduce the campus carbon emission by 40%. The capital investment for this conversion would be minimal because of the construction of the gas boiler in recent years but the annual operating costs would double. However, when considering pollution effects, the total cost including externalities would decrease by 63% from $2,016,456 to $740, 609.

2 LOCAL FOODS

Current Effort at Crookston:

The Crookston campus is located on the northern edge of the so named "bread basket of the world" where the U.S. grain production is abundant due to fertile soils, modern farming techniques and policy. The Crookston community acknowledges the significant role that food plays in the community. There is a campus Local Foods working group looking at the impact of food on the economy as well as on the nutrition and health of the community. It is estimated that each meal for an American will travel well over 1,500 miles. Both the production and transportation of food is energy intensive. When evaluating the carbon footprint of food, it is estimated that each person in the U.S. has a carbon footprint of 22 tons of CO_2/year. When comparing this to the energy footprint of 9 tons of CO_2/year for each student at Crookston, one can see the significance of food in the campus' quest for carbon neutrality.

The carbon footprint of food is difficult to reduce because of the long chain of supply required in the production of food. Shortening the travel miles is one solution to this dilemma. However, changing the purchasing of food for the campus can have a great impact on the carbon footprint as well as the nutrition of the students. Currently Sodexo is the campus food provider. Sodexo is a large corporation with corporate policies that may be in direct conflict with the purchase of local foods. Sodexo is also in other markets where the purchase of local foods is imperative to their acceptance as a food provider. Apparently, insurance requirements are a major obstacle in Sodexo being willing to buy from local suppliers. At Carleton College in Northfield, MN, Sodexo purchased local food from the community food cooperative and were able to carry the necessary insurance; similarly at University of Wisconsin, River Falls.

One possible solution to this impasse would be to have the college temporarily create a local food cooperative until some of the members can assume responsibility and operate it as a private non-profit food cooperative for the entire community. This cooperative would offer the possibility of local foods for the students, reduce the food carbon footprint and create a local food economy. Again, the college can show some leadership with education in the area of a new economic development for the region.

Weber and Matthews (2008) analyzed the carbon footprint of food as follows:

> "*Despite significant recent public concern and media attention to the environmental impacts of food, few studies in the United States have systematically compared the life-cycle greenhouse gas (GHG) emissions associated with food production against long-distance distribution, aka "food-miles." We find that although food is transported long distances in general (1640 km delivery and 6760 km life-cycle supply chain on average) the GHG emissions associated with food are dominated by the production phase, contributing 83% of the average U.S. household's 8.1 t CO_2e/yr footprint for food consumption. Transportation as a whole represents only 11% of life-cycle GHG emissions, and final delivery from producer to retail contributes only 4%. Different food groups exhibit a large range in GHG-intensity; on average, red meat is around 150% more GHG-intensive than chicken or fish. Thus, we suggest that dietary shift can be a more effective means of lowering an average household's food-related climate footprint*

than "buying local." Shifting less than one day per week's worth of calories from red meat and dairy products to chicken, fish, eggs, or a vegetable-based diet achieves more GHG reduction than buying all locally sourced food."

Encouraging the use of local foods in an area that is a primary food producer in our country will empower and educate students, faculty, and administration on the importance of being aware of food production. Using local foods will also stimulate the regional economy.

Possible Strategies that would reduce the carbon footprint of the food prepared by Sodexo:

1) **Continue the work with Sodexo:**. Good communications have been established with Sodexo. Now is the time to keep pushing for the inclusion of local foods into the menus. Ask Sodexo what they can do to track and reduce the carbon footprint of the food they buy.

2) **Look into setting up a local Coop with or without University assistance (insurance):** The University can act as a catalyst at a minimum cost to bring together food producers under the umbrella of a Food Cooperative. Currently, the needed organizational momentum is lacking. The University could play the role of an insurer for a short period of time until the cooperative can organize and take over the responsibility. This is an opportunity that presents a large upside for the University with little downside. Sodexo would be willing to purchase food from the food cooperative if there is sufficient insurance coverage and other food safety protocols .

3) **Strengthen connections with local food producers:** Currently there are several local food producers in the area that would like to sell their food to UMC, but cannot because of the insurance restriction. There is an organization called **"**Pride of the Prairie" that is a part of the Land Stewardship Project.

4) **Develop a business plan for campus local foods:** As an exercise in a business course, students can develop business plans by working with local food producers to start exploring the possibility of producing food for the campus. This can be an outreach and a service-learning project.

5) **Help Sodexo develop a business plan to incorporate local foods into their operations:** As in # 4, students could work with Sodexo to develop a business plan that could incorporate local foods into their way of preparing foods.

6) **Set goals each year for the percentage of local foods – perhaps as much as 5%/year:** The college should set a goal for including organic or local foods in the student meals each year. Without benchmarking a starting point, there will be little progress. Starting with 5% is a minimum; most colleges that have made commitment to local foods have started with 20%.

7) **Compost all organic matter from campus waste – soil supplement:** It is important to return the carbon of the waste organic matter from the college kitchen to the soil. Composting food waste will capture the CO_2 emissions in a soil supplement that can be placed on the University agricultural fields. Both the food waste from the student plates and the pre-meal food waste from the kitchen should be included. Earth Tub makes a composting container that would be big enough for the UMC kitchen. Carleton College is presently using Earth Tubs to compost all the organic waste from their campus dining facilities.

8) **Display the carbon footprint of foods in the dining facility:** By displaying the carbon footprint of foods, students and other consumers can make informed decisions on the type of food they want to consume. The carbon footprinting will also support the use of local foods. Bon Appetit has a carbon calculator for common foods located at: http://www.bamco.com/page/26/low-carbon-diet.htm

9) **Think of campus gardens as a business opportunity for students:** At St Olaf College in Northfield, MN students have developed campus gardens to produce local foods and make money for their college education. These students produce foods from May through October. The gardens supplement the student dining facility with local and very fresh foods.

10) **Think about how the current campus animal herds might become food for the students:** Currently, Crookston houses 200 head of cattle for research and income purposes. Another purpose of these animals might be to provide food for the campus. If all the meat products were produced on campus for the dining facility, students would get a sense of how many resources are required to produce meat products.

11) **Establish menus that use more of the foods that are in season:** Seasonal foods are always the freshest and probably local. Seasonal food gives a sense of variety to the dining experience as well as a healthy alternative to the usual fare. Seasonal foods will educate the students on what foods are available throughout the year and when they are the freshest. Seasonal foods will add a rhythm to the academic year and a marker on the passage of time.

12 **Use fair trade coffees, cocoas, and teas:** It is imperative that a college support the fair trade coffee and teas. These coffee and teas are sold at a similar price or at such a low premium that they are affordable. The support for these coffee growers is essential to support their local communities where the products are grown.

13) **Use unhealthy food to subsidize the healthy foods:** Currently, at Blue-Cross, Blue-Shield corporate dining rooms, healthy food is cheaper than unhealthy foods. Blue Cross, Blue Shield subsidizes healthy food by charging more for unhealthy food and under pricing healthy food. This system is a net zero cost for Blue Cross, Blue Shield but emphasizes the healthier foods. A similar system could be incorporated into Sodexo food pricing system.

14) **Use declining balance food purchasing system:** This system requires that students pay for everything that they select to eat. There are two reasons for incorporating this system into the dining services: One, students will tend to eat less and leave less waste on their trays. Secondly, student will be more selective about their choices of foods. If healthy foods are subsidized, students could select more healthy choices to save money. With the current all-you-can-eat option, student tends to over select foods because there is no penalty. Food waste is incentivized.

15) **Educate students on healthy eating choices:** Not all students arrive at college with a good sense of food selection. People tend to eat what is familiar to them rather than what could be good for them. Often times their food choices complemented with all-you-can-eat will lead to bad eating habits. Education of healthy eating styles is essential for students with little background in healthy foods.

16) **Reduce food waste by 50%:** Reduce food waste on both side of the kitchen (Sodexo and consumers) by 50% the first year and then set goals of further reduction of 5% in each of the subsequent years. Because of the amount of energy in the production, transportation, preparation and disposal of food, it is imperative that no unnecessary waste is created.

17) **Other suggestions:** a) Offer low calorie (label the food as 1) total food calories to produce the food and 2)how many calories in the food) choices so students be educated in their food choices, b) Offer food items that have both a low environmental footprint and a low carbon footprint, c) Offer food items with low miles-labels on the miles on the food product, d) Conduct a freshman healthy food orientation at the beginning of the school year so they can avoid the “freshman 20” (a gain of 20 pounds) that is so common among freshmen.

3 WATER and LANDSCAPE MANAGEMENT

Current Effort at Crookston:

There are some examples of small scale water and landscape management which help to reduce storm water runoff, encourage infiltration into the site, and sequester carbon on campus. The Nature Nook has various components: butterfly garden, rain garden, paver walk through native prairie grasses and a small pond which stores rainwater and creates a small ecosystem on site. There are two plans currently underway to manage campus storm water; the Campus Stormwater Management Plan, and University Teaching and Outreach Center (UTOC) Nutrient and Stormwater Management Plan. A local planning committee made up of University engineers, a water management consultant, agency personnel, and faculty designed the UTOC plan. UMN Landscape architect Eric Castle and Brenda Miller-a civil engineer from the community area- are developing the Campus Stormwater Plan.

UMC and the Northwest Research and Outreach Center collectively own approximately 1,500 acres of land in and around the City of Crookston (Figure 21). This land is used for research, production, forestry, and prairie research, natural areas, and campus lands. Each of these lands has the possibility to sequester carbon and equivalent CO_2. The following is a breakdown of the potential of each of the land functions to sequester carbon using a reference study completed on farmland and conversion lands in Indiana. (Smith et. al. 2002)

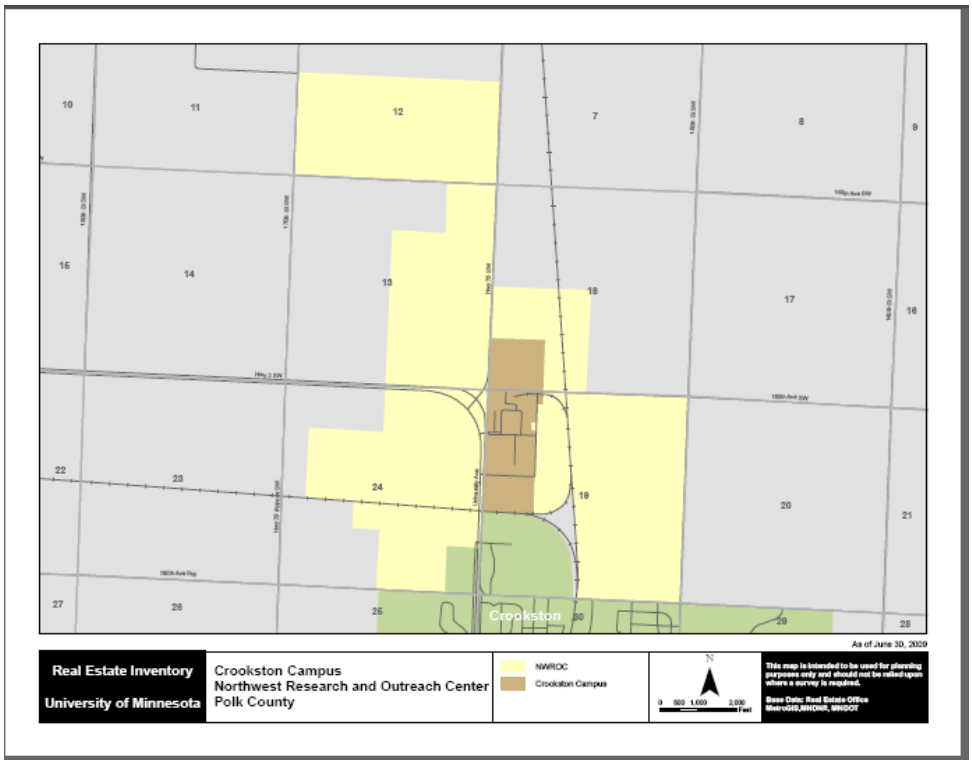


Figure 21. Location of university owned land and proximity to campus.

i) Huot School Forest – 40 acres x .209 tons/acre =8.36 tons/yr

ii) Red River Valley Natural History Area - 85 acres x .397 tons/acre = 33.745 tons/yr
iii) Northwest Research and Outreach Center and agricultural production lands – 1,200 acres x .169 tons/acre = 202.8 tons/yr (assuming moderate tillage)
iv) Campus grounds-175 acres (with almost a 1/3 building and roads and the opportunity for recreation on a 1/3 we will assume that about 1/3 can be converted to natural landscapes) x 1/3 x .397 tons/acre = 23.158

Total carbon sequestration = 268.06 tons of carbon = If you assume that one ton of carbon is equivalent to approximately 4.03 tons of carbon dioxide then the sequestration rate would be **1080.30 tons of CO_2/year** for all the lands that the University currently owns.

This strategy would reduce the carbon footprint by 1,080.30 tons of CO_2 year

Table 5. Reference values for carbon storage potential in different land uses in Indiana. (From Smith, et al. 2002).

By Management System	Tons of Carbon Stored Per Acre
Cropland	.107 Tons C/acre
CRP/Grassland Conversion	.397 Tons C/acre
Trees/Wetland Conversion	.209 Tons C/acre
Cultivation of Organic Soils	-3.52 Tons C/acre
By Tillage System	**Tons of Carbon Stored Per Acre**
Intensive Tillage	.042 Tons C/acre
Moderate Tillage	.169 Tons C/acre
No-Till	.223 Tons C/acre

Although water supply plays a minor part in the production of CO_2, it is a contributor. Currently the campus uses about 16,109,000 gals of potable water each year. Because electrical power is used in the cleaning of water for human consumption, this has a small CO_2 footprint of about 515 tons. About 50% water conservation is achievable by the use of water conserving fixtures. However, in most cases, water prices are low and do not reflect the true cost of production; the payback on water conservation is often long. Drinking water issues in the Crookston area are not of immediate priority due to water coming from a large underground aquifer located some 25 miles to the east. Any conservation and reuse of water would bring the campus water use within the parameters of sustainable use.

Wastewater is a bigger contributor to the production of CO_2 than potable water but is a small player in the overall campus carbon footprint. Again, the actual emissions do not occur on the campus but at the wastewater treatment plant where electrical power and chemicals are employed to clean the wastewater to MN PCA/EPA standards before returning it to the Red Lake River. The approximate CO_2 footprint of wastewater for Crookston is approximately 504 tons. As mentioned previously, the organic component of waste water could be a source of biofuel.

A sustainable landscape plan is also needed for the campus that would identify no-mow areas and designate zones where maintenance-intensive domestic grass covers could be replaced with native, low-maintenance vegetation. The energy and financial savings of such a plan would be an essential component.

4 TRANSPORTATION

Current Effort at Crookston:

Presently, there are not many options for alternative student and faculty transportation both to and from campus and around the city of Crookston. Both the student population (around 1,200) and the Crookston community population (7,790) are relatively small, making it difficult to create an elaborate bus system that could be very useful and cost effective. A significant number of students and faculty regularly commute from nearby Grand Forks, ND. Some attempts have been made to establish a bus system between Grand Forks and Crookston but without success. The majority of students own cars, though they live on campus, because of the available parking and need to get around the city of Crookston for groceries, etc.

Reducing the carbon footprint of transportation on the UMC campus will be one of the most difficult challenges of the Carbon Neutrality Plan. The campus is located on the north side of the City of Crookston and is separate from most city retail and services. In almost all situations, students will have to access transportation to use these services. Therefore the following strategies will have to be implemented in a synergistic manner. No one strategy will solve all the transportation problems.

The carbon footprint of transportation is 1,269 tons/year and is around 10% of the total campus carbon footprint. This carbon footprint breaks down into 45% students, 3% faculty, 16% staff and 37% campus fleet travel and commuting as well as the travel around campus for maintenance vehicles. These carbon numbers do not included air travel miles that can be significant contributor to the transportation carbon footprint. Air miles could account for about 10-20% of the total transportation footprint or an additional 127-254 tons of CO_2/year. This travel seems to be essential to the well being of the college and the need to reduce it is difficult.

Fuels and Vehicles: The first and most convenient option is to switch to more efficient vehicles for the campus operational vehicles. There are many 40-50 mpg vehicles on the market that could replace campus fleet vehicles. This could double the existing fleet efficiency.

This strategy would reduce the carbon footprint by 234 tons of CO_2 year.

Secondly, the use of cleaner fuels would reduce the carbon footprint. Biofuels made from grains are still controversial on whether they all are carbon negative when one considers the total life cycle analysis on an energy-in and energy–out basis. Biofuels from agricultural wastes are a better alternative. Using a non-grain grass such as switchgrass seems to be a more carbon negative alternative.

Alternative Transportation: Because of the limited possibility for a convenient bus route to campus, a good alternative for student cars on campus is the use of a common or shared car. These are called ‘Hour Car” and “WeCar.” These are membership based, car-sharing programs. Students can sign up for a campus car for an hour or a day. The cars are available on the campus for all to use. The cost of the “WeCar” program at Carleton College is as follows: “One-time non-refundable $20 application fee and $30 annual membership fee. Once you’re a member, you have access to an environmentally-friendly Prius Hybrid and Camry Hybrid for an hourly rate of $8 which includes gas. The daily rate is $59 for (any 24-hour period) and overnight rate is $39 (6 p.m. to 8 a.m.)” These programs reduce the need for students to bring cars to campus and reduces the need for the

college to buy vehicles for student and faculty field trips. These cars are usually fuel efficient hybrids that run partially on electricity. Fully-electric cars would be perfect for the students' short errands to town and back. The cars can be reserved on a first come, first serve basis by computer. Other options for alternative transportation can be investigated as they become available; for example, the U of MN Twin Cities has a "ZIP car" option and "Zimride" is a carpool network on Facebook which is available on Facebook (Amy Short, personal communication).

Reduce Vehicle Miles Traveled (VMT):

Reducing the miles that students and staff drive is similar to reducing transportation needs. Use more telecommuting opportunities for staff when possible. Establish alternative transportation days in the spring and fall when it is seasonally possible. During the winter, establish ride with buddy /student/staff/faculty day. Set a goal of a 10% reduction of VMT for the first year and then 5% after that.

Reduce Transportation Needs: Reducing the demand and need for transportation of any kind is the best alternative of all. If people don't drive, then the transportation footprint drops to zero. However, this option is probably the most difficult of all to solve but least thought about.

UMC could consider stocking students' most needed items in the bookstores and vending machines at reasonable prices so that it would be more expensive for the student to travel to Crookston for the items. The college might slightly subsidize the items to make this attractive. Students are very price sensitive.

Bike programs are becoming more popular in cities and schools. Bikes with large baskets for carrying student items would be convenient. The bike program could be run similar to the "Hour Car" where the student can reserve the bike when needed and is responsible for returning it to a secured rack. Incentives for the use of bikes by students could be created with a coupon for the snack bar or bookstore with each use. These new alternative programs will have to be incentivized for their adoption. They will have to be more convenient and cheaper than the alternative for them to be part of the students' life.

Building more student housing on campus will reduce commuting to and from campus.

5 CURRICULUM

Current Effort at Crookston:

The Crookston campus has been quite progressive in establishing and planning a series of sustainability related programs: Biofuels and Renewable Energy Technology (current), Environmental Science major (approved), and Sustainability minor and Sustainable Facility Management major which are in the early development phases. Each of these programs will better prepare Crookston students for the challenges of the 21st century. It is essential that the mission of carbon neutrality be fully integrated into the curriculum of the college if its goals are to be attained.

The transition to a climate neutral campus will support and expand existing programs and promote new related programs. Certainly the Biofuels and Renewable Energy Technology program will be invigorated by the development of functioning renewable energy systems on campus. There will be actual examples of the systems that they will be studying and the possibility of new developments that will harness other renewable energy in the region. The enhanced energy management programs that the college will undertake will also be a great application of the principles of the Sustainable Facility Management program.

Hopefully, the Agriculture & Natural Resources; Math, Science &Technology; Business; and Arts, Humanities, and Social Sciences Departments will be interested in the wind and solar applications as well as the biomass and animal waste applications to enhance case studies in their classrooms. Further application to agricultural economics could be foreseen as the farms of the future transition to renewable fuels for operations.

The Curriculum Working Group of the UMC Sustainability Committee, the Academic Affairs Office and all Departments can promote research in the following areas:

- Annual assessment of the reduction of carbon dioxide and probability of meeting the climate neutrality goals
- Monitoring of energy usage in buildings
- Monitoring of energy usage in subsystems of buildings
- Evaluate the effectiveness of building energy reductions (technological and social)
- Examining alternative methods to reduce energy in buildings both from a social and technological perspective
- Examine the feasibility of bio-mass boilers
- Examine the feasibility of expanded animal waste digesters
- Examine the economics of energy transition to renewable for a typical farmstead
- Examine the specifics of solar photovoltaic and solar thermal applications
- Evaluate the possibility of participation of the Crookston Community participating in the college quest for carbon neutrality
- Evaluate the economics of the college initiating a food cooperative
- Evaluate the initiation of an “Hour Car” program
- Evaluate the initiation of a bike program

Funding for these research efforts could be from the system-wide Undergraduate Research Opportunity Program (UROP) Grant program and the campus, Undergraduate Research Opportunity for Crookston (UROC) program for students. There are currently more funds available than are used by students, at least for the UROC program.

6 RECYCLING and WASTE MANAGEMENT

Current Effort at Crookston:

The Facilities and Operations Department at UMC manages solid waste disposal and tracking. Custodial and Maintenance Scrap Materials in Facilities and Operations and the Recycling Working Group of UMN Sustainability Committee are two entities working on solid waste and recycling at UMC. Beginning steps have included placing recycling containers around campus for sorting waste into separate bins. These containers are organized and managed by all campus clubs of the Crookston Student Association. to the campus participated in RecycleMania in 2010 which accelerated recycling on campus.

Data on solid waste and recycling at UMC are currently unavailable from Facilities and Operations and Peter Phaiah, Vice Chancellor of Student Services.

Recycling and waste management are important for climate neutrality because addressing them can reduce greenhouse gas emissions. According to the EPA, the disposal of solid waste produces greenhouse gas emissions in a number of ways. First, the anaerobic decomposition of waste in landfills produces methane, a greenhouse gas 21 times more potent than carbon dioxide. Second, the incineration of waste produces carbon dioxide as a by-product. In addition, the transportation of waste to disposal sites produces greenhouse gas emissions from the combustion of the fuel used in the equipment. Finally, the disposal of materials indicates they are potentially replaced by new products; which often requires the use of fossil fuels to obtain raw materials and manufacture the items. http://www.epa.gov/climatechange/wycd/waste/generalinfo.html

A concerted effort in the campus community will serve to reduce waste and increase recycling and engage the community in a long-term effort to reduce carbon emissions. Important to this process is the documentation of existing numbers on waste production and recycling as well as data on the content of the solid waste generated. In addition, this topic offers an excellent opportunity for engaging the community in making progress towards reducing current GHG emissions. The participation of each member of the community is essential to effectively meeting this goal.

Recommendations for UMC

1. Establish a protocol for solid waste and recycling measurement and tracking at UMC. Create a baseline for solid waste and recycling that can be measured and improved over the years.

2. Set specific goals to reduce GHG emissions associated with solid waste and recycling and develop strategies to meet those goals.

3. Continue to establish programs that accelerate the reduction of solid waste and increase recycling.

4. Develop a campus materials reuse/exchange program, potentially student managed to reduce solid waste and increase reuse.

5. Develop purchasing policies with waste prevention in mind.

6. Work with vendors to reduce transportation packaging.

7. Replace production of paper materials with online alternatives wherever possible.

8. Implement campus printing initiatives that discourage unlimited printing in computer labs and copy rooms.

9. Promote the use of printer settings and paper reduction software.

10. Discourage use of non-recyclable (bright, dark, or plastic-coated) paper.

11. Offer discounts or other incentives for using reusable mugs in campus dining operations.

12. Create an action plan for better materials management in concessions operations and sporting events.

13. Use bulk condiment dispensers instead of single serving packages in dining operations.

14. Create and promote a system for the campus community to report wasteful practices and offer suggestions for waste reduction.

7 RESEARCH

Research is a critical component of UMC implementing climate neutrality. Research related to sustainability and climate neutrality has the double benefit of advancing knowledge in these areas, preparing students in an area that is guaranteed to be of importance in the coming decades, enhancing the "Living Laboratory" function of the campus, and also meeting an important goal of the institution.

Current Effort at Crookston:

There are some existing campus research efforts related to carbon neutrality; potential carbon sequestration on campus, use of biofuels for campus vehicles, potential use of methane digesters on campus, and use of prairie plantings. These research efforts help strengthen climate neutrality efforts and connect faculty and students involved in this work to the larger campus-wide initiative. In addition, there have been some student research projects related to sustainability. These research projects are supported by grants such as CERTS, UROPs and UROCs . Research efforts related to biofuels and carbon sequestration are led by Paul Aakre and Katy Smith, respectively. Methane digester possibilities are being explored by Christo Roberts. Otter Tail Power Company has also expressed interest in funding research for increased energy efficiency and AURI (Agricultural Utilization Research Institute (AURI) has expressed interest in co-sponsoring internships. Up to this point, available funds for student and faculty research have not been utilized to their full extent.

Recommendations for UMC

1. Identify faculty research of value to the climate neutrality goals of UMC across all disciplines and programs.

2. Provide smaller, start-up grants and incentives to increase research interest in this area.

3. Use available UROP/UROC funding to advance climate neutrality goals of UMC. Develop a network of research support for students,the sustainability committees, individual faculty, and P&A staff who might advise the UROP/UROC students as they help UMC reach its climate neutrality goals.

8 COMMUNICATION and OUTREACH

Communication of UMC's progress towards climate neutrality is critical to making cultural change happen in the campus community. This cultural change, in turn, is critical to achieving climate neutrality. Outreach is another important aspect of the UMC's mission. In the context of UMC's climate neutrality efforts, UMC's work will serve to inform the region and assist in its transformation that is underway. UMC can be a leader (as it has been in the past within the context of agriculture) by helping rural communities on their own path to climate neutrality.

Current Effort at Crookston:

There are excellent outreach efforts at the Crookston campus by UMC , Northwest Regional Sustainable Development Partnership, Extension, Northwest Research and Outreach Center (NWROC), the Alternative Energy Working Group, and individual faculty work. The addition of a GreenCorps member at Crookston increased connections between the campus and community. Currently, the GreenCorps position is filled by Chris Waltz, a Crookston alumnus who coordinated completion of the GreenHouse Gas Report and is engaged in other energy-related outreach in the community.

While there is a long tradition of excellent outreach efforts at the Crookston campus, "climate action plans," as such, are new on the scene. Initiatives in sustainable resource management, renewable energy, biofuels, energy efficiency, and pollution prevention programs have been on the agenda for years; in some cases for decades. Climate action plans provides a more holistic umbrella to include on-going work and add other initiatives, such as carbon sequestration and life cycle analysis.

Recommendations for UMC

1. Communicate about UMC's climate neutrality efforts to an internal UMC audience as well as externally to a local, regional, and global audience.

2. Set targets and goals in terms of communication about climate neutrality and measure the outcomes every six months.

3. Build on current outreach efforts in other aspects of resource sustainability and connect to the broader context of climate neutrality.

4. Initiate new efforts to do outreach specifically in the area of climate neutrality. For example, the *Landowner's Guide to Prairie Managemen*t by Svedarsky, et.al (2002) could have a parallel, "Landowner's or Farmer's Guide to Climate Neutrality. " Also, an on-farm calculator for life cycle analysis of agricultural practices has recently been developed. The Fieldprint Calculator is a free, confidential, educational online tool designed to help U.S. corn, cotton, soybean, and wheat growers assess how some of their operational decisions affect sustainability performance. The Calculator is an easy way to estimate how a grower's land use, energy use, water use, greenhouse gas emissions, and soil loss per unit of output compare with state and national averages. The Keystone Alliance for Sustainable Agriculture announces that he Fieldprint Calculator is available at www.fieldtomarket.org.

9 CONNECTIONS and CONVERSATIONS

Connections and conversations refer to how connections with individuals and organizations can help UMC accelerate its progress towards climate neutrality and related sustainability initiatives. At a time where it is increasingly important to leverage limited resources by developing partnerships, this is a natural strategy to be employed – to partner and synergize with entities that have common goals and interests.

Current Effort at Crookston:

The conversations and forums that UMC has had in the past have helped it get to this point. The Regional Sustainable Development Conference in October of 2005, http://www3.crk.umn.edu/people/services/MediaServ/DL-SC.htm. Sustainability seminar series in 2005 and 2006, Sustainability forum in April of 2009, year-long series of student-lead sustainability programs in 08-09 year, and Sustainability programs on 15 October 2009 and 29 April 2010. Specific events include the following:

Campus presentations in 2008-09 – Robert Chronowski ("Financing the Carbon-cutting Initiative"); Paul Douglas ("A Slow Moving Transformation; Climate Change, and Minnesota Agriculture"); Alison Lindburg ("Sustainable Design for Rural Minnesota"); Richard Strong ("Sustainable Solutions for UMC");
Patrick Welle, (Environmental Economics and Sustainability");
Dan Daly, Energy and Environmental Research Center (EERC) UND ("Carbon Sequestration");
Myron Just ("Connecting the Dots of Sustainability – a Game Everyone Can Play"); and Richard Strong and Virajita Singh (A Campus Neutrality Plan for UMC);
26 January 2010 – Otter Tail Energy Challenge Kick-Off event ("Flip it off- save your energy until later.")
29 April 2010-Edward Anderson ("The role of science, technology and perception in the new age of resource scarcity")

Some of the emerging partnerships and connections for UMC around energy efficiency and climate neutrality are:

a) City of Crookston and the local school district.
b) Otter Tail Power Company Energy Challenge
c) Riverview Health Partners Hospital
d) New Flyer Bus Company located in Crookston
e) Dahlgrens, Inc.
f) City of Halstad (Building and street lighting retrofits)

Recommendations for UMC

1. Scope existing and potential connections of UMC around the topics of climate neutrality, energy efficiency, and sustainability. Identify organizations and individuals known to the campus community of UMC faculty, staff, students, that might help achieve UMC's climate neutrality goals and reach out to these connections.

2. Network within the campus community to discuss and act on climate neutrality goals. A campus survey (Appendix C) showed campus community members are committed to sustainability issues although it may not

be obvious on the surface. Building on the survey results, create opportunities to identify members of the campus community who are supportive and provide networking opportunities to grow this group of interested/committed individuals.

3. For every new project initiated with a climate neutrality-related goal, seek to partner with others. The current effort involving Otter Tail Power Company's Energy Challenge is a good example of how such a partnership is particularly helpful in advancing the goal of climate neutrality. Many other such potential partnerships in a variety of areas such as food and transportation are possible.

4. Continue the tradition of conversations around sustainability and connect the topics of climate neutrality, the green economy, and long-term economic vitality. UMC's past conversations and events around sustainability have proven to be catalysts of action towards UMC becoming more sustainable. These conversations should be continued in the spirit of a learning organization that also seeks to bring expertise and educate the campus community and region on these topics that in turn accelerate the process of transformation.

10 CULTURE AND PROCESS

Addressing and ultimately changing culture and process is critical to achieve climate neutrality. Why is this important? For any community to translate ideals and goals into action there has to be a concerted effort. This concerted effort is almost impossible unless the desired goal is held as important in the collective consciousness of the members of the community. The reason why communities are not sustainable or climate neutral, despite technologies being available to make this possible, is because the goals and actions towards that end have not been assimilated into the culture. When that cultural shift is made, and sustainable actions are just how things are intentionally done, achieving climate neutrality will be easy. This means that it is important to focus on a cultural transformation within the community. Addressing the process of developing goals and action is a means to implement this transformation. Every community/organization needs a process unique to its own needs or the effort will be irrelevant. In effect, to be on the road to climate neutrality means also to be on the road to continuous transformation and improvement. To be most effective, embracing such a cultural change would be a substantive principle to be incorporated into a campus' Strategic Plan as well as its Master Plan.

Current Efforts at Crookston

By establishing specific committees, starting a Center for Sustainability and by taking the initiative to develop a climate neutrality plan in response to President Bruininks's signing of the President's Climate Change Commitment, UMC has already made good headway in establishing a process. This process needs to be continued and accelerated. As an agricultural community, the students and faculty on this campus are very connected with the land and the effects that climate change will inevitably have on it. In this way, the issues they will be addressing by establishing a goal of climate neutrality will directly and dramatically impact their future direction as both a community and a learning/research institution.

The recent survey conducted at UMC (Appendix C) around the topic of sustainability and climate neutrality received a good response rate. The survey results indicated that a majority of the respondents thought these issues to be important to them. In addition, the responses on specific topics and the comments indicated that a majority of the participants were interested in involvement and action on campus in connection to these topics. This is very good news because it reveals a community largely receptive to the topic of climate change and interested in taking action. The survey results suggest that specific action be taken to involve and communicate across campus and accelerate action towards a climate neutral campus.

We suggest that cultural change be implemented by the following three actions: 1) ride the wave of external changes that are happening in our society, 2) integrate sustainability into efforts already important to the campus community, and 3) foster the internal changes one step at a time. Alan AtKisson (1999), author of *Believing Cassandra* examined the strengths and innovative ideas within constituents (students, faculty and staff), and offered three strategies for motivating transformation: (1) promote the new, (2) critique the old and (3) facilitate the switch.

Recommendations for UMC

1. Establish an institutional structure and process to oversee the implementation of its Climate Action Plan and related sustainability initiatives and integrate into the system-wide sustainability and reporting efforts as outlined in the Regent's Policy on Sustainability and Energy Efficiency (Appendix A.) and the Systemwide Sustainability Goals and Outcomes Report (O'Brien and Swackhamer 2009).

2. Set metrics in terms of achieving climate neutrality:

    For example, become 50% climate neutral by 2015

    Become 80% climate neutral by 2020 (Scientists are saying that we need to become 80% carbon neutral by 2020)

    Become 100% climate neutral by 2030

3. Annually, record progress in how UMC is meeting its Climate Action Plan.

ACKNOWLEDGEMENTS

UMN President Bruininks for signing the American College and University Presidents' Climate Commitment on behalf of the University of Minnesota and its campuses.

Chancellor Casey for establishing the Sustainability committee in the fall of 2008;
As a precursor to this plan, Martin Lundell and Chris Waltz were Co- Chairs of Sustainability Committee in 2008 and were responsible for completing the greenhouse gas inventory and many other leadership aspects of launching the Sustainability Committee.

Funding for the Climate Action Plan was provided by:
LEEDing Crookston to a Sustainable Future grant from Clean Energy Resource Team(CERTS)
Northwest Regional Sustainable Development Partnership
Northwest Minnesota Foundation
Office of Chancellor, UMC

Steve Hannah, Director of the UMC Center for Teaching and Learning and communications professor, Dr. Kevin Thompson, were especially helpful in in organizing the campus survey which gauged the campus attitudes regarding Sustainability and the concept of Climate Neutrality. Tim Norton, Director of Facilities and Operations provided many of the infrastructure and energy use data. Amy Short, Sustainability Coordinator for the Twin Cities campus provided numerous helpful edits. Dan Svedarsky and Linda Kingery provided edits and coordinated edits from the campus community. Additional input was provided by the campus community and most individuals are listed below in connection with the campus sustainability organizational structure.

Center for Sustainability: Dan Svedarsky, Director
Staff: Chris Waltz, GreenCorps Energy Efficiency Specialist
Lisa Gentele, Student Sustainability Assistant

Campus Sustainability Committee Membership:
Dan Svedarsky, Chair; Chris Waltz, Lisa Gentele (Student), Christo Robberts, Jason Brantner (NW Research and Outreach Center), Chris Winjum, David Demuth, Pat Kelly (City of Crookston), Linda Kingery, Rachel McCoppin, Tim Norton, Peter Phaiah, Tricia Sanders, and Jon Steiner.

Sustainability Working Groups:

Water and landscape management. Eric Castle, Chair. Brian Christianson, Lisa Gentele, Katy Smith, Kristie Walker, and Kenny Mendez.

Curriculum. Paul Aakre, Chair. Katy Smith, Ken Johnson, Kim Gillette, and Dan Svedarsky

Recycling and waste management. Peter Phaiah, Chair. Brian Christenson, Tom Feiro, Carol Larson, Bruce Felts, Lisa Gentele.

Energy operations and infrastructure. Tim Norton, Chair. Ken Johnson and Jon Fabre (Otter Tail Power Company), Gene Scales (Energy Consultant), Donn Anderson (UMC staff), Rob Stoe (UMC Staff), Kent Freberg, Rusty Remick (UMC staff), Chris Waltz, Tom Haarstick (student), Jason Brantner (NW ROC), and Doug Langer (UMC staff) (Ex Officio: Jerome Malmquist)

Energy use. Chris Waltz, Chair. Steve Hannah, Alysa Jensen (Student), Lauren Snively (Student), Marsha Odom, Jon Fabre and Jana Emery (Otter Tail Power Company), Jim Jarvis(Consultant) (Ex Officio: Jerome Malmquist)

Communications and outreach. Linda Kingery, Chair; Rachel McCoppin; Andrew Svec, Liz Tollefson, Heather Donati-Lewis, Stephanie Onken, Amber Evans-Dailey, Lisa Gentele, and Cindy Kuismi (Otter Tail Power Company).

Local foods. Linda Kingery, Chair. Peter Phaiah, Harouna Maiga, Terry Nennich, Deb Zak, Sharon Stewart, Ken Meyers, Sue Jacobson, and Natalie Brown (Sodexo).

Crookston Students for Sustainable Development (CSSD) Lisa Gentele, Chair;
Thomas Haarstick, Elizabeth Kern, Stefanie Rude, Nikolay Seregin, Lauren Snively, Ben Sullivan, Greg Summers, Abbie Tosh, Claire Hanson, and Cory Oestreich.

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APPENDIX-A

REGENTS POLICY ON SUSTAINABILITY AND ENERGY EFFICIENCY

Administrative

UNIVERSITY OF MINNESOTA

SUSTAINABILITY AND ENERGY EFFICIENCY
Adopted: July 9, 2004
Supersedes: (See end of policy)

BOARD OF REGENTS POLICY

SUSTAINABILITY AND ENERGY EFFICIENCY

SECTION I. COMMITMENT.

Sustainability is a continuous effort integrating environmental, social, and economic goals through design, planning, and operational organization to meet current needs without compromising the ability of future generations to meet their own needs. Sustainability requires the collective actions of the University of Minnesota (University) community and shall be guided by the balanced use of all resources, within budgetary constraints. The University is committed to incorporating sustainability into its teaching, research, and outreach and the operations that support them.

SECTION II. GUIDING PRINCIPLES.

Subd. 1. Leadership. Through excellence in environmental education, research, outreach, and stewardship, the University shall strive to be a world leader by promoting and demonstrating sustainability and energy efficiency and by producing leaders and informed citizens.

Subd. 2. Modeling. The University shall strive to be a model in the application of sustainability principles to guide campus operations by:

(a) meeting and aspiring to exceed all applicable regulatory requirements;

(b) preventing pollution at its source;

(c) reducing emissions to the environment; and

(d) encouraging the use of a life-cycle cost framework.

Subd. 3. Operational Improvements. The University shall undertake a continuous improvement process that seeks to meet the operational performance targets, goals, and objectives designed to achieve sustainability.

Subd. 4. Energy Efficiency. The University shall undertake a process to increase energy efficiency, reduce dependence on non-renewable energy, and encourage the development of energy alternatives through research and innovation.

Subd. 5. Research. The University shall (a) promote innovative, high visibility research projects focused on sustainability and energy efficiency to inform campus operations as a whole as well as the broader community; and (b) promote collaborative projects that include faculty research undertaken in partnership with operations staff, students, public entities, community organizations, and industry.

Subd. 6. Education and Outreach. The University shall promote educational and outreach activities that are linked to operational improvements and innovation principles.

SECTION III. IMPLEMENTATION.

Subd. 1. Administration. The University shall have sustainability goals that inform administrative policies and procedures in the areas of planning, decision-making, execution, assessment, reporting, and alignment. These policies and procedures shall rely on scientific analysis and support the efforts described in subds. 2-4 of this section.

Subd. 2. Operations. Each University campus shall develop specific sustainability objectives and targets in the areas of:

(a) physical planning and development, including buildings and infrastructure;

(b) operations;

(c) transportation;

(d) purchasing; and

(e) waste management and abatement.

Subd. 3. Accountability. The president or delegate shall develop indicators and measures of success in the implementation of the principles outlined in this policy in consultation with appropriate faculty, staff, students, and experts in the broader community.

Subd. 4. Reporting. The president or delegate shall report to the Board annually on progress toward established targets and standards, using this information to identify opportunities for subsequent improvement.

SUPERSEDES: POLLUTION PREVENTION AND WASTE ABATEMENT DATED JUNE 12,

1992.

APPENDIX-B

ENERGY PRECEDENT-MORRIS REPORT

UNIVERSITY OF MINNESOTA
MORRIS

The University of Minnesota

Fall Semester 2009 **Skip Carlson** **With the CSBR**

University of Minnesota
MORRIS

Energizing a Campus

The Story of the University of Minnesota, Morris

The University of Minnesota

Fall Semester 2009

Skip Carlson

Case Study Abstract. This case study focuses on the various alternative/renewable energy production technologies and strategies implemented on the University of Minnesota, Morris (UMM) campus within the last decade or so, attempting to document several of the important steps that the campus undertook in its quest to attain a carbon neutral campus. Research and documentation was gathered from a variety of literary and web-based resources but also from a number of on-site tours, interviews, and discussions with: **Mr. Lowell C. Rasmussen**, associate vice chancellor for physical plant and master planning; **Mr. Troy J. Goodnough**, director of sustainability with the plant services administration; and **Mr. James C. Barbour**, emissions specialist for the biomass gasification project. I would like to take this opportunity to express my sincere gratitude and appreciation for all the time that these faculty and staff members were willing to take out of their busy schedules to discuss the sustainable movement and initiative currently sweeping across the UMM campus.

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University of Minnesota Morris Students

Framing a Quest for Sustainability

As the rest of the world calmly prepared itself to enter the twenty-first century, in the rural Midwestern region of Minnesota, amidst the tall prairie grass, along the meandering Pomme de Terre River, beneath the blue prairie sky, near the small town of Morris, a sustainable movement was about to erupt. This is the story of the University of Minnesota, Morris (UMM) and its resolutely determined quest to attain a carbon neutral status for its entire campus.

As with most bold and ambitious quests, it would make a much more dramatic and compelling story to be able to attribute the UMM's many audacious undertakings, calculated risks, and resounding successes to a single soldier in the fight for sustainability, a solitary voice in the midst of the masses, or a lone man in the pursuit of a vision. In the case of the UMM, however, the framing of this quest for sustainability did not begin with the authoritative cry of a single voice from within the UMM faculty, but, instead, with the quiet petition of a thousand pleas from within the student body. As Lowell C. Rasmussen, associate vice chancellor for physical plant and master planning at the UMM, so aptly put it, "The students are the drivers [of this sustainable movement]…if they did not continue to support, encourage, and promote these processes [the UMM] would have abandoned its efforts years ago"[i].

As a result, the framing of this quest for sustainability at the UMM can be directly traced to the 2002 academic year when the student body began to earnestly promote a new proactive approach to the issue of sustainability on the campus and petitioned the UMM administration with a request for the campus to actively participate in a wind energy program recently implemented by the local electrical services provider, the Otter Tail Power Company. After considering the $15,000 additional cost associated with the purchasing of this "green energy", the administration eventually chose to accept the petition from the students but issued a request of their own to the student body challenging them to conserve the equivalent amount of money through the implementation and adoption of a variety of other resource conservation programs.

This single decision to purchase renewable energy from the Otter Tail Power Company was directly and indirectly responsible for framing and committing the UMM to a resolutely determined quest for sustainability that would ultimately transform the entire college campus as well as the lives of every single student, instructor, and faculty member. For example, in an attempt to meet this challenge the student body: agreed to an extensive water conservation program, changed from a paper-based campus newsletter to an electronic format, and greatly increased the amount of material recycled through the campus recycling program. In order to assist the students with these efforts, it also became necessary for the UMM to: commission a campus-wide water resource conservation study, switch to the use of hybrid vehicles for campus transportation needs, establish a Green Energy Task Force to review and monitor various campus operations, and contract with a number of Energy Service Consultants (ESCOs) to identify additional conservation methods and techniques that could be easily implemented on the campus[ii].

The students are the drivers [of this sustainable movement] – Lowell C. Rasmussen

Thus a seemingly straightforward and simple petition and request from the student body for the purchasing of "green energy" from the local electrical services provider ultimately resulted in the transformation of an entire college campus in terms of: power, food, water, transportation, waste stream infrastructure, academic study, and quality of life. Lowell describes the impact of this decision, "We started with a focus on 'green energy' but it has transcended to all aspects of our lives"[iii]. The results of these fundamental changes remain evident today on the current UMM campus, which proudly promotes: a local foods initiative (Pride of the Prairie Local Foods Initiative), green educational degree programs

(Environmental Studies Major), green vehicles (gas-electric Toyota Prius hybrids and zero emissions vehicles), green water use (UMM buildings conserve more than two million gallons of water annually, saving the campus nearly $15,000), & green disposal/recycling programs (UMM redirected 65 tons of recyclables from landfills in 2007, saving the campus nearly $14,000)[iv]. While this case study will focus primarily on the alternative/renewable energy production technologies and strategies implemented on the UMM campus, it is extremely important to note that these technologies and strategies are only a very small part of a much larger sustainable movement that is currently sweeping across the UMM.

Vice Chancellor
Lowell C. Rasmussen

Preparing for a Quest for Sustainability

With the voice of the student body having been expressed and heard, a conservation challenge from the UMM faculty having been issued and met, and a cost-neutral three-year power purchasing agreement for "green energy" having been proposed and implemented, the stage was set at the UMM for the faculty and administration to step in, take up the students' cause, and begin preparing the campus in earnest for a much more extensive and comprehensive quest for sustainability and carbon neutrality through the implementation of several on-site alternative/renewable energy production initiatives.

One of these faculty members was Lowell C. Rasmussen who, even before the student body brought its petition to the UMM faculty, had already expressed an interest in and a personal motivation towards implementing various on-site alternative/renewable energy production technologies as a potential strategy for resolving and mitigating a number of recent energy-related incidents and conditions on the existing UMM campus. For example, before embarking on its quest for sustainability, the UMM had been entirely dependent upon natural gas to supply all of its heating and cooling demands. Unfortunately, with the campus being located at the "end-of-the-line" in terms of the existing natural gas pipeline layout and supply chain, the natural gas company maintained the right to "curtail" or cut off the natural gas supply to the UMM when demand significantly increased. As a result, during the colder winter months the UMM frequently experienced natural gas curtailments that forced the UMM to switch its boilers over to more expensive fuel oil supplies in order to adequately heat the campus. Of perhaps even more significance, in 2001 the price of natural gas skyrocketed, tripling in cost in just a single year and very nearly bankrupting the UMM simply based upon its heating bills alone.

In response to these and other energy-related incidents and conditions on the existing UMM campus, Lowell brought a personal motivation and an unyielding determination to the students' cause that resulted in the proposal and establishment of a number of sustainable goals and objectives that would be largely responsible for guiding the UMM's quest for sustainability. Ultimately, these goals and objectives would lead to the campus being widely recognized as "a national leader in green initiatives including the implementation of wind energy, biomass energy, and sustainable food projects"[v]. For his part, Lowell would be considered by many to have "played a significant role within the University of Minnesota in initiating renewable energy projects and developing partnerships across the University that advanced sustainable energy priorities"[vi].

We started with a focus on "green energy" but it has transcended to all aspects of our lives – Lowell C. Rasmussen

As the efforts to prepare the UMM campus in earnest for a much more extensive and comprehensive quest for sustainability and carbon neutrality got underway, the campus quickly realized that the success of the UMM

North Central Soil Conservation Research Laboratory

would require the campus to: expand its education and familiarity with sustainable issues and technologies, forge a variety of effective and beneficial partnerships, and secure significant financial funding. The campus ultimately learned that, "Partnerships with University of Minnesota programs and a multitude of organizations, neighbors, and friends on the prairie have been essential in this work…and have advanced the collective efforts"[vii].

For the UMM, many of these partnerships were already in place, needing only to be further strengthened and, in some cases, formalized. The primary groups and organizations that the UMM has entered into partnerships with include: the State of Minnesota, the University of Minnesota collegiate system, the Center for Small Towns (CST), and what Chancellor Jacquie Johnson describes as an informal "research triangle" that had existed informally for several decades prior to the eruption of this sustainable movement on the UMM campus but was quickly formalized into the "Green Prairie Alliance". The Green Prairie Alliance consists of a local collaboration in the Morris region that coordinates the efforts of: the UMM, the United States Department of Agriculture (USDA) North Central Soil Conservation Research Lab (Soils Lab), and the West Central Research and Outreach Center (WCROC). As the UMM began to aggressively research, pursue, and develop its biomass gasification project, additional partnerships were forged with the Agricultural Utilization and Research Institute (AURI) and the MN Corn Growers Association.

In addition to these partnerships, the UMM also began to join a number of beneficial educational and sustainable organizations including the Association for the Advancement of Sustainability in Higher Education (AASHE) and the Upper Midwest Association for Campus Sustainability (UMACS). The campus understood that participation and membership in these types of organizations is vital to the success of any quest for sustainability, allowing for interaction with and access to a variety of expert knowledge, educational resources, and additional financial support. For example, the University of Minnesota's Initiative for Renewable Energy and the Environment (IREE) has provided nearly $4 million for renewable energy research projects and demonstration platforms at the UMM and the West Central Research and Outreach Center[viii].

However, even with the successful forging of these effective partnerships, joining of these beneficial organizations, and securing of these smaller financial resources, the UMM still did not have sufficient capital to allow the campus to embark upon its much-anticipated quest for sustainability. With only limited funding available, it came down to what Lowell describes as his best efforts to "beg, borrow, and steal" additional funding from a variety of other sources[ix]. As luck would have it (and luck is oftentimes an important factor in successfully embarking on and attaining a quest for sustainability), at around this same period of time Xcel Energy was petitioning the Minnesota state legislature to allow them to expand their dry-cast storage capacity for the Prairie Island nuclear power plant. The state legislature was on the verge of accepting their proposal with the stipulation that Xcel Energy provide the University of Minnesota with $10 million to be allocated for the researching of various alternative/renewable energy production technologies. Lowell and Greg Cuomo, former director of the WCROC, suggested that $3 million of this allocation be used to support research at the UMM and the WCROC. Summarizing their endeavors in the political realm and commenting on the impact of this series of fortunate events (and in an ironic twist to the sustainable movement) Lowell suggests, "Nuclear energy has been the catalyst for several of the renewable energy projects in the state of Minnesota"[x].

Partnerships with…a multitude of organizations, neighbors, and friends have been essential in this work – Lowell C. Rasmussen

Thus, the UMM was able to successfully forge a number of effective and beneficial partnerships as well as secure a significant amount of financial

capital. The UMM was now poised to embark on its quest for sustainability and carbon neutrality.

WCROC Wind Turbine Project

Embarking on a Quest for Sustainability

As the UMM prepared to embark on its quest for sustainability, it proposed and established a specific goal for the entire campus to become carbon neutral and energy self-sufficient by the year 2010. As Lowell describes, it was and still is the goal of the campus to "develop an integrated energy platform on a community scale that takes advantage of wind and biomass technologies"[xi].

Of the $3 million obtained from Xcel Energy, $2 million was allocated to the WCROC for the development and implementation of wind energy production technologies and, in 2005, the UMM and the WCROC erected the first large-scale wind research turbine ever constructed at a public university in the United States. The 1.65 megawatt Vestas NM 82 wind turbine (manufactured in the Netherlands) began generating power in March 2005, averages approximately 5.6 million kilowatt hours of power production annually, and currently supplies approximately sixty percent of the UMM campus's annual power requirements. Based upon this steady performance, the WCROC wind turbine project has resulted in annual savings of approximately $250,000 with an estimated payback period of only fifteen years. It is important to note that prior to the installation of this highly successful wind turbine project, numerous feasibility studies were conducted to determine the most effective and efficient location for the turbine, which ultimately led to it being constructed and placed on a ridge directly adjacent to the Pomme de Terre River. For their part, not only did the UMM rely on studies conducted by local organizations and resources, such as the Soils Lab, but they also entered into a partnership with the Energy and Environmental Research Center (EERC) located in North Dakota, which had significant experience with conducting feasibility studies in the Midwestern region of the United States to determine: biomass feedstocks, biopower, bioproducts, biofuels for transportation, wind energy, renewable hydrogen, and building efficiency.

Of the $3 million obtained from Xcel Energy, the UMM used the remaining $1 million to begin design work on a biomass gasification process as well as evaluate the potential for a biomass gasification research and demonstration platform in the UMM region. Like the WCROC wind turbine project, feasibility studies were conducted, which led to the identification of approximately 677,000 tons of annual agricultural residue located within about 100 miles of the town of Morris. Based upon the discovery of this abundant natural resource, the UMM then proposed and established an additional sustainable goal to focus their outreach efforts on contracting with and collecting all the campus's biomass requirements from local farms located within a twenty-mile radius of Morris.

Our goal is to develop an integrated energy platform on a community scale that takes advantage of wind and biomass technologies – Lowell C. Rasmussen

The UMM issued over forty requests for proposals to various companies and manufacturing plants in the solid fuel boiler industry to investigate the potential for a biomass gasification plant. The UMM received zero replies to these forty initial requests. Finally, the UMM was able to track down and contact a small start-up company in southern Illinois, Renewable Energy Resources, Inc. (RER), that was willing to test-fire sixty tons of corn "stover" in their boilers as a feasibility study to determine the potential for a biomass gasification plant.

In April 2005, the potential for a biomass gasification plant in the UMM region led to the Minnesota state legislature approving a bonding bill that allocated $4 million to the UMM for the construction of a biomass gasification demonstration and research facility on the campus. The

Biomass Gasification Demonstration and Research Facility

campus continued to explore other financial resources as well, managing to obtain an additional $1.8 million grant from the United States Department of Agriculture and secure several smaller grants and donations from various other sources to bring the total amount of available financial capital to $8 million[xii]. With construction completed during the summer of 2008, the biomass gasification plant at the UMM is the first of its kind in the country in terms of being designed to accommodate "multi-source feed stocks", an approach to alternative/renewable energy production that Lowell describes as a "multi-modal approach to research conservation"[xiii]. For the biomass gasification plant at the UMM, this approach means that, while the current configuration of the facility is intended to rely primarily upon corn stover feed stocks obtained from local farmers, the plant will also be capable of accommodating and burning: wood chips, grasses, wheat straw, corn cobs, etc. In collaboration with the Soils Lab, one of the first joint research projects scheduled to be conducted at the biomass gasification plant involves the determination of a series of emissions profiles emitted by a variety of biomass feed stocks during the biomass gasification process.

The biomass gasification plant is designed to convert these biomass feed stocks into a producer gas or "syngas" (similar to natural gas) and then utilize that producer gas in three different ways: to produce steam for district heating, to supply chilled water for district cooling (through the use of an absorption chiller that was installed in 2008), and to generate electricity (through the use of a "back pressure" steam turbine that was installed in 2009). At peak operation, the plant is designed to generate twenty-five million BTU/hour of energy, which will produce approximately 15,000 lbs/hour of 280 psi steam and potentially provide nearly eighty percent of the campus's total heating and cooling needs[xiv]. It is also estimated that the biomass gasification plant will consume approximately 36 tons of biomass each day and an estimated 9,000 tons of biomass each year[xv]. The campus has high hopes for these types of biomass gasification technologies, suggesting, "The biomass facility is an important step towards integrating renewable energy technology into rural settings and understanding what a biomass energy economy will look like in the near future"[xvi].

Looking back at this important achievement and essential step in the UMM's quest for sustainability, Lowell comments, "It's pretty much been trial and error since then"[xvii]. James C. Barbour, emissions specialist for the biomass gasification project at the UMM, adds, "[We're] making mistakes and taking the risks that the private sector is unwilling to take"[xviii]. These attitudes illustrate another significant aspect of any sustainability movement that needs to be much more widely recognized and understood, that this quest for sustainability frequently does not consist of a smooth progression of sustainable development and economic growth but, instead, a series of trial and error leading to gradual progress. The important thing, Lowell reassures, is that we need to look at these quests for sustainability as research and demonstration projects in which the knowledge gained from the inherent risks and failures and successes will, overall, benefit the entire region and even the state.

[We're] making mistakes and taking the risks that the private sector is unwilling to take – James C. Barbour

A good example of these inherent risks and failures in any quest for sustainability is how Lowell and the UMM were forced to deal with an issue related to variable fuel densities in biomass feedstocks on their biomass gasification project. Based upon their research, the UMM prepared the campus to be capable of supplying the biomass gasification plant with a biomass fuel density of as low as three pounds per cubic foot while, at the same time, the industry biomass gasification plants were designed to operate at a much higher biomass fuel density of ten pounds per cubic foot. In order to resolve this issue, the UMM managed to locate a

company in the small town of Emily, Minnesota, RENEW Energy Systems, that had the technology and capability to modify the UMM's lower density biomass fuel and convert it into higher density biomass fuel pellets containing the required ten pounds per cubic foot fuel density. The biomass gasification plant is currently scheduled to begin operating using these higher density biomass fuel pellets within the next six to eight weeks.

Biomass Gasification Feedstocks and Fuel Densities

Thus, the UMM was able to embark upon a quest for sustainability that resulted in: the erection of a wind turbine that currently supplies the campus with approximately sixty percent of its annual energy demands, the construction of a biomass gasification plant that has the potential to supply the campus with approximately eighty percent of its annual energy demands, and the resolution of several unanticipated complications inherent in any quest for sustainability.

Evolving with a Quest for Sustainability

While the united commitment and strong dedication of the UMM student body, faculty, staff, and administration of the UMM has managed, for the most part, to continue to work towards sustainable goals and objectives that were initially proposed and established as the campus prepared to embark on its quest for sustainability, the entire process has evolved into a continuous, perhaps even endless, journey towards sustainability that has required the UMM to constantly evolve, assess, and adjust its ultimate sustainable goals and objectives. The UMM has recently proposed a modified sustainable goal for the entire campus of not only carbon neutrality but also energy self-sufficiency by the year 2010. James C. Barbour even suggests that the ultimate sustainable goal and objective for the UMM would be that the campus "will not be off the grid, but a net generator of energy (carbon negative) for the Morris area"[xix]. For that to be feasible however, Barbour comments that it will be necessary to research and implement a "smart metering program" capable of monitoring and providing real-time analysis of weather forecasts, natural gas prices, etc., to determine the most cost-effective and efficient allocation of various on-site alternative/renewable energy production technologies at the UMM. It should be noted that research and deployment of this type of "smart metering program" has already begun on the UMM campus.

To assist with the campus's renewed efforts to become not only carbon neutral but also energy self-sufficient, the UMM has become involved in a number of additional research and demonstration projects and the Green Prairie Alliance has continued to coordinate its efforts in developing various other alternative/renewable energy production technologies. For example, the WCROC has begun to look into the feasibility of converting its wind turbine to a production and demonstration system that will produce hydrogen and anhydrous ammonia instead of electricity in an effort to address and perhaps resolve several issues associated with current wind energy production technologies. Wind to hydrogen to anhydrous ammonia would address current issues with: wind energy (lack of transmission), hydrogen (most rural agricultural communities have an anhydrous ammonia storage capability), natural gas (expensive and imported), and rural development (keeping money in the state). Approval from the Minnesota state legislature has already been received and this aspect of the research is expected to begin moving forward immediately. There is also the potential for hydrogen internal combustion engines in automobiles that could potentially serve as a bridge to future fuel cell vehicles. Lowell expresses his excitement for

[The UMM] will not be off the grid, but a net generator (carbon negative) for the Morris area – James C. Barbour

the potential of an "anhydrous ammonia infrastructure"[xx] .

Biomass Harvesting Techniques

The UMM has continued to push the campus's quest for sustainability. In addition to the research project already scheduled to be conducted at the biomass gasification plant to determine a series of emissions profiles emitted by a variety of biomass feed stocks during the biomass gasification process, further arrangements have been made to collaborate with the Soils Lab and explore the potential impact of reintroducing and injecting "char" and ash, byproducts of the biomass gasification process, back into the soil and possibly improving soil qualities in the local region. In 2005, the Soils Lab began laying out a series of test plots each containing a different biomass harvesting approach or technique intended to investigate the impact of biomass harvesting on local soil qualities. These plots will now be used to determine the potential impact of "char" and ash on local soil qualities as well.

The UMM is also involved in a project investigating the potential for an anaerobic digester system to serve the Morris community. This project is currently undergoing a series of feasibility studies and is being coordinated with the Minnesota Soybean Research and Promotion Council, the Minnesota Corn Research and Promotion Council, the Agriculture Utilization and Research Institute (AURI), the Center for Producer Owned Energy, the City of Morris, Riverview and West River Dairy (which currently produces all of its energy demands from an on-site anaerobic digester), and the University of Minnesota IREE.

In addition, the UMM is planning for a second wind turbine to be constructed on the ridge along the Pomme de Terre River near the existing wind turbine and plans to construct a third wind turbine directly on the UMM campus in the near future. The UMM campus plans to construct a solar-thermal heating and cooling system on the roof of the Regional Fitness Center to serve the building's two campus and public swimming pools. In terms of utilizing regional resources, this is an interesting development considering that a solar-thermal manufacturing plant is located in the nearby town of Starbuck (SolarSkies: Engaging the Sun) and a geothermal manufacturing plant is located in the nearby town of Appleton (Econar: Heating and Cooling Comfort from the Ground Up). It should also be noted that the WCROC facility located directly adjacent to the UMM campus already has a geothermal heating system and is in the process of installing a solar-thermal heating and cooling system.

Obviously these ambitious future projects and sustainable developments will require securing additional financial support. To that end, in 2008, the UMM received authorization from the Minnesota state legislature to issue Clean Renewable Energy Bonds (CREBs) for three purposes: to install a second wind turbine near the WCROC (allowing additional research into hydrogen and anhydrous ammonia processes); to add a steam turbine onto the biomass reactor (allowing production of electricity from "green" steam); and to erect a third wind turbine in western Minnesota (allowing additional power generation to potentially be shared with the Mille Lacs Band of Ojibwe). In other words, the CREBs are intended to "continue to move the Morris campus forward as a national leader in renewable energy systems"[xxi].

Clean Renewable Energy Bonds will allow the Morris campus to continue to move forward as a national leader in renewable energy systems – Office of University Relations

Thus, the UMM has not been content to merely strive for and attain the sustainable goals and objectives that were initially proposed and established as the campus embarked upon its quest for sustainability. Instead, they have continued to evolve along the journey, constantly assessing and adjusting their sustainable objectives in an effort to guide their continuous quest for sustainability.

Evaluating a Quest for Sustainability

Public Interest Research Group at the University of Minnesota Morris

As this quest for sustainability continues to evolve at the UMM, the progress, accomplishments, and impact that the efforts of the students, faculty, and campus has already had can begin to be evaluated and discussed. One aspect of the impact that this sustainable movement has had on not only the UMM but also the surrounding community involves the local economy. Many of the sustainable initiatives at the UMM were undertaken with the primary goal of obtaining a financial profit for the campus by saving money through: conserving energy, reducing water consumption, recycling waste products, and generating on-site energy. However, several of these sustainable initiatives indirectly served to support and boost the local economy. For example, the UMM is estimating that the biomass gasification plant will ultimately inject hundreds of thousands of dollars into the local economy annually. Lowell argues, "Anyone who looks at what portion of their budget goes to utilities will realize that this can be significant, especially with [Minnesota's] colder climate. But we are choosing biomass from local farmers over natural gas from out-of-state oil companies. We are giving back to the local economy. With our surroundings, we are finding economic and eco-friendly ways to achieve our goals"[xxii].

Another aspect of the impact that this sustainable movement has had involves the amount of regional and national recognition that the UMM has received. The National Green Power Leadership Club, an organization that recognizes outstanding commitments and achievements in "green power", awarded a Green Power Leadership award to the UMM in October 2005. The campus has also received recognition from the United States Department of Energy and the United States Environmental Protection Agency, among several others. These awards and national recognition demonstrate that, along with the inherent risks and increased financial costs associated with a quest for sustainability, a great amount and high degree of advantageous campus publicity and attractive college marketing can also be achieved and obtained.

Finally, the impact that this sustainable movement has had upon the student body continues to grow as students constantly expand their participation and increase their role in the UMM's quest for sustainability. Since embarking on this quest for sustainability, residence halls at the UMM have begun allocating a "sustainability floor" where students can specifically request to be housed in order to pursue additional sustainable issues and even conduct various sustainable research projects[xxiii]. The UMM greatly appreciates these student endeavors and strongly encourages students to "seek personal, academic, and professional development outside of the standard curriculum", which has contributed to the fact that many students at the UMM take on special academic projects that "expand and personalize" their studies[xxiv]. The Undergraduate Research Opportunities Program (UROP) and the Morris Academic Partnership (MAP) both assist students with these efforts to allow them to pursue additional research projects. The UMM emphasizes this commitment to the students, "This campus is a research facility for the students with more than sixty percent of the undergraduate students here doing research on our campus"[xxv].

We are choosing biomass from local farmers over natural gas from out-of-state oil companies. We are giving back to the local economy – Lowell C. Rasmussen

Students have also organized a series of "Campus Energy Wars" in which residential halls are pitted against each other in an attempt to conserve as much water and electricity as possible. The results of these Campus Energy Wars are then tracked and submitted to a national organization to allow the UMM to participate in the National Campus Energy Challenge (NCEC) that is intended to mobilize students to take broader climate action.

Future Leaders in the new Quest for Sustainability

In the rural Midwestern region of Minnesota, amidst the tall prairie grass, along the meandering Pomme de Terre River, beneath the blue prairie sky, near the small town of Morris, a sustainable movement erupted and was triggered through the determined efforts of a proactive and passionate student body. This sustainable initiative was then eagerly taken up by various faculty members with personal interests in and motivations towards the embarking of the campus on a somewhat daunting and risky quest for sustainability. Through the united commitment and strong dedication of the UMM student body, faculty, staff, and administration, the strength of a land grand institution, and the financial support and enduring faith of the University of Minnesota, this college campus has succeeded in providing an ideal example of the many: difficult challenges to anticipate, inherent risks to prepare for, and transcending impacts to expect from a quest for sustainability. As Lowell concludes, "That is what this [sustainable movement] is all about, pushing those horizons. What can we do and what can we achieve? If we can do it here, then why can't it be done at other locations?"[xxvi]. Why not indeed. How will other student bodies, faculty members, and collegiate institutions respond to the story of the University of Minnesota, Morris? How will other student bodies, faculty members, and collegiate institutions choose to prepare for and embark on their own quests for sustainability? How will other student bodies, faculty members, and collegiate institutions forge their own unique stories of sustainability? For those who do make the decision to attempt a similar quest for sustainability, remember the story of the University of Minnesota, Morris, and remember that no matter what difficulties or challenges you may face, you can count on enthusiastic encouragement and support from the UMM student body.

That is what this [sustainable movement] is all about, pushing those horizons. If we can do it here, then why can't it be done at other locations?
– Lowell C. Rasmussen

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[iii] Personal Interview with Lowell C. Rasmussen. September 29, 2009.

[iv] Office of University Relations. "Green Campus Facts". May 2008. University of Minnesota Morris: A Green Campus. Available: <http://www.morris.umn.edu/greencampus/> Accessed: September 2009.

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[ix] Personal Interview with Lowell C. Rasmussen. September 29, 2009.

[x] Personal Interview with Lowell C. Rasmussen. September 29, 2009.

[xi] Personal Interview with Lowell C. Rasmussen. September 29, 2009.

[xii] Office of University Relations. "High Energy. Low Consumption". May 2007. University of Minnesota Morris: A Green Campus. Available: <http://www.morris.umn.edu/greencampus/> Accessed: September 2009.

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[xv] Renewable Energy Initiatives. 2009. West Central Research and Outreach Center. Available: <http://renewables.morris.umn.edu/> Accessed: September 2009.

[xvi] Personal Interview with Lowell C. Rasmussen. September 29, 2009.

[xvii] Personal Interview with Lowell C. Rasmussen. September 29, 2009.

[xviii] Personal Interview with James C. Barbour. September 29, 2009.

[xix] Personal Interview with James C. Barbour. September 29, 2009.

[xx] Personal Interview with Lowell C. Rasmussen. September 29, 2009.

[xxi] Office of University Relations. "Green Campus Facts". May 2008. University of Minnesota Morris: A Green Campus. Available: <http://www.morris.umn.edu/greencampus/> Accessed: September 2009.

[xxii] Personal Interview with Lowell C. Rasmussen. September 29, 2009.

[xxiii] Personal Interview with Troy J. Goodnough. September 29, 2009.

[xxiv] University of Minnesota Morris: A Renewable, Sustainable Education. 2009. Regents of the University of Minnesota. Available: <http://www.morris.umn.edu/> Accessed: September 2009.

[xxv] Personal Interview with Lowell C. Rasmussen. September 29, 2009.

[xxvi] Personal Interview with Lowell C. Rasmussen. September 29, 2009

APPENDIX-C

UMN CROOKSTON SURVEY RESULTS

APPENDIX-C

UMN CROOKSTON SURVEY RESULTS

1_FACULTY

2_STAFF

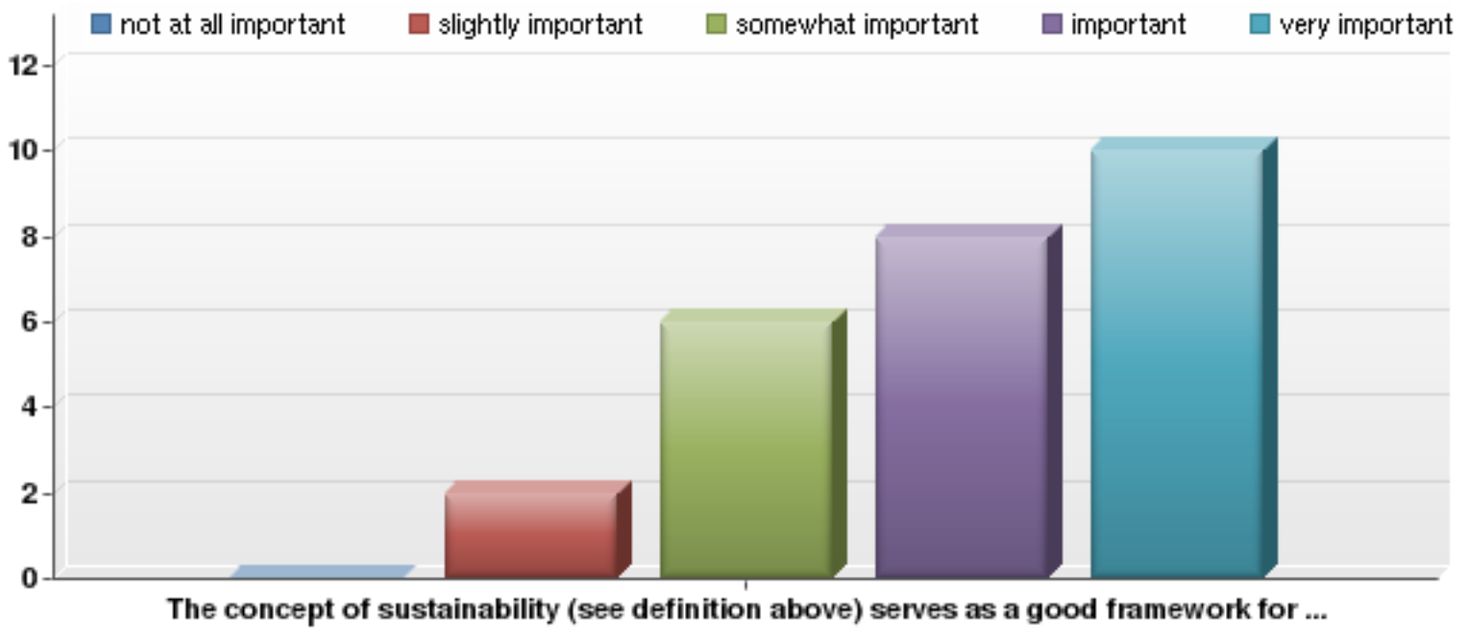
3_STUDENTS

1_FACULTY

Initial Report

Last Modified: 12/15/2009
Filtering by: RP_8qRetqLy6szyq4Q

1. Sustainability: "meeting present needs without compromising the ability of future generations to meet their needs"(World Commission for Environment and Development, 1987).

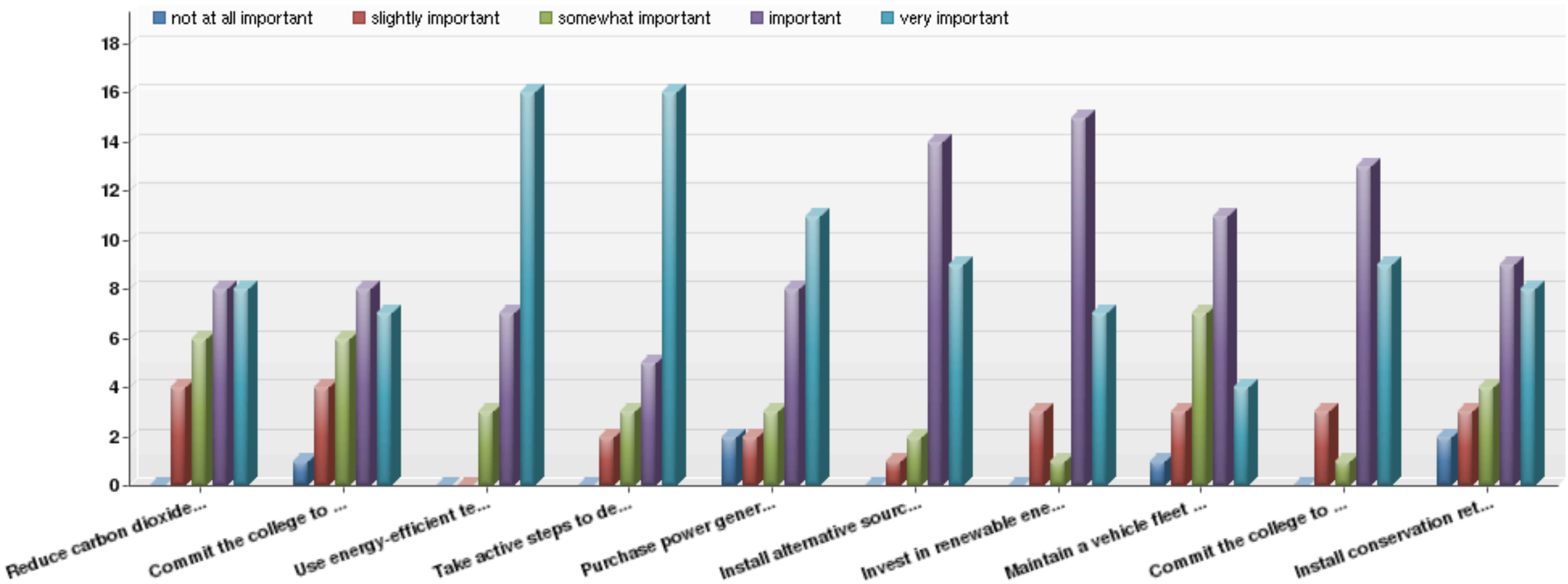


#	Question	not at all important	slightly important	somewhat important	important	very important	Responses	Mean
1	The concept of sustainability (see definition above) serves as a good framework for considering choices and living my life.	0	2	6	8	10	26	4.00

Statistic	The concept of sustainability (see definition above) serves as a good framework for considering choices and living my life.
Mean	4.00
Variance	0.96
Standard Deviation	0.98
Total Responses	26

2. Climate Neutrality: Efficiency, Reducing Emissions, and Green Building Policy

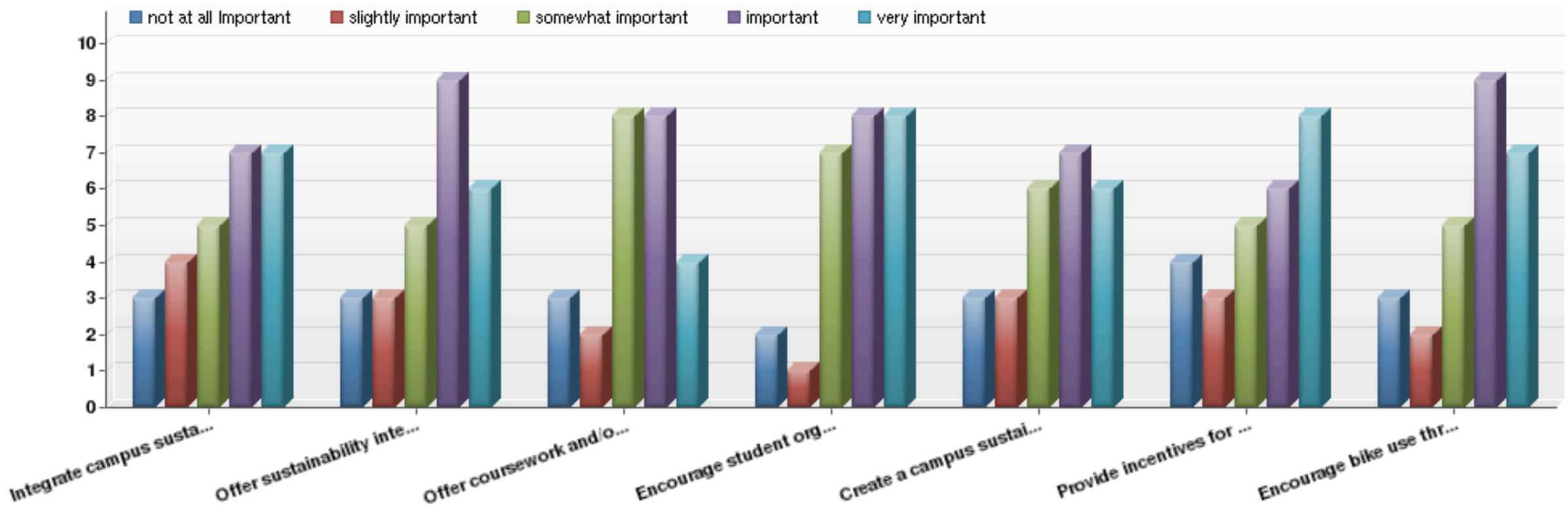
Climate Neutral is the concept of reducing or offsetting any greenhouse gases produced by any entity (individual, business, campus) so as to create a 'neutral' effect on global warming for that entity.



#	Question	not at all important	slightly important	somewhat important	important	very important	Responses	Mean ▲
3	Use energy-efficient technology on campus as much as possible	0	0	3	7	16	26	4.50
4	Take active steps to decrease energy consumption.	0	2	3	5	16	26	4.35
6	Install alternative sources of power on campus (e.g., solar, wind)	0	1	2	14	9	26	4.19
9	Commit the college to a formal policy of using green building criteria and standards in all construction and renovation.	0	3	1	13	9	26	4.08
7	Invest in renewable energy sources with the idea of benefiting the community beyond campus	0	3	1	15	7	26	4.00
5	Purchase power generated from renewable sources (e.g., solar, wind).	2	2	3	8	11	26	3.92
1	Reduce carbon dioxide emissions on campus	0	4	6	8	8	26	3.77
10	Install conservation retrofits (e.g., low flow plumbing) to conserve water.	2	3	4	9	8	26	3.69
2	Commit the college to â€œclimate neutrality.â€ (see definition above)	1	4	6	8	7	26	3.62
8	Maintain a vehicle fleet that runs on renewable, clean-burning fuels, or electricity.	1	3	7	11	4	26	3.54

Statistic	Reduce carbon dioxide emissions on campus	Commit the college to â€œclimate neutrality.â€ (see definition above)	Use energy-efficient technology on campus as much as possible	Take active steps to decrease energy consumption.	Purchase power generated from renewable sources (e.g., solar, wind).	Install alternative sources of power on campus (e.g., solar, wind)	Invest in renewable energy sources with the idea of benefiting the community beyond campus	Maintain a vehicle fleet that runs on renewable, clean-burning fuels, or electricity.	Commit the college to a formal policy of using green building criteria and standards in all construction and renovation.	Install conservation retrofits (e.g., low flow plumbing) to conserve water.
Mean	3.77	3.62	4.50	4.35	3.92	4.19	4.00	3.54	4.08	3.69
Variance	1.14	1.37	0.50	0.96	1.59	0.56	0.80	1.06	0.87	1.58
Standard Deviation	1.07	1.17	0.71	0.98	1.26	0.75	0.89	1.03	0.93	1.26
Total Responses	26	26	26	26	26	26	26	26	26	26

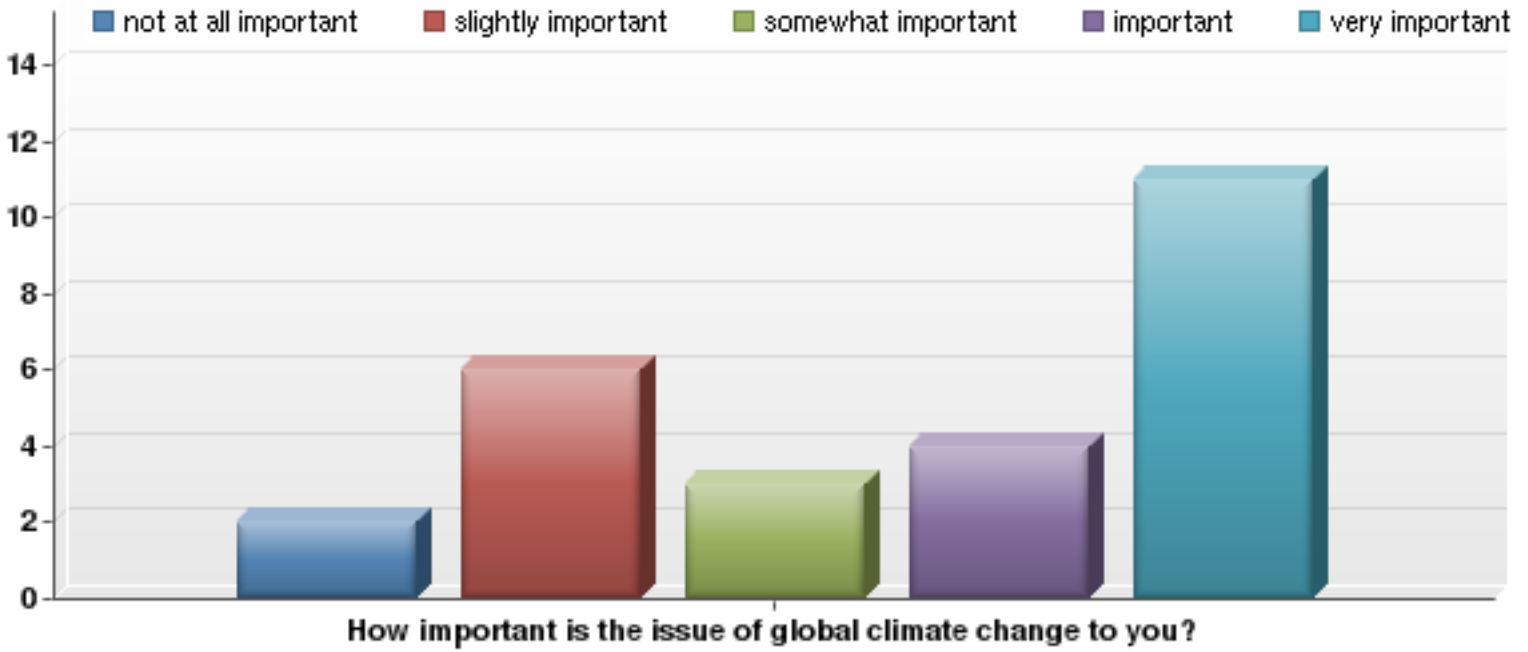
3. Student, Faculty, and Staff Involvement



#	Question	not at all Important	slightly important	somewhat important	important	very important	Responses	Mean
4	Encourage student organizations to practice sustainability efforts.	2	1	7	8	8	26	3.73
7	Encourage bike use through additional racks, repair service, and sharing.	3	2	5	9	7	26	3.58
2	Offer sustainability internships on campus.	3	3	5	9	6	26	3.46
6	Provide incentives for carpooling or use of public transportation by students, faculty, and staff.	4	3	5	6	8	26	3.42
1	Integrate campus sustainability policies and practices into freshman orientation.	3	4	5	7	7	26	3.42
5	Create a campus sustainability challenge or competition on an annual basis.	3	3	6	7	6	25	3.40
3	Offer coursework and/or degree programs in sustainability.	3	2	8	8	4	25	3.32

Statistic	Integrate campus sustainability policies and practices into freshman orientation.	Offer sustainability internships on campus.	Offer coursework and/or degree programs in sustainability.	Encourage student organizations to practice sustainability efforts.	Create a campus sustainability challenge or competition on an annual basis.	Provide incentives for carpooling or use of public transportation by students, faculty, and staff.	Encourage bike use through additional racks, repair service, and sharing.
Mean	3.42	3.46	3.32	3.73	3.40	3.42	3.58
Variance	1.85	1.70	1.48	1.40	1.75	2.09	1.69
Standard Deviation	1.36	1.30	1.22	1.19	1.32	1.45	1.30
Total Responses	26	26	25	26	25	26	26

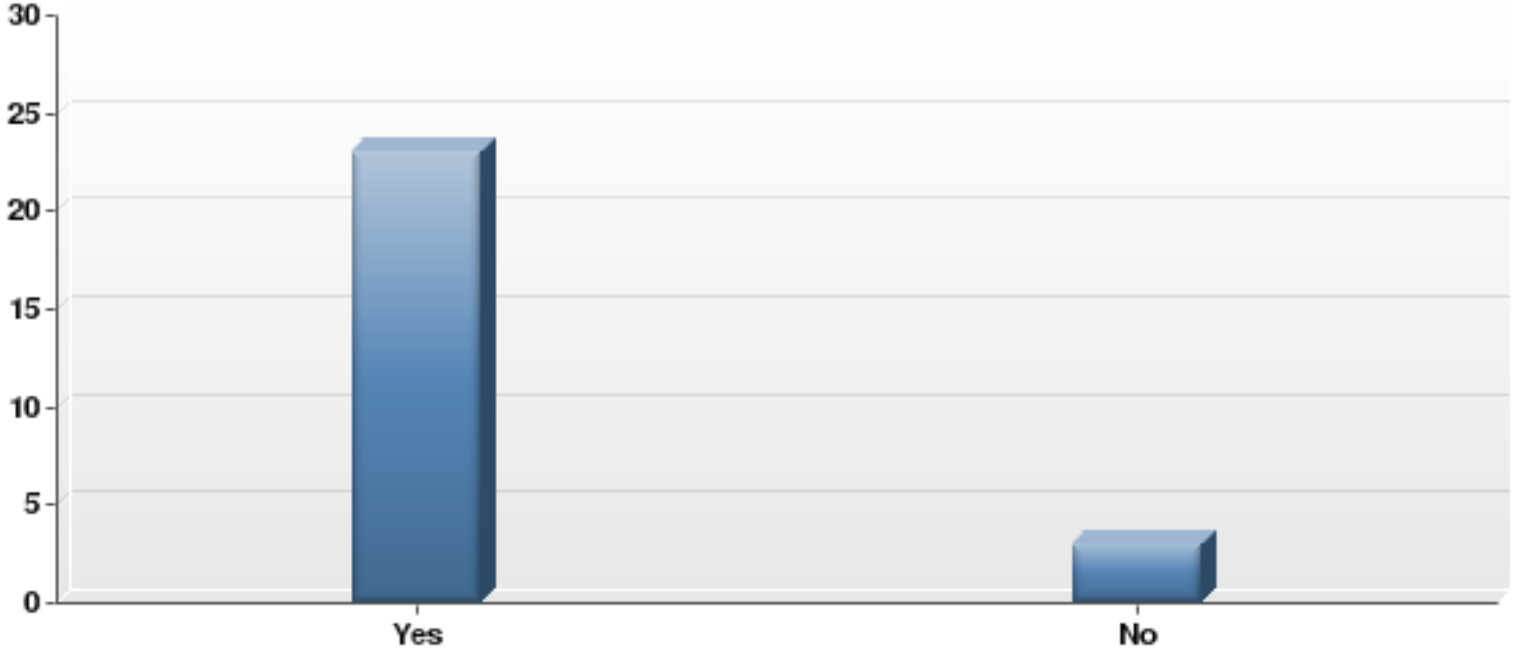
4. Climate Change:



#	Question	not at all important	slightly important	somewhat important	important	very important	Responses	Mean
1	How important is the issue of global climate change to you?	2	6	3	4	11	26	3.62

Statistic	How important is the issue of global climate change to you?
Mean	3.62
Variance	2.09
Standard Deviation	1.44
Total Responses	26

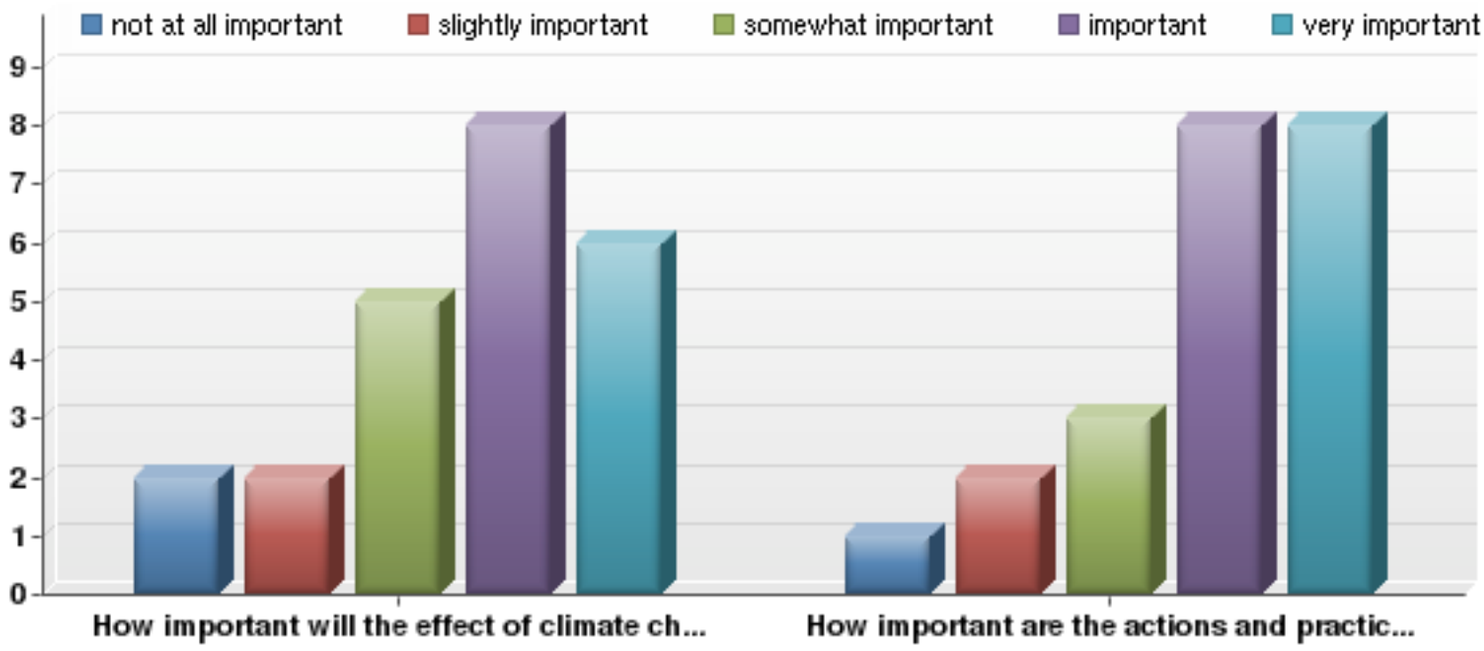
5. Do you believe that the climates or regions around the world are changing?



#	Answer	Bar	Response	%
1	Yes		23	88%
2	No		3	12%
	Total		26	

Statistic	Value
Mean	1.12
Variance	0.11
Standard Deviation	0.33
Total Responses	26

6. Importance of climate change to you.



#	Question	not at all important	slightly important	somewhat important	important	very important	Responses	Mean
2	How important are the actions and practices you can do to make a difference?	1	2	3	8	8	22	3.91
1	How important will the effect of climate change be for you?	2	2	5	8	6	23	3.61

Statistic	How important will the effect of climate change be for you?	How important are the actions and practices you can do to make a difference?
Mean	3.61	3.91
Variance	1.52	1.32
Standard Deviation	1.23	1.15
Total Responses	23	22

7. How can members of the campus community increase sustainability at UM Crookston?

Text Response
More recycling,
Right now to educate
Encourage a change in lifestyle in the community. For example if the only thing you change in your lifestyle is recycling, this is not enough. A rethinking of the way things are done is needed.
Turn off lights, keep windows closed, turn down the heat in classrooms and offices.
Reduce paper waste. Encourage recycling. Empty the recycling receptacles. Put more receptacles where they would be needed. Check from department to department. Figure out how to use less.
Restrict the total number of pages student can print to a printer, charging an additional fee if exceeding that threshold. Educate people on how to conserve, turn of lights, use laptops less often or for more purposeful work, slowing its use for entertainment - carpool, particularly for the Grand Forks/EGF residents - buy local foods to reduce carbon footprint.
by practicing what we preach. by teaching our students that this is an issue for everyone and it affects everyone regardless of their involvement in agriculture or use of our natural resources
reduce energy consumption and be positive and proactive toward sustainability issues.
Promotion of the topic
Actions start with personal choices. make smart ones.
Think before they act
The facilities people could regulate heat better in offices and classrooms. Everyone could recycle more. Possibly charge for printing to deter the use of paper and encourage the use of PDFs.
Incoporate a sustainability value broadly into the curriculum.
All ask to contribute in measureable ways (turn down heat, turn off lights, walk rather than drive)
recycling, knowledge enhancement, conservation efforts, etc.
Understand sustainability as a philosophy, not just a couple of things to change in the daily schedule.

Statistic	Value
Total Responses	16

8. What are you currently doing at UM Crookston to further understanding and action in terms of sustainability?

Text Response
Provide provide real life examples in my teaching/
Set an example of alternative ways of thinking and behavior. I show people that they don't have to do things the same way they've always been done.
Same as above
Definitely not watching Al Gore's horrible movie. Can he really back that up with some real science? Why are we so obsessed with this movie when there is no real scientific evidence that global warming exists?
Educating myself on all things related to sustainability, and striving to reduce my carbon footprint.
sustainability is talked about in nearly every classroom. the repetition of what needs to be done and who has to do it has got to come from every angle.
teaching energy efficiency and renewable energy alternatives at UMC
educate
Incorporating climate change information into course work.
Talking about it with students
Sort paper / trash; turn off lights and not needed items;
Not much. Recycle all of my paper and plastic. Use electronic handouts rather than making paper copies.
Sharing the importance of sustainability in the future careers of my students.
Incorporating the topic of sustainability in assignments.
Listening to those involved on campus
Reading emails about efforts

Statistic	Value
Total Responses	16

9. What do you see as barriers to the college becoming more sustainable?

Text Response
MONEY!
As I see it administrative will is the largest barrier.
Attitudes of some facilities maintenance folks.
Money. The buildings are all so incredibly inefficient. Too cold or too hot, there is no happy medium. The lighting systems could be better and more efficient.
Lethargy
$$$
Additional costs -will result in higher cost for students and the reduction of staff positions to offset these efforts
Not having the money to support a couple of large wind turbines which are the only way the campus can reach a zero energy condition.
expense
Obviously the economy. Tackling such an endeavor during two biennia wherein our budget will be cut to the bone is exceedingly difficult.
Remote location requires use of cars. Have you checked the temperture this week?
Lack of will to retrofit, Physical plant staff seems reluctant to act - except to apply name calling to other staff Awareness of specific steps for each to take
Money and time.
Ignorance and/or apathy toward sustainability
Two things: if leadership is weak and grass roots develops no direction.
Initial expenses.
Costs to implement certain energy-saving options.
Dollars
Administration and their focus on income regardless of eithics. Facilities being ineffective and having no flexibility or cohesion due to the 2 bozos over there. Why are two guys on the low end of the organizational structure dictating to the director? Who leads hear?

Statistic	Value
Total Responses	19

10. What would motivate you to become more proactive on sustainability issues?

Text Response
Motivate = reward, lets face it in this world, people will always take the easy route and sustainability is not easy.
Personal rewards or incentives to make additional changes in my life.
I encourage the students in regard to sustainability issues in their own lives. We also incorporate it into applicable courses.
Push the issues less. Incorporate it into everyday culture without all the pomp and circumstance. Do not jump on the media circus bandwagon.
Campus leadership embracing the need for sustainability and impressing upon Faculty, Staff, and Students that such is a significant part of the future success of the campus and region.
Better awareness myself - some type of continuing education that keeps us up to date and informed about what can be done at this level and what is actually feasible for us to promote and support from the classroom angle
For the campus to have several active renewable energy alternative on campus that can be used for teaching purposes. Wind turbine, solar voltaic array, solar hot water heater, geothermal system, alcohol still, etc.
less expensive to become susstainable at home
Regular inclusion of these issues in day to day management of campus
Show me how my individual actions really have an impact on me, personally
Knowledge of practices that would enhance sustainability issues
An Administration that seriously cared -- I already am proactive to the extent possible.

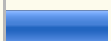
Statistic	Value
Total Responses	12

11. Demographic InformationI am a ...

#	Answer	Bar	Response ▲	%
2	Faculty		26	100%
4	Administration		0	0%
3	Staff		0	0%
1	Student		0	0%
	Total		26	

Statistic	Value
Mean	2.00
Variance	0.00
Standard Deviation	0.00
Total Responses	26

13. What is your age

#	Answer	Bar	Response	%
1	<20		0	0%
2	20-24		0	0%
3	25-29		4	15%
4	30-39		7	27%
5	40-54		8	31%
6	55+		7	27%
	Total		26	

Statistic	Value
Mean	4.69
Variance	1.10
Standard Deviation	1.05
Total Responses	26

14. Gender

#	Answer	Bar	Response	%
1	Male		13	50%
2	Female		13	50%
	Total		26	

Statistic	Value
Mean	1.50
Variance	0.26
Standard Deviation	0.51
Total Responses	26

15. What can the UM Crookston administration do to promote a culture of sustainability?

Text Response
Encourage and reward
Change lifestyle, make it a personal issue for them, not just something that is said at work.
Incorporate it into applicable courses and encourage clubs to support it.
Practice what it preaches. Do NOT make this into a media circus like the rest of the nation. We can do this without sinking millions of dollars into it. Administration needs to prioritize spending, throwing a bunch of money at it does not necessarily help us budget this campus. Our priority is students, and as of late, I do not see that.
Invest in the installation of demonstration renewable energy projects that draw attention to the technology and the campus for residents of the city of Crookston and the NW Region of MN.
support the efforts of the departments to promote and enhance public awareness.
promote recycling, energy savings, etc. with contests, rewards, publicity, etc. Financially support energy saving retrofits.
Encourage and educate
Effective changes need be made within existing structures. developing new courses, internships, etc are not as viable nor as direct a response as taking action where it can effect immediate change; light sensors to turn off unoccupied rooms, low flow plumbing, use of renewable energy all have immediate returns on investment environmentally and economically.
Make it a part of every decision and discussion, keep it in front of everyone
Do mmore meetings external over Skype, etc.
Educate people on how to be sustainable and how it actually affects them. It is pretty sad to see a trash can full of cans and bottles after faculty assembly when there are recycling bins everywhere on campus
Having the Chancellor make clear the role of sustainability in our campus mission through his own personal choices and what he expects other administrators to do.
Provide incentives to adopt desirable practices
Continue building initiatives into master plans, visions, and implementation of efforts
Raise sustainability to the level of 'expected' not inconvenient banter.

Statistic	Value
Total Responses	16

16. Other comments

Text Response
I truly believe we all could lead more efficient lives; recycle more, waste less, etc. But why do we continue to sink thousands of dollars of time and money into this? If faculty are truly research scientists, maybe we should research more of the truth of these global issues and not focus on the media. Coal still is the cheapest, most reliable and the most efficient source of energy available today. Building a wind generator that costs millions (and is subsidized by the government) still costs us money. The wind does not blow all the time, therefore the efficiency is not there.
With respect, I am quite skeptical of the sustainability movement. I see far too much political agenda motivating some who are pushing for sustainability goals. I'm sure you realize this survey assumes a generally positive stance toward sustainability. I feel the many questions raised by the movement are from answered nor is there a workable consensus for proceeding. I'm particularly concerned by news I read about sustainability that proposes population control as a key need for achieving goals. That kind of proposal demonstrates to me a misguided notion of where the problems of sustainability really lie and causes me, again, to resist the entire movement. History has quite a bit to tell us of the dangers of population control. Because of the ideological underpinnings I often see within the movement, I would not be in favor of our school making sustainability a kind of "required" frame work to which all our educational efforts might have to subscribe. Thanks.
I would like to see more organic and sustainable food choices from dining services.

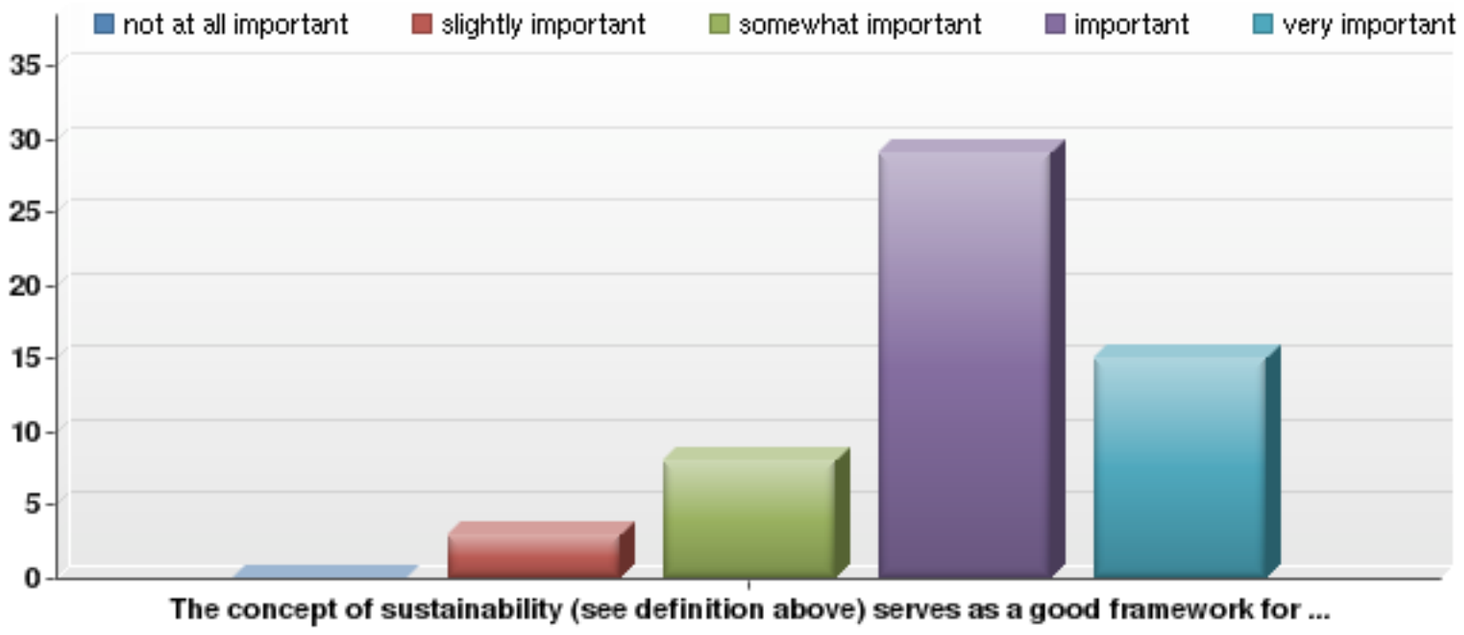
Statistic	Value
Total Responses	3

2_STAFF

Initial Report

Last Modified: 12/15/2009
Filtering by: RP_8qRetqLy6szyq4Q

1. Sustainability: "meeting present needs without compromising the ability of future generations to meet their needs"(World Commission for Environment and Development, 1987).

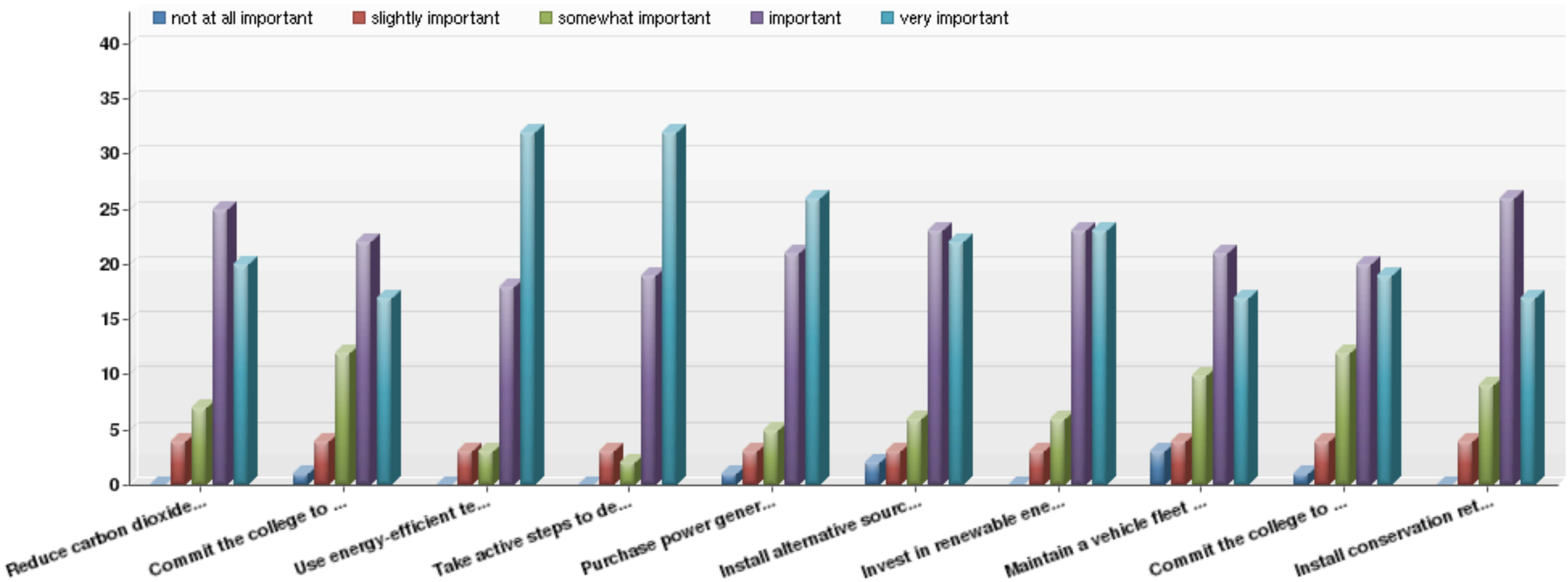


#	Question	not at all important	slightly important	somewhat important	important	very important	Responses	Mean
1	The concept of sustainability (see definition above) serves as a good framework for considering choices and living my life.	0	3	8	29	15	55	4.02

Statistic	The concept of sustainability (see definition above) serves as a good framework for considering choices and living my life.
Mean	4.02
Variance	0.65
Standard Deviation	0.80
Total Responses	55

2. Climate Neutrality: Efficiency, Reducing Emissions, and Green Building Policy

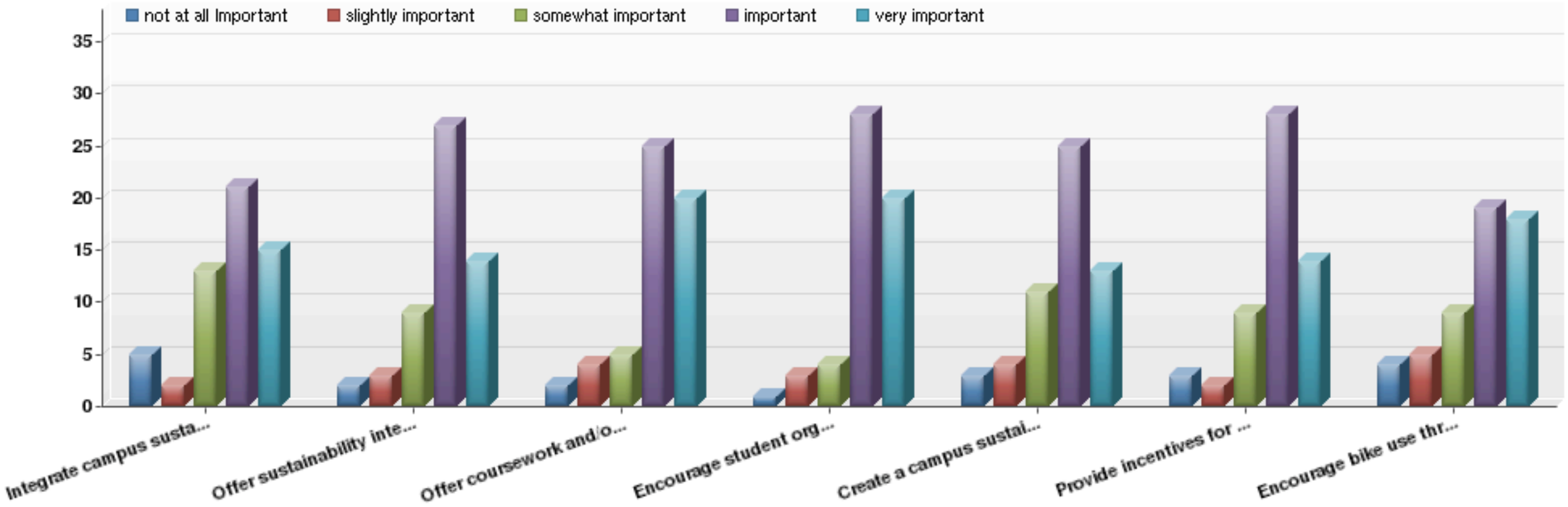
Climate Neutral is the concept of reducing or offsetting any greenhouse gases produced by any entity (individual, business, campus) so as to create a 'neutral' effect on global warming for that entity.



#	Question	not at all important	slightly important	somewhat important	important	very important	Responses	Mean
4	Take active steps to decrease energy consumption.	0	3	2	19	32	56	4.43
3	Use energy-efficient technology on campus as much as possible	0	3	3	18	32	56	4.41
5	Purchase power generated from renewable sources (e.g., solar, wind).	1	3	5	21	26	56	4.21
7	Invest in renewable energy sources with the idea of benefiting the community beyond campus	0	3	6	23	23	55	4.20
1	Reduce carbon dioxide emissions on campus	0	4	7	25	20	56	4.09
6	Install alternative sources of power on campus (e.g., solar, wind)	2	3	6	23	22	56	4.07
10	Install conservation retrofits (e.g., low flow plumbing) to conserve water.	0	4	9	26	17	56	4.00
9	Commit the college to a formal policy of using green building criteria and standards in all construction and renovation.	1	4	12	20	19	56	3.93
2	Commit the college to â€œclimate neutrality.â€ (see definition above)	1	4	12	22	17	56	3.89
8	Maintain a vehicle fleet that runs on renewable, clean-burning fuels, or electricity.	3	4	10	21	17	55	3.82

Statistic	Reduce carbon dioxide emissions on campus	Commit the college to â€œclimate neutrality.â€ (see definition above)	Use energy-efficient technology on campus as much as possible	Take active steps to decrease energy consumption.	Purchase power generated from renewable sources (e.g., solar, wind).	Install alternative sources of power on campus (e.g., solar, wind)	Invest in renewable energy sources with the idea of benefiting the community beyond campus	Maintain a vehicle fleet that runs on renewable, clean-burning fuels, or electricity.	Commit the college to a formal policy of using green building criteria and standards in all construction and renovation.	Install conservation retrofits (e.g., low flow plumbing) to conserve water.
Mean	4.09	3.89	4.41	4.43	4.21	4.07	4.20	3.82	3.93	4.00
Variance	0.77	0.97	0.68	0.65	0.90	1.05	0.72	1.26	1.01	0.76
Standard Deviation	0.88	0.98	0.83	0.81	0.95	1.02	0.85	1.12	1.01	0.87
Total Responses	56	56	56	56	56	56	55	55	56	56

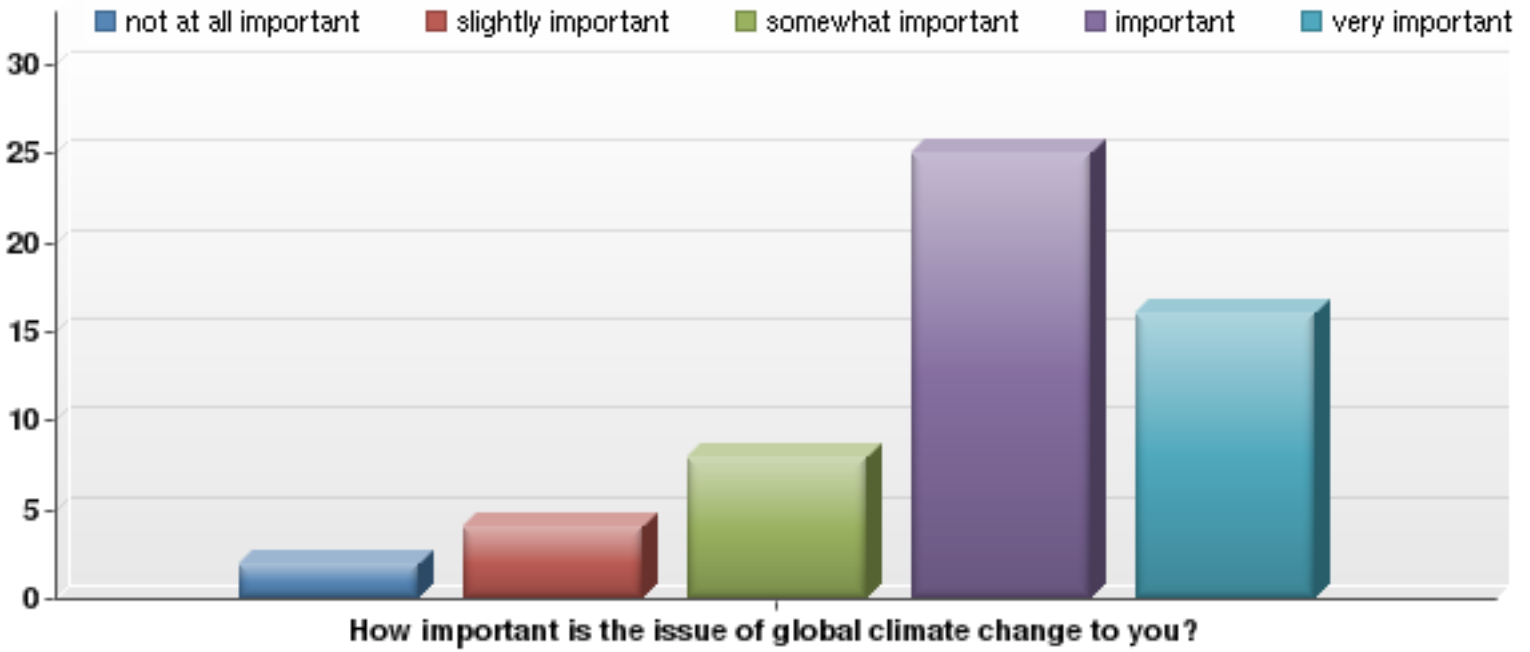
3. Student, Faculty, and Staff Involvement



#	Question	not at all Important	slightly important	somewhat important	important	very important	Responses	Mean
4	Encourage student organizations to practice sustainability efforts.	1	3	4	28	20	56	4.13
3	Offer coursework and/or degree programs in sustainability.	2	4	5	25	20	56	4.02
2	Offer sustainability internships on campus.	2	3	9	27	14	55	3.87
6	Provide incentives for carpooling or use of public transportation by students, faculty, and staff.	3	2	9	28	14	56	3.86
7	Encourage bike use through additional racks, repair service, and sharing.	4	5	9	19	18	55	3.76
5	Create a campus sustainability challenge or competition on an annual basis.	3	4	11	25	13	56	3.73
1	Integrate campus sustainability policies and practices into freshman orientation.	5	2	13	21	15	56	3.70

Statistic	Integrate campus sustainability policies and practices into freshman orientation.	Offer sustainability internships on campus.	Offer coursework and/or degree programs in sustainability.	Encourage student organizations to practice sustainability efforts.	Create a campus sustainability challenge or competition on an annual basis.	Provide incentives for carpooling or use of public transportation by students, faculty, and staff.	Encourage bike use through additional racks, repair service, and sharing.
Mean	3.70	3.87	4.02	4.13	3.73	3.86	3.76
Variance	1.38	0.96	1.07	0.80	1.15	1.03	1.48
Standard Deviation	1.17	0.98	1.04	0.90	1.07	1.02	1.22
Total Responses	56	55	56	56	56	56	55

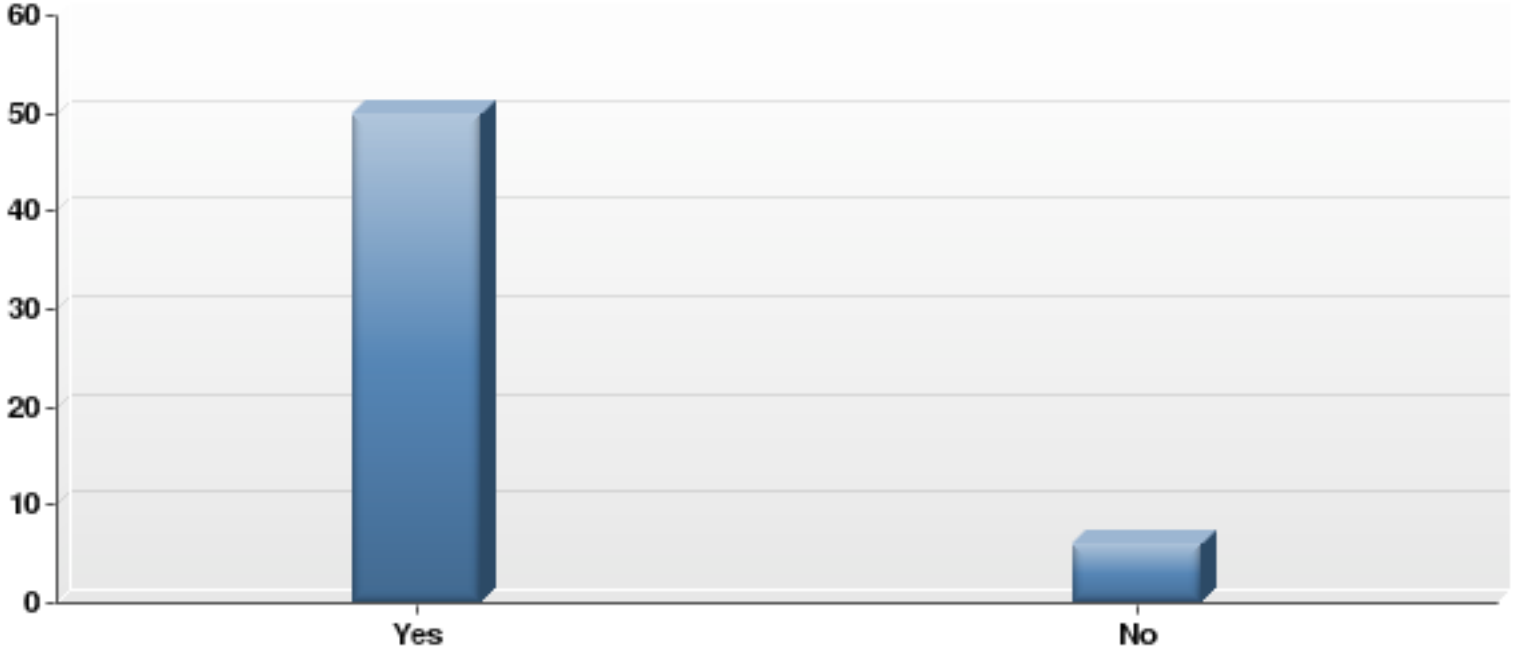
4. Climate Change:



#	Question	not at all important	slightly important	somewhat important	important	very important	Responses	Mean
1	How important is the issue of global climate change to you?	2	4	8	25	16	55	3.89

Statistic	How important is the issue of global climate change to you?
Mean	3.89
Variance	1.06
Standard Deviation	1.03
Total Responses	55

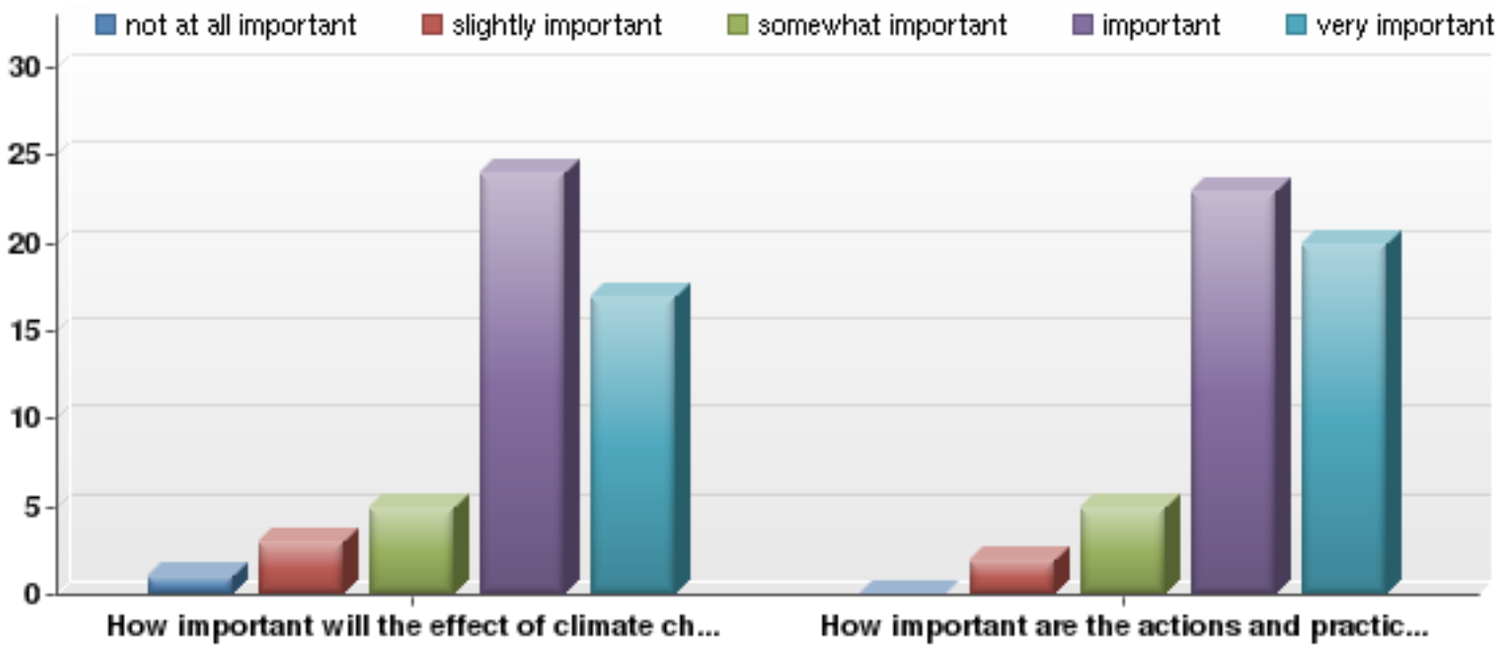
5. Do you believe that the climates or regions around the world are changing?



#	Answer	Bar	Response	%
1	Yes		50	89%
2	No		6	11%
	Total		56	

Statistic	Value
Mean	1.11
Variance	0.10
Standard Deviation	0.31
Total Responses	56

6. Importance of climate change to you.



#	Question	not at all important	slightly important	somewhat important	important	very important	Responses	Mean
2	How important are the actions and practices you can do to make a difference?	0	2	5	23	20	50	4.22
1	How important will the effect of climate change be for you?	1	3	5	24	17	50	4.06

Statistic	How important will the effect of climate change be for you?	How important are the actions and practices you can do to make a difference?
Mean	4.06	4.22
Variance	0.87	0.62
Standard Deviation	0.93	0.79
Total Responses	50	50

7. How can members of the campus community increase sustainability at UM Crookston?

Text Response
I think conserving energy as in turning off lights, printers, etc when not in use. Recycling.
Use less energy.
Car pool, less reliance on coal, change the culture around the idea of sustainability
shut off lights, efficient lighting, new windows, work 4 (10 hour day) workweek in the summers
By carpooling and limiting the amount of paper and ink that is used.
Cut down on the amount of paper used.
We need all.
There are many, many lights left on in classrooms when no one is in them. Everyone should learn to turn off the lights when they leave the room.
Possibly by trying to go paperless for the students. By e-mailing their papers to the professors.
By using bin to program on campus and support the Sustainabililty movement.
I like the idea of all future construction and rennovation be focused on environmentally friendly practices
Just use common sense It does not pay to go overboard and pay the rest lof time for an unproven idea. Do we really have global warming?
Participate in Conservation efforts
Integrate into mission of campus and academic curriculum across disciplines.
Access information, participate in opportunities presented, and approach the changes in an enthusiastic manner.
Each of us can just make small changes to increase sustainability on campus. We don't need expensive, drastic measures, but rather what are some small things that each of us can do to make an impact.
Continue to dialogue but set specific goals and push through the action to accomplish those.
by education and suggestions on what we can do individually or as departments, don't always talk "big" picture - talk about what we can do now :)
Less waste of paper, electronics, etc.
As far a less consumption of fuel, if we lower the thermostats in the offices employees must know to dress warmer.
-be - turning off lights -recycling -less printing become more aware of the energy that we are consuming and try to reduce the amount.
commit to reducing our carbon footprint through energy conservation
Doing little things that add up like shutting off lights in empty rooms for example.
It can start with simple things such as closing blinds when sun goes down and opening them during daylight, shutting off lights when space is not being used, hand washing dishes, not using clothes dryer, encourage use of renewable energy sources.
Increase awareness of current policies and procedures and work together to create change. Even small changes add up to big results.
Learn about the specific issues and invest more time in fixing or adjusting rather than complaining about sustainability
Think globally, act locally. Recycling is a very basic "first step," but if those who most promote sustainability don't actually recycle, it's difficult to take them seriously. People are most willing to accept change when they move to a new environment. We need to decide what is important and then convince the freshman that this is how it is here. At the same time, a little friendly competition and peer pressure among the residence halls and departments might be beneficial.
Be mindful everyday of how the choices you make impact the campus wide sustainability goals. Be mindful of fleet car use, be mindful of energy use on campus- Do you really need that space heater in your office? Do you really need all those lights on?
Energy conservation awareness, faculty/staff modeling good behaviors and emphasizing it through their interactions with students and community.
Think about what they are running on paper or print materials. Utilize email.
through education of the issue
use the same bottle of water, instead of a new bottle, everytime you empty that one in use. that would be less garbage to throw out.Use paper on both sides instead of just the one side.
Make small sustainable practices a part of daily routine.
Be willing to try new things and even change behaviors.
recycle ,turn off un use lights

Statistic	Value
Total Responses	35

8. What are you currently doing at UM Crookston to further understanding and action in terms of sustainability?

Text Response
Recycling and following procedure there but otherwise not much else.
Recycling and being conscience of the use of supplies
read as much I can to learn and implement policy
Trying to find recycled products to use and reuse
Trying to live as energy-wise as I can.
I am working with the Campus Energy Challenge. I also turn off electrical devices when I am not using them.
nothing
Small things for budget reasons more than global warming
Keeping abreast of campus activity as it pertains to sustainability. Participating in varying committees and action groups focused on the region and economic development and sustainability.
Turning off lights, using less energy when I can, tell other people we need to care, and read and try to learn new ways to save energy.
Reading credible information regarding climate change. Trying to get a true understanding of what is going on.
I took a class, attend all sessions I can on sustainability, and try to let me own life reflect my beliefs.
helping with the sustainability website and on the sustainability communication committee
Nothing.
I recycle whenever possible.
following the campus policies and being aware of the changes and opportunities for further eductaion.
keeping abreast of the literature concerned with reducing carbon emissions; researching opportunities to retrofit my home so that it is more energy efficient.
I serve on committees, recycle and assist with the planning of events.
Stay informed by reading about what the campus is doing including clubs and organizations and passing it on to the students I work with.
Trying to get more involved outside of my comfort zone. Eating at Ma Browns sitting and talking with the international student director and discussing how we can get everyone involved at ALL UMC events
Trying to model responsible behavior by using duplexing printer, recycling, writing on the backs of papers instead of throwing (creating my own scratch paper), reusing envelopes, ride sharing. Explaining to students how to get duplexing printer to actually duplex; since we received the last batch of computers, the process is now a 6-step process. Using my cool reusable bags and telling others where they can get them. Discussing why local foods is an important commitment and directing them to Ken Meter's presentation on the NW Partnership web site.
Sharing our goals and accomplishments with new entering students and prospective students.
Turning off lights when not in office.
there aren't many opportunities in my field (coaching)
I am trying to get my boss to see that the shift we are on is keeping the lights on longer, I used to beable to work 12-830pm, now they have us working 1:30-10pm,and they have only one custodian on until 12am, so in essence there are 4 or 5 buildings on for one guy, thats totally all light up, I feel thats a waste.I have not been able to get them to understand that lights are on 6am to 12am every day.
Turning off my office light on days when plenty of sun shines through to light up the room.
Thinking about and managing my office power usage
Recycling cans and plastic.
Small things. Turning lights off, printing less paper (emailing more), cooler office
encouraging the students to recycle,turn in work orders if their thermostat isn't working properly instead of opening their windows
Turning the lightsoff when I leave an area.

Statistic	Value
Total Responses	31

9. What do you see as barriers to the college becoming more sustainable?

Text Response
Getting follow through from faculty, staff, students.
Staff and faculty buy in
often costs more money in these trying times
costs
funding
Money and will-power for big-ticket changes that will get us away from burning coal to more renewable and less polluting sources.
Budget issues. I can be expensive to make conversions. Also, many of the older buildings on campus are not particularly efficient. It takes money to make that happen, and at this time, I believe it is more important to invest in our academic programs and recruitment efforts so we will have a college that can be sustainable.
Not enough knowledge about it
people confort(rooms at 76 degrees instead of 68
Cost
perception. I think we need to make it real for everyone. There is some idea that global warming isn't real or isn't going to affect me.
The cost involved in making major changes.
Red tape and too much talk too little action.
trying to break "old habits" - having the money to choose the more sustainable option would the the other side of the coin
The cost of installation of new heating systems and ability to receive funding for key projects.
older facilities and the cost of implementing newer more sustainable practices and procedures.
lack of community education about the issue.
careless people
Cost. Sustainable efforts are far more expensive at least by comparison to non-renewable resources and during lean budget times money is a major challenge. There is also a fairly apathetic attitude to most issues on campus so getting people excited enough to change behavior is a challenge as well.
Money and perhaps a willingness on the part of everyone to be open to changes and even convincing people that there is in fact a need to be more sustainable.
Facilities and an IDENTITY other than the "M"
A lack of believers in NW Minnesota. When you live some place that is experiencing clean water shortages, or where you turn around a corner on a mountain road and see a huge ugly clearcut that wasn't there last month, you get mad and you do something about it. People here don't believe that their actions are affecting the environment negatively--because they aren't as obvious. The sad part is that our actions are affecting other people across the nation and across the world. We're too stubborn to acknowledge it. Administrators who refuse to recycle because they say that the recycling center just burns it all anyway.
I don't see a lot of barriers- but everything on this campus moves slow - so this will take time but its making progress.
cost, student/staff apathy
Habit. I think many employees so used to printing everything out they don't look for other ways to be more sustainable.
being uneducated
The barriers, I see is, that, it is hard to get people to change habits.Other than that there should be no barriers.
Funds, close-mindedness, not enough resources.
Capital improvements costs and traditional habits.
Costs to implement new efficient (energy, water) equipment. Also, When the time comes to change behaviors.
cost

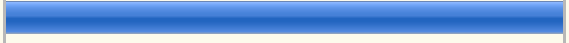
Statistic	Value
Total Responses	31

10. What would motivate you to become more proactive on sustainability issues?

Text Response
Incentives
The right tools
i am already
More knowledge on effects certain practices have on the environment.
I recycle and try to limit my use of energy to only my real needs. I also wish there were real tax incentives from the federal and state government to move to solar and other alternative energy sources.
More knowledge about it
A better understanding of the actions I could take.
Seeing those around me care.
Knowing that I do can make a difference.
Opportunity for action, money, results.
incentives (not sure of what kind), education, daily tips
I guess if everyone was actually involved in being more sustainable, instead of just lip service, I would go along with it too.
Maybe the university could come out with a list of suggestions for ways to be more proactive. For instance the smoking ban was a terrific step in the right direction. Helping to promote cleaner air is vital.
Just making it more available and affordable.
seeing more done to capture our natural energy resources. further develop a curriculum and offer a degree opportunity focused on energy and sustainable resources.
information
I would consider myself to be fairly motivated my only major constraint is time.
More education on the possibilities of not acting soon enough.
I am already motivated!
I realize that there are choices that we all make. I will continue to live my life in a sustainable way, attempt to stay on top of the issues, educate my children, assist and educate students on sustainable practices, and continue to evaluate how I'm doing. I believe I'm an environmentally responsible person and I don't need additional motivation. I'm always happy for additional education though.
continual reminders
making it easier, more convenient
I try to be motivated and pro active to make sure things run through our office need to be printed and I try to utilize older equipment that can still be used instead of throwing them away.
I think maybe get some insentives out there for people to work towards a goal, to make things better, maybe have some competion, or challenges,out there, exp, see what office area,can change their current way, to sustainable ways,make it challenging
Encouragement from others, to see sustainable changes happening on campus.
Continued information/communication on campus wide success examples and advances.
Seeing a tangible benefit.
time

Statistic	Value
Total Responses	28

11. Demographic InformationI am a ...

#	Answer	Bar	Response	%
3	Staff		56	100%
4	Administration		0	0%
2	Faculty		0	0%
1	Student		0	0%
	Total		56	

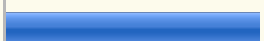
Statistic	Value
Mean	3.00
Variance	0.00
Standard Deviation	0.00
Total Responses	56

12. What is your major?

#	Answer	Bar	Response ▲	%
45	Horticulture		0	0%
44	Health Sciences (Pre-Professional)		0	0%
43	Health Management		0	0%
46	Environmental Landscaping		0	0%
47	Production Horticulture		0	0%
49	Hotel, Restaurant & Institutional Mgmt		0	0%
48	Urban Forestry		0	0%
42	Golf and Turf Management		0	0%
41	Pre-Veterinary Medicine		0	0%
36	Early Childhood Education		0	0%
35	Law Enforcement		0	0%
37	Primary Education		0	0%
38	Program Management		0	0%
40	Equine Science		0	0%
39	Equine Science		0	0%
50	Food Service Administration		0	0%
51	Hotel and Restaurant Management		0	0%
62	Organizational Psychology		0	0%
61	Wildlife Management		0	0%
60	Water Resource Management		0	0%
63	Consumer Service Settings		0	0%
64	Industrial and Production Management Settings		0	0%
66	Sport and Recreation Management		0	0%
65	Quality Management (B.M.M.)		0	0%
59	Park Management		0	0%
58	Natural Resources Management		0	0%
53	Information Technology Management		0	0%
52	Resort and Spa Management		0	0%
54	Manufacturing Management (B.M.M.)		0	0%
55	Marketing		0	0%
57	Natural Resources Law Enforcement		0	0%
56	Natural Resources		0	0%
34	Corrections		0	0%
33	Criminal Justice		0	0%
12	Agronomic Science		0	0%
11	Agronomy		0	0%
10	Precision Agriculture		0	0%
13	Crop Production		0	0%
14	Animal Science		0	0%
16	Pre-Veterinary Medicine		0	0%
15	Animal Science		0	0%
9	Power and Machinery		0	0%
8	Farm and Ranch Management		0	0%
3	Agricultural Education +		0	0%
2	Agricultural Business		0	0%
4	Agricultural Science & Technology Education		0	0%
5	Natural & Managed Environmental Education		0	0%
7	Bio-fuels and Renewable Energy Technology		0	0%
6	Agricultural Systems Management		0	0%
17	Applied Health (B.A.H.) **		0	0%
18	Applied Studies		0	0%
28	Business Aviation		0	0%
27	Business Management		0	0%
29	Entrepreneurship & Small Business Mgmt		0	0%
30	Management **		0	0%
32	Computer Software Technology		0	0%
31	Communication		0	0%
26	Biology		0	0%
25	Natural Resources Aviation		0	0%
20	Respiratory Care		0	0%
19	Self-Designed Program		0	0%
21	Aviation +		0	0%
22	Agricultural Aviation		0	0%
24	Law Enforcement Aviation		0	0%
23	Business Aviation		0	0%
1	Accounting		0	0%
	Total		0	

Statistic	Value
Mean	0.00
Variance	0.00
Standard Deviation	0.00

13. What is your age

#	Answer	Bar	Response	%
1	<20		0	0%
2	20-24		1	2%
3	25-29		6	11%
4	30-39		17	31%
5	40-54		21	38%
6	55+		10	18%
	Total		55	

Statistic	Value
Mean	4.60
Variance	0.95
Standard Deviation	0.97
Total Responses	55

14. Gender

#	Answer	Bar	Response	%
1	Male		17	31%
2	Female		37	69%
	Total		54	

Statistic	Value
Mean	1.69
Variance	0.22
Standard Deviation	0.47
Total Responses	54

15. What can the UM Crookston administration do to promote a culture of sustainability?

Text Response
Offer incentives
Provide money for better response to the recycling needs of the campus and information on way the staff and faculty can help
work on the infrastructure of the campus, add sustainability committee to faculty or campus assembly
Lead by example
Lead by example
Develop a culture of living and working with as little waste (energy and other) as possible.
They alread are doing a great deal by encouraging and supporting initiatives to reduce energy consuption and increase conservation and green initiatives. It comes down to the individual students, faculty, and staff to be responsible citizens.
Encourage more recycling.
I don't know
set some policies and enforce them
Invest in energy conservation opportunities, promote conservation actions: turn off lights, use telephone & video conferencing instead of travel. Signage helps create awareness.
Lead from the bottom up; engage middle management for integration throughout.
Continue to support efforts that move us forward. Talk about it until we all understand its imporance.
Probably just provide information to us on what we can do.
So many things! Too many to count. The little things matter.
lead by example
Use furniture/equipment that is already on campus instead of purchasing new every time someone changes an office. Not changing carpeting and desks because they don't like the color. Make do with what we have and not be throwing so much away.
Continue to look into the opportunities to make use of wind energy if possible.
keep us informed of potential energy saving opportunities; demonstrate a commitment to energy efficiency by setting policies that support sustainability; develop a model that takes advantage of energy potential within our natural resources like wind and solar.
learn and educate
Role model desired behaviors...shut off lights when leaving a room, recycling, encourage the use of renewable energies whenever possible
I think they are already doing it by working with the campus, Ottertail, etc. Evergreen is also a great example of sustainability at work.
What UMC does right now is good.
Model responsible behavior. Ban non-biodegradeable Styrofoam. Support local foods initiatives. Turn off lights when you leave your offices.
Continue to encourage and support the grass roots effort that is already strong on campus. Provide funding for alternative energy.
new construction (LEED certification), retrofitting, education programs
Departments should share what they are doing to other departments on campus.
I think if everyone, just thinks what they do throughout the day, they will see what they need to change to cut down on garbage and supplies,exp, in my childrens center, one of the teachers, informs her kids to use only one piece of paper,to cut down on waste, and I have already seen a BIG difference, in garbage that is to be recycled
Encourage faculty & staff to be as sustainable as possible to set a good example for the students.
Continue to communicate the concept, successful upgrades, practices, and advances.
Keep talking about it, make it a visible priority
evaluate each building annually and repair heating and cooling needs before more up keep is needed

Statistic	Value
Total Responses	32

16. Other comments

Text Response
All the dorms should have sensors on the lights so that when you walk in an area the lights turn on and will shut off when not in use.
I believe this is an important issue and one that each of us can influence. I hope that this is just the beginning of great strides we all can make to save our environment.
this is of paramount importance as we plan our next 20 to 50 years. We should keep the momentum going and build on our recent successes like Evergreen Hall.
I think that UMC, once again is making a great effort to be a leader in the U of M system as well as our region regarding these issues. Kudos to UMC!!
I think UMC does a good job on sustainability issues. We just have to keep plugging away and try to work together.
The term "sustainable" itself will evolve. Let's be prepared to evolve with the language too.
carpooling incentives might help,more flexable hours for people that could ride together if they worked the same hours

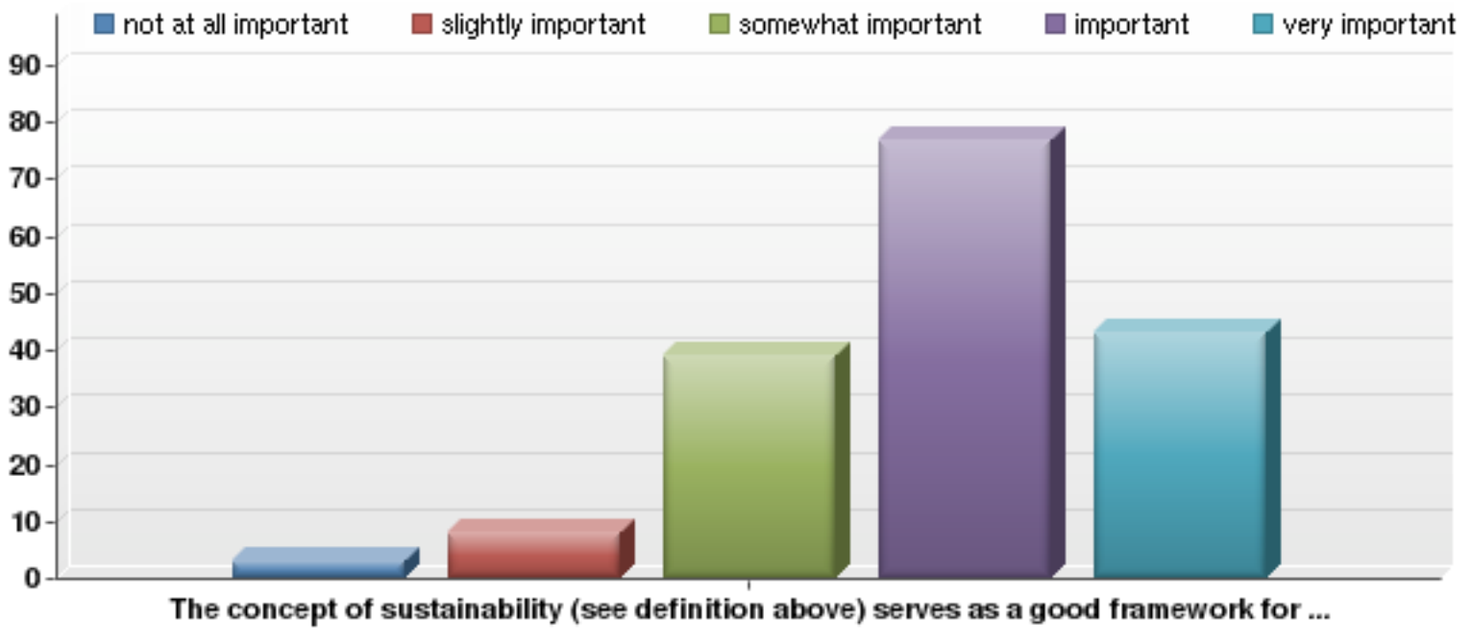
Statistic	Value
Total Responses	7

3_STUDENTS

Initial Report

Last Modified: 12/15/2009
Filtering by: RP_8qRetqLy6szyq4Q

1. Sustainability: "meeting present needs without compromising the ability of future generations to meet their needs"(World Commission for Environment and Development, 1987).

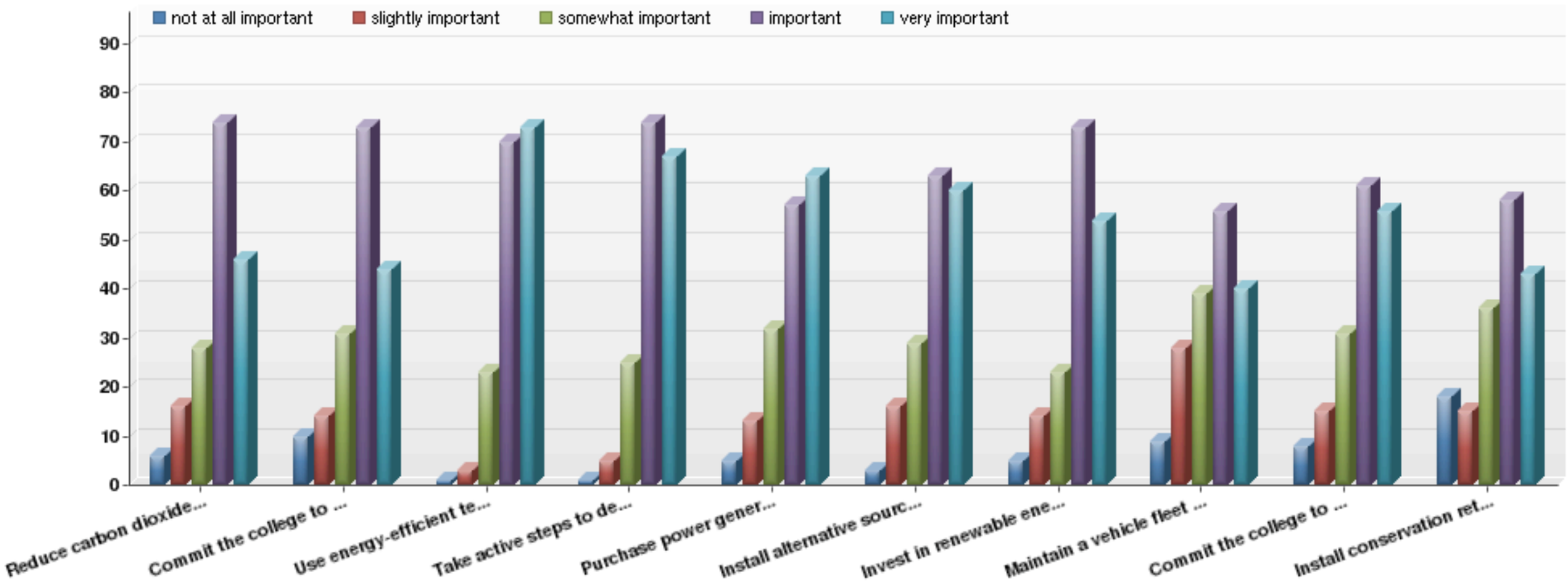


#	Question	not at all important	slightly important	somewhat important	important	very important	Responses	Mean
1	The concept of sustainability (see definition above) serves as a good framework for considering choices and living my life.	3	8	39	77	43	170	3.88

Statistic	The concept of sustainability (see definition above) serves as a good framework for considering choices and living my life.
Mean	3.88
Variance	0.82
Standard Deviation	0.90
Total Responses	170

2. Climate Neutrality: Efficiency, Reducing Emissions, and Green Building Policy

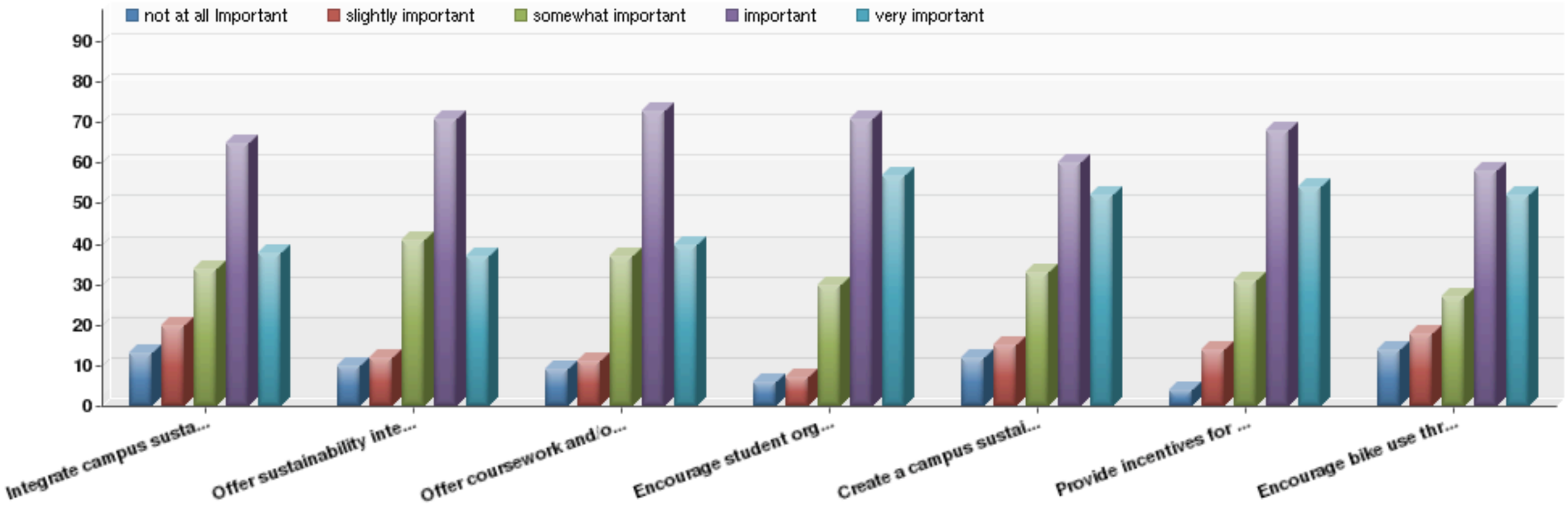
Climate Neutral is the concept of reducing or offsetting any greenhouse gases produced by any entity (individual, business, campus) so as to create a 'neutral' effect on global warming for that entity.



#	Question	not at all important	slightly important	somewhat important	important	very important	Responses	Mean ▲
3	Use energy-efficient technology on campus as much as possible	1	3	23	70	73	170	4.24
4	Take active steps to decrease energy consumption.	1	5	25	74	67	172	4.17
6	Install alternative sources of power on campus (e.g., solar, wind)	3	16	29	63	60	171	3.94
5	Purchase power generated from renewable sources (e.g., solar, wind).	5	13	32	57	63	170	3.94
7	Invest in renewable energy sources with the idea of benefiting the community beyond campus	5	14	23	73	54	169	3.93
9	Commit the college to a formal policy of using green building criteria and standards in all construction and renovation.	8	15	31	61	56	171	3.83
1	Reduce carbon dioxide emissions on campus	6	16	28	74	46	170	3.81
2	Commit the college to â€œclimate neutrality.â€ (see definition above)	10	14	31	73	44	172	3.74
10	Install conservation retrofits (e.g., low flow plumbing) to conserve water.	18	15	36	58	43	170	3.55
8	Maintain a vehicle fleet that runs on renewable, clean-burning fuels, or electricity.	9	28	39	56	40	172	3.52

Statistic	Reduce carbon dioxide emissions on campus	Commit the college to â€œclimate neutrality.â€ (see definition above)	Use energy-efficient technology on campus as much as possible	Take active steps to decrease energy consumption.	Purchase power generated from renewable sources (e.g., solar, wind).	Install alternative sources of power on campus (e.g., solar, wind)	Invest in renewable energy sources with the idea of benefiting the community beyond campus	Maintain a vehicle fleet that runs on renewable, clean-burning fuels, or electricity.	Commit the college to a formal policy of using green building criteria and standards in all construction and renovation.	Install conservation retrofits (e.g., low flow plumbing) to conserve water.
Mean	3.81	3.74	4.24	4.17	3.94	3.94	3.93	3.52	3.83	3.55
Variance	1.10	1.22	0.63	0.68	1.13	1.06	1.05	1.36	1.26	1.57
Standard Deviation	1.05	1.11	0.80	0.82	1.06	1.03	1.03	1.17	1.12	1.25
Total Responses	170	172	170	172	170	171	169	172	171	170

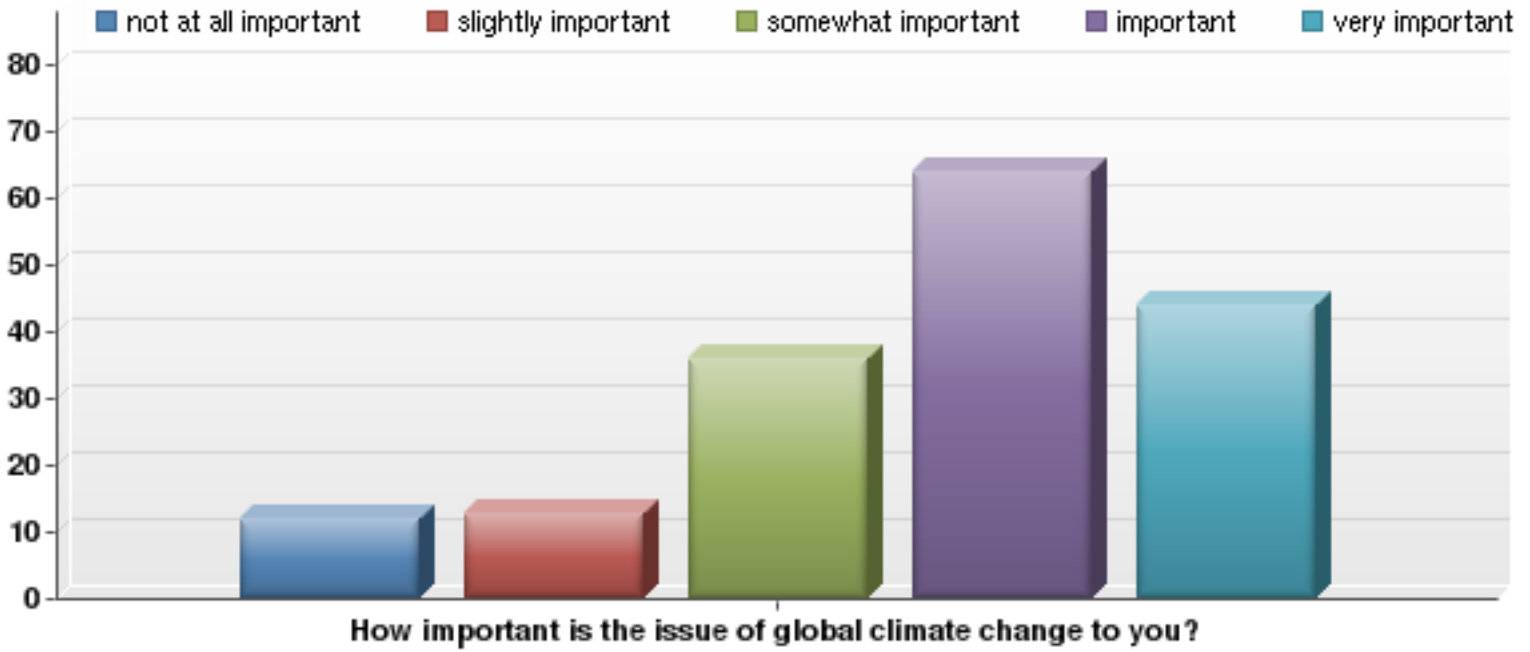
3. Student, Faculty, and Staff Involvement



#	Question	not at all Important	slightly important	somewhat important	important	very important	Responses	Mean
4	Encourage student organizations to practice sustainability efforts.	6	7	30	71	57	171	3.97
6	Provide incentives for carpooling or use of public transportation by students, faculty, and staff.	4	14	31	68	54	171	3.90
5	Create a campus sustainability challenge or competition on an annual basis.	12	15	33	60	52	172	3.73
3	Offer coursework and/or degree programs in sustainability.	9	11	37	73	40	170	3.73
7	Encourage bike use through additional racks, repair service, and sharing.	14	18	27	58	52	169	3.69
2	Offer sustainability internships on campus.	10	12	41	71	37	171	3.66
1	Integrate campus sustainability policies and practices into freshman orientation.	13	20	34	65	38	170	3.56

Statistic	Integrate campus sustainability policies and practices into freshman orientation.	Offer sustainability internships on campus.	Offer coursework and/or degree programs in sustainability.	Encourage student organizations to practice sustainability efforts.	Create a campus sustainability challenge or competition on an annual basis.	Provide incentives for carpooling or use of public transportation by students, faculty, and staff.	Encourage bike use through additional racks, repair service, and sharing.
Mean	3.56	3.66	3.73	3.97	3.73	3.90	3.69
Variance	1.40	1.15	1.12	0.99	1.40	1.03	1.55
Standard Deviation	1.18	1.07	1.06	1.00	1.19	1.02	1.24
Total Responses	170	171	170	171	172	171	169

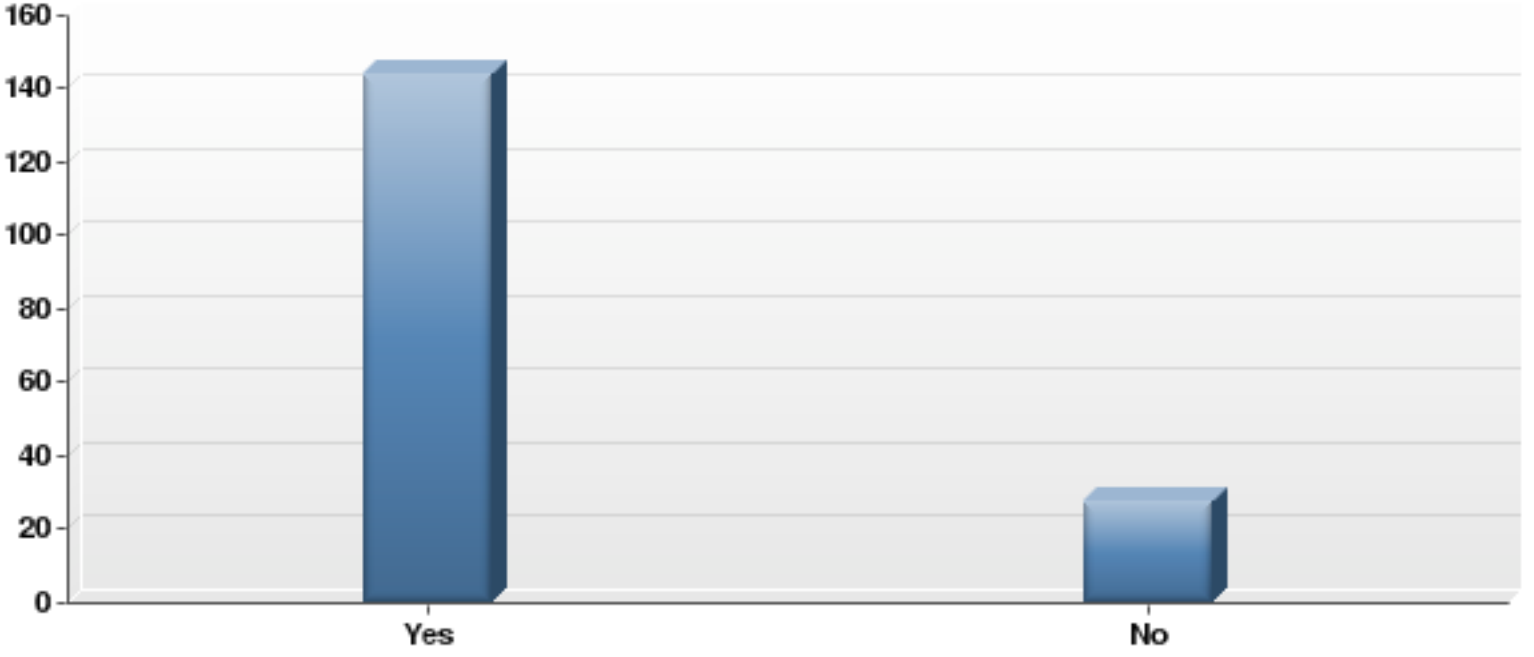
4. Climate Change:



#	Question	not at all important	slightly important	somewhat important	important	very important	Responses	Mean
1	How important is the issue of global climate change to you?	12	13	36	64	44	169	3.68

Statistic	How important is the issue of global climate change to you?
Mean	3.68
Variance	1.33
Standard Deviation	1.15
Total Responses	169

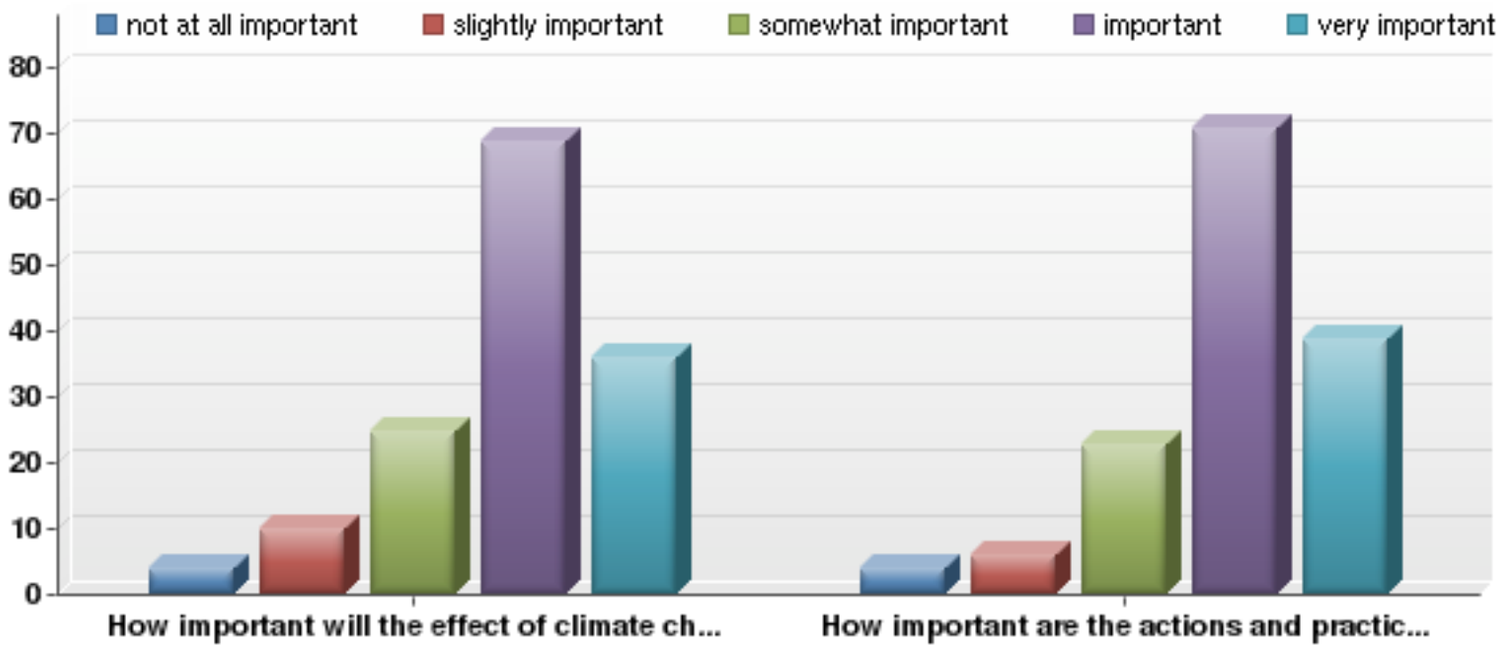
5. Do you believe that the climates or regions around the world are changing?



#	Answer	Bar	Response	%
1	Yes		144	84%
2	No		28	16%
	Total		172	

Statistic	Value
Mean	1.16
Variance	0.14
Standard Deviation	0.37
Total Responses	172

6. Importance of climate change to you.



#	Question	not at all important	slightly important	somewhat important	important	very important	Responses	Mean
2	How important are the actions and practices you can do to make a difference?	4	6	23	71	39	143	3.94
1	How important will the effect of climate change be for you?	4	10	25	69	36	144	3.85

Statistic	How important will the effect of climate change be for you?	How important are the actions and practices you can do to make a difference?
Mean	3.85	3.94
Variance	0.94	0.86
Standard Deviation	0.97	0.93
Total Responses	144	143

11. Demographic InformationI am a ...

#	Answer	Bar	Response ▲	%
1	Student		172	100%
4	Administration		0	0%
2	Faculty		0	0%
3	Staff		0	0%
	Total		172	

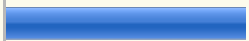
Statistic	Value
Mean	1.00
Variance	0.00
Standard Deviation	0.00
Total Responses	172

12. What is your major?

#	Answer	Bar	Response ▲	%
27	Business Management		23	14%
39	Equine Science		12	7%
66	Sport and Recreation Management		10	6%
58	Natural Resources Management		8	5%
26	Biology		7	4%
31	Communication		7	4%
61	Wildlife Management		7	4%
44	Health Sciences (Pre-Professional)		6	4%
16	Pre-Veterinary Medicine		5	3%
14	Animal Science		5	3%
57	Natural Resources Law Enforcement		5	3%
2	Agricultural Business		5	3%
59	Park Management		4	2%
1	Accounting		4	2%
56	Natural Resources		4	2%
11	Agronomy		4	2%
54	Manufacturing Management (B.M.M.)		3	2%
62	Organizational Psychology		3	2%
42	Golf and Turf Management		3	2%
36	Early Childhood Education		3	2%
33	Criminal Justice		3	2%
18	Applied Studies		3	2%
3	Agricultural Education +		3	2%
6	Agricultural Systems Management		3	2%
32	Computer Software Technology		2	1%
40	Equine Science		2	1%
49	Hotel, Restaurant & Institutional Mgmt		2	1%
43	Health Management		2	1%
41	Pre-Veterinary Medicine		2	1%
37	Primary Education		2	1%
45	Horticulture		1	1%
47	Production Horticulture		1	1%
51	Hotel and Restaurant Management		1	1%
4	Agricultural Science & Technology Education		1	1%
60	Water Resource Management		1	1%
8	Farm and Ranch Management		1	1%
55	Marketing		1	1%
53	Information Technology Management		1	1%
12	Agronomic Science		1	1%
15	Animal Science		1	1%
21	Aviation +		1	1%
25	Natural Resources Aviation		1	1%
23	Business Aviation		1	1%
30	Management **		1	1%
29	Entrepreneurship & Small Business Mgmt		1	1%
17	Applied Health (B.A.H.) **		1	1%
35	Law Enforcement		1	1%
13	Crop Production		0	0%
38	Program Management		0	0%
7	Bio-fuels and Renewable Energy Technology		0	0%
5	Natural & Managed Environmental Education		0	0%
24	Law Enforcement Aviation		0	0%
64	Industrial and Production Management Settings		0	0%
63	Consumer Service Settings		0	0%
20	Respiratory Care		0	0%
65	Quality Management (B.M.M.)		0	0%
9	Power and Machinery		0	0%
19	Self-Designed Program		0	0%
48	Urban Forestry		0	0%
34	Corrections		0	0%
50	Food Service Administration		0	0%
52	Resort and Spa Management		0	0%
28	Business Aviation		0	0%
10	Precision Agriculture		0	0%
22	Agricultural Aviation		0	0%
46	Environmental Landscaping		0	0%
	Total		169	

Statistic	Value
Mean	35.69
Variance	357.43
Standard Deviation	18.91

13. What is your age

#	Answer	Bar	Response	%
1	<20		62	36%
2	20-24		92	53%
3	25-29		9	5%
4	30-39		6	3%
5	40-54		2	1%
6	55+		1	1%
	Total		172	

Statistic	Value
Mean	1.82
Variance	0.72
Standard Deviation	0.85
Total Responses	172

14. Gender

#	Answer	Bar	Response	%
1	Male		76	44%
2	Female		95	56%
	Total		171	

Statistic	Value
Mean	1.56
Variance	0.25
Standard Deviation	0.50
Total Responses	171

APPENDIX-D

CLIMATE NEUTRALITY PLAN MAP

The purpose of the Climate Neutrality Plan Map was to put the information from the Climate Neutrality Report into a visual and publically accessible and understandable format. By creating a poster-sized visual, which outlines each aspect of the report, the Crookston Campus community: faculty, staff and students are provided with a transparent opportunity to understand; the process of the report, what current initiatives are happening on campus and what the future goals for Crookston. The hope for this map is that members of the campus can align their personal interests with what is being done and who to contact to become involved in the process of climate neutrality on this campus.

E ENERGY

CONTACT: Tim Norton, chair

CURRENT INITIATIVES | FUTURE GOALS/IDEAS

GRANTS:

_OTTER TAIL ENERGY CHALLENGE GRANT
_LEEDing Crookston to a Sustainable Future
_Crookston Students Paving a Green Path

PEOPLE:

_Custodians and maintenance staff of FMO can play a key role
GreenCorps Energy Conservation Specialist position
Chris Waltz

ENTITIES:

_CERTS team
_Otter Tail Energy
_Alternative Energy Work Group

LOCAL EXAMPLES:

New maintenance facility of NW ROC has a geothermal assisted heating
_LEED certified dormitory
Evergreen Hall

REPORTS

_McKinstry report
_Schools cutting carbon report
_Fabian Pommier campus energy audit of 2005

WORKSHOPS:

_CERTS Wind Workshop (2005)
_Sustainable Development Conference (2005)

Committee Membership:
Ken Johnson, Jon Fabre, Gene Scales, Donn Anderson, Rob Stoe, Kent Freberg, Rusty Remick, Chris Walts, Tom Haarstick, Jason Brantner, Doug Langer, Dan Svedarsky,(Ex Officio: Jerome Malmquist)

WIND ENERGY **58%**
_Offsite or small scale generators
_50% energy potential

SOLAR PHOTOVOLTIAC **21%**
_20% energy potential

BIOMASS **3%**
_on-campus animal waste for methane generation (St. Paul campus example)

GEOTHERMAL **18%**
_400% efficiency
_when used as a backup only 18% of energy use

ENERGY MANAGEMENT
_B3 Benchmarking program
_Energy Star program

CONSERVATION OF ENERGY
_50% reduction being pursued by OtterTail Energy **50%**

CONVERSION OF COAL TO RENEWABLE ENERGY
_from coal to: wind, geothermal and solar, natural gas as backup

GREEN BUILDINGS:

EVERGREEN HALL
LEED CERTIFIED DORM

FUTURE GREEN BUILDINGS
_energy standards
_Architecture 2030 challenge
_UMC updated Master Plan contains sustainability guiding principles

F LOCAL FOODS

CONTACT: Linda Kingery, chair

_Local foods working group
_encourage the use of local foods

_stimulates the local economy and heightens awareness

_Campus food service (Sodexo)

localfoods.umn.edu

website dedicated to local rural foods in NW Minnesota

Linda Kingery

Committee Membership:
Harouna Maiga, Terry Nennich, Deb Zak, Sharon Stewart, Ken Meyers, Sue Jacobson, and Natalie Brown

FUTURE:
LOCAL FOOD COOPERATIVE
_temporarily run through the university

COMPOST ALL ORGANIC MATTER
_soil supplement
_Earth Tubs (Carlton College)

STRENGTHEN CONNECTIONS WITH LOCAL FOOD PRODUCERS
_"Pride of the Prairie" part of the Land Stewardship Project

CHANGING DINING FACILITIES
_display the carbon footprint of foods in the dining facility
_use unhealthy food to subsidize the healthy foods
_use declining balance good purchasing system

DEVELOP A BUSINESS PLAN FOR CAMPUS LOCAL FOODS
_integration into a business course
_outreach or service learning project
_campus gardens

REDUCE FOOD WASTE BY 50%
_both Sodexo and consumers

W WATER + LANDSCAPE MANAGEMENT

CONTACT: Eric Castle, chair

REPORTS:
_Campus Stormwater Management Plan

_UTOC Nutrient and Stormwater Management Plan

CURRENT ACTIONS:
_Permeable paver walkway and rain-garden in Nature Nook

LAND FOR CARBON SEQUESTRATION
School land
_1500 acres
_used for research farming, forest research and natural areas

NW Outreach Center Land
_1500 acres
_in and around city of Crookston

LOCAL PLANNING COMMITTEE

_University engineers, water management consultant and agency personnel

Committee Membership:
Brian Christianson, Lisa Gentele, Katy Smith, Kristie Walker and Kenny Mendez

FUTURE:
STORMWATER REDUCTION

_Green roof installation on campus flat roofs

T TRANSPORTATION

CONTACT: Peter Phaiah

CURRENT CONDITION:
_main form of transportation on the Crookston campus is individual cars, there is a great opportunity here to reduce energy use through alternative transport

FUTURE:
FUELS AND VEHICLES:

_switch to more efficient vehicles for campus fleets
_use cleaner fuels (biofuels)

ALTERNATIVE TRANSPORTATION:

_common/shared cars
_"Hour Car" We Car"

REDUCE VEHICLE MILES TRAVELED:

_reduce driving miles by using more telecommuting
_bike programs
_more student housing on campus

REDUCE TRANSPORTATION NEEDS:

_provide student needed items in bookstores and vending machines at reasonable prices

R+W RECYCLING + WASTE MANAGEMENT

CONTACT: Peter Phaiah, chair

ENTITIES:
_Custodial and Maintenance Scrap Materials (FMO is lead)

_Recycling Working Group of UMN Sustainability Committee

Committee Membership:
Brian Christenson, Tom Feiro, Carol Larson, Bruce Felts, Lisa Gentele

RECYCLING CONTAINERS:

organized and managed by all campus clubs

CSA Clubs/ Organizations

PRECEDENTS:

SIFE Project at Red Lake Reservation

FUTURE DIRECTION
_Sustainable Committee and working groups to guide research neutral to sustainable
_Professor devoted to advising and research

T+C CURRICULUM

CONTACT: Paul Aakre, chair

Committee Membership:
Katy Smith, Ken Johnson, Kim Gillette, Dan Svedarsky, Marsha Odom

Academic Affairs Office/Department Heads/Curriculum Working Group of UMC Sustainability Committee

SUSTAINABILITY CURRICULAR PROGRAMS:

_Biofuels and renewable energy
_Environmental Science (in progress)
_Sustainable Facilities Management (in progres)
_Sustainability minor (in progress)

FUTURE:
SUPPORT AND EXPAND EXISTING PROGRAMS
_promote new related programs
_integrate classes into new renewable energy developments

CURRICULUM WORKING GROUP INITIATE RESEARCH:
_assess carbon dioxide reductions annually
_monitoring of energy usage
_feasibility studies

R RESEARCH

CONTACT: David Demuth, chair

Faculty role in proposing programs and conducting basic research

FUNDING:
_Otter Tail (expressed interest in funding)
_UROP and UROC grants + CERTS
_AURI (agricultural utilization research institute)
_David Demuth and Dan Svedarsky (co chairs)

TOPICS:
_Prairie Plantings
_Methane Digestion
Christo Roberts
_Carbon Sequestration-Katy Smith
_Linda Kingery-Regional Partnerships
_BioFuels for campus vehicles
Paul Aakre

FUTURE:
Smaller, start up grants and incentives

_increases research interest

CREATE A RESEARCH NETWORK:

_Identify potential advisors
_move forward with climate neutrality goals

C+O COMMUNICATION + OUTREACH

CONTACT: Linda Kingery

COMMUNICATION + OUTREACH WORKING GROUP
_assist in coordinating relations/marketing aspects
_suggesting new projects which can improve campus visibility

COMMITTEE MEMBERSHIP: Andrew Svec, Liz Tollefron, Stephanie Onken, Amber Evans-Dailey, Linda Kingery, Lisa Gentele, Dan Svedarsky, and Cindy Kuismi

ALTERNATIVE ENERGY WORK GROUP
_meets once a month, a variety of representatives:
mayor chairs, member of regional development, Otter Tail, organic farmer

OTHER ENTITIES:
_Northwest Regional Sustainable Development Partnerships
_Extension
_Northwest Research and Outreach Center (NWROC)
_Green Corps Energy Efficiency Specialist

FUTURE:
SET TARGETS AND GOALS:

_measure outcomes every six months

COMMUNICATE:

_about climate neutrality efforts to an internal UMC audience as well as externally to a local, regional and global audience

NEW EFFORTS:

_outreach specifically in the area of climate neutrality

CC CONNECTIONS + CONVERSATIONS

CONTACT: Dan Svedarsky

CENTER FOR SUSTAINABILITY

_Provides overall campus coordination for sustainability activities

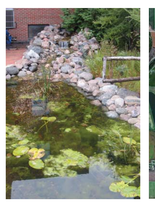
CLIMATE CHANGE SURVEY:

_indicated that a majority of respondents considered these important issues

FUTURE:
ESTABLISH AN INSTITUTIONAL STRUCTURE
to oversee implementation of Climate Neutrality Plan

SET METRICS for achieving climate neutrality

_map progress



+87% COAL -58% WIND -18% GEOTHERMAL

CURRENT CARBON EMISSIONS

PROJECTED POTENTIAL OFFSETS FOR CLIMATE NEUTRALITY

CROOKSTON CLIMATE NEUTRAL BY 2030

"In the end, we will conserve only what we love, we will love only what we understand, and we will understand only what we are taught."
Baba Dioum, Senegalese conservationist, in The Diversity of Life by E.O. Wilson, 1992