Center for Sustainable Building Research

Climate Neutrality Report-Draft

University of Minnesota -Crookston

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TABLE OF CONTENTS

ACKNOWLEDGEMENTS

INTRODUCTION

The global climate change is often times incomprehensible in its science as well as over whelming in its impacts. However, in the 21st century we as a civilization are confronted with changes that are seemingly beyond our control and yet 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 should be and are within the financial capability of each of us. In a lot of ways the appropriate response to climate change is more of a design problem than insurmountable structural problem. We will only conduct our same business differently in the future is more in concert with the natural world around us. This change in most cases, will not cause us suffering or inconvenience us. The change will facilitate new opportunities in looking at ourselves to reduce waste, create new management systems, and operate with a renewed sense of commitment to the new paradigm that we will have developed.

There is no doubt that it will require changes in how we do business because our present mode of operations will not be viable in 10 or 20 years. Crookston, because it is a learning and teaching institution as well as the leader in northwestern Minnesota is the ideal organization to lead in developing and communicating this new paradigm to the communities and businesses around the campus. It is important to comprehensively create and examine the principles that this effort will be guided by. The following principles, developed in Wingspread Wisconsin in 2005 is a good start.

Wingspread Principle on the U.S. Response to Global Warming:

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.

The University of Minnesota Crookston, believes that Crookston along with the United States must take immediate, comprehensive action against global warming, guided by these principles:

- **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.

- **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 longterm 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 marketbased 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. 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.

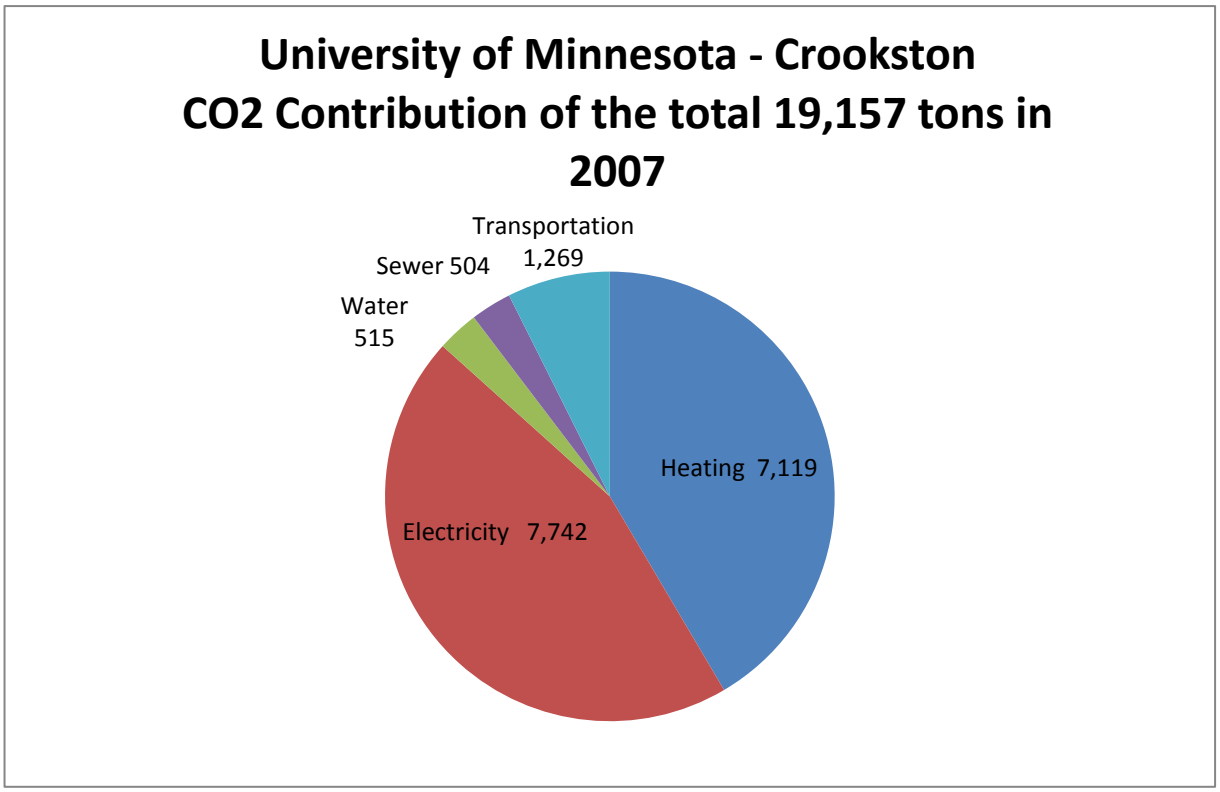
- **International Solutions:** U.S. government and civil society must act now to reduce their own greenhouse gas emissions, regardless of the actions of other nations. Because greenhouse gas emissions and the effects of climate change are global, however, the ultimate solutions also must be global. The 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 principles above, the University of Minnesota Crookston is making the commitment to reduce its net carbon emissions to zero by the year 20xx.

EXCECUTIVE SUMMARY

Where is the carbon?



Heating – 7119 tons of CO_2/year

Electricity – 7742 tons of CO_2/year

Vehicles – 1269 tons of CO_2/year

Water - 515 tons of CO_2/year

Wastewater - 504 tons of CO_2/year

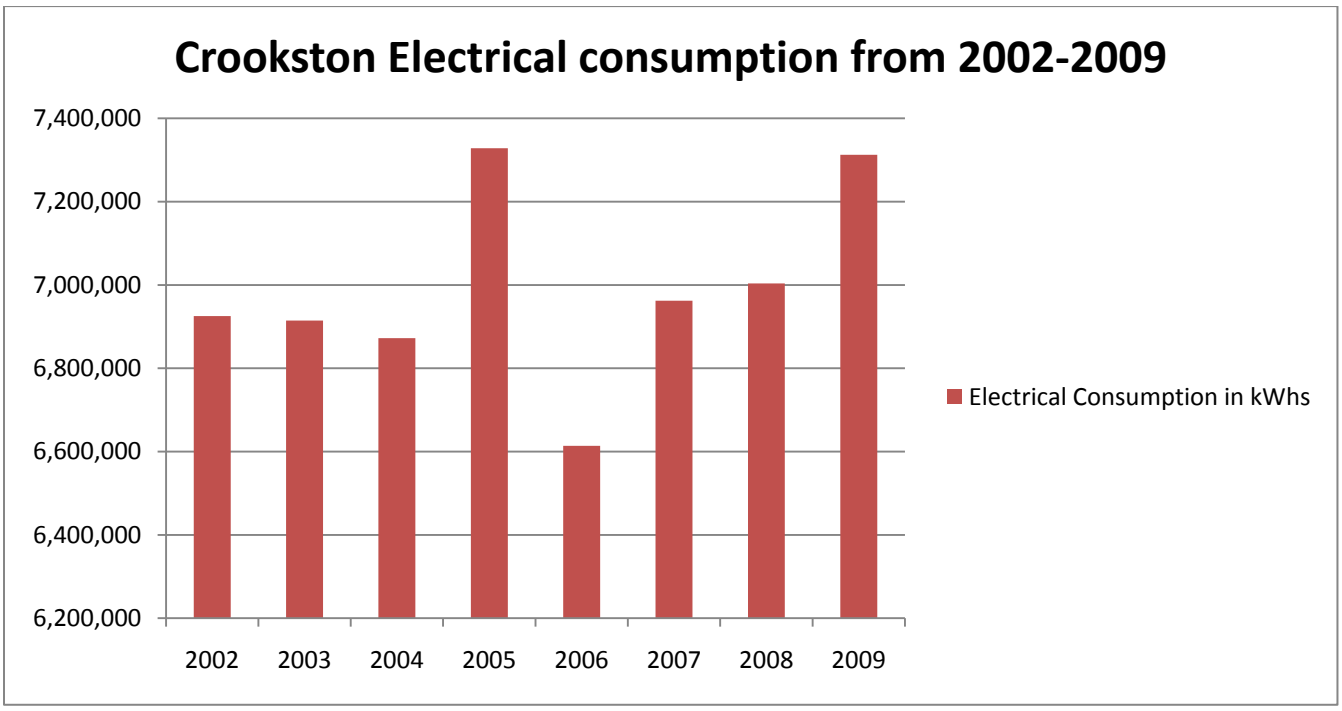
Solid Waste - xxx tons of CO_2/year

Sequestration rate would be **1080.30 tons of CO_2/year** for all the lands that the University of Minnesota-Crookston currently owns.

1 ENERGY

This section on campus energy is broken down further into two sections: Energy Conservation and Energy Production. In order to effectively convert to a climate neutral campus, aggressive energy conservation goals will have to be implemented and worked towards. Secondly, the existing energy production will have to de-carbonized over time. Both of these strategies can work in concert and reduce the timeframe to climate neutrality.

The use of heating, cooling and electrical energy produces the highest levels of CO2 on the Crookston Campus. It amounts to nearly 10,800 tons of Co2 per year. That amounts to close to 9 tons per year for the 1200 students attending the college. The average American produces 20 tons of CO2 each year through their day-to-day activities.



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

In order to be able to convert the campus to an alternative energy system in the future to attain the goals of climate neutrality, a fifty percent reduction in energy usage will have to be accomplished. Although this goal seems outside the realm of possibilities, private sector building management companies have been able to accomplish this. This goal will not only save a lot of money for the college, it will also demonstrate leadership in an area that is extremely cost effective and not usually selected. This reduction in energy use is not intended to reduce the quality of the indoor air or occupant comfort but only to attain maximum energy efficiency. Occupant comfort should remain the top priority of the campus when balanced with energy efficiency not at its determent.

Current Efforts at Crookston

A) Alternative Energy Work Group

This campus group is chaired by the mayor and includes members of regional development, former head of water, Ottertail power representatives, an organic farmer in the community and a school board member.

B) Custodial and Grounds Management staff

Play a key role in making a difference between 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, and monitoring ventilation-opening and closing windows as necessary and all ways which allow buildings to function energy efficiently.

C) _Ottertail Energy Grant

Local Energy Company, Ottertail Energy, is running a grant program…

1

2.

3.

4.

5.

6.

A CONSERVATION goal of 50% REDUCTION of existing energy use.

I_Capitial Improvements

In has been known in the building industry for some time that conservation is the most cost effective means to save energy but its implementation has been sparely applied. There are two trains of thought about energy conservation in existing buildings. 1) 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 the 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 pay backs, are usually implemented. This method usually can bring the operational costs of a building down over the next few years. Lighting, mechanical controls and sensors are usually included in the list of items to be replaced. This is the strategy that Ottertail Power is pursuing. The individual building metering of heating, cooling and electrical usage should also be installed. Presently there is no immediate way of accurately measuring energy use savings achieved, therefore it would 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.

II_Energy MANAGEMENT

However, there is a second method that can be employed that is not often effectively used. Most 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 is "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 conversion to renewable energy.

One quick way to determine if a building is performing with in building energy code guidelines is to register it with the State of Minnesota B3 Benchmarking program. 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. This method will require that each of the University's buildings be separately metered for 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 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 they are using the correct amount of energy. 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 using temporary energy meters placed on each of the systems over a set period of time. This establishes the key 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. The no brainers are to reduce the run time when there are no occupants. Buildings can be heated and flushed between 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 very haphazard, unsystematic and energy consumptive manner. This management system requires careful reoccurring 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. Oftentimes, energy management is a one-time fix and then it is assumed nothing changes from season to season or semester to semester.

III_GREENBUILDINGS

Crookston has been at the forefront of green building for the University of Minnesota campuses. Evergreen Hall is Crookston campus's first LEED certified building and the first LEED certified dormitory in the U of M system. Although this was quite a first step, more in terms of energy conservation will have to accomplished. New buildings present a greater opportunity for energy conservation in buildings. 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 envelops 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. The building designers are required to design with this energy standard and the 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 the energy standards ask for a 50-60% reduction in energy use from comparable buildings. All energy standards can be found at www.mn2030@umn.edu

B_Energy PRODUCTION

Current Campus Efforts:

a) Wind Power
The opportunities to have on-site wind turbines are limited by the airport flight paths. As the campus is located only three miles from this airport, large wind turbines are not an option. Off-site wind energy, or small scale wind generators could be considered.

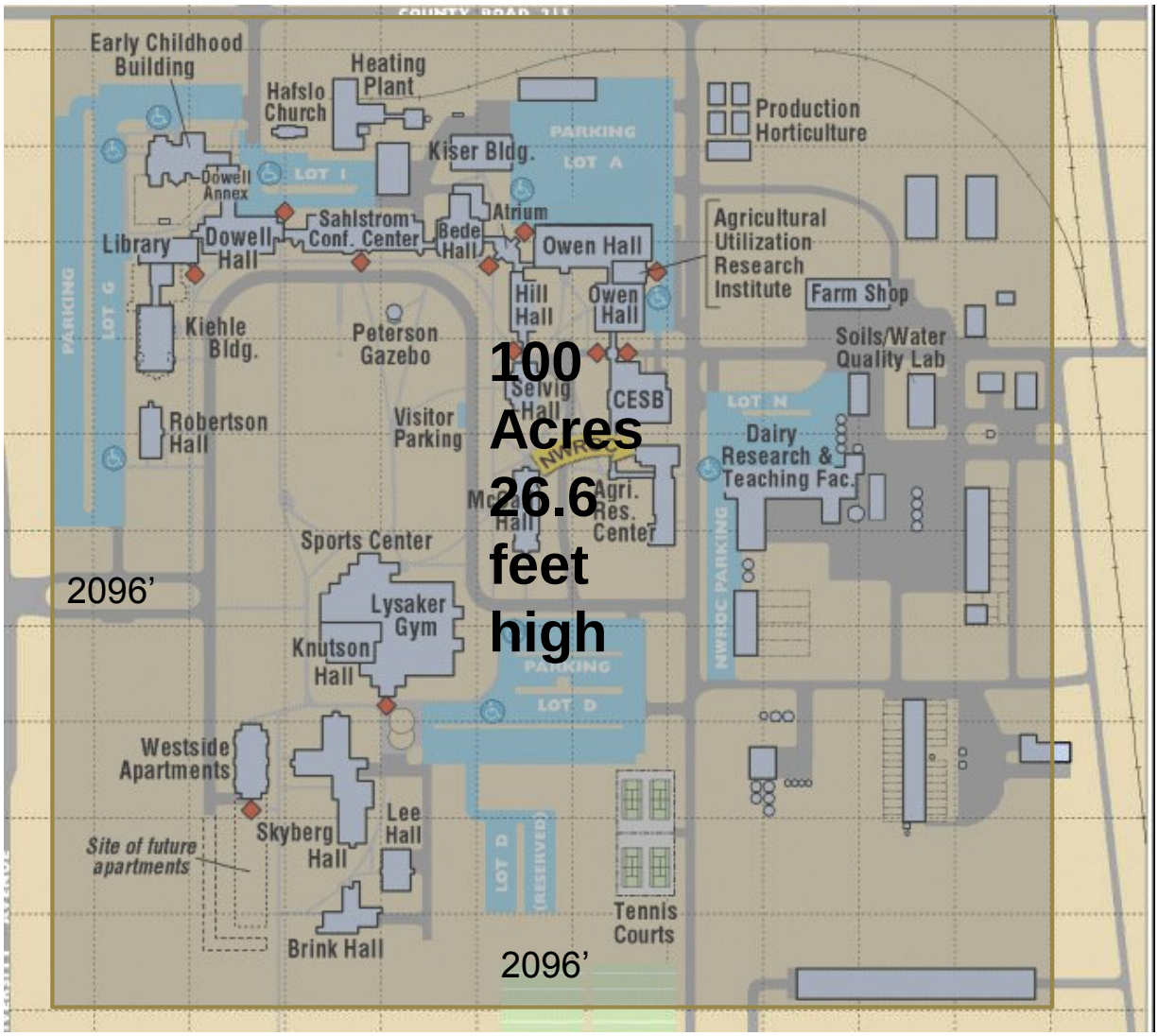
b) Biomass
There is a great opportunity to use animal waste for methane. Crookston has a rare opportunity to utilize this resource in a positive way as it has many animals that live directly on the campus. A precedent for use of manure for a methane generator can be found on the St. Paul campus. The prospects for biomass to expand into the academic sector include the creation of a Biofuels and Renewable Energy major.

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

I_NON RENEWABLE ENERGY

_Coal

Currently the Crookston Campus is being fueled by predominately coal. Although coal is abundant in the US, its combustion causes significant environmental effects. Crookston is burning about 3,266 tons of coal annually but producing 6,830 tons of CO2 emissions. In an average year, these emissions would cover the entire campus to a height of 26 feet. During a four year baccalaureate, the height of the carbon would be over a hundred feet high. The weight of the CO2 would crush the campus structures if Crookston would retain its environmental emissions over a four year period on its campus. However, Crookston as have other producers is able to diffuse the CO2 emissions into the air above them and they are carried with the wind currents to other locations in a less dense and toxic state.



Although diffusion of coal emissions in the past has been an effective strategy for individual producers, the combined effect is resulting in climate change for the world. Although the detrimental effects of climate change will be produced differently throughout the world, the responsibility for this change falls directly on each of the producers of the emissions. Since Crookston is such a producer, it is now time that the college states its intentions on how to deal with its waste. Continued combustion of coal and spreading its emissions throughout the atmosphere is irresponsible for an institute of higher learning that is teaching its students the cutting edge technology.

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. Therefore its ability to take on additional costs for world-wide environmental concerns is limited. However, we should look at all costs and the total cost of the fuel system before making a decision.

Energy Cost Comparison

Currently the annual cost of coal for Crookston is about $158,000 per year. According to the **xxxx**, environmental costs of each kWh of energy are about 7.5 cents for coal fired production. If we were to apply this cost to the current heating plant the indirect cost of the plant would be $1,340,000. If Crookston was 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 below)

Cost of the current energy source for the campus: **Coal Fired Plant:**

1) cost of fuel for a season	$143,192.52 (2007-2008) $172,761.16 (2008-2009) $158,000 average
2) cost of labor for a season	Around $210,000 without Overtime or Holiday-pay figured in
3) environmental cost for a season	$1,265.71 (MPCA – Annual Air Emissions Tests) $1,537.50 (NOVA – Air Monitoring)
4) annual maintenance for a season	$300,000.00
5) other annual costs	$300.00 (MVTL – Coal Testing – per month)(3,600/year)
6) cost of construction	$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**

Total Annual Cost is

Annual Operating Costs: **$675,000**

Annual Replacement Cost: (20 year life cycle): $190,000

Pollution Cost: $1,340,000.

Total Annual Cost for operations of a coal fired heating plant: $2,205,000

Let's look at the annual operating cost of converting to natural gas. If the same amount of energy is generated with the combustion of natural gas, the annual cost would be approximately $500,000. The environmental cost of natural gas is significantly smaller, about $6,700 for a total cost of $506,700 or about 3 times less than the total cost of coal. If Crookston is willing to take full responsibility for its energy combustion for heating, it would be substantially cheaper to convert to natural gas.

1) anticipated cost of fuel for a season $500,000

2) anticipated cost of labor for a season

3) anticipated environmental cost for a season

4) anticipated annual maintenance for a season

5) anticipated other annual costs

6) cost of construction

Total Annual Cost is

Annual Operating Costs: **$675,000**

Annual Replacement Cost: (20 year life cycle): $190,000

Pollution Cost: $6,700

Total Annual Cost for operations of a natural gas fired heating plant:

Operating Cost Comparison between coal, gas and wind

YET to received

Emission Comparison

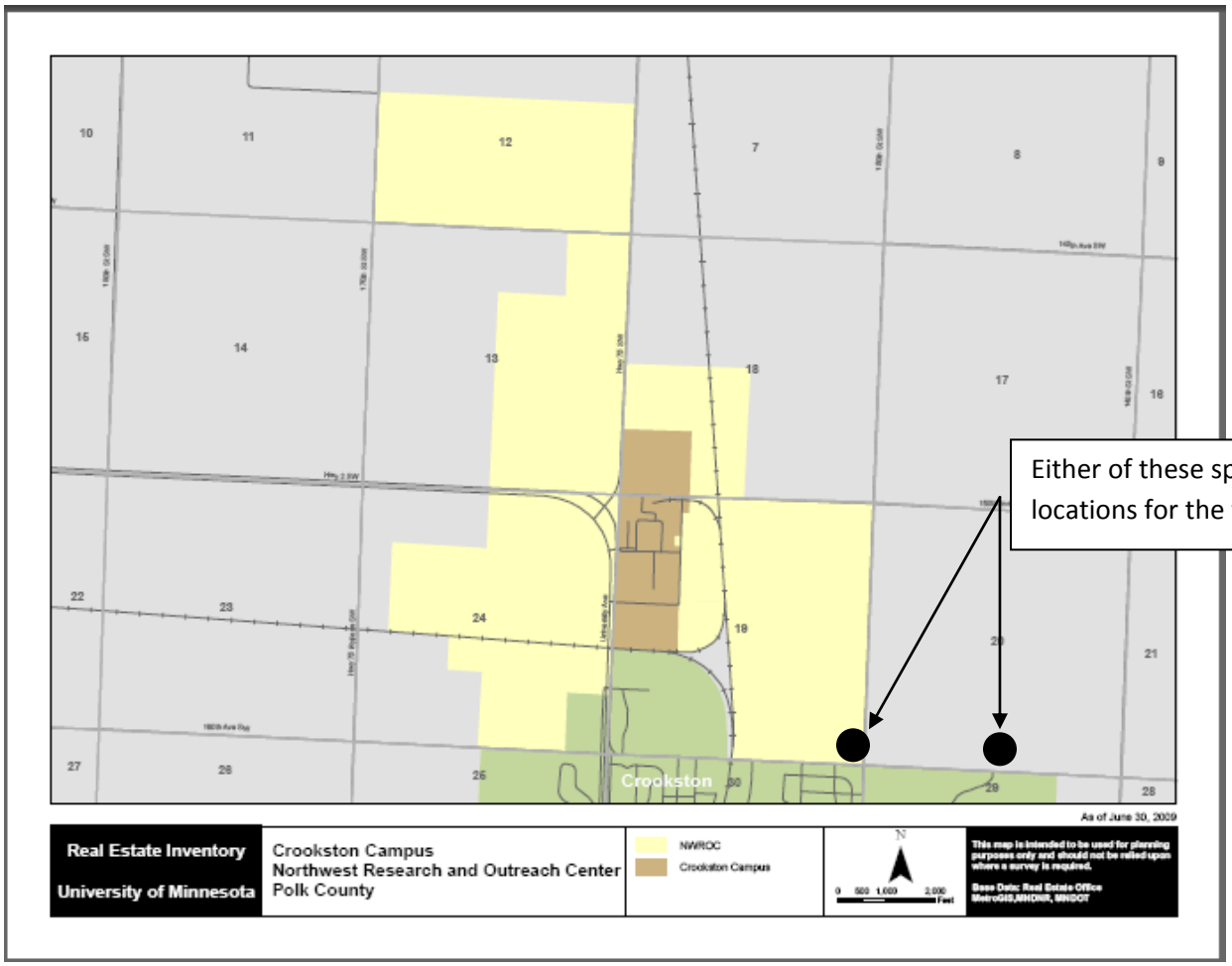
The emissions from the combustion of coal are estimated to be around 6,800 tons of CO2 annually. The emissions from the combustion of natural gas for the same about of heating energy would be about 3,576 tons of CO2 or a reduction of a little less than half (47%). A renewable source of energy would reduce this emission load even more.

I_RENEWABLE STRATEGIES

The most cost effective alternative energy source in the Crookston area is wind. Minnesota contains some of the best wind resources in the US. The Red River Valley is referred to as the "Saudi Arabia" of Wind. Even without subsidies, wind often represents the lowest cost option for the production of energy. The lower 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. Today, there are many wind farms in the Midwest that are being constructed for merely economic reasons.

Wind could provide up to 52% of the energy needed on the campus with one large scale turbine. Although this turbine couldn't be located on campus land because of the airport, the college should consider the purchase of a small parcel of land close to the campus and interconnecting to the campus energy systems. In research completed by Skip Carlson, there is a possibility of a variance to the airport restrictions on the far southeastern corner of the university property. However, wind is variable and other energy sources are needed to supplement wind.

This increase in efficiency would reduce the carbon footprint by xxx tons of CO2 / year



A good compliment to wind is solar. Generally solar energy is the highest when wind if the 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. It is estimated that solar could provide about 20% of the campus energy demand. Although solar 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

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.

This increase in efficiency would reduce the carbon footprint by xxx tons of CO2/ year

Biomass is also a possibility to supplement the campus' heating and cooling . The University of Minnesota, Morris is currently implementing a bio-mass fired boiler to produce steam for both winter heating and summer cooling. The bio-mass resource of corn stover for Morris is similar to Crookston. There is a coal-fired boiler at Crookston which could be retro-fitted to utilize bio-fuels 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, 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 relate to the feedstock and are as follows:

- Biofuel supply and homogeneity is a challenge since there is an insufficient supply of one product that is close by and transportation is a major cost determinant. 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 the 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 some 3 miles distant and this could affect the feasibility of use at UMC.

This increase in efficiency would reduce the carbon footprint by xxx tons of CO2/ year

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

This increase in efficiency would reduce the carbon footprint by xxx tons of CO2/ year

Final Campus Energy Climate Neutral Configuration:

All campus and NWROC buildings will be supplied by ground source heat pumps for heating and possible cooling energy. The ground source heat pumps will share a common source field located either under the existing parking lots (which have replaced with pervious paving), the central mall or the horse barn padlock area. A common source field will create redundancies and reduce the amount of the field required. The total heat load estimated is approximately xxx tons at 55 btus/squarefoot. Each building shall have its separate heat pump for it heating and air conditioning needs. Each of the buildings that has existing hot water system, the energy

source will be converted from steam to ground source heat pump. Each of the buildings that has existing steam system can either be convert to a hot water system or the stream replaced with a hot water system. The source energy will be con converted from steam to ground source heat pump. Each of the buildings that has existing air conditioning systems, the existing chiller water or DX HVAC system will be converted from the existing cooling system to ground source heat pump.

The electrical energy for the ground source heat pump system will be supplied by an on campus 2.0 megawatt wind turbine. Therefore the heating, cooling, air conditioning, lighting and power for all campus building will be carbon free and the campus will be climate neutral as far as building operations.

"A **geothermal heat pump** or **ground source heat pump** (GSHP) is a central heating and/or cooling system that pumps heat to or from the ground. It uses the earth as a heat source (in the winter) or a heat sink (in the summer). This design takes advantage of the moderate temperatures in the ground to boost efficiency and reduce the operational costs of heating and cooling systems." Wikipedia

Common ground source field.

Schedule of Implementation:

The conversion of the existing campus buildings to a ground source heat pump system will require some time. The first installation is the common ground heat source field. This will take a summer to install and connect to all the existing buildings. However not all the buildings can be converted at the same time. They must be systematically scheduled over the summer months to be converted. It is anticipated that two buildings can be converted each summer. One of these buildings will be an existing hot water system and the other an existing steam system. There are approximately xxx buildings on the campus included the NWROC. Therefore it will be about xxx years before the total conversion of the campus to a ground heat source system will be completed. During the conversion, the coal fired heating plant should be decommissioned because of the reduced loads

required as the building conversion to ground source heat pumps takes place. The natural gas fired boilers are much more flexible and efficient in producing heat in varying demands.

2 LOCAL FOODS

Current Effort at Crookston:

A_ENTITIES

II_Campus Food Service-Sodexo (Peter Phaiah)

B_OPPORTUNITIES

LOCAL FOODS

"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." (Food-Miles and the Relative Climate Impacts of Food Choices in the United States, Christopher L. Weber* and H. Scott Matthews, Department of Civil and Environmental Engineering and Department of Engineering and Public Policy, Carnegie Mellon University, Pittsburgh, Pennsylvania 15213, Environ. Sci. Technol., 2008, 42 (10), pp 3508–3513)

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 economy.

The Crookston campus is located on the northern edge of the so named "bread basket of the world". The US grain production is abundant due to modern farming techniques. Crookston community acknowledges the role that food plays in the community. There is a Local Food group looking at the impact of food on the economy as well as on the nutrition of the community. It is estimated that each meal for an American will travel well over 1500 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 US has a carbon footprint of 22 tons of CO2/year. When

comparing this to the energy footprint of 9 tons of CO2/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 a difficult one 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 are 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. Insurance on the food seems to be the major obstacle in Sodexo willing to buy from local suppliers. At Carleton College in Northfield, Sodexo purchased local food from the community food cooperative. They were able to carry the insurance required by Sodexo.

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.
Possible Strategies that would reduce the carbon footprint of the food prepared by Sodexo:
1) ***Continue the work with Sodexo:****. Good communications have been establish 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 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 catalyze at a minimum cost to bring together food producers under a the umbrella of a Food Cooperative. Currently the organizational momentum is lacking. The University could play the role of an insurer for a short period of time until the cooperative can organizes and take over the responsibility. This is a opportunity that present large upside for the University will little downside. Sodexo would be willing to purchase food from the food cooperative if there is enough insurance coverage*

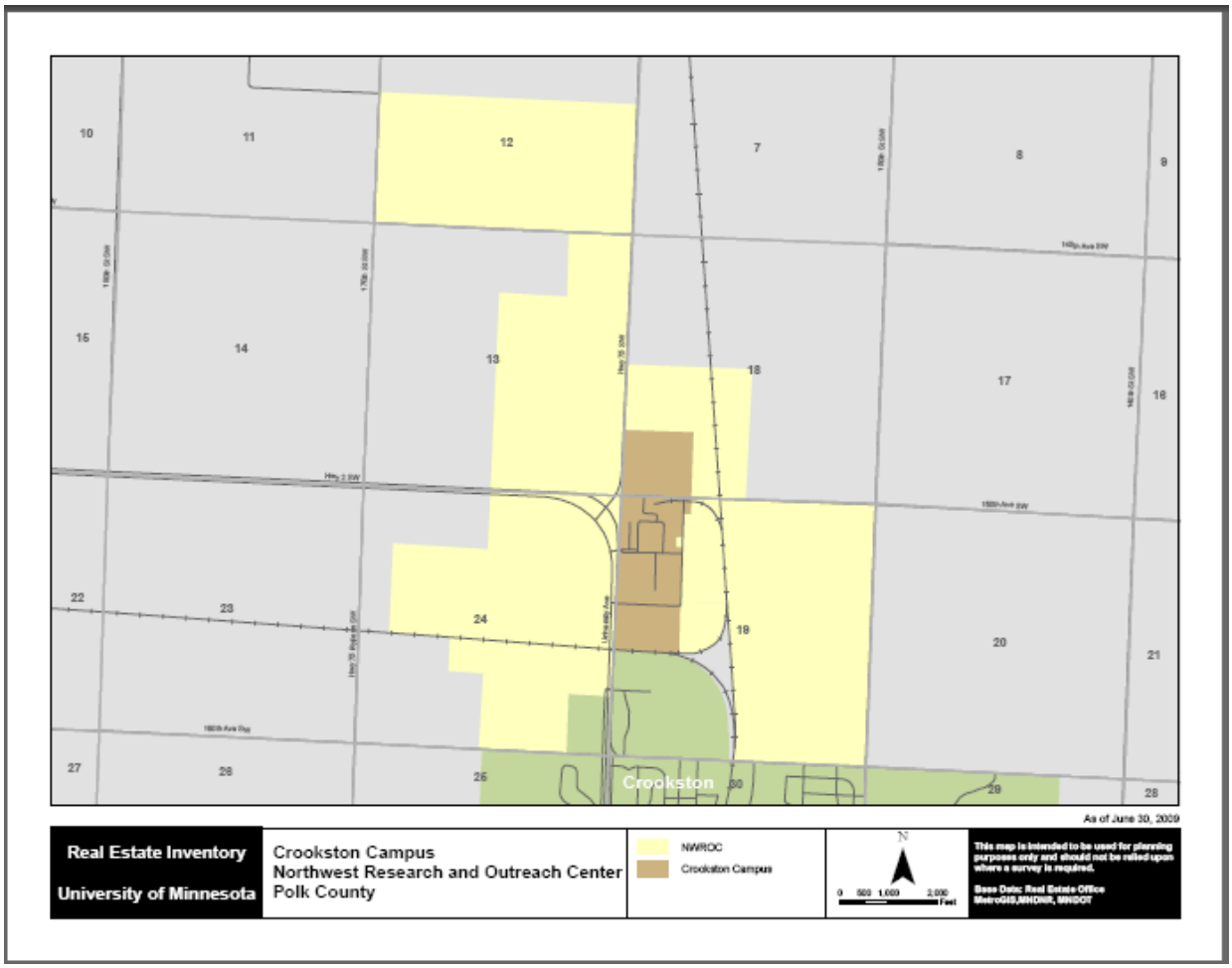
3) Strengthen connections with local food producers: Currently there is the

- *Strengthen connections with local food network*
- *Develop a business plan for campus local foods*
- *Set goals each year for the percentage of local foods – perhaps as much as 5%/year*
- *Compost all organic matter from campus waste – soil supplement*
- *Display the carbon footprint of foods in the dining facility*
- *Help Sodexo develop a business plan to incorporate local foods into their operations*
- *Think about campus gardens as a – business opportunity for students (St Olaf)*
- *Think about how the current campus herds might became food for the students*
- *Establish menu that use more of the foods that are in season*
- *Use fair trade coffees, cocoas and teas*

This strategy would reduce the carbon footprint by xxx tons of CO2 year

3 WATER/LANDSCAPE MANAGEMENT

The University of Minnesota Crookston owns approximately 1500 acres of land in and around the City of Crookston. This land is used for research farming, forest research, natural areas and campus lands. Each one of these land functions has the possibility to sequester carbon and equivalent CO2. The following is a breakdown of the potential of each of the land functions to sequester carbon according to a study completed on farm land and conversion lands.



I) School Forest – 40 acres x .209 tons/acre =8.36 tons/yr
ii) Natural Area - 85 acres x .397 tons/acre = 33.745 tons/yr
iii) Farm Grounds – 1200 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 CO2/year** for all the lands that the University of Minnesota-Crookston currently owns.

This strategy would reduce the carbon footprint by 1080.30 tons of CO2 year

Table 1. Carbon Stored on IN Lands in 1999. [1]

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

[1] From Smith, P., J. Brenner, K. Paustian, G. Bluhm, J. Cipra, M. Easter, E.T. Elliott, K. Killian, D. Lamm, J. Schuler and S. Williams. 2002. Quantifying the change in greenhouse gas emissions due to natural resource conservation practice application in Indiana. Final report to the Indiana Conservation Partnership. Colorado State University Natural Resource Ecology Laboratory and USDA Natural Resources Conservation Service, Fort Collins, CO, USA. (Metric to U.S.

Although water plays a minor part in the production of CO2, it is a contributor. Currently the campus uses about xxx gals of potable water each year. Because so much electrical power is used in the cleaning of water for human consumption, this has a small CO2 footprint of about xxx lbs. 50% water conservation is achievable by the use of water conservation fixtures. However, in most cases, water prices are so low and don't reflect the true cost of production, the payback on water conservation is often long. The water issues in the Crookston area are acute because of the lack of large underground aquifers. Any conservation and reuse of water would significantly bring the campus water use within the parameters of sustainable use.

Wastewater is a bigger contributor to the production of CO2 than potable water but is a small player in the overall campus carbon foot print. Again, the actual emissions do not occur on the campus but at the wastewater treatment plant where significant electrical power and chemicals are employed to clean the wastewater to EPA standards before returning it to the environment. The approximate CO2 footprint of wastewater for Crookston is approximately xxxx lbs.

This strategy would reduce the carbon footprint by xxx tons of CO2 year

4 TRANSPORTATION

Reducing the carbon footprint of transportation on the Crookston 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 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 synergist manner. No one strategy will solve all the transportation problems.

The carbon footprint of transportation is 1269 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 the 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 x% of the total transportation footprint or an additional xxxx tons of CO_2/year. All 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 mph vehicles for sale that would replace campus fleets. In most cases this would 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. Bio-fuels made from grains are still controversial on whether they all are carbon negative.
Bio-fuels from grain wastes are a better alternative. Using a non grain grass such as switch grass seems to be a more carbon negative alternative.

This strategy would reduce the carbon footprint by xxx tons of CO2 /year

Alternative Transportation: Because of the lack of a 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: ("There is a one-time non-refundable $20 application fee and $30 annual membership fee. Once you're a member, you'll have access to our environmentally-friendly Prius Hybrid and Camry Hybrid for an hourly rate of $8 which includes your gas. The Daily rate is $59/day (any 24 hour period) and overnight rate is $39/overnight (6 p.m. to 8 a.m.))" These programs reduce the need for students to bring cars to campus and reduce the need for the college to buy vehicles for student and faculty field trips. These cars are usually fuel efficient and hybrids that run on electricity. 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.

This strategy would reduce the carbon footprint by xxx tons of CO2 /year

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.

This strategy would reduce the carbon footprint by xxx tons of CO2 /year

Reduce Transportation Needs: Reducing the demand and need for transportation of any kind is the best alternative of all. If you 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.

The college could think about 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.

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

This strategy would reduce the carbon footprint by xxx tons of CO2 /year

5 CURRICULUM

Current Crookston Efforts:

The Crookston campus curriculum has been quite progressive in establishing a series of sustainable programs in Biofuels and Renewable Energy, Sustainability minor and Sustainable Development minor and soon to be majors in Environmental Science and Sustainable Facility Management. Each one of these programs will better prepare Crookston students for the challenges of the 21st century in the world. 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.

It is anticipated that the transition to a climate neutral campus will support and expand the existing programs, bring existing programs into sustainability and might initiate new programs. Certainly the biofuels and renewable energy programs will be invigorated by the development of the renewable energy systems. There will actually be 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 program that the college will undertake will be a great application of the principles of the Sustainable Facility Management Program.

It is hoped that the physics and chemistry departments will be interested in the wind and solar applications as well as the bio-mass 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 Curricular Working Group of UMC Sustainability Committee as well as the Academic Affairs Office could initiate 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
- Examining the feasibility of bio-mass boilers
- Examining the feasibility of expanded animal waste digesters
- Examining the economics of energy transition to renewable for a typical farmstead
- Examining the specifics of solar photovoltaic and solar thermal application
- Evaluate the possibility of participation of the Crookston Community in the college quest for carbon neutrality
- Evaluate the economics of the college to initiate a food cooperative
- Evaluate the initiation of the hour car program
- Evaluate the initiation of a bike program

Funding for these research efforts could be the annual Urop Grants for students. There is more than enough money for students that are interested in the college transition to the carbon neutrality.

6 RECYCLING +WASTE MANAGEMENT

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; this production 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 of 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 on reduction of current GHG emissions. The participation of each member of the community is essential to effectively meeting this goal.

Current Efforts at Crookston

The Facilities and Operation Department at UMC manages solid waste disposal and tracking. Custodial and Maintenance Scrap Materials in Facilities and Operation and the Recycling Working Group of UMN Sustainability Committee are two entities working on solid waste and recycling at UMC. There is a plan to participate in Recycle Mania in 2010 that will accelerate increase in recycling on campus.

The current data on solid waste and recycling at UMC is as follows: (to be added)

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 against 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 generated and increase recycling.

4. Develop a materials reuse/exchange program, potentially student managed, on campus that will 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 non-recyclable (bright, dark, or plastic-coated) paper;

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

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

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

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

7 RESEARCH

Research is a critical area for UMC to consider in its implementation of climate neutrality. Research related to sustainability and climate neutrality has the double benefit of advancing knowledge in these areas, preparing students in area that is guaranteed to be of importance in the coming decades and also meeting an important goal of the institution.

Current Efforts at Crookston

There are some existing research efforts related to carbon neutrality such as the research on potential carbon sequestration on campus, research on use of bio fuels for campus vehicles, research on potential use of methane digesters for use on campus and use of prairie plantings on campus. These research efforts help

strengthen the 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.

Recommendations for UMC

1. Identify faculty research that might be of value to the climate neutrality goals of UMC across all disciplines and programs. (The survey development example)

2. Provide micro grants and incentives to increase research interest in this area.

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

8 COMMUNICATION + OUTREACH

Communication of the efforts around UMC's progress towards climate neutrality is critical to making cultural change happen in the 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 slowly underway. UMC can be a natural 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 Efforts at Crookston

There are excellent outreach efforts at the UMC through the North West Outreach Center (NWOC), through the Alternative Energy Work Group and through individual faculty work.

Recommendations for UMC

1. Communicate about UMC's climate neutrality efforts internally to a 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 to connect to climate neutrality.

4. Initiate new efforts to do outreach specifically in the area of climate neutrality (For example, the Landowner's Guide to Prairie management could have a parallel Landowner's or Farmer's Guide to Climate neutrality)

I_Communications dept/staff involved in communications about UMC
All entities, individual faculty involved in outreach

B_OPPORTUNITIES
Assist in coordinating relations/marketing aspects
Suggesting new projects which can improve campus visibility

9 CONNECTION + CONVERSATIONS

Connections and conversations refer to the how connections with individuals and organizations might be able to help the process for UMC to accelerate its progress towards climate neutrality. At a time where it is increasingly important to leverage constrained resources by developing partnerships this is a natural strategy to be employed – to partner with entities who have common goals and interests.

Current Efforts at Crookston

The conversations and forums that UMC has had in the past have helped it get to this point. (List past events here). This process should be continued.

Some of the emerging partnerships for UMC around climate neutrality are:

a) City of Crookston
b) Ottertail Grant
c) Crookston Hospital
d) Winnipeg Bus Company (name?)

Recommendations for UMC

1. Scope existing and potential connections of UMC around climate neutrality.

2. For every new project initiated with the goal to achieve climate neutrality, seek to partner with others.

3. Continue the tradition of conversations around sustainability, and focus some of them directly on the topic of climate neutrality.

10 CULTURE AND PROCESS

Addressing 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 there being the technologies available to make this possible, is because the goals and actions towards that end have not deeply entered into the culture if the community to the point of easy implementation. When that cultural shift is made, achieving climate neutrality will be easy. This means that it is important to focus on 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.

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, Crookston has already made good headway in establishing a process. This process needs to be continued and accelerated.

(Include paragraph on survey results and its implications here.)

Opportunities

How can cultural change be brought into effect? By riding the wave of external changes that are happening in our society and by fostering the internal changes one step at a time. By looking for the strengths and innovative ideas within constituents – students, faculty and staff. Alan AtKisson author of *Believing Cassandra* offers 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 Neutrality Plan.

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, map how Crookston is meeting its climate neutrality plan and how far along it is in achieving the goal.

APPENDIX

MIDDLEBURY COLLEGE

report completed by a class

holistic approach

"many colleges and universities have begun to address the climate issue in a piecemeal fashion-eliminating wasted electricity, investing in renewable sources of electricity, improving the energy efficiency of new builidngs.etc. While these are all laudable efforts, in many cases, they overlook the synergistic relationships and potential cost savings of attacking the issue holistically. Establishing a goal of carbon neutrality for those working toward it to keep checking the "big picture" to find ways to minimize cost and effort and maximize results. A carbon neutral approach is clearly the way to demonstrate leadership in the climate issue."

"In the context of the class it was important to set the most ambitious goal possible to see the greatest possible result. For example, had we asked the class to investigate ways to reduce our footprint by 10%, the Space Heating and Cooling sector would have found sufficient reductions by replacing windows and resetting thermostats and would never have considered more massive possibilities like converting the campus heating plant to use biomass as its fuel."

logical framework-three objectives
1-reducing our GHG emitting activities
2-replacing dirty technologies with greener technologies
3-offsetting what we can't eliminate

ranking system for each strategy
each strategy explains:
timeline
magnitude of potential GHG reduction
benefits and costs
stakeholders
examples from elsewhere

organization
1_Introduction: Climate Change and Carbon Neutrality
- Key of Terms
- World View of Climate Change
- Local Context and impacts

2_Space Heating and Cooling
- reduction of oil use associated with air heating and cooling
- reduction of oil use associated with water heating

3_Electricity

reduce electricity consumed by Middlebury College

reduce the carbon emissions associated with purchased and generated (on campus) sources of electricity

offset existing carbon emissions associated with college electricity and consumption

4_Transportation

reduce vehicle miles traveled (VMT)

switch to cleaner, more energy efficient vehicles

switch to cleaner fuels

develop alternative transportation

reduce transportation needs

5_Solid Waste

reduce emissions associated with land filling

reduce campus material consumption

6_Sequestration

off campus sequestration

on campus sequestration

preservation of college forests

on campus reforestation

agricultural sequestration

7_Conclustion: Achieving Carbon Neutrality at Middlebury

Presentation of two sample carbon neutral portfolios: for fiscal years 2005-2009 and for 2010-2020. Presenting in different ways allows a range of stakeholders to begin to make conclusions about how to cost-effectively reduce our GHG impact.

institutional opportunities

organizational chart
sustainable campus and carbon neutral (SCCN) coordinator
carbon neutral sub-committee of the EC
a monthly and public and monitoring of CO2 emissions

OBERLIN COLLEGE

climate neutral by 2020
report by the rocky mountain institute

acknowledgements and thanks

1_executive summary (overall summary)
2_emissions inventory
- _table of “on campus emissions”, “off campus emissions” and “beyond the boundary” emissions which are unacceptable emissions (looking at Oberlin as a living system)
- _boundary wheels, which sectors are the most consumptive (transportation, heating etc…)
- _building type audits (sample buildings of different uses and their energy consumption)

3_emissions reduction measures
- building and systems audit
- building energy efficiency measures
- other building related greenhouse gas reductions
- transportation
- water and waste water
- landfill and garbage
- energy supply options
- _three scenarios
  - Baseline Scenario : Existing coal-fired plant
  - 1-No-Brainers Scenario: Gas-Fired replacement plant
  - 2-No-Regrets Scenario: Natural Gas-Fired combustion turbine
  - 3-No Prisoners Scenario: Hydrogen Fuel Cells
- reduction costs and benefits

4_offset options
- carbon sequestration
  - no known carbon sequestration technology besides photosynthesis (a well proven one)
- own energy and electricity projects that reduce emissions elsewhere
- green power
  - biomass, geothermal power and small hydroelectric plants
- emissions offset markets and prices
- investment strategy and timing for offset purchases
- local carbon offset options
  - tree planting, investing in Oberlin businesses and schools energy efficiency, households

5_emissions reduction scenarios 2001-2020
- methods and assumptions
- technological opportunities and assumed trajectories
- baseline “business as usual” scenario

technology changes only as result of natural progress and mandatory standards, not extensive improvements, serves as a benchmark

50% reduction: no-brainers "low hanging fruit" scenario

takes advantage of the need to upgrade facilities or replace equipment as an opportunity to install efficient replacement technology. Net cost is only the difference.

90% reduction: no regrets (aggressive energy efficiency and co-generation) scenario

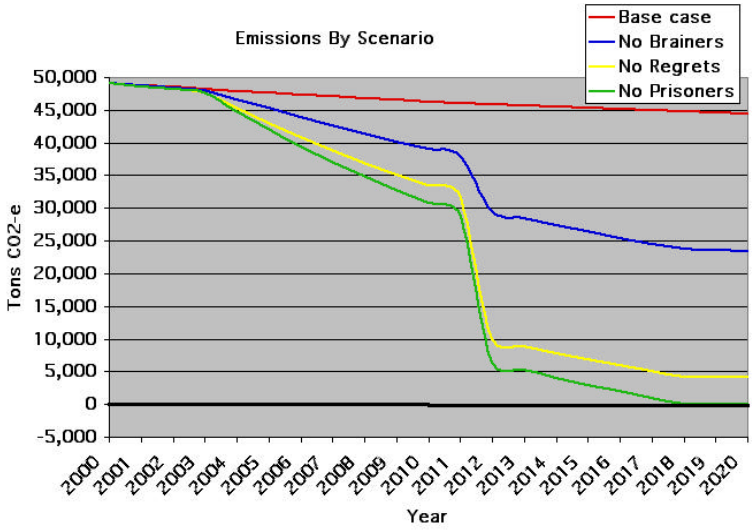
_electric chillers are mostly replaced by air-conditioning equipment that relies on absorption, desiccant and evaporative cooling technology.

_changes made opportunistically, but would require serious funding/policy changes to be supported

100% reduction: no prisoners (carbon neutral) scenario

_hydrogen fuel cell technology

_V2G: Vehicle to Grid system, using nighttime to create surplus hydrogen fuel



discussion of scenario results

discussion of assumptions and methodological issues

6_barriers and risks

barriers to energy efficiency and distributed energy sources

institutional barriers to program efficacy

risks of pursuing aggressive emission reduction goals

risks of the status quo (not reducing emissions)

_accelerated GHG emission limits which lead to mandatory emission limits

_risks to the security and reliability of energy supplies

_risk of losing Oberlin's position as an innovator and leader

7_implementation and financing mechanisms

Partnerships, tax exempt debt financing, performance contracting

8_oberlin policy initiatives

budgets and financing energy efficiency

procurement

contracts and outsourcing of utilities, operations
renewable electricity and distributed utilities
facilities and operations
_transfer of information to operators
planning and architecture
student residences: energy efficiency and fire safety
transportation and parking
_fuel cell vehicles

Conclusion

Where does Oberlin stand in the world of climate neutrality and energy use

_Three key resources are:

Strategy
Advanced Technology
Time (something not typically associated with sustainability, however over the next 20 years many campus buildings will be remodeled, many facilities will be upgraded, and almost all equipment will be replaced or refurbished.

Suggested Timeline

appendices

definitions and terms
precedents (climate projects at other colleges and universities)
Oberlin College GHG inventory

CORNELL CLIMATE ACTION PLAN

Website based-allows for a lot of transparency and opportunity for education and involvement

Process

View our planning process by stages

Profile the situation

_creation of the forecast model, built from the GHG report, was a model compared with the Business-As-Usual Cornell which decisions were assessed from.

Solicit ideas: 706 Ideas Generated

_"Wedge Groups" formed:

Green development
Energy Conservation
Fuel Mix and Renewables
Transportation
Carbon Offsets

_created a web-based form that the entire community could use to generate 706 ideas

_Ideas screened to determine if they fit with the university mission and then were:

accepted into a "theme" for future analysis or
eliminated and placed in the "compost"
parked for future consideration in the "bike rack"
identified as potential research or development "test tube rack"

Screen ideas: 114 Themes Identified

19 actions endorsed

Implement the Actions

Inventory

Establishing our carbon footprint

Forecast

Projecting Greenhouse Gas Reduction Through 2050

Actions

19 initiatives to achieve net-zero emissions

Culture Change

Get informed Get Involved