UWSP Carbon Neutrality Plan

Adopted December 22, 2011

About this Report

This report is the culmination of effort by the UW-Stevens Point Sustainability Taskforce and was compiled by the Campus Sustainability Coordinator, Shelly Janowski. It is intended to be a living document that will grow and change with the goals of the campus over time. It represents campus potential as well as its accomplishments and while it does catalog effort and progress, it is not, and was never intended to be a fully inclusive document.

The Sustainability Taskforce respectfully submits this report to Chancellor Bernie Patterson for his consideration and approval on December 22, 2011.

Charge of the Sustainability Taskforce

The UW-Stevens Point Sustainability Taskforce was created to achieve the goals set forth in the Chancellor's Climate Commitment. This climate action plan was developed by the taskforce to comply with the requirements of the American College and University President's Climate Change Commitment (ACUPCC).

2011-12 Sustainability Taskforce

Susan Crotteau, Assistant Director Centers Operations
Samuel Dvorak, Student Government Assn. Environmental & Sustainability Issues Director
Anna Haines, Director Center for Land Use
Katie Hardy, Residence Hall Association Officer
Shelly Janowski, Sustainability Coordinator
Scott Johnson, Director Central WI Environmental Station
Lizzy Lepinski, Student Sustainability Coordinator
Rob Manzke, Executive Assistant to the Chancellor
Bob Oehler, Facility Services Director
Michael Reisner, Energy Policy Professor
Jasia Steinmetz, Health Promotion & Human Development Professor
Mike Zsido, Assistant Director Residential Living Bldg. Services

Energy Sub-Committee

Tom Brown, Interior Architecture Lecturer
Pat Bruckhart, Community Member
Sam Dvorak, Student Government Assn. Environmental & Sustainability Issues Director
Shelly Janowski, Sustainability Coordinator
Jennie Lane, Director K-12 Energy Education Program
Bob Oehler, Director Facility Services
Gary Oudenhoven, Wisconsin Public Service Representative
Michael Reisner, Energy Policy Professor

Sustainability Task Force and Subcommittees – Past Members

John Blakeman, Political Science Professor
Michael Demchik, Forestry Professor
Robert Govett, Wood Lab Professor
Paul McGinley, Water Resource Scientist
Eric Olson, Director, UW-Extension Lakes
Scott Trzebiatowski, IT Technical Support Specialist
Carrie Ziolkowski, Energy Education Program Coordinator

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EXECUTIVE SUMMARY

UWSP has pledged sustainability by becoming a signatory of two of the most important documents for universities regarding a commitment to sustainability, the Talloires Declaration and the American College and University President's Climate Change Commitment (ACUPCC). In the fall of 2007, the UWSP Sustainability Task Force was created to achieve the goals set forth in the Chancellor's Climate Commitment. Goals of the Sustainability Task Force included completing a greenhouse gas inventory, selecting actions to reduce greenhouse gas emissions, and establishing a climate neutrality action plan. These goals will be revisited and updated by campus leadership or through Chancellor's designee every two years in accordance with the commitment.

The university strategic plan and campus master plan both played key roles in developing management strategies for energy, transportation and waste. By managing our energy use, waste reduction and transportation options, we will be able to meet our carbon neutrality goal.

Based on state energy initiatives and mandates, the University of Wisconsin Stevens Point will focus on the following eleven energy strategies: 1) conservation, 2) hiring a dedicated energy manager, 3) existing building retrofits, 4) new building design, 5) computing, 6) lighting, 7) renewable energy options, 8) co-generation, 9) sustainability reserve fund, 10) purchasing policy and 11) renewable energy purchases.

In order to achieve sustainable waste management, the university must 1) eliminate or minimize certain types of waste (source reduction), 2) increase its resource recovery efforts, 3) advance its composting effort, 4) commit to 100% natural lawn care 5) improve reuse strategies 6) continue with E-waste management and 7) perhaps explore waste-to-energy opportunities.

Each direct transportation source - fleet services, commuting and air travel – has several possible solutions for reducing carbon emissions. They include 1) a reduction in student commuting, 2) a reduction in faculty and staff commuting to campus, 3) an increase in the percent of the population that uses alternative transportation, 4) a decrease in single occupancy vehicles, 5) a reduction of miles traveled for official business by faculty and staff, 6) a reduction in emissions associated with fleet operations, 7) 100% offset of air travel for faculty and staff, and 8) 100% offset for air travel for international student travel.

In addition to reducing our carbon emissions, we must also increase the level of carbon offsets. Examples include on-campus carbon sinks – like composting and managed forests, off-campus institution-funded carbon reduction projects, and the purchase of "green electricity". The purchase of green energy and renewable energy credits should be a minor initiative towards achieving carbon neutrality.

We are using the baseline of 43,572 metric tons of eCO2 to measure and benchmark our emissions reductions against. It is our goal to reach carbon neutrality by the year 2050.

STRATEGIC PLAN

The university's strategic plan is driven by the institution's mission and guided by its vision and core values. Our mission: "Through the discovery, dissemination and application of knowledge, UWSP stimulates intellectual growth, provides a liberal education, and prepares students for a diverse and sustainable world". We will uphold our mission, honor our values and realize our vision through strategic themes, goals, and action steps.

Several of the themes and goals of the strategic plan give direction to the creation of our carbon neutrality plan. They include:

- Valuing "ecological stewardship"
- Advanced learning that cultivates an inclusive and ecologically responsible world view among all constituents by promoting the values of ecologically responsible stewardship in curriculum and programs
- Enhance living by providing a campus culture that encourages engagement, responsibility, respect, and inclusivity
- Enhance living by developing sustainable relationships between the university and its partners-local, state, regional, national, and global.
- We shall develop and leverage physical resources through 1) maintenance of a master plan which establishes sustainable use of physical facilities; and 2) establish a sustainability plan for energy, materials, recycling, facilities and usage/schedule.

MASTER PLAN

The 2006 campus master plan will guide campus development for the next 15 to 20 years. It identifies three primary themes for creating a distinct, functional and aesthetically pleasing campus. These themes support the mission of campus and include:

UWSP is a Sustainable Campus: Home to one of the premier natural resource programs in the country, UWSP is committed to sustainability and has expressed interest in taking that commitment to a higher level. Potential opportunities identified included reducing the amount of impervious surface area; using innovative stormwater management systems; planting native species; encouraging dense, human-scale land use patterns; using 'green' architectural design and interior building functions; reducing imported/produced energy and the levels of its consumption; and promoting alternative transportation and attitude toward parking. The campus will serve as a national model for how a university can conduct daily life, growth and development in an environmentally conscious manner.

UWSP is a 24/7 Campus: The master plan seeks to make this campus an engaging environment to support active learning and living. The master plan proposes key new places and facilities, including a multipurpose sports complex, a new student services center, new academic buildings and unique outdoor spaces to create a vibrant destination for a high quality academic experience.

UWSP is a Wellness Campus: The master plan promotes a healthy lifestyle for students and staff of the university. Wellness is an important aspect of the culture and development of the campus. Wellness initiatives reinforce sustainability by creating places for active and passive recreation, walking and bicycling. In addition, good design and art stimulate the senses and intellect, and support good emotional health. Providing for and supporting wellness opportunities are core values of UWSP.

The university strategic plan and campus master plan both played key roles in developing management strategies for energy, transportation and waste. By managing our energy use, waste reduction and transportation options, we will be able to meet our carbon neutrality goal.

GREENHOUSE GAS INVENTORY

The initial inventory of greenhouse gas emissions was developed using the Clean Air-Cool Planet (CACP) Campus Carbon Calculator (Version 5.0). Data from a variety of campus sources was combined with utility information to estimate the emissions from 1996 through 2007. The Campus Carbon Calculator follows protocols developed by the Intergovernmental Panel on Climate Change (IPCC) and reports the impact of all the gases in terms of an equivalent
amount of carbon dioxide based on their relative global warming potential. The emission calculations are based on worksheets developed by IPCC.

Institutional data that was collected and entered includes budget figures for operating expenses, research dollars and energy costs, population data for students, faculty and staff, and building space. Energy data entered includes purchased electricity and on-campus stationary sources of emissions, which include oil, natural gas, coal and paper pellets used in the heating plant (UWSP does not operate a co-generation plant). Transportation data includes (or was extrapolated from, in the case of commuter data) statistics from the university fleet vehicles, air travel miles, and faculty/staff and student commuter data. Fertilizer application is included under the agriculture section; UWSP does not have any animal agriculture information to report. Under the solid waste section, the quantity of waste sent to the landfill is reported. Chemical and refrigerants replaced, due to maintenance and leaks are reported. The emissions associated with fertilizers, solid waste and refrigerants were very small compared to all other emissions. Lastly, actions taken to offset greenhouse gas emissions are reported in the offsets section of the input sheet. UWSP offsets include renewable energy credits, which are purchased through Wisconsin Public Service, composting efforts, and carbon sequestered due to forest preservation.

Although the inventory is a detailed estimate of UWSP emissions, it does not include emissions associated with products that are manufactured elsewhere and then used on the UWSP campus. Examples include the energy used to pump water that is provided by the Stevens Point Water Utility or the energy used in manufacturing white board markers that are purchased by the University. These "embedded" or "embodied" emissions represent a portion of the campus carbon footprint, and may be included in the future, but they are not part of the Carbon Calculator nor are they required components of the ACUPCC inventory.

The principal greenhouse gases emitted by UWSP are carbon dioxide, methane, nitrous oxide and fluorinated gases. These gases absorb and trap heat at the earth's surface. These gases can be released from many activities. Carbon dioxide is released when fuels such as coal, oil, wood and natural gas are burned. Methane is released in the production of fossil fuels and by decomposing waste in landfills. Nitrous oxide is also released during fuel consumption and from fertilizers. Fluorinated gases such as hydrofluorocarbons and perfluorocarbons can be released through operation and maintenance of refrigeration equipment. Many activities at UWSP can lead to the release of these greenhouse gases.

The greenhouse gas inventory includes the main UW-Stevens Point campus and several off campus, non-contiguous properties. The main campus occupies 400 acres and contains thirty five different buildings. Thirteen of the buildings are residence halls that house approximately 3,100 students. Several of the main campus buildings, such as the Dreyfus University Center and the Noel Fine Arts Center have been renovated in the last five years. Others, such as Old Main and Nelson Hall are more than ninety years old.

UWSP greenhouse gas emissions were calculated in six different sectors: 1) purchased electricity; 2) stationary on-campus emissions from heating and cooling; 3) transportation; 4) emissions from agriculture and fertilizer application; 5) emissions associated with decomposition of landfilled waste; and, 6) emissions associated with the loss of refrigerants on campus.

Figure 1 shows the total carbon dioxide equivalent (eCO2) emissions for UWSP between 1996 and 2007 in these six sectors. The carbon dioxide equivalent or eCO2 is a measure used to compare emissions from various greenhouse gases based upon their global warming potential (GWP). Carbon dioxide equivalents are commonly expressed as "metric tons of carbon dioxide equivalents" (MTCDE).

Because the data used to make these estimates is not uniform across all of the years, some caution must be exercised in using these estimates to examine trends over time. For example, air travel was included in the transportation sector, but data was only available for the last two years. That is one reason for the apparent increase in emissions from transportation in 2006 and 2007.

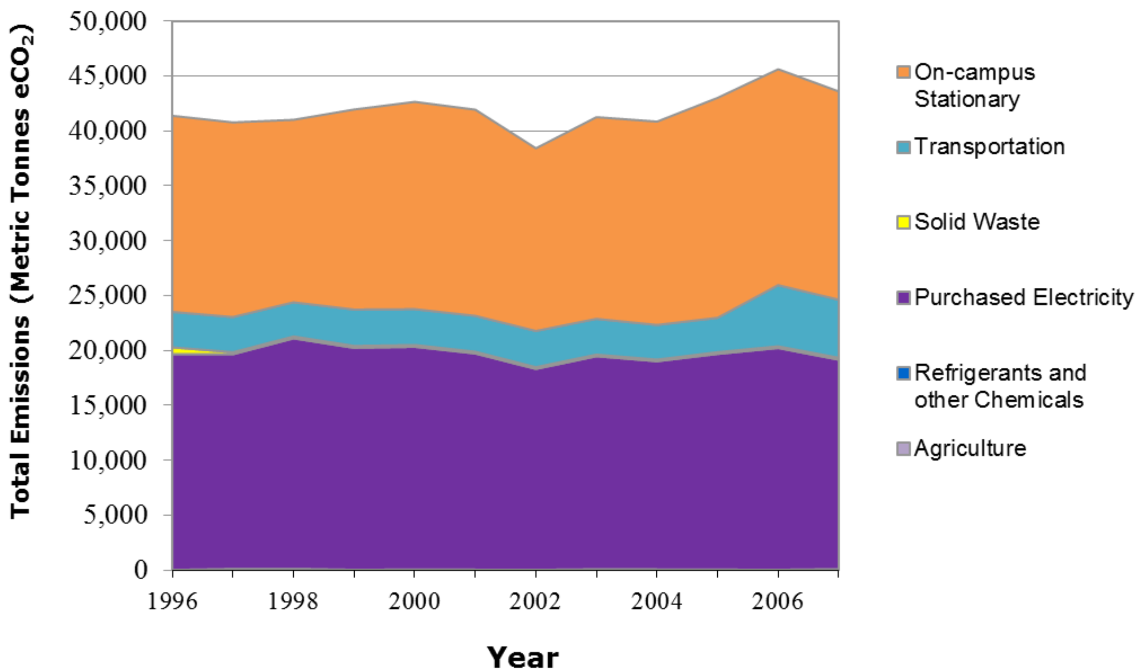


Figure 1 Total greenhouse gas emissions by sector

Table 1 shows total emissions for UWSP for 2007 at 43,572 metric tons of eCO2. Based on these estimates, the largest carbon sources are the purchased electricity at 44% of the total emissions (19,071 metric tons), stationary on-campus fuel use for steam generation for heating and cooling at 44% (18,962 metric tons), and transportation at 12% (5,283 metric tons). Agriculture, solid waste and refrigerant emissions total less than 1%. The preliminary emissions estimates are useful for assigning this general ranking to the different sources.

UNIVERSITY	University of Wisconsin Stevens Point							
Select Year -->	2007	Energy Consumption	CO_2	CH_4	N_2O	Other Chemicals	eCO_2	eCO_2
		MMBtu	kg	kg	kg	kg	Short Tons	Metric Tonnes
Purchased Electricity		201,899	19,025,644	77	146		21,021	**19,071**
Purchased Steam/Chilled Water		-	-	-	-		-	-
Stationary Sources		246,466	18,849,885	2,041	219		20,901	**18,962**
	Non Co-Gen	246,466	18,849,885	2,041	219		20,901	**18,962**
	Co-Gen Electric	-	-	-	-		-	-
	Co-Gen Steam	-	-	-	-		-	-
Transport Total		54,809	5,199,571	624	232		5,823	**5,283**
	University Fleet	5,036	354,782	65	23		400	**363**
	Student Commuters	15,179	1,067,966	202	70		1,205	**1,093**
	Faculty/Staff Commuters	23,916	1,679,032	335	115		1,897	**1,721**
	Air Travel	10,677	2,097,790	21	24		2,321	**2,105**
Agriculture Total		-	-	-	60		20	**18**
Solid Waste		-	-	7,745	-		196	**178**
Refrigeration						-	67	**61**
Total		**503,174**	**43,075,100**	**10,486**	**657**	**-**	**48,029**	**43,572**
Offsets							**(10,161)**	**(9,218)**
	'Green' Electric Credits						**(2,526)**	(2,292)
	Composting						**(8)**	(7)
	Forest Preservation						**(7,627)**	(6,919)
Net Emissions							**37,868**	**34,354**

Table 1 Annual greenhouse gas emissions for 2007

The greenhouse gas emissions calculations provide a framework for establishing baselines and identifying and prioritizing actions to approach climate neutrality. Although the data entered is accurate to the best of our knowledge, some assumptions and estimates were made. Therefore, this baseline may change with further analysis and adjustment. Changes over time are likely to be relatively small unless there are changes to energy use and fuel sources.

ENERGY MANAGEMENT

The greatest sources of carbon emissions at UW-Stevens Point are purchased electricity at 44% of the total emissions (19,071 metric tons) and stationary on-campus fuel use for steam generation for heating and cooling at 44% (18,962 metric tons). It is imperative that we develop and implement a plan that will permanently eliminate our carbon emissions. The plan will incorporate guidelines regarding the selection of utility purchases, and guide the design, upgrade and repair of new and existing facilities.

The energy plan at UWSP is based on several state policies; the State of Wisconsin Energy Use Policy, and the Sustainable Facilities and Energy Conservation Policies found in the State of Wisconsin Building Commission Policy and Procedures Manual, section VI. Additional programs and state legislation direct our energy plan. All these initiatives are described below.

The State of Wisconsin Energy Use Policy is intended to reduce the use of energy from fossil fuels and other sources in order to manage utility budgets and reduce generation of air emissions from fossil fuels in state owned and leased facilities. Agency heads, building users, managers, physical plant staff and facility designers share the responsibility for achieving this goal. Reducing energy usage in state government helps state agencies to manage utility budgets and reduce the demand for fossil fuels and generation of related air emissions.

The purpose of the Sustainable Facilities Policy is to promote the planning, improvement and management of state facilities in a sustainable manner that:

- Promotes the effective use of existing state space
- Respects the larger environmental and social context into which they fit

· Promotes human health, comfort and performance

· Conserves natural resources and reduces detrimental effects on the environment;

· Ensures energy efficiency

· Considers the life-cycle cost of initiatives

The purpose of the Energy Conservation Policy is to support an aggressive energy conservation program to reduce consumption and achieve optimum energy efficiency in state facilities. To achieve this goal all new facility, remodeling, and energy improvement projects must incorporate energy efficient materials and equipment, utilize methods of energy recovery and other energy saving concepts where practical and cost effective. Existing energy using systems must also be properly maintained for efficient operations.

A variety of tools are provided in the policy, including energy design guidelines, energy conservation funding, economic evaluation criteria, operations and maintenance programs, and optional energy conservation audits performed by private contractors.

The Clean Energy Wisconsin plan is a comprehensive strategy developed in 2006 to secure Wisconsin's clean energy future. It is a plan for energy independence, which set the following goals:

- *25 by 25* - Generate 25 percent of our electricity and 25 percent of our transportation fuel from renewable fuels by 2025. This goal will be accomplished through increasing production of renewable fuels and power, and improving the deployment of energy-efficient technologies.
- *10 percent of Renewables Market* - Capture 10 percent of the market share for the production of renewable energy and bioproducts.

- *Research Leadership* - Become a national leader in groundbreaking research that will make alternative energies more affordable and available to all – and to turn those discoveries into new, high-paying jobs for Wisconsin workers.

Executive Order 132 issued by then Governor Jim Doyle in November 2005 *Relating to Winter Heating Season Energy Conservation Measures for Facilities Owned by the State of Wisconsin* directs state agencies to take immediate steps to reduce energy consumption at state facilities. Guidelines are set related to temperature, humidity, business/non-business hours of operation and other variables that affect energy usage.

- Hold energy use to the minimum level possible
- Issue energy conservation guidelines
- Promote employee awareness and understanding of conservation measures.

Executive Order 141 issued in March 2006 *Relating to Increased Utilization of Renewable Fuels in Vehicles Owned and Operated by the State of Wisconsin* directs

- all state agencies reduce the use of petroleum-based gasoline in state-owned vehicles by twenty percent (20%) by 2010 and by fifty percent (50%) by 2015, and reduce the use of petroleum-based diesel fuel by those vehicles ten percent (10%) by 2010 and twenty five percent (25%) by 2015;
- develop an awareness plan designed to facilitate usage of renewable fuels in the State's flex fuel vehicle fleet
- actively pursue the establishment of additional renewable fuel refueling facilities at public retail outlets

The 2005 Wisconsin Act 141: *Energy Efficiency, Renewable Resources, and Energy Policy* established a more ambitious Renewable Portfolio Standard (RPS). With regard to energy used in state facilities, the act:

- Established goals for the purchase and use of renewable energy by the six state agencies that consume the great majority of electricity purchased by the state. By the end of 2007, 10% of the electricity purchased by the state be derived from renewable resources and, by the end of 2011, 20% be derived from renewable resources.
- Directs the same six agencies to biennially prepare energy cost reduction plans that include life cycle analysis to determine cost effectiveness of equipment.
- Established energy efficiency standards for equipment installed in state buildings.
- Ensures that geothermal technologies are used for space and water heating in all state building projects, to the greatest extent cost-effective and technically feasible.

April 2006 Executive Order #145 *Relating to Conserve Wisconsin and the Creation of High Performance Green Building Standards and Energy Conservation for State Facilities and Operations* gives direction for:

- Sustainable Construction of New Facilities,
- Sustainable Facility Management Operations,
- Energy Conservation goals (20% energy use reduction per square foot by June 30, 2010)
- Establish a performance based contracting program
- Ensuring energy efficiency in all new facilities (New construction 30% more efficient than commercial code)
- Energy Procurement - Audit energy bills, Consolidate accounts, Verify utility meters

In April, 2007 the Governor established a Task Force on Global Warming through Executive Order 191. The Task Force's final report to the governor, entitled "Wisconsin's Strategy for Reducing Global Warming," was released in July 2008. In the report, the Global Task Force recommends that the state reduce GHG emissions to 2005 levels by 2014, 22% below 2005 levels by 2022, and 75% below 2005 levels by 2050.

Executive Order 192 created the Wisconsin Office of Energy Independence to support the state's goals for a clean energy future through the "25 by 25" initiative. The goals of this initiative include:

- Generate 25% of electricity and 25% of transportation fuel from renewable sources by 2025
- Capturing 10% of the market share for renewable energy and bioproduct production
- Becoming a national leader on research to make alternative energies more affordable and accessible, and using the findings to create new jobs in the state

FOUR CAMPUSES "OFF THE GRID"

In 2006, four University of Wisconsin campuses were tasked with the then Governor's five year pilot effort designated as the "Off the Grid Campus" program. The campuses participating in this sustainability initiative are UW Green Bay, UW Oshkosh, UW River Falls, and UW Stevens Point. They comprise eight million gross square feet of building space with weighted average energy use of 139,188 Btus/s.f. of annual energy use based on FY 2005 consumption.

The definition of "off-the-grid" adopted 10/20/2008 states that "*by 2012, each campus will reduce its carbon dioxide (CO_2) emissions equal to the emissions produced by its*

2005 electric consumption." Applying this definition the four campuses need to reduce greenhouse gas emissions by a combined 74,500 tons of CO_2 per year.

The general strategy towards accomplishing this emission reduction goal is as follows:

Energy Reductions:

- Electric Conservation 30%
- Heating Fuel Reduction 20%
  - Coal or Natural Gas

Renewable Energy Utilization:

- Renewable Energy Purchases 30%
- Renewable Energy Systems (on site) 20%

An integral part of this strategy is to emphasize energy conservation as a top priority. The investment in costly renewable energy sources will be greatly reduced by improving operating efficiency, reducing energy loads, and eliminating energy waste. Energy consumption trends are typically reduced in the range of 30% to 50% through a good energy conservation plan.

All State of Wisconsin owned facilities are required to reduce energy consumption by 20% and utilize 20% of electrical power from renewable sources by 2010. **This off-the-grid program requires the four campuses to be at or near a 50% level in each energy management category.**

The Department of Administration will directly purchase 20% of electrical power used by all state facilities from renewable sources, which counts towards the off-the-grid program. Therefore, **these four campuses are typically expected to purchase**

another 10% or more through their own initiatives and then pursue on-site renewable energy projects to the extent they are economically feasible.

A table summarizing all the state energy initiatives is found in the appendices section.

University energy consumption data, similar to the university's carbon emissions inventory, includes the main UW-Stevens Point campus and several off campus, non-contiguous properties. The main campus occupies 400 acres and contains thirty five different buildings. Thirteen of the buildings are residence halls.

Due to accounting challenges, the scope of the energy consumption data collected by the State of Wisconsin includes only the major facilities. All forms of energy consumption are converted to units of Btu/GSF/year. The conversion also removes any variation in energy use over time caused by changes in the size of an individual facility. Therefore, there will be variances between UW-Stevens Point energy data records compared to energy consumption data reported by the State of Wisconsin.

The following table and graph is from the "Energy Use in State Facilities" fiscal year 2010 report for the Stevens Point campus, which was prepared by the Wisconsin Department of Administration, Division of State Facilities, Conserve Wisconsin.

		BTU/GSF				Weather-Adjusted			
Fiscal Year	**GSF**	**Thermal**	**Electricity**	**Total**	**% Change from FY05**	**Thermal Adjusted to FY05**	**Electric Adjusted to FY05**	**Total Adjusted Btu/GSF**	**Adjusted % Change From FY05**
FY05	2,335,965	128,082	36,054	164,136	0.0%	100.0%	100.0%	164,136	0.0%
FY06	2,460,496	119,379	35,690	155,069	-5.5%	104.7%	99.7%	160,596	-2.2%
FY07	2,460,496	113,304	34,134	147,438	-10.2%	102.4%	99.9%	150,076	-8.6%
FY08	2,493,729	118,947	34,919	153,866	-6.3%	95.6%	100.3%	148,746	-9.4%
FY09	2,493,729	119,936	33,824	153,759	-6.3%	93.3%	100.9%	146,070	-11.0%
FY10	2,453,362	108,706	34,311	143,018	-12.9%	98.7%	100.1%	141,635	-13.7%

Percent Change from Base (BTU/GSF)

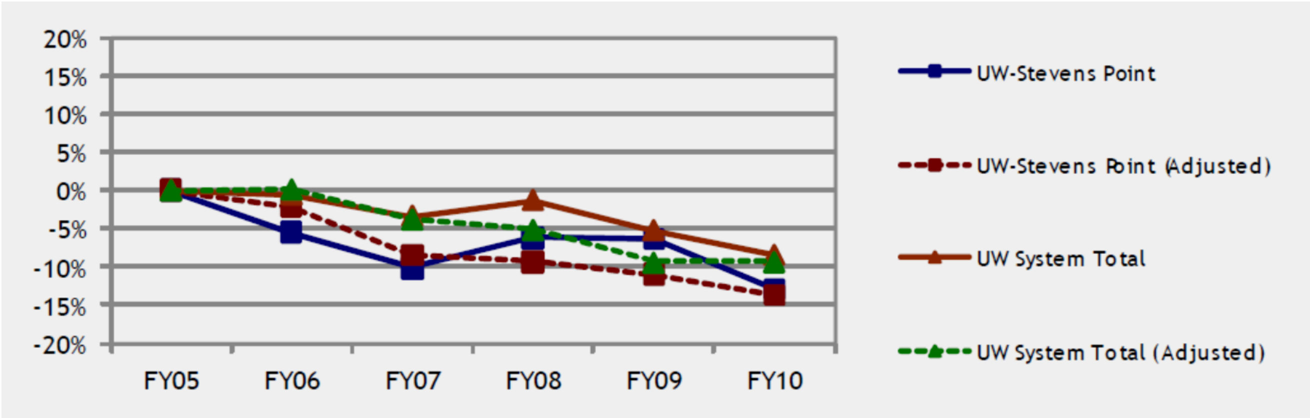


Figure 2 Conserve Wisconsin 2010 Energy Use Report

ENERGY CONSERVATION AND EFFICIENCY STRATEGIES

Based on state energy initiatives and mandates, the University of Wisconsin - Stevens Point will focus on the following eleven energy conservation and efficiency strategies that are also outlined in more detail below: conservation, hiring a dedicated energy manager, existing building retrofits, new building design, computing, lighting, renewable energy options, co-generation, sustainability reserve fund, purchasing policy and renewable energy purchases.

1. Conservation: UW-Stevens Point will reduce energy use through:
    - behavior change; education and awareness
    - encourage and support student driven energy and sustainability initiatives, such as energy competitions, the Eco-Fair, the Eco-hall and Greenest Resident Room, campus garden, vermiculture-worm composting, Green Advocates, move-in and move-out recycle/reuse program
    - peak demand awareness
    - curtailment; scheduled building shutdowns
    - temperature setbacks and building automation scheduling
    - charging departments for usage to encourage conservation

- integrate energy conservation projects into the Energy Policy minor for students to work on and gain hands-on experience
- work with Faculty Senate to get energy projects supported by them
- install an energy dashboard to engage, educate and motivate staff and students to conserve energy

2. Develop a position for a dedicated Energy Manager, whose role is focused on finding system deficiencies through continuous investigative work, measurement, engineering, writing project requests, payback, problem solving, verification of savings, and energy/utility projects management in an attempt to complete efforts that decrease emissions and cost across the campus infrastructure and facility portfolio.

3. Existing building retrofits:

   The University of Wisconsin-Stevens Point campus facilities are owned by the State of Wisconsin and operate under the Department of State Facilities. Administratively, the campus functions under the leadership of the University of Wisconsin System. As part of the UW-System, infrastructure improvements, utility projects, capital renewal, and to a large degree, deferred and regular maintenance, are not in the control of the campus exclusively. Funds for the aforementioned are requested through an all-agency, state-wide prioritization effort. Also, in addition to the budgetary cue for projects and funding, the campuses must also demonstrate a specified payback prior to submission. Often, these projects require survey work as well as engineering/design and other services that are not organic to the campus.

   One costly option to remedy campus energy challenges is through the use of an Energy Service Company (ESCO) that would be hired to analyze energy conservation measures (ECM) and other options, perform payback calculations, explore cost savings and funding opportunities, manage energy projects through to completion and verify savings afterwards. Please visit the WI Department of Administration website for information on performance contracting. http://www.doa.state.wi.us/category.asp?linkcatid=858&linkid=135&locid=4

- Specific ECMs have been identified in several studies completed for the campus. They include:
    - Lighting control upgrades
    - Outdoor lighting fixture retrofit
    - Lighting fixture retrofit
    - Exhaust hood projects and air handler improvements
    - Fume hood decommissioning
    - Exhaust heat recovery
    - Install VAV hoods
    - Heating and cooling pump projects
    - Steam system repairs
    - Compressed air survey
    - Chilled water efficiency projects
    - Energy Management System Direct Digital Control
    - Demand Side Ventilation
    - Optimal Start Sequence on Air Handler Systems
    - Swimming Pool Water and Air Temperature Modifications
    - Replace Steam Traps
    - Envelope Improvements

4. New building design:

   The Wisconsin Division of State Facilities is responsible for managing the state's real estate portfolio. The State Building Commission, through the "Wisconsin Energy Initiative", supports an aggressive energy conservation program to reduce consumption and achieve optimum energy efficiency in state facilities. To achieve this goal **all new facility, remodeling, and energy improvement projects** must incorporate energy efficient materials and equipment, utilize methods of energy recovery and other energy saving concepts where practical and cost effective. Existing energy using systems must also be properly maintained for efficient operations.

Energy conservation features included in state facilities should significantly reduce energy consumption at an optimum investment of state funds. Improvements must also be compatible with the functional program, provide savings over an extended period of time, and take into account the net energy balance. UW-Stevens Point adheres to the Division of State Facilities Sustainable Facilities Standards.

5. Computing
   A. Datacenters
      1. Combine datacenters:
         - Look at phasing out smaller datacenters rather than trying to upgrade
         - Investigate alternate options for equipment instead of locations like mechanical rooms or storage closets
      2. Improve datacenter efficiency:
         - Add economizer cooling, multi-stage compressors, water loops, etc. to locations that do not have it.
         - When multiple AC units have been added, like in the LRC 004 datacenter, allow them to work together at high efficiency to cool the spaces. Currently, they do not "talk" to each other and may have one cooling at high power consumption while the other feels cold and wants to add heat.
         - Investigate tying economizer cooling cold water loop into central chiller plant via heat exchanger for summer cooling
         - Utilize DX units as fallback or for when cold water supply is unavailable

- Upgrade the datacenters to row-oriented cooling from room-oriented cooling by utilizing hot aisle design

3. Reduce datacenter demand
   - Combine: Reduce the number of single purpose systems and combine systems of similar purposes across organizations
   - Modernize: New systems can be upwards of ten times the capacity as older systems at the same power consumption
   - Virtualize: (multiple virtual computers within physical computers) 25 to 1 is possible.

B. Non-datacenters

1. Workstation power management
   - Put machines to sleep when not in use
   - Do not have data on workstations to eliminate the need to wake them up to back them up or retrieve data. This should also allow for better overall data availability and may recover the cost in other areas.
2. Printing changes
   - Fewer printers/phase-out desktop printers unless a business case can be shown.
   - Switch away from printers with a lot of consumable parts. Some printers just use bottles of toner rather than replacing much of the mechanics of the device when adding ink. Should be more green since it disposes of less plastic per page and often is less costly in the long term.
3. HVAC upgrades
   - Improve airflow in hot locations, like computer labs.
   - When local AC units have been added, integrate their controls so they do not compete with the building HVAC.

4. Recyclable batteries stocked in IT for use in clickers, etc.
5. Modernize
    - Replace monitors/TVs with LED instead of CRT, etc.
    - Many old printers do not have green/sleep modes

6. Lighting
    - Maintain and expand "dark sky" lighting policy.
    - Reduce outdoor lighting intensities to the minimum required for each site.
    - Replace all campus site lighting with the most efficient practical fixtures.

7. Renewable energy

    A. Solar:

    Current sources of renewable energy produced on campus include photovoltaic panels on the Noel Fine Art Center and thermal solar panels on Pray-Sims, Knutzen and Neale residence halls and Suites@201 Reserve Street. Solar panels are stored on the roof of the Health Enhancement Center, but were never connected to be made functional.

    A non-residential solar thermal and photovoltaic site assessment was done in 2008 to provide unbiased site-specific information on solar performance options at UWSP. Advantages and disadvantages of siting options were provided in the final report.

    Thermal solar panels on additional buildings will reduce the electricity needs required to heat water for domestic purposes.

    B. Wind:

Two wind assessments have been completed for the university; the first done in 2005 by Wisconsin Focus on Energy, and a second in 2009 by North Wind Renewable Energy to assess placing a wind turbine on the radio tower.

The 2005 assessment noted several locations where a small turbine could be sited on campus. The turbine would not offset a significant amount of electricity, but would make a suitable demonstration project. Please see the appendices section for the 2005 assessment.

A full site assessment report was never produced for the radio tower effort, in order to save the Student Government Association the cost associated with the report. North Wind Renewable Energy determined the site was unsuitable for wind, both in terms of physical space and wind resource. The land space was too small, wooded and dominated by the radio tower itself and the spinning turbine blades will cause radio interference if the blades are in a path between the transmitting antenna and the FM radio receiver. Radio towers are not meant to hold things like wind turbines unless they are engineered to do so at the time they are built, however, installing a separate tower was deemed impractical because of the relatively poor wind resource, financial payback was poor.

C. Geothermal

Per the 2008 UW-Stevens Point Campus Energy Independence Study performed by Stanley Consultants, Inc., large scale geothermal cogeneration plants use heat from the Earth's crust to generate steam for running turbines. A small scale application for geothermal energy is ground source heat pumps that use a refrigeration cycle to transfer heat to and from the ground. The probability of a useful amount of ground heat for geothermal cogeneration is minimal in Wisconsin. The cost of exploratory studies would be difficult to justify. Also, ground-source heat pumps would not be justified at UWSP due to the short cooling season in Wisconsin.

D. Ice Thermal Storage

Thermal storage was an energy conservation opportunity identified by Stanley Consultants, Inc. as reported in their 2008 UW-Stevens Point Campus Energy Independence Study. "Thermal storage moves cooling load generation from using peak electric rates during the day to take advantage of off peak electric rates at night. Thermal storage is cooling the chilled water and storing it in a storage tank or as ice during the night and circulating the stored chilled water or running the chilled water through the secondary loop during the day. The primary benefit of thermal storage is typically economic. Without thermal storage, chillers are usually not operating during the night when the electric rates are more favorable. They increase their output through the day until a peak in the afternoon and then decreases until they are no longer needed and turned off for the night again. This cyclic process usually follows the outside ambient temperature. Since the peak cooling load usually occurs at the same time as peak electrical rates, there is an added cost savings benefit to displacing the peak cooling load. There are also energy conservation advantages. Thermal storage can reduce the runtime of the chillers at partload when the chillers are less energy efficient. The cooling load is generated operating the chillers at full of their most efficient flow rate."

E. Biofuel

- Convert existing solid fuel boilers to 100% biomass pellets with syn-gas or bio-methane overfiring.

- Purchase pipeline quality bio-methane to replace natural gas use. Bio-methane sources include landfills, municipal solid waste, manure, compost, agricultural waste digestion systems, etc.

- Maximize use of Renewable Fuel allowed under existing Air Operating Permits. Approximately 30% of the annual boiler fuel use at UW-Stevens Point could be replaced with wood and paper pellets.

8. Co-generation

   Per the 2008 UW-Stevens Point Campus Energy Independence Study performed by Stanley Consultants, Inc., co-generation, or combined heat and power (CHP), is a major consideration when investigating options to reduce UW-Stevens Point dependence upon fossil fuels because of the improved efficiencies that can be achieved over separate electrical power and heating systems. CHP is the simultaneous production of electricity and useful thermal energy at or near the point of use.

9. Student Government Association Sustainability Reserve Fund

   The Sustainability Reserve Fund was established in 2004 and can be utilized by any student organization, or individual, for sustainability-related projects or campaigns. Following is the criteria to use the reserve funds:

   - Initiatives must be on campus property
   - Submit completed applications to the SGA Environmental & Sustainability (E&S) Committee
   - SGA Finance committee shall hear projects endorsed by the E&S committee and consider the value of each request as it relates to overall campus sustainability
   - SGA Finance submits recommendations to senate for approval

The Sustainability Task Force and the SGA Environmental and Sustainability Issues Director and E&S committee will work on a better process for developing sustainability projects paid for the SGA Sustainability Reserve fund.

10. Purchasing Policy

The University of Wisconsin-Stevens Point is committed to the use and purchase of environmentally and socially responsible materials and products. These procurement decisions amend economic criteria with strong commitments toward environmental and social responsibility.

Recognizing our impact as a major purchaser of goods and services, The University of Wisconsin-Stevens Point gives preference to environmentally friendly products whose quality, function, and cost are equal or superior to more traditional products. This policy will:

- conserve natural resources
- minimize pollution
- **reduce the use of water and energy**
- eliminate or reduce environmental health hazards to workers and our community
- support strong recycling markets
- reduce materials that are land filled
- increase the use and availability of environmentally preferable products
- reward vendors who reduce environmental impacts in their production and distribution of systems or services
- create a model for successfully purchasing environmentally preferable products that encourages other purchasers in our community to adopt similar goals
- support locally produced goods and services
- educate ourselves, our vendors, and our end users

Goals of our purchasing policy include:

1. Maintain high environmental standards
2. Integrate a Closed Loop Supply Chain
3. Integrate High Environmental Standards into Buildings and the management of Facilities
4. **Research and Procure Alternative Energy:**
   To conduct research and procure alternative energy from reliable, certified alternative energy suppliers.
5. Safety

11. Renewable Energy Purchases

A. 2005 Wisconsin Act 141 states that by the end of 2007, 10% of the electricity purchased by the state be derived from renewable resources and, by the end of 2011, 20% be derived from renewable resources. The chart below shows historical and projected renewable electric purchases. The 2012 projection figure was determined by the UW-Stevens Point sustainability coordinator and the UWSP Wisconsin Public Service representative, based on information available at the time.

Fiscal Year	Campus kWh	Naturewise kWh	State Purchased	WPS Donations	Total renewable energy purchase	% Renewable Energy Purchases	WPS portfolio	Campus % Renewable Energy Usage
2006	26,421,578	208,300	-		208,300	0.79%	5.74%	6.53%
2007	25,560,897	3,099,900	-		3,099,900	12.13%	5.74%	17.87%
2008	26,463,335	4,577,500	-		4,577,500	17.30%	5.74%	23.04%
2009	25,725,905	5,007,000	2,513,000		7,520,000	29.23%	5.74%	34.97%
2010	25,912,239	4,161,500	3,433,892		7,595,392	29.31%	5.74%	35.05%
2011	27,412,237	3,500,800	3,894,337		7,395,137	26.98%	5.74%	32.72%
2012*	28,803,794	1,132,505	3,894,337	5,000	5,031,842	17.47%	5.74%	23.21%

* 2012 is a projection based on information available at the time
WPS = Wisconsin Public Service

Table 2 Renewable Electric Purchases

B. Encourage our current electric service provider to increase its renewable energy portfolio. At the time of this writing, Wisconsin Public Service had a green energy portfolio of 5.74%. WPS is currently working towards meeting the Wisconsin Renewable Portfolio Standard, which requires 10% of the state's electricity to come from renewable energy by 2015. UW-Stevens Point will encourage WPS to exceed the 10% standard.

WASTE MANAGEMENT PLAN

In order to achieve sustainable waste management, the university must 1) eliminate or minimize certain types of waste (source reduction), 2) increase its resource recovery efforts, 3) advance its composting effort, 4) commit to 100% natural lawn care, 5) improve reuse strategies, 6) continue with E-waste management and 7) perhaps explore waste-to-energy opportunities. Each of these strategies is described in detail below.

1. Source Reduction

   It takes energy to make things, ship things and dispose of things. Methane from solid waste created by UW-Stevens Point equates to 178 metric tons of carbon. The university must make operational choices to reduce solid waste. Some examples include increase a product's useful life, buying in bulk, reducing paper usage, lunch packaging, substitute reusable products for single-use disposable products. Following are some examples of operational changes that can be made to reduce waste on campus.

   A. Integrate a Closed Loop Supply Chain and purchasing process which considers economic, ethical, social and environmental impacts for all contracts and purchases; where all waste should first be eliminated or avoided and where any remaining waste be considered feedstock for new product development. To reuse, return or negotiate with suppliers the reduction or elimination of all packing materials.

   B. Educate faculty, staff and students on product life-cycle assessment. A one-day course is currently available through the Wisconsin Institute for Sustainable

Technology (WIST) Scholar Program at UW-Stevens Point. (*Life Cycle Assessment and Environmental Product Declarations*.)

C. Reduce the number of personal size appliances and desk-top printers used on campus.

D. Custodial Services

Custodial Services has been identified as a large producer of waste at the university. Paper towels, mop heads and other cleaning supplies are some examples that end up in the landfill. In the fall of 2011, facility services began to research use of reusable microfiber towels and mop heads. Another opportunity is to refill versus replace plastic bottles of cleaning solution in the dispenser units.

E. Dining Services

The university has adopted many sustainable practices to decrease the waste produced in dining services. Examples include a dish machine and pulper which composts food waste from the dining hall, biodegradable to-go containers, elimination of personal-sized items, and tray-free dining. Waste audits are conducted on a semester basis to set and measure benchmarks. Based on the outcomes of these audits, dining services will adjust current procedures and develop new practices to reduce its waste. A current example is to explore the appropriateness of biodegradable to-go containers versus using paper products – a renewable resource.

F. Information Technology

Information Technology should require vendors to assume responsibility for some of their shipping materials, such as wooden pallets and excess packaging materials. When ordering computer shipments request products ship blanket-wrapped or using reduced packing material.

G. Plastic Bottle Ban

When the university's vending contract was renewed in 2009-10, a resolution was made by the Student Government Association to discontinue the sale of bottled water in vending machines. University Dining Services also agreed to cease sales of bottled water. Bottled soda, juice, sports drinks and flavored water are still sold in the vending machines. (Bottled water is still sold in the Brewhaus.)

The university could revisit the initiative to consider removing all plastic bottles form vending machines, and perhaps research biodegradable soda bottles.

H. RecycleMania

Participate in the nationwide recycling event, which includes informational campaigns to educate the campus community. The efforts of UW-Stevens Point should **stress waste minimization and reduction**.

2. Recycling and Recovery Efforts

On April 18, 1988 Wisconsin's first legislation regarding recycling and recovery methods became effected. For state agencies this act was defined as the following:

"Purchasing specifications; purchasing of products made from recycled and recovered materials; resource recovery and recycling programs for state agencies and local

governmental units; use of recycled and recovered materials in state construction projects; and annual reporting."

The legislation, Act 292 specified that a minimum of 50% of paper generated by office agencies would be recycled by January 1, 1990. The Wisconsin Department of Administration initiated research with experts in recycling and waste efforts through the University of Wisconsin – Madison. Among the topics researched were waste composition, recycling potential, market assessment, and procurement policies. Five locations were chosen for the research efforts. Among those was a university campus – University of Wisconsin – Stevens Point. In the fall of 1989, the University officially began its resource recovery program with initial collections of office paper, newspaper, aluminum cans and glass items. Originally, the program started with a small core of buildings on campus. By January of 1990 all buildings were included in the recycling program, which has continued through present day.

The University of Wisconsin - Stevens Point Resource Recovery Center is located at the north end of the campus. The department is responsible for disposal of all university waste, with the exception of items classified as hazardous waste. Our recycling policy is based on good, consistent environmental practices and meets or exceeds all national, state and local laws, regulations and ordinances as they relate to resource recovery.

The goal of the Resource Recovery Center is to conserve our natural resources by reducing consumption of materials, reusing materials whenever possible, recycling materials using current technology and practicing wise procurement policies, including the purchase of recycled materials. It seeks cost efficient means for accomplishing its goals, assesses commodity markets for revenue producing opportunities, and strives to involve all students, employees, and contractors of the campus community in its recycling effort.

3. Composting

Combined fertilizer application, solid waste and refrigerant releases total less than 1% of UW-Stevens Point's greenhouse gas emissions. On-campus composting, on the other hand, is an offset to our emissions total.

The following graph shows our total offsets, which include composting and forest preservation. Composting is a very small percentage of the offset amount, yet we have opportunity to increase that offset.

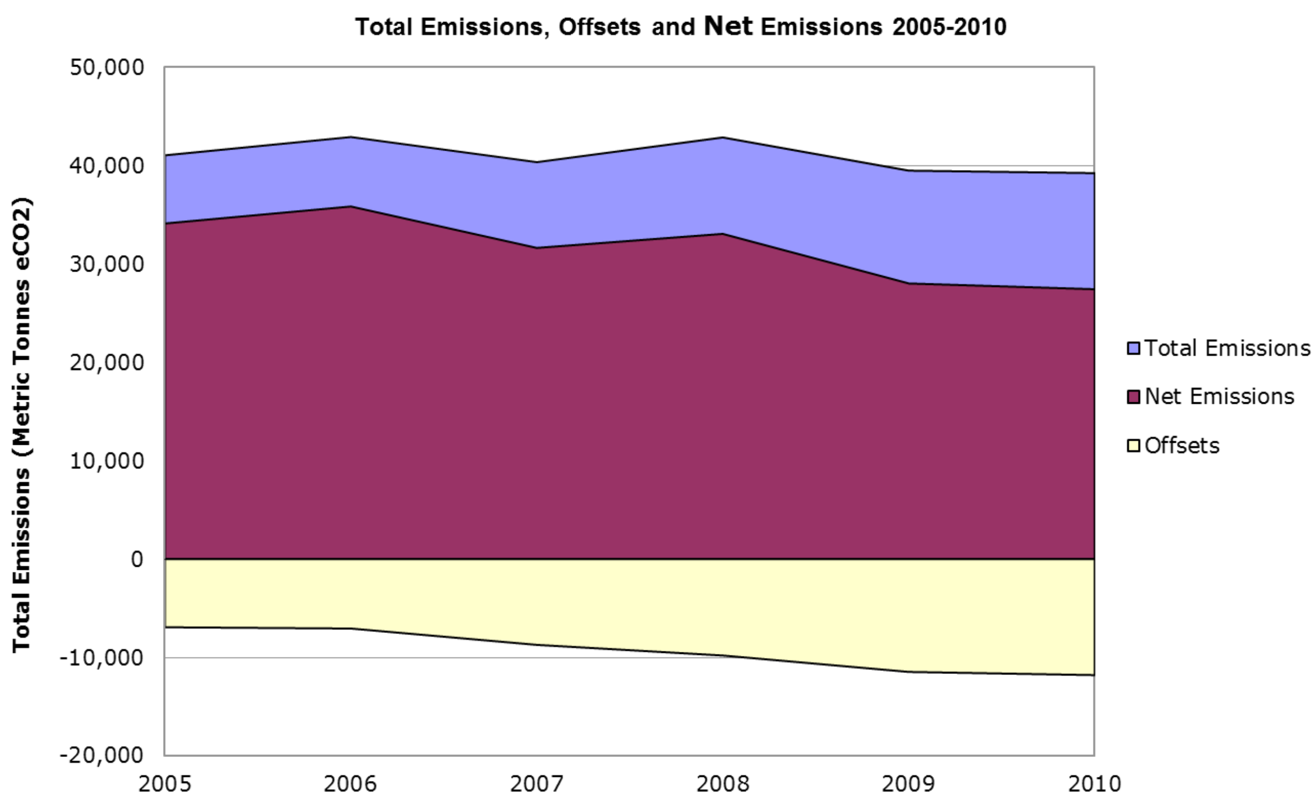


Figure 3 Offsets to Emissions

In order to manage organic waste, we need to explore cutting edge solutions to divert food waste from landfills. The goal of UW-Stevens Point will be to compost 100% of pre- and postconsumer food waste on site, which will be used for landscaping and the campus garden. One solution is to purchase a small anaerobic digester or in-vessel composter to maximize compost efforts at the dining hall through on-site organic waste treatment.

Studies will be done to determine the appropriateness of purchases of compostable food containers used on campus; an example is the FRESH project, which began in 2011. UWSP uses a variety of disposable food containers made of PLA. PLA stands for polylactic acid and it is the material used to make a type of bio-based plastic produced using sugars derived from plants such as corn, potatoes, tapioca, sugarcane, sugar beets, soy protein or wheat. It is popular because it's made from renewable resources rather than petroleum, like traditional plastics. PLA plastics are compostable under industrial composting conditions. Plastics made from PLA are not, however, a perfect replacement for petroleum based plastics. PLA doesn't share the same physical properties as all petroleum based plastics, such as heat tolerance and plasticity. Also, since PLA's basic composition is different, it cannot be placed into the existing plastics recycling stream without using additional resources of manpower or mechanical sorting equipment because it would cause imbalances in the recycling process.

The FRESH project mission is to see if this special recycling program is not only sustainable, but is also an economically feasible option for the campus. More broadly it will provide important information about the widespread adoption of bio-based plastics throughout the United States. PLA products are more expensive than traditional plastic containers, therefore, the benefit to the environment must be greater than the economic cost. Project data will be compiled and evaluated after the 2011-2012 academic year to determine the environmental sustainability and the economic feasibility of clear PLA product use at UWSP

4. Natural Lawn Care

   Nitrates from fertilizer used on campus converts to 18 metric tons of carbon emissions. UW-Stevens Point will occasionally use herbicides to control broadleaves but we continue our efforts, through a very talented and environmentally aware grounds staff, to reduce and move entirely towards natural lawn care. In 2011, building and grounds experimented with using an all organic fertilizer for the campus common areas. Unfortunately, it costs twice as much as normal fertilizer but it is 100% organic. Additionally, we are continually using our compost tea machine and campus created compost for topdressing our grass and for our perennial beds. At this point, our fertilizer for the athletic fields is 30% organic.

5. Expand Food Shelf options

   The Cupboard is a food pantry open to current students who need emergency or supplemental food to meet their basic needs to that they can focus on succeeding in school.

   The Cupboard's inventory is dependent on donations and does its best to provide students with a variety of protein, fruits/vegetables, and grains, but the number of items will vary based on inventory. Toiletries may also be available. All food items are non-perishable. Because of health codes and food safety, we are not able to distribute perishable items or baby food.

6. E-Waste Management

   Because electronic waste can contain such impurities as lead, mercury, lithium, bromine, cadmium, and other heavy metals, we must continue our efforts to mitigate the disposal of electronic waste including cell phones, TVs, DVD and VHS players, computers, and microwaves from landfills. Our goal is to get E-waste to recyclers through E-waste drives and collection sites.

Staff computers, printers and other computer hardware is sent to Information Technology to review and assure equipment functionality prior to delivery of items to Surplus Sales. Equipment and parts determined to be reusable will be distributed on campus as needed. Equipment can often be repaired by using spare parts obtained from pre-surplus sales equipment. Property that is beyond its usefulness to UW-Stevens Point will be sent to Surplus Sales for sale to the general public.

7. Waste to energy

   Using waste as an energy source can help achieve reductions in greenhouse gas emissions. By generating electrical power or steam, waste-to-energy avoids carbon dioxide (CO2) emissions from fossil fuel based electrical generation, the waste-to-energy combustion process effectively avoids all potential methane emissions from landfills thereby avoiding any potential release of methane in the future and the recovery of ferrous and nonferrous metals from MSW by waste-to-energy is more energy efficient than production from raw materials.

The tool used to develop and administer our waste management efforts is the *Socially Responsible and Environmentally Sustainable Purchasing Policy*. The draft of the sustainable purchasing policy was submitted to the Sustainability Task Force in March of 2008. Some of its key points include:

A. Purpose

   University of Wisconsin-Stevens Point is committed to the use and purchase of environmentally and socially responsible materials and products. This document outlines the multiple factors that determine UWSP's procurement decisions. These procurement decisions amend economic criteria with strong commitments toward environmental and social responsibility.

People authorized to make purchases on behalf of the university are expected to support our commitment to environmental responsibility through the guidelines and procedures contained in this Socially Responsible and Environmentally Sustainable Purchasing Policy. This Policy shall be implemented to complement the American Colleges and University President's Climate Commitment signed by UW-Stevens Point in April 2007.

Recognizing our impact as a major purchaser of goods and services, The University of Wisconsin-Stevens Point gives preference to environmentally friendly products whose quality, function, and cost are equal or superior to more traditional products. This policy will:

- conserve natural resources
- minimize pollution
- reduce the use of water and energy
- eliminate or reduce environmental health hazards to workers and our community
- support strong recycling markets
- reduce materials that are landfilled
- increase the use and availability of environmentally preferable products
- reward vendors who reduce environmental impacts in their production and distribution of systems or services
- create a model for successfully purchasing environmentally preferable products that encourages other purchasers in our community to adopt similar goals
- support locally produced goods and services
- educate ourselves, our vendors, and our end users

B. Responsibilities of Departments

- Develop and maintain information about environmentally and socially preferable products. Departments should use the list composed in this document as a guideline and may add or modify the list as needed.
- Inform employees of their responsibilities under this policy; provide them with information about sustainable procurement opportunities. Check the Purchasing web page for frequent updates on vendor commitments to sustainability, including new annual contracts and participation in vendor shows.

Goals of our purchasing policy include:

i. Maintain high environmental standards:
Purchase products that meet the latest and most credible environmental standards available. In addition, any product that earns LEED credit will be considered a priority.

ii. Integrate a Closed Loop Supply Chain:
To develop and maintain a consistent ”cradle-to-cradle“ supply chain and purchasing process which considers economic, ethical, social and environmental impacts for all contracts and purchases; where all waste should first be eliminated or avoided and where any remaining waste be considered feedstock for new product development. To reuse, return or negotiate with suppliers the reduction or elimination of all packing materials. Ethical and social impact will be documented by posting the supplier and subcontractor’s annual corporate, social, ethical and environmental reports and other supporting documentation. When reports are not currently available the goal will be to work with suppliers to develop and implement corporate social, ethical and environmental reports.

iii. Integrate High Environmental Standards into Buildings and the management of Facilities:
To integrate green purchasing concepts and products into designs, construction documents, final construction and outfitting of all university of Wisconsin-Stevens Point buildings, renovations of property or facilities owned by University of Wisconsin-Stevens Point.

iv. Research and Procure Alternative Energy:
To conduct research and procure alternative energy from reliable, certified alternative energy suppliers.

v. Safety:
To ensure that the products and services purchased by University of Wisconsin-Stevens Point improve and strengthen the health of the campus community and natural resources. In addition proper MSDS (Material Safety Data Sheets) are identified in all contract specifications and kept on record.

To view the purchasing policy in its entirety, please visit:
https://campus.uwsp.edu/sites/projcollab/sustainability/Shared%20Documents/Carbon%20Neutrality%20Report/UWSP%20Procurement%20Policy%20draft%208%2008.pdf

Sustainable waste management efforts will ultimately lead to the elimination of waste production at the university – "zero-waste". As defined by the Zero Waste International Alliance, *"Zero Waste is a goal that is ethical, economical, efficient, and visionary, to guide people in changing their lifestyles and practices to emulate sustainable natural cycles, where all discarded materials are designed to become resources for others to use. Zero Waste Means designing and managing products and processes to systematically avoid and eliminate volume and toxicity of waste and materials, conserve and recover all resources, and not burn or bury them. Implementing Zero Waste will eliminate all discharges to land, water, or air that are a threat to planetary, human, animal, or plant health."*

In the fall of 2011, UW-Stevens Point began to work on developing a zero-waste policy. It was clear that the initial task would be to perform a waste audit. A waste audit is a process to collect, calculate and analyze an organization's waste composition and production. Waste audits aim to evaluate the effectiveness of an organization's recovery efforts regarding waste reduction, maximizing recycling efforts and determining the amount of recoverable materials. Effective waste reduction begins with detailed knowledge of the contents, types, and amounts of waste disposed of. Data collected provides a baseline for future waste management policies and strategies as well as new program implementation. Because of the data collected in a waste audit, it is possible to analyze the effectiveness of these programs developed in the future. It also allows the organization to reestablish new purchasing habits when item(s) are consistently found to be disposed of.

The goals for this waste audit and reduction project are as follows:

- Separate and quantify wastes
- Identify opportunities to reduce waste
- Develop a "Zero Waste" committee comprised of members from the following: Recycling/Grounds, University Dining Services, Veolia, Athletics, Conferences and Reservations, as well as others as necessary
- Strive to achieve "Zero Waste" by 20xx (year undetermined at this time)

Furthermore, several objectives will be completed as outlined here:

- Provide historical waste and recycling information relevant to the University of Wisconsin – Stevens Point campus
- Documentation of this project in its entirety; included but not limited to: an action plan, assessments and outcomes
- Acquire useful analytical data to be applied to waste reduction strategies
- Develop a marketing strategy to reduce waste and maximize recovery efforts
- Increase revenue acquired from recycled commodities
- A complete review of waste contracts pertaining the University of Wisconsin – Stevens Point
- Implement a vigorous composting program on campus

TRANSPORTATION PLAN

The following is a list of possible solutions to reduce carbon emissions from transportation at UW-Stevens Point. Each is described in more detail below.

- Reduce student commuting
- Reduce commuting to campus by faculty and staff
- Increase percent of the population that uses alternative transportation
- Decrease single occupancy vehicles
- Reduce miles traveled for official business by faculty and staff
- Reduce emissions associated with fleet operations
- 100% offset of air travel for faculty and staff
- 100% offset of air travel for international student travel

Transportation is vital to our campus activities. Students, staff and faculty commute to class or work on a regular basis; campus fleet provides a means to travel to out-of-town meetings and conferences; the mission of our International Programs is to advance international education and global awareness through study abroad programming.

Although travel is necessary, it is also a source of greenhouse gas emissions. Strategies to reduce and offset emissions include reducing carbon-intensive travel activities, using low-carbon fuel vehicles and vehicles with increased fuel economy, improving the efficiency of existing local transportation systems and purchasing carbon offsets for transportation emissions. The following table shows our 2007 carbon emissions due to travel.

	eCO2 Metric Tons	
University Fleet	363	0.83%
Student Commuters	1,093	2.51%
Faculty/Staff Commuters	1,722	3.95%
Air Travel	2,105	4.83%
Total Transportation Emissions	5,283	12.12%

Table 3 Carbon Emissions from Transportation for 2007

Direct transportation sources at UW-Stevens Point include its fleet, faculty, staff and student commuting, and air travel. Per our estimate, direct transportation makes up 12% of our total carbon emissions. Each direct transportation source - fleet services, commuting and air travel - is described below along with potential solutions.

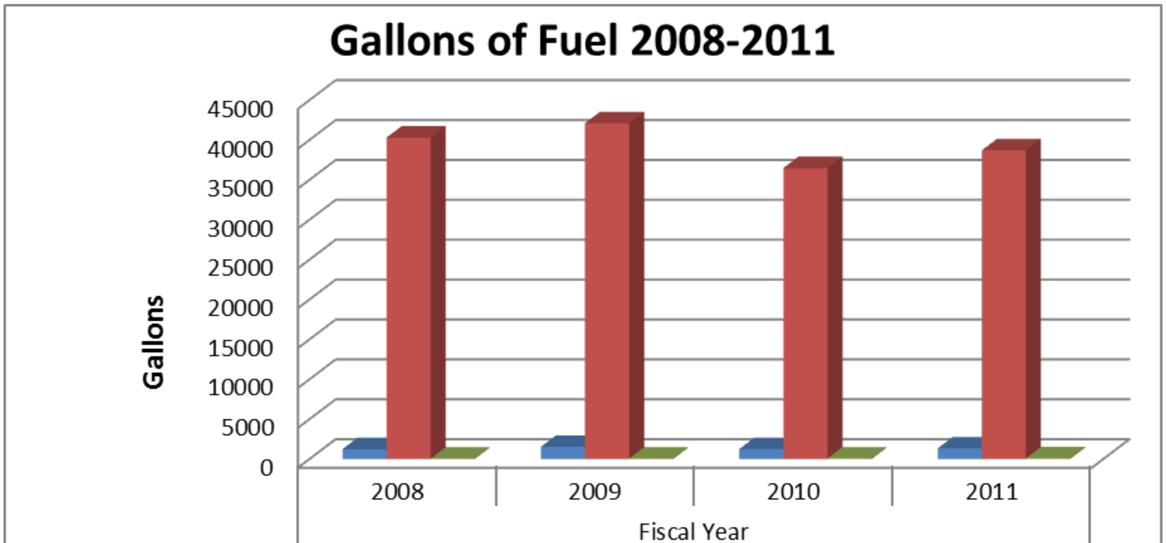
A. University Fleet

As of 2011, UW-Stevens Point had 85 vehicles in their fleet, including federal, Division of Administration (DOA), university and electric vehicles. There are five 100% electric vehicles, four in Facility Services and one in the Athletic Department. We have one gasoline-electric hybrid.

FLEET ASSIGNMENT		
DEPARTMENT	FUEL TYPE	NUMBER
Division of Administration	Gas	26
Facility Services	Gas	23
College of Natural Resources	Gas	12
Federal	Gas	9
Residential Living	Gas	4
Web & Media Services	Gas	1
Telephone	Gas	1
University Dining	Gas	1
Informational Technology	Gas	1
Theater and Dance	Gas	1
Academic Custodial	Electric	1
Facility Services	Electric	1
Heating Plant	Electric	1
Mailroom	Electric	1
Athletics	Electric	1
UW-Extension Lakes	Gas-Electric Hybrid	1
Total		85

Table 4 Fleet Assignment

The following table summarizes fuel consumption data for 2008-2011 fiscal years. This is only fuel recorded by the fleet department; fuel consumed by employees using their personal vehicles for work-related use is not included in these totals.



	2008	2009	2010	2011
Diesel	1255.27	1550.39	1269.92	1354.32
Unleaded Gasoline	40311.56	42114.84	36493.07	38710.29
*Alternative Fuel	71.06	65.33	84.8	103.6

*Ethanol, 10% Gasohol, E85

Figure 4 Fuel Consumption Data

Executive Order 141 March 2006 *Relating to Increased Utilization of Renewable Fuels in Vehicles Owned and Operated by the State of Wisconsin*

1. Direct all state agencies to reduce the use of petroleum-based gasoline in state-owned vehicles by twenty percent (20%) by 2010 and by fifty percent (50%) by 2015, and reduce the use of petroleum-based diesel fuel by those vehicles ten percent (10%) by 2010 and twenty five percent (25%) by 2015;

2. Develop an awareness plan designed to facilitate usage of renewable fuels in the State's flex fuel vehicle fleet. This program shall ensure:
   a. All flex fuel vehicles in the State’s fleet shall be identifiable; and
   b. All state employees driving flex fuel vehicles shall be made aware of the renewable fuel refueling stations in the location of their destination; and
   c. All state employees shall strive to use renewable fuels when operating flex fuel and diesel powered vehicles in the fleet, whenever practical and cost effective; and

3. Actively pursue the establishment of additional renewable fuel refueling facilities at public retail outlets

In order to meet Executive Order 141 mandates and ultimately achieve carbon neutrality, the following practices must be considered:

- Reduce or eliminate miles traveled by faculty and staff
- Decrease single occupancy trips
- Utilize the teleconference/videoconference system (installed in 2011) to reduce travel to the system offices for meetings
- Participate in webinars rather than travel offsite
- Replace fleet vehicles with low-carbon fuel vehicles and vehicles with increased fuel economy
- Purchase offsets and incorporate the cost into the rental rates

Per the transportation department, the greatest waste in business travel is the lack of carpooling to meetings and events. Quite often there are multiple vehicles going to the same destination on the same day, usually by people from the same area or department. The main reasons given for not carpooling are 1) individuals want to arrive to and/or depart from their destination at different times and 2) the employee prefers not to carpool or prefers to take their personal vehicle.

B. Commuting

Universities represent highly concentrated commuting communities and off-campus fossil fuel consumption by commuters often exceeds that of the institution. For example, in 2010 there were 5,200 students living off campus with an average commute distance of 6.7 miles. Together we travel over 35,000 miles getting to campus and another 35,000 going home. In some cases cars account for more than 50% of campus commute miles although there are instances where car use is just nearly 20%. We don't know how many miles we commute to campus by car, bike, bus, or on foot and green-house gas emissions.

Commuting shapes our lives and they shape our community and university landscapes. There are 3,200 parking spaces on campus and parking lots occupy 20% of the 110 acres that comprise the built portion of campus. The university also has 198 bicycle racks. Nearby campus there are roughly 1,400 on street parking spaces that are regularly used by commuting students and staff. Stevens Point has 117 miles of sidewalk and developed a bicycle and pedestrian plan.

<u>The UWSP Sustainable Commute Project</u> is a research project led by principle investigator and research director, Gene Martin of the UW-Stevens Point Geography department. The project will estimate UWSP commuting patterns, costs, and emissions while raising awareness and identifying opportunities for change.

The project outcomes will be relevant to the university's concern for:

- Location and installation of bicycle racks, shelters, placement
- Vehicle circulation and accessibility
- Health and safety related to exercise and traffic incidents
- Parking reduction, relocation and use practices

In addition, the community's interests will be reflected in information on:

- Road, sidewalk and intersection use and congestion
- Reduction of off-campus parking pressures

Data acquired from the UWSP Sustainable Commute Project, along with the following strategies, will assist us in reducing our carbon emissions from commuting.

1. Bike and Pedestrian Pathways:

   UW-Stevens Point must develop programs and infrastructure that encourages the university community to minimize driving to and from campus, and within the university campus.

An example of a current program is the free bike rental program that is administered by the Student Government Association of the University. The program is available to students in need of a bicycle. The program is run by students for students and has a fleet of over 85 bikes.

An initial responsibility of the 2006 master planning process was the identification and recognition of primary themes on campus, as well as developing a strategy to incorporate those themes into the master plan. They are important in terms of creating a distinct, functional and aesthetically pleasing campus. These themes support the life and mission of the campus. One of the main themes of the master plan is "UWSP is a Sustainable Campus".

UWSP is home to one of the premier natural resource programs in the country. In keeping with this campus-wide land ethic, this master plan has identified respect for natural resources or "sustainability" as a core value. During the master planning process, the steering committee and other key stakeholders expressed interest in bringing their commitment to sustainability to a higher level. This includes exploring additional aspects of the campus in relation to sustainability. Of the many possible opportunities, promoting alternative transportation, such as pedestrian and bicycle circulation, was one of the opportunities discussed.

The master plan proposes creating a clear hierarchy of pedestrian pathways within campus. The significance of each pathway will be reflected in path width, materials, landscaping and amenities provided. Creating a hierarchy also improves way-finding on campus, as circulation routes become more logical and obvious. Consideration should be given to reducing the amount of walks, while still providing convenient access, as a way of clarifying circulation routes and reducing impervious surfaces and maintenance costs.

2. Expand and Improve Bus Routes

   Work with local transit authority to improve and expand on current bus route programs. At present, the University offers students with a valid identification card to use the services of the city of Stevens Point bus transit system free of charge through the U-Pass program. The bus line passes several points on campus and then travels throughout the city of Stevens Point, surrounding communities and several different student apartment complexes. The U-Pass system also runs late at night giving students a safe mode of transportation at all times of the day.

3. Low-Energy, Fuel Efficient Vehicles

   Encourage and incentivize the use of low-energy, fuel efficient vehicles by faculty, staff and students. They may include scooters, mopeds, motorcycles, electric vehicles (EV) and hybrids. This may be done through parking incentives and by providing EV charging stations.

4. Carpooling

   The existing carpool program through Parking Services must be publicized and promoted to faculty and staff. *"A single permit/hangtag will be issued for each car pool. A car pool shall consist of at least two people. They will share transportation in a single vehicle to and/or from campus on a regular and consistent basis. The permit/hangtag must be transferred to the vehicle that will be on campus for that day. Only one (1) vehicle of a car pool is authorized on campus at a time. Additional vehicles must be registered with Parking Services and payment of the temporary fee must be made prior to parking on campus."*

5. Rideshare Program

a. UW-Stevens Point currently encourages the use of Rideshare Etc. via the sustainability website. It is a free online matching service that provides commuters with opportunities to find carpooling, bike buddies, vanpooling, mass transit, and park & ride transportation options.
b. Students currently use the University of WI-Stevens Point Ride Share Facebook Group to match commuting needs.
c. In March, 2011 the Sustainability Task Force researched Zimride, an online social network/ridesharing community. The cost was $12,000/year for a three-year contract. At that time, budget constraints did not allow us to pursue this option. It should, however, be reconsidered in the future.

6. Telecommuting

UW-Stevens Point should support and encourage the use of the telecommuting policy, which is based on Wisconsin state statute. The policy is found in the UWSP Employee Handbook under General Employment Policies & Procedures-Alternative Work Patterns:

State policy encourages the use of alternative work patterns by full-time or part-time employees when such schedules are consistent with efficient and effective University operations. Alternative work patterns include job sharing; alternate work weeks such as four, ten-hour days; and, staggered work hours, such as 7:00 a.m. – 3:30 p.m., with a thirty-minute lunch break. Requests for alternative work patterns should be made to the employee's immediate supervisor who will determine if the proposal is feasible for the work unit.

<u>Wisconsin State Statute 230.215</u>

(1) Declaration of policy. The legislature finds and declares:

(1)(a) (a) That employment practices which provide flexibility in scheduling hours of work often result in increased worker productivity, reduced absenteeism, improved employee morale and a more economical and efficient use of energy, highways and other transit systems.

230.215(1)(b) (b) That traditional full-time work patterns fail to meet the needs of many potentially productive citizens who, due to age, health or family circumstances, are effectively prevented from engaging in full-time employment.

230.215(1)(c) (c) That a greater number of permanent part-time employment opportunities are necessary to allow citizens a higher level of participation in the work force and to permit a greater utilization of the skills, talents and abilities of all citizens who want to work.

230.215(1)(d) (d) That it is the intent of the legislature that all agencies of state government participate in developing and creating flexible-time work schedules, additional permanent part-time positions and other alternative work patterns in order to maximize, in a manner consistent with the needs of state service, the employment options available to existing and potential state employees.

230.215(1)(e) (e) That it is the intent of the legislature that all agencies of state government make available permanent part-time employment opportunities in classified positions.

230.215(2) (2) Flexible-time employment scheduling. In this subsection "flexible-time schedule" means a work schedule which includes required days or hours during which an employee subject to the work schedule must be present for work and designated hours during which the employee, with the approval of his or her supervisor, may elect a time of arrival to and departure from work. Every agency shall develop a plan for the establishment of employee flexible-time schedules. The plan shall attempt to maximize efficiency of agency operations, the level of services to the public, energy conservation and employee productivity and shall consider traffic congestion, transit facilities and other relevant factors.

7. Prohibit Idling

   UW-Stevens Point should develop and enforce a campus-wide "No Idling" policy. Vehicle engines should not idle for more than 3 minutes while the vehicle is parked, stopped, or standing.

C. Air Travel

1. Official business travel

   Any official business travel by state employees must be authorized and appropriate; it must be approved in accordance with individual agency procedures as established by the appointing authority or designee.

   Pursuant to s. 16.53(12)(b), Wis. Stats., the appointing authority or designee shall determine that the proposed travel is appropriate and necessary to the mission, responsibilities or duties of the employee's unit. Pursuant to s. 16.53(1)(c)7., Wis. Stats., before employees are permitted to attend out-of-state conferences, conventions, seminars, meetings or training courses, the appointing authority or designee should ensure that a clear state interest is being served.

2. International Programs

   The mission of UW-Stevens Point International Programs is to advance international education and global awareness through study abroad programming. Its vision is to develop the best possible learning experiences through collaboration with UWSP colleges and our international partners.

International Programs values the following in its programs and services:

- Academic rigor and curricular relevance
- Cultural awareness and respect for others
- Financial affordability and sound fiscal stewardship
- A healthy sense of adventure and experiential learning.

International Programs goals are:

- to expand study abroad learning while maintaining academic integrity
- to promote global awareness and internationalization in the community
- to help students and faculty become better global citizens.

Because official business travel is necessary, and study abroad is an important aspect of education at UW-Stevens Point, carbon offsets need to be applied against the emissions from air travel. One option is to purchase carbon credits to offset air travel emissions. Further study must be done to determine who pays for the offsets.

FOREST PRESERVATION OFFSETS

In addition to reducing our carbon emissions, we must also increase the level of carbon offsets. Examples include on-campus carbon sinks – like composting and managed forests, off-campus institution-funded carbon reduction projects, and the purchase of "green electricity". The purchase of green energy and renewable energy credits should be a minor initiative towards reaching carbon neutrality. This section describes forest preservation offsets. Composting was described in the waste management section, and purchasing green energy was described in the energy section.

Among the managed forests at UW-Stevens Point is the 280-acre Schmeeckle Reserve, a natural area on the campus, the Central Wisconsin Environmental Station, a 200-acre teaching and learning center and Treehaven, a residential natural resources education and conference facility with 1,400 acres of forest and wetlands. There are also numerous other small protected forests.

1. Forest Preservation – carbon storage

   Our current calculation for carbon sequestration in our managed forests is estimated. The energy policy professor in the College of Natural Resources is currently charged with performing a managed forest inventory for UW-Stevens Point and calculating its carbon sequestration capacity to a greater degree of accuracy.

   Our goal is to increase the size of our managed forests owned by UW-Stevens Point by seeking out sources of funding to purchase additional land.

2. Campus Tree Care Plan

The University of Wisconsin – Stevens Point Campus Tree Care Plan was developed to foster a healthy and sustained tree population. This valued urban resource is vital to educate students as well as the public about quality tree care and sound urban forest management techniques. This plan follows the Arbor Day Foundation's Tree Campus USA program which helps establish and maintain healthy community forests on campuses. UWSP's underlining mission in the creation of this plan is to maintain a safe and diverse urban tree population that is sustainable and a visual and ecological foundation that is an integral part of the campus infrastructure. Through strategic placement of trees, we can reduce energy consumption and develop a more energy efficient campus.

Trees are planted on campus each year by student organizations

3. Treehaven

Treehaven is the first tree farm in Wisconsin to receive a 50-year recertification in the American tree Farm System. The 1,400-acre Treehaven forest was originally accepted in the tree farm system on May 13, 1957, and since that time has continually practiced resource stewardship according to the standards of sustainable forestry advocated by the American Tree Farm System. Sustainable management of the Treehaven forest fulfills the College of Natural Resources commitment to sustaining healthy forests, wildlife habitat, water resources, and outdoor education, and provide wood products that provide local jobs that are necessary to sustain our economy and standard of living.

CARBON REDUCTION TARGET

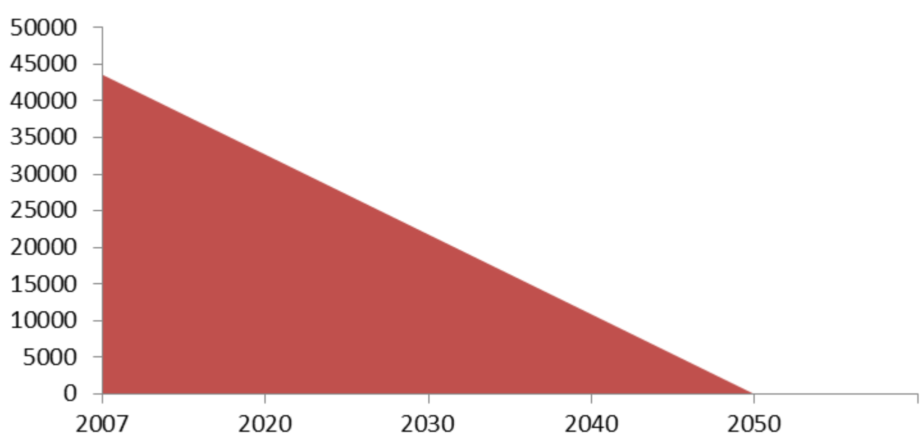
Global Warming National Policy Solution states we must reduce U.S. global warming pollution 2% per year, or 20% per decade. The U.S. Climate Action Partnership (USCAP) states the U.S. must reduce emissions 10-30% within 15 years, 60-80% by 2050. In addition to the 2% per year reduction, new construction must also be taken into consideration, resulting in an amount slightly greater than 2% per year.

It is our goal to reach carbon neutrality by the year 2050. The following table shows our emission reduction targets for 2020-2050 starting with the initial greenhouse gas inventory reported for 2007 at 43,572 metric tons of eCO2.

Year	Emissions Target	Change from previous target	Cumulative Reduction %
2007 Baseline	43,572		
2020	32,679	-10,893	25%
2030	21,786	-10,893	50%
2040	10,893	-10,893	75%
2050	0	-10,893	100%

Figures shown are in metric tons

Table 5 Carbon Emissions Reduction Targets



GLOSSARY

These glossary terms are found in the Clean Air Cool Planet greenhouse gas calculator.

Term	Definition
Aerobic	A life or process that occurs in and is dependent upon oxygen. See methanotrophic, anaerobic.
Alternative energy	Energy derived from nontraditional sources (e.g., compressed natural gas, solar, hydroelectric, wind).
Anaerobic	A life or process that occurs in, or is not destroyed by, the absence of oxygen.
Anaerobic decomposition	The breakdown of molecules into simpler molecules or atoms by microorganisms that can survive in the partial or complete absence of oxygen.
Ash	The mineral content of a product remaining after complete combustion.
Baseline Emissions	The emissions that would occur without policy intervention (in a business-as-usual scenario). Baseline estimates are needed to determine the effectiveness of emissions reduction programs (often called mitigation strategies).
Biodegradable	Material that can be broken down into simpler substances (elements and compounds) by bacteria or other decomposers. Paper and most organic wastes such as animal manure are biodegradable. See nonbiodegradable.
Biofuel	Gas or liquid fuel made from plant material (biomass). Includes wood, wood waste, wood liquors, peat, railroad ties, wood sludge, spent sulfite liquors,
Biomass	Total dry weight of all living organisms that can be supported at each tropic level in a food chain. Also, materials that are biological in origin, including organic material (both living and dead) from above and below ground, for example, trees, crops, grasses, tree litter, roots, and animals and animal waste.
Biomass energy	Energy produced by combusting biomass materials such as wood. The carbon dioxide emitted from burning biomass will not increase total atmospheric carbon dioxide if this consumption is done on a sustainable basis (i.e., if in a given period of time, regrowth of biomass takes up as much carbon dioxide as is released from biomass combustion). Biomass energy is often suggested as a replacement for fossil fuel combustion. See biomass.
Bituminous coal	A dense, black, soft coal, often with well-defined bands of bright and dull material. The most common coal, with moisture content usually less than 20 percent. Used for generating electricity, making coke, and space heating. See coal.
British thermal unit	The quantity of heat required to raise the temperature of one pound of water one degree of Fahrenheit at or near 39.2 degrees Fahrenheit.
Carbon dioxide	A colorless, odorless, non-poisonous gas that is a normal part of the ambient air. Carbon dioxide is a product of fossil fuel combustion. Although carbon dioxide does not directly impair human health, it is a greenhouse gas that traps terrestrial (i.e.,

	infrared) radiation and contributes to the potential for global warming. See global warming.
Carbon dioxide equivalent	A metric measure used to compare the emissions from various greenhouse gases based upon their global warming potential (GWP). Carbon dioxide equivalents are commonly expressed as "million metric tons of carbon dioxide equivalents (MMTCDE)." The carbon dioxide equivalent for a gas is derived by multiplying the tons of the gas by the associated GWP. (MMTCDE = (million metric tons of a gas) * (GWP of the gas))
Carbon Equivalent	A metric measure used to compare the emissions of different greenhouse gases based upon their global warming potential (GWP). Greenhouse gas emissions in the U.S. are most commonly expressed as "million metric tons of carbon equivalents" (MMTCE). Global warming potentials are used to convert greenhouse gases to carbon dioxide equivalents - they can be converted to carbon equivalents by multiplying by 12/44 (the ratio of the molecular weight of carbon to carbon dioxide). The forumula for carbon equivalents is: MMTCE = (million metric tons of a gas) * (GWP of the gas) * (12/44)
Carbon sequestration	The uptake and storage of carbon. Trees and plants, for example, absorb carbon dioxide, release the oxygen and store the carbon. Fossil fuels were at one time biomass and continue to store the carbon until burned. See carbon sinks, fossil fuel.
Chlorofluorocarbons	Organic compounds made up of atoms of carbon, chlorine, and fluorine. An example is CFC-12 (CCl2F2, used as a refrigerant in refrigerators and air conditioners and as a foam blowing agent. Gaseous CFCs can deplete the ozone layer when they slowly rise into the stratosphere, are broken down by strong ultraviolet radiation, release chlorine atoms, and then react with ozone molecules. See ozone depleting substance, fluorocarbons.
Climate	The average weather, usually taken over a 30 year time period, for a particular region and time period. Climate is not the same as weather, but rather, it is the average pattern of weather for a particular region. Weather describes the short-term state of the atmosphere. Climatic elements include precipitation, temperature, humidity, sunshine, wind velocity, phenomena such as fog, frost, and hail-storms, and other measures of the weather. See weather.
Climate change	The term "climate change" is sometimes used to refer to all forms of climatic inconsistency, but because the Earth's climate is never static, the term is more properly used to imply a significant change from one climatic condition to another. In some cases, *climate change* has been used synonymously with the term, *global warming*; scientists however, tend to use the term in the wider sense to also include natural changes in climate. See climate, global warming, greenhouse effect, enhanced greenhouse effect, radiative forcing.
Coal	A black or brownish black solid, combustible substance formed by the partial decomposition of vegetable matter without access to air. The rank of coal, which includes anthracite, bituminous coal, subbituminous coal, and lignite, is based on fixed carbon, volatile matter, and heating value. Coal rank indicates the

	progressive alteration, or coalification, from lignite to anthracite. See anthracite, bituminous coal, subbituminous coal, lignite.
Coal coke	A hard, porous product made from baking bituminous coal in ovens at temperatures as high as 2,000 degrees Fahrenheit. It is used both as a fuel and as a reducing agent in smelting iron ore in a blast furnace.
Coal gasification	Conversion of solid coal to synthetic natural gas (SNG) or a gaseous mixture that can be burned as a fuel.
Cogeneration	Production of two useful forms of energy such as high-temperature heat and electricity from the same process. For example, while boiling water to generate electricity, the leftover steam can be sold for industrial processes or space heating.
Combustion	Chemical oxidation accompanied by the generation of light and heat.
Compost	Partially decomposed organic plant and animal matter that can be used as a soil conditioner or fertilizer. See decomposition.
Composting	Partial breakdown of organic plant and animal matter by aerobic bacteria to produce a material that can be used as a soil conditioner or fertilizer. See compost.
Concentration	Amount of a chemical in a particular volume or weight of air, water, soil, or other medium. See parts per billion, parts per million. See parts per billion, parts per million.
Crude oil	A mixture of hydrocarbons that exist in liquid phase in underground reservoirs and remain liquid at atmospheric pressure after passing through surface separating facilities. See petroleum.
Decomposition	The breakdown of matter by bacteria and fungi. It changes the chemical composition and physical appearance of the materials. See composting.
Deforestation	Those practices or processes that result in the change of forested lands to non-forest uses. This is often cited as one of the major causes of the enhanced greenhouse effect for two reasons: 1) the burning or decomposition of the wood releases carbon dioxide; and 2) trees that once removed carbon dioxide from the atmosphere in the process of photosynthesis are no longer present and contributing to carbon storage.
Distillate fuel oil	A general classification for the petroleum fractions produced in conventional distillation operations. Included are products known as No. 1, No. 2, and No. 4 fuel oils and No. 1, No. 2, and No. 4 diesel fuels. Used primarily for space heating, on and off-highway diesel engine fuel (including railroad engine fuel and fuel for agricultural machinery), and electric power generation.
eCO_2	CO_2 Equivalents. A metric measure used to compare the emissions from various greenhouse gases based upon their global warming potential (GWP). Carbon dioxide equivalents are commonly expressed as "metric tons of carbon dioxide equivalents (MTCDE)." The carbon dioxide equivalent for a gas is derived by multiplying the tons of the gas by the associated GWP. (MTCDE = (million metric tons of a gas) * (GWP of the gas))
Emission inventory	A list of air pollutants emitted into a community's, state's,

	nation's, or the Earth's atmosphere in amounts per some unit time (e.g. day or year) by type of source. An emission inventory has both political and scientific applications.
Emissions	The release of a substance (usually a gas when referring to the subject of ***climate change***) into the ***atmosphere***.
Emissions coefficient/factor	A unique value for scaling emissions to activity data in terms of a standard rate of emissions per unit of activity (e.g., grams of carbon dioxide emitted per barrel of fossil fuel consumed).
Energy conservation	Reduction or elimination of unnecessary energy use and waste. See energy-efficiency.
Energy	The capacity for doing work as measured by the capability of doing work (potential energy) or the conversion of this capability to motion (kinetic energy). Energy has several forms, some of which are easily convertible and can be changed to another form useful for work. Most of the world's convertible energy comes from fossil fuels that are burned to produce heat that is then used as a transfer medium to mechanical or other means in order to accomplish tasks. In the United States, electrical energy is often measured in kilowatt-hours (kWh), while heat energy is often measured in British thermal units (Btu).
Energy-efficiency	The ratio of the useful output of services from an article of industrial equipment to the energy use by such an article; for example, vehicle miles traveled per gallon of fuel (mpg).
Enhanced greenhouse effect	The concept that the natural greenhouse effect has been enhanced by anthropogenic emissions of greenhouse gases. Increased concentrations of carbon dioxide, methane, and nitrous oxide, CFCs, HFCs, PFCs, SF6, NF3 and other photochemically important gases caused by human activities such as fossil fuel consumption, trap more infra-red radiation, thereby exerting a warming influence on the climate. See greenhouse gas, anthropogenic, greenhouse effect, climate, global warming.
Ethanol (C_2H_5OH)	Otherwise known as ethyl alcohol, alcohol, or grain spirit. A clear, colorless, flammable oxygenated hydrocarbon with a boiling point of 78.5 degrees Celsius in the anhydrous state. In transportation, ethanol is used as a vehicle fuel by itself (E100), blended with gasoline (E85), or as a gasoline octane enhancer and oxygenate (10 percent concentration).
Fertilization, Carbon Dioxide	An expression (sometimes reduced to *fertilization*) used to denote increased plant growth due to a higher carbon dioxide concentration.
Fertilizer	Substance that adds inorganic or organic plant nutrients to soil and improves its ability to grow crops, trees, or other vegetation. See organic fertilizer, fertilization.
Flaring	The burning of waste gases through a flare stack or other device before releasing them to the air.
Fluorocarbons	Carbon-fluorine compounds that often contain other elements such as hydrogen, chlorine, or bromine. Common fluorocarbons include chlorofluorocarbons (CFCs), hydrochlorofluorocarbons (HCFCs), hydrofluorocarbons (HFCs), and perfluorocarbons (PFCs). See chlorofluorocarbons, hydrochlorofluorocarbons, hydrofluorocarbons, perfluorocarbons, ozone depleting

	substance.
Forest	Terrestrial ecosystem (biome) with enough average annual precipitation (at least 76 centimeters or 30 inches) to support growth of various species of trees and smaller forms of vegetation.
Fossil fuel	A general term for buried combustible geologic deposits of organic materials, formed from decayed plants and animals that have been converted to crude oil, coal, natural gas, or heavy oils by exposure to heat and pressure in the earth's crust over hundreds of millions of years. See coal, petroleum, crude oil, natural gas.
Freon	See chlorofluorocarbons.
Fugitive emissions	Unintended gas leaks from the processing, transmission, and/or transportation of fossil fuels, CFCs from refrigeration leaks, SF_6 from electrical power distributor, etc.
Gasohol	Vehicle fuel consisting of a mixture of gasoline and ethyl or methyl alcohol; typically 10 to 23 percent ethanol by volume.
Geothermal energy	Heat transferred from the earth's molten core to under-ground deposits of dry steam (steam with no water droplets), wet steam (a mixture of steam and water droplets), hot water, or rocks lying fairly close to the earth's surface.
Global warming	The progressive gradual rise of the earth's surface temperature thought to be caused by the greenhouse effect and responsible for changes in global climate patterns. An increase in the near surface temperature of the Earth. Global warming has occurred in the distant past as the result of natural influences, but the term is most often used to refer to the warming predicted to occur as a result of increased emissions of greenhouse gases. See climate change, greenhouse effect, enhanced greenhouse effect, radiative forcing.
Global Warming Potential (GWP)	The index used to translate the level of emissions of various gases into a common measure in order to compare the relative radiative forcing of different gases without directly calculating the changes in atmospheric concentrations. GWPs are calculated as the ratio of the radiative forcing that would result from the emissions of one kilogram of a greenhouse gas to that from emission of one kilogram of carbon dioxide over a period of time (usually 100 years).
Greenhouse effect	The effect produced as greenhouse gases allow incoming solar radiation to pass through the Earth's atmosphere, but prevent part of the outgoing infrared radiation from the Earth's surface and lower atmosphere from escaping into outer space. This process occurs naturally and has kept the Earth's temperature about 59 degrees F warmer than it would otherwise be. Current life on Earth could not be sustained without the natural greenhouse effect.
Greenhouse Gas	Any gas that absorbs infrared radiation in the atmosphere. Greenhouse gases include water vapor, carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), halogenated fluorocarbons (HCFCs), ozone (O_3), perfluorinated carbons (PFCs), and hydrofluorocarbons (HFCs). See carbon dioxide, methane,

	nitrous oxide, hydrochlorofluorocarbons, ozone, hydrofluorocarbons, perfluorocarbons, sulfur hexafluoride.
Hydrocarbons	Substances containing only hydrogen and carbon. Fossil fuels are made up of hydrocarbons. Some hydrocarbon compounds are major air pollutants. Seefossil fuel.
Hydrochlorofluorocarbons (HCFCs)	Compounds containing hydrogen, fluorine, chlorine, and carbon atoms. Although ozone depleting substances, they are less potent at destroying stratospheric ozone than chlorofluorocarbons (CFCs). They have been introduced as temporary replacements for CFCs and are also greenhouse gases. See ozone depleting substance.
Hydroelectric power plant	Structure in which the energy of fading or flowing water spins a turbine generator to produce electricity.
Hydrofluorocarbons (HFCs)	Compounds containing only hydrogen, fluorine, and carbon atoms. They were introduced as alternatives to ozone depleting substances in serving many industrial, commercial, and personal needs. HFCs are emitted as by-products of industrial processes and are also used in manufacturing. They do not significantly deplete the stratospheric ozone layer, but they are powerful greenhouse gases with global warming potentials ranging from 140 (HFC-152a) to 11,700 (HFC-23).
Hydropower	Electrical energy produced by falling or flowing water. See hydroelectric power plant.
Inorganic compound	Combination of two or more elements other than those used to form organic compounds. See organic compound.
Inorganic fertilizer	See synthetic fertilizer.
Intergovernmental Panel on Climate Change (IPCC)	The IPCC was established jointly by the United Nations Environment Programme and the World Meteorological Organization in 1988. The purpose of the IPCC is to assess information in the scientific and technical literature related to all significant components of the issue of climate change. The IPCC draws upon hundreds of the world's expert scientists as authors and thousands as expert reviewers. Leading experts on climate change and environmental, social, and economic sciences from some 60 nations have helped the IPCC to prepare periodic assessments of the scientific underpinnings for understanding global climate change and its consequences. With its capacity for reporting on climate change, its consequences, and the viability of adaptation and mitigation measures, the IPCC is also looked to as the official advisory body to the world's governments on the state of the science of the climate change issue. For example, the IPCC organized the development of internationally accepted methods for conducting national greenhouse gas emission inventories.
Landfill	Land waste disposal site in which waste is generally spread in thin layers, compacted, and covered with a fresh layer of soil each day.
Liquefied natural gas (LNG)	Natural gas converted to liquid form by cooling to a very low temperature.

Liquefied petroleum gas (LPG)	Ethane, ethylene, propane, propylene, normal butane, butylene, and isobutane produced at refineries or natural gas processing plants, including plants that fractionate new natural gas plant liquids.
Litter	Undecomposed plant residues on the soil surface. See decomposition.
Low Emission Vehicle (LEV)	A vehicle meeting the low-emission vehicle standards.
Manure	Dung and urine of animals that can be used as a form of organic fertilizer. See fertilizer, organic fertilizer.
Methane (CH4)	A hydrocarbon that is a greenhouse gas with a global warming potential most recently estimated at 21. Methane is produced through anaerobic (without oxygen) decomposition of waste in landfills, animal digestion, decomposition of animal wastes, production and distribution of natural gas and petroleum, coal production, and incomplete fossil fuel combustion. The atmospheric concentration of methane as been shown to be increasing at a rate of about 0.6 percent per year and the concentration of about 1.7 per million by volume (ppmv) is more than twice its pre-industrial value. However, the rate of increase of methane in the atmosphere may be stabilizing.
Metric Ton	Common international measurement for the quantity of greenhouse gas emissions. A metric ton is equal to 2205 lbs or 1.1 short tons. See short ton.
MMBtu	One Million Btus. A Btu is the quantity of heat required to raise the temperature of one pound of water one degree of Fahrenheit at or near 39.2 degrees Fahrenheit.
Montreal Protocol on Substances that Deplete the Ozone Layer	The Montreal Protocol and its amendments control the phaseout of ozone depleting substances production and use. Under the Protocol, several international organizations report on the science of ozone depletion, implement projects to help move away from ozone depleting substances, and provide a forum for policy discussions. In the United States, the Protocol is implemented under the Clean Air Act Amendments of 1990. See ozone depleting substance, ozone layer.
Motor gasoline	A complex mixture of relatively volatile hydrocarbons, with or without small quantities of additives, obtained by blending appropriate refinery streams to form a fuel suitable for use in spark-ignition engines. Motor gasoline includes both leaded and unleaded grades of finished gasoline, blending components, and gasohol. See hydrocarbons.
Municipal solid waste (MSW)	Residential solid waste and some non-hazardous commercial, institutional, and industrial wastes. This material is generally sent to municipal landfills for disposal. See landfill.
Natural gas	Underground deposits of gases consisting of 50 to 90 percent methane (CH4) and small amounts of heavier gaseous hydrocarbon compounds such as propane (C3H8) and butane (C4H10).
Nitrogen Oxides (NOx)	Gases consisting of one molecule of nitrogen and varying numbers of oxygen molecules. Nitrogen oxides are produced, for example, by the combustion of fossil fuels in vehicles and electric power plants. In the atmosphere, nitrogen oxides can

	contribute to formation of photochemical ozone (smog), impair visibility, and have health consequences; they are considered pollutants.
Nitrous Oxide (N2O)	A powerful greenhouse gas with a global warming potential most recently evaluated at 310. Major sources of nitrous oxide include soil cultivation practices, especially the use of commercial and organic fertilizers, fossil fuel combustion, nitric acid production, and biomass burning.
Nonbiodegradable	Substance that cannot be broken down in the environment by natural processess. See biodegradable.
Nuclear electric power	Electricity generated by an electric power plant whose turbines are driven by steam generated in a reactor by heat from the fissioning of nuclear fuel. See nuclear energy.
Nuclear energy	Energy released when atomic nuclei undergo a nuclear reaction such as the spontaneous emission of radioactivity, nuclear fission, or nuclear fusion.
Oil	See crude oil, petroleum, fossil fuel, hydrocarbons.
Ore	Mineral deposit containing a high enough concentration of at least one metallic element to permit the metal to be extracted and sold at a profit.
Organic compound	Molecule that contains atoms of the element carbon, usually combined with itself and with atoms of one or more other element such as hydrogen, oxygen, nitrogen, sulfur, phosphorus, chlorine, or fluorine. See inorganic compound.
Organic fertilizer	Organic material such as manure or compost, applied to cropland as a source of plant nutrients.
Ozone (O3)	A colorless gas with a pungent odor, having the molecular form of O3 , found in two layers of the atmosphere, the stratosphere (about 90% of the total atmospheric loading) and the troposphere (about 10%). Ozone is a form of oxygen found naturally in the stratosphere that provides a protective layer shielding the Earth from ultraviolet radiation's harmful health effects on humans and the environment. In the troposphere, ozone is a chemical oxidant and major component of photochemical smog. Ozone can seriously affect the human respiratory system. See atmosphere, ultraviolet radiation.
Ozone depleting substance (ODS)	A family of man-made compounds that includes, but are not limited to, chlorofluorocarbons (CFCs), bromofluorocarbons (halons), methyl chloroform, carbon tetrachloride, methyl bromide, and hydrochlorofluorocarbons (HCFCs). These compounds have been shown to deplete stratospheric ozone, and therefore are typically referred to as ODSs. See ozone.
Ozone layer	The layer of gaseous ozone (O3) in the stratosphere that protects life on earth by filtering out harmful ultraviolet radiation from the sun. See stratosphere, ultraviolet radiation.
Perfluorocarbons (PFCs)	A group of human-made chemicals composed of carbon and fluorine only. These chemicals (predominantly CF4 and C2F6) were introduced as alternatives, along with hydrofluorocarbons, to the ozone depleting substances. In addition, PFCs are emitted as by-products of industrial processes and are also used in manufacturing. PFCs do not harm the stratospheric ozone layer, but they are powerful greenhouse gases: CF4 has a global

	warming potential (GWP) of 6,500 and C2F6 has a GWP of 9,200. See ozone depleting substance.
Petroleum	A generic term applied to oil and oil products in all forms, such as crude oil, lease condensate, unfinished oils, petroleum products, natural gas plant liquids, and non-hydrocarbon compounds blended into finished petroleum products. See crude oil.
Petroleum coke	A residue that is the final product of the condensation process in cracking.
Photovoltaic and solar thermal energy	Energy radiated by the sun as electromagnetic waves (electromagnetic radiation) that is converted into electricity by means of solar (i.e., photovoltaic) cells or useable heat by concentrating (i.e., focusing) collectors.
Population	Group of individual organisms of the same species living within a defined area.
Recycling	Collecting and reprocessing a resource so it can be used again. An example is collecting aluminum cans, melting them down, and using the aluminum to make new cans or other aluminum products.
Reforestation	Replanting of forests on lands that have recently been harvested.
Renewable energy	Energy obtained from sources that are essentially inexhaustible, unlike, for example, the fossil fuels, of which there is a finite supply. Renewable sources of energy include wood, waste, geothermal, wind, photovoltaic, and solar thermal energy. See hydropower, photovoltaic.
Short Ton	Common measurement for a ton in the United States. A short ton is equal to 2,000 lbs or 0.907 metric tons. See metric ton.
Sink	A reservoir that uptakes a chemical element or compound from another part of its cycle. For example, soil and trees tend to act as natural sinks for carbon.
Soil	Complex mixture of inorganic minerals (i.e., mostly clay, silt, and sand), decaying organic matter, water, air, and living organisms.
Solar energy	Direct radiant energy from the sun. It also includes indirect forms of energy such as wind, falling or flowing water (hydropower), ocean thermal gradients, and biomass, which are produced when direct solar energy interact with the earth. See solar radiation.
Source	Any process or activity that releases a greenhouse gas, an aerosol, or a precursor of a greenhouse gas into the atmosphere. See point source, non-point source.
Sulfur dioxide (SO2)	A compound composed of one sulfur and two oxygen molecules. Sulfur dioxide emitted into the atmosphere through natural and anthropogenic processes is changed in a complex series of chemical reactions in the atmosphere to sulfate aerosols. These aerosols are believed to result in negative radiative forcing (i.e., tending to cool the Earth's surface) and do result in acid deposition (e.g., acid rain). See aerosol, radiative forcing, acid deposition, acid rain.

Synthetic fertilizer	Commercially prepared mixtures of plant nutrients such as nitrates, phosphates, and potassium applied to the soil to restore fertility and increase crop yields. See organic fertilizer.
Synthetic natural gas (SNG)	A manufactured product chemically similar in most respects to natural gas, resulting from the conversion or reforming of petroleum hydrocarbons. It may easily be substituted for, or interchanged with, pipeline quality natural gas.
Transportation sector	Consists of private and public passenger and freight transportation, as well as government transportation, including military operations.
United Nations Framework Convention on Climate Change (UNFCC)	The international treaty unveiled at the United Nations Conference on Environment and Development (UNCED) in June 1992. The UNFCCC commits signatory countries to stabilize anthropogenic (i.e. human-induced) greenhouse gas emissions to "levels that would prevent dangerous anthropogenic interference with the climate system." The UNFCCC also requires that all signatory parties develop and update national inventories of anthropogenic emissions of all greenhouse gases not otherwise controlled by the Montreal Protocol. Out of 155 countries that have ratified this accord, the United States was the first industrialized nation to do so. See Conference of the Parties, Berlin Mandate, Kyoto Protocol, Montreal Protocol.
Vehicle miles traveled (VMT)	One vehicle traveling the distance of one mile. Thus, total vehicle miles is the total mileage traveled by all vehicles.
Volatile organic compounds (VOCs)	Organic compounds that evaporate readily into the atmosphere at normal temperatures. VOCs contribute significantly to photochemical smog production and certain health problems. See non-methane volatile organic compounds.
Wastewater	Water that has been used and contains dissolved or suspended waste materials. See sewage treatment.
Wetland	Land that stays flooded all or part of the year with fresh or salt water.
Wood energy	Wood and wood products used as fuel, including roundwood (i.e., cordwood), limbwood, wood chips, bark, sawdust, forest residues, and charcoal.

APPENDICES

Appendix A

State of Wisconsin Energy Use Policy (separate link to Word document)
http://www.doa.state.wi.us/category.asp?linkcatid=785&linkid=135&locid=4

Appendix B

State of Wisconsin Building Commission Policy and Procedures Manual, Section VI. Sustainable Facilities and Energy Conservation Policies (separate link)
http://www.doa.wi.gov/docview.asp?docid=317&locid=4

Appendix C

Division of State Facilities Sustainable Facilities Standards (separate PDF)
ftp://doaftp04.doa.state.wi.us/master_spec/Sustainable%20Facilities%20Standards/Sustainable%20Facilities%20Standards.pdf

Appendix D

Table of State Mandated Energy Initiatives (attached)

Appendix E

Focus on Energy Commercial Wind Energy Site Assessment Report (separate PDF)

Wind site assesment
2005 by focus on ene

STATE OF WISCONSIN ENERGY-USE POLICY

Wisconsin Department of Administration
Division of State Facilities (DSF)
November 2006

Table of Contents **Page**

I. Introduction

This policy is intended to reduce the use of energy from fossil fuels and other sources in state owned and leased facilities without adversely affecting program operations. Agency heads, building users, managers, physical plant staff and facility designers share the responsibility for achieving this goal. (Designers reference DSF Energy Design Guidelines**.**

II. Energy Conservation

Energy conservation is not a one-time activity or project. It is an on-going responsibility, requiring daily attention and providing daily opportunities. Reducing energy usage in state government helps state agencies to manage utility budgets and reduce the demand for fossil fuels and generation of related air emissions.

III. Agency Heads and Program Managers

Energy conservation starts here. Agency heads and program managers in state agencies are in position to provide strong leadership in the area of energy conservation. Building users, building managers, and physical plant staff look for leadership in this area and for clear direction and purpose. The management of facilities is a difficult and complicated task. Energy conservation efforts impact the physical work environment and individuals may not be completely comfortable with set temperatures, air movement, or other environmental variables. Physical plant staff and building managers may be asked to adjust the physical environment to address individual comfort levels.

Agency heads and program mangers provide leadership and direction by reinforcing the policies that support energy conservation and working with building users to balance comfort with conservation. Clear communications regarding what to expect in work settings, support for energy conservation, and continued attention to energy conservation as a leadership and management responsibility can greatly improve the effectiveness of the state's Energy-Use Policy. Equally, lack of attention to energy conservation, poor role-modeling, and lack of support for building operational decisions can undermine the effectiveness of the Energy-Use Policy and lead to excessive use of energy in state operations.

Recognize that energy conservation is a continuing responsibility in state government and not a one-time effort to address current situations. Successful energy policies are supported visibly by agency heads and are continual, building on prior successes to achieve long-term success.

IV. Building Users

A. Buildings

Windows: Close operable windows when heating or air conditioning space. If windows have storm windows, use during heating season.

Window Blinds and Shades: Adjust blinds and shades during air conditioning season to reflect direct sunlight outdoors. At other times adjust to maximize natural daylighting. Close blinds and shades during heating season at night.

Doors: Keep passage and overhead doors closed as much as possible and do not block open while heating or air conditioning.

Elevators: Promote the use of stairs in place of elevators, where possible.

Process Equipment

Fume Hoods: Close sashes when not in use. Do not use as storage cabinets or to evaporatively dispose of chemicals.

Kilns, Drying/Curing Ovens, Sterilizers: Minimize preheat and run times. Shut off when not in use.

Food Service and Kitchen Ventilation Equipment: Shut off when not in use.

Wood Dust Collection, Process Exhaust and Makeup Air Ventilation: Shut off when not in use.

B. Plumbing Systems

Water Conservation: Avoid using domestic water as a source of heating or cooling. Water lawns and plantings before 10 a.m. or during the evening hours. Run dishwashers and clothes washers using full loads. Minimize shower time. Sweep paved areas clear of debris rather than hosing off.

C. Heating, Ventilating and Air Conditioning (HVAC)

Thermostats: In small buildings and in exterior zones of large buildings, adjust to 68^{o}F maximum in the winter and 76^{o}F minimum in the summer. Reduce to 60^{o}F during unoccupied winter hours.

In interior variable air volume zones of large buildings, adjust to 76^{o}F minimum.

In interior constant air volume zones of large buildings, adjust to 68°F maximum in the winter and 76°F* minimum in the summer. Reduce to 60°F during unoccupied winter hours. *(For reheat systems, subject to discharge reset control strategy and temperature setting necessary to minimize cooling and reheat.)

In vestibules, stairwells, mechanical/electrical rooms, elevator equipment rooms, unoccupied storage and similar spaces, adjust to 60°F in the winter.

Dress for comfort and plan for the conditions in your working environment.

Ventilation and Air Conditioning: Shut down equipment during unoccupied hours. Use building automation systems or time clocks to automate operations.

D. Lighting and Electrical Systems

Lighting: Turn off lights when space is not in use or natural daylighting is adequate. Use task lighting to reduce overall illumination levels.

Office Equipment: Turn off personal computers, printers, copy machines and other office equipment when not in use and during unoccupied hours. Use Energy Star rated electrical products and appliances. Set up office equipment for automatic sleep modes.

Personal Equipment: Eliminate use of individual cooking, space heating or cooling appliances and incandescent or halogen floor lamps.

V. Building Managers and Physical Plant Staff

A. Building

Insulation: Repair damaged, displaced or missing building insulation.

Windows and Doors: Maintain weather stripping, glazing compound, caulking, seals and door closers to minimize infiltration. Repair broken glazing. Keep overhead doors closed as much as possible when heating or air conditioning. Close operable windows when heating or air conditioning space. If windows have storm windows, use during heating season.

Finishes and Furnishings: When refinishing and refurnishing, use light colors for better illumination at lower lighting levels. Minimize height of systems furniture and partitions for transfer of daylight.

B. Plumbing Systems

Water Conservation: Repair leaking faucets, fixtures, valves and piping. Avoid using domestic water as a source of heating or cooling. Water lawns and plantings before 10 a.m. or during the evening hours. Use 0.5 GPM flow restrictors on faucet outlets and 2.5 GPM restricted flow showerheads. Use 1.6 gallon/flush water closets and 1.0 gallon/flush urinals when replacing fixtures. Select water conserving models when purchasing dishwashers and clothes washers.

Pumping: Shut down domestic hot water recirculating pumps when unoccupied. Adjust domestic water pressure booster pumps for the minimum pressure and run time necessary to maintain adequate delivery pressure to fixtures.

Water Heaters: Periodically blow down water heaters to eliminate sediment buildup on heat exchange surfaces. Adjust burners and induced draft fans for optimum combustion efficiency. Adjust water temperature setpoint to minimum acceptable to building occupants.

C. Heating, Ventilating and Air Conditioning (HVAC)

Thermostats: In small buildings and in exterior zones of large buildings, adjust to 68°F maximum in the winter and 76°F minimum in the summer. Reduce to 60°F during unoccupied winter hours.

In interior variable air volume zones of large buildings, adjust to 76°F minimum.

In interior constant air volume zones of large buildings, adjust to 68°F maximum in the winter and 76°F* minimum in the summer. Reduce to 60°F during unoccupied winter hours. *(For reheat systems, temperature setting necessary to minimize cooling and reheat dependent on discharge air reset control strategy.)

In vestibules, stairwells, mechanical/electrical rooms, elevator equipment rooms, unoccupied storage and similar spaces, adjust to 60°F in the winter.

Use setback thermostats for perimeter heating zones.

Calibrate thermostats on a regular basis.

Ventilation and Air Conditioning: Shut down equipment during unoccupied hours.

Do not air condition gymnasiums, locker rooms, swimming pools, food service occupancies, commercial/institutional laundry areas, mechanical/electrical rooms, unoccupied storage spaces, correctional facility inmate areas, state park toilet/shower facilities, vehicle service and storage buildings, industrial/shop occupancies, utility buildings, wastewater treatment plants and similar areas.

Filters: Routinely replace or clean filters to minimize pressure drop.

Belts: Routinely adjust drive belts for proper tension and replace worn belts.

Bearings: Routinely lubricate motor and equipment bearings.

Dampers: Inspect dampers, damper seals, linkages and operators for proper sealing and operation. Repair and replace as needed for proper cycling, full closure and tight sealing.

Insulation: Repair or replace damaged or missing pipe, duct and equipment insulation. Provide high level of insulation in unconditioned spaces.

Piping Systems: Routinely blowdown strainers and clean strainer screens. Repair or replace leaking system components. Where excessive pump throttling is used, trim impellers or add variable frequency drive pump control.

Air Systems: Seal leaks in ductwork, around coils and in air handling equipment with duct sealer and/or sheet metal closures. Periodically check louver screens and accessible turning vanes and clean to minimize pressure drop.

Building Automation and Controls: Train appropriate building operators in the use of building automation and controls to minimize energy use. Optimize building start/stop equipment schedules to minimize operating time and stagger start-up times to limit electrical, central plant steam and chilled water demand. Shut down non-essential equipment when not occupied, heating pumps when heating isn’t in demand and cooling/condenser pumps when cooling isn’t in demand.

Calibrate controls and check for correct operation on a regular basis.

Review air compressor run times on a routine basis, adjust pressure setting to minimum acceptable and repair pneumatic system leaks.

Use reset schedules to minimize energy use for discharge air temperature control, heating hot water temperature and humidification setpoints.

Boiler Tubes, Chiller Tubes, Coils and Heat Exchange Surfaces: Clean fouled surfaces on a routine basis to ensure efficient heat exchange and minimal pressure drop. Use proper chemical water treatment program to minimize scale, fouling, corrosion and biological activity.

Boiler and Cooling Tower Blowdown Systems: Check and adjust automated blowdown systems to minimize blowdown while maintaining appropriate cycles of concentration.

Cooling Towers: Check and clean spray nozzles, distribution basin, fill and sump screens.

Burners: Routinely analyze flue gas and adjust burners for optimum fuel-air ratios.

Steam Traps: Routinely test and repair or replace leaking or failing steam traps.

D. Lighting and Electrical Systems

Lighting: Turn off lights when space is not in use. Use occupancy sensors indoors and photoelectric sensors outdoors when retrofitting systems. Maintain sensors to ensure lights are off when not needed. Use LED exit lights when retrofitting.

Office Equipment: Turn off personal computers, printers, copy machines and other office equipment when not in use and during unoccupied hours. Use Energy Star rated electrical products and appliances.

V. Types of Facilities

The application of the above guidelines will vary by type of building. Agency decisions regarding energy conservation need to reflect facility type and operational needs.

A. Residential Facilities

Residential facilities with varying occupancies, such as college dormitories, should schedule lighting, room temperature setpoints and equipment operating schedules to take advantage of periods of light use or no occupancy. Facilities with continuous occupancies should schedule similar energy reduction measures for unoccupied hours in common areas with intermittent or daytime only use.

B. Office Buildings

State office facilities should be managed to reflect primary business hours and non-business hours. Office facilities should take maximum advantage of energy conservation during non-business hours and weekends. HVAC systems should be scheduled to reflect the limited use of these buildings on weekends. Motion sensors for lighting and HVAC terminal control and other passive energy conservation tools should be used extensively in these buildings.

C. Research Facilities

Research and laboratory facilities are particularly energy-intensive and need to be carefully managed to ensure maximum conservation while meeting the program needs of occupants. Building users, building managers and program managers should jointly identify and implement energy conservation plans and operating procedures. Research facilities should not be operated 24x7 as if fully occupied at all times; agencies should initiate energy conservation planning for these buildings based on office building hours of operation and make adjustments, if warranted, from this. Usage may be monitored during non-business hours and on weekends to determine if HVAC systems need to be operated beyond minimal levels. Operating procedures, such as closing the sashes of fume hoods when not in use, need to be set with building users, communicated, and followed for maximum energy conservation.

D. Academic Facilities

Usage of academic facilities varies from location to location and may differ from office buildings and research buildings. Building managers and building users should assess the hours of use and plan for energy conservation based on building scheduling. Opportunities for energy conservation exist in classrooms if not used through the day, if unused on certain days, and during off-hours such as weekends and evenings.

E. Other Facilities and Infrastructure

Exterior Lighting: Evaluate the amount of exterior lighting provided around facilities and on the grounds of campuses and institutions. Lighting is required for safety, security and way finding and can be accomplished with energy-efficient fixtures. Lighting for purposes other than safety, security and way finding should be assessed and reduced as appropriate.

Athletic Facilities: Assess the hours of operation and usage patterns to identify appropriate hours of operation for HVAC systems, lighting systems, exterior lighting, and other electrical systems.

Central Heating and Power Plants: State agencies own and operate central heating and power plants at many institutions across Wisconsin. Improvements in the operational efficiency of these facilities can have significant impacts on energy usage at state facilities.

STATE OF WISCONSIN BUILDING COMMISSION
POLICY AND PROCEDURES MANUAL
STAFF:
Department of Administration
Division of State Facilities
Updated: August, 2011

VI. SUSTAINABLE FACILITIES AND ENERGY CONSERVATION POLICIES

A. Sustainable Facilities Policy

Purpose

It is the policy of the State Building Commission to be a leader in improving the overall quality and performance of state facilities and to minimize the total cost of occupancy.

The Building Commission adopts this Policy to promote the planning, improvement and management of state facilities in a sustainable manner that

- Promotes the effective use of existing state space
- Respects the larger environmental and social context into which they fit
- Promotes human health, comfort and performance
- Conserves natural resources and reduces detrimental effects on the environment; and
- Ensures energy efficiency
- Considers the life-cycle cost of initiatives

Policy
The Department of Administration shall develop and implement guidelines and minimum standards to incorporate environmentally responsible and sustainable concepts and practices into the planning, design, construction, operation and maintenance of all state facilities. These guidelines and minimum standards shall include, but not be limited to: establishing performance criteria in the following categories: portfolio management, sustainable sites, water efficiency, energy and atmosphere, materials and resources, adaptive use and preservation of existing building, indoor environmental quality, construction waste and recycling, operation and maintenance, and purchasing of furniture, fixtures and equipment.

The Department shall report annually on the implementation of this policy and shall annually recognize the projects that most successfully contribute to the development of sustainable state facilities.

B. Energy Conservation Policy Purpose

The State Building Commission, through the "Wisconsin Energy Initiative", supports aggressive energy conservation program to reduce consumption and achieve optimum energy efficiency in state facilities. To achieve this goal all new facility, remodeling, and energy improvement projects must incorporate energy efficient materials and equipment, utilize methods of energy recovery and other energy saving concepts where practical and cost effective. Existing energy using systems must also be properly maintained for efficient operations.

C. Energy Design Guidelines

Energy conservation features included in state facilities should significantly reduce energy consumption at an optimum investment of state funds. Improvements must also be compatible with the functional program, provide savings over an extended period of time, and take into account the net energy balance.

1. All projects must meet the minimum requirements of the Wis. Admin. Code, COMM Chapter 63, relating to Energy Conservation.

2. In accord with Wis. Stats, s. 13.48(2), Building Commission; Powers and Duties, funding may not be authorized for bidding and construction of a major building project unless the design concept provides maximum practical use of passive solar energy system design elements, offers life-cycle cost estimates of the energy resource consuming systems and, where technically and economically justified, incorporates an active solar energy or photovoltaic or other renewable energy resource system.

3. In accord with the responsibility provided by Wis. Stats, s. 16.85(5), the Department of Administration shall develop suitable guidelines to promote energy conservation in state buildings.

D. Energy Conservation Funding

Funding for energy improvement projects has been available through the All Agency Wisconsin Energy Initiative. This funding allocation, when available, is to be used to increase energy efficiency in new and existing state facilities.

1. The all agency funding can only be used for improvements to GPR funded facilities. Projects for non-GPR funded facilities are eligible for loans from the all agency funds provided they meet the intent of this policy. Such loans are to be paid back as provided in Chapter V, Section G.

2. Funding of projects with mixed funding shall be in proportion to the GPR/non-GPR projected savings.

3. Energy efficient materials and equipment normally used in the design and construction of a new facility or remodeling project, or required by Division of State Facilities guidelines, shall be included in the project budget. Funding may be provided for special energy systems or design features, which are supported by an economic evaluation.

4. All agency funding is available for energy conservation equipment in UW College facilities consistent with s. 13.48(2)(f), Wis. Stats.

E. Economic Evaluations

In accord with Wis. Stats. 13.48(2)(i), Building Commission; Powers and Duties, all energy conservation projects will be evaluated using the discounted payback method of "life-cycle costing" to assure that proposed improvements are cost effective.

1. The discounted payback period shall not exceed the service life of the improvement or the remaining useful life of the facility or recovery of costs of the work within a reasonable period

of time. Projects involving special circumstances which warrant a longer payback period may be considered on a case-by-case basis.

2. In addition to the initial project costs and energy cost savings, the payback analysis shall also consider changes in maintenance, staffing needs, and other costs resulting from the improvement project.

3. The Division of State Facilities shall develop and maintain suitable guidelines for performing the discounted payback analysis.

F. Agency Operation and Maintenance

An effective energy conservation program requires that energy systems and equipment are properly maintained. Each agency shall initiate appropriate operating procedures and maintenance programs to keep equipment and building systems in good operating condition to minimize energy consumption.

G. Energy Conservation Audits and Construction Projects by Private Contractors

1. The department may contract with a qualified contractor for energy conservation audits to be performed at any state-owned building, structure or facility as provided in s. 16.858(1), Wis. Stats.

2. The department may enter into contracts with private contractors to undertake construction work at the contractor's own expense or using the master lease program at a state facility for the purpose of realizing potential savings of future energy costs identified in the audit if, in the judgment of the department, the anticipated savings to the state will enable recovery of the costs of the work within a reasonable period of time.

3. Payments to the contractor for such construction work shall be charged to the applicable appropriation for fuel and utility costs for the facility where the work is performed utilizing the procedures provided under s. 16.858(2), Wis. Stats.

4. The Secretary shall make such reports on this program as required by the Commission and by the Joint Committee on Finance under s. 16.858(4), Wis. Stats.

COMMITMENT	2011	2012	2014	2015	2022	2025	2050
Act 141	20% purchased electricity from renewable sources						
“Off-the-grid” 5-year pilot		30% electric conservation; 20% heating fuel reduction; 30% renewable energy purchases; 20% on-site renewable energy systems					
Exec Order 191			Reduce greenhouse gas emissions to 2005 levels		Reduce GHG emissions 22% below 2005 levels		Reduce GHG emissions 75% below 2005 levels
Exec Order 141				50% reduction in petroleum-based gas usage in state-owned vehicles		25% reduction in diesel fuel use in state-owned vehicles	
Exec Order 192						Generate 25% electricity & 25% transportation fuel from renewable sources	
ACUPCC Commitment							Zero net carbon emissions

Wisconsin Focus on Energy
Commercial Wind Energy Site Assessment Report
Yahara Linden Energy, LLC

Site Assessor contact information
Walt Novash
Yahara Linden Energy, LLC
2442 Upham St.
Madison, WI 53704
(608) 257-2267
waltnv@prodigy.net

Date of Consultation: February 7, 2005

Time Spent: 3.5 hours at site **Mileage:** 232 miles round trip

Latitude/Longitude of Sites Discussed:
Site A: 44.5324 N, 89.5662 W
Site B: 44.5351 N, 89.5716 W
Site C: 44.5404 N, 89.5635 W

Name of Client: University of Wisconsin Stevens Point

Contacts: Larry Beck, Director of Facility Services, 715-346-3059, lbeck@uwsp.edu
Josh Stolzenburg, Student Project Coordinator, 715-592-6595, josh@the-mrea.org

Street Address: 1848 Maria Drive
City: Stevens Point
County: Portage
State: WI
Zip: 54481-3897

Electric Utility: Wisconsin Public Service (WPS)

Project Overview: The University of Wisconsin Stevens Point (UWSP) is investigating the possibility of installing a wind turbine at their main campus. The project has educational and demonstration elements, although it would be desirable to produce a meaningful amount of power as well. Larry and Josh are most interested in turbines in the 50 kW – 250 kW range at this point.

1. What types of system(s) were discussed during the site visit?
X Wind
Photovoltaic
Wind/PV Hybrid

2. Is the system being installed as a part of new construction, or as a retrofit?
Retrofit on existing buildings/facilities.

3. What is the client's timeline for installation?
The project is in a research phase at this point – the timeline would depend largely on the availability of financing.

4. How involved is the customer willing to be with the system?
X Is interested in being involved in the installation of the system. Will take full responsibility for the maintenance of the system.
x Will perform basic maintenance, but wants technical back up for problem situations.
x Wants maintenance performed by outside contractor.

Comments: It is possible that UWSP personnel could be involved with the turbine maintenance, although an outside contractor would be needed to supervise this work.

6. Existing electrical service

WPS supplies power to the campus at 12 kV, and there is a central campus electrical substation located on Maria Drive not far from **Site B** (see **Figure 1**). There is 480V three-phase power available at many places on campus, including near **Sites A and B**. There is a single-phase service at the Schmeeckle Shelter Building near **Site C**. There are three-phase distribution lines running along North Point Drive, within several hundred feet of **Site C**. According to an engineer I spoke with at WPS, this is a 14.4 kV three-phase distribution line.

7. Electrical usage and cost, most significant loads

The overall electrical usage for the entire campus is on the order of 22,000,000 kWh/year. The billing is based on three components: total usage, demand, and power factor charges. Larry provided me with a photocopy of one bill during the site visit (December 2004). In this month, the total usage was 1,954,892 kWh, and the total charge was $87,536.23. The total-usage-based portion of the bill was approximately $57,600, or on the order of 65% of the total bill. The rest of the bill consisted essentially of demand-based charges – the power-factor-based charges were negligible. I would expect that the demand charges might make up a larger portion of the bill in the summer months, when demand usually peaks. If we assume that a wind turbine will have no effect on the demand or power-factor-based portions of the bill (this is usually a fair assumption), then we are mainly interested in the part of the bill based on the total number of kilowatt-hours used. For this particular bill, if the usage-based part of the bill was $57,600 for approximately 1,955,000 kWh, by simple division we get an average cost of electricity of **2.95 cents/kWh**. This represents the value of the electricity produced by a wind turbine if that electricity was used to directly offset usage at the main campus. If instead a wind turbine were tied directly into the utility grid, the most relevant rate would be WPS' published buyback rate for customer-owned electricity generating systems. For systems over 20 kW in capacity, the published rates are listed in WPS tariff Schedule PG-2, available on the internet at http://www.wisconsinpublicservice.com/news/electric/pg2.pdf . I spoke with John Christiano at WPS (920-433-1869) recently, and he indicated that the rates that would probably apply in this case would be in the section of the tariff for Non-Combustion Renewable Resource Generators, Voltage under 6 kV, Year-round rates. (There is a listing for seasonal rates, but according to John these are being phased out.) The listed buyback rates for this category are 6.493 cents/kWh on-peak, and 2.422 cents/kWh off-peak. If we assume for simplicity that the production of the wind turbine will be spread out equally over all hours of the day, days of the week, and months of the year, and we perform a calculation where we "weight" the on-peak and off-peak rates according to how many of each type of hours there are in a week, we arrive at an average effective buyback rate of **4.32 cents/kWh**. This represents the value of the electricity produced by a wind turbine if that electricity was sold directly to WPS, and was not used to offset usage at the campus. Based on these preliminary numbers it would seem that the best scenario would be to sell electricity directly to WPS, rather than to use the electricity to offset usage at the campus. For **Site C**, at the Schmeeckle Shelter Building, there is a single-phase service that is not demandbased. The billing is based simply on a straight rate per kWh. Larry provided me with a recent bill (January 2005), on which the total usage was 4,682 kWh, and the total charges were $440.71. By simple division (subtracting out the "customer charges"), this results in an average cost of electricity of approximately **9.0 cents/kWh** for this building. The total usage for this building for the calendar year 2004 was 73,313 kWh according to records supplied by Larry. This is a site where it would make much more sense to use a wind turbine to offset the usage at the site directly, rather than to sell the electricity produced to WPS. However, because the instantaneous output of the wind turbine is likely to be higher than the instantaneous electricity usage at the building on occasion, some of the electricity produced by a turbine at the Schmeeckle Shelter Building will inevitably be put back onto WPS' grid. This electricity should be valued at WPS' standard buyback rate of approximately **4.32 cents/kWh,** as explained above.

8. Description of site and property

The UWSP main campus is located in the northern part of the town of Stevens Point, which is in turn located in central Portage County. The developed, lower part of the campus covers approximately 200 acres, and there are few open spaces in this section of campus other than the sports fields. The Schmeeckle Reserve is an undeveloped area covering approximately 300 acres, and is located in the northern part of the campus. This reserve is mostly wooded and contains recreational trails and wetland areas. **Figure 1** shows an aerial photo/sketch of a large portion of the campus. In this figure, the approximate campus boundaries are indicated, along with various other landmarks and two potential sites for wind turbines, labeled in the figure as **Sites A and B**. It can be seen from this photo that the area surrounding the campus is quite heavily developed. The development to the west of campus is mostly commercial, and to the east the development is mostly residential. **Figure 2** shows an aerial photo/sketch of an area at the northern boundary of the Schmeeckle Reserve, where the Schmeeckle Shelter Building is located. There is a potential wind turbine site labeled as **Site C** in this figure, which is in a clearing to the south of the parking lot for the Shelter Building. It can be seen from **Figure 2** that the area surrounding **Site C** can essentially all be described as either wooded or partially wooded. **Figure 3** shows a topographical map of the area within a half-mile to a mile of the three potential wind sites. It can be seen that the campus and surrounding area are quite flat for the most part. Based on **Figure 3**, **Site C** should be at a ground elevation of approximately 1110', **Site B** should be at an elevation on the order of 1100', and **Site A** should be at an elevation a few feet lower than **Site B**. In the lower part of campus where **Sites A and B** are located, development is dense, both on campus and on the neighboring properties. There are many trees and buildings that will serve to slow wind speeds and create turbulence, and these effects will likely be felt up to a considerable height, certainly up to the tower heights discussed in this report, and even up to the tower heights of commercialscale wind farm turbines. The presence of so much residential and other development will be a factor in terms of the public acceptance of the wind turbine project as well, and may potentially be a problem. Historically, wind turbine projects and dense residential development have not been a good mix in Wisconsin. There is no residential development close to **Site C** – the nearby neighbors are an industrial building and a golf course to the north, and a nature preserve to the south. The surrounding area is however very wooded, which I would expect to have a negative effect on wind speeds at the site.

9. Prevailing wind direction winter versus summer

Figure 4 shows a Wind Rose graph of wind speed and direction data taken at a site approximately 50 miles to the northwest of the campus, near the town of Abbotsford. This data was collected between late 1997 and early 2001 as part of the Wisconsin Wind Resource Assessment Program (WRAP), a tall-tower wind monitoring study. According to the Final Report from this study, available on the internet at ttp://www.focusonenergy.com/page.jsp?pageId=1091 (under "GEC Reports"), the site near Abbotsford had good exposure in all directions, and was at a ground elevation of approximately 1475'. In **Figure 4**, the inner, shaded bars represent the amount of time that the wind comes from the various directions of the compass, while the outer, unshaded bars represent the amount of energy in the winds coming from these directions, which is a function of the average wind speed from each direction. The figure shows a fairly even distribution of winds, with the winds from the southeastern quadrant of the compass containing the most energy, followed by approximately equal contributions from the southwestern and northwestern quadrants. The northeastern quadrant would appear to be the least important in terms of the wind energy available at the Abbotsford site. Given that the Abbotsford site is 50 miles away from the campus, I would expect that the distribution of prevailing winds in the area of the campus could be quite different from the distribution shown in **Figure 4**, and I would consider this figure to give only a general idea of the most important prevailing wind directions in the area.

10. Are there any airports located nearby?

Yes, the Stevens Point Municipal Airport is located approximately 2 miles away toward the east/northeast. The FAA will normally want to perform a study to evaluate the effect that a wind turbine or wind monitoring tower will have on air traffic in the region if the tower erected is within 20,000 feet (3.79 miles) of an airport runway, or if the combined height of the tower and extended turbine blade is greater than 200'. In this case, I would say that the UWSP will definitely need to file Form 7460 with the FAA. A good contact person at the local level is Gary Dikkers (608-267-5018), who is the Airspace Manager for the Wisconsin Department of Transportation. He may be able to provide some assistance in filling out Form 7460.

11. Description of potential tower sites

Site A is located within a group of sports fields, near the eastern edge of campus. The site is in what is probably the largest open treeless area on campus. There are two rows of light poles running north-south within the group of fields, and **Site A** was chosen to be within the westernmost row of these light stanchions. It is possible that a wind turbine tower could actually replace one of the light stanchions, and the lights could be hung from the turbine tower. The light poles are on the order of 80' tall, and are approximately 100' apart within the rows. The two rows of poles are approximately 350' – 400' apart. There is a pad-mounted transformer supplying 3-phase 480V power located within the westernmost row of light stanchions, quite close to **Site A**. The proximity of a wind turbine located at **Site A** to a variety of flying sports balls could be an issue. I believe that the closest fields to the site are soccer/football fields. Assuming a tower height such that the turbine blades at the lowest point of their swing would be above 100' in height, and given that the turbine would not actually be on the playing field, I would think that it would be very unlikely that a ball would hit the spinning turbine blades in the normal course of an athletic event. I

wonder if the temptation to try to hit the spinning blades with a ball (or frisbee?) would be too great to resist for some students, however. I have never heard of this being an issue with a wind turbine before.
The fact that the sports fields are a public-use area could be an issue as well, but I do not consider it to be a large issue. I would definitely recommend making sure that the electronics and control panel for the wind turbine are off-limits to the public through appropriate locks or possibly a small locked shed. "Danger – High Voltage" signs are usually a good deterrent in addition to locks. The electronics would typically be situated near the base of the tower. WPS will probably need to have access to a shut-down switch for the wind turbine. The only other consideration that I can think of in this regard would be that during an ice storm, wind turbine blades can become coated with a thin layer of ice. This ice tends to be shed fairly gently from the turbine blades as they thaw, but if there is a large ice storm it might be prudent not to allow the public near the base of the turbine until the ice has thawed from the blades. I would expect that just after an ice storm would generally be a very low-use time for sports fields. To date, the issue of ice being shed from turbine blades has never proved to be a problem for other wind turbines installed in Wisconsin. There is residential development to the east and south of **Site A**, at a distance of approximately 500' – 700' away. This is fairly close for this type of project, and it could turn out to be an issue. I believe that the housing to the east is largely student housing, but to the south there appear to be privatelyowned houses. Beyond the open areas of the sports fields and the parking lot immediately to the south, there are many trees in the area. The tallest of these trees are mostly in the 60' – 70' height range, but there are specimens on the order of 80' tall. **Site B** is located in a more behind-the-scenes location, in an area known as the "Resource Recovery Center", used for recycling dumpsters, piles of soil, piles of wood, etc. I am not sure if this area is technically accessible to the general public, but a wind turbine put here would be fairly out of the way. The closest neighbors to **Site B** are a large wooded area to the north, a parking lot to the southeast, the Maintenance and Materiel Building to the southwest, and a shopping center to the west. The shopping center is on the order of 300' away from **Site B** based on **Figure 1**, but this is actually the back of the shopping center, with the loading docks, dumpsters, etc. It is not an area that will be frequented by the public. The front of the shopping center is on the order of 600' from **Site B**. Local zoning requirements vary widely from place to place, but one typical requirement is that a wind turbine needs to be located a minimum setback distance from all property lines. This setback distance is often equal to the height of the wind turbine tower plus the blade length of the turbine. If we assume that this restriction is in effect here, **Site B** should satisfy this minimum setback distance for the wind turbines discussed in this report, based on **Figure 1**. (**Sites A and C** should satisfy this requirement as well, based on **Figures 1 and 2**, respectively.) There is a wooded area immediately to the north of **Site B**, within approximately 150' of the site. There are more trees toward the east and south at a somewhat greater distance away, on the order of 400' away. As with **Site A**, the tallest of these trees are mostly in the 60' – 70' height range, but I will assume that there are some trees as tall as 80' in the area. There is a 170' tall smokestack located to the south of the site, on the other side of Maria Drive, approximately 500' away. From the point of view of a turbine located at **Site B**, I would consider this to be an obstacle to the wind, but only when the wind is coming from a relatively small section of the compass. **Site C** is located in a small clearing (approximately 200' X 300') that is just to the south of the parking lot for the Schmeeckle Shelter Building. This site has the advantage of being somewhat farther from development, compared to **Sites A and B**. It has the disadvantage of being largely surrounded by woods, however. Most of the surrounding trees are in the 60' – 70' height range, but as with the other sites I would assume that there are some trees as tall as 80' in the area. All three of the potential wind sites discussed here are somewhat surrounded by trees and/or buildings, and these features will typically tend to slow down the wind, even at the hub height of a wind turbine. In addition, these features will create some turbulence, which is not good for wind turbines, since turbulent winds cause more wear and tear on a turbine as compared to smoothlyflowing winds. I would say that in general none of the three sites discussed here are excellent sites for a wind turbine, based simply on the number of trees and buildings in the area. If the UWSP decides to move forward with a wind turbine project, I would recommend using a tall tower to try to mitigate the effect of these ground obstacles.

12. Recommended tower heights based on sites

As described above, the tallest trees in the area have heights in the 80' range. Due to the overall level of development and tree cover in the area, I would recommend the tallest towers that are reasonably available and affordable for all of the potential sites discussed here. Looking at turbines in the 35 kW – 90 kW capacity range (more about specific turbines later in the report), one rule of thumb that is sometimes used to determine a minimum tower height would be to make sure that the entire turbine rotor is at least 30' above the height of the tallest obstacles in the area. If we assume a turbine blade length of 25' or 28' (typical for turbines in the 65 kW – 90 kW size range) and apply this rule of thumb for these sites, we arrive at recommended minimum tower heights of
80' (obstacles) + 30' (rule of thumb) + 25' (blade length) = 135 feet, and

80' (obstacles) + 30' (rule of thumb) + 28' (blade length) = 138 feet.
For larger wind turbines, that is, 100 kW-or-larger wind turbines, I would say the recommended tower height would depend on a wind resource study that would need to be performed at the site. Typically for projects on this scale, the first step is to erect a wind monitoring tower in the 50m (164') height range, and to measure wind speed and direction at several different heights for a period of at least one year. To make some preliminary output estimates for larger turbines later in this report, I will assume various tower heights that are typically used for these turbines, with the understanding that these tower heights might not be appropriate at **Sites A – C** due to the presence of the large number of trees and buildings in the area.

13. Soil type and depth of bedrock
According to Larry, the soil is sandy in general, and some soil borings have been done on the campus. Because the soil type will affect the digging and trenching work involved in these projects, and may also affect the design of the foundation for a wind turbine, the soil type should be discussed with the wind system dealer/installer before work begins on the project or estimates are given for the work.

14. Wind resource estimate
Based on the most recent version of the Wisconsin Wind Map (provided to the customers during the site visit), the annual average wind speed at the site at a height of 60m (197') above ground should be between 12.5 and 13 mph. I accessed the database containing the computer-generated wind speed values which were used to make this map, and based on this information, which consists of latitude/longitude/wind speed values for the entire state, laid out on a 1 km grid size, the closest grid points to the campus show a predicted annual average wind speed in the range of 12.7 mph at a height of 197' above ground. The formula for computing wind speed at a given tower height based on a known speed at a reference height is

$$V = (H/H0)\alpha V0, \text{ where}$$

V = the wind speed at tower height
V0 = the wind speed at reference height
H = the tower height
H0 = the reference height
α = the wind shear coefficient.

The wind shear coefficient is based on the surface roughness of the area in the vicinity of the site. In this case, the area has many trees and buildings, and I will use a value of 0.35 (ref. *The Wind Power Book* by Jack Park). Based on the above equation and values, we arrive at estimated annual average wind speeds of

11.3 mph at 140' tower height, and
11.9 mph at 164' tower height.

These are the tower heights that I will assume would be used for the specific turbines discussed in more detail later in the report.

15. Wind turbine options – estimated costs and outputs
Based on our conversation during the site visit, it seemed that Larry and Josh are most interested in turbines in the 35kW – 250kW range, and I would say that this size range makes the most sense for them in terms of their goals of making an appreciable amount of power within a reasonable budget. Based on the estimated wind speeds calculated above, I will do output and cost estimates for five turbines: the EMS E-15 (single and three-phase versions), the Vestas V17-90, the Fuhrlaender FL100, and the Fuhrlaender FL250. The EMS E-15 turbine is a reconditioned Vestas V15 turbine, reconditioned and sold by Energy Maintenance Service of Gary, South Dakota (http://www.energyms.com). These turbines were originally installed in windfarms in California in the 1980s, and they are now being replaced in these windfarms with much larger machines. The used turbines are being reconditioned by EMS and are sold with a full one-year warranty. The typical cost of one of these machines fully installed is approximately $110,000, assuming that a 140' tower would be used. There are both single-phase and three-phase versions of this machine available. The single-phase version is rated for a maximum output of 35 kW, and comes with a brand new generator. The three-phase version is rated for a maximum output of 65 kW, and comes with a reconditioned generator. Both machines have a rotor diameter of 15m (approximately 50'), and are essentially

the same price, for a given tower height. One of the three-phase versions of this turbine was recently installed at Lakeshore Technical College in Cleveland, WI, and there is real-time monitoring data available for this installation on the internet at http://windmonitor.gotoltc.edu/rsviewweb/RSViewWEB.asp?display=main . Reconditioned Vestas V17 turbines are also available, primarily through a company called Halus Power Systems, located in California (http://www.halus.com). In the case of this turbine and the EMS turbine mentioned above, I would recommend that the UWSP contact the full service wind system dealers/installers on the list provided during the site assessment to obtain these turbines, rather than contacting EMS or Halus directly. The local installers would be in a better position to do a complete installation and to provide ongoing maintenance for these machines. The Vestas V17 turbines have a similar history to the V15 turbines in the California windfarms. The turbines are rated at 90 kW peak output, have a rotor diameter of 56', and produce 480V 3-phase power. The approximate installed price of one of these turbines would be in the range of $135,000. Unfortunately, the tallest tower that I know of for this turbine would be a 40m (131') tower, and the recommended minimum tower height calculated earlier in the report for a turbine with a 28' blade length was 138'. Because **Site A** is fairly open for a distance of 400' or so in all directions, I would not have major qualms about installing this turbine on a 131' tower at **Site A**. Because the other two sites discussed here have many trees within 200' of the site, I would not consider this turbine to be a good option at either **Site B** or **Site C**. I will do output estimates for this turbine at a tower height of 131', with the understanding that I only consider this to be an option at **Site A**. The Fuhrlaender FL100 and FL250 turbines are new turbines made in Germany and distributed in North America by Lorax Energy Systems of Block Island, Rhode Island http://www.loraxenergy. com). They are rated for a peak output of 100 kW and 250 kW respectively, and have rotor diameters of 69' and 97'. The turbines are available with a 50m (164') monotube tower option, and they would produce 480V 3-phase power. The cost of these turbines would be in the range of $300,000 for the FL100 and $400,000 for the FL250, fully installed on the monotube tower. Based on the manufacturer's output estimates for their turbines and the estimated annual average wind speeds calculated above, the estimated annual output of these turbines at typical tower heights for each turbine would be as follows:

Turbine Assumed Tower Height Est. Annual Average
Wind Speed at Tower Ht.
(mph)
Est. Annual Output
(kWh) at this Avg. Wind
Speed,

Turbine	Assumed Tower Height	Est. Annual Average Wind Speed at Tower Ht. (mph)	Est. Annual Output (kWh) at this Avg. Wind Speed,
EMS E-15 Single-Phase	140'	11.3	51,700
EMS E-15 Three-Phase	140'	11.3	60,300
Vestas V17-90	131'	11.0*	82,200
Fuhrlaender FL100	164'	11.9	139,800
Fuhrlaender FL250	164'	11.9	291,500

* this wind speed estimate is based on the same formula used above for the other tower heights.

To compute these estimated outputs, the manufacturer's "power curves" were used in a standard mathematical model to compute long-term average output at a particular average wind speed. The power curve is the manufacturer's published data for the instantaneous output of a turbine at a given instantaneous wind speed. A loss factor of 20% was applied to the power-curve based output estimate, which would account for losses due to turbine down time, losses in the system wiring and electronics, losses due to some local turbulence, etc. A loss factor of 15% is more typically used for power-curve-based output estimates, but I have used 20% in this case due to the large possibility for turbulence at these sites (due to the many trees and buildings). The Focus on Energy is currently offering a Special Equipment Grant for Non-Profits for Wind Turbines at Educational Sites. Unfortunately, as of this writing, state-owned facilities such as the UWSP are not eligible to apply for these grants. Because this policy may be reviewed by the Focus on Energy at some point in the future, and because these grants would have a significant effect on the economic feasibility of the projects discussed here, I will list the maximum grant amounts that could be awarded for these systems **if** the UWSP were eligible for the Special Equipment Grants for Non-profits. The grant amounts for each system would be based on the estimated annual output of the turbine, multiplied times a "Reward Factor". These Reward Factors are listed in the grant application given to the customers during the site visit. Note that the Special Equipment Grant amounts listed here represent the **maximum** grant amount that could be awarded. The Focus on Energy grant reviewer may award less than this maximum computed grant amount. The Special Equipment Grant amounts are "capped" at 50% of the total system cost, or $65,000, so the grant amount will not exceed this cap even if the amount computed using the Reward Factor comes out higher. Using the estimated monthly outputs from the table above, multiplied times the applicable Reward Factors, we arrive at the following estimated Focus on Energy Special Equipment Grant amounts for these systems (I have included the estimated installed system costs in this table as well):

Turbine	**Assumed Tower Height**	**Est. Annual Output (kWh)**	**Est. Installed System Cost, [Est. max. Focus on Energy Special Equipment Grant]**
EMS E-15 Single-Phase	140'	51,700	$110,000 [$36,190*]
EMS E-15 Three-Phase	140'	60,300	$110,000 [$42,210*]
Vestas V17-90	131'	82,200	$135,000 [$50,964*]
Fuhrlaender FL100	164'	139,800	$300,000 [$65,000*]
Fuhrlaender FL250	164'	291,500	$400,000 [$64,130*]

*** Note:** State-owned facilities **are currently not eligible** to receive Focus on Energy Special Equipment Grants for Non-Profits for Wind Turbines at Educational Sites.

The annual maintenance costs for these turbines would typically be estimated at approximately 1% of the total installed system cost. This is a very general rule-of-thumb which is often used for smaller wind turbine projects. Based on this rule-of-thumb, estimated annual maintenance costs would range from a low of $1,100 for the single-phase E-15 to a high of $4,000 for the Fuhrlaender FL250. The estimated average wind speeds, system outputs, installed system costs and maintenance costs, and grant amounts listed above should be treated as rough guidelines only, and should in no way be taken as a guarantee of average wind speed, system performance, system cost, maintenance cost, or Focus on Energy grant amount. The estimates are based on the wind data referenced above, as well as the best information available from the turbine manufacturers/distributors, the local wind system dealers/installers, and the Focus on Energy at the time of this writing, and actual average wind speeds, system outputs, system costs, maintenance costs, and Focus on Energy grant amounts may be higher or lower than the numbers shown above.

16. Simple Economic Payback

As a starting point for an examination of the economic payback of the five wind turbines listed above, I will do a very basic payback calculation. I will assume that the installed system costs, maintenance costs, and average system outputs are as estimated in the above discussion. I will assume that no grants or other financial assistance are available to help pay for the installations. I will ignore time-related effects such as the "time value of money", interest rates on financing, inflation, and the potential rise in electricity costs over the lifetime of the wind system to simplify the calculations.

As explained above, the effective value of the electricity produced by a wind turbine will be different depending on how the turbine is hooked into WPS' electrical grid, and depending on whether the turbine is located at **Site A, B, or C**. For the purposes of this site assessment, I will assume that the single-phase E-15 turbine would be installed at **Site C.** I will also assume that some of the electricity produced by this turbine would be used immediately at the Schmeeckle Shelter Building (effectively worth 9 cents/kWh as discussed above), and that some of the electricity produced would be put back onto WPS' electrical grid (worth 4.32 cents/kWh as discussed above). It is essentially impossible to predict how much of the electricity will be credited as retail, and how much as wholesale, since this depends on when the electricity is generated and when it is used. For the purposes of this very rough analysis I will make the assumption that approximately 20,000 kWh of the turbine's annual output will be credited at the retail rate, and that the rest will be credited at the wholesale rate. I will emphasize that this is purely a guess, and it is not based on any particular experience or analysis. I am just choosing a number so that we can do some sort of rough payback estimate for the E-15. For the three phase turbines discussed above, I will assume that all of the electricity produced by the turbines will be sold to WPS at their standard buyback rate, and that the electricity will effectively be worth 4.32 cents/kWh. Because it would be easier to tie the turbines into the campus electrical grid, getting WPS' standard buyback rate may require a special negotiation with WPS, or an additional expense for WPS to provide an extra three-phase service specifically for the wind turbine. For the purposes of this assessment, I will assume that this will be possible. If it turns out that this is not possible, I will leave it up to the UWSP to re-compute payback numbers for these turbines based on a value of electricity of 2.95 cents/kWh, which was the value estimated earlier for electricity used to offset usage on the campus electrical grid, and not sold directly to WPS.

The assumptions outlined above yield the following simple payback times for these five wind turbines:

Manufacturer	EMS/Vestas	EMS/Vestas	Vestas	Fuhrlaender	Fuhrlaender
Model	E-15	E-15	V17-90	FL100	FL250
Capacity	35 kW	65 kW	90 kW	100 kW	250 kW
Voltage	240	480	480	480	480
Phase	1	3	3	3	3
Rotor diameter	49'	49'	56'	69'	97'
Tower type	Freestanding lattice	Freestanding lattice	Freestanding lattice	Monopole	Monopole
Tower height	140'	140'	131'	164'	164'
Est. avg. windspeed @ hub height (mph)	11.3	11.3	11.0	11.9	11.9
Est. total annual production (kWh)	51,700	60,300	82,200	139,800	291,500
Est. annual production (kWh) valued at 4.32 cents/kWh	31,700	60,300	82,200	139,800	291,500
Est. annual production(kWh) valued at 9.0 cents/kWh	20,000	0	0	0	0
Est. total value of energy produced annually	$3,169	$2,605	$3,551	$6,039	$12,593
Est. annual maintenance costs	[$1,100]	[$1,100]	[$1,350]	[$3,000]	[$4,000]
Est. Net Earnings Per Year	$2,069	$1,505	$2,201	$3,039	$8,593
Est. Installed System Cost	$110,000	$110,000	$135,000	$300,000	$400,000
Est. System Payback (yrs.)	53	73	61	99	47

The above table assumes that no Focus on Energy grants are available to help pay for these wind systems. If the Special Equipment Grants outlined above were available for these systems, and were awarded at the maximum amounts possible, the estimated payback times for these systems would appear as follows:

Manufacturer	EMS/Vestas	EMS/Vestas	Vestas	Fuhrlaender	Fuhrlaender
Model	E-15	E-15	V17-90	FL100	FL250
Capacity	35 kW	65 kW	90 kW	100 kW	250 kW
Est. Net Earnings Per Year	$2,069	$1,505	$2,201	$3,039	$8,593
Est. Installed System Cost	$110,000	$110,000	$135,000	$300,000	$400,000
Est. Max. FoE Special Equip. Grant	$36,190	$42,210	$50,964	$65,000	$64,130
Est. Installed Cost with Grant	$73,810	$67,790	$84,036	$235,000	$335,870
Est. Payback (yrs.) with Grant	36	45	38	77	39

17. Funding Opportunities

Focus on Energy Special Equipment Grants

According to Larry Krom and Mick Sagrillo at the Focus on Energy program, the UW Stevens Point is currently not eligible to receive grants from the Focus on Energy program because it is a state institution. This is the Department of Administration's policy through the end of June, 2005, although the issue is being re-examined for fiscal year 2006. I would encourage the UWSP to contact the Wisconsin Department of Administration to investigate this issue further – their input could actually help to get the current policy changed. At this time, state institutions are only eligible for "technical assistance" from the Focus on Energy program, such as the cost-share for this site assessment. A good person to talk to at the state Department of Administration would be Steve Tryon , Administrator of the Division of Energy. I would actually recommend contacting Mick Sagrillo at the Focus on Energy (920-837-7523) before contacting Steve Tryon, to get the full background on this issue.

Focus on Energy Feasibility Study Grants
For the turbines under 100 kW in capacity discussed in this report, the total cost of the systems is low enough that the UWSP may feel comfortable installing one of these turbines without doing wind monitoring at the proposed turbine site. For the larger systems discussed, it may be prudent to erect a wind monitoring tower at the proposed turbine site to measure wind speed and direction directly for a period of at least a full year before erecting a wind turbine. A Focus on Energy Feasibility Study Grant would typically be used to help defray up to 50% of the cost of this sort of study (up to a maximum grant of $10,000). I would assume that under the current rules regarding grants to state institutions the UWSP is not eligible for these grants, but I mention them in case this situation changes in the future.

WPS
WPS may have funds available that could help to pay for part of these projects, and I would strongly encourage UWSP to try to include them as a partner. I would also think that WPS would profit from their participation in a high-visibility renewable energy project such as this one. I would recommend that the UWSP make contact with their Account Representative at WPS as a starting point for this discussion.

Database of State Incentives for Renewable Energy
I would also encourage the UWSP to visit the website of the Database of State Incentives for Renewable Energy (http://www.dsireusa.org). This site lists financial incentives available for renewable energy systems both at the state level and at the federal level. Here is one opportunity listed on this website that the UWSP may want to look into further:

Green Tags
Renewable Energy Certificates or "Green Tags" are tradable financial entities that represent the environmental benefits from renewably-produced power. There are companies set up to trade these certificates, and it may be possible to sell the green tags from this project through one of these companies. One source of information about Green Tags is on the internet at
http://www.dsireusa.org/library/includes/incentive2.cfm?Incentive_Code=WI10F&state=WI&CurrentPageID=1 .
According to the website of Mainstay Energy (http://mainstayenergy.com/index.php), one of the companies that trades in Green Tags, the estimated amount that they might pay for the Green Tags for a wind system less than 100 kW capacity would be 0.23 cents/kWh to 0.30 cents/kWh, depending on the contract length. It is stressed on the website that this is an estimate only, not a guaranteed amount. For systems 100 kW or larger, it would appear that they would negotiate on a case-by-case basis. Note that the sale of Green Tags comes with very specific contract requirements from the Green Tag purchaser. The customer should review any proposed Green Tag purchase contract carefully and get bids from multiple companies to determine if this arrangement meets their needs.

18. What educational resources did you recommend for the client?
X Midwest Renewable Energy Association (www.the-mrea.org)
Comments:
19. What follow up, if any, needs to be done by the client.
Here are some of the next steps that I would recommend to the UWSP personnel involved with this project:
1. Talk to Mick Sagrillo and Larry Krom at the Focus on Energy program regarding the possibility of getting Focus on Energy funding for this project.
2. Talk to a number of the wind system installers on the list provided during the site visit to get more ideas for possible systems, and to get more accurate pricing information for the systems discussed in this report.
3. Speak to the owners of the specific wind turbines discussed in this report where possible to get their impartial opinions about the turbines.
4. Consider erecting a wind monitoring tower at the desired turbine tower location and height, and collecting data for a period of at least a full year before beginning construction of the wind turbine, especially if one of the larger turbines discussed here is being considered.

5. Speak to Gary Dikkers at the Wisconsin Department of Transportation regarding the possible need for an FAA study, and file Form 7460 with the FAA if necessary.
6. Speak with representatives from WPS to try to enlist them as a partner in this project, both financially and in terms of the positive exposure that the project will generate.
7. Make sure that any applicable local zoning and permitting requirements are met before beginning construction on any of the systems described in this report.
8. Make sure to give local residents, homeowners, and business owners an adequate opportunity to express their views about the project. Public hearings may be in order, or possibly a written survey distributed to potential neighbors of the project.

20. Materials given to customer during site visit:

1. Wisconsin Wind Map
2. Spreadsheet of wind system installation costs
3. Full service wind installer list
4. "Apples & Oranges" article
5. FAA Form 7460
6. Focus on Energy Implementation Grant Application for Wind Systems
7. Focus on Energy Special Equipment Grant Application for Wind Systems
8. Focus on Energy Feasibility Study Grant Application
9. Information on the EMS E-15 and Fuhrlander FL100 and FL250 turbines

21. Materials enclosed with site assessment report:

1, 2.. Aerial Photos/Sketches of Property
3. Topographical Map of the Surrounding Area
4. Wind Rose graph from the Abbottsford site

Figure 1. Aerial Photo/Sketch showing area near **Sites A and B.**

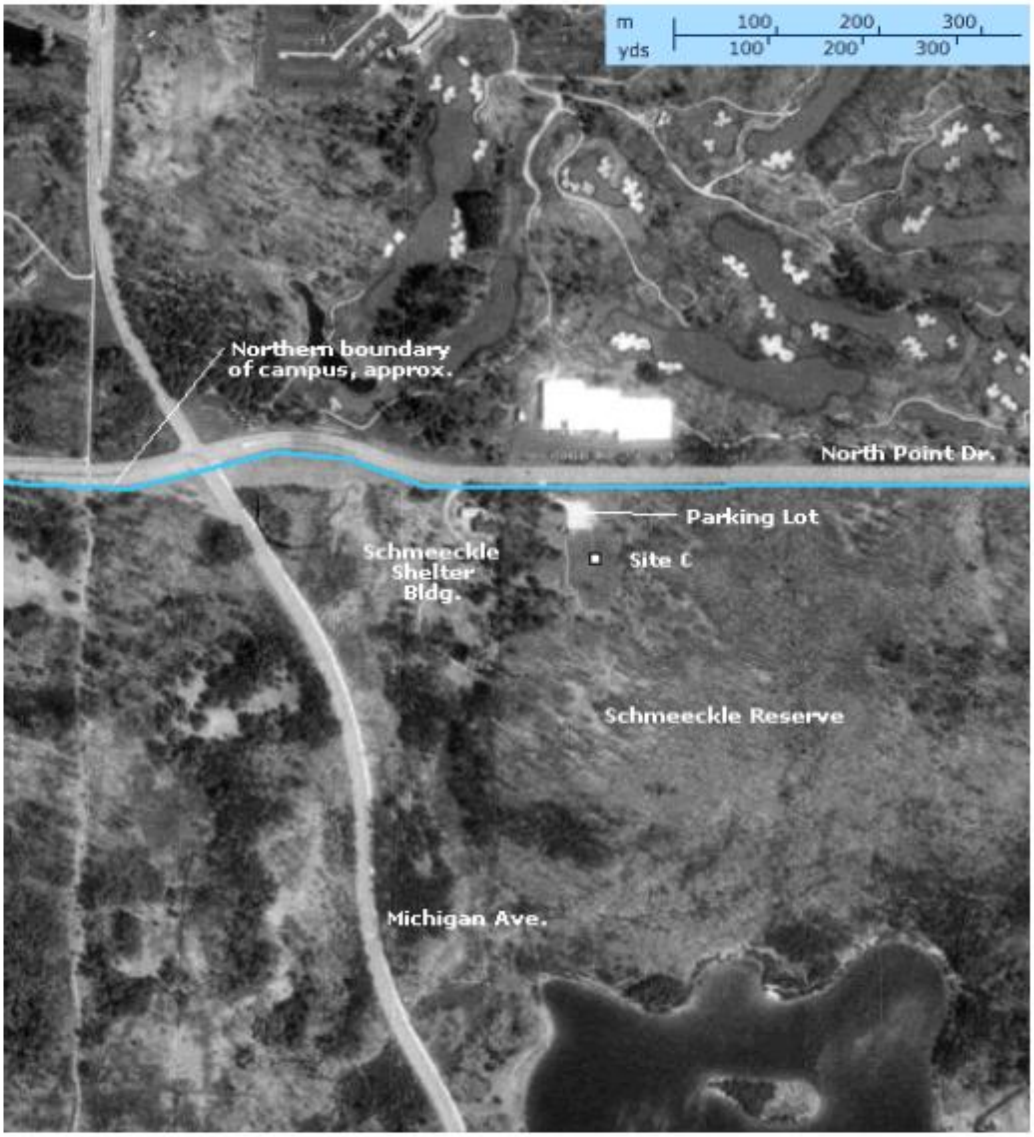


Figure 2. Aerial Photo/Sketch showing area near **Site C.**

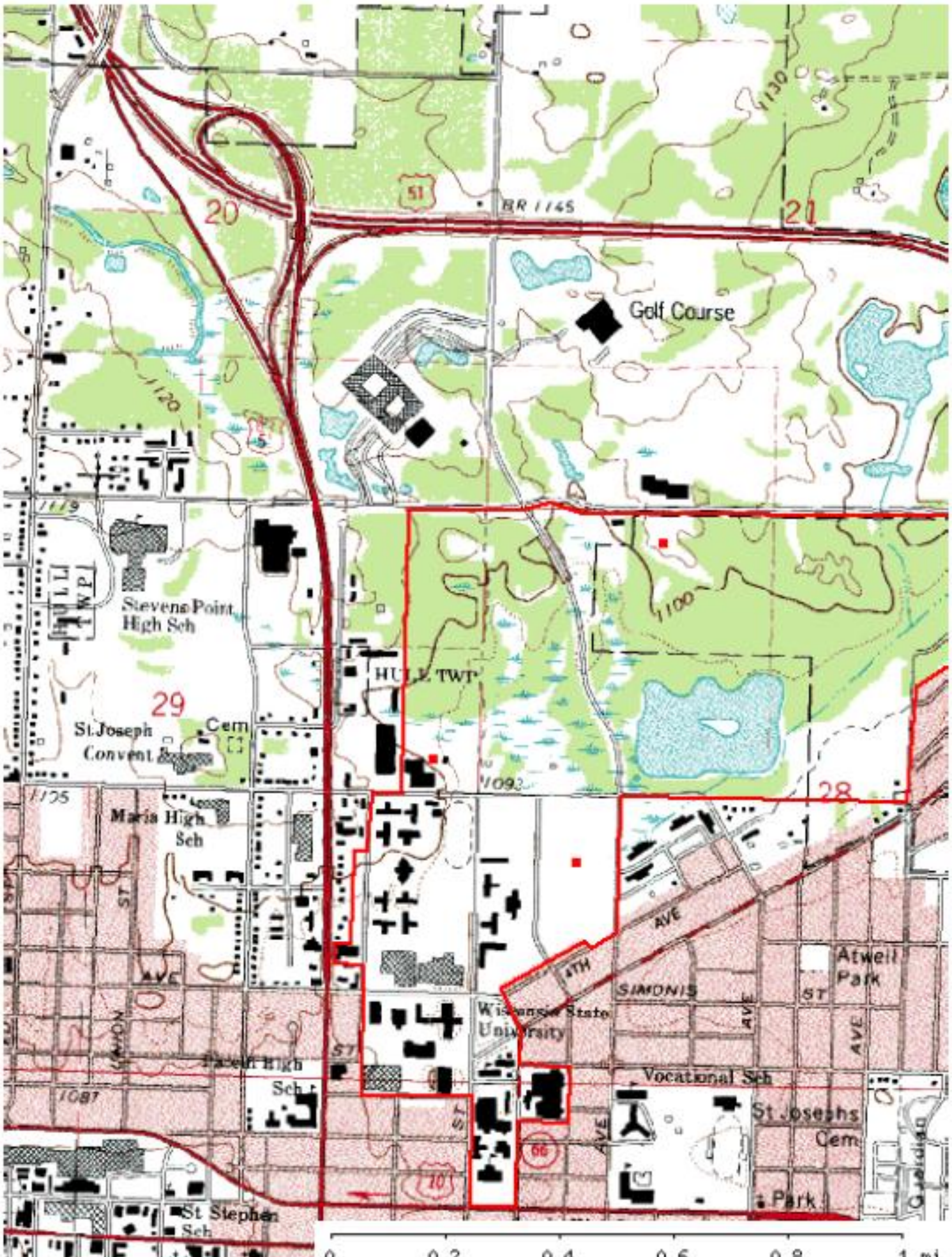


Figure 3. Topographical Map of the Surrounding Area.
Elevations are in feet above sea level, contour lines are 10' contours.
Approximate property boundaries, wind site locations indicated in red near center.

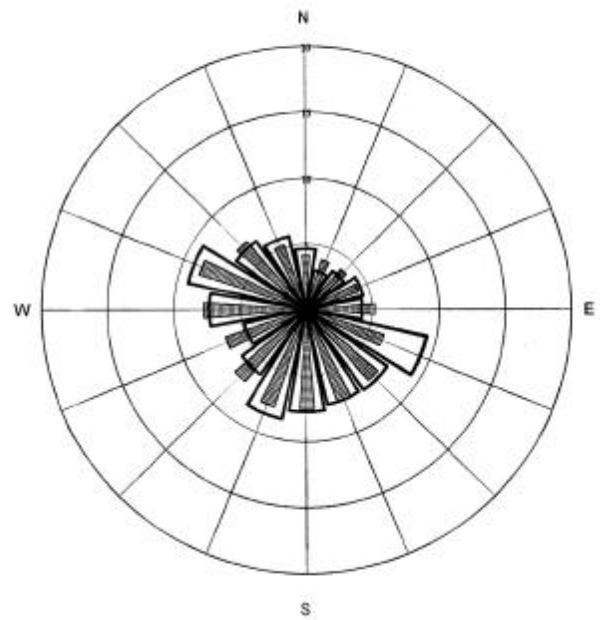


Figure 4. Wind Rose graph taken at the Abbotsford site, approximately two miles north of Abbotsford in Marathon County. The inner shaded bars represent the amount of time that the wind comes from the various directions, while the outer unshaded bars represent the amount of energy in the wind from these directions. *(Reprinted from Wisconsin Wind Resource Assessment Program Final Report, prepared by Global Energy Concepts, 2002.)*