Analysis of the Feasibility of Utilizing the STARS 0.5 Rubric as a Guide for the Worcester Polytechnic Institute Sustainability Initiative

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EXECUTIVE SUMMARY

STARS is a powerful tool that may assist WPI in developing into a sustainable community. The goal of this project was to determine whether or not STARS is a practical method for WPI to track and improve its sustainability, and if any adjustments are necessary to improve its efficacy. Given the extensive scope of the STARS 0.5 rubric, this project only focused on "Category 2: Operations." Therefore, the objectives of this study were:

1. To analyze the STARS 0.5 program to better understand its form and function.
2. To discuss key information regarding the operations and practices of the WPI campus as they pertain to the rubric.
3. To investigate the feasibility of utilizing the "STARS 0.5 Operations Category" at WPI and employ the rubric to identify areas in which WPI can improve its sustainability.

The group made some key findings upon analyzing the STARS 0.5 rubric. In most areas, STARS is a comprehensive program that effectively addresses various aspects of sustainability. However, in some areas the STARS rubric is deficient in certain ways. The documentation for the STARS rubric is detailed and it is time-consuming to gather the information necessary to complete it. STARS also omits a food waste credit that we believe to be relevant considering the rubric's focus on waste reduction.

WPI has recently made sustainability improvements in several areas. WPI has been recycling furniture, office waste, electronics, cardboard, and universal waste since 2006. Chartwells, the contracted dining services at WPI, has refrained from using trays to conserve water and reduce food waste by reducing the amount of dishes that are washed and reducing the amount of food students can carry at one time, respectively. The boilers installed in 2005 are

significantly more efficient than the antiquated boilers they replaced and reduce emissions by approximately 2,000,000 kilograms of carbon dioxide per year.

WPI has also made initial progress in other aspects of campus sustainability. WPI has a policy in place to ensure all new construction is built to LEED standards. East Hall, the newest building on campus, saves an estimated $16,000 per year in water alone compared to a residence hall of the same size that is not built to LEED standards. Gateway Park was built to LEED certification standards but WPI has no plans to officially pursue certification. East Hall is currently cleaned exclusively with environmentally friendly cleaning products, but the rest of campus is cleaned with conventional products that have greater cleaning potency, which are better equipped to clean older buildings. WPI uses moisture sensors to prevent potable irrigation water consumption from exceeding one inch per week but does not utilize active measures to irrigate using non-potable water. The institution is supporting new options for transportation with the addition of rentable hybrid cars on campus, although in the future WPI should emphasize other high efficiency vehicle options such as electric and Blue Tec diesel vehicles in addition to hybrids.

Our team also discovered many areas where WPI can improve. WPI performed poorly in the Energy and Climate section of "STARS Category 2: Operations," as WPI does not currently use any renewable electricity or on-site combustion with renewable fuel. It is currently difficult to measure energy consumption on a per building basis because there is only one meter to measure electricity for the main campus, which includes more than twenty buildings. Currently, the institution does not have an energy policy in place to reduce total energy consumption on campus.

In order to make WPI more transparent and improve its public image, WPI needs to change informal policies currently in place within departments into official policies. WPI currently has a decentralized purchasing system that makes completing the Purchasing section of "STARS Category 2: Operations" difficult, since many of these credits are dependent on centrally tracked purchasing. WPI purchases many of its supplies through a consortium in order to reduce costs. This does not allow much room for the enforcement of a vendor code of conduct, which WPI is currently lacking.

Based on our findings regarding the STARS rubric and how well WPI performed, we have developed several recommendations to the AASHE:

1. The AASHE should add a credit to address food waste. This credit could fall within the domain of either the Dining Services section or the Materials, Recycling, and Waste Minimization section, but we recommend that it be appended to the Dining Services section because food waste is the responsibility of the institution's dining services provider. This credit should be expressed as a decreasing trend in pounds of food waste per year normalized by the number of meals served in that year.
2. The AASHE should change "OP Credit 5: Local Food" to a Tier Two credit until they review the credit. This investigation should focus on the efficacy of local food as a sustainability indicator, taking into account the environmental impact of all aspects of food production, packaging, and shipping.
3. The AASHE should expand "OP Credit 7: Fair Trade Coffee" to include other Fair Trade products once certification becomes more widely available for other Fair Trade products. We recommend the AASHE tier this credit using benchmark percentages of eligible Fair Trade purchases.

4. The AASHE should adjust "OP Credit 3: Potable Non-Irrigation Water" to measure reduction in potable water used for irrigation compared to a baseline of the 2005-2006 academic year, which is used throughout the STARS rubric. In this way, the credit rewards institutions for both irrigating less and irrigating with non-potable water.
5. The AASHE should change "OP Credit 28: Air Travel" to a Tier Two credit because implementation of this credit has no effect on the sustainability of an institution since it only requires a calculation and has no tangible goal.

We have also developed recommendations to WPI regarding policy changes to help facilitate the process of becoming more sustainable:

1. WPI should adopt the STARS program to identify areas in which it can improve or implement sustainable practices. We have concluded that "Category 2: Operations" of the STARS rubric is well suited to WPI's need for a method of assessing sustainability of its campus.
2. WPI should implement a system in which all data pertaining to the STARS rubric is sent to the Sustainability Coordinator by one of two methods based on the type of data being collected.
    a. The first method is to send the data to the Sustainability Coordinator as it is being collected. This is appropriate for information that is not normally tracked on its own in its originating office, such as electricity and water data.
    b. The second method is to compile the data in the originating department and send it periodically to the Sustainability Coordinator. This method is appropriate for information that is useful to the originating department, such as greenhouse gas emissions or hazardous waste minimization. Tracking greenhouse gas emissions

is useful for the operation of the power plant, since information regarding the fuel consumption of the boilers can be used to track boiler efficiency and identify waste. In addition, tracking the amount of hazardous waste generated on campus is necessary for regulations compliance.

3. At the end of each fiscal cycle, each department should file a report itemizing expenditures on certain items, such as paper or organic food. The Sustainability Coordinator should design the forms used for this report and hold a workshop on their proper use. A representative from each department should be in charge of measuring expenditures on these items throughout the year and filing this report.
4. The Facilities Department of WPI should formalize policies pertaining to sustainable practices.

To continue improvements in practices that lead WPI to greater sustainability, we have compiled a list of potential research projects that will be useful in addressing the operations of campus:

1. Develop an operational definition of sustainability and determine appropriate methods of weighing options for selecting the next priority, whether it is cost, environmental benefit, or availability of resources.
2. Compile all past and present data from the Sustainability Coordinator and build on the existing SharePoint website, making the information available to the WPI community.
3. Determine a method for measuring energy consumption of buildings on campus that are on the shared meter. If no acceptable commercial systems exist, the project should develop a non-disruptive system for measuring energy consumption in the older buildings on campus.

4. Compare the operation and maintenance costs of East Hall to those of other residence halls on campus, focusing on water and electricity consumption, heating efficiency and fuel consumption, maintenance expenditures, and state and federal grants and tax credits for green buildings.
5. Investigate funding that WPI could pursue for its sustainability initiative by locating sources of funding, determining what is required to obtain funding, and applying for funding if possible.
6. Investigate electricity consumption reduction methods that could be implemented at WPI. This project should gather estimates on the cost to implement these methods, develop a cost benefit analysis on the feasibility of instituting them, and calculate the payback period for each method.
7. Assess the feasibility of utilizing "STARS Category 1: Education and Research" at WPI.
8. Assess the feasibility of utilizing "STARS Category 3: Administration and Finance" at WPI.
9. Reduce boiler fuel consumption through improvements to climate control efforts. This climate control project would consist of investigating more efficient means of temperature regulation in campus buildings. The long term benefits of more efficient climate control should be weighed against any initial investments that will be necessary to implement a new climate control system.
10. Track the quantity of WPI's electronic waste that is recycled, thrown out, and sold to China. The project should investigate the environmental, economic, and social impact of recycling broken electronic waste domestically versus current practices and explore

potential recycling programs that WPI could use to recycle broken electronic waste in the US.

11. Study the effectiveness of Tier Two credits in the STARS rubric. There are many practices outlined in Tier Two credits that may be valuable to an institution concerned with sustainability. For example, using geothermal energy, LED lighting, and low-flow shower heads are significant steps that an institution can take towards becoming sustainable.
12. Investigate the implementation of alternative energy systems in campus heating and electricity production. We recommend this project weigh the initial investments required to implement alternative energy sources against its potential long term savings to determine if implementation would be feasible.
13. Investigate various ways that WPI could prepare its graduates for sustainability job markets. This project could involve exploring new courses and programs related to sustainability in the workplace that WPI could adopt.
14. We recommend keeping a record of oil consumption, gas consumption, and boiler emissions by creating a database and transcribing data from past logbooks into this database.
15. Create a high efficiency vehicle registration system for the Campus Police. This system would allow any vehicle that meets specific emission or fuel consumption and emissions standards to receive benefits, such as priority parking or a reduced cost of parking passes.

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CHAPTER ONE: INTRODUCTION

Modern society draws upon many resources that are both non-renewable and finite. This practice raises many issues regarding the responsible use of existing resources. Irresponsible use and disposal of resources will result in a poorer, more polluted world for future generations (Hart, 2006c). Tilton (1996), the former Director of the Division of Economics and Business at the Colorado School of Mines, indicates that these concerns can be dated back to over two hundred years ago to classical economists like Thomas Matthew. More recently, in an article for the Proceedings of the National Academy of Sciences of the United States of America, Mathis Wackernagel (2002) indicated that since the 1980s, human demand on the biosphere has exceeded the earth's ability to regenerate and approached 120 percent of the capacity of the global biosphere in 1999.

Sustainability addresses the issues associated with resource management. Paul Hawken (1994), the head of the Natural Capital Institute in Sausalito, California, defines sustainability as "an economic state where the demands placed upon the environment by people and commerce can be met without reducing the capacity of the environment to provide for future generations." However, focusing on environmental issues alone will result in economic and social complications. Hart (2006c), an author on the topic of sustainability, maintains that a community is composed of social, economic, and environmental elements; therefore, sustainability must address each of these interrelated systems.

Institutions of higher learning are ideal candidates to spearhead the sustainable society movement. Research universities are small communities in themselves, complete with their own resources and "citizens" endowed with youthful and creative energy. A university's small size enables it to be more flexible with policies and experiment more easily (University of California

Riverside, 2007). According to a report by the Hamilton-Wentworth Regional Council (1992 & 2004), these qualities are advantageous because sustainable development requires experimentation within these fields as well as public participation and the will to make necessary changes.

Having all of these qualities, WPI is in a position to move towards sustainability. WPI has embarked on a sustainability initiative, both to propel the movement forward and to invest in sustainability expecting financial, social, and environmental benefits in the long run. For this purpose, WPI created the President's Task Force on Sustainability in September of 2007. The function of the task force is to coordinate and provide leadership for campus-wide efforts towards resource and energy conservation as well as the reduction of the harmful impacts of campus operations (President's Task Force on Sustainability, 2008).

In order to efficiently analyze WPI's progress toward sustainability, the task force has investigated a number of assessment tools. One program in particular is Sustainability Tracking, Assessment and Rating System (STARS), which focuses specifically on higher education campus communities. STARS is a grading rubric developed by the Association for the Advancement of Sustainability in Higher Education (AASHE), intended to standardize measures of sustainability within institutions (Matson, Dautremont-Smith, Newport, & Walton, 2008). STARS is potentially an appropriate system for WPI because it encompasses the social, environmental, and economic aspects of sustainability. These elements of sustainability are addressed in the STARS rubric by the corresponding categories of education and research, operations, and administration and finance (Matson et al., 2008).

The goal of this project was to determine whether the current revision of the STARS rubric, version 0.5, is a practical method for WPI to develop its sustainable practices and if any

adjustments are necessary to improve the efficacy of STARS. Given the comprehensiveness of the STARS 0.5 rubric, this project only focused on "Category 2: Operations." The specific objectives of this project were to analyze the STARS 0.5 program to better understand its form and function, discuss key information regarding the operations and practices of the WPI campus as they pertain to the rubric, and investigate the feasibility of utilizing "Category 2: Operations" of the STARS 0.5 rubric at WPI.

CHAPTER TWO: BACKGROUND

This chapter is intended to educate the reader about sustainability and programs that support sustainable institutions. In an increasingly industrial world, it has become progressively more important to understand the impact institutions have on the environment and society itself. To this purpose, this chapter explores the significance of sustainability, the reasons for the movement towards sustainable communities within institutions of higher education, and the methods and purpose of measuring the progress of an institution towards sustainability.

SIGNIFICANCE OF SUSTAINABILITY

In 1987, the United Nations published the Brundtland Report, identifying the degradation of the environment and increasing energy consumption as an indication of the need for sustainability. That report is where the word "sustainability" originated. First noticed in wealthy countries as a side effect of an industrial society, environmental decay had turned into a matter of survival in developing nations by 1987 (Brundtland, 1987). Since our basic needs – water, food, and air – come from the environment, Hart (2006a), author of *Guide to Sustainable Community Indicators*, has emphasized that society cannot use more resources than those available.

Resource exhaustion, greenhouse gas accumulation, ozone depletion, soil degradation, and accelerated species loss are some of the ramifications of our imbalance with nature. Rees (2000), professor at the University of British Columbia, claims most solutions to these problems are built upon the assumption that the root cause is environmental, externalizing the blame on nature instead of human activities. However, there is debate about the effects of resource exhaustion. Simon (1995), an economist, claims that the reduction of prices over time indicates that scarcity of natural resources is decreasing rather than increasing; therefore, resource

depletion is a non-issue. Alternatively, Kesler (1994), a geologist, argues that the threat of using all available resources is indicated by the increasing rate of mineral resource consumption.

Sustainability does come with its detriments. The short term cost of implementing sustainable practices inhibits many organizations from becoming sustainable. According to the Pollution Prevention Resource Center (2001), the broadness of the topic of sustainability causes confusion, deterring willing people from assisting in the sustainability movement. As a result, their efforts are often weak and fail to make progress towards becoming sustainable (Pollution Prevention Resource Center [PPRC], 2001).

RATIONALE FOR A SUSTAINABLE CAMPUS

Organizations may begin a sustainability initiative for a number of different reasons. The financial benefit of sustainability is often the primary consideration. According to Willard (2002), author of *The Sustainability Advantage: Seven Business Case Benefits of a Triple Bottom Line*, international firms are saving money and increasing share performance by improving their environmental performance. In Texas, several private companies have requirements that any new large building must be certified to LEED Silver (see Appendix A) certification standards. Wood (2007), a writer for *Texas Construction*, maintains that these requirements are a result of corporations realizing the long term savings of improved efficiency. Private companies incorporating sustainable design into their own practices is an indication that sustainability is a practical, economically sound idea and applicable for other types of organizations such as universities.

The rationale for sustainability in institutions of higher learning is threefold. First, the lower repair and operating costs of sustainable buildings allow the administration to allocate more of the budget for education. Second, students achieve more academically with a healthy

and safe environment (Pollution Prevention Resource Center [PPRC], 2001). Third, a sustainable university benefits from a positive public image. Taylor (2005), American Institute of Architects Fellow, writes, "Just like a company, every academic institution has a 'brand' to uphold, and its campus settings are a big part of it…Sustainability has become a visible part of the academic brand." The higher press ratings and better public image that a school obtains from a reputation for sustainability can be useful in attracting the top faculty and students that all schools desire (Taylor, 2005).

INSTITUTIONS ACROSS THE COUNTRY

With the surge of attention to the issue of sustainability, institutions of higher education have recently begun to implement sustainability into their operations, policies, and curriculum. The first official assessment of a campus's sustainability was with the publication of April Smith and the Student Environmental Action Center's (SEAC) book, *Campus Ecology* in 1993 (Cole, 2003). In the 2008 Report Card, based on a survey done with Princeton Survey Research Associates International, more than 240 individual schools are recognized for having exemplary levels of sustainability activities (National Wildlife Federation, 2008).

One school that has made particularly large strides towards sustainability is Butte Community College in northern California. Butte College has begun using solar panels to reduce fossil fuel based energy. The campus plans to generate all the necessary electricity for the campus and already has 25 percent of their power needs met by a solar panel array. Butte College also has a large bus transportation system in place and has a designated wildlife refuge (Carlson, 2008).

Another school making progress towards improving their sustainability is the University of New Hampshire. They are among over ninety universities piloting the STARS program.

UNH has the oldest endowed sustainability program, the University Office of Sustainability, founded in 1997. UNH was one of fifteen schools nationwide to receive the highest score on the Sustainable Endowments Institute's College Sustainability Report Card 2009. They received A grades on a scale of A through F in six of nine campus categories: administration, food and recycling, climate change and energy, endowment transparency, and transportation (Kelly & Farrell, 2008).

Although sustainability is being pursued by many institutions, they often struggle to make progress because of the complexity of sustainability. According to a survey of 41 schools in England, most schools have limited functional knowledge of sustainable living and their attempts to educate on this subject have been piecemeal (Owen, 2008). The management of an institution can also contribute to the slow progress made towards sustainability. Shriberg (2002), doctor of natural resources and environment, believes this is related to the factors involved with institutions making decisions, which can include risk aversion, funding, standard operating procedures, and inertia.

SUSTAINABILITY AT WPI

WPI has used the momentum of society's sustainability movement and the formation of the STARS program to overcome the inertia often encountered when implementing sustainability. WPI has formed the President's Task Force on Sustainability to address the issues associated with conserving energy and reducing the impact of campus operations on the environment. The Task Force deals with several topics of concern, including climate protection, materials management, and facilities. WPI also supports a plethora of projects that deal with issues of sustainability including reducing pollution, alternative energy sources, recycling, and waste management (President's Task Force on Sustainability, 2008).

One focus of the Task Force is climate protection. This includes reducing greenhouse gas emissions, a known source of climate change. In 2007, a student project at WPI estimated GHG emissions from energy consumption sources such as heating and cooling buildings, transportation, and electricity. Also, in 1997, another student project involved measurability of electricity use on a building by building basis (President's Task Force on Sustainability, 2008a).

The Task Force has also implemented a policy regarding waste minimization and recycling. Recyclable waste is divided into four categories: mixed paper, corrugated cardboard, mixed electronics, and other, which can include furniture, cans and bottles. The Task Force reports annually on WPI's progress on recycling and waste minimization (President's Task Force on Sustainability, 2008b).

IMPORTANCE AND METHODS OF MEASUREMENT

Determining an institution's progress towards sustainability can be a highly subjective process. This is due to the broad definitions of sustainability as well as the varied nature of the value individuals assign to aspects of sustainability. In addition, many aspects of sustainability, such as social and environmental impact, are abstract and difficult to quantify. Using a system of measurement to determine sustainability can help make the process more objective. According to Pickett et al. (2000), editors of *The American Heritage Dictionary of the English Language*, to measure is defined as "to estimate by evaluation or comparison" and is based on a measure, which is "a reference standard or sample used for the quantitative comparison of properties." Through application of accepted measurement standards for sustainability, a more objective perspective can be taken and a greater understanding of an institution's progress towards sustainability can be attained. Utilizing accepted standards for measurement facilitates direct comparison of any number of institutions and their relative progress towards sustainability.

Trochim (2006), Professor of Policy Analysis and Management at Cornell University, claims quantitative measurement is useful for direct comparison and developing generalizations because it is ideal for summarizing large quantities of data and can be analyzed statistically. However, Hak, Moldan, and Dahl (2007), editors of *Sustainability Indicators*, argue that some issues of sustainability, such as social cohesion, can only be assessed through qualitative measurement.

One method of measurement that helps define qualitative information in a measurable format is the use of indicators and indexes, which can also be used to categorize quantitative data. Indicators are used to parse physical and social information into manageable units that can help measure and calibrate an institutions' progress towards sustainability goals (Shah, 2004). According to Bell and Morse (2003), authors of *Measuring Sustainability: Learning by Doing*, indicators have become the most common way of measuring many of the more abstract aspects of progress towards sustainability in part because of their long record of implementation in economics and environmental science. However, there are many issues to consider in the appropriate development and application of indicators. These include questions about who selects them, why and how they are selected, and their relation to and balance with various aspects of sustainability (Bell & Morse, 2003).

THE STARS RUBRIC

As previously stated, STARS is a rubric designed to measure campus sustainability relative to a common standard. According to AASHE:

> STARS is designed to provide a guide for advancing sustainability in all sectors of higher education, enable meaningful comparisons over time and across institutions by establishing a common standard of measurement for sustainability in higher education, create incentives for continual improvement in sustainability, facilitate information

> sharing about higher education sustainability practices and performance, and build a stronger, more diverse campus sustainability community. (Matson et al., 2008)

The three categories of STARS – Education and Research, Operations, and Administration and Finance – are all split into sections and credits. A credit is a specific measure of an aspect of sustainability, while a section is a related group of credits. For instance, "Category 2: Operations" has a Buildings section, and all credits within this section relate to different ways the operations of a building can be sustainable. Additionally, some credits are worth a varying number of points, with an increase in points earned as criteria become more rigorous (Matson et al., 2008).

STARS is a holistic sustainability program, meaning that it covers all aspects of a college campus. Other more specialized programs focus primarily on buildings, neglecting important topics such as curriculum, grounds, and transportation. Matson (2008), STARS Program Associate, argues that for the purpose of assessing campus sustainability, a holistic approach is desirable.

Although there are other holistic programs that provide useful sustainability information, STARS is unique in the manner in which it operates. To begin with, the program is a transparent ratings process, meaning that it is clear to the participant what steps are necessary to achieve a higher STARS rating. Also, every institution of higher education has the option to participate in the STARS program, which is being developed through the feedback from many of its participants. Most of the institutional data submitted to the STARS program is public and can be referenced by other institutions looking to improve their sustainability. The main difference between STARS and other similar programs is that STARS provides institutions with a rating

instead of a ranking, meaning that it is compared against a standard measure rather than other institutions (Matson et al., 2008).

OTHER NOTABLE MEASUREMENT TOOLS

There are myriad evaluation tools designed to measure different areas of sustainability and focus on different project types (Fowler & Rauch, 2006). However, Bell and Morse (2003) claim there exists no single universally accepted method for gauging sustainability.

The measurement tool that is most similar to STARS is the College Sustainability Report Card. The College Sustainability Report Card (CSRC) is a holistic campus sustainability measurement tool. It is a free service provided by the Sustainable Endowments Institute, a division of Rockefeller Philanthropy Advisors. The CSRC assesses 300 public and private schools across forty-three indicators in nine categories. It is different from STARS for several reasons: only schools with a significant endowment are assessed, the categories are implemented differently and focus on different things, and it is not as transparent (Sustainable Endowments Institute, 2009).

According to Matson (2008), buildings are an institution's largest consumers of energy and produce most of its greenhouse gas emissions. It would be impossible to analyze every tool for measuring sustainability. Therefore, given the significant impact buildings have on the overall sustainability of an institution, this discussion will focus primarily on notable measurement tools designed for existing buildings and new construction. Fowler and Rauch (2006), analysts for Pacific Northwest National Laboratory, believe BREEAM, CASBEE, GBTool, Green Globes, and LEED are all notable sustainable building rating tools and several of them are the development basis for numerous derivative systems.

Several of the tools of interest are used multi-nationally and a few of them are confined to a specific country. Level of acceptance is relevant because a system for relative comparison is only useful if there are other institutions with which to compare results, and certification means little if the standard is not accepted in a given institution's region. GBTool has been used within the U.S. during the Green Building Challenge, but has had otherwise limited exposure in the United States. BREEAM has an extensive track record in the United Kingdom but, due to the requirement that a rating may only be acquired through a licensed assessor, it has seen little implementation in the US (Fowler & Rauch, 2006). CASBEE is a relatively new system and is unheard of in the US as it has only been implemented for 23 sites, all of which are located in Japan (Japan Sustainable Building Consortium [JSBC], 2007) .

In the United States, the two most widely accepted tools from our pool of interest are Green Globes and LEED. Green Globes has received accreditation as a standards developer for the ANSI process and is working towards making Green Globes US an official ANSI standard (Green Building Initiative [GBI], 2008). However, Sigmon (2008), US Green Building Council Staff, claims that LEED is the US market leader in "green" building assessment with 1,700 LEED certified buildings and another 13,700 registered for certification. LEED is also widely used by both Federal and state agencies.

An important aspect of any rating system is its general usability. It is difficult to find information on the current version of the BREEAM system (Fowler & Rauch, 2006) and, as mentioned earlier, the current version can only be attained through a licensed assessor (Building Research Establishment Ltd, 2007). CASBEE is designed to be simple, easy to use, and quickly implemented. It requires documentation of quantifiable design standards, which can only be assessed by architects who have passed the CASBEE assessor examination (Fowler & Rauch,

2006; JSBC, 2006). GBTool is flexible and was developed to be applicable across a wide range of regions and building types, but requires greater technical expertise than other rating systems. GBTool is also not permitted for commercial use without agreement from a relevant national team, making it very difficult to apply broadly (Henley & Field, 2006). Both Green Globes and LEED require a project be assessed by a licensed assessor, but the LEED system also requires a minimum number of points in order to receive any level of certification (Henley & Field, 2006).

One important factor to consider when discussing a sustainability measuring system is the system's approach to rating. The core of all five systems is the use of point values for various criteria (Fowler & Rauch, 2006). The main differences lie in what criteria are selected, how they are organized, how the points are calculated to arrive at a final result, and the general approach for gauging sustainability.

CASBEE takes a unique approach at sustainability comparison. It uses a lifecycle approach, wherein it uses a methodology tailored to the specific life stage of a building, including pre-design, new construction, existing buildings, and renovation (Henley & Field, 2006). CASBEE also distinguishes between environmental loads and quality of building performances, comparing these two factors to arrive at a more holistic perspective (Fowler & Rauch, 2006). Similar to CASBEE, LEED also uses methods tailored to the new construction, existing building, and renovation life stages of buildings, but it goes further and provides application guides to increase the applicability and flexibility of the system for numerous different building and site types (U.S. Green Building Council, 2008). However, like Green Globes, it rates on a straight point scheme where points earned for all rating criteria are totaled (Henley & Field, 2006). Green Globes is not as rigid as LEED in grading because, unlike LEED, the total number of possible points that the building's score is compared against is

adjusted to ignore criteria that are not applicable to that particular building (Fowler & Rauch, 2006).

BREEAM is similar to the other systems in that it assigns a point value to the major criteria it opts to rate, but it takes a unique approach wherein it gives each criteria a weighted value for determining the total score (Henley & Field, 2006). This means that any individual criterion may have as many points assigned to it as necessary to develop a detailed assessment of the degree to which the criterion is being met, but the relative number of points from one criterion to another does not affect its weight in the final score. GBTool also uses weights to adjust the relative value of its rating criteria. However, GBTool assesses its criteria using scales based on local benchmarks of typical practice, allowing the system to better reflect its regional and local codes, practices, context, and priorities (Fowler & Rauch, 2006).

Institutions planning to use one of these evaluation tools must determine what system is most appropriate for their own purposes. Fowler and Rauch (2006) believe this decision should take into account the availability of the tools, their applicability, costs of assessment, general acceptance of the tool as a standard for comparison, the robustness and versatility of the tool, and the tool's assessment methodology.

CHAPTER THREE: METHODOLOGY

The goal of this project was to determine the feasibility of using or adapting the STARS assessment tool to identify areas in which WPI can improve its sustainability and, if practical, implement the rubric. Due to the expansive scope of the STARS 0.5 rubric, this undertaking focused on analysis of "Category 2: Operations," and its compatibility with the WPI campus. We identified a number of objectives as integral to accomplishing this goal. These objectives are enumerated below:

1. Analyze the STARS 0.5 program to better understand its form and function.
2. Collect key information regarding the operations and practices of the WPI campus as they pertain to the rubric.
3. Investigate the feasibility of utilizing the assessment guidelines of "STARS Category 2: Operations" and employ the rubric to identify areas in which WPI can improve its sustainability.

ANALYZING STARS

The group collected data on the STARS program by first determining why they use the categories that they use. This included each individual credit and section. To do so, we read the discussion provided within each section of the "Category 2: Operations" of the STARS 0.5 rubric in order to develop a basic understanding of the rationale for including each credit. We then contacted Laura Matson, a Program Associate for the AASHE, to determine the methods the AASHE used to determine the full list of credits in the "Category 2: Operations." The significance of each criterion to the issue of sustainability was the subject of our research.

We also studied the specifics of STARS. The group determined the reasoning behind the tiering of certain credits. Similarly, the tiers themselves were reviewed on the basis of their steps, how simple it was to get the lowest score, and how rigorous it was to get the highest score.

STARS employs several qualified external programs throughout its rubric, including LEED for buildings, Green Seal for cleaning products, EPEAT for electronics and Energy Star for energy consumption. Through communications with Laura Matson the group inquired about these programs and determined the reasoning behind their selection.

Additionally, the group researched the documentation and verification process for the STARS 0.5 rubric. The rubric requires detailed documentation which, at times, seemed more detailed than should be necessary. We asked Laura Matson, STARS Program Associate, about the level of detail required in the documentation process and why the AASHE set such rigorous guidelines. We then reviewed the documentation process for various credits ourselves and read through the STARS 0.5 Feedback document to understand the pilot program participants' opinions of and experiences with the documentation process.

COLLECTING WPI OPERATIONS DATA

The team attempted to collect all data from WPI that is relevant to "Category 2: Operations" of the STARS rubric. We began by locating the persons responsible for retaining the necessary data. We performed several preliminary interviews in order to generate a comprehensive list of individuals who would be able to provide us with information or, at a minimum, direct us to the data related to each of the credits in the "STARS Category 2: Operations."

Our first two interviews were with Robert Krueger, Assistant Professor in Interdisciplinary and Global Studies and a member of the President's Task Force on

Sustainability, and Keilin Bickar, an undergraduate student representative to the President's Task Force on Sustainability. Professor Krueger and Mr. Bickar helped us understand what WPI had been doing in the past with regards to sustainability and referred us to Elizabeth Tomaszewski, Facilities Systems Manager, and Christopher Salter, the Director of Project Management and Engineering. Mr. Salter and Mrs. Tomaszewski identified one or more contacts for nearly every credit and offered their assistance in finding additional data. With this list compiled, we then contacted each individual and requested an interview. The purpose of those interviews was to gather the information necessary for both determining the feasibility of utilizing the STARS rubric at WPI and applying it to the WPI campus. This process proceeded as follows:

For the first section, Buildings, the group interviewed Mrs. Tomaszewski and Neil Benner, the Gilbane Inc. Project Manager for the construction of East Hall, about the new construction on campus and the LEED rating of the existing buildings on campus. We determined whether or not LEED certification, required by "OP Credit 1: New Green Buildings," has been met in the Bartlett Center, East Hall, and Gateway Park. We also referenced posters made by Canon Design (2008) for data to illustrate the benefits of building to LEED standards. In addition to the new buildings, we checked whether any existing buildings meet LEED-EB standards. The group also acquired annual records of the water usage of WPI properties from Mrs. Tomaszewski, which was used to determine reduction of potable non-irrigation water usage. We then compared the water usage from the 2007-2008 fiscal year to the 2000-2001 fiscal year and calculated a percent difference between the two. Mrs. Tomaszewski also provided us with an inventory of properties owned by WPI, which we used to normalize water consumption based on conditioned floor space. The team interviewed Naomi Carton, the Director of Residential Services, to determine the current on-campus resident population,

including students, faculty, and staff, and used this information to normalize water consumption based on the campus resident population. We also questioned Mrs. Carton about the use of Green Seal Certified cleaning agents on campus. We wanted to know if the cleaning service used on campus use "green" (see Appendix A) cleaning products – ones that do not harm the environment and are not made by methods that produce greenhouse gases or harmful chemicals.

The second section of "STARS Category 2: Operations" rubric is Dining Services. In order to investigate dining services on campus, we interviewed Joseph Kraskouskas, District Manager of Chartwells Food Service, and requested that he fill out a questionnaire provided by Carol Okumura, a work study student employed by the Facilities Department and assistant to Mrs. Tomaszewski. This questionnaire requested the information regarding the Dining Services credits. Once we received a copy of the completed questionnaire through Mrs. Tomaszewski, we were able to calculate what percent of all food expenditures were purchased from local sources as well as the amount of Organic Certified Food and Fair Trade certified coffee that adhere to the standards of the National Organic Program (for more information on organic certified food or fair trade certified coffee, see Appendix A).

The third section of the "STARS Category 2: Operations" of the rubric is Energy and Climate. The group requested information from Mrs. Tomaszewski regarding electricity and heating fuel consumption for the past five years. Mrs. Tomaszewski submitted energy and fuel bills to Sightlines, a facilities asset advisory firm, to compile it into a usable table. With the data from this table, we calculated the percent change in energy consumption over the last three years and plotted energy consumption over this timeframe. We interviewed William Grudzinski, the Chief Engineer of Facilities, about the fuel consumption and emissions of both the new and the old boilers.

For the Grounds section of "STARS Category 2: Operations," we interviewed Ronald Klocek, the Manager of Grounds and Properties. We asked him about organic fertilizer and pesticides usage on campus and the method WPI uses for irrigation of the campus grounds. Mrs. Tomaszewski also gave us an overview of some of WPI's environmentally friendly landscaping techniques.

The team interviewed Terrence Pellerin, the Custodial Manager, about waste management at WPI. Particular topics included recycling at WPI, construction waste diversion, and general waste disposal. We were directed to speak with David Messier, Manager of Environmental and Occupational Safety, who explained WPI's hazardous waste disposal policy. He specified the quantity of waste produced at WPI each year for the last three years for each of the three principle types of hazardous waste, which are chemical, biological or medical, and nuclear waste. We also inquired about the number of hazardous waste safety violations and the number of visits from federal regulatory agencies. Mrs. Tomaszewski provided us with the total amount of waste generated on campus as well as the percent of that waste that was recycled. The group also interviewed Mary Beth Harrity, Director of the Academic Technology Center, about the way in which WPI recycles or disposes of electronic waste.

When investigating the Purchasing section of "STARS Category 2: Operations," we interviewed Ann Schlickmann, Director of Administrative Services, for information about WPI's purchasing methods, the priority of purchasing environmentally friendly products at WPI, and WPI's Vendor Code of Conduct. The team also interviewed Naomi Carton for information regarding purchases made by Residential Services. The group also interviewed Mary Beth Harrity and discussed if WPI currently purchases EPEAT certified or EPEAT equivalent electronics. We were able to determine if WPI purchased energy efficient appliances, such as

Energy Star and EPEAT certified appliances, and if they purchased "environmentally preferable furniture"; however, since purchasing at WPI is decentralized, we were unable to find the total expenditures on these products. We were also able to determine if WPI has committed to purchasing "Environmentally friendly paper" and "green" cleaning products.

In order to calculate fleet vehicle emissions per passenger mile we interviewed Alfredo DiMauro about alternative modes of transportation, Cheryl Martunas about police transportation, and Kenneth Stafford about emissions calculation. With the information from Mr. DiMauro and Ms. Martunas about the Gateway shuttle, SNAP, and campus police vehicles, we took the fuel economy of the vehicles from the Research and Innovative Technology Administration of the Bureau of Transportation Statistics and multiplied it by the mileage each vehicle had driven in a one week sample of time. Then we took the amount of fuel burned and converted that to emissions using an Environmental Protection Agency conversion factor. We then divided the emissions by the amount of miles driven in the sample time. We took that calculation and divided it by the average number of passengers in the vehicle, this yielded carbon dioxide emissions per passenger mile. Finally, we took the average across all six vehicles to find the average carbon dioxide emissions per passenger mile.

DETERMINING FEASABILITY AND IMPLEMENTATION

Once all data relevant to "Category 2: Operations" of the STARS rubric was collected from WPI as well as methodological and logistical data from the STARS rubric itself, the group began to evaluate the feasibility of implementing the program at WPI. We scrutinized all suitable data from both WPI and STARS, both on an individual basis and as a group. The team reviewed all collected data and put them through three filters.

The first filter was relevance. The group inspected each credit evaluated in the STARS rubric and its WPI counterpart for relevance. In cases where little evidence could be found to support the importance of a credit to sustainability, we marked the credit for low relevance. On the rare occasions that the difference in impact on the campus between the theoretical highest and lowest scores for a given credit was negligible, or if the credit had no application on the WPI campus, we marked it for revision. When the data collected from WPI was insufficient to complete its related credit or did not properly represent WPI, the group marked it for further review as a candidate for adjustment. In addition, we searched through articles and other sustainability tracking programs like STARS to identify any important considerations that have been omitted from the STARS program.

After a STARS credit and its associated WPI data passed all measures in the relevance filter, the group held them against a logistical filter. When the information required to complete a credit was difficult to collect from WPI, we marked the credit for further review of alternative methods for gathering the necessary information. STARS credits with overly complicated, obscure, or expensive assessment and verification processes were marked by the group for review of more logistically friendly alternatives.

The third filter was potential cost versus benefit. This filter used the evaluations developed in the previous two filters and weighed them against the expected costs to improve an institute's score in that credit. The team compared the benefits of improvement in the credit against the immediate and long term costs to WPI, including expense of funds, upkeep, administrative work, documentation and verification, the effort involved in implementation and maintenance, and the personal and institutional value of luxuries that can no longer be

maintained. This filter was not meant to dismiss any credit outright, but to provide more information for the adjustment process.

Once all credits and information had been scrutinized, credits and the associated information from WPI that failed to pass a filter were reviewed by the group and researched in more depth. Once we were able to gather more information regarding the failed credits, we compiled a list of potential solutions, applied them, and ran the adjusted credits through the filters again.

RECOMMENDATION PROCESS

We used both our own and E. Tomaszewski's experiences gathering data from WPI to develop a comprehensive set of recommendations regarding the collection of sustainability information at WPI and improving the STARS rubric. We compiled the discrepancies from Chapter 4: Findings and formulated recommendations based on logical solutions. These recommendations were organized into three categories: recommendations to the AASHE on how to make the STARS rubric more effective at measuring sustainability, recommendations to WPI on what policy changes must be made to ease in the utilization of the STARS rubric, and recommendations to the Task Force regarding future work on campus to improve WPI's sustainability.

CHAPTER FOUR: FINDINGS

This chapter is intended to provide the reader with information that we have collected regarding the current state of sustainability at WPI, the administration's priorities with respect to sustainability, and the functional aspects of the STARS rubric. We will begin with an introduction to WPI's current policies on sustainability. The majority of this chapter is the result of passing the data through the filters we mentioned in our methodology section. These results are broken down into two main categories: WPI and STARS. The WPI section will discuss what WPI is doing well overall with respect to sustainability and what it needs to improve. The STARS section will include the benefits and detriments of the STARS grading system and how it applies to both WPI and institutions in general. The last section of this chapter is a discussion of WPI's performance in the "Category 2: Operations" of the current edition of the STARS rubric. These discussions will illustrate the feasibility of using the STARS rubric at WPI and explore potential incompatibilities with its implementation.

CURRENT SUSTAINABLE PRACTICES OF WPI

Until recently, sustainable practices at WPI were based largely on informal policies within departments. M. Harrity (personal communication, November 11, 2008), Director of the Academic Technology Center, explained that informal policies lack the authority of official policies. When the person who instituted the policy leaves, it is up to his or her replacement to decide if an informal policy will have continued use. When inconvenient, informal policies are more likely to be ignored or set aside than formal policies.

According to A. DiMauro (personal communication, November 13, 2008), Assistant VP for Facilities, the graders for publications like Sustainability Report Card only look at official written policy and not what departments are doing informally. He explained that WPI cannot be

recognized for informal progressive policies. He is currently drafting proposals to the President's Task Force on Sustainability that will make some of the more significant policies formal. Formal policies make clear which standards and goals are considered important to the institution. However, at this point the Task Force is determining which areas of sustainability are most important to WPI, so formal policies have not yet been implemented.

C. Salter (personal communication, November 3, 2008), Director of Project Management and Engineering, identified saving money and improving the institute's image in the public eye as two of WPI's key priorities. By implementing cost-effective approaches to tasks required by the institution, WPI uses its resources more carefully. According to E. Connor (personal communication, February 9, 2009), Director of Admissions, WPI is behind current social trends in terms of sustainability; however, this does not seem to deter students from applying. Although there is no evident correlation between sustainability and student applications, WPI's interest in its public image extends beyond potential students. We investigated WPI's public image regarding its progress towards sustainability, but we did not receive any information.

WPI is beginning to establish its sustainability priorities. According to Provost John Orr (personal communication, February 18, 2009), member of the President's Task Force on Sustainability, the President's Task Force currently lacks a sustainability priority ranking system. However, the agreed upon areas of focus are to expand programs that compel the entire campus community to participate in sustainability, such as the recycling initiative, and to conserve energy wherever possible.

ANALYSIS OF "STARS CATEGORY TWO: OPERATIONS"

"Category 2: Operations" of the STARS rubric has its advantages and disadvantages. It is a comprehensive system that measures sustainability across various aspects of campus

operations. The point system allows meaningful comparison between institutions. It also allows for modification as technology and sustainable practices change. However, the documentation required for STARS certification is expensive, complicated, and time consuming.

STARS is based on a point system, quantifying the sometimes intangible aspects of sustainability in order to facilitate direct comparison with other institutions and identify areas for improvement. Another positive aspect of the STARS point system is that the AASHE understands that some credits do not apply to every institution. STARS does not penalize institutions for credits that are not relevant to them; instead, the denominator for the total score is based on the institution's circumstances. This ineligibility for credit only occurs in three circumstances. "OP Credit 1: New Green Buildings" does not apply to institutions that have not constructed or renovated any buildings in the past three years. The dining services section does not apply to institutions without residential dining halls or an on-site institution-affiliated catering service. The grounds section does not apply to institutions with cultivated grounds that comprise less than 1 percent of the institution's total area.

In general, the value assigned to a given credit is proportional to its significance. L. Matson (personal communication, November 25, 2008), a STARS Program Associate, states that "The point allocation and credit scaling included in the current version of STARS is just a rough starting point – [the AASHE was] focused primarily on developing strong credits and getting feedback on those credits." Currently, the level of detail of the grading system is low; values of each credit may be between only 1 and 5 points. This limited level of detail only allows for the most significant credit to be five times more important than the least significant credit. In some situations it may be necessary for one credit to be worth ten times as many points as another, but this is not possible with the current configuration. This is the case when comparing "OP Credit

16: Construction & Demolition Waste" to "OP Credit 28: Air Travel." Both credits are currently worth 1 point, but diverting 75 percent of waste from construction and demolition has more environmental impact than merely calculating greenhouse gas emissions from air travel without doing anything about it.

STARS strives to be the standard for assessing sustainability of an educational institution. In order to be a standard, it must use techniques to allow comparison between different scales of institutions. Some of these techniques, such as the use of trend information to draw conclusions, may not produce the most accurate representation of an institution, but they can be applied consistently. For example, "OP Credit 8: Reduction in Energy Intensity" uses a percentage reduction in energy consumption from a baseline year. This allows for comparison between institutions of different sizes. However, trend measurement penalizes institutions that are currently very sustainable because it is difficult for them to improve further. An institute of higher learning needs to use resources such as water and electricity to operate normally. When an institution is wasting excessive quantities of these resources, a small percent reduction is relatively easy to manage. As an institution approaches its inherent operational minimum, it becomes significantly more difficult to attain even a small percent reduction without adversely affecting normal operations.

Some credits, like "OP Credit 8: Reduction in Energy Intensity," are open ended, allowing the institution to determine their own course of action to address the credit. However, other credits are overly specific and neglect institutions that may have viable alternative solutions to the same issues. For example, "OP Credit 20: EPEAT Purchasing" requires the purchasing of EPEAT or EPEAT equivalent computers, which use software to adjust power settings on idle computers in order to reduce energy consumption. A similar function can be

performed through a server-side solution where a server monitors individual computer use and adjusts power settings accordingly.

In order to better understand the intricacies of the STARS rubric, we will discuss the merits of each section within "Category 2: Operations" individually. Each credit addresses a unique concern and must also be analyzed independently. However, some credits are interrelated to the point where they lend themselves more to group analysis than individual scrutiny.

"OP Credit 2: Building Operations and Maintenance" requires the use of LEED-EB. While LEED-EB is a comprehensive system for rating the sustainability of existing buildings, any form of LEED certification is both expensive and time-consuming. Understanding this, the AASHE only requires a small percentage of an institution's building square footage to be LEED-EB certified and another larger percent of building square footage to meet the criteria for certification. This is appropriate because it is more difficult to obtain LEED certification for an entire existing campus than it is to obtain certification for a new building under construction with LEED in mind from the beginning. Additionally, "OP Credit 1: New Green Buildings" only requires 25 percent of new building square footage to be LEED certified while the rest of new building square footage is only required to meet LEED criteria.

"OP Credit 3: Potable Non-Irrigation Water" allows institutions to be flexible in their approach to conserving resources; it does not impose any particular restrictions on the method of conservation. This credit specifies that water consumption must be reduced by square footage of building space, allowing institutions to physically grow without being penalized. Furthermore, this credit currently uses a baseline of academic year 2000-2001. We understand that the AASHE initially used a three-year downward trend but changed in favor of comparison against a

single baseline year. However, academic year 2000-2001 is nearly a decade past and may no longer be relevant given the changes a university can undergo in a decade, such as enrollment and purpose of buildings. A more appropriate and consistent baseline is the 2005-2006 academic year because it is used throughout the STARS rubric.

Several of the credits in the STARS rubric pertain to food and we will analyze them as a whole. "OP Credit 5: Local Food" specifies that a given percentage of food expenditures go towards food that is grown and processed within 150 miles of the institution. We could not find enough evidence to support "OP Credit 5: Local Food" as a viable indicator of sustainability. According to Saunders, Barber, and Taylor (2006), measuring the environmental impact of a food based on the distance it has been shipped is overly simplistic and "does not consider total energy use, especially in the production of the product." Whether the food is local or not, its packaging may not necessarily be produced locally, and packaging is subject to the same concerns as food. Food Alliance and organic certified foods (see Appendix A) are generally more expensive than non-organic food, meaning the increased costs of organic food must be weighed against its benefits. Fair Trade (see Appendix A) covers many more products than just coffee, yet STARS only has credits relating to coffee. A similar credit could be conceived for virtually any other food, but coffee is the only one included on the rubric. Additionally, "OP Credit 7: Fair Trade Coffee" requires documentation for other Fair Trade products such as sugar and rice, which is irrelevant to the credit. Within the dining services section there exists an omission: STARS lacks a credit that addresses reduction in food waste, despite the intense focus on waste minimization elsewhere on the rubric. Food waste prevention is a significant aspect of both social and environmental sustainability.

The Energy and Climate section approaches its credits in a logical and universally fair manner. "OP Credit 8: Reduction in Energy Intensity" is relevant for schools in many different climates and circumstances because the trend is normalized by conditioned floor space. This is done by dividing total energy consumption by square footage of conditioned floor space. The usage of renewable electricity has a significant impact on an institution's sustainability, justifying its high value as a credit. The benefits include low cost environmentally friendly energy once the generator is purchased and implemented. Renewable electricity is expensive to implement, requiring a large initial investment, but the environmental and economic benefits are also great (International Energy Agency [IEA], 2004). "OP Credit 10: Combustion with Renewable Fuel" exists to measure the percentage of the heating and cooling load that is met by renewable sources. However, it neglects technologies and techniques other than renewable fuel, such as passive solar design, geothermal, and solar thermal techniques, because the impact of techniques such as these is difficult to measure. There needs to be some way to acknowledge these other sustainable heating and cooling techniques; to omit this point is counterintuitive. "OP Credit 11: Greenhouse Gas Emissions Reductions" uses a percent reduction in GHG emissions from a baseline of the 2005-2006 academic year. Though this balances the measurements of most schools, it penalizes those institutions already performing above average at baseline year. This does not take into account what progress has been accomplished previous to the baseline year.

The Grounds section contains credits for an organic campus, as described below, and non-potable water usage for irrigation. "OP Credit 12: Organic Campus" requires an institution to use only pesticides and fertilizers allowed under the U.S. Department of Agriculture's standards for organic crop production. This standard was established because the USDA has

identified materials used in some pesticides and fertilizers as either harmful or potentially harmful to humans, causing serious health problems such as cancer. "OP Credit 13: Non-potable Irrigation Water Usage" is too specific; potable irrigation water usage can be reduced by methods other than utilizing non-potable water sources, such as irrigating less often or limiting irrigation based on rainfall. This credit limits options to reduce potable water usage for irrigation purposes and gives no points for reducing potable water use in general, which is the core issue of the credit. This credit is also biased based on geographic location, as schools situated in areas with high annual rainfall do need to irrigate as much as institutions in more arid regions.

The Materials, Recycling and Waste Minimization section is consistently effective. "OP Credit 14: Waste Minimization" is valuable because it goes beyond tracking recycling programs; it aims to reduce the amount of potential waste or recyclable material. "OP Credit 15: Waste Diversion" includes recycling all types of materials in any way, whether it is reuse of the material or recycling cans, bottles, and papers. Instead of a per capita trend, waste diversion is measured as an absolute percentage because it is a more meaningful measure of an institution's performance than waste minimization. Waste minimization works better as a per capita trend because potential waste is inevitable, but it can be diverted from a landfill or incinerator through some form of recycling. To remain relevant for a wide variety of campuses, a trend is the only meaningful way to give credit for waste minimization. However, waste diversion does not utilize a trend because the ultimate goal is to divert all waste. This makes the rubric more comprehensive. "OP Credit 17: Electronic Waste Recycling" is a separate credit for the same reason. There are few ways in which an institution can deal with electronic waste. Electronic waste that is no longer usable must be recycled through a contracted recycling company who is licensed to deal with hazardous waste. Institutions have the option of donating outdated

electronic equipment that is still operational to charity organizations or public schools. All these options are sustainable in nature, and use of any of these recycling methods will be rewarded in the STARS rubric. "OP Credit 18: Hazardous Waste Minimization" consists of tracking and safely disposing of hazardous waste to protect both human health and wildlife growth.

The Purchasing section is fundamentally flawed because many institutions operate using decentralized purchasing. Each credit applies to all purchases made by an institution, which assumes that they have a central mechanism for tracking purchases. Forcing institutions to implement centralized purchasing only serves to facilitate data collection for these credits and does not affect the sustainability of the campus or take into account the culture of the institution. This section effectively reflects goals of purchasing ENERGY STAR, EPEAT, and green cleaning products as well as environmentally preferable paper and furniture. However, the manner in which it does so may not apply to many institutions because credit is awarded only for centrally tracked purchases. In addition to this, this section calls for a vendor code of conduct, an agreement between the institution and its vendors that the vendors uphold a minimum standard of the school's choosing regarding environmental and social sustainability. This policy is logistically difficult to implement because many institutions do not centrally track purchases, making it difficult to enforce a vendor code of conduct on all purchases.

The Transportation section primarily focuses on greenhouse gas emissions. "OP Credit 25: Fleet Greenhouse Gas Emissions" normalizes fleet greenhouse gas emissions per passenger mile. "OP Credit 26: Commute Modal Split" tracks the percentage of faculty, staff, and students that avoid single-occupancy vehicle commuting. This would have to be found using a campus wide survey on methods of getting to and from campus across students, faculty, and staff. This credit is meant to reveal how effective options provided to commuters are by how many are

using these options. This data cannot be held as completely accurate, as it requires participation in mass quantities. Those who do participate may not represent the overall campus, so the data collected from this survey may not be accurate. Both of these credits are imperfect because some form of vehicle transportation is necessary for the normal operation of most institutions, but they are practical ways to reduce greenhouse gas emissions. "OP Credit 26: Commute Modal Split" requires a count of the total population of the institution as well as an itemization of the modes of transportation that they use. This requires a comprehensive survey of the school at least once every five years. "OP Credit 27: Commuter Options" necessitates that the institution meet the criteria for being recognized by the Best Workplaces for Commuters (see Appendix A). This credit is redundant because the programs in place that would satisfy this credit contribute to "OP Credit 26: Commute Modal Split." "OP Credit 28: Air Travel" lacks substance; the credit calls for the institution to calculate emissions data based on all institution-funded air travel but does not require any proactive measures to increase sustainability. Emissions calculations do not promote sustainability unless those calculations are used to improve current practices. Furthermore, institutions send faculty and students to various places for a reason; it would be difficult to ask an institution to modify its policy on air travel without interfering with the normal operation of the institution.

ANALYSIS OF WPI OPERATIONS ACCORDING TO STARS

After collecting all the data required to complete "Category 2: Operations" of the STARS rubric for WPI, the group assessed the sustainability of campus operations. Using the rubric we were able to view the operations of WPI comprehensively and evaluate areas in which the institute needs to improve and areas in which it excels.

Among the areas in which WPI did well is recycling. WPI implemented a recycling program in 2006, which consisted of collecting surplus furniture, mixed office waste, mixed electronics, cardboard, and universal waste such as light bulbs, batteries, and ballasts. Scrap metal and mixed electronics are picked up by appointment, ink cartridges are sent to Information Technology as they become available, and pallets are returned to vendors.

Prices in the recycling industry have plummeted due to the recent economic recession, reducing the amount that outside sources will pay for recyclables. In November 2008, the price of mixed paper and Number 6 newspaper dropped from $60 per ton to $0 per ton. In some cases, instead of being reimbursed for recycling materials, an institution must pay to dispose of unwanted recyclables. The current recession has diminished the demand for recycled products and has caused the price of recycled materials to fall drastically. China, where much of these recycled materials are shipped, has a surplus of materials that can last for three months. According to T. Pellerin (personal communication, November 12, 2008), Associate Director of Buildings and Events of the Facilities Department, this price drop may result in WPI reducing its recycling efforts in some cases where it costs WPI to recycle a given material.

Recently, three new buildings have been built on campus: Gateway Park, Bartlett Center, and East Hall, which were completed in 2007, 2007, and 2008 respectively. East Hall was completed with LEED Silver certification and efforts are currently underway to improve to a Gold rating. During East Hall's construction, 82.293 percent of all construction waste was recycled. Table 1 shows construction waste data from records of the East Hall construction project contracted by Gilbane Construction. The Bartlett center has not been LEED certified but it is in the process. Gateway Park, however, is not LEED certified but was built to be LEED certified equivalent. Although WPI did well certifying recent additions to the campus with

LEED, we found a lack of certification for the existing buildings on campus. STARS recommends using LEED-EB to grade all buildings on campus for sustainability.

Table 1

Waste Data from East Hall Construction

Material	Amount Generated (Tons)	Amount Diverted (Tons)	Percentage Diverted
Concrete	1277	1277	100%
Asphalt	312	312	100%
Brick	903	903	100%
Metal	152	152	100%
Gypsum Wallboard	43	43	100%
Cardboard	2	2	100%
Rubble Foundations	1537	1537	100%
Wood	73	73	100%
Waste	325	0	0%
Comingled	600	0	0%
Totals	5224	4299	82.3%

Note. Table is derived from East Hall LEED submission forms -- 2008.

WPI has been taking action to reduce potable water consumption on campus. The accounting department keeps records of the water bills for each year as a reference to measure progress in reducing water usage. The most significant progress towards water consumption reduction has been made in the new residence hall. According to Canon Design (2008), the low flow faucets installed in East Hall use 0.5 gallons per minute instead of the standard 2.5 gallons per minute. Toilets in East Hall have a dual-flush function, meaning the toilet is flushed by pulling the lever either up or down. One direction uses 1.1 gallons of water, while the other uses the standard 1.6 gallons of water. The showers use 1.5 gallons per minute versus the standard 2.5 gallons per minute. East Hall is estimated to be 31 percent more water efficient than a typical dormitory of the same size, saving WPI 600,000 of gallons of water. At a price of $7.11

per cubic meter used, this would save WPI over $16,000 each year in water and sewage expenses.

According to E. Tomaszewski (personal communication, January 23, 2009), Facilities Systems Manager, in addition to the progress made in East Hall, WPI has begun implementing closed loop cooling systems. These systems recycle cooling water rather than constantly using new potable water like the open loop systems that were previously in place. These changes are recent and are not yet represented in the available data. However, E. Tomaszewski (personal communication, January 23, 2009) notes that prior to these efforts, WPI experienced a decrease in water consumption from 8.273 gallons per square foot in 2001 to 7.530 gallons per square foot in 2007. This trend is shown in Figure1.

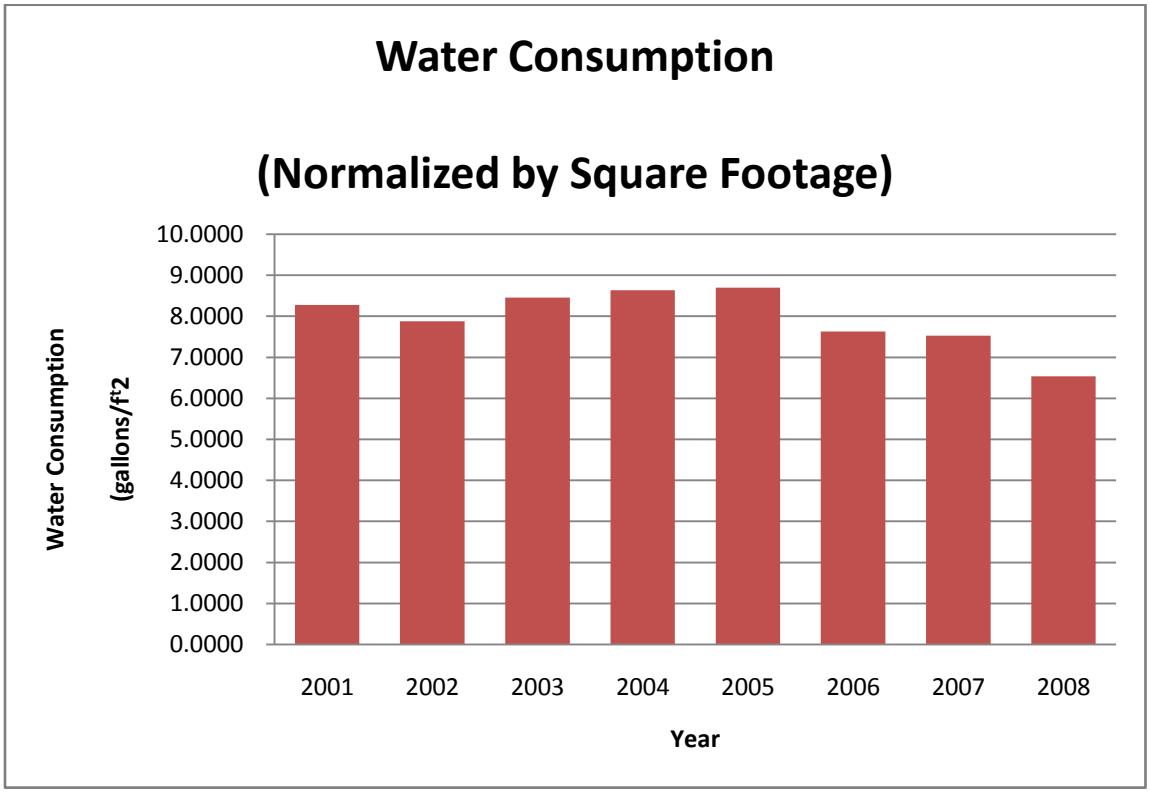

Figure 1: Annual Water Consumption

According to N. Carton (personal communication, November 7, 2008), Director of Residential Services, the new residence hall has adopted a plan to "go green" with their cleaning products. East Hall is cleaned exclusively with green cleaning products, while all other buildings are cleaned with a mix of traditional and green products. This is because green cleaning products are not effective enough for every application; the older buildings on campus need a more robust cleaning agent than the new residence hall, which can be cleaned with the weaker but more environmentally friendly green cleaning products. Each room in East Hall has been assigned a box of green cleaning supplies that the students are responsible for using to clean their rooms. Common areas are cleaned by a service that uses green cleaning products as well.

Chartwells and Compass Group, Chartwells's parent company, have taken the initiative to provide sustainable food services through various means. One such method has been to remove trays from the dining halls, which reduces the amount of wasted food by limiting the amount of food students can carry at one time and lowers operating costs by eliminating the need to use water to clean the trays. This policy was implemented on April 8, 2008, when Phil Clay, Director of Student Affairs at WPI, published an article in the campus newspaper praising the merits of trayless dining. The policy was adopted full time at WPI with little student complaint. J. Kraskouskas (personal communication, November 12, 2008), District Manager of Chartwells Food Service, contends that trayless operation has reduced food waste, although it has increased the amount of metal silverware being thrown out accidentally since the students are now responsible for disposing of their own garbage. He also added that Chartwells has policies promoting trans-fat free foods, cage free eggs (see appendix A) and antibiotic free pork and chicken.

WPI could pursue an additional credit in the food subcategory by increasing the proportion of food purchased locally. However, Chartwells buys food from Foodbuy LLC, a group purchasing organization (GPO) which purchases food in bulk from suppliers at a discount. As a result, some food may be local but the determining factor for choosing a vendor is the price. The economic benefits of using the GPO outweigh the uncertain benefits of "OP Credit 5: Local Food." J. Kraskouskas (personal communication, November 12, 2008) acknowledges that there have been a few students trying to get more organic food on the menu, but purchasing organic food is often not as cost effective as purchasing non-organic food. However, Chartwells does offer some retail-side organic food at the various retail outlets in the Campus Center and in Founders Hall.

WPI has also taken the initiative to increase sustainability in its grounds maintenance. According to R. Klocek (personal communication, November 12, 2008), Manager of Grounds and Properties, in order to promote a healthy environment for the students and wildlife, no pesticides are used on the campus. He also explained that a system is in place where sensors detect if the lawn is wet from rain and adjusts the watering cycle accordingly. On average, this irrigation system uses a maximum of one inch of water per week, including rainfall.

Another aspect of sustainability in which WPI has made significant effort is waste management. Electronics are reused as much as possible on campus. M. Harrity (personal communication, November 11, 2008) explained that if computers and related electronics need to be replaced, they are donated to non-profit organizations such as churches or local high schools. Beyond that they are recycled by the Facilities Department through Allied Recycling. WPI currently sells broken electronic waste to China, where it is disassembled and its constituent parts and materials are reused. Electronic waste is classified as hazardous material and

electronic waste recycling facilities in China do not follow as rigorous safety standards as in the United States (Puckett & Smith, 2002). Though it would cost more to recycle electronic waste domestically, it would be safer for the workers involved, so there is a tradeoff.

Significant effort has also been made with hazardous waste. D. Messier (personal communication, November 10, 2008), Manager of Environmental and Occupational Safety, said that a detailed and comprehensive plan to safely deal with hazardous waste was implemented in December of 2000. This plan promotes the reduction of hazardous waste through measure including recycling materials such as lead-acid batteries when appropriate, controlling the quantity of hazardous materials purchased, encouraging students and professors to conduct small scale experiments whenever possible, and redistributing chemicals that need to be moved rather than replacing them. These measures are designed to help reduce the hazardous waste generated on campus. Figure 2 shows the hazardous waste produced by WPI over the past eight years.

Many labs were relocated from the central campus to the new Gateway Park building in 2006. The large amounts of chemical waste produced in 2005, 2006, and 2007 are due to this move activity, since it would have been prohibitively expensive to move such a large quantity of open chemical containers. This spike in chemical waste in 2005 can also be attributed to the installation of the new boilers used for heating the majority of campus. The older boilers were considered to be chemical waste and contributed 14,966 pounds to the total chemical waste disposed of in 2005. The normal trend for chemical waste is estimated to be less than the figure for 2006, as shown by the data from 2002-2004 as well as 2008.

According to D. Messier (personal communication, February 22, 2009), the amount of radioactive waste disposed in any given year is dependent on what particular radioisotopes researchers are using at the time. He explained, “if [professors and students] are using

Phosphorous 32, its half life is 14 days, meaning that if we hold the waste material for that long, it's no longer a hazard and can be discarded in the normal trash. If, however, Carbon 14 is being used, this isotope has a half life of 5,730 years, and must be stored on site and ultimately shipped to a secure land facility."

Figure 2: Annual Hazardous Waste.

When purchasing products and appliances, WPI makes an effort to purchase energy efficient and environmentally friendly products. N. Carton (personal communication, November 7, 2008) confirmed that all appliances in the new residence hall and all new appliances purchased in the last two years are ENERGY STAR certified. M. Harrity (personal communication, November 11, 2008) claims that most electronics, such as lab computers and monitors, meet EPEAT qualifications. However, the qualifications for EPEAT certification are more involved

than merely purchasing a certified product. To meet EPEAT standards a computer must have software based control of the power settings. WPI controls power settings with a server-side solution (see Appendix A) where all computers under the jurisdiction of the ATC are put into a low power setting when not in use. It is in this manner that labs meet equivalent EPEAT standards. Ninety-five percent of electronics at WPI are eligible to be registered as EPEAT Silver or better. WPI began buying EPEAT Silver and Gold flat screen monitors in 2004 and has expanded its purchases to include more EPEAT products including desktop computers and laptops.

The lack of a vendor code of conduct is a weakness in WPI's sustainability initiative. Purchasing is decentralized and delegated to specific departments. This restricts any blanket policies on purchasing sustainable products. Consequently, WPI cannot guarantee that all products are purchased from vendors that employ sustainable business practices. Cases exist in which WPI is not in a position to purchase environmentally preferable supplies. Office supplies are mostly acquired through a purchasing consortium, which lowers costs by ordering large quantities at discount and redistributing them to individual WPI departments as well as other schools. WPI is currently a member of several purchasing consortia, including MHEC, ENI Cooperative, and the Worcester Purchasing Consortium. There has been a movement throughout these consortia, especially MHEC and ENI Cooperative, towards more environmentally friendly products; however, the main driving force in selecting a product is the price.

WPI has also made progress in sustainability in the area of transportation. According to A. DiMauro (personal communication, November 13, 2008), various alternative modes of transportation for commuter students are in place, namely the Woo bus, taxis, ZipCars, shuttles, and SNAP (See Appendix A). Through our research we calculated the emissions for all police

vehicles and shuttles on campus. These results are found in Table 2 below. According to Chief C. Martunas (personal communication, December 10, 2008), Director of Public Safety, the WPI Campus Police use a type of consortium purchasing system when buying new vehicles. They buy their vehicles through the Municipal Council, which offers discounts on vehicles as well as a special selection of vehicles with aftermarket law enforcement modifications. WPI Campus Police is more concerned with power and traction in their vehicles than fuel economy, and the SNAP shuttles require passenger capacity first and foremost.

Table 2

Fleet Vehicles Emissions Data

Vehicle				Data	
Organization	Year	Make	Model	Fuel Economy (miles per gallon)	CO_2 per passenger mile
Police	2005	Ford	Crown Victoria	16	1.069
	2007	Ford	Expedition	12	1.604
	2009	Dodge	Charger	17	1.1323
Snap	2006	Nissan	Quest	17	0.37743
	2008	Dodge	Caravan	17	0.37743
Gateway	2007	Ford	E 250	15	0.32083
				Average:	0.8135

Note. Table is generated from data gathered from WPI Campus Police Chief C. Martunas (personal communication, December 10, 2008).

The lack of alternative fuel in fleet vehicles provides room for improvement for WPI. K. Stafford (personal communication, November 7, 2008), Director of the Robotics Resource Center, explained that although there are parking spaces for hybrid vehicles, there are no parking spaces for high efficiency vehicles in general. WPI does not currently offer incentives for commuters driving non-hybrid high fuel efficiency vehicles, smaller vehicles, bicycles, or

carpooling. This system of hybrid-only parking spots also draws emphasis away from other high efficiency power trains such as Blue Tec diesel, biodiesel, electric, or hydrogen fuel cell cars.

One of the most significant areas for improvement at WPI is energy. Our research has not yielded any formal policies for energy reduction on campus. Labs are open and operational every day for student use. There exists a tradeoff between availability and sustainability. The energy consumption for the past three years has been an increasing trend, whether it is normalized by conditioned floor space (see Figure 2) or by number of matriculating students (see figure 3). The unit used to measure total energy consumption, both electrical and heating, is millions of British Thermal Units per square foot (MBTU/ft^2). Energy consumption is normalized by square feet because additional buildings have been constructed over the past three years. Similarly, energy consumption has been normalized by student population due the increase in enrollment in recent years. Further detail regarding the data compiled in Figure 3 and Figure 4 is located in Appendix H.

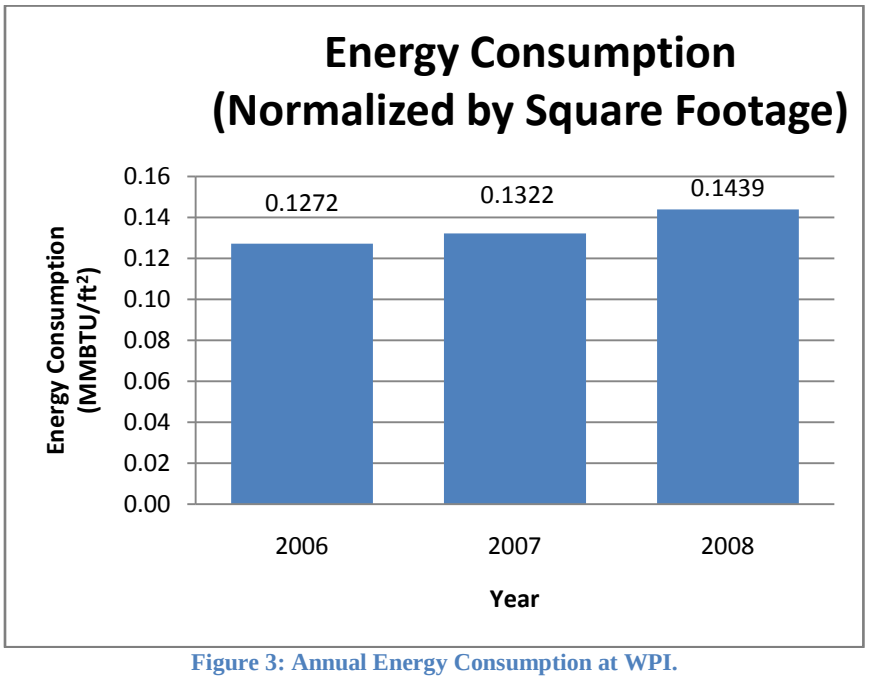

Figure 3: Annual Energy Consumption at WPI.

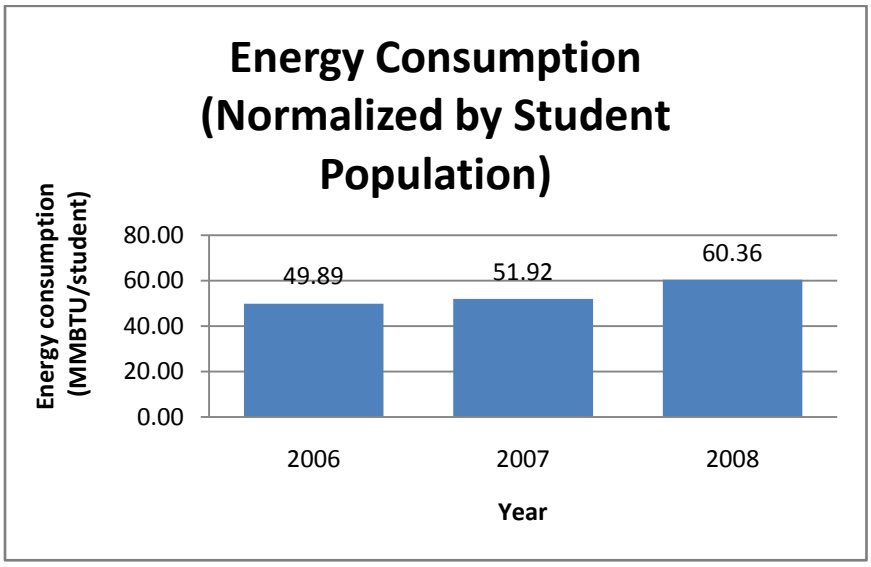

Figure 4: Annual Energy Consumption at WPI per Student.

According to C. Salter (personal communication, November 3, 2008) the largest effort in the area of energy conservation has been a wind generator on the roof of Atwater Kent, which is not a viable power source because it only generates one kilowatt of electricity. Solar panels are on light posts around Alumni Field and there is also a small solar array on top of Morgan Hall; however, the array is for research only. The presence of only one electricity meter for the main campus is not conducive to further assessment of sustainability at a more detailed level. In addition to this, WPI has been tracking energy data only since 2006. W. Grudzinski (personal communication, November 11, 2008), Chief Engineer of Facilities, said that no attempt has been made to employ renewable fuel at WPI; however, three antiquated boilers were replaced in 2005. These new boilers are more energy efficient and have significantly reduced on-campus stationary greenhouse gas emissions by 1,997,673.5 kilograms of carbon dioxide during their first year. They produce 90 percent fewer emissions than the old boilers. According to E. Tomaszewski (personal communication, January 23, 2009), the new boilers "burn natural gas as the primary fuel. The two large boilers also burn distillate fuel oil with 0.05% sulfur content as backup. Because of the current high price of natural gas, WPI has decided to burn the distillate fuel for up

to the 90 days allowed in the Performance Standards and will switch back to gas when required." From an environmental standpoint, this approach is less than optimal for the boilers installed at WPI; however, it is a more economical solution for WPI in the current fuel market.

"STARS CATEGORY 2" ASSESSMENT OF WPI

In our evaluation of how accurately STARS assesses the environmental performance of WPI, the group has looked at every credit in the "STARS Category 2: Operations" portion. In its present state, if WPI were formally graded with the STARS 0.5 rubric, we anticipate that "Category 2: Operations" would be scored 13 out of a possible 61 points. This rating reflects WPI's performance using the current edition of the STARS rubric based on the data we were able to collect and confirm.

WPI earns points for the buildings section of the STARS rubric due to the administration's recent decision to become more sustainable. WPI receives 2 points for "OP Credit 1: New Green Buildings" since all new buildings on campus, such as the Bartlett Center and East Hall, will be LEED certified. WPI only receives 2 points for this credit because East Hall is currently certified LEED Silver but is awaiting Gold certification. In addition, the Bartlett Center is not currently certified, but is expected to be LEED Silver when the certification process is complete. Though WPI is making progress in new construction, no points are earned for "OP Credit 2: Building Operations and Maintenance" because the existing buildings on campus do not meet LEED-EB standards. Through its new program for buying green cleaning products, WPI is close to achieving a point with "OP Credit 4: Green Cleaning Service" but falls short because these products are not Green Seal Certified.

WPI and Chartwells were able to earn 2 points out of a possible 7 points in the Dining Services section. $547,530 out of the $2,027,895 spent on food purchases in 2008 were for

locally purchased food, putting WPI's food services into the 20 to 50 percent tier of "OP Credit 5: Local Food" valued at 2 points. With regards to "OP Credit 7: Fair Trade Coffee," only $6,804 of the $28,250 spent on coffee is used to purchase Fair Trade Certified Starbucks coffee, earning WPI no points. The Dunkin' Donuts located in the Campus Center uses Fair Trade coffee for its specialty drinks, but specific purchasing information was unavailable.

In terms of energy, WPI did not perform well on the STARS rubric. The institution does not currently use any renewable energy and the new, more efficient boilers were installed in the 2005-2006 school year, which is also the baseline year for "OP Credit 11: Greenhouse Gas Emissions Reduction." As a result, the changes that produced the largest decrease in GHG emissions in recent history at WPI may be considered part of the baseline year. If the baseline were to include the full reduction in emissions caused by the new boilers, WPI would earn no points for this credit. If the baseline were to exclude the new boilers, there would be a sharp decrease of 90 percent in emissions and WPI would be eligible for 4 points from this credit. However, without data on the actual emissions from the old and the new boilers that year, we cannot determine an exact baseline.

WPI was able to earn 1 point out of the possible 3 points in the Grounds section. WPI does not use pesticides for the majority of campus and minimizes the use of chemicals to those approved by USDA to limited areas. According to E. Tomaszewski (personal communication, January 23, 2009), "landscaping strategies include the planting of slow growing plants, such as blue carpet juniper, with stone instead of mulch to prevent erosion. Rip-wrap is installed to prevent erosion, and matting is used to prevent the growth of weeds so that the need to use herbicide is unnecessary." Necessary weeding is minimal and is performed manually. This classifies WPI as an organic campus and earns WPI 1 point for "OP Credit 12: Organic

Campus." In addition, the off-campus properties owned by WPI are maintained by Bartlett Tree Service who also uses environmentally friendly fertilizers and pesticides. Since "OP Credit 13: Non-potable Irrigation Water Usage" only awards points for use of non-potable water for irrigation, WPI does not receive any points for its attempts to reduce water usage in irrigation through moisture sensor regulation.

WPI has recently made progress in the Materials, Recycling, and Waste Minimization section, earning 3 points out of a possible 7 points. According to E. Tomaszewski (personal communication, January 23, 2009), in the past year, WPI recycled 383,100 pounds of material through Institution Recycling Network and disposed of 122,580 pounds of waste through Waste Management Corporation. This new recycling program diverts 23.8 percent of the campus' total waste, earning WPI 1 point out of a possible 3 points for "OP Credit 15: Waste Diversion." In addition to an increase in the percentage of waste diverted from landfills, WPI has reduced total waste generation from 1,663,229 to 1,608,680 pounds over the past three years, earning 1 point for "OP Credit 14: Waste Minimization." WPI earns 1 point for "OP Credit 16: Construction & Demolition Waste" by recycling more than 75 percent of construction and demolition waste. WPI sells some of its electronic waste to China, preventing it from receiving a point from "OP Credit 17: Electronic Waste Recycling," which requires all electronic waste to be recycled domestically. At this time, WPI does not track the total quantity of electronic waste produced on campus. However, WPI carefully tracks hazardous waste production and disposal, qualifying it for 1 point from "OP Credit 18: Hazardous Waste Minimization."

WPI was able to earn 3 points of the 6 points available in the Purchasing section of the STARS rubric. All new appliances purchased by WPI are ENERGY STAR or ENERGY STAR equivalent, qualifying the school for 1 point from "OP Credit 19: ENERGY STAR Purchasing."

WPI earns 1 point from "OP Credit 20: EPEAT Purchasing" by using a server-side control system that has power saving settings equivalent to EPEAT standards. For "OP Credit 21: Green Cleaning Products Purchasing," WPI earns another point for purchasing Butchers Brand green cleaning products. WPI does not earn points for "OP Credit 22: Paper Purchasing" or "OP Credit 23: Furniture Purchasing." Due to the increased cost associated with these products, they were not purchased by the school to replace conventional paper or furniture. In addition, WPI purchases supplies through a consortium, meaning WPI has limited options for available items.

Transportation related credits were not implemented at WPI. WPI was not eligible for points from "OP Credit 25: Fleet Greenhouse Gas Emissions" because Campus Police do not usually carry passengers in their vehicles and are not concerned with fuel efficiency. SNAP vehicles and the Gateway shuttle carry passengers, reducing the carbon emissions per passenger mile, but not to enough to overcome the inefficiencies of the Campus Police and achieve 0.5 pounds of carbon dioxide per passenger mile required for credit. The data required to evaluate "OP Credit 26: Commute Modal Split" could not be collected by our group due to the large survey that would be necessary to measure how extensively transportation options are utilized. However, this data will be discussed in Professor Matthew Ward's Interactive Qualifying Project in 2008 and 2009. WPI does not meet the requirements to be recognized as a Best Workplace for Commuters (see Appendix A) and, consequently, does not earn credit for "OP Credit 27: Commuter Options." WPI also does not receive points for "OP Credit 28: Air Travel" because travel is decentralized and not tracked.

CHAPTER FIVE: CONCLUSIONS AND RECOMMENDATIONS

This chapter is intended to present our assessment of "Category 2: Operations" from the STARS 0.5 rubric and the feasibility of using it to track sustainability at WPI. This chapter will also propose recommendations to the AASHE regarding the efficacy of "STARS Category 2: Operations" and to WPI with regards to current sustainability practices and possibilities for future work. We will begin by briefly summarizing our recommendations for alterations to "Category 2: Operations" of the STARS rubric. We will then provide our assessment of the feasibility of utilizing "Category 2: Operations" of the STARS rubric to track sustainability at WPI. We shall also make recommendations to the President's Task force on the adoption of the STARS rubric and changes that can be made to improve data collection and overall compatibility. This chapter will close by proposing projects and programs to improve sustainability at WPI and future research projects to illuminate further information.

RECOMMENDATIONS TO STARS

We find that "STARS Category 2: Operations" does well in assessing the overall sustainability of campus operations. STARS is a comprehensive system that is fair, balanced, and applicable to most institutions of higher learning. However, as a pilot program it is expected that the program requires further refinement. The following are our recommendations to the AASHE on how they can improve their rubric to better address the needs of institutions seeking sustainability.

As previously mentioned on page 37, one shortcoming of STARS is that it lacks a credit to address food waste. We recommend that the AASHE add a credit to address food waste. This credit could fall within the domain of either the Dining Services section or the Materials, Recycling, and Waste Minimization section, but we suggest that it be appended to the Dining

Services section because food waste is the responsibility of the institution's dining services provider. We recommend this credit be a decreasing trend in pounds of food waste per year normalized by the number of meals served in that year.

Chapter 4: Findings discusses the relevance of a local food credit on page 37. Since we were unable to substantiate the environmental benefit of purchasing local food, we recommend that the AASHE remove "OP Credit 5: Local Food" from the STARS rubric. It may be better suited as a Tier Two credit until the AASHE can review the grounds of this credit.

When developing "OP Credit 7: Fair Trade Coffee," we understand that the AASHE primarily focused on coffee since it was one of the first widely available Fair Trade certified foods. We recommend that once Fair Trade products become more widely available the AASHE make "OP Credit 7: Fair Trade Coffee" more comprehensive by expanding it to encompass the full range of fair trade products. We recommend that the AASHE change "OP Credit 7: Fair Trade Coffee" to a Tier Two credit until the credit can be expanded. Furthermore, we recommend the AASHE tier the credit using various benchmark percentages of eligible fair trade purchases.

As discussed on page 36 of Chapter 4: Findings, "OP Credit 3: Potable Non-Irrigation Water" currently uses a baseline of academic year 2000-2001, which may be outdated. We recommend that the AASHE change the baseline to academic year 2005-2006. This baseline is used consistently throughout the rubric and is current enough to be relevant.

On a related topic, there is no credit that addresses reduction of potable water consumption due to irrigation. As previously mentioned, "OP Credit 13: Non-potable Irrigation Water Usage" fails to address the issue of potable water usage in irrigation. We recommend that the AASHE adjust this credit to measure reduction in potable water used for irrigation compared

to a baseline of the 2005-2006 academic year. In this way, the credit rewards institutions for both irrigating less and irrigating with non-potable water. This baseline also takes into account variability in rainfall based on geographic location of an institution.

Chapter 4: Findings discussed the effectiveness of "OP Credit 28: Air Travel" on page 41. The AASHE has mentioned that this credit will eventually change but has not specified in what way. We recommend the AASHE change "OP Credit 28: Air Travel" to a Tier Two credit because it does not currently involve any active attempts to become more sustainable.

In summation, we find that STARS is a program that is well on its way to being comprehensive and accurate in evaluating sustainability in institutions of learning. Nevertheless, there are still many areas that have discrepancies, omissions of relevant information, and inaccurate weighting of credits. With implementation of the changes that we have recommended, we feel that STARS will become a more effective tool for assessing sustainability in institutions of higher education.

RECOMMENDATIONS FOR POLICY AT WPI

After thoughtful deliberation, we have concluded that "Category 2: Operations" of the STARS rubric is well suited to WPI's need for a method of assessing sustainability of its campus. We recommend that WPI adopt the STARS program to identify areas in which it can improve or implement sustainable practices. The following are some recommendations to WPI to increase compatibility with the STARS rubric and facilitate future assessments.

While collecting data for the STARS rubric, we discovered that some important statistics are not actively tracked at WPI while others have only recently begun being collected or retained. In addition, the efforts to track these statistics are highly decentralized. We recommend that WPI implement a system where all data pertaining to the STARS rubric is sent

to the Sustainability Coordinator by one of two methods based on the type of data being collected. The first method is to send the data to the Sustainability Coordinator as it is being collected. The second method is to compile the data in the originating department and send it periodically to the Sustainability Coordinator.

The first method is appropriate for information that is not normally tracked on its own in its originating office, such as electricity and water data. Electricity and water consumption information is collected in the Accounting Department in the form of bills. Accounting cannot be expected to compile the bills into the data required for the STARS rubric and, consequently, the information should be sent in its raw form to the Sustainability Coordinator as it is received.

The second method is appropriate for information that is useful to the originating department, such as greenhouse gas emissions or hazardous waste minimization. Tracking greenhouse gas emissions is useful for the operation of the power plant, since information regarding the fuel consumption of the boilers can be used to track boiler efficiency and identify waste. In addition, tracking the amount of hazardous waste generated on campus is necessary for regulations compliance.

Another significant logistical issue is decentralized purchasing at WPI. Several of the credits in "Category 2: Operations" of the STARS rubric are tracked through expenditures, which is difficult with WPI's decentralized approach to purchasing. We recommend each department assign one representative the responsibility of tracking annual expenditures on certain items, such as paper or even organic food. In order to reduce reporting errors, we recommend that this process use a common reporting method designed by the Sustainability Coordinator. The Sustainability Coordinator should create forms for each department and host a short workshop to explain to each department's representative how to complete the forms, what

information is desirable, and the methods through which this information is calculated or compiled. At the end of each fiscal cycle, each representative will submit these forms to the Sustainability Coordinator.

The administration at WPI can also take some steps to improve the sustainability of WPI. As previously mentioned, there are currently many informal policies that put light pressure on departments to be sustainable. We recommend making these policies formal so that they may have a greater effect on campus sustainability. This will also make the sustainable effort of WPI more transparent to third party organizations such as the Green Report Card, increasing public opinion.

RECOMMENDATIONS FOR FUTURE PROJECTS

Our project has helped WPI in a very broad sense; we have touched upon many subjects in an effort to give the reader a comprehensive view on the issue of sustainability at WPI. However, we did not investigate many areas deeply enough to promote changes in administrative policy. We feel that many other projects are in an ideal position to stem from our research. Through our findings we have noticed a few potential areas for improvement in sustainability that may be ideal candidates for student research projects, and we have even received a few requests from interviewees to recommend further research in certain areas. These future projects are described below, prioritized by importance from most important to least important. The first five projects detailed below constitute groundwork that should be completed as early as possible to facilitate the other projects.

We recommend that another project help determine the next course of action in WPI's sustainability initiative. This project should involve developing an operating definition of

sustainability at WPI and determining appropriate methods of weighing options for selecting the next priority, whether it is cost, environmental benefit, or availability of resources.

A sustainability website already exists at WPI, but there is room for improvement. The website has a link to a SharePoint website which contains a number of data-containing documents as well as a forum for various sustainability discussions. We recommend that another project compile all past and present data from the Sustainability Coordinator and build on the existing SharePoint website to make the information available to the WPI community. This expanded SharePoint website will both serve as a valuable resource for other sustainability projects and increase the transparency of sustainable practices at WPI.

Before WPI can assess the sustainability of any of the buildings on campus, we need a way to measure the energy consumption of individual buildings. We recommend that a project determine a method for measuring energy consumption of buildings on campus that are on the shared meter. If no acceptable commercial systems exist, the project should develop a non-disruptive system for measuring energy consumption in the older buildings on campus. This project should be an Electrical and Computer Engineering or Civil Engineering MQP due to its focus on technology related to civil power systems.

East Hall and the Bartlett Center were constructed to LEED standards and are arguably the most environmentally friendly and efficient buildings on campus. We recommend that a project compare the operation and maintenance costs of East Hall to those of other residence halls on campus. The project could focus on water and electricity consumption, heating efficiency and fuel consumption, maintenance expenditures, and state and federal grants and tax credits for green buildings. To facilitate direct comparison, the project could normalize collected

data by conditioned square footage or by resident population. Information gathered by this study would be valuable to WPI's administration when planning future policies and capital projects.

Sustainable programs and technologies often require a substantial initial investment and WPI's sustainability initiative is hindered by a lack of funding. We recommend that another project investigate funding that WPI could pursue for its sustainability initiative. This project would consist of locating sources of funding, determining what is required to obtain funding, and applying for funding if possible. With a larger sustainability budget, WPI could implement projects such as renewable energy and improving the efficiency of campus buildings.

In Chapter 4 on page 51, we discussed the increasing trend of energy consumption at WPI over the last three years. This increase combined with an 86 percent increase in the unit cost of electricity since 2003 results in annual electricity expenditures at WPI doubling in the last five years. We recommend that a project investigate electricity consumption reduction methods that could be implemented at WPI. This project should gather estimates on the cost to implement these methods and develop a cost benefit analysis on the feasibility of instituting them. The project should also calculate the payback period for each of these methods.

Due to time constraints, our group was only able to assess "Category 2: Operations." However, in order to fully evaluate the feasibility of using the STARS rubric at WPI, it must be looked at in its entirety. We recommend that another project assess "STARS Category 1: Education and Research." Likewise, we recommend that "Category 3: Administration and Finance" be the subject of a project as well.

Thermostats are currently installed in all buildings on campus to regulate their temperature; however, the climate is held constant during all hours of the day and night. Some buildings are closed at night and therefore do not need to be heated during those hours. Other

buildings have antiquated or broken thermostats and the temperature is not accurately monitored. Additionally, most buildings are significantly warmer on the top floors than the bottom floors. All of these factors contribute to inefficient temperature regulation, resulting in increased fuel consumption by the boilers. We recommend these issues be addressed by another project. This project has the potential to save WPI a significant amount of money as well as reduce emissions from the boilers. The long term benefits of more efficient climate control should be weighed against any initial investments that will be necessary to implement a new climate control system.

As mentioned on page 46 of Chapter 4, WPI reuses electronics as much as possible, donates obsolete electronics to non-profit organizations, and sells broken electronic waste to China. WPI needs a policy on broken electronic waste that promotes environmental responsibility. We recommend a project track the quantity of WPI's electronic waste that is recycled, thrown out, and sold to China. The project should investigate the environmental, economic, and social impact of recycling broken electronic waste domestically versus current practices. Additionally, the project should explore potential recycling programs that WPI could use to recycle broken electronic waste in the US so that the constituent materials can be reused domestically.

Another recommended area for study is the effectiveness of Tier Two credits in the STARS rubric. There are many sustainable practices that are outlined in Tier Two credits that may be valuable to an institution concerned with sustainability. For example, using geothermal energy, LED lighting, and low-flow shower heads are significant steps that an institution can take towards becoming sustainable. However, these are Tier Two credits and are worth no points on the current STARS rubric. The AASHE has started a second pilot program to explore the

effect of adding fractional point values to Tier Two credits. We recommend another project explore the effectiveness of Tier Two credits and give STARS more feedback on their rubric.

WPI does not presently use renewable fuel or have the means to generate a significant amount of renewable electricity. We recommend that a project investigate the implementation of alternative energy systems in campus heating and electricity production. The use of alternative energy at WPI would improve WPI's score on the STARS rubric, improve public opinion of WPI, and be financially beneficial in the long run. We recommend this project weigh the initial investments required to implement alternative energy sources against its potential long term savings to determine if implementation would be feasible.

As previously mentioned on page 10 of Chapter 1, society is becoming increasingly concerned with sustainability. This change has created new job markets for entrepreneurs and engineers who wish to promote sustainable practices in their industries. We recommend that a project investigate various ways that WPI could prepare its graduates for this opportunity. This project could involve exploring new courses and programs related to sustainability in the workplace that WPI could adopt.

One recommendation we received from a faculty member of WPI was to create a database to store energy consumption data. W. Grudzinski (personal communication, November 11, 2008) informed us that there is no system in place to electronically track and store data from the boilers on campus. This project would involve the creation of a database and transcription from past logbooks into this database. We recommend keeping a record of oil consumption, gas consumption, and boiler emissions. Boiler exhaust is the biggest contributor to the greenhouse gas emissions of the WPI campus and this data should be collected for the Sustainability

Coordinator. A database would make data collection more efficient and the accumulated data easier to analyze.

Another recommendation we received from a WPI faculty member is a project to address sustainable transportation on the WPI campus. K. Stafford (personal communication, November 7, 2008) recommended that a system be implemented to promote the use of high efficiency vehicles by WPI commuters. This project could also look into lowering the carbon dioxide emissions per passenger mile of WPI's fleet vehicles. The current system of hybrid only parking spots draws emphasis away from other high efficiency power trains such as Blue Tec diesel, biodiesel, electric, or hydrogen fuel cell cars. This project could create a high efficiency vehicle registration system for the campus police. This would allow any vehicle that meets specific emission or fuel consumption standards to receive benefits, such as priority parking or a reduced cost of parking passes. Additionally, we recommend that this project compare the emissions of various alternative energy power trains to conventional gasoline engines. This would allow WPI to give priority parking to all high efficiency vehicles rather than only hybrid vehicles.

APPENDIX A: GLOSSARY OF TERMS

Best Workplace for Commuters – A program that provides qualified employers with national recognition for offering outstanding commuter benefits.

Cage Free Eggs – A term with no legal definition. It is thought to be less misleading than the phrase "free range," which means that the chickens are allowed to outside. One other definition of "free range" also includes that they are not fed any hormones or non-organic additives.

ENERGY STAR – A joint program of the U.S. Environmental Protection Agency and the U.S. Department of Energy intended to help save money and protect the environment through energy efficient products and practices.

EPEAT certified – A system to help purchasers evaluate, compare and select electronics based on their environmental attributes by providing a clear and consistent set of performance criteria for the design of products.

Fair trade certified – A certification conducted by third-party organizations to determine whether the farmer of the food product was given fair compensation and working conditions

Food Alliance – A nonprofit third-party organization that certifies farms, ranches and food handlers practicing sustainable agriculture and socially-responsible commerce in the food industry.

Green – A term meaning being beneficial or supportive to the environment

LEED – A third-party certification program that aims for efficient, low environmental impact buildings. LEED is the most popular system for environmentally conscience buildings.

LEED-EB – A version of the LEED program that is focused on existing buildings

LEED Silver certification – Certification that is awarded to buildings that receive 33-38 points out of the 69 possible LEED rubric points.

Organic certified – Certification for food items that are made with at least 70% organic ingredients. The U.S. Department of Agriculture (USDA) and the Canadian Food Inspection Agency oversee organic certification to restrictions on the types of seeds, pesticides, fertilizers, and livestock practices that are allowed. In addition, organic agriculture operations must implement practices to conserve soil, manage manure and rotate crops to preserve the value of agricultural lands.

Server-side solution – Server control over the power consumption of a computer as opposed to software control.

APPENDIX B: CONTACTS (WITH BRIEF DESCRIPTION)

Neil Benner (Gilbane Construction): 508-754-1163 (main line) HBenner@gilbaneco.com

Relevant STARS Credits: (1) New Construction, Renovations, and Commercial Interiors, (16) Construction and Demolition Waste Diversion

- Neil Benner worked on construction and LEED certification of the Bartlett Center and East Hall.

Naomi Carton (Director of Res Services): 508-831-5308 letendre@WPI.EDU

Relevant STARS Credits: (19) ENERGY STAR Purchasing, (23) Environmentally Preferable Furniture Purchasing

- Naomi Carton was in charge of purchasing for the new residence hall. She is an avid proponent of sustainability, although most of her green policies are informal.

Alfredo DiMauro (Asst. VP for Facilities): 508-831-5500 x6678 fred@wpi.edu

Relevant STARS Credits: (1) New Construction, Renovations, and Commercial Interiors

- Alfredo DiMauro has been a primary driving force for WPI's sustainability efforts, including proposing policies for becoming more environmentally conscious.

William Grudzinski (Lead Operating Engineer): 508-831-5497 williamg@wpi.edu

Relevant STARS Credits: (11) Greenhouse Gas Emissions

- Mr. Grudzinski works at the power plant that heats campus and wants there to be an energy team established to improve energy related practices at WPI.

Mary Beth Harrity (Director of the ATC): 508-831-5810 mharrity@WPI.EDU

Relevant STARS Credits: Relevant STARS Credits: (17) Electronic Waste Recycling Program, (20) EPEAT Purchasing

- Mary Beth Harrity is in charge of purchasing computers and electronic equipment for the campus. She explained to us about the server control system for computers' power settings.

Ronald Klocek (Manager, Grounds & Properties): 508-831-5500 x5071 rklocek@wpi.edu

Relevant STARS Credits: (12) Organic Campus, (13) Irrigation Water Consumption

- Mr. Klocek works for maintaining the campus grounds at WPI.

Joseph Kraskouskas (District Manager of Chartwells Food Service): 508-831-5253 joe_k@wpi.edu

Relevant STARS Credits: (5) Local Food, (6) Food Alliance and Organic Certified, (7) Fair Trade Coffee

- Joseph Kraskouskas is in charge of dining services at WPI and at least one other local college.

Laura Matson (STARS Program Associate for AASHE): 510-893-1583 laura@aashe.org

STARS data source

- Laura Matson is our contact at AASHE, she is one of the people that put together the STARS rubric to begin with

David Messier (Mgr Environment & Occup Safety): 508-831-5216 dmessier@WPI.EDU

Relevant STARS Credits: (18) Hazardous Waste Minimization

- David Messier keeps track of all the hazardous waste and the waste disposal policies.

Carol Okumura (Work Study Student): okumurac@WPI.EDU

- Okumura is the first work study student devoted to sustainability at WPI. She works for Elizabeth Tomaszewski and has been tasked with filing out the STARS Rubric.

Terrence Pellerin (Custodial Manager): 508-831-5133 pellerin@wpi.edu

Relevant STARS Credits: (pre 1) Recycling, (2) Building Operations and Maintenance, (4) Green Cleaning Service, (14) Waste Minimization, (15) Waste Diversion, (21) Purchasing Green Cleaning Products

- Terrence Pellerin is in charge of cleaning supplies and recycling and WPI. He wanted a recycling program for 6 years before one was formed on campus.

Kent J. Rissmiller (Associate Dean, IGSD and Prof): 508-831-5296 or 508-831-5019

kjr@wpi.edu

- We interviewed Dean Rissmiller regarding any potential legal or psychological issues involved in requiring statements verifying that information provided is accurate to the best of the signor's knowledge.

Christopher Salter (Director of Project Mgmt & Eng): 1 508-831-6060 csalter@WPI.EDU

- Christopher Salter manages the major capital projects at WPI and is very business oriented.

Ann Schlickmann (Director of Admin Services): 508-831-5025 aschlick@WPI.EDU

Relevant STARS Credits: (19) ENERGY STAR Purchasing, (22) Environmentally Preferable Paper Purchasing, (23) Environmentally Preferable Paper Purchasing, (24) Vendor Code of Conduct

- Ann Schlickmann is in is in charge of all the purchasing operations of campus. Purchasing is decentralized so she can only make recommendations about what to buy; coupled with the effect of purchasing consortia she does not have much power to be sustainable.

Kenneth Stafford (Dir, Robotics Resource Center): 508-831-6122 stafford@WPI.EDU

Relevant STARS Credits: (25) Fleet Greenhouse Gas Emissions, (26) Commute Modal Split, (27) Commuter Options, (28) Air Travel

- Kenneth Stafford is a car enthusiast and has made recommendations to the President's Taskforce on Sustainability regarding the hybrid-only parking spaces and bicycle storage.

Elizabeth Tomaszewski (Facilities Systems Manager): 508-831-5454 ltomasz@wpi.edu

Relevant STARS Credits: (3) Potable Non-Irrigation Water Consumption Reduction, (8) Energy Intensity Trend

- Elizabeth Tomaszewski works with Alfredo DiMauro on sustainability issues at WPI, including filling out the STARS rubric.

Matthew Ward (Professor): 508-831-5671 matt@WPI.EDU

Relevant STARS Credits: (25) Fleet Greenhouse Gas Emissions, (26) Commute Modal Split, (27) Commuter Options, (28) Air Travel

- Matthew Ward is advising a transportation and commuter option IQP in BCD of the 2008-09 school year.

APPENDIX C: INTERVIEWS (LISTED IN ALPHABETICAL ORDER)

Interview with Neil Benner

(Gilbane Construction)

508-754-1163 (main line) HBenner@gilbaneco.com

Office in East Hall, Main Floor

11/10/2008 12:00 PM

Topics: (1) New Construction, Renovations, and Commercial Interiors, (16) Construction and Demolition Waste Diversion

- A large portion of the waste recycled (by weight) comes from the demolition to clear the lot that the new building will be built on. In the case of East Hall, 3 buildings that used to occupy that space were torn down and recycled, composed mostly of masonry and concrete.
- Between 85 and 95% of the waste was recycled during construction of East Hall, it would have been closer to 75% if the demolition of the previously existing buildings was not part of the same project.
- Gilbane is responsible for 6-8 of the points for the LEED scorecard, the rest fall to the architect of the building.
- The most important thing for LEED certification is getting all the documentation while construction is underway.

- The person we would want to talk to about building automation and comparing the efficiency of buildings is Norman F Hutchins (Mechanical Operations Super, 1 508-831-6979, nhutch@WPI.EDU).
- Gilbane assembled the records for LEED and USGBC has them online. All backup records go to the architect. The East Hall project had a LEED supervisor.
- Benner will be able to show us their hard copies of the notes on the East Hall construction.
- LEED is more work than conventional building, but is becoming more mainstream. LEED cost more than conventional building, but that can be minimized if taken into account at the beginning of the project.
- To consider the additional cost of making something greener, it was decided that if the payback time period was under 10 years, then it was worth implementing into the building.
- Specific examples from East Hall are the green roof (which is not required for LEED, but saves on water running into the main water drains) and the chillers (which make cold water for the air conditioning) are more efficient but more expensive.
- The Bartlett center should be compared against Boynton (both offices primarily) on a per square foot basis.

Interview with Keilin Bickar

(Student)

kbickar@wpi.edu

Campus Center Top Floor

10/29/2008 1:00 PM

STARS: Why did WPI decide to go sustainable?

Bickar: There was a push from the community, specifically aimed at presidents of the Worcester Consortium.

S: How did it begin?

B: The top administrators at the school were chosen to form the committee. The first thing the committee did was the "bottles & cans" recycling; however, it was not very effective. The second thing they did was strive for higher LEED standards in the new residence hall. It is currently rated Silver and they want to make it Gold. The third accomplishment was the website.

The task force does not do much. They hold biweekly meetings and use a bureaucratic, slow process. They use IQPs to do the brunt of the work, such as data collection.

S: Where does the data go? Where can we find it?

B: All data we collected last year is on the SharePoint website. We collected it from other IQPs and talking to people. Waste from companies and electricity are on SharePoint.

S: What is the origin of STARS?

B: Do not know

S: What did WPI do with the data?

B: We gave them the data and a specific recommendation. Example: Here is the data, we want to increase recycling, here is how.

S: How does WPI track Sustainability?

B: Clean Air Calculator (another IQP); Sustainable Scorecard (another IQP)

S: Is there a way to get specific data for measuring water or energy?

B: Nope, there is only one meter on campus and data is scattered about. We did not look at water in our IQP. The IQP 2 years back looked at energy, but had a problem applying a solution due to a lack of funding.

S: How do we cope with the lack of data?

B: The Task Force worries more about the website and the public image. There also exists a lack of funding so not much effectively happens.

S: How do we reach the Task Force to get a solution?

B: Be specific; ex. "change fertilizer to x brand."

S: What about other schools?

B: The Worcester Consortium, Robert Krueger talks to them.

S: Do you have any recommendations for another sustainability IQP (ours)?

B: Schedule meetings early!!!! People will not be prompt to respond to you so act quickly.

Interview with Naomi Carton

(Director of Residential Services)

508-831-5308 letendre@WPI.EDU

Office in Residential Services, East Hall

11/07/08 10:20 AM

Topics: (19) ENERGY STAR Purchasing, (23) Environmentally Preferable Furniture Purchasing

- Ms. Carton is responsible for all the furniture purchasing in the new residence hall and elsewhere
    - All furniture is 95% recycled fabric and wood
    - Further literature has been e-mailed out to our alias
- She does not know about EPEAT purchasing, ask Alfredo DiMauro
- The 12 hybrid parking spaces were part of the requirements for the new residence hall to get LEED certification (silver)
    - Keyless entry to the buildings is another green aspect
    - Cards are recyclable
- She was also responsible for all purchasing of appliances in the new building and elsewhere
    - Every appliance in the new building is ENERGY STAR
    - Every appliance purchased in the last 2 years (campus wide) is ENERGY STAR

- She was also responsible for purchasing cleaning products
    - All cleaning products are green in the new residence hall

    - Students are supplied with supplies so they can clean their own personal space
    - Janitors use green supplies to clean common areas
    - More literature was e-mailed to our alias on this subject
- Chartwells is also going green
    - They use local farms for fruit
    - They went trayless
    - Talk to Joseph Kraskouskas for more details
- For paper we should talk to Ann Schlickmann
- Ask Alfredo DiMauro about Vendor Code of Conduct

Interview with Alfredo DiMauro

(Asst. VP for Facilities)

508-831-5500 x6678 fred@wpi.edu

27 Hackfeld Rd

11/13/2008 10:00 AM

Topics: (1) New Construction, Renovations, and Commercial Interiors

- Talk to Ann Schlickmann about the vendor code of conduct
- Ronald Klocek would have the inventory of fleet vehicles
- DiMauro is trying to get a formal policy approved regarding transportation (considering alternative fuel vehicles, based on functionality and upkeep) meant to minimize the number of commuting personal vehicles. It also says about commuter options (Woo bus, taxis, housing around campus, ZipCars, shuttles). He will propose this and 2 other policies at the November 17 meeting of the Green Team.
- Electrics cars were considered a year ago, but concerns about safety led to a decision to not get electric cars. They are being considered in the future.
- The Task Force has been addressing the items of the Sustainability Report Card.
- In a few weeks the CCC will present about power usage of computers (sleep mode vs. turning off computers)
- Informal policies are being made formal, since assessments only look at what policies are written, not necessarily which ones are practiced.
- Tracking air travel is not really done at WPI, since travel is decentralized.
- The Green Team allows groups to meet with them on specific issues in sub committees.

Grudzinski Interview

(Chief Engineer, Facilities)

508-831-5500 or 508-831-5497

Power Plant

11/11/2008 10:00 AM

- They are not doing anything on the rubric
- 3 Antiquated boilers were replaced in 2005 by 3 victory energy boilers
- They use #2 dyed ultra low sulfur fuel
- They have implemented a touch-free chemical system as a safety measure, everything is mechanically controlled and that equipment is adjusted by people if necessary
- The control room is computerized now for efficient data collection and measurements, although records are still kept manually
- The roof is insulated
- There is atmospheric control that ventilates the plant to prevent it from sucking carbon monoxide out of the boilers
- All in all, the plant has been updated to be much safer but the sustainability initiative has not yet moved to the plant
- In the future he would like to get an energy team together to set up a database for data collection and measurements

Interview with Mary Beth Harrity

(Director of the ATC)

508-831-5810 mharrity@WPI.EDU

Office in the ATC in Fuller Labs

11/11/08 2:00 PM

Topics: (17) Electronic Waste Recycling Program, (20) EPEAT Purchasing

- WPI re-uses electronics as much as possible
    - If not then they are given as "hand me downs" to other schools, or donated
        - Worcester Tech High, Churches, NPOs (non-profit organizations) are examples
    - If it cannot be re-used then it is recycled
        - Facilities deals with that aspect
    - WPI does not deal with personal computers (students')
- EPEAT is a complicated topic
    - WPI buys from dell
    - They buy mostly EPEAT Gold products, but the definition of EPEAT is loose
    - Gold means certain power saving options are controlled by software, not just hardware
    - WPI buys the computers blank and programs them themselves, so it may be difficult to verify or authenticate the gold status

    - Lab settings do qualify under EPEAT (or are equivalent)
    - We do not know whether or not Apple computers qualify for EPEAT
        - About 10% of the computers are apple
- There are no formal policies in place regarding energy use
    - It is hard for some computers to be in sleep mode or to be shut down because they are used for remote connection
    - Lab machines do go into sleep mode after one hour without use, however staff machines do not
    - It is difficult to implement EPEAT policies with a server based system
    - They are looking to implement and address server based power management programs in the coming year
- Student machines and electronics are sometimes left behind after graduation
    - There is no policy on dealing with this, ask facilities maybe?
- Also present at the meeting was Jon Bartelson – jonb@wpi.edu
    - We may contact the following people for computer use within their department:
        - Bob Brown – ECE operations
        - Andy Robinson – ME
        - Michael Voorhis – CS
- We will receive a list of models that the ATC bought this past year (or the one prior) via e-mail

Interview with Ronald Klocek

(Manager, Grounds & Properties)

508-831-5500 x5071 rklocek@wpi.edu

27 Hackfeld Rd

11/12/08 10:00 AM

Topics: (12) Organic Campus, (13) Irrigation Water Consumption

- Pesticides are not used on campus except for ornamental shrubs and a couple spots such as the president's house
- Irrigation uses city water (not any grey water) and uses a maximum of 1 inch of water per week on an area
- There is a moisture sensor used that will not turn on the irrigation system if it rained
- Irrigation systems are used on the president's house, west street, the quad, campus center, the beech tree, and freeman plaza

Interview with Joseph Kraskouskas

(District Manager of Chartwells Food Service)

508-831-5253 joe_k@wpi.edu

Office in Morgan, Main Floor

11/12/08 4:00 PM

Topics: (5) Local Food, (6) Food Alliance and Organic Certified, (7) Fair Trade Coffee

- Compass Group (parent company) and Chartwells are on the sustainability path.
    - They have instituted policies which are environmentally and health conscious.
    - Some policies apply to some locations but not others
- Policies that the WPI branch of Chartwells follows:
    - Zero trans-fats
    - Cage free eggs (see Appendix A for a definition)
        - The WPI branch of Chartwells is the first account to institute this standard
    - Antibiotic free pork and chicken
    - Trayless operation since August 12, 2008
        - This has reduced food waste, but has increased the amount of silverware being thrown out
- Chartwells has been considering composting waste food at WPI. Mr. Kraskouskas has been talking with Terrence Pellerin on this issue.
- When asked about "OP Credit 6: Organic and Food Alliance Food," Mr. Kraskouskas did not recognize the term Food Alliance and explained that Chartwells does not track this figure.

    - There have been a couple of students that have been trying to get more organic food on the menu, but most organic food is far more expensive than non-organic food and is not cost effective
    - Chartwells does offer some retail-side organic food at the various retail outlets in the Campus Center and in Founders Hall
- Clean Plate Initiative
    - When there is a major decrease in food waste, Chartwells makes donations to local food banks
    - Sometimes, they give out raffle tickets or candy for having a clean plate
    - Every time there was a decrease of 20 percent, they would hold a raffle and donate to the community
- When asked about "OP Credit 7: Fair Trade Coffee," he said:
    - Chartwells has a number of different coffee outlets on campus
    - All of the Chartwells coffee outlets use Starbucks brand coffee, which is Fair Trade Certified
    - He cannot speak for the Dunkin' Donuts in the Campus Center, as it is the single coffee outlet on campus not managed by Chartwells, but he imagines that it is likely Fair Trade
- He has recently been interviewed by Carol Okumura on the same topics. She has given him a questionnaire and we should ask her to provide us with a copy upon his completion of the form.

Interview with Robert Krueger

(IGSD professor)

508-831-5110 krueger@wpi.edu

Project Center, 2nd Floor

10/29/08 5:00 PM

WPI first chose sustainability through Scott Jiusto's involvement in the idea of saving energy. Jiusto and Krueger did some research on local and regional sustainability with respect to energy. Eventually Matthew Ward suggested WPI adopt a sustainability stance to the Provost, and that is how it began.

Data collection is conducted through a federal work study position that collects data (Carol Okumura) as well as through volunteers. Alfredo DiMauro has what compiled data there is and his assistant, Elizabeth Tomaszewski, is the person to talk to about data.

This is the first time the task force has used STARS and the framework for the STARS program has been studied this year. The truth is that there is so much that should be done and only so much can be done in a short period of time, so the Task Force is focusing on what they feel is important instead of studying the rubric and trying to rack up as many points as possible.

The general implementation process begins with the Task Force deliberating together over what should be done. They are very open to ideas that can be submitted by anyone. There was a student forum last year where the whole campus was invited to have their say in the matter of what WPI should do to be sustainable.

In regards to adapting recommendations for the Task Force, we should be specific. We should identify the supply chains for what we think WPI should implement as well as

recommending alternatives if something is already in place, preferably multiple alternatives with the pros and cons of each. This is an important thing to do because the Task Force needs input and volunteers; they all have separate jobs from sustainability.

The Task Force has loosely looked into sustainability in other schools. They have looked at websites from other schools. Robert Krueger has spoken with David Schmitt, the man responsible for the sustainability initiative at Clark University. The Task Force will reach out to see what other schools are doing, but the Task Force will still do what they believe in.

John Orr might have water bills.

Interview with Laura Matson

(STARS Program Associate for AASHE)

510-893-1583 laura@aashe.org

Email Interview

11/25/08

1. Why does STARS use LEED specifically instead of an alternative such as BREEAM or GBTool?
   - LEED is used because it is recognized widely as the leading standard for green building. It is more popularly used on campuses than other systems.
2. Why does STARS use Green Seal for cleaning products? Is there another system similar to it that was looked at and rejected?
   - There are two credits related to green cleaning. For green cleaning products (OP Credit 22), STARS recognizes Green Seal and Environmental Choice certified or equivalent products. These are the leading standards in the US and Canada respectively and the credit is consistent with a credit in the LEED for Existing Building Operations & Maintenance.
3. Why is the documentation involved in STARS so rigorous and detailed?
   a. Example – OP credit 1
      i. Why is it necessary of the give the URL and date of implementation where applicable?
      ii. Why is the statement needed for saying the data is to the best of their knowledge?

- We have tried to minimize the reporting burden to the extent possible. Because this is a pilot project and STARS is a work-in-progress, we have asked for some additional information that may be helpful in understanding how schools are currently performing that may help as we work to revise the credits. In the example above, we will likely still ask for the URL because it is how we would verify that the policy exists and will be a helpful resource for schools looking to create similar policies, and we will likely continue asking for the date the policy was adopted because it provides helpful context for understanding the policy and institution's history with green building.
- A statement from a responsible party attesting to the accuracy of the submission is not required for the pilot project. This is one of several strategies STARS has implemented to help ensure self-reported data is accurate.

4. How was the full list of "Category 2: Operations" determined?

- The categories were determined in a similar fashion to how credits were determined. We reviewed many campus sustainability assessments to see what things colleges and universities were looking at and we looked at other sustainability assessment tools and frameworks to see how other sectors were measuring sustainability. In addition to this research, we have worked with hundreds of technical experts and campus sustainability practitioners over the course of the past two years to refine the credits and sections.

5. On what basis were the credits scaled?

- The point allocation and credit scaling included in the current version of STARS is just a rough starting point – we were focused primarily on developing strong credits

and getting feedback on those credits. We are still working out the methodology and basis for allocating points for the next version of STARS.

6. Some credits are worth a variable amount of points, depending on the degree of sustainability. Why did you decide these credits should operate that way? Why do not all credits do this?

- In some instances, earning the credit is based on a yes or no answer – For example, do you include sustainability in your master plan is either a yes or no. The scaling of the credits will be something we are revisiting as we continue to develop the point allocation methodology.

7. Why did you choose the year 2000 as the baseline for water use (OP credit 3)? What about schools that do not have that data available?

- Experts who provided feedback on this credit suggested 2000 was a good year because it is recent enough that schools will still have the data, but far back enough that schools will be recognized for water efficiency upgrades made in the interim.

8. Some credits require documentation that is irrelevant to that specific credit?

    a. Example – OP credits 5

        i. What does local food supply have to do with organic certified expenditures?

- This is similar to question 3. For this specific example, we wanted to determine the level of overlap. That is, because the food credits may be combined in future versions, we wanted to know what percentage of local food is also organic. Depending on how the system evolves, we will likely drop this supplemental reporting for version 1.0.

9. Why did you use the Department of Agriculture's standard for organic pesticides for use on organic campuses?

- The standards are transparent and clear. We were not aware of anything similar for landscaping. The credit will likely change in response to feedback we have received so far that using a food production standard for grounds-keeping is not appropriate.

10. How important is using environmentally friendly paper?

- In STARS, paper is one credit, which is currently worth one point.

11. What is the difference between a commuter options plan and a commute modal split? Commuter modal split is a measure of how your population is getting to campus. For example, a university's commuter modal split may be 25% drive alone, 25% carpool, 25% take public transportation, and 25% walk or bike.

- Commuter benefits are incentives provided to employees and/or students to make environmentally preferable modes of transportation more desirable (examples include free or reduced fare bus passes, preferable parking for carpoolers, and all of the programs recognized in the Best Workplaces for Commuters program).

12. For OP credit 28, does the calculation of CO2 equivalent emissions take into account per person or total? The credit is awarded for just calculating the projected GHG emissions from travel? Is there a way to better quantify this credit?

- The only criterion for this credit is that schools calculate emissions from air travel. At this point, it does not matter what the total is – we are really just looking for schools that are taking the initiative to measure this source because it is particularly tricky to measure.

Interview with David Messier

(Mgr Environment & Occup Safety)

508-831-5216 dmessier@WPI.EDU

Office in Daniels Basement

11/10/08 10:00 AM

Topics: (18) Hazardous Waste Minimization

- Regulatory visits:
    - EPA: 0
    - DEP: Last was 7 or 8 years ago
    - NRC: biannual
    - OSHA: 0
- WPI has had no violations that he is aware of
- Hazardous Waste Policy (EOS website has a lengthy description) summary below:
    - WPI licensed a small quantity generator (DEP)
    - WPI has 180 days t store chemical waste
    - 2 licenses with DEP
    - Goddard Hall + Kaven (main accumulation areas)
    - 40 to 45 generation sites
    - 20 to 25 generation sites in Gateway
    - Regenerators are required to take training
    - All shipping manifests are maintained in his office

- Page 23 and 24 of the WPI Hazardous Waste Management Plan address waste minimization (attached in Appendix G)
- The numbers are very high in 2007 and 2008 because we moved labs out of Salisbury and Goddard to move to Gateway, but the chemicals were not moved and became hazardous waste instead
- We should talk to Terrence Pellerin about electronic waste
- Messier will send us the totals in the next couple days

Interview with Terrence Pellerin

(Custodial Manager)

508-831-5133 pellerin@wpi.edu

27 Hackfeld Rd

11/12/08 10:00 AM

Topics: (pre 1) Recycling, (2) Building Operations and Maintenance, (4) Green Cleaning Service, (14) Waste Minimization, (15) Waste Diversion, (21) Purchasing Green Cleaning Products

- State law mandates that construction waste must be recycled
- East Hall has low flow toilets that help reduce water usage
- Butchers brand green cleaning products are used for normal cleaning; conventional cleaners are used for tougher cleaning needs
- Universal (light bulbs, batteries, ballast) is recycled and averages 1 ton per year (light but bulky) (all numbers are based on 05-06 and 07-08)
    - 45 tons mixed office paper recycled per year
    - 30-40 tons of cardboard recycled per year
    - 13 tons of electronics (TV's, computers, printers) recycled per year
    - 17 tons of surplus furniture (started 3 years ago; not many schools do this, but becoming more popular) recycled per year. They go somewhere inside USA mostly but can go to Dominican Republic or Haiti
    - 600 tons of trash per year collected
- Gateway has a 45 yard recycler (co-mingled recyclables)

- Due to slow down of economy, price of selling recyclables decreased (ex. One ton of cardboard used to sell for $125, now sells for $60) (most recycled products get sold to China)
- Recycling at WPI started in 92-93 with an MQP that spent 6 months sorting out trash to see how many recyclables were being thrown out
- If trash is in recyclable bins, they will just throw out everything in it
- WPI has not allotted much money towards sustainability (ex. Two people are full time recycling people, collecting 110-120 tons a year)
- Pellerin wanted a recycling program for 6 year and put in budgeting requests but was denied. When Green Report Card gave WPI a grade of D- due to not having a sustainability website, and thus no numbers to gauge their environmental performance, our sustainability efforts started, including the recycling program that was requested for the last 6 years.

Interview with Kent Rissmiller

(Associate Dean, IGSD and Prof)

508-831-5296 or 508-831-5019 kjr@wpi.edu

Atwater Kent 124

11/21/2008 2:00 PM

Topics: Legal issues regarding the statement veracity required by STARS

- He sees no reason that there should be any legal issues with people giving statements to the best of their knowledge. WPI gives numbers all the time to people, and those numbers will change. The numbers are like momentary looks at a topic.
- As long as the people involved know what they being asked and how their answers will be used (published opinions, citations, etc), then there should not be an issue. The only case where there would be an issue is if someone is intentionally giving false information, in which case you would not want to use them for information anyway.
- Federal law states that an Institutional Review Board has to supervise any project involving human research studies to make sure participants are aware of everything that will be reported and done to them.
- There are exemption forms for minimal risk situations (nobody is at risk of losing their job or anything about data for STARS)

Interview with Christopher Salter

(Director of Project Management and Engineering)

Contact Info: csalter@wpi.edu, 508-831-6060

Office in Daniels Basement

11/3/08

Christopher Salter's purview has changed in the recent past. The two sides of his department are repair/maintenance and general construction/projects. He used to run the repair and maintenance side and he got involved when the former director of project management retired, and has since been given the director position of project management and given up his position in repair and maintenance. The new person in charge of repair and maintenance is Michael Lane.

Projects can be development plans or renovations as far as large magnitude projects go all the way down to smaller projects like a $2000 to $3000 painting job. Information that Christopher Salter has is limited to specifications for construction, electronically scanned blueprints, and accurate reference information for buildings. Note that some of these are things that he plans to have eventually, and he may not have them when we need them.

Sustainability comes into play because it is Alfredo DiMauro's priority as well as because it is popular, so that is just the way buildings are built these days. The real test, according to Salter, is what happens 5 or 10 years down the line? If WPI builds a green roof over a rubber roof, and 20 years later that rubber roof fails, will WPI put the green roof back up after the rubber roof is repaired?

LEED is a lengthy process, both time-consuming and expensive. Goddard Hall renovations are planned and the building will be renovated to LEED protocol but they will not be applying for certification. This is how STARS works, as they expect some LEED certification but for the most part if a school wants to simply be qualified for LEED certification in most buildings that is acceptable.

Salter's department's approach is in line with anything that will provide financial payback, it is all about cost. This approach is applied only where it makes sense, he does not seek sustainability in every aspect of everything he does. However, it is an early discussion point in any project. For instance, the library roof needs work, and the old glass will be replaced to be more thermally efficient. In fact, WPI's building code has become stricter since the library was built and now it calls for more thermally efficient windows. Whether you call it code, sustainability, or common sense, it is all the same thing and it all saves money. This illustrates the point that there have been efforts to be sustainable before the word became a buzzword. WPI has always been looking to save money, and if there are more expensive windows that will lower a heating bill as long as they are in the building, obviously WPI is going to make the investment as long as it saves money in the long run.

The Bartlett Center and East Hall construction were managed by others, so Salter has no direct information about those projects. Drawings and specifications could be a source of information, however. The project manager was Neil Benner (nbenner@gilbaneco.com) and Salter knows they track recycling but he is not sure whether they track energy.

A major problem in this data collection process is that previous administrations were not data driven and WPI lacks comprehensive data about individual electricity, steam and water consumption for each building on campus. Energy consumption is the big thing but direct data

on this is rare by building. Information is available, but not necessarily "data" or numbers. Then again, where do we draw the line between data and information? This may be acceptable for STARS as we can use the total campus data and divide it over the total area, which is actually what STARS wants. An important note is that the WPI campus only consists of the boundaries between Park, Salisbury, Institute and that other street that goes between Founders and the library. The other buildings get their electricity, water, etc on an individual basis. Also, Higgins House uses the main campus power but has its own boiler for heating.

For heating, WPI used to use #6 residual (some kind of fuel) but now they use natural gas or #2 diesel fuel oil, whichever is cheaper. Emissions have decreased as a result. Steam heat is inefficient so that is not used. Campus electricity information and individual water meter records are available at 27 Hackfeld if we speak with Yvette. The gas usage information can be ambiguous because gas is used for various things. We can speak with William Grudzinski (williamg@wpi.edu) about natural gas information from the campus plant. He can also be reached at (508)-831-6406. WPI uses mechanical control to save energy but there is no control for lighting to be shut off by occupancy sensing. For waste information, we should contact Terrence Pellerin (pellerin@wpi.edu). For appliances information (purchasing, etc) we should contact Naomi Carton. For fleet vehicle information, we should contact Ronald Klocek (rklocek@wpi.edu).

Finally, there is project money available this year to prototype a data collection system for two individual buildings that will upload resource consumption data to a server. This can be viewed over time, by day, week, month, year, or whatever the user wants. Eventually the goal is for each building to monitor resource consumption like this. This could be tremendously useful, unfortunately for the purposes of this project it is not going to be around.

Interview with Kenneth Stafford

(Dir, Robotics Resource Center)

508-831-6122 stafford@WPI.EDU

HL 08

11/07/08 3:00 PM

Topics: (25) Fleet Greenhouse Gas Emissions, (26) Commute Modal Split, (27) Commuter Options, (28) Air Travel

- Kenneth Stafford was not exactly sure how much he could help our project, but was curious
- The reason that Elizabeth Tomaszewski recommended us to him is his expertise on automobiles, he was against hybrid parking spots on campus, since many non-hybrids get actually better gas mileage than some hybrids (hybrid SUV's). He believes that giving preferential parking only to hybrids is a poor message for a technical school to send, since it does not encourage other alternative forms of reducing emissions. He also advised a project regarding alternative fuels.
- He gave a list of alternatives he thought should have been encouraged:
    - Hydrogen
    - Fuel Cell
    - Electric
    - Blue Tec Diesel
- He explained that diesel engines get better mileage than gasoline engines, especially at idle.

- Stafford said that the school's fleet of vehicles probably does not have a large effect.
- He also since driving conditions in Worcester are ultra urban (never above 40 mph), that hybrids and diesels engines are superior to gasoline ones for this purpose. He also said that the John Deere vehicles used could easily become plug in electric vehicles.
- If we make an inventory of the vehicle fleet used by campus and miles they drive per year, Stafford will help calculate the emissions they produce.
- Stafford suggests that the school makes a covered bicycle storage area on the main portion of campus. He also suggests that instead of hybrid stickers to get preferential parking, there be high mileage vehicle parking spots (30 mph or better). Stafford feels that the school should encourage using smaller vehicles (such as motorcycles). Since parking for faculty is difficult, encouraging higher efficiency parking spots would encourage them to drive more low impact vehicles to campus.
- Car pool parking spots exist on campus but are not clearly defined.
- For OP credit 26, he said it sounds like a survey would be how to collect that data.
- For OP credit 25, he said to convert the gasoline into its CO2 emissions and work off the fuel efficiency of the vehicle.
- For OP credit 27, he estimates a jet gets 1000 gallons per hour – working out to ½ mile per gallon. With 100 people on the plane, it would indicate 50 mpg – better than most cars.

Interview with Elizabeth Tomaszewski & Carol Okumura

(Facilities Systems Manager) & (Work Studies Student) respectively

508-831-5454 ltomasz@wpi.edu & okumurac@wpi.edu

Campus Center, 2nd Floor

11/03/2008 3:00 PM

- Ms. Okumura is the first person to really be dedicated to sustainability at WPI (maintains WPI sustainability website since September 2008.
- Green committee, Sustainability task force, and green team are synonymous
- For the near future, data collecting at WPI will need to be centralized; currently data will probably be held by facilities
- Prerequisite 1 (recycling) – Talk to Terrence Pellerin (phone extension 5133, pellerin@wpi.edu , Custodial Manager)
- Recyclemania is planned to happen in January for 10 weeks (recycling competition with weekly measurement of amount recycled). To work up enthusiasm for recyclemania, precyclemania will start in 2 weeks (recycling competition between dorms on campus).
- Recently WPI was graded a C- on the Green Report Card, indicating the need for more involvement across campus
- Building topics should be talked with Christopher Salter (interview with him conducted at 1 PM today)
- OP credit 16 (construction waste), talk to Neil Benner (HBenner@gilbaneco.com) about LEED
- Talk to Alfredo DiMauro about new buildings

- OP credit 21 (green cleaning), talk to Terrence Pellerin
- OP credit 3 (non-potable water) talk to Michael Lane (1 508-831-5225, mclane@wpi.edu, Director of Facilities Operations). [Busy and relatively new here]
- Dining Services – talk to Joseph Kraskouskas
- Elizabeth Tomaszewski will help us get data on water, energy, and fuel used with sightline utility recordkeeping software (amount used and cost) at 27 Hackfeld Street
- That will be a baseline for renewable energy credit OP credit 9
- Ms. Tomaszewski is not sure about data regarding Greenhouse gas Emissions, but suggests William Grudzinski (williamg@wpi.edu, extension 6406 [does not answer phone usually], Lead Operating Engineer)
- For grounds credits OP credit 12 and 13, talk to Ronald Klocek (1 508-831-5500x5071, rklocek@wpi.edu, Manager, Grounds & Properties) ask about grey water usage
- OP credit 14 and 15, talk to Terrence Pellerin
- OP credit 17 (electronic waste) talk to Mary Beth Harrity (1 508-831-5810, mharrity@WPI.EDU, Director of the ATC)
- OP credit 18 (hazardous waste) talk to David Messier (1 508-831-5216, dmessier@WPI.EDU, Mgr Environment & Occup Safety)
- OP credit 22 and 23 (environmentally friendly paper/furniture) Ms. Tomaszewski was not sure about, but we will assume our best bet is with Naomi Carton (1 508-831-5308, letendre@WPI.EDU, Director of Res Services)
- OP credit 20, talk to Mary Beth Harrity

- OP credit 19 and 24, talk to Ann Schlickmann (1 508-831-5025, aschlick@WPI.EDU, Director of Admin Services)
- OP credit 25, talk to faculty – they seemed to be knowledgeable about hybrid cars when ZipCars was discussed, perhaps Kenneth Stafford (1 508-831-6122, stafford@WPI.EDU, Dir, Robotics Resource Center) or Matthew Ward (1 508-831-5671, matt@WPI.EDU, Professor)
- Ms. Tomaszewski attended a web seminar discussing credits for STARS and will check her notes so she can send us information from the one session she attended
- Not much collaboration with other schools other than Alfredo DiMauro doing a recycling program with Clark
- Decision making at WPI falls into either policies or programs
- Policies have to be decided by Senior management, so Berkey and his administration
- Programs can be started by interest by faculty or students (Carol Okumura was the one to generate interest in recyclemania)
- Mr. Tomaszewski will send invitations to the next task force meeting (next week)
- Mr. Tomaszewski had nothing to selecting STARS, she thinks it was John Orr
- Most of the data collected previously has been energy related
- If we encounter problems getting access to data, mention Ms. Tomaszewski and say to contact her via email, and if we need more power to get the data, then she will get more people with power on our side
- Next week Ms. Tomaszewski will be attending an AASHE conference

APPENDIX D: GREEN REPORT CARD 2008 (WPI)

WORCESTER POLYTECHNIC INSTITUTE D-

Administration	**F**	Worcester Polytechnic Institute has no known policy relating to campus-wide sustainability initiatives.
Climate Change & Energy	**F**	A class installed a small solar array on campus in order to raise awareness of green energy options. The institute has not made public any steps taken to address energy efficiency or conservation possibilities, and has not made progress toward the use of renewable energy.
Food & Recycling	**C**	The institute contracts with two local producers, including a local dairy. Dining services provides reusable dishware to students and has eliminated the use of Styrofoam products. Cooking oil is recycled through the institute's "Fry-o-Later" program.
Green Building	**D**	The institute dedicated its first LEED-certified building in 2006, but has no known green building policy.
Transportation	**F**	The institute has not made public any programs or practices that encourage or facilitate the use of alternative forms of transportation.
Endowment Transparency	**F**	The institute has no known policy of disclosure of endowment holdings or its shareholder voting record. Therefore, there is no known ability to access this information.
Investment Priorities	**C**	The institute aims to optimize investment return and has not made any public statements about investigating or investing in renewable energy funds or community development loan funds.
Shareholder Engagement	**F**	The institute has not made any public statements about active ownership or a proxy voting policy.

Data compiled from independent research. For information on data collection and evaluation, please see the Methods section.

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APPENDIX E: GREEN REPORT CARD 2009 (WPI)

WORCESTER POLYTECHNIC INSTITUTE C-

Grade higher than last year

Administration	**D**	The President's Task Force on Sustainability is charged with promoting and coordinating sustainability efforts, both in education and in campus operations and facilities. A Sustainability at WPI website was launched in March 2008 that provides a space for the campus community to learn about and engage in reducing WPI's ecological footprint.
Climate Change & Energy	**D**	The institute conducted a major program to replace lighting with energy-efficient designs, install room occupancy sensors in renovated classrooms, and replace the campus boiler system with energy-efficient units that reduce greenhouse gas emissions. In 2007, a team of students initiated the development of a campus greenhouse gas emissions inventory as a first step toward understanding and targeting programs to reduce emissions.
Food & Recycling	**C**	WPI spends approximately 2 to 4 percent of its food budget on locally grown items. In addition, the institute contracts with a vendor that sources local dairy products, and purchases only cage-free eggs and antibiotic-free pork and chicken. Dining services is encouraging waste reduction by providing a reusable coffee mug to freshmen and offering a discount with use of the mug. Cooking oil is recycled. The institute recently expanded its recycling program, resulting in a 13 percent diversion rate.
Green Building	**B**	In February 2007, the board of trustees passed a resolution stating that all new buildings be designed to achieve LEED certification. One building project is LEED-certified, and the newest residence hall, which will feature a green roof, is expected to achieve at least LEED Silver certification. The institute is also designing a major new recreation center to LEED standards.
Student Involvement	**C**	The Global Awareness of Environmental Activity student organization promotes sustainability awareness on campus. The Task Force on Sustainability is organizing events and competitions focused on energy conservation. Students are involved in projects such as developing the sustainability website and the greenhouse gas emissions inventory.
Transportation	**D**	The institute is implementing a commercial car-sharing program on campus and has provided dedicated parking spaces for carpoolers and hybrid vehicles in the new parking garage.
Endowment Transparency	**F**	The institute makes neither a list of endowment holdings nor its shareholder voting record public. Endowment holdings information is available only to trustees and senior administrators and the institute does not receive information on shareholder voting records from the fund managers.
Investment Priorities	**A**	The institute aims to optimize investment return and is currently invested in renewable energy funds.
Shareholder Engagement	**F**	The institute asks that its investment managers handle the details of proxy voting.

Data compiled from independent research and survey responses from schools. For information on data collection and evaluation, please see the Methodology section.

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APPENDIX F: SUMMARY OF POSTERS IN EAST HALL

Canon Design, 2008

To see all of the posters, go to http://www.wpi.edu/About/Sustainability/eastha764.html

Floor 1: Sustainable Site

- WPI's East Hall site is located within close proximity to an internal bus route, city bus routes, and the MBTA
- Dedicated internal storage for bicycles
- Roof made up of 12,985 square feet of white, ENERGY STAR roofing and 4,802 square feet of Sedum™ or green roof
- Green roof provides:
    - Insulation
    - Storm water storage
    - Habitat creation for plant life
- Roof is a modular system placed above a drainage mat on a membrane roof. In a storm situation, the roof helps reduce flooding by retaining water on the roof.
    - Reduces rate and volume of storm water leaving the roof and filters out pollutants
    - Storm water runoff will be reduced by an estimated 50 percent
    - This method is intended to reduce runoff and is not designed to collect rain water for other uses

Floor 2: Indoor Environmental Qualities

- During construction, all mechanical equipment and ductwork was covered to prevent construction dust and debris from entering these systems

- All materials were specified to contain little or no volatile organic compounds (VOCs)

Floor 3: Materials

- 95 percent of all construction waste was diverted from a landfill and either recycled or reused.
- 5200 Tons (10.4 million pounds) of construction waste were diverted
- At least 20 percent of the content used in the building came from recycled material
- 50 percent of all building materials were manufactured within a 500 mile radius
- 60 percent of the wood is certified in accordance with the Forest Stewardship Council's principles and criteria

Floor 4: Water Efficiency

- Each bathroom in East Hall is equipped with low flow sensor faucets that use 0.5 gallons per minute versus a standard 2.5 gallons per minute
- "Dual-flush" toilets that offer a choice of using either a1.1 gallons per flush or 1.6 gallons per flush
- Showers in each unit shall have a low flow shower head that uses 1.5 gallons per minute vs. a standard of 2.5 gallons per minute.
- East Hall is 31 percent more efficient than a typical building of this size and type
- Saves over 600,000 gallons of water each year

Floor 5: Energy

- East Hall uses 32 percent less energy than a typical building of the same size and type

- More efficient building envelope features a white, ENERGY STAR roofing material to reflect heat in the summer, low-E high performance insulated glazing at all windows, and innovative polyurethane spray foam insulation/air and vapor barrier assembly that was comprehensively applied to the exterior wall
- The composite building envelope is in itself 32 percent more energy efficient than a code compliant building of the same size and type
- Four energy recovery units serve the building, capturing exhausted air from the building spaces and using this air to transfer energy to the fresh outside air being supplied to the building
- High efficiency air cooled chillers reduce chiller energy consumption by 15 percent
- High efficiency boilers reduce boiler consumption by approximately 18 percent
- All of the building's mechanical systems are controlled by a building automation system to further optimize building system performance and reduce the overall building energy consumption
- The building envelope construction and mechanical/electrical/plumbing systems account for a reduction of 533,788 kilowatt hours and 32,957 therms of natural gas per year
- Saves close to $120,000 a year in energy costs

Side Note:

- WPI is instituting a program that will use only housekeeping materials that meet the strict Green Seal standards
- If successful. This program will be expanded for comprehensive implementation in all campus facilities

APPENDIX G: HAZARDOUS WASTE MANAGEMENT PLAN

Worcester Polytechnic Institute

Hazardous Waste Management Plan©

Issued: December, 2000
Revised: July, 2004

12.0 Waste Minimization

In WPI's ongoing efforts to minimize costs, control liability, and maintain a sound environmental program, every effort will be made to minimize the generation of hazardous waste. To accomplish this objective, WPI has developed a waste minimization strategy designed to identify and develop opportunities to control chemical use and reduce waste generation. Various methods have been identified and implemented where appropriate and applicable. These methods include the following:

- Chemical Redistribution Program - When laboratories no longer need chemicals they maintain, the EOSO will attempt to identify a suitable campus laboratory that can use the chemical. The Environmental and Occupation Safety Department will arrange for redistribution of the chemical to the new location. Contact David Messier for additional information.

- Purchasing control - Chemical purchases may be reviewed to ensure that appropriate materials and quantities are purchased. This helps to prevent purchasing more than minimum quantities of materials that could become P-listed waste.

- Laboratory Inventory Control - Outdated or obsolete chemical inventories are periodically evaluated and excess quantities, removed. These "removals" are performed periodically and can be scheduled by contacting the EOSM.

- *Universal Waste Management - A universal waste management program has been developed and implemented by WPI. Currently, WPI will handle mercury containing devices and pesticides under the Universal Waste Management rules established by the MADEP. Contact the EOSO for additional details.* **<Pending>**

- Recycling - Where appropriate, WPI will recycle materials instead of disposing of them as solid waste or hazardous waste. Currently, lead-acid batteries are recycled by WPI.

- Micro-Scale Experiments - WPI's Chemistry Department utilizes, where appropriate, and has designed and attempts to design experiments in undergraduate teaching laboratories using scale reduction techniques. The "micro-scale" method is utilized to minimize use of hazardous materials and the subsequent hazardous waste generation.

Worcester Polytechnic Institute

Hazardous Waste Management
December 2000

As new strategies are identified, evaluated and implemented, this section will be updated to reflect methods available for use by WPI. Contact EOSM to provide ideas or obtain information on waste minimization strategies.

APPENDIX H: ANNUAL ENERGY CONSUMPTION DATA

Table 3

Annual Energy Consumption: WPI

	FY2003	FY2004	FY2005	FY2006	FY2007	FY2008
Fossil Fuel						
Centralized						
MMBTU	130,338	132,256	124,315	88,080	88,982	96,534
Unit Cost ($/MMBTU)	6.07	6.65	7.62	14.23	14.44	13.88
Cost	791,406	879,633	947,064	1,252,953	1,284,840	1,339,931
Decentralized						
MMBTU	-	-	-	27,386	32,340	65,640
Unit Cost ($/MMBTU)	#DIV/0!	#DIV/0!	#DIV/0!	15.91	13.92	13.91
Cost	-	-	-	435,600	450,255	912,777
Total Fossil						
MMBTU	**130,338**	**132,256**	**124,315**	**115,467**	**121,322**	**162,174**
Unit Cost ($/MMBTU)	**6.07**	**6.65**	**7.62**	**14.62**	**14.30**	**13.89**
Cost	**791,406**	**879,633**	**947,064**	**1,688,553**	**1,735,095**	**2,252,708**
Electricity						
Centralized						
Units (kWh)	18,513,360	16,872,240	17,987,760	18,799,200	19,914,532	17,953,920
Unit Cost ($/kWh)	0.0706	0.0851	0.0870	0.1286	0.0819	0.1285
Cost	1,306,299	1,436,102	1,564,073	2,418,049	1,631,001	2,307,293
MMBTU	63,205	57,602	61,410	64,180	67,988	61,295
Unit Cost ($/MMBTU)	20.67	24.93	25.47	37.68	23.99	37.64
Decentralized						
Units (kWh)	4,497,215	5,021,007	5,555,344	3,264,758	3,216,014	8,036,252
Unit Cost ($/kWh)	0.0698	0.0852	0.0866	0.1591	0.1547	0.1371
Cost	313,704	427,980	480,912	519,347	497,584	1,101,956
MMBTU	15,353	17,142	18,966	11,146	10,979	27,436
Unit Cost ($/MMBTU)	20.43	24.97	25.36	46.60	45.32	40.16
Total Electricity						
Units (kWh)	**23,010,575**	**21,893,247**	**23,543,104**	**22,063,958**	**23,130,546**	**25,990,172**
Unit Cost ($/kWh)	**0.0704**	**0.0851**	**0.0869**	**0.1331**	**0.0920**	**0.1312**
Cost	**1,620,003**	**1,864,082**	**2,044,985**	**2,937,396**	**2,128,585**	**3,409,249**
MMBTU	**78,558**	**74,744**	**80,376**	**75,326**	**78,968**	**88,730**
Unit Cost ($/MMBTU)	**20.62**	**24.94**	**25.44**	**39.00**	**26.96**	**38.42**
Total Energy						
MMBTU	**208,896**	**207,000**	**204,691**	**190,793**	**200,290**	**250,904**
Unit Cost ($/MMBTU)	**11.54**	**13.25**	**14.62**	**24.25**	**19.29**	**22.57**
Cost	**2,411,409**	**2,743,715**	**2,992,049**	**4,625,949**	**3,863,680**	**5,661,957**

Note. Table is derived from information found in the Sightlines report -- 2008.

APPENDIX I: NORMALIZED ENERGY CONSUMPTION DATA

Table 4

Normalized Energy Consumption

Year	Square Footage	Energy (MBTU)	Energy (MBTU/ft^2)
2008	1,743,623	250,904	0.1439
2007	1,515,623	200,290	0.1322
2006	1,499,423	190,793	0.1272

Note. Table is generated from information in Appendix H – 2008.

APPENDIX J: ANNUAL HAZARDOUS WASTE DATA

Table 5

Hazardous Waste: WPI

Waste Data			
Year	Chemical	Radioactive	Total
2001	15936	0	15936
2002	6395	100	6495
2003	8080	0	8080
2004	9712	100	9812
2005	19471	0	19471
2006	11524	0	11524
2007	11914	100	12014
2008	8106	0	8106

Note. Table is generated from information given by D. Messier (personal communication, February 16, 2009)

APPENDIX K: BOILER EMISSIONS DATA

AIR POLLUTION CONTROL

WPI has completed the boiler replacement project and submitted a report documenting its compliance with the Boiler Industry Performance Standards at 310 CMR 7.26(30) by January 1, 2006. The report included copies of the Environmental Results Program Compliance Certification forms and a discussion on the emissions reductions achieved with the new boilers.

WPI installed three Victory Energy water tube boilers with input ratings of 27.55, 27.55 and 15.32 mmBTU/hr in October 2005. All burn natural gas as the primary fuel. The two large boilers also burn distillate fuel oil with 0.05% sulfur content as backup. Because of the current high price of natural gas, WPI has decided to burn the distillate fuel for up to the 90 days allowed in the Performance Standards and will switch back to gas when required.

With the three new boilers, the Company has reduced its potential sulfur dioxide and nitrogen oxide emissions to the atmosphere by 251 tons and 72 tons, respectively. Particulate and VOC potential emissions have also been reduced by 18 tons and 1 ton. Potential carbon monoxide emissions increased slightly by 3 tons.

No further action by the Bureau of Waste Prevention is required at this time.

POUNDS OF EMISSIONS - OLD BOILERS (Based on 8760 Hours of Operation and AP-42)

Stack 1	Max Rate (1000	Gallons of Fuel	TSP	SOx	NOx	VOC	CO
Point 1 Boiler #1							
POTENTIAL	0.1	876	10512	137532	48180	990	4380
Point 2 Boiler #2							
POTENTIAL	0.1	876	10512	137532	48180	990	4380
Point 3 Boiler #3							
POTENTIAL	0.17	1489	17870	233804	81906	1683	7446
Totals POUNDS		0	38894	508868	178266	3663	16206
		POTENTIAL TONS	19	254	89	2	8

: EMISSIONS - NEW BOILERS (Based on Maximum Use of No. 2 fuel Oil (90 days) and total of 8760 Hours o

	Max Rate		Gallons of Fuel or	TSP	SOx	NOx	VOC	CO
Point 1 Boiler #1								
POTENTIAL No. 2	197	1000 gal/hr	425	850	3052	8501	145	2125
POTENTIAL Nat.	0.0276	MMCF/Hr	182	545	109	6364	509	6364
Point 2 Boiler #2								
POTENTIAL No. 2	109	1000 gal/hr	236	473	1697	4727	80	1182
POTENTIAL Nat.	0.0153	MMCF/Hr	101	303	61	3539	283	3539
Point 3 Boiler #3								
POTENTIAL No. 2	197	1000 gal/hr	425	850	3052	8501	145	2125
POTENTIAL Nat.	0.0276	MMCF/Hr	182	545	109	6364	509	6364
Totals POUNDS			0	3567	8080	37997	1671	21699
			POTENTIAL TONS	2	4	19	1	11

	TSP	SOx	NOx	VOC	CO
Change in Potential Emissions	-18	-250	-70	-1	3

APPENDIX L: WATER CONSUMPTION DATA

Table 6

Water Consumption Data

Fiscal year	Amount Paid (USD)	Water Price per unit ($/m^3)	Sewer Price per unit ($/m^3)	Combined Price	Units Used (m^3)
6/30/2001	163,814.37	1.96	1.7	3.66	44,758.02
6/30/2002	173,005.76	2.09	1.78	3.87	44,704.33
6/30/2003	196,761.95	2.20	1.90	4.10	47,990.72
6/30/2004	201,002.35	2.20	1.90	4.10	49,023.96
6/30/2005	246,363.90	2.38	2.61	4.99	49,371.52
6/30/2006	237,619.56	2.38	3.11	5.49	43,282.25
6/30/2007	264,810.73	2.61	3.52	6.13	43,199.14
6/30/2008	289,479.85	2.74	3.97	6.71	43,141.56
6/30/2009	118,239.21	2.84	4.27	7.11	16,629.99*

Note. Table is generated from information given by L. Tomaszewski (personal communication, January 7, 2009)

*Estimate as of 1/07/2009

APPENDIX M: STUDENT POPULATION

Table 7

Student Enrollment:

		2004-2005	2005-2006	2006-2007	2007-2008	2008-2009
Undergraduate	Full Time			2816	2981	3075
	Part Time			36	35	85
	Total	2759	2806	2816	3016	3160
Graduate	Full Time			497	472	363
	Part Time			398	669	542
	Total	949	1018	1042	1141	905
Totals		3708	3824	3858	4157	4065

Note. Table is generated from student enrollment information retrieved from Registrar data on February 2, 2009

APPENDIX N: LETTER TO THE AASHE

March 2, 2009

Mrs. Laura Matson
STARS Program Associate
Association for the Advancement of Sustainability in Higher Education
213 ½ N. Limestone
Lexington, KY 40507

Dear Mrs. Matson,

WPI has been participating in the STARS 0.5 Pilot Program and has also commissioned a student project to determine the feasibility of utilizing STARS Category 2: Operations at WPI. We have been collecting data at WPI to complete Category 2: Operations of the STARS rubric and have also researched the credits used in the STARS rubric.

We found that STARS Category 2: Operations does well in assessing the overall sustainability of campus operations. STARS is a comprehensive system that is fair, balanced, and applicable to most institutions of higher learning. However, as a pilot program it is expected that the program requires further refinement. The following are some comments and recommendations on how the AASHE may be able to improve the STARS rubric to better address the needs of institutions seeking sustainability.

One shortcoming of STARS is its lack of a credit to address food waste. Food waste prevention is a significant aspect of both social and environmental sustainability. We recommend that the AASHE add a credit to address food waste. This credit could fall within the domain of either the Dining Services section or the Materials, Recycling, and Waste Minimization section, but we suggest that it be appended to the Dining Services section because food waste is the responsibility of the institution's dining services provider. This credit should

be a decreasing trend in pounds of food waste per year normalized by the number of meals served in that year.

We could not find enough evidence to support OP Credit 5: Local Food as a viable indicator of sustainability. The credit specifies that a given percentage of food expenditures go towards food that is grown and processed within 150 miles of the institution. However, the issue of local food is complex and the credit criteria should account for the environmental effects of the food's packaging and processing in addition to the food's source. Whether the food is local or not, its packaging may not necessarily be produced locally, and packaging is subject to the same concerns as food. The total carbon footprint from local food may be just as high as food from further than 150 miles away. This emphasis on local food is unsound; therefore, we recommend that the AASHE remove OP Credit 5: Local Food from the STARS rubric. It may be better suited as a Tier Two credit until the AASHE can review the grounds of this credit.

When developing Op Credit 7: Fair Trade Coffee, we understand that the AASHE primarily focused on coffee since it was one of the first widely available Fair Trade certified foods. We recommend that once Fair Trade products become more widely available the AASHE make OP Credit 7: Fair Trade Coffee more comprehensive by expanding it to encompass the full range of fair trade products. We recommend that the AASHE change OP Credit 7: Fair Trade Coffee to a Tier Two credit until the credit can be expanded. Furthermore, we recommend the AASHE tier the credit using various benchmark percentages of eligible fair trade purchases.

OP Credit 3: Potable Non-Irrigation Water Consumption Reduction currently uses a baseline of academic year 2000-2001. We understand that the AASHE initially used a three-year downward trend but changed in favor of comparison against a single baseline year. However, academic year 2000-2001 is nearly a decade past and may no longer be relevant due to changes a

school has undergone. We recommend that the AASHE change the baseline to academic year 2005-2006. This baseline is used consistently throughout the rubric and is current enough to be relevant.

On a related topic, there is no credit that addresses reduction of potable water consumption due to irrigation. OP Credit 13: Non-potable Irrigation Water Usage is too specific; potable irrigation water usage can be reduced by methods other than utilizing non-potable water sources, such as irrigating less often or limiting irrigation based on rainfall. This credit limits options to reduce potable water usage for irrigation purposes and gives no points for reducing potable water use in general, which is the core issue of the credit. The purpose of this credit should be to reduce usage of potable water in irrigation by any means and not restrict it to the use of non-potable water. We recommend that the AASHE adjust this credit to measure reduction in potable water used for irrigation compared to a baseline of the 2005-2006 academic year. In this way, the credit rewards institutions for both irrigating less and irrigating with non-potable water. This baseline also takes into account variability in rainfall based on geographic location of an institution.

OP Credit 28: Air Travel lacks substance; the credit calls for the institution to calculate emissions data based on all institution-funded air travel but does not require any proactive measures to increase sustainability. Emissions calculations do not promote sustainability unless those calculations are used to improve current practices. Furthermore, institutions send faculty and students to various places for a reason; it would be difficult to ask an institution to modify its policy on air travel without interfering with the normal operation of the institution. The AASHE has mentioned that this credit will eventually change but has not specified in what way. We

recommend the AASHE change OP Credit 28: Air Travel to a Tier Two credit because it does not currently involve any active attempts to become more sustainable.

In summation, we find that STARS is a program that is well on its way to being comprehensive and accurate in evaluating sustainability in institutions of learning. Nevertheless, there are still many areas that have discrepancies, omissions of relevant information, and inaccurate weighting of credits. With implementation of the changes that we have recommended, we feel that STARS will become a more effective tool for assessing sustainability in institutions of higher education.

Sincerely,

David Boudreau

Thomas Strott

Adam Belanger

Mike Bedford

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