SUSTAINABILITY at St. Mary's College of Maryland

THE PUBLIC HONORS COLLEGE

at Historic St. Mary's City

THE SUSTAINABILITY COMMITTEE'S

ENERGY CONSERVATION INITIATIVE

Draft Report



FALL 2008

Executive Summary:

President O'Brien signed the President's Climate Commitment in the spring of 2008, pledging to move St. Mary's College towards climate neutrality. On September 10, 2008, during its first meeting of the year, the Sustainability Committee concluded that helping the College reduce its energy consumption would be a significant first step towards climate neutrality. In order to engage the College community in helping to reduce energy consumption, a campaign was launched in the last three weeks of September to raise awareness among students, faculty and staff about the use of energy on campus and to solicit ideas to save energy. The Sustainability Committee took the lead in collecting, researching, evaluating and selecting the ideas submitted by the College community.

This report presents the ideas that a) were deemed feasible within the constraints of St. Mary's College, b) enable the largest reduction of energy consumption, and c) provide the greatest benefits to the College in terms of cost savings, environmental impact reduction and public image. This report is not intended to propose an exhaustive evaluation of all the energy saving possibilities. The selected energy saving ideas have been organized into three portfolios.

- Portfolio A is composed of 7 energy saving ideas that require little to no initial investment and are unlikely to be controversial within the College community. They include retrofitting the campus' 355 outdoor lights to high efficiency fluorescent lights, aligning the building HVAC temperature set points to the Governor's requirements (78 F in summer, 68 F in winter), operating a trayless cafeteria and implementing a resource conservation awareness training program for students, faculty and staff, to name a few. For an initial investment of approximately $6,000, Portfolio A is anticipated to generate close to $150,000 in energy savings annually.
- Portfolio B is composed of 14 energy saving ideas that necessitate significant initial investments or a significant change in users' behaviors or facilities operations. It includes propositions of on-site renewable energy production such as solar water heaters, a medium-scale photovoltaic system and a small-scale wind turbine. For an initial investment of approximately $400,000, Portfolio B is anticipated to generate about $275,000 in energy savings annually. The average simple payback time is 1.4 years.
- Portfolio C consists of one idea – the installation of a large wind turbine or wind farm located off campus. The initial investment is estimated to be $3,000,000. If it is confirmed that a wind turbine is a viable project in our region, it could generate about $210,000 in energy savings annually. The simple payback time is 15 years.

We recommend that Portfolio A be implemented immediately while Portfolios B and C be vetted by the College community before implementation. Students expressed interest to use a portion of their Green Fund to finance renewable energy production projects. In addition, we suggest that the College explore with DGS and NORESCO the possibility to amend the current Energy Performance Contract to help finance some of the more costly energy saving ideas presented in this report.

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Foreword:

On September 10, 2008 the Sustainability Committee met for the first time of the school year to establish a plan of action for the months to come. It was decided that the Committee's principal goal would be to develop a Sustainability Strategic Plan that would help the College move toward sustainability in an organized and effective manner. The development of a Sustainability Strategic Plan was deemed an important and necessary step, but also understood to be a goal that would take time to achieve. It seemed to be the general consensus among the attendees that working on the Sustainability Strategic Plan should not prevent the Sustainability Committee from engaging at the same time in other projects advancing sustainability on campus. The Committee wanted to balance its action between long term goals and more short term concrete objectives.

The College's use of energy appeared to be the most important and pressing issue to tackle for multiple reasons. The College's consumption of energy has been mostly on the rise over the past few years (up 19% from fiscal year 2004 to fiscal year 2008), due to more students, more buildings, and more equipment. The costs of electricity, oil and propane (the three main College energy sources) have hit record highs these past few months. High prices combined with increased consumption mean that energy is having a larger than ever impact on the College budget. The College's total expenditure on energy has indeed approximately doubled over the last five years, exceeding $2 million in 2008, an amount of money that the College community would certainly rather see spent on educational programs and student activities.

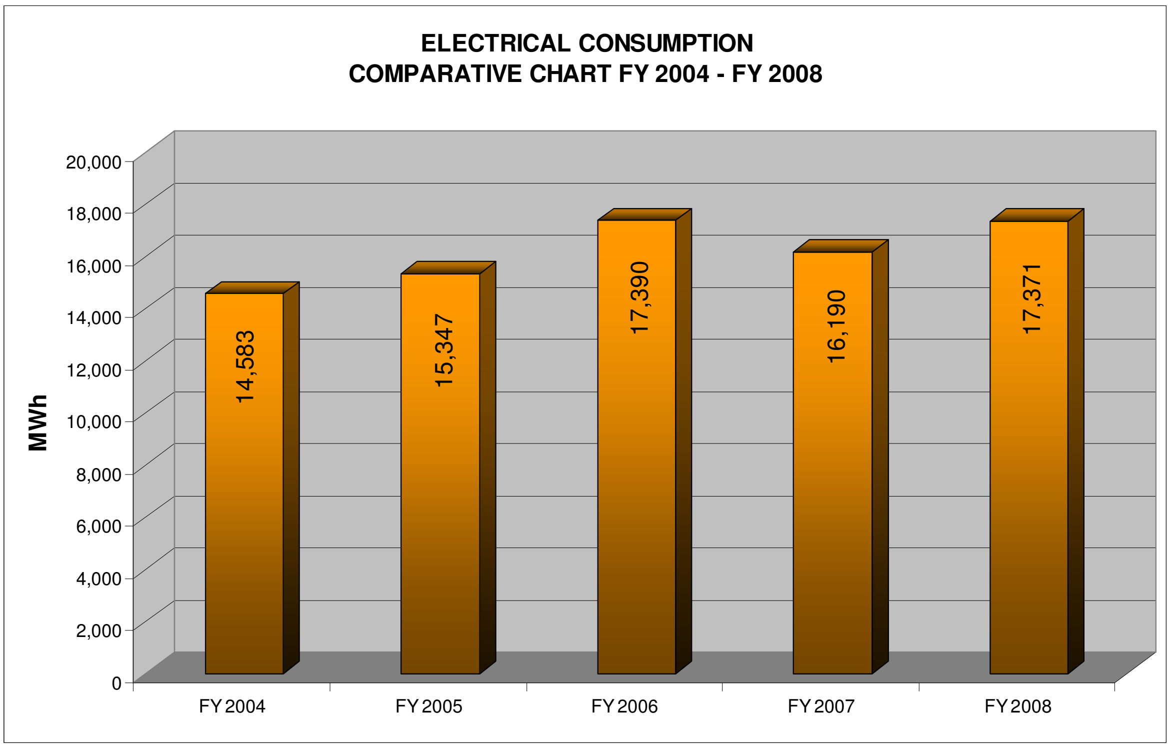
Most apropos to the Sustainability Committee, the College's use of energy has a significant impact on the environment. Electricity generated in remote power plants for use on campus, as well as oil and propane burned on campus to activate boilers and other mechanical systems, are direct sources of greenhouse gas (GHG) emissions that contribute to global warming. In fact we estimate that on-campus energy usage constitutes about 80% of the College's carbon footprint. President O'Brien signed the President's Climate Commitment in the spring of 2008, pledging to move St. Mary's College towards climate neutrality. The Sustainability Committee concluded that helping the College reduce its energy consumption would be a significant first step towards climate neutrality.

The Sustainability Committee decided that helping the College reduce its energy consumption would be its first major task of the school year.

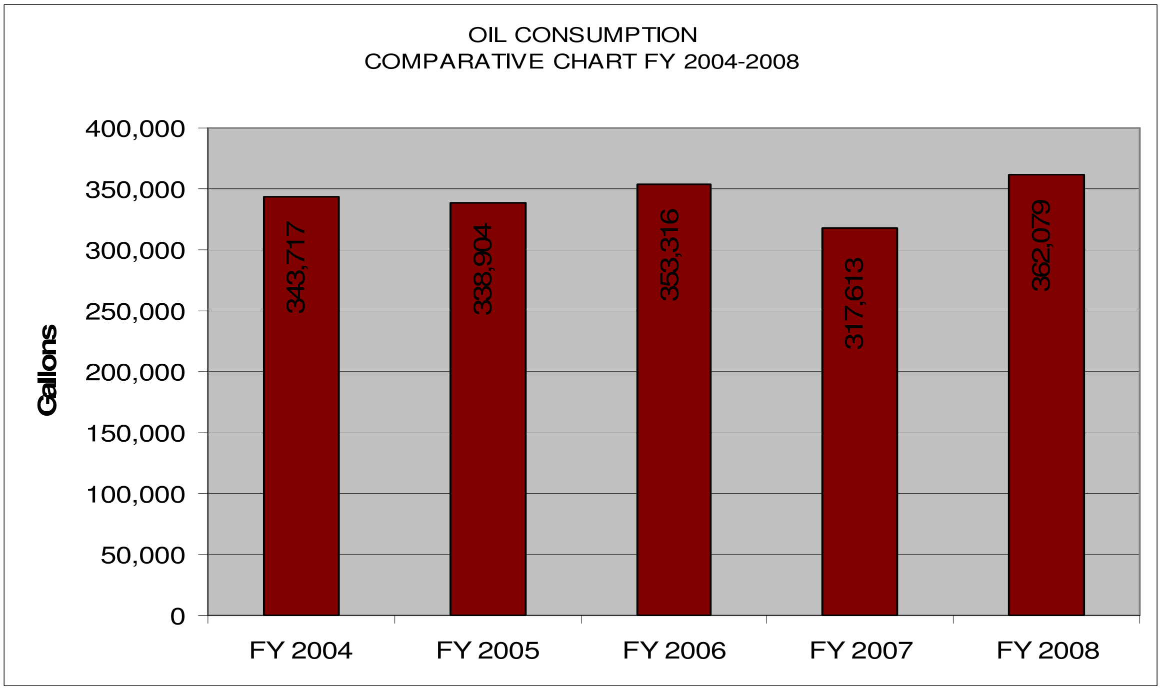
Introduction:

1. Energy consumption at St. Mary's College

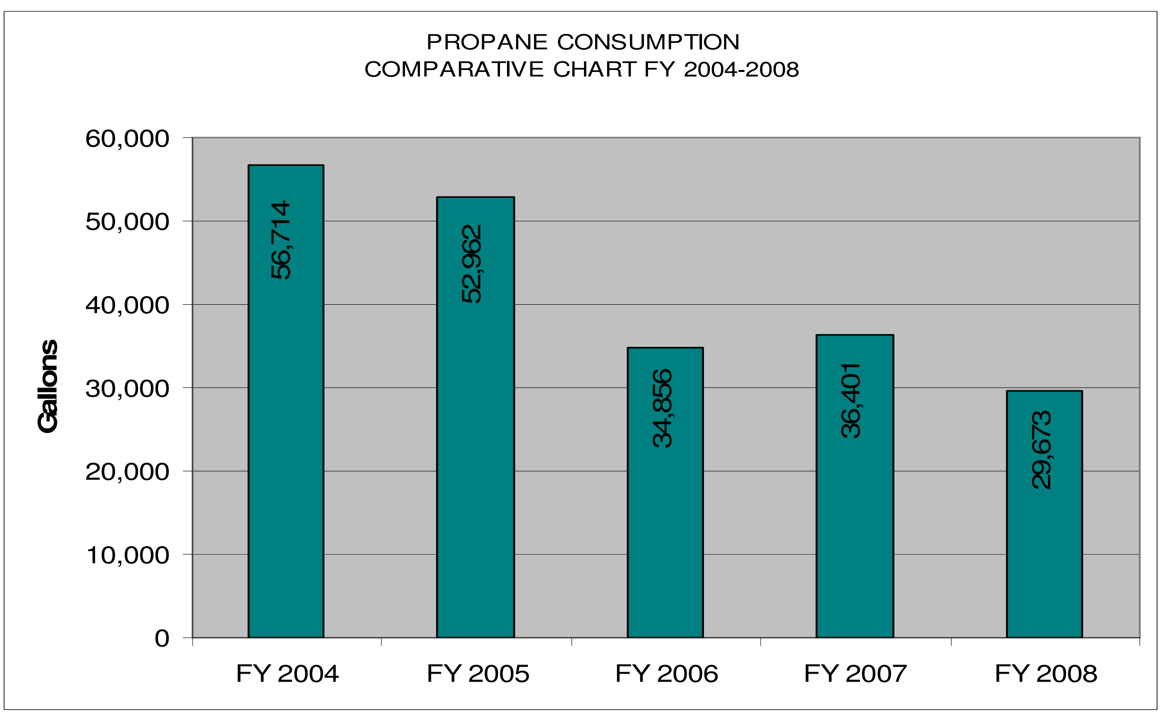
Before focusing on ways to save energy on campus, we thought it would be useful to give a brief overview of the current energy consumption trends at St. Mary's College.
St. Mary's College has three main sources of energy: electricity, #2 fuel oil and propane. Electricity is the largest source of energy used by the College. It is provided to the College by SMECO. As shown on the chart below the College's electrical consumption has increased about 19% over the last five fiscal years.



No. 2 fuel oil is used in boilers in most large buildings on campus to provide hot water for space heating in the winter and reheat in the summer. As shown in the chart below, the College consumption of No 2 fuel oil has followed a similar trend to electrical consumption and has increased by approximately 5% over the last five fiscal years.



The chart below indicates the consumption trend of propane on campus. Propane is used at several locations on campus including labs in Goodpaster Hall and Schaeffer Hall, and the dining services in the Campus Center. Propane consumption on campus has decreased about 48% over the last five fiscal years, mostly due to the removal of the BAT.



2. The Energy Conservation Initiative

The College had in fact previously launched a similar effort to curb its energy consumption in 2006 when it hired NORESCO, a private consulting firm, to conduct an Energy Performance Contract (EPC). The EPC consisted of an audit of the College's energy usage followed by the implementation of a number of energy conservation measures selected for their reasonably quick return on investment. The energy conservation measures selected were mostly infrastructural upgrades and were intended to cut energy consumption 20% from a 2005 baseline.

In this new energy saving initiative, the Sustainability Committee made the decision to be as far reaching as possible in its search for energy saving ideas by:

- Not limiting itself to the recommendations of outside experts but encouraging the entire college community to contribute energy saving suggestions.
- Considering ideas and strategies developed in-house by Physical Plant and the people who know the College's energy system better than anyone else.
- Being open to suggestions impacting building operations and human behavior, in addition to infrastructural upgrades.

In order to engage the College community in helping to reduce energy consumption, a campaign was launched in the last three weeks of September to raise awareness about the use of energy on campus and to solicit ideas to save energy. The campaign consisted of a combination of mass mailings to students, faculty and staff, meetings with staff groups (housekeeping staff, trades and grounds staff), presentations to the Student Government Association (SGA) and at an All-Staff meeting, soliciting ideas from visitors during the 2008 RiverFest put on by the St. Mary's River Watershed Association in St. Mary's City, and through an article in the Point News.

The numerous responses from the campaign were collected, reviewed and compiled into a list of approximately 35 ideas. These ideas were then split among the six subcommittees to be researched according to predefined guidelines. For each idea assigned to them, the subcommittees' task was to gather the following information:

- Type of proposed energy conservation measure (infrastructural upgrade, operational change or behavioral change)
- Estimated annual energy savings
- Estimated annual cost savings
- Estimated upfront cost
- Estimated payback time
- Other costs and benefits (environmental, social, educational or other)
- List of stakeholders

- Proposed implementation timeline
- Examples from elsewhere

This volume, presenting the work of the Sustainability Committee over the course of 8 weeks, presents ideas that a) were deemed feasible within the constraints of St. Mary's College, b) enable the largest reduction of energy consumption, and c) provide the greatest benefit to the College in terms of cost savings and environmental impact reduction.

The ideas assessed in this volume are not intended to present an exhaustive evaluation of all the energy saving possibilities. As mentioned earlier, this is not the work of experts. The energy saving ideas have been imagined and researched by the College community, a group with no particular expertise on energy management. The short timeframe we allowed ourselves obviously limited the amount and depth of the research that could be accomplished.

We feel it is important that these energy saving strategies be reviewed by the College community at large. A significant number of the proposed energy saving strategies presented here may have a small, but nonetheless noticeable, impact on our daily life on campus, whether the target of the strategy is our behavior, facilities operations or an infrastructural upgrade. So it is important that students, faculty and staff understand the purpose of this initiative, be informed about the different ideas and their expected benefits and impact, and also have a chance to provide constructive feedback on this effort.
Indeed none of these ideas can really provide the intended energy savings if they do not obtain the buy-in of their stakeholders.

I. Ranking system for the energy saving ideas

In order to help the College decision makers and better inform the College community about the respective merit of the energy saving ideas, we have developed a ranking system that is based on three criteria:

1. Financial Benefits: These were measured by calculating the estimated simple payback time. The shorter the pay back time is, the more financially beneficial the energy saving idea is. Ideas received a grade between 7 and 0. A grade of 7 was given to ideas with a payback time of a year or less. 0 was given to energy saving ideas with a payback time of 7 years or more.
2. Environmental Benefits: These include environmental benefits, social impacts, and public relations and educational opportunities. A subjective grade between 7 and 0 was given to each idea, taking into account these parameters.
3. Risk and Uncertainties: Some ideas are easy to implement and based on well-known technology. Others rely on technology that is new and still quickly evolving, often with quite a small track record of reliability and effectiveness. Also, some operational and behavioral changes could initially enjoy wide spread support but have the risk to lose momentum after some time, thus generating less saving than anticipated. A subjective grade between 7 and 0 was given to each idea to cover this aspect. A grade of 7 was given to ideas with minimum risk and uncertainty. 0 was given to ideas with a high risk and uncertainty.

II. Summary Ranking of Energy Saving Ideas

	Energy Conservation Ideas	Type	Financial Benefit Index	Other Costs and Benefits Index	Uncertainty and Risks Index	Summary Index	Rank
1	Encourage the use of Compact Fluorescent Light (CFL) bulbs for all personal lights on Campus	Infrastructure Upgrade	7	5	6	**6.1**	***2***
2	Retrofit campus outdoor light poles with 42W fluorescent lights	Infrastructure Upgrade	7	5	7	**6.4**	***1***
3	Install passive solar water heater at ARC	Infrastructure Upgrade	1	6	6	**4.0**	***19***
4	Install Passive Solar water heaters for Residence halls	Infrastructure Upgrade	4	6	5	**4.9**	***16***
5	Install occupancy sensors for lighting in buildings common spaces	Infrastructure Upgrade	5	5	6	**5.3**	***7***
6	10 KW Photovoltaic panels on building roofs	Infrastructure Upgrade	0	7	6	**3.9**	***20***
7	Weather-proof old windows in residences and older buildings	Infrastructure Upgrade	5	4	5	**4.7**	***17***
8	Install large wind turbine off campus	Infrastructure Upgrade	0	7	5	**3.6**	***21***
9	Install small scale wind turbines on campus	Infrastructure Upgrade	0	6	5	**3.3**	***22***
10	Hook up gym equipment to generators to power parts of the ARC	Infrastructure Upgrade	0	6	3	**2.7**	***23***
11	Turn-off decorative fountains at night (10 pm?)	Operational Change	7	3	5	**5.2**	***11***
12	Reduce boiler reheat in summer months	Operational Change	7	3	5	**5.2**	***9***
13	Adjust buildings temperature set points to Governor's requirements (78 deg F in summer, 68 deg F in winter)	Operational Change	7	3	6	**5.5**	***4***
14	Use waste cooking oil from Cafeteria or Lexington Park eateries to heat campus buildings	Operational Change	0	7	2	**2.7**	***24***

	Energy Conservation Ideas	Type	Financial Benefit Index	Other Costs and Benefits Index	Uncertainty and Risks Index	Summary Index	Rank
15	Four-day work week June to August	Operational Change	7	5	2	**4.9**	***14***
16	Tighten buildings occupancy schedule	Operational Change	7	5	3	**5.2**	***8***
17	Establish policy restricting the use of individual space heaters in offices	Operational Change	7	3	2	**4.3**	***18***
18	Establish/enforce policy of 'no fridge, no microwave ovens allowed in students' rooms	Operational Change	7	4	3	**4.9**	***13***
19	Operate a tray-less cafeteria	Operational Change	7	5	4	**5.5**	***6***
20	Energy Load Shedding	Operational Change	7	4	3	**4.9**	***15***
21	Set up Resources Conservation awareness training program for Students	Behavioral Change	7	6	4	**5.8**	***3***
22	Set up Resources Conservation awareness training program for Faculty & Staff	Behavioral Change	7	6	3	**5.5**	***5***
23	Encourage students to use clotheslines and drying racks instead of dryers	Behavioral Change	7	4	3	**4.9**	***12***
24	Incite students to optimize usage of washing machines by establishing quotas for laundry loads	Behavioral Change	7	3	5	**5.2**	***10***

III. Description of Energy Saving Ideas

III-1 Infrastructure Upgrades

III-1-1 Encourage the use of Compact Fluorescent Light (CFL) bulbs for all personal lights on Campus

CFL bulbs are 4 to 5 times more energy efficient and last up to 10 times longer than traditional incandescent bulbs. The replacement of incandescent light bulbs with energy efficient CFL bulbs has been accomplished for most building lights over the last couple of years. Students and faculty's personal lights in the residences and offices haven't yet received the same level of attention. Though a light bulb exchange program was implemented last year, it seems it hasn't yet reached its full potential and could be improved with better communication. The proposed strategy would include the following:

- The College would provide CFL bulbs available for free at the Campus Center front desk when a student, faculty, or staff member brings in an incandescent light bulb for exchange
- For freshmen: all pre-arrival literature for freshmen (which includes a suggested list of materials to bring) would require personal lights to be CFL.
- For returning students: all pre-arrival literature would specify the new light bulb stipulation requiring CFLs for all personal lights
- For staff: a memorandum would be released requiring faculty and staff to buy any new light bulbs or replace burned out light bulbs with CFLs for all personal lights (desk lamps, etc.)

Several announcements should be made through mass emails and newspaper articles to educate the college community about the benefits of CFLs light bulbs and inform them about the free exchange program.

Cost: 100 x $2.00 each = $200.00 for Energy Star rated 60W equivalent CFL bulbs

Annual Energy Saving: 100 x (60W-14W) x 2h x 270 days /1000 = 2,484 KWh

Annual cost saving: 2,484 x $0.11 / KWh = $273

Timeline: The program should start immediately with the free exchange program combined with information and education. The pre-arrival literature should also be modified very soon to be available for the next fall move-in (summer 09).

Stakeholders: Students, Staff, Faculty.

Impacts/benefits: The inconvenience to students, faculty and staff is very limited. The exchange of light bulbs, though strongly encouraged, is only voluntary.
It is difficult to estimate precisely the number of light bulbs that will be exchanged annually through this program. We think we can count on at least 100 light bulbs to be upgraded annually.
The energy saved through this strategy also translates into environmental benefits thanks to reduced green house gas emissions.

Possible Financing Mechanisms: None is needed. The initial investment cost is small and can be absorbed in current operating budget.

Examples from elsewhere: This strategy is now commonly used in colleges and Universities. Tufts University and Middlebury College, to name only two, have implemented successful light bulb exchange programs.

III-1-2 Retrofit Campus outdoor light poles with fluorescent lamps.

The campus outdoor light poles are currently equipped with 150 Watt metal halide lamps and ballast. This strategy would replace the current lamps with 42 Watt fluorescent lamps. In addition to using less energy, fluorescent lamps also require less maintenance.
The retrofit will be implemented in-house by the Physical Plant maintenance staff.

Cost: Initial cost of purchasing the 355 lamps: 355 x $16 each = $5,680
Because the labor will be done by the College maintenance staff, the labor cost will not be taken into account.

Annual Energy saving: 355 x (150-42) x 8h x 365 / 1000 = 112,000 KWh

Annual cost saving: Maintenance: 355 x ($60-$6) = $19,170
Energy : 112,000 x $0.11 = $12,320
Total = $31,140

Simple payback time: Immediate

Timeline: This program should start immediately.

Stakeholders: Physical Plant maintenance staff

Impacts / Benefits: The change to fluorescent lights will have not impacts on the users. The energy saved through this strategy also translates into environmental benefits thanks to reduced green house gas emissions.

Possible Financing Mechanisms: None is needed. The initial investment cost is small and can be absorbed in current operating budget.

III-1-3 Install a Passive Solar Water Heating System at ARC

The technology of solar water heating systems has improved in the last few years and is becoming increasingly affordable. The ARC has been identified as a good candidate to host such a system because of the significant quantity of hot water that is consumed by the facility. Domestic hot water is currently provided at the ARC by boilers consuming #2 fuel oil.

Cost: Purchase and installation cost of the system is estimated at $75,000

Annual energy saving: 20 gal of oil/day x 270 days + 1,000 gal /summer
= 6,400 gallons of #2 fuel oil / year

Annual cost saving: 6,400 gal x $3 / gal = $19,200

Simple payback time: 3.9 years

Timeline: 2-3 years

Stakeholders: Users of ARC, maintenance crew at Physical Plant

Impacts/benefits: No impact is expected on users. Solar panels on the roof would provide great public relation benefits. They have the potential to become a symbol of SMCM's commitment to be an environmental leader. The energy saved through this strategy also translates into environmental benefits thanks to reduced green house gas emissions.

Possible Financing Mechanisms: This infrastructural upgrade could be financed with the cost savings generated by other energy saving strategies. The College could also apply for grants such as the Maryland DOE Solar Energy Grant Program.

Examples from elsewhere
Tufts University - Schmalz House (1999)

III-1-4 Install Passive Solar Water Heating Systems in Residence Halls

The technology of solar water heating systems has improved in the last few years and is becoming increasingly affordable. The Residence Halls have been identified as good candidates to host such systems because of the significant quantity of hot water that is consumed by these facilities. Domestic hot water in the residences is typically provided by steam boilers using #2 fuel oil.

Cost: Purchase and installation cost of the system is estimated at $25,000 per Residence Hall. Total for four buildings is $100,000.

Annual energy saving: 1,300 gal /year / building
Total for (4) buildings = 5,200 gallons of #2 fuel oil / year

Annual cost saving: 1,300 gal x $3 / gal = $3,900 / building / year
Total for (4) buildings = $15,600 / year

Simple payback time: 6.4 years

Timeline: 1-2 years for first residence hall. Then one residence every year following, until completed for all residence halls.

Stakeholders: Students, maintenance crew at Physical Plant. Admissions and Public & Media office for public relations benefits

Impacts/benefits: No impact is expected on users. Solar panels on the roof would provide great public relations benefits. They have the potential to become a symbol of SMCM's commitment to be an environmental leader. The energy saved through this strategy also translates into environmental benefits thanks to reduced green house gas emissions.

Possible Financing Mechanisms: This infrastructural upgrade could be financed with the cost savings generated by other energy saving strategies. The College could also apply for grants such as the Maryland DOE Solar Energy Grant Program. Also, the installation of a solar water heating system for one residence hall is the kind of project that students have shown interest in and have the ability to finance through the students' green energy fund after this year's REC contract is fulfilled.

Examples from elsewhere
Tufts University - Schmalz House (1999)

III-1-5 Install occupancy sensors for lighting in buildings' common spaces

In most common spaces on campus, lights stay on 24 hours a day 7 days a week, even if the space is unoccupied. This results in energy waste. This energy saving strategy proposes to install sensors in the common spaces that would detect occupancy and turn the lights on only when the space is in use. Placing motion sensors in such locations as restrooms, studies and recreation areas, halls, offices and classrooms has the potential to reduce lighting use by 50% in these areas.

Cost: Total of 176 mention sensors at $100.00 each = $17,600

Annual energy saving: 78,000 KWh

Annual cost saving: 78,000 x $0.11 = $8,580

Simple payback time: 2.1 years

Timeline: Summer 2009

Stakeholders: All students, faculty and staff

Impacts/benefits: The most often heard comment about the implementation of such a strategy is that common spaces would feel less safe because these spaces would be dark most of the time. It is important to address this perception of a reduced level of safety by good communication and education about how occupancy sensors work and control the lights. This concern will certainly alleviate itself through time and the experience of users with the system. Occupancy sensors have been in place in the restrooms and classrooms of several buildings including the Library, Campus Center, Schaefer Hall and Goodpaster Hall and seem to have been accepted by the buildings' users.
The energy saved through this strategy also translates into environmental benefits thanks to reduced green house gas emissions.

Possible Financing Mechanisms: The initial investment is not very high. However if necessary this infrastructural upgrade could be phased in over some time and be financed with the cost savings generated by other energy saving strategies.

Examples from elsewhere: This is now a common practice in all new academic buildings at St. Mary's and across the country.

III-1-6 Photovoltaic panels on building roofs

Solar photovoltaic technology is very exciting and has been reliable for some time. This strategy consists of installing photovoltaic panels on the campus buildings' roofs. It appears that the campus electrical needs could hardly be supported by photovoltaic panels only. To do so, the panels would need to cover a very large area. The research for this idea studies the option of installing panels providing 20 KW. The panels could be agglomerated on one roof and serve as a demonstration project.

Cost: $150,000 for a 20 KW system.

Annual energy saving: approximately 60,000 KWh

Annual cost saving: 60,000 x $0.11 = $6,600

Expected single payback time: 23 years

Timeline: 2-3 years

Stakeholders: Physical Plant maintenance staff, Admissions and Public & Media office to take advantage of the public relation benefits.

Impacts/benefits: No impact is expected on users. Solar panels on the roof would provide great public relations benefits. They have the potential to become a symbol of SMCM's commitment to be an environmental leader. The energy saved through this strategy also translates into environmental benefits thanks to reduced green house gas emissions.

Possible Financing Mechanisms: The initial investment is quite large and the payback time quite long. Financing mechanisms include:

- Grants from the Maryland Department of Energy –Solar Grant Program ($10,000).
- Private donations
- Students' Green Energy Fund
- Zero interest loan with State Agency Loan Program (SALP)
- Using the cost savings generated by other energy saving strategies, in the form of a revolving loan fund.
- Establishing a partnership (or lease) with an energy provider which would pay the initial investment and sell the energy provided by the PV panels to the College at a fixed rate.

Examples from elsewhere: Arizona State University (2 MW, June 08)
Whitman College (23 KW, Oct 08)

III-1-7 Weather-proof old windows in residences and older buildings

Several old buildings on campus have old single-pane wooden frame windows that provide very poor thermal insulation. A number of these old windows have broken panes, poor sealing and no storm screens. Poorly insulated spaces need more energy to be heated or cooled. Rather than replacing these windows, this strategy proposes that old windows leaking air be identified, repaired (caulked, sealed), equipped with storm windows. We estimate that at least 150 windows on campus need to be repaired.

Cost: 150 sealed windows x $50
100 storm windows x $150
Total = $22,500

Annual energy saving: 15 gallon No 2 fuel oil / window / year x 150 = 2,250 gal oil

Annual cost saving: 2,250 x $3 / gal = $6,750

Expected single payback time: 3.3 years

Timeline: 1 – 2 years

Stakeholders: Students, Office of Planning & Facilities

Impacts/benefits: No impact on students if work is done during school break. The energy saved through this strategy also translates into environmental benefits thanks to reduced green house gas emissions.

Possible Financing Mechanisms: Use the cost savings generated by other energy saving strategies, in the form of a revolving loan fund

Examples from elsewhere:

III-1-8 Install large wind turbine off campus

Wind is a promising renewable energy. A large wind turbine located on a high spot exposed to the winds could contribute a significant portion of the College energy needs. This strategy proposes the construction of a 230 feet high, 1.65 MW turbine. Energy provided by turbine and that is not used by the College could be sold back to the grid. However, at this point we do not know if there is any location within reasonable distance of the College that would be exposed to sufficient and consistent wind to activate the wind turbine and generate the estimated amount of energy. The feasibility of this idea needs to be validated by an expert.

Cost: $3 million construction + $10,000 / year land lease

Annual energy saving: 2 million KWh / year

Annual cost saving: 2,000,000 KWh x $0.11/KWh - $10,000 = $210,000

Expected single payback time: 14.3 years

Timeline: more than 2 years

Stakeholders: All students, faculty, staff, Admissions and Public &Media Relations office to take advantage of the public relation benefits. SMECO.

Impacts/benefits: A large wind turbine would provide great public relation benefits but may also attract negative attention from the community for being an "eyesore." It has the potential to become an icon of SMCM's commitment to be an environmental leader. The energy saved through this strategy also translates into environmental benefits thanks to reduced green house gas emissions.

Possible Financing Mechanisms: The initial investment is quite large and the payback time quite long. Financing mechanisms include:

- Private donation
- Establishing a partnership (or lease) with an energy provider which would pay the initial investment and sell the energy provided by the turbine to the College at a fixed rate.

Examples from elsewhere: University of Minnesota Morris (1.65 MW turbine)
Carleton College, Northfield, MN (1.65 MW turbine)

III-1-9 Install small scale wind turbines on campus

Small scale wind turbine on campus would produce a small amount of energy. It would be used as a demonstration project rather than with the purpose of producing a significant portion of the College energy needs. This strategy proposes to install a 10 KW wind turbine. However, at this point we do not know if there is any location on campus or its close vicinity that would be exposed to sufficient and consistent wind to activate the wind turbine and generate the estimated amount of energy. The feasibility of this idea needs to be validated by an expert.

Cost: $10,000

Annual energy saving: 3,000 KWh / year

Annual cost saving: 3,000 KWh x $0.11/KWh = $330

Expected single payback time: 30 years

Timeline: more than 2 years

Stakeholders: All students, faculty, staff, Admissions and Public & Media Relations office to take advantage of the public relation benefits.

Impacts/benefits: No impact is expected on users. A small scale wind turbine would provide great public relation benefits. If installed at a prominent location on campus, it could provide a great educational opportunity and a visual reminder of SMCM's commitment to be an environmental leader. The installation of such a showpiece and its subsequent media attention may increase the likelihood of receiving grants or private donations for further renewable energy projects. The energy saved through this strategy also translates into environmental benefits thanks to reduced green house gas emissions.

Possible Financing Mechanisms: The payback time quite long, so from an economic perspective it is not a very attractive project. Financing mechanisms include:

- Private donation
- SGA Green Energy Fund
- US Department of Energy grants

Examples from elsewhere: University of Vermont (10 KW)

III-2 Operational Changes

III-2-1Tturning off decorating fountains at night

The existing decorative fountains at the Garden of Remembrance, the Library and Goodpaster Hall currently function 24 hours a day. At night, they use energy while providing little to no benefit. We are proposing that the fountains be turned off ten hours every night between the hours of 9 pm and 7 am.

Cost: Purchasing and installation of timers: $60.

Annual energy saving: 5,730 KWh / year

Annual cost saving: 5,730 x $0.11 / KWh = $630

Timeline: Immediately

Stakeholders: Maintenance crew at Physical Plant, Students.

Impacts/benefits: Very limited impact. Shutting down the fountains at night would be a loss of an aesthetic feature, enjoyed by some students at night. However, the fountains are enjoyed by many parties much more significantly during the day. The energy saved through this strategy translates into environmental benefits thanks to reduced green house gas emissions.

Possible Financing Mechanisms: None needed, since the initial cost is small.

Examples from elsewhere: Peninsula School District, WA

III-2-2 Reduce boilers reheat in summer months

The HVAC system in most large buildings on campus functions in such a way that in the summer the air temperature has to be cooled down typically to the mid-50s F to remove the excess humidity from the air before the air is reheated to a more comfortable temperature (mid to upper 70s F). The process of reheating the air consumes a lot of energy. This use of energy can be minimized through a better management of the reheat system based on the conditions such as the usage of the building and the outside temperature. This can be achieved through programming adjustments in the Energy Control Management System (ECMS). The proposed adjustments are:

1. Turn off the heating boilers for all buildings and run reduced capacity reheat using one boiler for Goodpaster, Schaefer, Montgomery, and Glendening Halls from June through August.
2. Turn off the heating boilers for reheat in Campus Center, ARC, and Kent Hall from June through August.

Cost: None

Annual energy saving: 1- 5,800 gallons oil
2- 19,000 gallons oil Total: 24,800 gallons of #2 fuel oil

Annual cost saving: 24,800 gal x $3 / gal = $74,400

Timeline: by next summer

Stakeholders: All Students, Faculty, Staff, especially Physical Plant energy managers.

Impacts/benefits: Turning off the boiler reheat may impact the comfort of the occupants as the buildings may at times be cooler than normal,though temperature adjustments can be made via the Building Automation System (BAS). It is likely that the lowering of the temperature will, at first, generate complaints from a few people. However, the complaints are likely to decrease once the reasons of the lowered temperature are understood and occupants learn to dress appropriately.
The energy saved through this strategy also translates into environmental benefits thanks to reduced green house gas emissions.

Possible Financing Mechanisms: None needed.

Examples from elsewhere
University of Dayton

III-2-3 Adjust buildings temperature set points to Governor's requirements (78 deg F in summer, 68 deg F in winter)

Until now the building temperature set points have been 74 deg F in summer and 69 deg F in winter. Following the Governor of Maryland's required temperature set points has the potential for substantial savings in both electric and fuel oil. Resetting the summer cooling temperature to 78 degrees in all non critical areas reduces electrical consumption on chillers and HVAC systems. Lowering winter heating temperature to 68 degrees reduces the fuel consumption by the boilers.

Cost: None

Annual energy saving: summer set point adjustment: 643,000 KWh
Winter set point adjustment: 7,000 gallons fuel oil

Annual cost saving: 643,000 x $0.11/KWh + 7,000 x $3.00/gal = $91,730

Timeline: immediately

Stakeholders: All Students, Faculty, Staff, especially Physical Plant energy managers.

Impacts/benefits: Adjusting the temperature set point may slightly impact the comfort of the occupants as the buildings may be cooler or warmer that normal. It is likely that the temperature adjustment will, at first, generate complaints from a few people. However the complaints are likely to decrease once the reasons of the temperature change are understood and occupants learn to dress appropriately.
The energy saved through this strategy also translates into environmental benefits thanks to reduced green house gas emissions.

Possible Financing Mechanisms: None needed.

Examples from elsewhere: Middlebury College**,** Tufts University

III-2-4 four-day work week in the summer

Each year from June to August, the academic activity on campus is reduced and facilities are often not used to their full capacity. This strategy proposes to compress the activity on campus to four days a week during the summer months. This would allow putting most buildings HVAC system into "unoccupied mode" during three days of the week for three months a year. The HVAC "unoccupied mode" uses less energy than the typical active mode.
Option 1: During the summer months, staff would need to work 10 hours a day four days a week to be able to achieve a 40-hour work week. Monday (or Friday) would be off. The energy and cost savings calculated below are based on this option.
Option 2: Alternate Monday (or Friday) off. Staff would need to work 9 hours a day the rest of the time to achieve a 40-hour work week. Annual energy and cost savings based on this option would be half of the numbers presented below.

Cost: None

Annual energy saving: 386,300 KWh + 6,300 gallons fuel oil

Annual cost saving: 386,300 KWh x $0.11 / KWh + 6,300 gal x $3 / gal = $61,393

Simple payback time: Immediate

Timeline: by next summer

Stakeholders: Summer session Students, Faculty, Staff, especially Physical Plant energy managers.

Impacts/benefits: Impacts include a schedule change for a wide variety of campus events and classes. Services provided by the College could also be perceived as being reduced because they would only be available 4 days a week. The new work hours would have to be discussed in each department and office. The impacts of the new schedule will need to be assessed and mitigated on a case by case basis. We can imagine that some labs, Public Safety and the mail room, for example, would not change their current work schedule.
Benefits include better employee morale. The modified work schedule is more family friendly and will appeal to most employees. It also reduces the amount of commuting (time and cost) for employees. Four-day work week experiments at other institutions have reported lower sick leave and a decrease in staff turn over.
The energy saved through this strategy also translates into environmental benefits thanks to reduced green house gas emissions.

Possible Financing Mechanisms: None needed.

Examples from elsewhere: Southeastern Louisiana University, Miles College
Florida International University, Western Carolina University

III-2-5 Tighten building occupancy schedule

Most buildings on campus are currently operated 24 hours a day, seven days a week. It means that in each building the lights are on and the HVAC system is functioning at all time as if the building was fully occupied. In fact, with a few exceptions, the campus buildings are used during the daytime, roughly from 8 am to 6pm. The lights and HVAC system waste a significant amount of energy when they operate beyond these hours for mostly empty buildings.
This energy saving strategy proposes to limit the operating hours of some building spaces (staff areas, offices, ARC Arena, Cole Cinema, Great Room, DPC, classroom in Montgomery, Kent and Schaeffer) from 7 am to 6pm Monday through Friday. Outside of these operating hours, the buildings HVAC system would be turned into energy saving "un-occupied" mode.

Cost: None

Annual energy saving: 80,000 KWh + 4,000 gallons fuel oil

Annual cost saving: 80,000 x $0.11 + 4,000 x $3.00 = $20,800

Simple payback time: Immediate

Timeline: Fall 2009

Stakeholders: All Students, Faculty, Staff, especially Physical Plant energy managers

Impacts/benefits: The purpose of this energy saving strategy is not to restrict the activities in buildings to fixed hours, but rather to avoid energy waste. A careful assessment of the building usage and dialog with the users would need to be done before implementation in order to avoid impacting activities within the buildings. Indeed, buildings could still be used at all time, provided that a protocol is established to schedule building usage during off-hours.
The energy saved through this strategy translates into environmental benefits thanks to reduced green house gas emissions.

Possible Financing Mechanisms: None needed.

Examples from elsewhere:

III-2-6 Establish policy restricting the use of individual space heaters in offices

Space heaters consume a large amount of energy and often overload the campus power system. In addition the use of individual space heaters creates a safety concern.
This strategy proposes to discourage the excessive or unnecessary use of individual space heaters in offices by establishing a policy that limits its use. The College Physical Plant office is doing its best to provide adequate temperature in all offices. However because of the age of the infrastructure, some spaces may not be able to be heated to an acceptable temperature. In these conditions the College may accept the temporary use of an individual space heater, provided the adequate procedures are followed.
We anticipate this strategy can reduce the usage of individual space heaters by 25%.

Cost: None

Annual energy saving: 0.25 x 100 units x 1,500W x 8h x 20 days x 3 months
= 18,000 KWh

Annual cost saving: 18,000 x $0.11 = $1,980

Timeline: Winter 2009

Stakeholders: Faculty and Staff, Physical Plant energy managers.

Impacts/benefits: Faculty and staff currently using space heaters may perceive that this policy impacts not only their comfort but also their freedom. It is important to recognize that individuals have different levels of comfort associated with temperature. Each situation of space heater usage should be evaluated and allowed on a case by case basis. On a campus that is not fond of policies, this strategy will be successful and accepted only if clear and fair guidelines about the allowed usage of the space heaters are established and explained to the College community.
The energy saved through this strategy also translates into environmental benefits thanks to reduced green house gas emissions.

Possible Financing Mechanisms: None needed.

Examples from elsewhere: Auburn University**,** UT Southwestern

III-2-7 Establish policy restricting the use of fridge and microwave ovens in students rooms

Refrigerators and microwave ovens consume a large amount of energy and have become ubiquitous in student rooms. In addition to a large energy use they are the cause of numerous circuit overloads. This strategy proposes to establish a policy that forbids the use of personal fridges and microwave ovens in students' rooms. We estimate that there are currently individual fridges and ovens in excess of 200 in the students' rooms.

Cost: None

Annual energy saving: Fridge: 60 W x 8 h a day x 270 days = 130 KWh / year
Microwave ovens: 1,000W x 1 h a day x 270 days = 270 KWh/year
200 Fridges + 200 microwave ovens: 130 x 200 + 270 x 200 = 80,000 KWh / year

Annual cost saving: 80,000 x $0.11 = $8,800

Timeline: Fall 2009

Stakeholders: Students, Residence Life staff, Physical Plant energy managers

Impacts/benefits: Students who take their lunch in their rooms would be impacted by this policy that would drastically restrict their ability to store and reheat food in the residences. The impact however could be mitigated by making a few extra Energy STAR-rated fridges and microwaves available in common spaces to be shared among students.
The establishment of this new rule is a good opportunity to inform and educate students about the benefits of conserving resources.
The energy saved through this strategy also translates into environmental benefits thanks to reduced green house gas emissions.

Possible Financing Mechanisms: None needed.

Examples from elsewhere:
Muhlenberg College has a policy that does not allow students to bring their own appliances, but that proposes an Energy Star-rated fridge / microwave oven combo for lease.

III-2-8 Operate a tray less cafeteria

Tray removal in dining halls has been shown to reduce the amount of food waste as well as the overall quantities of energy and water used in the kitchen.

Cost: None

Annual resource conservation: 200,000 KWh saved
250,000 gallons of water saved

Annual cost saving: 200,000 KWh x $0.11/KWh + 250,000 gal x $0.00334 / gal = $22,835

Timeline: Immediately

Stakeholders: All students, faculty and staff eating at the cafeteria, dining services vendor.

Impacts/benefits: Everyone who eats at the cafeteria, including visitors would be impacted and could complain at first of the inconvenience of the tray removal. However, a campaign of information and education of the cafeteria users on the benefits of tray removal should help ease the transition. Other benefits of removing trays include a reduction in food waste, the reinforcement of a healthy lifestyle and a very good public relation potential for the College.

Possible Financing Mechanisms: None needed.

Examples from elsewhere:
Georgia Tech
University of NC - Chapel Hill
New York University
University of Minnesota
University of Maine-Farmington

III-2-9 Energy Load Shedding

Load shedding is very difficult to evaluate because there are many variables to consider which require actual measurement of systems, equipment and outside air temperature. Load shedding can be accomplished mainly through the air handler systems raising the discharge air temperature in the chill water coil. This would also lessen the requirement for the use of pre-heat in the VAV system.

Cost: Depending on what method of load shedding is uses there may not be any additional costs other than programming of BAS system. The majority of the BAS programming could be done in house. If additional programming is required we anticipate vendor support to cost about $15,000 for Goodpaster Hall.

Annual Energy Conservation: Estimate energy savings Campus wide as previously described is very difficult. However based on typical general savings through out the industry of HVAC systems, between May of October estimated potential energy savings are:

- 275,000 KWh
- 6,000 gallons of #2 fuel oil

Annual cost saving: 275,000 x $0.11 + 6,000 x $3.00 = $48,250

Estimated payback time: 0.3 year

Timeline: Fall 2009

Stakeholders: The following buildings are capable of load shedding and the stakeholders are the users in the buildings:

- Kent Hall, Library, Campus Center, Schaefer Hall, Montgomery Hall, Glendening Hall, ARC, Prince George Hall, Caroline Hall, DPC, St. Mary's Hall.

Impacts/benefits: Impacts can include the shutdown of the buildings energy system for several minutes to an hour at the time of peak energy demand, incapacitating operations for the same amount of time. To avoid disruption, load shedding should be done selectively and properly managed. The energy saved through this strategy also translates into environmental benefits thanks to reduced green house gas emissions

Examples from elsewhere: Load shedding is being done basically at all major corporations and a many colleges through out the country.

III-3 Behavioral changes

III-3-1 Resource conservation awareness training program for students

It appears that a notable part of energy waste on campus is due to careless behavior and bad habits. Things as simple as turning off lights when you live a room, taking shorter showers, turning off equipments like computers or printers when they are not in use are not routinely done by a significant number of students. Changing habits is not simple. It requires investing in a well defined awareness and education program about the consequences of energy-wasteful habits, designed to reach a large number of students. The psychology department has expressed interest in leading a student project on this topic that would include the development of a program and assessment of its impact over time. Such a program could be combined with a system of incentives to lower energy usage in residences. In addition concrete energy reduction targets for residences could be set as a challenge to students.

Cost: If the program is developed and run by the College, the cost would be very limited. $400/year

Annual Resource Saving: Based on target of 10% of students taking shorter showers and implementing energy saving practices when using their computers: 1,400 gal fuel oil, 400,000 gallons of water.

Annual cost saving: $6,600

Expected simple payback: immediate

Timeline: The program should start being developed immediately and be ready for implementation in the fall of 2009.

Stakeholders: Students, staff of Residence Life, faculty of Psychology department.

Impacts/benefits: No detrimental impact anticipated. It is expected that the students' change of attitude and behavior with regard to energy consumption in the residences will call for a change of attitude all over campus: classrooms, dining hall, sports and recreation facilities. The energy saved through this strategy also translates into environmental benefits thanks to reduced green house gas emissions.

Possible Financing Mechanisms: None is needed.

Examples from elsewhere: Middlebury College, Amherst College

III-3-2 Resource conservation awareness training program for faculty and staff

Wasteful energy consumption behaviors have sometimes been observed among faculty and staff. They could be the result of misinformation or bad habits. Changing engrained habits is certainly difficult but could be accomplished through a carefully designed program geared toward better energy usage behaviors. An education and training session on the importance of efficient energy usage should be integrated in the orientation program for newly hired staff and faculty.

Cost: If the program is developed and run by the College, the cost would be very limited. $100/year

Annual Resource Saving: Based on target of a 10% increase each year of faculty and staff adopting energy saving behaviors regarding the usage of computers, printers, and lights: 2,400 KWh

Annual cost saving: $264

Expected simple payback: immediate

Timeline: The program should start being developed immediately and be ready for implementation in the fall of 2009.

Stakeholders: Faculty and staff.

Impacts/benefits: No detrimental impact anticipated. It is expected that the faculty and staff change of attitude and behavior with regard to energy consumption will foster energy saving behaviors among students as well.
The energy saved through this strategy also translates into environmental benefits thanks to reduced green house gas emissions.

Possible Financing Mechanisms: None is needed.

Examples from elsewhere: Middlebury College, Amherst College

III-3-3 Encourage students to use clotheslines and drying racks instead of dryers

Electric dryers use a large amount of energy, while on dry days the sun can provide the same service for free. This strategy proposes to install clothesline outside residences and to provide individual drying racks for purchase by students. Also students should be informed about the cost and environmental impacts of using dryers. The goal is to reduce the use of electric dryers by 15%.

Cost: 10 clothesline at $100 each = $1,000

Annual Resource Saving: 15% x 48 electric dryers (3,400 W) used 6 hours a day x 270 days = 39,658 KWh

Annual cost saving: 39,658 KWh x $0.11/KWh = $4,362

Expected simple payback: immediate

Timeline: The program should start being developed immediately and be ready for implementation in the fall of 2009.

Stakeholders: Students, Residence Life staff.

Impacts/benefits: The main impact is visual. Some may say that clotheslines on campus would be unsightly. However, it seems possible to find locations behind the buildings were they would be hidden from view.
The energy saved through this strategy also translates into environmental benefits thanks to reduced green house gas emissions.

Possible Financing Mechanisms: None is needed.

Examples from elsewhere: Middlebury College, Berea College

III-3-4 Incite students to optimize usage of washing machines by establishing quotas for laundry loads

Washing machines consume a significant amount of energy. Students currently benefit from a free unlimited laundry program which is not conducive to energy saving behaviors. Indeed it appears that most students don't wash full loads, which amounts to wasting energy. This strategy proposes to reduce the number of energy-wasteful laundry cycles done on campus by eliminating the unlimited free laundry program and establishing a quota. We propose that each student be given a fair amount of free laundry loads (2 per week for example). Students would have to pay for additional laundry loads. We estimate this strategy should be able to reduce the number of laundry loads done on campus by 20%.

Cost: programming of machines and student cards: $2,000

Annual Resource Saving: 0.2 x 1,400 students x 2 loads x 30 weeks x 500 W x 1 h = 8,400 KWh
0.2 x 10 gal water x 1,400 x 2 x 30 = 168,000 gallons of water

Annual cost saving: 8,400 KWh x $0.11/KWh + 168,000 x 0.00334= $1,485

Expected simple payback: 1.4 years

Timeline: Fall 2009

Stakeholders: Students, Residence Life staff, laundry services vendor, office of Technical Support.

Impacts/benefits: Students will have to pay if they don't want to adjust their laundry habits. Some students may grumble at first. To be successful, this operation needs to be coupled with an effective information and education campaign regarding the importance of energy conservation behaviors.

Possible Financing Mechanisms: None is needed. The initial investment is limited.

Examples from elsewhere: Currently evaluated by Dickinson College.

IV.Institutional opportunities

Based on our discussion with members of the College community we feel that a number of steps could be taken to ensure, in the long term, a better management of the College energy consumption.

IV-1 Metering and monitoring

Most buildings on campus don't have a separate electrical meter. We believe that equipping each building with its own meter, developing a well kept database of the electrical consumption and monitoring the consumption trends are prerequisites to a good electrical energy management. Meters could either be owned and operated by SMECO or purchased, installed and operated by the College. We estimate that approximately 40 electric meters would be needed (at $900 each = $36,000, if purchased by the College).

On the same line, No. 2 fuel oil consumption should be measured at each building on a regular (monthly) basis. This will provide a better assessment of the actual fuel consumption than relying on the delivery slips of the oil provider. A centralized database of the buildings' fuel oil consumption should be developed and consumption trends monitored.

IV-2 Campus Energy Manager

Optimizing the use of energy on campus is a daunting task. There are currently more than forty buildings on campus. Each building is unique by its usage, equipments, location. Opportunities abound to improve the campus' overall usage of energy. However researching and taking advantage of these opportunities requires specific skills, experience and a consistent, focused effort.

We propose that a new position of Campus Energy Manager be created at the Physical Plant. The campus energy manager would be responsible for developing a campus-wide energy management plan and initiating actions and programs with a goal of reducing energy consumption to the maximum extent feasible. Whether this new position would be on the College's payroll or contracted, it seems likely to generate sufficient savings to pay for itself.

V. Proposed Energy Saving Portfolios

As explained in section I, we have developed a methodology to rank energy saving ideas through a combination of their financial and other benefits or impacts to the College and their level of risk and uncertainty. We have used this ranking system to develop three sample energy saving portfolios.

V-1 Energy Saving Portfolio A - for Immediate Implementation

Energy Saving Portfolio A gathers the energy saving ideas which in our judgment can be implemented by winter 2009. Most of the energy saving strategies in Portfolio A require no initial investment, and do not require a lot of preparation time. They are also likely to be supported by the vast majority of the College community.

As summarized in the table below, for an initial investment of $5,884, this portfolio is expected to generate approximately $148,520 of savings annually, or $74,260 for the last 6 months of fiscal year 2009.

If implemented in January 2009 this portfolio is expected to reduce our electrical consumption by 2.8% and our consumption of #2 fuel oil by 1.1% in fiscal year 2009.

Portfolio A - For Immediate Implementation

Energy Conservation Ideas	Type	Report Heading	Rank	Initial cost	annual saving of KWh	annual saving of gallons of #2 oil	Annual saving of gallons of water	annual cost saving	Simple payback time
Retrofit campus outdoor light poles with 42W fluorescent lights	Infrastructure Upgrade	*III-1-2*	1	$ 5,680	112,180			$ 31,510	0.2
Encourage the use of Compact Fluorescent Light (CFL) bulbs for all personal lights on Campus	Infrastructure Upgrade	*III-1-1*	2	$ 204	2,484			$ 273	0.7
Set up Resources Conservation awareness training program for Students	Behavioral Change	*III-3-1*	3	$ -	4,838	703	206,250	$ 2,640	0.0
Adjust buildings temperature set points to Governor's requirements (78 deg F in summer, 68 deg F in winter)	Operational Change	*III-2-3*	4	$ -	643,000	7,000		$ 91,730	0.0
Set up Resources Conservation awareness training program for Faculty & Staff	Behavioral Change	*III-3-2*	5	$ -	1,737			$ 191	0.0
Operate a tray-less cafeteria	Operational Change	*III-2-8*	6	$ -	200,000		250,000	$ 22,000	0.0
Turn-off decorative fountains at night (10 pm?)	Operational Change	*III-2-1*	11	$ -	1,600			$ 176	0.0
TOTAL				**$ 5,884**	**965,839**	**7,703**	**456,250**	**$ 148,520**	**0**

6- month Scenario:	**By end of June 2009**	**$ 5,884**	**482,919**	**3,851**	**228,125**	**$ 74,260**
	Net cost saving					**$ 68,376**

	KWh	gal. Fuel oil
Baseline FY 2008	17,371,000	362,079
% annual energy reduction from Baseline	**2.8%**	**1.1%**

V-2 Energy Saving Portfolio B

Energy Saving Portfolio B gathers all the energy saving ideas, with the exception of very costly strategies that necessitate heavy financing or loans. Most of the ideas in Portfolio B will need to be vetted by the College Community. Some of them also need preparation time before implementation, in the form of study/design by experts, bid, contract award, and construction/installation.

According to the table below, Portfolio B's initial cost will be $393,100. However, Portfolio B is expected to generate savings up to $276,911 each year (a 1.4 year payback). The annual savings in electrical and fuel oil consumption are anticipated to reach 5.8 % and 15.2% respectively. By the end of a 5-year implementation plan (end of FY 2014) the savings generated by Portfolio B alone could amount to approximately $1.5 million.

A portion of the initial cost can be paid by the savings generated by Portfolio A in the last 6 months of fiscal year 2009. Students also expressed interest to use a portion of their Green Fund to finance renewable energy production projects. We also suggest that the College explore with NORESCO the possibility to amend the current Energy Performance Contract to help finance some of the more costly energy saving ideas presented in this volume.

Portfolio B - FY2010-FY2014

Energy Conservation Ideas	Type	Report Heading	Rank	Initial cost	annual saving of KWh	annual saving of gallons of #2 oil	Annual saving of gallons of water	annual cost saving	Simple payback time
Install occupancy sensors for lighting in buildings common spaces	Infrastructure Upgrade	*III-1-5*	7	$ 17,600	78,000			$ 8,580	2.1
Tighten buildings occupancy schedule	Operational Change	*III-2-5*	8		80,000	4,000		$ 20,800	0.0
Reduce boiler reheat in summer months	Operational Change	*III-2-2*	9			24,800		$ 74,400	0.0
Incite students to optimize usage of washing machines by establishing quotas for laundry loads	Behavioral Change	*III-3-4*	10	$ 2,000	8,400		168,000	$ 1,485	1.3
Encourage students to use clotheslines and drying racks instead of dryers	Behavioral Change	*III-3-3*	12	$ 1,000	39,658			$ 4,362	0.2
Establish/enforce policy of 'no fridge, no microwave ovens allowed in students' rooms	Operational Change	*III-2-7*	13		66,000			$ 7,260	0.0

Portfolio B - FY2010-FY2014 (Continued)									
Energy Conservation Ideas	**Type**	**Report Heading**	**Rank**	**Initial cost**	**annual saving of KWh**	**annual saving of gallons of #2 oil**	**Annual saving of gallons of water**	**annual cost saving**	**Simple payback time**
Four-day work week June to August	Operational Change	*III-2-4*	14		386,300	6,300		$ 61,393	0.0
Energy Load Shedding	Operational Change	*III-2-9*	15	$ 15,000	275,000	6,000		$ 48,250	0.3
Install Passive Solar water heaters for Residence halls	Infrastructure Upgrade	*III-1-4*	16	$ 100,000		5,200		$ 15,600	6.4
Weather-proof old windows in residences and older buildings	Infrastructure Upgrade	*III-1-7*	17	$ 22,500		2,250		$ 6,750	3.3
Establish policy restricting the use of individual space heaters in offices	Operational Change	*III-2-6*	18		18,000			$ 1,980	0.0
Install passive solar water heater at ARC	Infrastructure Upgrade	*III-1-3*	19	$ 75,000		6,400		$ 19,200	3.9
Photovoltaic panels on building roofs	Infrastructure Upgrade	*III-1-6*	20	$ 150,000	60,000			$ 6,600	22.7
Install small scale wind turbines on campus	Infrastructure Upgrade	*III-1-9*	22	$ 10,000	3,000			$ 330	30.3
TOTAL				**$ 393,100**	**1,014,358**	**54,953**	**168,000**	**$ 276,991**	**1.4**
5-year Scenario:	**By end of FY 2014**			**$ 398,984**	**5,554,709**	**278,616**	**1,068,125**	**$ 1,459,212**	
	Net cost saving							**$ 1,060,228**	
Baseline FY 2008					17,371,000	362,079			
% annual energy reduction from Baseline					**5.8%**	**15.2%**			

V-3 Energy Saving Portfolio C – Long Term

Energy Saving Portfolio C requires significant initial investment (approximately $3 million). At this point we do not know for certain if the construction of a large wind turbine is feasible in the vicinity of the College. Refer to section III-1-8 for discussion on this issue.

According to the table below, Portfolio C is expected to generate savings up to $210,000 each year (a 14.3 year payback). The annual savings in electrical consumption is anticipated to reach 11.5%.

Portfolio C - Long term (FY 2015 and Beyond)									
Energy Conservation Ideas	**Type**	**Report Heading**	**Rank**	**Initial cost**	**annual saving of KWh**	**annual saving of gallons of #2 oil**	**Annual saving of gallons of water**	**annual cost saving**	**Simple payback time**
Install large wind turbine off campus	Infrastructure Upgrade	*III-1-8*	21	$3,000,000	2,000,000			$ 210,000	14.3
TOTAL				**$3,000,000**	**2,000,000**	**0**	**0**	**$ 210,000**	**14.3**
Baseline FY 2008					17,371,000	362,079			
% annual energy reduction from Baseline					**11.5%**	**0.0%**			

V-4 Potential reductions in Green House Gas (GHG) emissions

The table below presents an estimate of our current annual GHG emissions.

	Electricity		#2 fuel oil		Propane		TOTAL	
GHG emissions from Energy sources	**Annual consumption**	**Annual GHG emissions**	**Annual consumption of #2 oil**	**Annual GHG emissions**	**Annual consumption of Propane**	**Annual GHG emissions**	**Annual GHG emissions from energy**	**Annual College GHG emissions**
	KWh	tons eCO2	gallons	tons eCO2	gallons	tons eCO2	tons eCO2	tons eCO3
Baseline FY 2008	17,371,000	9,432	362,079	3,621	29,673	160	13,213	16,517

The table below shows how the proposed energy saving portfolios would contribute to the reduction of the College's total annual Green House Gas emissions.

	Electricity		#2 fuel oil		TOTAL	
Portfolios	**annual saving of KWh**	**Annual GHG reduction**	**annual saving of gallons of #2 oil**	**Annual GHG reduction**	**Total Annual GHG reduction**	**% reduction from baseline**
	KWh	tons eCO2	gallons	tons eCO2	tons eCO2	
Portfolio A	965,839	524	7,703	77	601	3.6%
Portfolio B	1,106,358	601	56,550	566	1,166	7.1%
Portfolio C	2,000,000	1,086	0	0	1,086	6.6%
Total	4,072,197	2,211	64,253	643	2,854	17.3%

Conclusion:

As mentioned earlier, the intent of this energy conservation initiative was not to study in detail all possible energy saving strategies. It is rather to show that although significant efforts have already been made at St Mary's College to use energy more effectively, there are still numerous opportunities for progress. Also, our quick research shows that new technologies (such as wind power and solar energy) to produce renewable energy and reduce our dependence on the electric grid and fossil fuels are increasingly attractive and do not seem too far out of reach.

We hope this document will be a useful additional step in the College's efforts to control its energy consumption and reduce its environmental impact.