



Dickinson College

# Climate Change Action Plan

*Climate Neutral by 2020*



Climate Change Action Plan Working Group  
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Dickinson College  
Carlisle, PA

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## I. Executive Summary

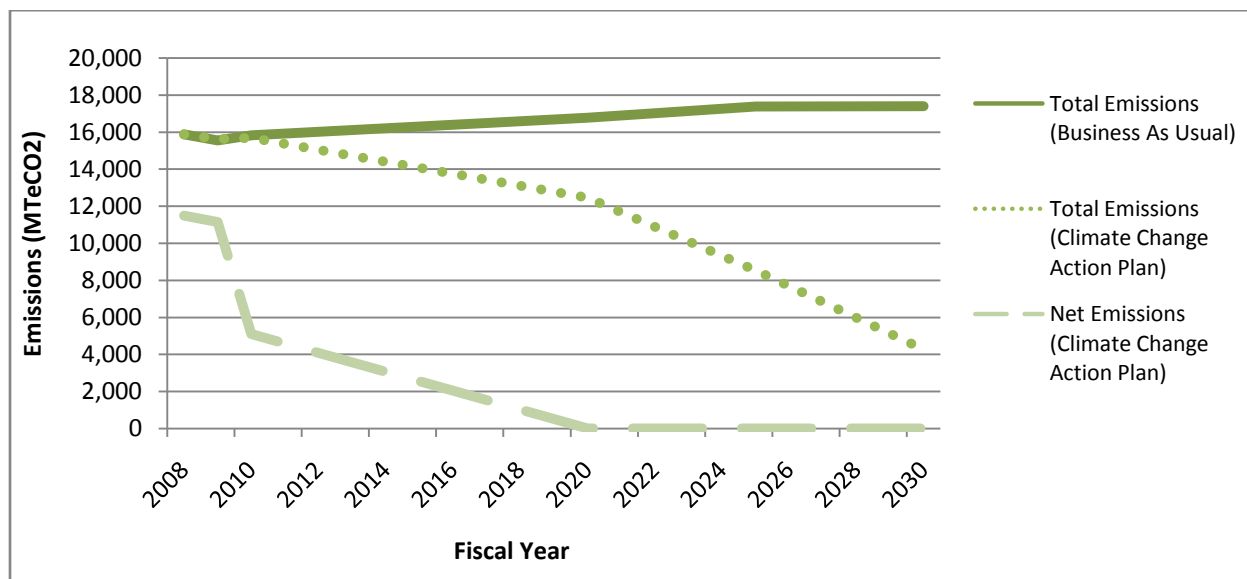
The world is facing an unprecedented change in global climate. Human society now must face a great challenge to dramatically reduce greenhouse gas emissions in an effort to slow the warming of the planet. Dickinson College has taken a proactive stance on climate change. President William G. Durden '71 signed the American College and University Presidents' Climate Commitment (ACUPCC) in 2007. In doing so, Dickinson College pledged to become climate neutral. This commitment not only signifies the College's dedication to playing a role in the global fight against climate change, but also reflects Dickinson's dedication to its central mission: education. By joining the Presidents' Climate Commitment, Dickinson is setting an example of sustainability to its students, staff, and faculty, and helping to educate the next generation of environmentally-conscious citizens.

Dickinson has set a date of 2020 for becoming climate neutral. The Climate Change Action Plan details how the College will achieve this ambitious goal. Dickinson has already made important strides in recent years to reduce and offset its greenhouse gas emissions and these efforts are being intensified. Implementation of the action plan will reduce emissions 25 percent from 2008 levels by the year 2020. The balance of emissions will be offset through projects with community partners, composting and recycling, purchases of renewable energy certificates, and other measures. The commitment, however, does not end there. Dickinson will continue to reduce its emissions to 50 percent below the 2008 level by 2025 and to 75 percent below 2008 level by 2030. The deepening reductions after 2020 will lessen the College's reliance on offsets for attainment of climate neutrality. Emissions reductions will result from projects focusing on conservation, efficiency, and renewable energy. Helping the campus community to adopt more sustainable behaviors will be at the core of the conservation projects. Outreach programs will decrease students' energy consumption in the residence halls. Other projects will concentrate on faculty and staff behaviors in their offices and encouraging the most sustainable commute possible, through carpooling, walking, and biking. Efficiency projects will focus on efficient technology, such as LEDs, and efficient construction and renovation. Renewable energy, such as solar and wind, will be utilized as much as possible over the next 20 years to further emissions reductions. In addition, two combined heat and power plants will provide electricity and heat to large portions of the campus and will be run on waste vegetable oil. Through this incremental approach to climate neutrality, Dickinson will be able to take immediate actions to achieve climate neutrality and reduce emissions while also planning for a sustainable future.

The action plan will build on measures already taken. Dickinson has improved energy efficiency in recent years through energy demand management, a new more efficient central energy plant, near 100 percent conversion to compact fluorescent lighting, purchases of Energy Star appliances for residence halls, campus conservation programs, and a green building policy that sets LEED Silver as a minimum standard – the two most recently completed College buildings are LEED Gold certified and a nearly completed renovation is also aiming for Gold certification. Students and staff are working together to install a new 3 kW solar photovoltaic array on the roof of the Center for Sustainable Living, a student residence, which will bring the total installed solar electrical capacity at Dickinson to 300 kW. A biodiesel shop, operated by students with supervision from an environmental safety officer, produces fuel from waste vegetable oil to power equipment on the Dickinson College Farm and a number of college vehicles using a carbon-free energy source. These and other climate friendly actions are woven into the curriculum and co-curricular activities of Dickinson College, engaging students in the planning, design and implementation of strategies to combat climate change.

Dickinson began offsetting some of its emissions in 2002 by promoting and financially supporting wind energy development through the purchase of Renewable Energy Certificates (RECs). In 2002, RECs equivalent to 9 percent of the emissions from the College's electricity consumption were purchased. In 2005 purchases of RECs increased to 12.5 percent of electricity emissions and to 50 percent in 2008. Now, as of September 1, 2009, Dickinson is purchasing wind energy RECs equivalent to 100 percent of its emissions from electricity. By this action, Dickinson's electricity consumption is already climate neutral.

Consistent with the ACUPCC, the Action Plan seeks to neutralize the climate impact of emissions of greenhouse gases that result directly from the College's operations plus emissions that result from generation of the electricity that the College consumes, daily commuting by faculty, staff, and students, and air travel for study abroad and College business. Taking action on these emissions represents an important step in combating climate change. However, excluded from the requirements of the ACUPCC, and therefore the scope of this Action Plan, are other indirect emissions that result from the production, processing, and distribution of the goods and services consumed by the Dickinson community. This exclusion was a focus of discussions during the review of the draft action plan by the Dickinson community, with particular emphasis on emissions that derive from the food that is served in the College's dining venues. The College is already taking significant steps to reduce the environmental impact of its Dining Services by serving sustainably grown food from the Dickinson College Farm, composting all food waste, and going trayless. Over the coming year, members of the Dickinson College community will examine the magnitude of indirect emissions from food and other sources, identify possible actions for reducing these emissions, and consider their place in our commitment to climate neutrality. As a member of the Leadership Circle of signatories, Dickinson invites other colleges and universities to join it in examining the question of food related emissions.



## II. Introduction

Dickinson College President William G. Durden, class of '71, signed the American College & University Presidents' Climate Commitment<sup>1</sup> (ACUPCC) on behalf of the College in September 2007 and joined the Leadership Circle of the ACUPCC. In signing, Dickinson College committed to becoming climate neutral by reducing and offsetting our emissions of greenhouse gases. A number of interim steps are required as we travel a path to our goal of climate neutrality. These include, among others, completing a comprehensive inventory of the College's greenhouse gas emissions, promptly initiating tangible actions to reduce emissions, integrating climate change and sustainability into the educational experience at Dickinson, and developing a comprehensive action plan to become climate neutral.

Our first Greenhouse Gas Inventory was completed in 2008. Several tangible actions to reduce emissions have already been implemented and we have launched a college-wide curricular initiative on sustainability that encompasses the study of climate change. Now, with the adoption of Dickinson College's Climate Change Action Plan, described in this document, and its submission to the Association for the Advancement of Sustainability in Higher Education (AASHE), we take the next important step on our journey to climate neutrality.

Dickinson's Climate Change Action Plan identifies projects to build on actions already taken, prioritizes new projects, and presents a timeline for their implementation. Our goal is to attain climate neutrality by the year 2020. In that year, we estimate that the projects identified in this report will reduce total emissions by the College to 12,000 metric tons of CO<sub>2</sub> equivalent, which represents a reduction of 25 percent from our 2008 emission level. We plan to offset our remaining emissions by a variety of measures to attain climate neutrality. Beyond 2020, we will continue to reduce our emissions and the degree to which we will rely on offsets for meeting our commitment. Our target is to reduce emissions by 50 percent of 2008 emissions by 2025 and by 75 percent in 2030, with the remainder made up by a decreasing quantity of offsets. In addition, our plan of action includes efforts in the areas of education, research, campus culture, and community engagement.

Our commitment to climate change action is consistent with and supports the mission of Dickinson College to provide a useful education in the liberal arts for engaged citizenship and leadership in service to society. Human actions are transforming the Earth's climate, atmosphere, oceans, and landscape in ways that threaten the environment and human well-being on an unprecedented scale. Faced with these challenges, an education that is useful to today's generation of students must build literacy about sustainability and climate change and the knowledge and skills to create sustainable solutions. Dickinson College is committed to providing this type of education for our students. But to be effective, our efforts must extend beyond the classroom and be integrated into the operations of our campus, student life, co-curricular programs, student and faculty research, and our engagement with the communities in which we work and study. This college-wide approach models responsible behavior for our students and demonstrates what can be achieved by deliberate, concerted action.

The scientific evidence on climate change and the risks to the environment, human well-being, and future social and economic development are compelling. In a recent review of the science, the U.S. National Academies, an independent, non-governmental body composed of the National Academy of Sciences, National Academy of Engineering, Institute of Medicine, and the National Research Council,

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<sup>1</sup> <http://www.presidentsclimatecommitment.org/html/commitment.php>

stated that the Earth is warming and that the changes are likely mostly due to human activities.<sup>2</sup> A large and growing volume of peer-reviewed scientific observations and studies of the Earth's climate support these findings. They are consistent with conclusions drawn by other national science academies<sup>3</sup>, scientific societies<sup>4</sup>, and the Intergovernmental Panel on Climate Change (IPCC), an organization that convenes hundreds of leading scientists from around the world to assess the scientific evidence on climate change and whose reports are subjected to extensive and open peer review by several hundred more scientists.<sup>5</sup>

To be sure, there are unanswered questions about climate change. But many of the critical questions have been answered and there is an extensive, well-supported body of accumulated knowledge about climate change available to guide prudent and effective action. If the world decides to stay on its present course, the following outcomes will result with a high degree of certainty. Annual emissions of greenhouse gases will continue to grow, their carbon dioxide equivalent concentration in the atmosphere will increase by a multiple of two or more relative to the pre-industrial level, the climate will warm at a rate that is rapid relative to rates that have been reconstructed from Earth's geologic past, and sea level will rise. Terrestrial, freshwater, and marine ecosystems will be substantially disrupted, water resources and food production will be impacted, and human wellbeing threatened. Warming also risks triggering positive feedbacks that could amplify warming and result in abrupt and extreme climate change that would have even more severe impacts. Alternatively, decisions to reduce greenhouse gas emissions can slow the pace and magnitude of climate change and sea level rise, but the reductions would need to cut deeply into global emissions if climate change risks are to be measurably reduced.

One tangible action already taken by Dickinson College is the purchase of wind power emission reduction credits. In 2007 wind power credits equivalent to 15 percent of the electricity consumption of our campus were purchased, which we increased to 50 percent in 2008. We are now increasing our wind power purchases to 100 percent of our electricity consumption, entirely offsetting the electricity portion of our greenhouse gas emissions. These purchases provide financial support for the expansion of a wind energy technology, a zero-carbon power source.

We recognize that our responsibility goes beyond offsetting our emissions and requires that we make substantial reductions in the emissions that are generated by the College. We have made good initial progress on emissions reductions through a variety of measures that have been implemented. These include establishing a policy to attain LEED Silver certification or higher for all new construction and renovation projects over \$500,000; purchasing Energy Star appliances for replacement of equipment whenever available; increasing access to and encouraging use of public transportation; purchasing at least 15 percent of the College's electricity consumption from renewable sources within a year of signing the Commitment; establishing a committee to guide socially responsible and sustainable investing; and

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<sup>2</sup> The National Academies, 2008. *Understanding and Responding to Climate Change*. National Academy of Science, Washington, DC.

<sup>3</sup> See, for example, the Joint Science Academies' Statement: Global Response to Climate Change, 2005, and the G8+5 Academies' Joint Statement: Climate Change and the Transformation of Energy Technologies for a Low Carbon Future, 2009.

<sup>4</sup> The American Meteorological Society, the American Geophysical Union, and the American Association for the Advancement of Science have issued statements concluding that the evidence of human caused climate change is compelling. See Oreskes, N., Beyond the Ivory Tower, the Scientific Consensus on Climate Change. *Science*, vol. 306, no. 5702, p. 1686.

<sup>5</sup> See the IPCC's most recent four volume report, *Climate Change 2007*, Cambridge University Press, Cambridge, UK and New York, USA.

continuing to participate in the Waste Minimization section of RecycleMania and adopting three or more waste minimization strategies. These efforts have demonstrated the feasibility and cost-effectiveness of greenhouse gas emission reduction and developed support for further action.

Dickinson's Climate Change Action Plan lays out a long-term strategy and priorities for building on the actions already taken. Over the coming year, we will begin the process of scoping and initiating work on the highest priority projects. Addressing climate change is not a static process; it is one that requires flexibility and response to a constantly changing world. This plan represents Dickinson's initial approach in the fight against global warming. As technology and science progress, the plan will need to be adapted accordingly. We anticipate revisions and updates and present this Climate Change Action Plan as the first step of many towards Dickinson's climate neutrality.

## **Presidents' Climate Commitment**

Dickinson College recognizes that as an institution of higher education in the United States, it must lead by example in the face of seemingly insurmountable challenges. By maintaining high-caliber, environmentally-friendly, and energy-efficient facilities, we reap not only the short-term financial and environmental benefits on our own campus, but we are able to educate our students and provide the long-term benefits of an environmentally-conscious mentality to the global community. Dickinson strives not only to set an example for other colleges and universities but also to set an example of a sustainable lifestyle to its students, staff, and faculty.

In accordance with the Presidents' Climate Commitment, the College initiated multiple actions after becoming a signatory to immediately begin reducing greenhouse gas emissions. The requirement was to implement at least two of seven possible tangible actions; Dickinson implemented six<sup>6</sup>.

## **Greenhouse Gas Inventory**

In preparation of preparing a climate neutrality plan and in compliance with the Presidents' Climate Commitment, it is first necessary to calculate total greenhouse gas emissions for which the College is responsible. The first Greenhouse Gas Emissions Inventory for Dickinson College was completed in 2008 by a Summer Sustainability Intern, Kate Consroe '09. The Clean Air-Cool Planet Campus Carbon Calculator, version 5, was used. Data were collected for the fiscal years 2002 through 2008. The fiscal year 2002 was the earliest year for which the most complete data could be collected. For some data, exact numbers were not available, due to a lack of centralized recordkeeping, among other reasons. When this occurred, the best estimation possible was used, and the most accurate data possible were recorded. Great attention was used to ensure that the Greenhouse Gas Emissions Inventory is a correct representation of the emissions of the College.

## **Climate Change Action Plan**

To facilitate the creation of Dickinson's Climate Change Action Plan, a Climate Change Action Plan Working Group was created in Fall 2008. The Working Group was comprised of representatives from a variety of offices and departments across campus. Members included:

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<sup>6</sup> <http://acupcc.aashe.org/report.php?id=3290>

- Ken Shultes, Associate Vice President of Campus Operations (Facilities Management)
- Don Lindemuth, Customer Service Supervisor (Facilities Management)
- Sean Diamond, Sustainability Coordinator 2008-2009 (Facilities Management)
- Neil Leary, Director of the Center for Environmental and Sustainability Education
- Sarah Brylinsky, Sustainability Education Coordinator (the Center for Environmental and Sustainability Education)
- Jill Hans, Director of Budget and Planning (Financial Operations)
- Margaret Stafford, Budget Analyst (Financial Operations)
- Vallie Edenbo, Program Coordinator for the Environmental Studies Department
- Kate Consroe '09, Sustainability Office Intern

The group met weekly during the 2008-2009 school year to discuss potential projects and strategies to reduce Dickinson's greenhouse gas emissions.

After completion of a list of feasible reduction projects, Kate Consroe, Sustainability Coordinator 2009-2010, and Angelo Lan '12, Summer Sustainability Intern, analyzed each project to calculate the potential annual emissions reduction possible. The calculations of potential reductions were estimated using the best information currently available. These data provide the basis for Dickinson's plan and timeline to reach climate neutrality. The Climate Change Action Plan was drafted by Kate Consroe, and members of the Climate Change Action Plan Working Group collaborated to produce the final copy.

The Working Group sought to keep all stakeholders in the campus community informed throughout the process of creating the Action Plan. Several public presentations were held throughout the 2008-2009 school year, including a special presentation to the Student Senate. In addition, the draft of the Climate Change Action Plan was presented to numerous groups for their input in August and September 2009, including the President's Staff, the President's Commission on Environmental Sustainability, the Planning and Budget Committee, Dickinson SAVES, and Student Senate. There was also a public comment meeting, open to all members of the campus community. This meeting provided an opportunity for everyone to share their questions, comments, concerns, and thoughts on the Action Plan.

## **History of Sustainability at Dickinson**

Dickinson has a long history of environmental consciousness, beginning in 1970 with the first Environmental Studies class. Today, sustainability plays a role in all aspects of the College, from buildings to campus operations to academics to co-curricular programming to student organizations<sup>7</sup>.

Recycling began at the College in 1988 as a voluntary, student-run initiative and in 1991 became an institutional program. To this day, Dickinson continues to have a comprehensive recycling program, including comingled recyclables, paper, and cardboard, as well as compact fluorescent light bulbs, batteries, printer cartridges, plastic bags, and cell phones.

1991 also marked the creation of the President's Commission on the Environment (COTE), a committee of faculty, staff, students, and alumni that provided guidance to the College President on environmental

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<sup>7</sup> For a complete history of sustainability at Dickinson, please see the first Annual Sustainability Report produced by the Center for Environmental and Sustainability Education, expected to be released in Fall 2009.



issues. COTE submitted an official proposal in 2004 recommending that environmental sustainability be elevated to a Defining Characteristic of the College in the Strategic Plan. COTE was reorganized and renamed in 2006, becoming the Society Advocating Environmental Sustainability (Dickinson SAVES) and continues to serve as a forum for students, staff, faculty, and alumni to share information about sustainability at Dickinson and work together to promote additional sustainable initiatives.

## Administrative Policies

### College Master Plan

The College Master Plan envisions the future of the College and lays out eight specific goals to help guide development. One of these goals focuses specifically on sustainability, affirming the College's desire to:

*Create a campus culture that is committed to ecological sustainability, both operationally and academically [and to make] Dickinson known for the quality of its environmental stewardship.*<sup>8</sup>

Several objectives are set out as part of this goal, including considering environmental accountability in decision-making, educating the campus community through the implementation of sustainable initiatives, and involving the campus community in the pursuit of sustainability. The incorporation of environmental impact into the Campus Master Plan ensures an institutional commitment to sustainability, both through the operation of the College as well as through academic programming.

### Strategic Plan II

In 2005 Dickinson College released its Strategic Plan II as a guiding document for the fiscal years 2006 to 2010 in an effort to establish Dickinson "permanently as a leading liberal arts college in America".<sup>9</sup> The Strategic Plan identifies six "Defining Characteristics" that make the College distinctive, one of which is Accountability and Sustainability. The Strategic Plan asserts that:

*We[, Dickinson College,] will embrace the goals of accountability and sustainability as individuals and as an institution of integrity and principle. We will state our goals clearly and communicate them to those both within and outside of our limestone walls. We will be accountable for the goals we set. We recognize that engaged global citizenship requires an awareness of, and respect for, the natural world that supports the social world. We also recognize that responsible citizenry requires the prudent use of resources of all types, physical and fiscal. Educating for sustainability requires a holistic approach to decision making which embodies liberal arts education and promotes an engaged community. The College must serve as a living example of sustainability in all arenas. We will always remember that Dickinson's future is our responsibility*<sup>10</sup>.

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<sup>8</sup> Dickinson College Campus Master Plan, 2007, <http://www.dickinson.edu/departments/facilities/campusmasterplan.html>

<sup>9</sup> Dickinson College Strategic Plan II, 2005, <http://www.dickinson.edu/plan/planII.htm>

<sup>10</sup> Dickinson College Strategic Plan II, 2005, <http://www.dickinson.edu/plan/planII.htm>

The inclusion of sustainability in the College's Strategic Plan highlights the sincerity with which Dickinson approaches its environmental impact and proves that sustainability is not just a passing fad but rather a permanent characteristic of the institution.

### III. Campus Emissions

The Greenhouse Gas Emissions Inventory reports total emissions from Dickinson College from fiscal year 2002 to fiscal year 2008. The Inventory accounts for emissions of methane (CH<sub>4</sub>), carbon dioxide (CO<sub>2</sub>), and nitrous oxide (N<sub>2</sub>O).

These emissions can be subdivided into various categories, based on both scope and emissions source. Scope refers to the degree of control the institution has over a certain category of emissions<sup>11</sup>. There are three scopes that represent varying levels of responsibility for emissions based on how directly they can be controlled. Scope 1 emissions are under the highest level of control, and thus responsibility, and are emitted from sources that are either owned or controlled by the College. Scope 2 emissions refer to sources that are directly linked with on-campus energy consumption but are not directly owned or operated by the College. Although there is no ownership of the source of Scope 2 emissions, these emissions would not exist if not for the institution because it is the institution that is consuming the energy. Scope 3 emissions are considered the most indirect. The sources of these emissions are again neither owned nor operated by the institution but are directly financed by the institution or the result of an encouraged or required behavior.

As laid out in the Commitment, signatories agree to report Scope 1 and 2 emissions, and report Scope 3 emissions to the best of their ability, based on the available data<sup>12</sup>. At a minimum, institutions must report their Scope 3 emissions from staff and faculty commuting and air travel financed by the institution. Dickinson's Greenhouse Gas Emissions Inventory includes all required Scope 3 emissions, reported as accurately as possible. At present, the Greenhouse Gas Emissions Inventory does not consider emissions stemming from food and other purchased goods. However, as diet is an integral and significant component of a carbon footprint, the College will include emissions associated with food in future versions of the Greenhouse Gas Emissions Inventory. Furthermore, Dickinson feels omitting food emissions from the Presidents' Climate Commitment does not truly lead institutions to climate neutrality. Although the College has not quantified emissions from food, it has already taken actions to reduce the environmental impact of the food it purchases. Dickinson purchases food directly from 13 local farmers and spends approximately 18 percent of its annual food budget on local products, including fruits, vegetables, milk, and honey<sup>13</sup>. In addition, the Dining Hall converted to trayless operations in July 2009 in an effort to reduce food waste, as well as water and energy consumption. Dickinson College strives to take a leadership position on this issue, and will continue to address it in future versions of the Climate Change Action Plan.

Emissions can also be categorized more broadly by the source of the emissions. Dickinson's emissions fall into the following categories: purchased electricity, on-campus fuel combustion, transportation (campus fleet, faculty and staff commuting, directly-financed airfare, study abroad air travel), agriculture

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<sup>11</sup> Clean Air-Cool Planet Campus Carbon Calculator User's Guide, version 6, August 2008

<sup>12</sup> American College and University Presidents' Climate Commitment, Implementation Guide, September 2007

<sup>13</sup> Sustainable Endowment Institute's College Sustainability Report Card 2010: Response for Dickinson College

(fertilizer, livestock), solid waste, and refrigerants. In addition, the Clean Air-Cool Planet Campus Carbon Calculator version 5 recognizes several greenhouse gas sinks and offsets, including green electric certificates, composting, and recycling. Sources of emissions, as relevant to Dickinson, are categorized by scope in Table 1.

Scope	Description	Emission sources at Dickinson
Scope 1	Directly owned or controlled by the institution	On-campus fuel combustion; fleet vehicles; fugitive emissions from refrigerants; College-owned livestock; fertilizer
Scope 2	Neither owned nor operated by the institution, but directly linked to the campus energy consumption	Purchased electricity
Scope 3	Neither owned nor operated by the institution, but directly financed by the institution or the result of an encouraged or required behavior	Solid waste; air travel directly financed by the College; commuting by faculty and staff; study abroad air travel

Table 1. Emissions sources at Dickinson College, organized by scope.

## Current Emissions

For the fiscal year (FY) 2008, Dickinson College's total greenhouse gas emissions amount to approximately 15,500 metric tons of carbon dioxide equivalent<sup>14</sup> (MTeCO<sub>2</sub>). The net emissions, which take greenhouse gas sinks and offsets into account, total to approximately 11,500 MTeCO<sub>2</sub> for FY 2008. From FY 2002 through FY 2008, the total emissions have fluctuated between about 14,000 MTeCO<sub>2</sub> and 16,000 MTeCO<sub>2</sub>. The amount of offsets significantly increased in FY 2008, resulting in net emissions below 12,000 MTeCO<sub>2</sub> (Figure 1).

<sup>14</sup> Carbon dioxide equivalent, or eCO<sub>2</sub>, is a unit used to account for differences in the global warming potential of various greenhouse gases, including carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), and nitrous oxide (N<sub>2</sub>O).  
<http://www.epa.gov/climatechange/glossary.html#C>

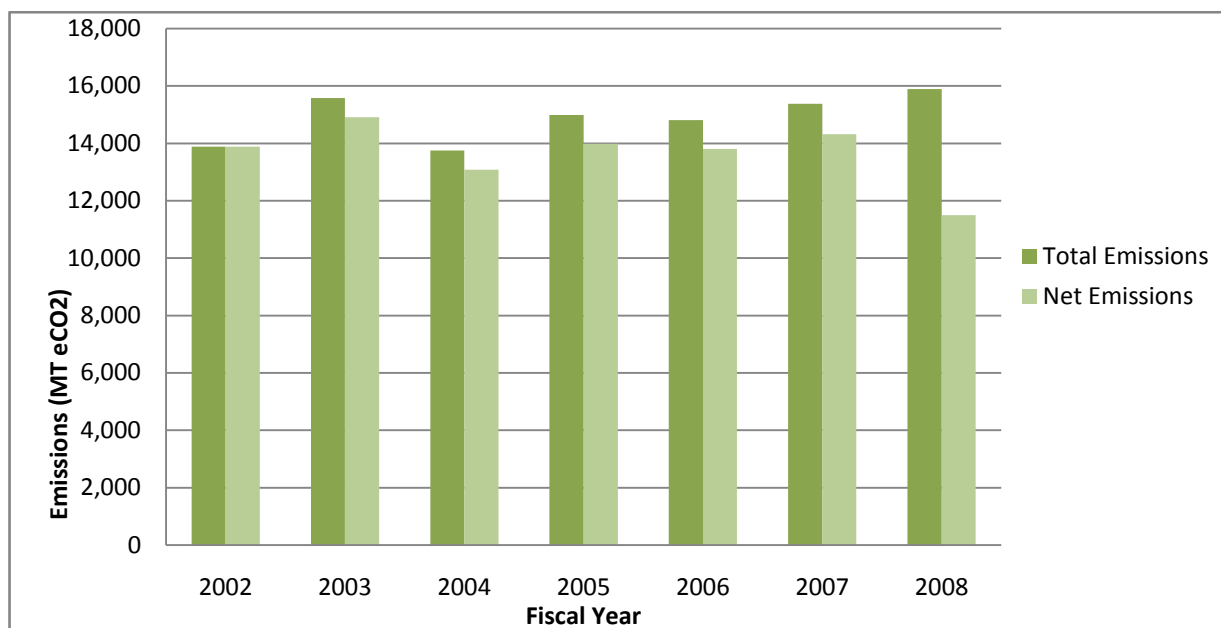
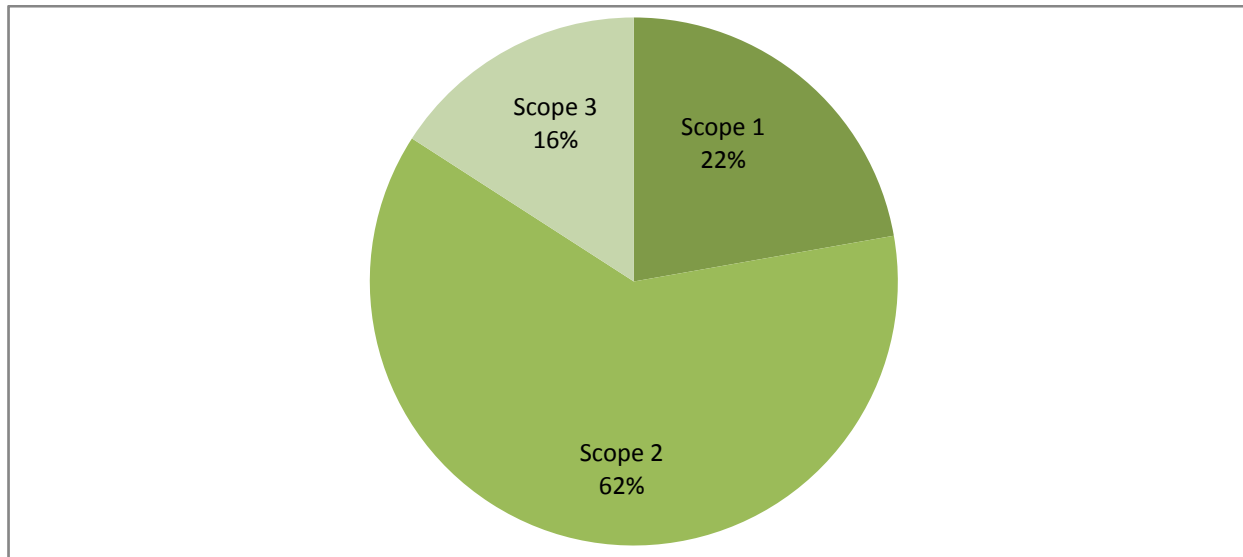


Figure 1. Total and net emissions from FY 2002 to FY 2008.

The main greenhouse gas emitted by Dickinson is carbon dioxide. In FY 2008, approximately 21,000,000 kilograms (kg) of CO<sub>2</sub> were emitted, equivalent to 21,000 MT. A net negative weight of methane, -380 kg, is released, because of how the solid waste is handled at the Cumberland County Landfill, where methane is recovered and flared. Approximately 610 kg of nitrous oxide (N<sub>2</sub>O) was released in FY 2008. In the conversion to eCO<sub>2</sub>, the global warming potential of each gas is considered. Methane has a global warming potential approximately 20 times the global warming potential of carbon dioxide, while the global warming potential of nitrous oxide is about 200 times the global warming potential of carbon dioxide<sup>15</sup>.

Over 60 percent of emissions in FY 2008 come from Scope 2 sources, as a result of purchased electricity. The remaining emissions are split approximately evenly between Scope 1 and Scope 3 sources (Figure 2).

<sup>15</sup> [http://www.grida.no/publications/other/ipcc%5Ftar/?src=/climate/ipcc\\_tar/wg1/248.htm](http://www.grida.no/publications/other/ipcc%5Ftar/?src=/climate/ipcc_tar/wg1/248.htm)



**Figure 2. Breakdown of total emissions by scope in FY 2008.**

Purchased electricity is the largest source of emissions in FY 2008, followed by on-campus fuel combustion and transportation. Agricultural activities (livestock and fertilizer use) account for a very small percentage of total emissions (Figure 3). Emissions from solid waste were not included in Figure 3. Due to the capture and flaring of methane at the Cumberland County Landfill in FY 2008, the Clean Air-Cool Planet Emissions Calculator considers this an offset of emissions. Thus, the total emissions from solid waste at Dickinson for FY 2008 are -46 MTeCO<sub>2</sub>. The Clean Air-Cool Planet Emissions Calculator uses an emissions factor of -0.073 MTeCO<sub>2</sub> per short ton of waste that is landfilled with methane recovery and flaring (as the Cumberland County Landfill treated its waste in FY 2008). In comparison, the emissions factor for waste that is landfilled with no methane recovery is 0.623 MTeCO<sub>2</sub> per short ton of waste, while the emissions factor for waste that is landfilled with methane recovery that is used for electrical generation is -0.220 MTeCO<sub>2</sub> per short ton of waste.

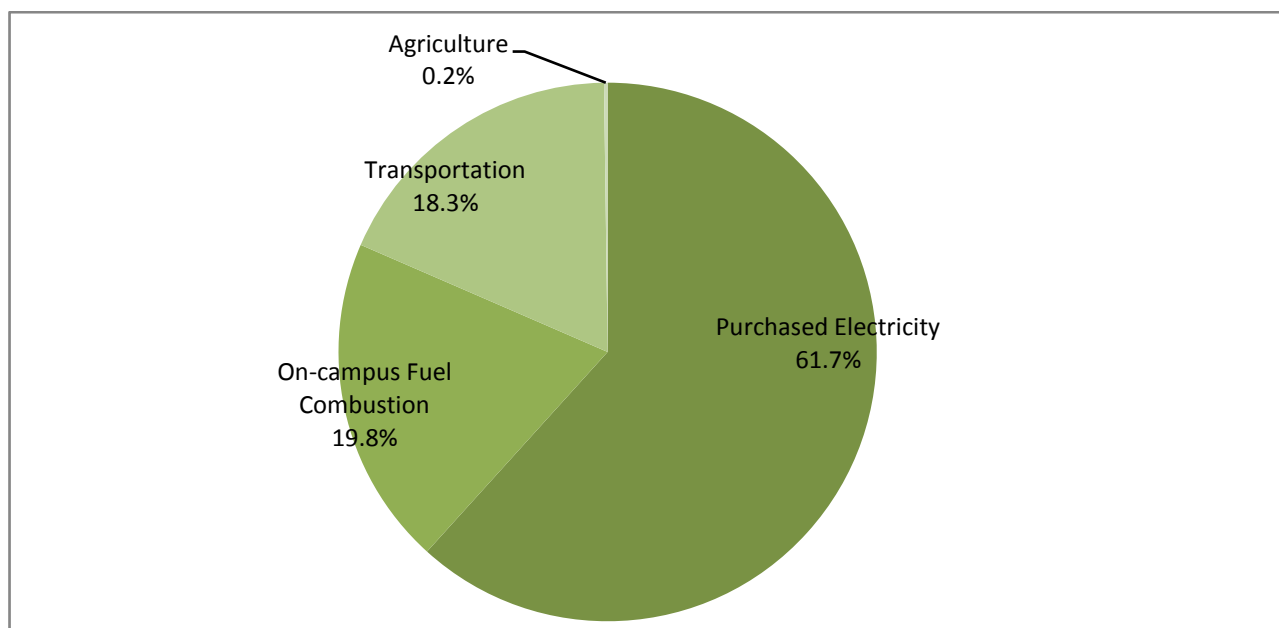


Figure 3. Breakdown of total emissions by source for FY 2008 (excluding solid waste).

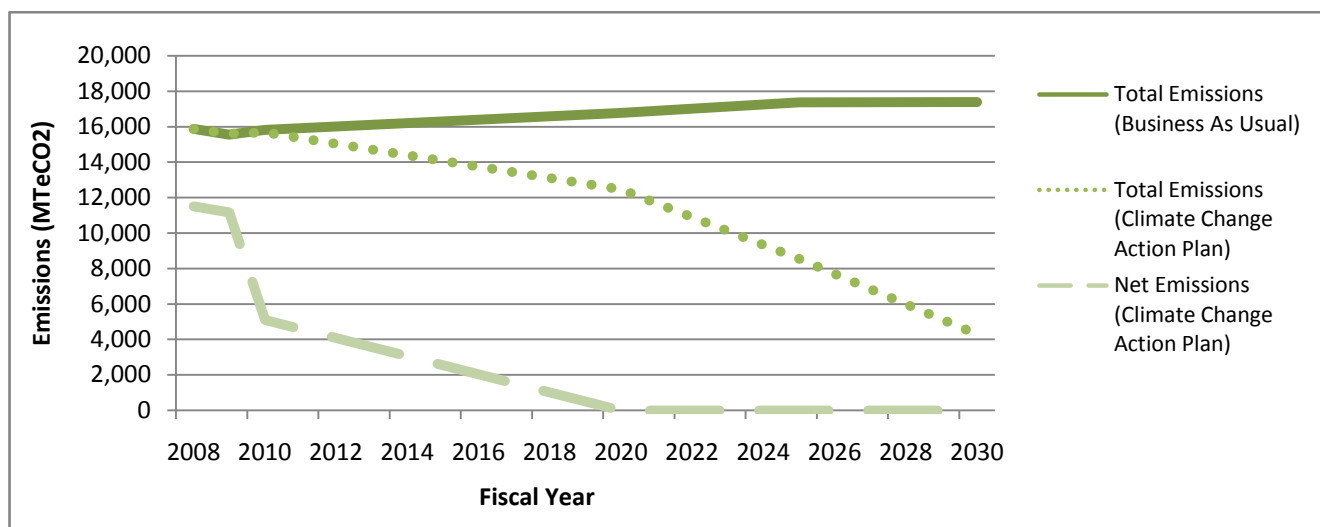
## Projected Emissions

Future emissions can be predicted based on the current emissions per square foot of building space. In the next 20 years, it is unlikely there will be a significant change in the campus population (students, faculty, and staff)<sup>16</sup>. However, the built space of the campus will almost certainly increase. Based on scheduled and anticipated construction projects, it is expected that Dickinson College will grow from 1,883,140 square feet in FY2008 to approximately 2,062,085 square feet by 2030. The projected increase in building space allows for a corresponding forecast for future emissions over the next 20 years in the absence of any additional actions to reduce greenhouse gas emissions.

To account for an increase only in built space, emissions per square foot was calculated based only on the emissions from purchased electricity and on-campus fuel combustion, since these are the only emissions that directly relate to built space. For FY 2008, this number is 0.0069 MTeCO<sub>2</sub> per square foot of built space. It is assumed that emissions not directly related to built space will remain constant in the future.

If the College continues along in a “business as usual” scenario and does not take any actions to address its emissions, total emissions will be approximately 17,300 MTeCO<sub>2</sub> by 2030 (Figure 4).

<sup>16</sup> Dickinson College Master Plan, 2007, <http://www.dickinson.edu/departments/facilities/campusmasterplan.html>



**Figure 4. Total emissions in the "business as usual" scenario compared to total and net emissions by following the Climate Change Action Plan.**

This prediction assumes that the greenhouse gas emissions per square foot of building space remain approximately constant throughout the next 20 years. This is a safe assumption given the proactive initiatives Dickinson has already taken to reduce its energy consumption and greenhouse gas emissions and the future steps it plans to take. If anything, it is likely that the emissions per square foot will naturally decrease in the future due to increased efficiency of technologies and buildings. With the planned mitigation projects, total emissions in 2020 will total approximately 12,000 MTeCO<sub>2</sub> and by 2030, total emissions will be only 4,000 MTeCO<sub>2</sub> (Figure 4).

## Achieving Climate Neutrality

Dickinson College strives to be a leader among colleges and universities in achieving climate neutrality. The institution plans to attain climate neutrality by 2020, but recognizes that this will be achieved with approximately 75 percent offsets. Thus total emissions will be reduced by 25 percent from FY 2008 levels. In acknowledging that increasing efficiency and conservation and utilizing renewable energies are far more important to decreasing emissions than offsets, Dickinson has set additional goals. By 2025, Dickinson will continue to be climate neutral but with a maximum of 50 percent offsets by further reducing emissions to 50 percent of FY 2008 levels. The College will continue to further its efforts to mitigate emissions, so that by 2030, there is a maximum of only 25 percent offsets. In the end, Dickinson will reduce its emissions by 75 percent from FY 2008 levels.

It is worth noting that as of September 1, 2009, Dickinson College is offsetting over 100 percent of its annual electricity use through the purchase of wind power. This offsets over 60 percent of Dickinson's current annual emissions.

To have the greatest impact on global climate change, it is critical that offset use is kept to a minimum, and total emissions are reduced as much as possible. The three-step approach to climate neutrality will allow for immediate action, as well as continued action in the future. It is not enough just to achieve climate neutrality. Dickinson College intends to reach climate neutrality and continue to progress by

remaining a carbon-neutral campus while reducing the use of offsets. We feel that this is a realistic yet challenging goal.

## IV. Strategies for Climate Neutrality

Although Dickinson's initial goal of climate neutrality includes room for a large percentage of carbon offsets, it is nonetheless necessary for the College to decrease total emissions through a variety of strategies. Mitigation projects can be classified as conservation projects, efficiency projects, or renewable energy projects. Conservation projects address emissions related to behaviors of the campus community. Efficiency projects reduce emissions through increased efficiency, specifically of mechanical equipment. Renewable energy projects seek to replace energy from conventional, emissions-producing sources with energy from renewable, emissions-free sources. Though differing approaches, all three strategies achieve the same end result: decreased emissions. Conservation projects tend to be the least-costly, as behavior changes have minimal costs, yet can be the most challenging to implement. As research into more efficient machinery continues and expands, the amount of emissions that can be reduced through efficiency projects will grow as equipment attains higher efficiencies.

In addition to the projects presented in this Climate Change Action Plan, Dickinson anticipates that future technological innovations will play a role in reducing emissions. It is impossible to predict what new and innovative technologies will be available beyond 2020 but they will be important to helping both the College and the world reduce their carbon emissions.

While all types of projects are important to carbon reductions, conservation projects simultaneously reduce emissions while most directly serving as educational tools for the campus community. They support both the environmental and educational goals of the College. Advancements in technology can only go so far; many emissions are still dependent on the behaviors of users. Dickinson will place great importance on the sustainable behaviors of students, faculty, and staff of the College.

Strategies for emissions mitigation were brainstormed and thoroughly discussed by the Climate Change Action Plan Working Group. The projects that were judged to be the most implementable were analyzed in detail to quantify the possible emissions reductions. Emissions factors from the Clean Air-Cool Planet Calculator were used for consistency. These emissions factors are included in Appendix A.

Figure 5 shows a graph of the planned mitigation projects. Each wedge in the graph represents the emissions reduction projects within a category of emissions: electricity, on-campus fuel combustion, and transportation. In addition, there are wedges representing offsets, reductions from future technological innovations, and renewable energy sources. The black line at the top of the graph represents the total emissions under the business as usual scenario, if the College took no additional actions. The white line symbolizes the total emissions under this Climate Change Action Plan. The space between these two lines is composed of the various reduction wedges. The net emissions are represented by the dark green shape, which decrease overall from FY 2002 to FY 2010 due to the increased amount of offsets, most significantly from increased purchasing of renewable energy credits. It also continues to decrease from FY 2010 to FY 2020, eventually reaching zero in FY 2020, marking the achievement of climate neutrality.



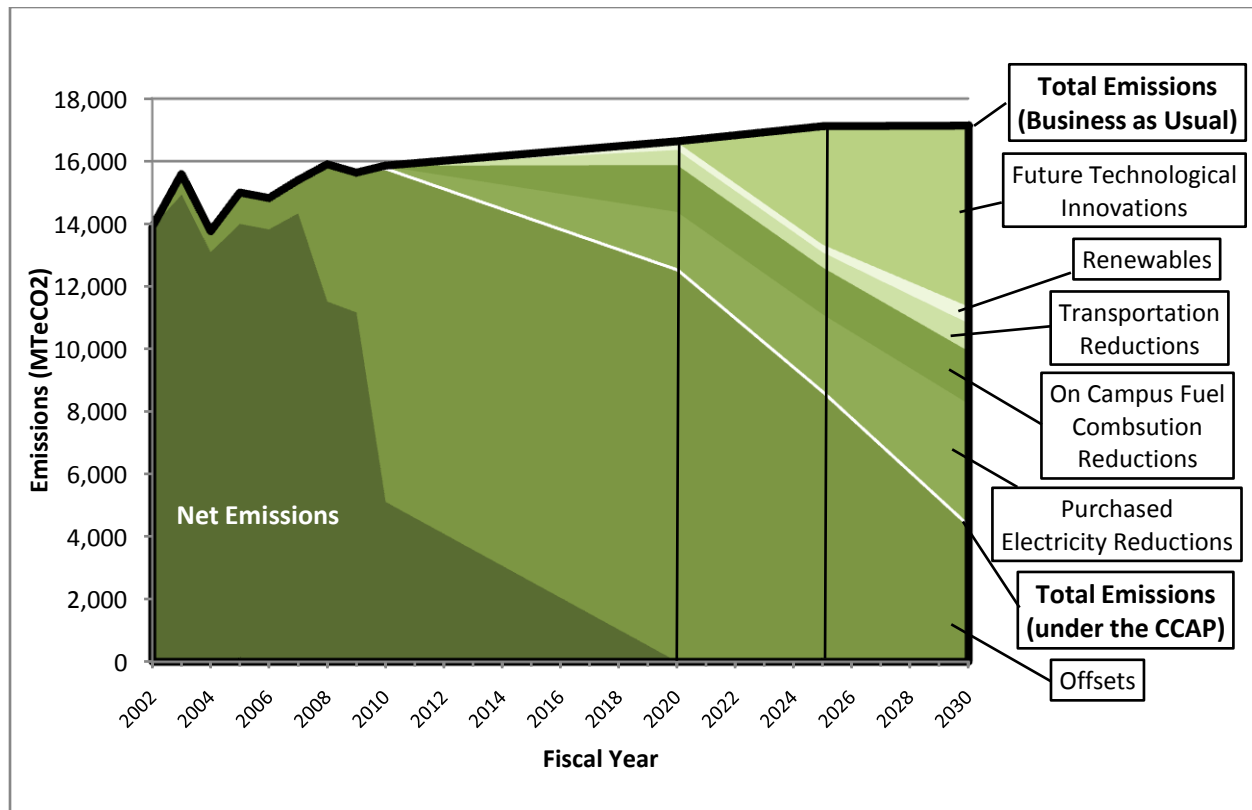


Figure 5. Historical and projected total emissions (FY 2002 - FY 2030) and planned emissions reductions (FY 2010 - FY 2030).

## Purchased Electricity

Emissions from purchased electricity account for more than half of the College's greenhouse gas emissions. The emissions associated with purchased electricity reflect the use of coal in regional power plants; approximately 45.1 percent of the fuel mix of PPL Electric Utilities comes from coal-fired power plants<sup>17</sup>.

There is a slight overall increase in emissions from electricity from FY 2002 to FY 2007. In FY 2008, there is an increase of around 2,000 MTeCO<sub>2</sub> (Figure 5). Increasing demand of purchased electricity is an indication of the growing physical size of campus, an increase of the campus population since 2002, and perhaps the increasing use of electronics. The sizeable increase in emissions in FY 2008 can be attributed to the completion of the Rector Science Complex. Although a LEED Gold Building, it nonetheless has an electricity consumption that is higher than the average campus building, due its nature as a science and research building.

<sup>17</sup> [http://oaspub.epa.gov/powpro/ept\\_pack.charts](http://oaspub.epa.gov/powpro/ept_pack.charts)

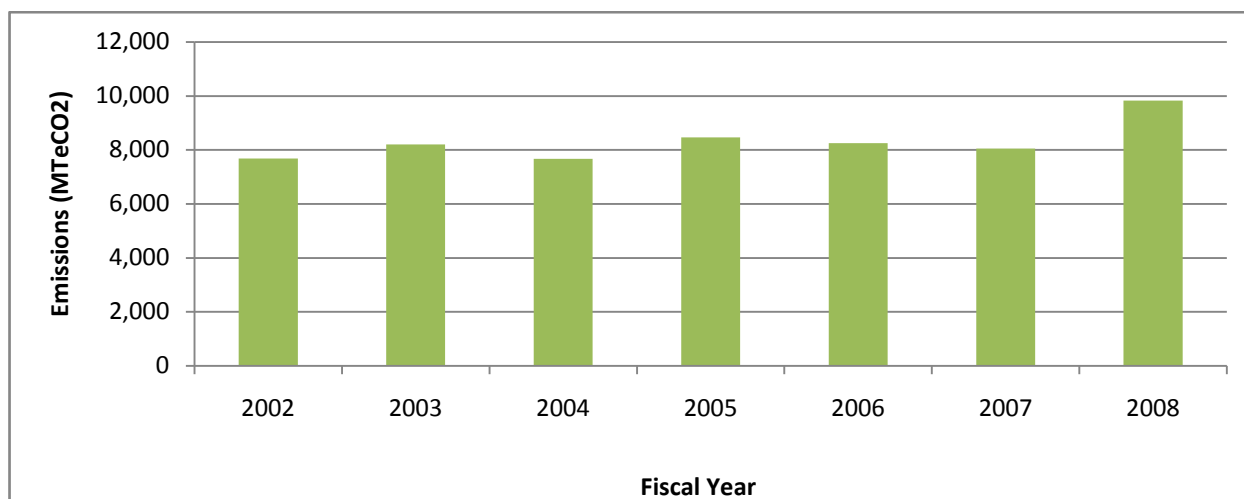


Figure 6. Emissions from purchased electricity from FY 2002 to FY 2008.

## **Strategies**

### **1.0 Electricity Consumption in Residential Spaces**

As a residential college, a significant portion of Dickinson's electricity consumption stems from energy used by students living in the nearly 75 on-campus residence halls, apartment buildings, and small houses. Reductions can be made by addressing electricity use from laundry facilities, televisions, microwaves, and refrigerators in residential spaces.

#### **1.1 Laundry**

Dickinson owns both natural gas and electric dryers. Reducing the loads of laundry dried in the dryers will impact the College's carbon emissions through reduced electricity consumption and reduced consumption of natural gas (in the On-Campus Fuel Combustion category). The mitigated emissions were calculated separately for electricity and natural gas, allowing the decrease in emissions to be placed in the appropriate category without double-counting.

In August 2009, Dickinson implemented a laundry quota system through the use of eSuds software. Previously, students were allowed to do as many loads of laundry as they desired, at no additional upfront cost. With the introduction of the laundry quota, students are limited to 34 cycles<sup>18</sup> per semester at no cost. Additional cycles may be purchased if required. By itself, the laundry quota has the potential to reduce dryer use by over 11,000 cycles, if students do not go beyond the quota. This will result in a savings of approximately 16,000 kWh.

Because there is no difference between one cycle in the washing machine versus one cycle in the dryer under the new quota system, a student has incentive to hang dry their laundry, thereby saving the use of a cycle in the dryer and allowing the student to do an additional load in the washing machine instead. Dickinson College Facilities Management provided each laundry room on campus with a drying rack to

<sup>18</sup> One cycle refers to one use of either the washing machine or the dryer. Thus, students can do 17 complete loads of laundry per semester (one cycle in the washing machine, one cycle in the dryer).

further encourage and enable students to air dry their laundry instead of using the dryer, with the goal of diverting 10 percent of cycles meant for the dryer. This has the potential to save an additional 11,000 kWh.

## **1.2 Televisions**

Historically, the College offered complimentary cable connections in all bedrooms on campus. Beginning in August 2009, cable connections were only made available in the common rooms of residence halls and living rooms in small houses and apartments; cable connections in all bedrooms were removed. In addition to being fiscally responsible, the new policy will hopefully discourage some students from bringing their own televisions, thereby reducing the electricity consumption due to personal televisions. We estimate that there will be 10 percent fewer televisions in rooms, potentially reducing electricity consumption by 6,700 kWh.

Another component of the electricity consumption from televisions is phantom draw. Phantom draw is the use of electricity by electronics that are turned off but still drawing some electricity. Although an appliance typically draws a very small amount of electricity when turned off, the electric load can add up to a significant amount because many appliances are left plugged in 24 hours a day. As part of the Green Devil Challenge, a semester-long program designed to reduce students' environmental impact, students are educated about phantom draw and encouraged to eliminate phantom draw by unplugging electronics, like televisions, that are not in use. We anticipate that some students will continue to bring their own personal television to campus, and aim to encourage them to change their behaviors to reduce their phantom load. We anticipate a 10 percent participation rate for this behavioral change, saving over 400 kWh.

## **1.3 Microwaves and Refrigerators**

It has become an emblem of the independent college life for each room in a residence hall to have a mini-fridge and a microwave. Dickinson has already taken steps to help reduce the electricity consumption of these appliances by offering combined Energy Star qualified mini-fridge/microwave units that can be rented from the College Bookstore. Many students opt to bring their own appliances, which may not be Energy Star qualified. Although it may be convenient for each room to have these appliances, the practice is very inefficient, as many students make little use of the mini-fridge and the microwave in their room.

All residence halls at Dickinson have common rooms that are equipped with refrigerators and microwaves; these appliances are rarely used as well. Through the Green Devil Challenge and a partnership between the Office of Campus Sustainability and the Office of Residential Life, students will be encouraged to give up their personal mini-fridges and microwaves, and utilize the ones in the common room instead. Incentives will be provided to support this change, particularly at the end of the fall semester, when students will have the opportunity to take the unneeded appliances home over winter break. We aim for a 10 percent participation rate for using the common room appliances. By taking part in the "appliance diet", students have the potential to conserve 12,000 kWh.

The Green Devil Challenge will also work to reduce the phantom draw of microwaves by educating students so they unplug theirs when not in use. We expect a 10 percent participation rate for this behavioral change, with a savings of over 600 kWh.

## **2.0 Combined Heat and Power**

Combined heat and power, also known as cogeneration, simultaneously produces both electricity and heat<sup>19</sup>. Using a single fuel source for two end products makes combined heat and power systems more efficient than systems generating solely electricity or heat. The College proposes two combined heat and power systems. One will serve all campus buildings south of High Street, and will be implemented in two phases. Phase I will cover the residential buildings on the Rush Campus, and Phase II will incorporate additional academic, administrative, and residential buildings on the south side of High Street. The second will serve the Kline Center, home to the gym and athletic facilities. Both combined heat and power systems will be fueled by waste vegetable oil. As this is a waste product and would otherwise be disposed of, it is a carbon-neutral fuel source. The combined heat and power systems would provide electricity, and the waste heat from the electrical generation process would be used to heat water that can be used to heat the buildings. These systems will eliminate the need for these buildings to use electricity from the grid and the natural gas that is currently used to provide heat. The mitigated emissions from electricity and natural gas were calculated separately so that the decrease in emissions can be placed in the appropriate category without double-counting. Both phases of the Rush campus combined heat and power plant will each mitigate over 1,000,000 kWh and the Kline Center's system will mitigate over 800,000 kWh.

## **3.0 Outdoor Lighting**

The use of sufficient outdoor lighting is necessary for campus security. By using outdoor lighting fixtures with built-in photovoltaic panels and efficient LED bulbs, the electricity required for outdoor lighting can be decreased. Solar-powered fixtures will be installed in the Kaufman Hall parking lot, the Facilities Management parking lot, the Children's Center parking lot, the east parking lot of the Kline Center, and at the Center for Sustainable Living. Bulbs will be changed to LEDs on both the John Dickinson Campus and the Ben Rush Campus. Both changes combined will save over 85,000 kWh. This will allow the College to make progress towards climate neutrality without compromising campus security.

## **4.0 Indoor Lighting**

Decreasing emissions related to indoor lighting can be achieved through two strategies—avoiding the use of lights by ensuring they are turned off when not needed, and reducing their electricity consumption by increasing their efficiency. The College already uses fluorescent lights in campus buildings, which are much more efficient than incandescent bulbs.

### **4.1 Motion Sensors**

There is a College-wide campaign to remind all members of the campus community to turn off the lights when they leave a room through stickers above all light switches that feature the Green Devil and the phrase "Turn Me Off!". However, this is not always sufficient. Motion sensors guarantee that lights are turned off when a room is unoccupied. Motion sensors have already been installed in Bosler Hall, East College, Tome Hall, Denny Hall, the Holland Union Building (HUB), the Facilities Management Office, and the Rector Science Complex. The installation of 100 additional motion sensors across campus will save over 3,000 kWh and contribute to decreased emissions.

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<sup>19</sup> <http://www.epa.gov/chp/basic/index.html>

## **4.2 Switch to LEDs**

The functionality of LED technology continues to grow and it is quickly becoming widely used. LED lights are highly efficient and now an acceptable alternative to both incandescent and fluorescent lighting<sup>20</sup>. Fluorescent ballasts in the Holland Union Building (HUB), Anita Tuvin Schlechter Auditorium (ATS), Tome Hall, and the Waidner-Spahr Library can be replaced with LED lighting for a savings of 420,000 kWh. In addition, fluorescent lighting in Bosler Hall, the Stern Center, East College, Dana Hall, and Denny Hall can also be replaced with LED lighting for an annual savings of 125,000 kWh.

## **5.0 Buildings**

### **5.1 Renovations to Kaufman Hall**

Kaufman Hall is home to the Environmental Studies and Geology departments as well as the Center for Environmental and Sustainability Education. It was originally the Reeves-Hoffman crystal factory and was renovated and opened as an academic building in August 2006. To address some structural and aesthetic issues, as well as to make it more distinctively sustainable, the building will be undergoing additional renovations in the near future. The use of a variety of sustainable technologies, including photovoltaics, day lighting, and a green roof, will help to craft Kaufman Hall as a building to learn in as well as a building from which to learn<sup>21</sup>. Many of the aspects of the renovation plans will contribute to a decrease in electricity consumption, expected to be around 7 percent or 44,000 kWh.

### **5.2 Smarter Scheduling Between Semesters**

During the summer, the Dickinson College campus is used for a variety of activities, including Dickinson College Summer School, Johns Hopkins University's Center for Talented Youth programs, and the Central Pennsylvania Youth Ballet's Summer Program. By carefully choosing which buildings will remain open and in use during periods when classes are not in session, some buildings can be taken off-line, thereby greatly reducing, or perhaps eliminating, their electricity consumption. We believe that through smarter scheduling, we can reduce 1 percent of the annual electricity usage. This will save over 190,000 kWh.

### **5.3 Small Houses**

Dickinson owns numerous small houses, particularly in the 500 block of West Louther Street, and along Cherry and Reed Streets. These buildings tend to be older and inefficient. The College plans to gradually replace them with more energy-efficient buildings that will be joined to the previously mentioned combined heat and power systems. Thus, the emissions from the houses as they currently stand will be eliminated and any new construction will not have any associated emissions. There will be a reduction in both emissions from electricity and on-campus fuel combustion. Each reduction was calculated separately. The electricity savings is over 80,000 kWh.

## **6.0 On-Campus Production of Renewable Energy**

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<sup>20</sup> [http://www.energystar.gov/index.cfm?c=lighting.pr\\_what\\_are](http://www.energystar.gov/index.cfm?c=lighting.pr_what_are)

<sup>21</sup> The Environmental Studies Senior Seminar in Spring 2009 examined numerous facets of Kaufman's renovation. The final product of their projects provides additional information about the plans. See <http://sites.google.com/site/kaufmanproject/Home>

Even with aggressive conservation and efficiency projects, there will still be electricity consumed on the College's campus. To further mitigate emissions, Dickinson will need to produce its own energy, from renewable sources with no direct emissions.

### **6.1 Solar**

Presently, there is a 60 kW photovoltaic array on the roof of Kaufman Hall that has produced over 138,000 kWh of electricity to date. The potential for additional arrays on other campus buildings depends on the suitability of the roofs, based on orientation, shading from nearby buildings or trees, slope, and size. An analysis by the company Solar Monkey shows that there is potential for enough photovoltaic arrays to produce approximately 1,000,000 kWh of electricity annually.

### **6.2 Wind**

Wind power is another source of renewable energy. Preliminary analysis indicates that the Dickinson College Farm, in Boiling Springs, Pennsylvania, is in a Class 2 wind area<sup>22</sup>. It would be an appropriate site for a small wind project with the potential to produce over 70,000 kWh of electricity annually.

## **7.0 Purchased Electricity Fuel Mix**

### **7.1 Pennsylvania's Alternative Energy Portfolio Standards Act**

In 2004 the Alternative Energy Portfolio Standards Act mandated increases in the percentage of alternative energy distributed by the utility companies<sup>23</sup>. As a result of this act, the fuel mix for our electricity generation will change and decrease our dependence on coal, an emissions-heavy source of electricity. We expect the equivalent of a 6.5 percent decrease in electricity emissions from the increase of renewable energies in PPL's energy portfolio.

### **7.2 Increased Standard for Renewable Energy**

Dickinson plans to go above and beyond the percentages set forth by Pennsylvania law and purchase electricity with a higher percentage of renewable energy. The College will seek out electricity that is at least 15 percent from renewable energy sources.

## **8.0 Additional Conservation Projects**

There are additional projects that will further decrease the consumption of electricity on Dickinson's campus. The Division of Library and Information Services (LIS) is currently implementing multiple strategies to reduce the energy consumption of the campus computers and technology infrastructure. Server virtualization and desktop virtualization are two strategies that lower the amount of electricity

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<sup>22</sup> Renewable Energy Center, St. Francis University,

<sup>23</sup>

<http://www.legis.state.pa.us/CFDOCS/Legis/PN/Public/btCheck.cfm?txtType=PDF&sessYr=2003&sessInd=0&billBody=S&billTyp=B&billNbr=1030&pn=1973>

needed. Electricity is also saved through the use of Software as a Service (SaaS) to run the library's online catalog. Cloud computing, an emerging trend, is also being examined for its use at Dickinson<sup>24</sup>.

Wherever possible, Dickinson purchases Energy Star appliances. To improve the efficiency of motors in campus buildings, the College has installed variable-speed drives in Tome Hall, Rector Science Complex, and the Central Energy Plant. Variable-speed drives will continue to be installed where appropriate, saving approximately 10 percent over traditional motors.

Increasing conservation by the campus community is a priority at Dickinson, and necessary for climate neutrality. The College strives to continuously educate the campus population about energy conserving behaviors through the Green Devil Challenge for students, the Green Devil Agent program for staff and faculty, and training of the Facilities Management staff. In addition, the installation of energy monitors in residence halls can help reduce energy consumption by the students. Similar to the Energy Orbs at Oberlin College<sup>25</sup> and the animated polar bear initiative at Dartmouth College<sup>26</sup>, stoplights that will be placed near the entrance of residence halls (beginning with Davidson-Wilson Hall in Fall 2009) will help students assess their energy use in real-time and make adjustments accordingly. The stoplight will turn red, yellow, or green depending on how the energy use of the residence hall compares to the historical use: red if more energy is being used; green if less energy is being used. This system of feedback can help change students' behaviors.

These projects are important components of energy conservation at Dickinson, but quantifying the exact savings, and thus greenhouse gases avoided, is very difficult, if not impossible. All energy savings will be reflected in the total electricity use of the campus, and can be estimated to be a 5 percent reduction from the FY 2008 electricity use, equivalent to 980,000 kWh.

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<sup>24</sup> Additional explanation can be found in the LIS section of the first Annual Sustainability Report produced by the Center for Environmental and Sustainability Education, expected to be released in Fall 2009.

<sup>25</sup> <http://www.oberlin.edu/news-info/08apr/energyorbs.html>

<sup>26</sup> <http://www.dartmouth.edu/~news/releases/2008/04/17.html>

**Summary—Purchased Electricity Reductions**

Strategy	Description	Potential Annual Mitigation (MTeCO <sub>2</sub> )	Implemented by...	Strategy Focus	Co-benefits	Relative Emissions Reduction (High/Low)	Relative Level of Difficulty (cost/ability to implement) (High/Low)
1.1a Laundry – Quota	Implementing a laundry quota that will limit students to 34 cycles (17 full loads) per semester (electric reduction only)	8	2010	Conservation	Reduce water consumption; reduce spending on electricity	Low	Low
1.1b Laundry – Drying Racks	10 percent of loads meant for dryer are air-dried on provided laundry racks (electric reduction only)	5	2010	Conservation	Reduce spending on electricity; teaching sustainable lifestyle habits	Low	High
1.2a TVs – Eliminating bedroom cable connections	Cable channels are no longer provided in bedrooms, resulting in an estimated 10 percent fewer television sets in rooms	3	2010	Conservation	Reduce spending on electricity	Low	Low



1.2b TVs – Unplugging	Encouraging students to unplug their televisions when not in use (10 percent participation)	<1	2010	Conservation	Teaching sustainable lifestyle habits	Low	High
1.3a Microwaves & Refrigerators – Sharing refrigerators	Encouraging students to use the shared refrigerator in the common room instead of a personal mini-fridge (10 percent participation)	5	2010	Conservation	Teaching sustainable lifestyle habits	Low	High
1.3b Microwaves & Refrigerators – Sharing microwaves	Encouraging students to use the shared microwave in the common room instead of a personal mini-fridge (10 percent participation)	<1	2010	Conservation	Teaching sustainable lifestyle habits	Low	High
1.3c Microwaves & Refrigerators – Unplugging microwaves	Encouraging students to unplug their personal microwaves when not in use (10 percent participation)	<1	2010	Conservation	Teaching sustainable lifestyle habits	Low	High
2.1 Combined	A combined heat	500	2020	Renewable	Reduce spending	High	High

Heat and Power – Rush Campus Phase I	and power system for Morgan, Adams, Drayer, and Witwer Halls (electric reduction only)				on electricity		
2.2 Combined Heat and Power – Rush Campus Phase II	A combined heat and power system for Todd House, Matthews House, the President's House, South College, 34 S. West St., 50 Mooreland Ave., and Reed House (electric reduction only)	700	2030	Renewable	Reduce spending on electricity	High	High
2.3 Combined Heat and Power – Kline	A combined heat and power system for the Kline Center (electric reduction only)	450	2020	Renewable	Reduce spending on electricity	High	High
3.0 Outdoor Lighting	Using solar- powered outdoor light fixtures (Kaufman, Facilities, Children's Center, Kline, Treehouse) and LED bulbs in outdoor light fixtures (John Dickinson and Ben	40	2020	Efficiency, Renewable	Reduce spending on electricity from solar- powered fixtures; LED bulbs don't need to be replaced as often	Low	Low

	Rush campuses)						
4.1 Indoor Lighting – Motion Sensors	Installing an additional 100 motion sensors in buildings across campus	2	2020	Efficiency	Reduce spending on electricity	Low	Low
4.2a Indoor Lighting – LEDs	Using LED lighting in the HUB, ATS, Tome, and library	200	2020	Efficiency	Decreased maintenance as bulbs don't need to be replaced as often	High	Low
4.2b Indoor Lighting – LEDs	Using LED lighting in Bosler, Stern, East, Dana, Denny	60	2020	Efficiency	Decreased maintenance as bulbs don't need to be replaced as often	High	Low
5.1 Buildings - Renovations to Kaufman Hall	Decrease in electricity use in Kaufman Hall as a result of large-scale renovation and greening of the building	20	2020	Efficiency	Reduce spending on electricity	Low	High
5.2 Buildings - Smarter Scheduling Between Semesters	Taking buildings off-line when school isn't in session through more efficient scheduling (1 percent electricity reduction)	100	2010	Conservation	Can help better facilitate maintenance to buildings when unoccupied	High	Low
5.3 Buildings - Small Houses	Replacing small, inefficient houses with energy-	40	2030	Efficiency	Reduce spending on electricity	Low	High

	efficient buildings connected to the combined heat and power plants						
6.1 On-campus Production of Renewable Energy - Solar	Electricity from PV arrays on roofs of campus buildings	500	2030	Renewable	Reduce spending on electricity	High	High
6.2 On-campus Production of Renewable Energy - Wind	Installation of wind turbines at the Dickinson College Farm	40	2030	Renewable	Reduce spending on electricity	Low	High
7.1 Purchased Electricity Fuel Mix - Pennsylvania's Alternative Energy Portfolio Standards Act	Increased percentage of electricity from alternative sources mandated by Pennsylvania state law (expect reduction equivalent to 6.5 percent decrease in electricity consumption)	650	2025	Renewable	Supporting the local renewable energy industry	High	Low
7.2 Purchased Electricity Fuel Mix - Increased Standard for Renewable Energy	Additional increase in percentage of electricity from renewable sources by seeking out electricity that is at least 15	700	2030	Renewable	Supporting the local renewable energy industry	High	High

	percent renewables						
8.0 Additional Conservation Projects	Increasing efficiency of LIS; Energy Star purchasing; variable speed drives; conservation by campus population	500	2020	Conservation, Efficiency	Decreased cost to College	High	High

**Table 2. Summary of electricity mitigation projects.**

## On-campus Fuel Combustion

On-campus fuel combustion includes natural gas and oil, used for heating both water and space. Emissions due to on-campus fuel combustion account for almost one fifth of the College's total emissions in FY 2008. Emissions can vary from year to year depending on the weather. For instance, a winter that is colder and longer than usual will result in increased demand for heating. Emissions over the last six years have fluctuated between 3,000 and 4,000 MT eCO<sub>2</sub> (Figure 6). Some of this variability is due to varying weather patterns throughout the different years.

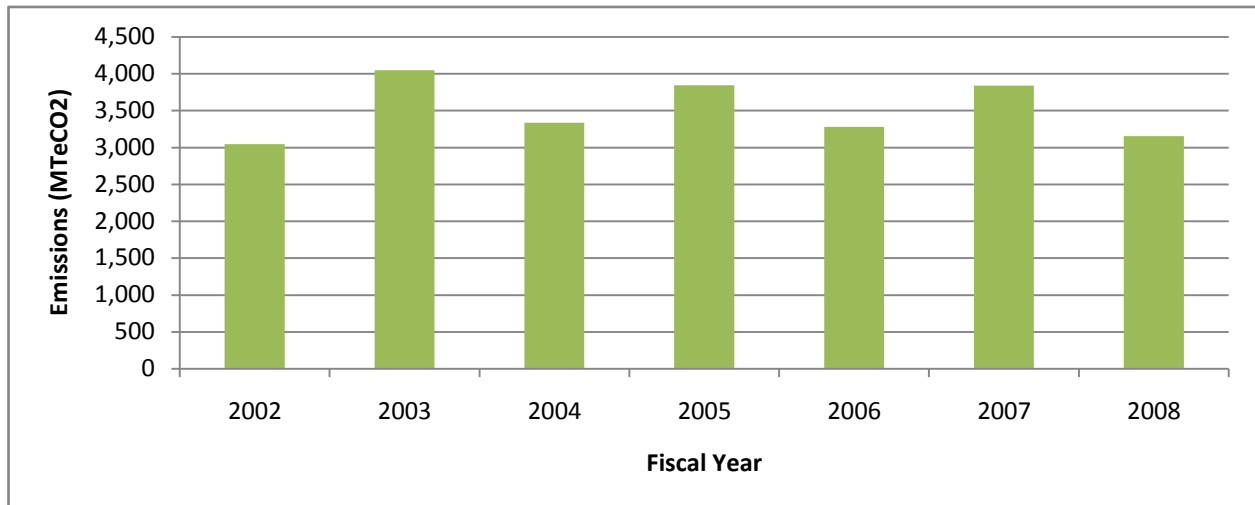


Figure 7. Emissions from on-campus fuel combustion from FY 2002 to FY 2008.

## Strategies

### 1.0 Laundry

The implementation of the laundry quota in August 2009 and encouraging the use of drying racks as an alternative to using a dryer (described in the Electricity section) will also bring about a decrease in emissions from on-campus fuel combustion, as some of the dryers on campus use natural gas. The quota will reduce natural gas consumption by 90,000 cubic feet (cf). The drying racks initiative will save 66,000 cf.

### 2.0 Combined Heat and Power

A combined heat and power system will eliminate the need for heating from natural gas in the buildings served by the system. The proposed systems, Rush Campus Phase I and II and the Kline Center (described in the Electricity section), will also result in a decrease of emissions from on-campus fuel combustion. Phases I and II of the Rush Campus system will save over 9,000,000 cf of natural gas and the Kline Center system will lead to a decrease of 3,000,000 cf.

### 3.0 Central Energy Plant on Waste Vegetable Oil

The Central Energy Plant, located in the basement of the Kaufman Building, serves the heating needs of the majority of campus buildings on the north side of High Street, between Cherry and West Streets. The

Central Energy Plant currently runs on #2 fuel oil and natural gas. Switching to waste vegetable oil as the main fuel source will mitigate emissions, as waste vegetable oil is a waste product and is a carbon-neutral fuel source. The College will be able to reduce emissions from the Central Energy Plant by at least 50 percent with the switch to waste vegetable oil. 15,000,000 cf of natural gas and 3,700 gallons of oil will be saved.

#### **4.0 Switch to Trayless Operations in Dining Hall**

In July 2009 the Dining Hall converted to trayless operations. Eliminating the use of trays results in energy, water, and waste savings. If trays are used, they must be washed, requiring both water and the energy to heat the water. In addition, there is evidence that students take more food than they can eat when using trays<sup>27</sup>. Without trays, students are more likely to take only what they will consume and waste less food.

By not having to heat the water to wash the trays, converting to trayless operations will result in a decrease of over 200,000 cf of natural gas.

#### **5.0 Buildings**

##### **5.1 Renovations to Kaufman Hall**

The renovations to Kaufman Hall (described in the Electricity section) will also result in reductions in the consumption of natural gas and oil for heating. It is predicted that natural gas use by Kaufman will decrease by 18 percent, resulting in a savings of 190,000 cf.

##### **5.2 Small Houses**

Replacing some small houses with energy-efficient new construction (as mentioned in the Electricity section) will also lead to a decrease in emissions from on-campus fuel combustion. There will be a decrease of 1,500 gallons of oil and 1,000,000 cf of natural gas.

##### **5.3 Solar Hot Water**

The demand for hot water in residential spaces contributes to emissions from on-campus fuel combustion. Utilizing the energy from the sun to heat water avoids these emissions. Solar-hot water systems will be placed near the residential halls of the Upper and Lower Quads to help reduce emissions from domestic hot water production. By decreasing demand for water heated by natural gas by 50 percent, over 700,000 cf of natural gas can be saved.

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<http://www.aramarkhighered.com/pdfs/articles/ARAMARK%20Trayless%20Dining%20July%202008%20FINAL.PDF>

**Summary—On-Campus Fuel Combustion Reductions**

Strategy	Description	Potential Annual Mitigation (MTeCO <sub>2</sub> )	Implemented by...	Strategy Focus	Co-benefits	Relative Carbon Reduction (High/Low)	Relative Level of Difficulty (cost/ability to implement) (High/Low)
1.1a Laundry –Quota	Implementing a laundry quota that will limit students to 34 cycles (17 full loads) per semester (natural gas reduction only)	5	2010	Conservation	Reduce water consumption; reduce spending on fuel	Low	Low
1.1b Laundry – Drying Racks	10 percent of loads meant for dryer are air-dried on provided laundry racks (natural gas reduction only)	4	2010	Conservation	Reduce spending on fuel; teaching sustainable lifestyle habits	Low	High
2.1 Combined Heat and Power – Rush Campus Phase I	A combined heat and power system for Morgan, Adams, Drayer, and Witwer Halls (natural gas reduction only)	400	2020	Renewable	Reduce spending on fuel	High	High
2.2 Combined Heat and Power – Rush Campus Phase II	A combined heat and power system for Todd House, Matthews House, the President's House, South College, 34 S. West St., 50 Mooreland Ave., and Reed House (natural gas reduction only)	100	2030	Renewable	Reduce spending on fuel	High	High



	only)						
2.3 Combined Heat and Power – Kline	A combined heat and power system for the Kline Center (natural gas reduction only)	200	2020	Renewable	Reduce spending on fuel	High	High
3.0 Central Energy Plant on WVO	Using waste vegetable oil to power the Central Energy Plant located in Kaufman	850	2020	Renewable		High	Low
4.0 Trayless in Dining Hall	Eliminating the use of trays in the Dining Hall, reducing the need for hot water to wash the trays	10	2010	Conservation	Reduce food waste; reduce water consumption	Low	Low
5.1 Buildings - Renovations to Kaufman Hall	Decrease in electricity use in Kaufman Hall as a result of large-scale renovation and greening of the building (natural gas/oil reduction only)	10	2020	Efficiency	Reduce spending on fuel	Low	High
5.2 Buildings - Small Houses	Replacing small, inefficient houses with energy-efficient buildings connected to the combined heat and power (natural gas/oil reduction only)	70	2030	Efficiency	Reduce spending on fuel	Low	High
5.3 Buildings - Solar Hot Water	Using solar hot water in the Upper and Lower Quads to reduce demand for hot water using fossil fuels by 50 percent	40	2020	Conservation	Reduce spending on fuel	Low	High

Table 3. Summary of on-campus fuel combustion mitigation projects.

## Transportation

The transportation category consists of faculty and staff commuting, fleet vehicle use, air travel by students studying abroad, and air travel paid for by the College for employee travel. In FY 2008, emissions from transportation accounted for almost 20 percent of the total emissions. Approximately half of these emissions stem from faculty and staff commuting. Over one-third of these emissions are the result of students studying abroad. Global education is an integral part of the Dickinson experience and central to its core mission, and the College does not anticipate a decrease in the number of students studying abroad. Thus, these emissions will have to be offset.

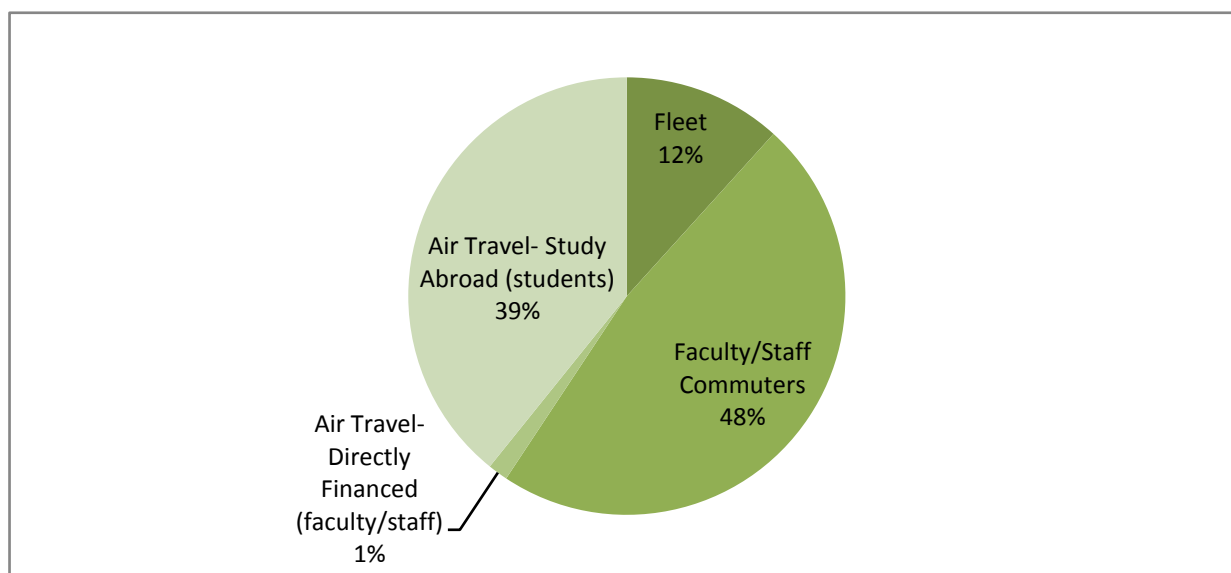


Figure 8. Breakdown of transportation emissions in FY 2008.

There is not currently a wide offering of public transportation options in Carlisle. There were initial plans for a regional rail line, Corridor One, to connect Carlisle and Harrisburg. The proposal is not supported by Cumberland County (where Carlisle is located) but the College remains hopeful that the Corridor One project will eventually become feasible in the county. A regional rail line like Corridor One would help faculty and staff commute and thus reduce emissions. It would also be very helpful for students who need to travel, as Harrisburg has a bus and train station and an airport.

## Strategies

### 1.0 Staff and Faculty Commuting

Staff and faculty commuting is considered a Scope 3 emission, the category of emissions most removed from the College's direct control. However, Dickinson plans to implement a number of strategies to help reduce the emissions associated with the commuting of its employees.

#### 1.1 CO<sub>2</sub>-free Commuting

Carlisle, Pennsylvania, home of Dickinson College, is a small town that is pedestrian- and cyclist-friendly. In fact, the Borough of Carlisle received a grant in June 2009 to implement a "road diet" for High Street,

a main street in the town that runs through the center of Dickinson's campus<sup>28</sup>. Dickinson played a key role by contributing over \$50,000 towards traffic studies of High Street. Plans include reducing the lanes of traffic from four to two, and adding two bike lanes. Over 400 employees live in Carlisle (in zip codes 17013 and 17015), more than half of the total number of employees. Through incentives and programs with the Human Resources Office, such as a Guaranteed Ride Home program and coupons for the local bike store, College employees that live close enough to walk or bike to work will be more inclined to do so, thereby lowering the emissions due to commuting. If 10 percent of employees that live in the Carlisle zip codes commuted in a CO<sub>2</sub>-free way, it would save over 4,000 gallons of gas annually.

## **1.2 Carpooling**

Nearly 200 employees live in zip codes outside of Carlisle with at least 5 other College employees. There is great potential for carpooling among College employees. Creating a formal carpooling program and providing incentives, such as a Guaranteed Ride Home program and reserved parking spaces for carpools, will further promote carpooling. If 10 percent of the people living in zip codes with at least 5 other College employees joined a 2-person carpool, over 3,000 gallons of gas could be saved.

## **1.3 Increased Fuel Efficiency**

Recent legislation will raise the minimum fuel efficiencies of American vehicles<sup>29</sup>. On average, fuel efficiencies will increase by approximately 10 miles per gallon. As these more efficient vehicles become mandatory beginning in 2016, the College expects a subsequent gradual decrease in emissions attributable to faculty and staff commuting. We expect a decrease of 25 percent of fuel consumption by 2020 and an additional 25 percent decrease by 2030. A 25 percent decrease in overall fuel consumption of commuters results in a savings of over 38,000 gallons of gas.

## **2.0 Decreased Fuel Consumption of Fleet Vehicles**

Dickinson has two fleets of vehicles. The Department of Public Safety operates a fleet of vehicles (gasoline-powered cars and minivans) available for use by student organizations and academic departments. There are currently 6 hybrid cars in the 35-vehicle fleet. In the coming years, the College plans to purchase additional hybrid vehicles to replace the gasoline-powered ones. Hybrid cars use significantly less gasoline, which will contribute to a decrease in emissions.

Facilities Management also has a fleet of vehicles it uses in its day-to-day operations. The College plans to replace some of these vehicles with electric cars that would be charged by photovoltaics, making them climate neutral. In addition, whenever possible, diesel vehicles will be fueled by the biodiesel produced in-house from waste vegetable oil.

Furthermore, as the fuel efficiencies of vehicles increase in coming years, the overall fuel consumption of the fleets will show a corresponding decrease.

Given the increased efficiencies of the vehicles in the College and Facilities Management fleets, Dickinson expects a decrease of 25 percent of fuel consumption by 2020 and an additional 25 percent

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<sup>28</sup> <http://www.dickinson.edu/news/nrshow.cfm?1523>

<sup>29</sup> <http://www.nhtsa.dot.gov/portal/site/nhtsa/menuitem.43ac99aefa80569eea57529cdba046a0/>

decrease by 2030. A 25 percent decrease in overall fuel consumption of the fleet is equivalent to over 7,000 gallons of gas.

**Summary—Transportation Reductions**

Strategy	Description	Potential Annual Mitigation (MTeCO <sub>2</sub> )	Implemented by...	Strategy Focus	Co-benefits	Relative Carbon Reduction (High/Low)	Relative Level of Difficulty (cost/ability to implement) (High/Low)
1.1 Staff and Faculty Commuting – CO <sub>2</sub> -free commuting	10 percent of the employees in Carlisle (17013, 17015) commute to work in a CO <sub>2</sub> -free way (walking, biking)	40	2020	Conservation	Health benefits for employees; decreased air pollution in Carlisle	Low	High
1.2 Staff and Faculty Commuting – Carpooling	10 percent of the employees living in zip codes with at least 5 employees carpool to work in 2-person carpools	30	2020	Conservation	Decreased air pollution	Low	High
1.3 Staff and Faculty Commuting – Increased Fuel Efficiency	10 mpg average increase in fuel efficiencies of vehicles starting in 2016; 15 percent of employees buy a more fuel efficient vehicle by 2030	50	2030	Efficiency		Low	Low
2.0a Decreased	25 percent	60	2020	Efficiency	Reduce	Low	Low

Fuel Consumption of Fleet Vehicles – by 2020	decrease in fuel consumption of fleet vehicles through replacing with hybrids and electric vehicles (with solar charging station), and increasing fuel efficiencies				spending on fuel		
2.0b Decreased Fuel Consumption of Fleet Vehicles – by 2030	25 percent decrease in fuel consumption of fleet vehicles through replacing with hybrids and electric vehicles (with solar charging station), and increasing fuel efficiencies	60	2030	Efficiency	Reduce spending on fuel	Low	Low

Table 4. Summary of transportation mitigation projects.

## Offsets

After implementing as many mitigation strategies as possible, there will be some remaining emissions that must be offset. While offsets will be a necessary component of climate neutrality, Dickinson recognizes that they are secondary to mitigation projects that directly decrease emissions. The College is committed to using carbon offsets that produce legitimate emissions reductions. Dickinson will evaluate potential offsets on a variety of criteria, including many qualities considered by the ACUPCC Voluntary Carbon Offset Protocol<sup>30</sup>, such as additionality, transparency, measurability, permanence, validity, not being double counted, and the ability to be retired<sup>31</sup>.

As part of Dickinson's plan for climate neutrality, offsets will not exceed 75 percent of the total campus emissions when the College initially reaches climate neutrality in 2020. By 2025, the proportion of offsets will decrease to 50 percent, and by 2030, account for only 25 percent of the total emissions.

## Renewable Energy Certificates

Dickinson College began purchasing renewable energy certificates (RECs) in 2002, buying RECs equal to 9.2 percent of the total electricity consumption of the campus. In 2005, the percentage increased to 12.5 percent, and again in 2007 to 50 percent. Beginning September 1, 2009, the College will be buying 18 million kWh of wind energy annually, equal to 100 percent of the total electricity consumption. This will offset approximately 60 percent of the College's total annual emissions.

## Composting and Recycling

Composting and recycling both divert waste from the landfill, and are considered offsets in version 5 of the Clean Air-Cool Planet emissions calculator. Dickinson has a robust composting program that sends all organic waste from the Dining Hall to the College Farm. The installation of a pulper in 2007 allowed for a significant increase in the volume of waste sent as compost. The College intends to continue this program and monitor its success.

Recycling has been a longtime facet of Dickinson's waste management program. We are constantly striving to increase the diversion rate, through both national programs, like ReycleMania, and programs unique to Dickinson, such as the Green Devil Challenge.

Dickinson also strives to reduce waste sent to the landfill through the annual U-Turn Yard Sale, an event cosponsored by Dickinson College and the Carlisle United Way. At the end of the spring semester, students can donate items they do not have space to take home or no longer want. These items are then sold in June in a community-wide yard sale; all proceeds go to the United Way. In 2009, 3 tractor trailers worth of items were diverted from the landfill to the U-Turn Yard Sale, and over \$14,000 was raised for the United Way.

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<sup>30</sup> <http://www.presidentsclimatecommitment.org/offsetprotocol.php>

<sup>31</sup> All terms are explained in detail in the Protocol.

### **Local Offsets**

The College feels strongly that offsets should be as local as possible. Dickinson is investigating the possibility of starting a home efficiency offset project, potentially overseen by an AmeriCorps Vista, which would help Carlisle residents with upgrades to improve the efficiency of their houses, such as installing more efficient windows, adding insulation, and using compact fluorescent bulbs. The energy that these homes save due to the changes implemented as part of the project could count as an offset to the College. It would provide internship opportunities for students, as well as financial assistance for Carlisle residents that may not be otherwise be able to make these efficiency upgrades. This would provide another connection between Dickinson and the Carlisle community, as well great experience for students.

## **V. Taking Action**

This Action Plan is intended to not only fulfill Dickinson's obligation through the Presidents' Climate Commitment, but also to inform and empower the campus community as the College begins its journey towards climate neutrality. In an effort to best assist students, staff, and faculty in becoming involved and ultimately contributing to Dickinson's quest for neutrality, the following sections outline actions students and faculty and staff can take to reduce emissions.

### **Students**

- Reduce electricity consumption—turn off lights and electronics when not in use.
- Use daylight whenever possible instead of turning on a light.
- Reduce phantom draw—unplug electronics like computers, TVs, and microwaves when not in use.
- Turn your computer off when leaving your room. Adjust the settings to put the computer into sleep or hibernate mode automatically after a period of non-use.
- In the winter, put on an extra sweatshirt or blanket instead of adjusting the thermostat.

*More?*

### **Faculty/Staff**

- Walk or bike to work, if and when possible.
- Carpool to work, if and when possible.
- Turn off lights and electronics when not in use.

*More?*

## **VI. Educational, Research, and Community Outreach Efforts**

Working toward climate neutrality, the focus of this Climate Change Action Plan, is just one dimension of Dickinson College's commitment to sustainability. We are also taking action in the areas of education, research, campus culture, and community engagement. Actions in these areas, summarized below, contribute to a coherent, multifaceted, College-wide approach to educating for a sustainable society.



## Education

Dickinson College launched a new curricular initiative in 2008 to make study of the environment and sustainability a defining characteristic of a Dickinson education. The initiative is building on Dickinson's history of excellence and leadership in environmental studies and science, global education, active learning pedagogies, student engagement in research, and co-curricular programs that connect students with the local environment and community.

With the support of a \$1.4 million grant from the Andrew W. Mellon Foundation, matched by more than \$1.6 million from Dickinson College, sustainability is being integrated across the curriculum. The grant and matching funds are being used to support a new Center for Environmental and Sustainability Education (CESE), enhance our Environmental Studies program with the addition of a new tenure track faculty position to teach environmental health, and provide financial support to faculty for sustainability related curriculum development and research. We are also strengthening GIS education and scholarship, a critical tool for studying sustainability, by creating a new position for a GIS Specialist and a visiting scholar program for spatial analysis of sustainability,

CESE, staffed by a Director, Sustainability Education Coordinator, and two student interns, opened in September 2008 to assist the faculty with infusing and enhancing sustainability content throughout the curriculum. The Center is also working with the Office of Campus Operations and other offices and programs to offer experiential education through the *Dickinson Living Laboratory for Sustainability*. The Living Laboratory is connecting operational, co-curricular, and community outreach efforts with the curriculum to create opportunities for students to learn about sustainability through direct experience. Examples include involvement of students in campus building renovations, the climate change action plan, sustainable agriculture at the College Farm, and college-community partnerships to protect local watersheds.

The curriculum currently includes more than 140 courses that explore environmental, social and/or economic dimensions of sustainability. These are distributed across 5 arts and humanities departments, 13 social science departments, and 6 natural science departments. Many of the courses focus intensively on problems of sustainability, while others touch on sustainability themes to varying degrees as they relate to other problems and fields of study.

Three courses at Dickinson focus entirely on climate change. *Global Climate Change*, offered in the Geology department, examines atmosphere, land, ocean, and biosphere processes and interactions and their effects on climate of the distant past as well in the postindustrial era. *Climate Change Causes, Consequences, and Responses*, offered by the Environmental Studies department, focuses on social and economic drivers of climate change, ecological and human consequences, and adaptation and mitigation policies and measures. In Fall 2009, students in the new interdisciplinary course *From Kyoto to Copenhagen* will study the climate change negotiations and attend the 15<sup>th</sup> Conference of the Parties to the United Nations Framework Convention on Climate Change to conduct a team research project. In addition, climate change is a topic of study in several other courses offered in the departments of biology, economics, environmental studies, geology, international business, philosophy, and physics.

*Go Green, Challenges and Opportunities* is a class offered in Fall 2009 by the International Business and Management (IB&M) department and co-taught by an IB&M professor and the Interim Vice President of Campus Operations. In studying the changing attitudes and actions of businesses and organizations as they address sustainability, the class intends to act as a consulting firm for the College as Dickinson

continues to implement sustainable initiatives. The class also provided concrete feedback about this Action Plan.

The College is committed to increasing the number of sustainability focused and sustainability related courses. One mechanism by which this is being promoted is the Valley and Ridge Project, an interdisciplinary faculty study group for place based teaching about sustainability. Participating faculty members work together to explore ideas for new courses, new content to add to existing courses, and use of active and place-based learning pedagogies. Sixteen courses have been created or significantly revised thus far by Valley and Ridge participants. Expansion and enhancement of sustainability teaching and research are also being facilitated by a new Environmental Education Fund (EEF), which makes small grants to faculty members for curriculum development, professional development, and student-faculty research.

## Research

Dickinson College faculty members are active contributors to environmental and sustainability research and scholarship. Students participate in much of this research, often co-authoring papers and presenting papers at academic conferences. Following are a few selected examples of environment and sustainability research at Dickinson.

- *Responses of marine organisms to ocean acidification.* Tom Arnold, Professor of Biology, is beginning a new research effort on the effects of ocean acidification on marine ecosystems using a free-ocean-carbon-enrichment system that he constructed. As the project evolves, students will be involved in the research.
- *Three Mile Island Emergency.* Professors Daniel Bechtel (Religion), Julius Kassovic and Melissa Kassovic (Anthropology) and Lonna Malmshemer (American Studies), working with a student research team, interviewed more than 400 people in the months following the 1979 accident at the Three Mile Island nuclear power plant to study and document their reactions to the emergency. The taped interviews and other materials are archived on a website that continues to be heavily used by researchers, students, the media, and the general public. It can be accessed at [www.threemileisland.org](http://www.threemileisland.org).
- *Water quality, watersheds, and aquatic ecosystems.* Candie Wilderman, Professor of Environmental Studies, Julie Vastine and Jinnie Woodward, directors of Dickinson's Alliance for Aquatic Resource Monitoring (ALLARM), and student workers at ALLARM conduct extensive research on freshwater systems and water quality in the Chesapeake watershed in partnership with community watershed associations. The project applies a community-based research model developed by Professor Wilderman that is known nationally.
- *Deer browsing, species diversity, and forest dynamics and regeneration.* Biology professors Carol Loeffler and Brian Pedersen have conducted research with students over many years on the impacts of an uncontrolled deer population on the deciduous forest system of nearby Reineman Wildlife Sanctuary. The research has resulted in numerous papers and conference presentations with students at annual meetings of the Ecological Society of America and the Pennsylvania Academy of Sciences, as well as other conferences.
- *Solar vehicle conversion.* Samuel Wheeler '10 and Matt Steiman, Assistant Farm Manager, are converting an electric vehicle to run on solar power by mounting a solar photovoltaic panel on the vehicle's roof. They will test the vehicle's viability and reliability as a utility vehicle for use on the College Farm. The project is supported by an EEF grant.

- *Interactions of Birds, Reptiles, Amphibians and Humans in the Environment*. Atandi Anyona '10, Scott Boback, Professor of Biology, and Gene Wingert, Adjunct Professor of Environmental Studies, are using an EEF grant to set up long-term research projects at the College Farm to study bird, reptile, and amphibian populations and their interactions with people.
- *Ecocriticism and American Nature Writing*. Professor Ashton Nichols explores literary and scientific texts from 1750 to 1859 to trace current environmental concerns to their sources in earlier ideas about relations between human beings and the natural world. He is currently working on an invited chapter for the first textbook for use in China on nature writing.
- *Climate change in the Developing World*. Neil Leary, CESE Director, conducts research on climate change vulnerability and adaptation in Africa, Asia, and South America. He was a leader of the 2001 Third Assessment Report of the Intergovernmental Panel on Climate Change (IPCC), was a member of the IPCC Editorial Review Board for the 2007 Fourth Assessment Report, and is helping to plan the IPCC's Fifth Assessment Report.

## Campus Culture

A vibrant campus culture for sustainability has evolved and strengthened among the students, faculty, staff, and administrators of Dickinson College. This culture is increasingly evidenced by our personal behaviors, our chosen areas of study, teaching, and research, active student organizations, and collaborative efforts to reduce our ecological footprint. It is evidenced by the creation of community on campus, promotion of social justice, and the development of institutional structures to support our sustainability goals. Ecological sustainability, prudent use of resources, environmental accountability, service to society, global citizenship, diversity, equal opportunity, and inclusive, transparent, and democratic governance are set as goals in Dickinson's Strategic Plan and Campus Master Plan.

The President of Dickinson College, William Durden, has firmly, unambiguously, and publicly established sustainability as a priority for the College with the signing of the American College and University President's Climate Commitment, the launching of the curricular initiative for sustainability, and the incorporation of sustainability in the Strategic Plan and Master Campus Plan. The newly formed President's Commission on Environmental Sustainability, composed of senior officers of the college, faculty, staff, and students, oversees strategic level planning for sustainability. Dickinson SAVES provides an open forum in which members of the Dickinson community come together biweekly to share information and collaborate in the promotion of sustainability. The Office of Campus Sustainability and CESE provide administrative support for sustainability efforts.

The College has adopted a 'triple bottom line' policy for managing its investments and has made its portfolio and investment practices more transparent as a result of the activities of the Socially Responsible Investment (SRI) Discussion Group. The SRI group was created in response to student interest in college investment policies regarding Darfur, the environment, and other social issues. Members of student groups EarthNow and Students Interested in Sustainable Agriculture (SISA), student residents of the Center for Sustainable Living (the Treehouse), and student interns in the Office of Campus Sustainability and CESE raise awareness of sustainability problems on campus by organizing and participating in a variety of events. These include the Green Devil Challenge, Recyclemania, Trash on the Plaza, Focus the Nation, Earthfest, and 'Soup and Bread' nights. A residential learning community for students in First Year Seminars with environment and sustainability themes is entering its second year in 2009/2010. Environment and sustainability topics are the focus of numerous public lectures and

seminars sponsored by the Clarke Forum, the Environmental Studies, Geology and other departments, and CESE. Sustainability is now a prominent part of orientation of new students, faculty, and staff.

## Community Engagement

Since its founding in 1783, the mission of Dickinson College has been to prepare young people, through a useful education in the liberal arts, for engaged lives of citizenship and leadership in service to society. In the 1980s we embarked on a distinctly global interpretation of our responsibility to society and approach to education. These principles have made engagement with community, locally and globally, an integral part of the College. Our engagements with community help to advance environmental, social, and economic goals that underlie sustainable living and sustainable development.

ALLARM, created more than 20 years ago by Professor Wilderman, supports community watershed organizations with research, training, and technical support for monitoring and protecting water quality. Over 2,500 community volunteers have benefited from working with ALLARM, a partnership that has helped to protect more than 10,000 square miles of watersheds in Pennsylvania.

Dickinson College initiated and helped fund a traffic study for the Borough of Carlisle that sparked more than a year of discussion in the community. What emerged was a plan for a “Road Diet” to calm traffic and make Carlisle a more pedestrian and bike friendly community. The Borough was recently awarded a \$2.8 million grant from the Pennsylvania Department of Transportation to implement the Road Diet. Work on the diet will begin in the coming year. The College is also working with the Borough and others to promote development of a regional rail system.

The Dickinson College Farm grows produce for the College’s dining services, a Community Supported Agriculture (CSA) program with a 60-family membership, and a community food bank. The farm is a community resource for learning about sustainable farming practices, creation and protection of wildlife habitat, and applications of renewable energy technologies. Numerous school groups and other organizations visit the farm to learn about environmentally sound practices for ‘green’ living. The College Farm played a critical role in launching a weekly farmers market in the central square of Carlisle, hosts popular and well-attended annual local food dinner for the community, and is an active participant in the Pennsylvania Association for Sustainable Agriculture (PASA).

Dickinson students learn the importance of, and skills for, working in communities through service learning courses, community-based research courses, and integrated multi-course semester long programs called Mosaics, which engage students in an intensive field research activity in and with a community. These programs are planned in partnership with community organizations and designed to provide benefits for the community. Examples of problems that have been the focus of service learning with communities include storm water runoff, watershed protection, sustainable business strategies, women’s rights, needs of migrant communities, natural hazards planning, and sustainable agriculture.

Dickinson is also working to build community with other colleges and universities in our region. Dickinson is an active member of the National Council for Science and the Environment (NCSE), and CESE Director Neil Leary participates in a NCSE project to develop climate change curricula for US colleges and universities. In August 2008 Dickinson hosted the first Sustainable Energy Fund *Solar Scholars Conference*, an event that brought over 100 faculty, students and administrators from twenty schools to learn about solar technologies and discuss their integration into college curricula. In April 2009

Dickinson organized and hosted the first Intercollegiate Biodiesel Conference, attended by representatives of more than two-dozen schools and members of the biodiesel industry. And in May 2009 we hosted the Sustainability Coordinators Conference in partnership with the Pennsylvania Environmental Resource Consortium, a statewide association of colleges and universities.

## VII. Prioritization and Financing

Dickinson College has committed to climate neutrality and is dedicated to achieving this goal. Due to both time and monetary constraints, the College cannot immediately implement all mitigation projects. Cost will be one of the factors that will determine the order in which projects are executed. As always, the College will use fiscal responsibility when deciding among the projects.

The exact cost and return-on-investment of each mitigation strategy were not calculated for this plan. In many cases, the calculations were overly complex, data was often unavailable, and cost can be considered secondary to the amount of eCO<sub>2</sub> that can be mitigated by each project. Many of the projects the College foresees implementing before 2020 are lower-cost projects. Projects with a higher upfront cost are planned for the years after 2020. This timeline further negates the logic to do financial calculations now, as many variables will change before these projects are implemented. It also gives the College sufficient time to financially plan for any projects with significant up-front cost. In addition, most projects that reduce emissions are also reducing energy consumption, which correlates with decreased operating costs. It is also important to keep in mind that many projects relate to replacing outdated equipment with more efficient models. There is already money in the budget set aside for facilities and equipment maintenance, so not all of projects presented in the Plan need to be financed with money beyond the current budget. Furthermore, the College is already purchasing the bulk of the offsets necessary for the 2020 climate neutrality date. These offsets, in the form of wind energy RECs, are paid for through the Facilities Management operation budget.

All projects presented in this plan are ones the College intends to implement in the next 20 years and are included in our projections in achieving climate neutrality by 2020. However, no specific order for putting them into action is included in the plan, to allow for future flexibility. In the summary tables of the mitigation strategies, a benchmark year for completion of the project is included. This year is only the best estimate for when a project could potentially be fully executed. The prioritization included below does not take that year into account and is simply meant to guide future decisions of the College when considering a number of mitigation projects.

To aid in the prioritization of projects, a four-category approach is taken (Table 5)<sup>32</sup>. All mitigation strategies are classified based on two characteristics: the amount of greenhouse gases they mitigate (a low amount or a high amount), and the relative level of difficulty (low difficulty or high difficulty, based on relative cost and/or ease of implementation). These categories are qualitative, rather than quantitative. Instead of a providing specific order of projects, the categories roughly group the projects.

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<sup>32</sup> Inspired by the state of Maryland's Climate Action Plan, <http://www.mde.state.md.us/assets/document/Air/ClimateChange/Chapter4.pdf>

	<b>Lower Difficulty (Low Cost/Easier to Implement)</b>	<b>Higher Difficulty (High Cost/Harder to Implement)</b>
<b>Higher Emissions Reduction</b>	Priority 1	Priority 3
<b>Lower Emissions Reduction</b>	Priority 2	Priority 4

Table 5. The four categories for prioritization of mitigation projects.

The strategies presented in this plan have been categorized in Table 6.

## DRAFT #2

	<b>Lower Difficulty (Low Cost/Easier to Implement)</b>	<b>Higher Difficulty (High Cost/Harder to Implement)</b>
<b>Higher Emissions Reduction</b>	PE 4.2 Indoor Lighting – LEDs PE 5.2 Buildings – Smarter Scheduling Between Semesters PE 7.1 Purchased Electricity Fuel Mix – Pennsylvania’s Alternative Energy Portfolio Standards Act	PE 2.1 Combined Heat and Power – Rush Campus Phase I PE 2.2 Combined Heat and Power – Rush Campus Phase II PE 2.3 Combined Heat and Power – Kline PE 6.1 On-campus Production of Renewable Energy - Solar PE 8.0 Additional Conservation Projects OC 2.1 Combined Heat and Power – Rush Campus Phase I OC 2.2 Combined Heat and Power – Rush Campus Phase II OC 2.3 Combined Heat and Power - Kline
<b>Lower Emissions Reduction</b>	PE 1.1a Laundry - Quota PE 1.2a TVs – Eliminating bedroom cable connections PE 3.0 Outdoor Lighting PE 4.1 Indoor Lighting – Motion sensors OC 1.1a Laundry – Quota OC 4.0 Trayless in Dining Hall TR 1.3 Staff and Faculty Commuting – Increased Fuel Efficiency TR 2.0a Decreased Fuel Consumption of Fleet Vehicles – By 2020 TR 2.0b Decreased Fuel Consumption of Fleet Vehicles – By 2030	PE 1.1b Laundry – Drying Racks PE 1.2b TVs – Unplugging PE 1.3a Microwaves and Refrigerators – Sharing refrigerators PE 1.3b Microwaves and Refrigerators – Sharing microwaves PE 1.3c Microwaves and Refrigerators – Unplugging microwaves PE 5.1 Buildings – Renovations to Kaufman Hall PE 5.3 Buildings – Small Houses PE 6.2 On-campus Production of Renewable Energy - Wind OC 1.1b Laundry – Drying racks OC 5.1 Buildings – Renovations to Kaufman Hall OC 5.2 Buildings – Small Houses OC 5.3 Buildings – Solar Hot Water TR 1.1 Staff and Faculty Commuting – CO2-free commuting TR 1.2 Staff and Faculty Commuting – Carpooling

**Table 6. Mitigation strategies separated into four prioritization categories. Abbreviations: PE = Purchased Electricity, OC = On-campus fuel combustion, TR = Transportation**

## VIII. Tracking Progress and Future Steps

Dickinson's Greenhouse Gas Emissions Inventory serves as a tool to track the College's progress towards climate neutrality. The Office of Campus Sustainability is responsible for updating Dickinson's Greenhouse Gas Emissions Inventory each year and will make the results of the inventory publically available. The Climate Change Action Plan sets forth a goal for climate neutrality that is challenging yet achievable. Dickinson fully intends to adhere to the goals set forth in this plan. At the same time, the College anticipates changes in technology over the next two decades. The Climate Change Action Plan includes a certain amount of flexibility to account for this. Dickinson will work diligently to stay abreast of any new developments. This Action Plan will be reviewed annually and any necessary revisions will be made.

Beyond the scope of this plan, Dickinson would like to explore additional projects to reduce emissions. These projects include: expanding upon the production of wind power, utilizing geothermal power, using more electric cars, and exploring hydrogen vehicles. The College intends to employ new technologies as they become available and practical.

## IX. Conclusion

As a signatory to the American College and University Presidents' Climate Commitment and in the interest of combating global climate change, Dickinson College is committed to climate neutrality by 2020, reducing emissions 25 percent from 2008 levels. Dickinson will continue to reduce emissions to 50 percent below 2008 levels by 2025, and 75 percent by 2030.

The Climate Change Action Plan was presented to various groups on campus for their review and approval. The Plan was presented to and reviewed by the President and the President's Staff on August 25, 2009. The President's Commission on Environmental Sustainability discussed the Plan on September 7, 2009 and recommends adoption of the Plan, with some minor changes. Dickinson SAVES (Society Advocating Environmental Sustainability) reviewed the plan at the first meeting of the semester on September 8, 2009 and none of the members present had any objections to the adoption of the Plan by the College. The Plan was also presented to the International Business and Management class *Go Green, Challenges and Opportunities*. The members of the class also provided comments and feedback. In addition, it was reviewed and supported by the Student Senate Cabinet on September 9, 2009 (approval from the entire Student Senate was not possible before the September 15 deadline as elections were not yet completed). The Planning and Budget Committee of the College reviewed the Plan on September 10, 2009 and also supports the adoption of the Plan.

In addition, a presentation and comment meeting open to the entire campus community was held on September 3, 2009. The Plan was also available on the College's website beginning that day for review by any member of the campus community. Comments and suggestions on the Plan could also be made online. Comments from all groups were taken into consideration. As this plan spans two decades, there is a need to create a plan with flexibility. This Action Plan will be reviewed annually and changes made as needed. Input from the groups will continue to be sought as future revisions are made.



Achieving climate neutrality is not just beneficial for the environment, but provides an invaluable educational experience for the students, faculty, and staff of the College. Dickinson has set a timeline for climate neutrality that is demanding yet realistic. Global climate change demands immediate action. Dickinson College is prepared to act as quickly as possible to mitigate its greenhouse gas emissions to reduce its contributions to global warming.

## **X. Acknowledgements**

The Office of Campus Sustainability would like to thank the members of the Climate Change Action Plan Working Group for their time, expertise, and commitment to such an important issue. Special thanks to Kate Consroe '09, Sustainability Coordinator 2009-2010, who drafted the Action Plan and dedicated a great deal of time and energy.

In addition, the staff of Facilities Management generously shared their technical knowledge and was instrumental in the analysis of the mitigation strategies. Also, thank you to the numerous Summer Sustainability Interns and Sustainability Office Interns who worked on the plan.

Most importantly, the Office of Campus Sustainability and the entire campus community commends President William Durden '71 for taking strong leadership on the issue of climate change and committing Dickinson College to the worthy goal of climate neutrality.

## **Appendix A: Emissions Factors Used in Reduction Calculations**

### Electricity

1 kWh = .0005 MTeCO<sub>2</sub>

### #1 - #4 Oil

1 gallon = .010087 MTeCO<sub>2</sub>

### Natural Gas

1 MMBtu = .052944 MTeCO<sub>2</sub>, where 1 cubic foot (cf) = 1027 Btu

### Diesel Fuel

1 gallon = .010083 MTeCO<sub>2</sub>

### Gasoline Fuel

1 gallon = .008935 MTeCO<sub>2</sub>