Climate Action Plan

Bennington College

Fall 2011

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1. Introduction

As part of its commitment to sustainability, Bennington College has taken the first steps toward climate neutrality by developing this Climate Action Plan. This plan will help Bennington fulfill one of the main requirements of the American College & University Presidents Climate Commitment (ACUPCC) in which colleges and universities set climate neutrality as a long-term climate goal.

The ACUPCC is a high-visibility effort by a network of colleges and universities to address global climate change. Participating institutions have committed to eliminate net greenhouse gas emissions from specified campus operations and to promote research and educational efforts to equip society to re-stabilize the earth's climate. Its mission is to accelerate progress toward climate neutrality and sustainability by empowering the higher education sector to educate students, create solutions, and provide leadership by example for the rest of society.

1.1. ACUPCC Commitments

The ACUPCC provides a framework and support for colleges and universities to implement comprehensive plans in pursuit of climate neutrality. It recognizes the unique responsibility that institutions of higher education have as role models for their communities and in educating the people who will develop the social, economic, and technological solutions to reverse global warming and help create a thriving, sustainable society.

By singing the ACUPCC, Bennington will agree to:

- Develop a greenhouse gas emissions inventory. Inventories at Bennington have been completed for fiscal years 2004 through 2011.
- Within 2 years, set a target date and interim milestones for becoming climate neutral. This Climate Action Plan strives to meet this commitment.
- Take immediate steps to reduce greenhouse gas emissions by choosing from a list of short-term actions presented below.
- Integrate sustainability into the curriculum and make it part of the educational experience.
- Make plans, inventories, and progress reports publicly available.

Signatories are required to take two or more of the following tangible actions to reduce greenhouse gas emissions while the Climate Action Plan is being developed:

a. Establish a policy that all new campus construction will be built to at least the U.S. Green Building Council's Leadership in Energy and Environmental (LEED) Silver standard or equivalent.

b. Adopt an energy-efficient appliance purchasing policy requiring purchase of ENERGY STAR certified products in all areas for which such ratings exist.

c. Establish a policy of offsetting all greenhouse gas emissions generated by air travel paid for by the institution.

d. Encourage use of and provide access to public transportation for all faculty, staff, students, and visitors.

e. Within 1 year of signing the ACUPCC, begin purchasing or producing at least 15 percent of the institution's electricity consumption from renewable sources.

f. Establish a policy or a committee that supports climate and sustainability shareholder proposals at companies where the institution's endowment is invested.

g. Participate in the Waste Minimization component of the national RecycleMania competition, and adopt three or more associated measures to reduce waste.

Currently Bennington's Sustainability Committee is evaluating adoption of the ENERGY STAR and waste minimization tangible actions.

1.2. Climate Action Plan Approach

Since Bennington is considering signing the ACUPCC, this plan and associated analyses were prepared in accordance with the guidelines established by the ACUPCC as well as the *Implementation Guide: Information and Resources for Participating Institutions* authored by ACUPCC. It includes a discussion of Bennington's greenhouse gas emissions, its curriculum and research related to sustainability, and a set of greenhouse gas mitigation options to carry Bennington toward long-term climate neutrality.

The term "climate neutrality" refers to achieving net zero greenhouse gas emissions by reducing or mitigating emissions through projects addressing energy efficiency, renewable energy, transportation, solid waste diversion, and other strategies along with a means to offset any remaining emissions by purchasing carbon offsets.

This plan was developed through a collaborative and iterative process between the Bennington College Sustainability Committee and the consultant team. The first phase of plan development included a campus visit by the consultant to learn about campus operations and meet with the Sustainability Committee to begin discussing climate reduction strategies for Bennington. A draft list of strategies was then developed by the consultant, including projections for climate reduction. The Sustainability Committee provided comments and feedback on this draft plan that are incorporated into the final plan presented here.

2. Campus Greenhouse Gas Emissions Inventory

Prior to developing this plan, Bennington calculated and documented its greenhouse gas inventory for fiscal years 2004 through 2009. As part of this planning effort, the fiscal year 2010 (July 2009 through June 2010) inventory was calculated. Bennington is using the Clean Air – Cool Planet (CACP) Campus Carbon Calculator, Version 6.3 for its greenhouse gas inventory efforts. The CACP tool was developed specifically to provide higher education institutions with a consistent approach to calculating campus greenhouse gas emissions and is recognized as an acceptable tool by the ACUPCC.

The inventory is based on utility data, other college records, discussions with staff, and a Fall 2010 campus commuting survey. The units of metric tons of carbon dioxide equivalent ($MTCO_2e$) are used in the inventory and throughout this plan to account for the collective global warming potential of all six greenhouse gases, including carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and various refrigerants. The total emissions inventoried by Bennington in the last 5 years are presented in Figure 1. The significant drop in emissions in the last few years can be mainly attributed to the increase in biomass operations to replace fuel oil use on campus.

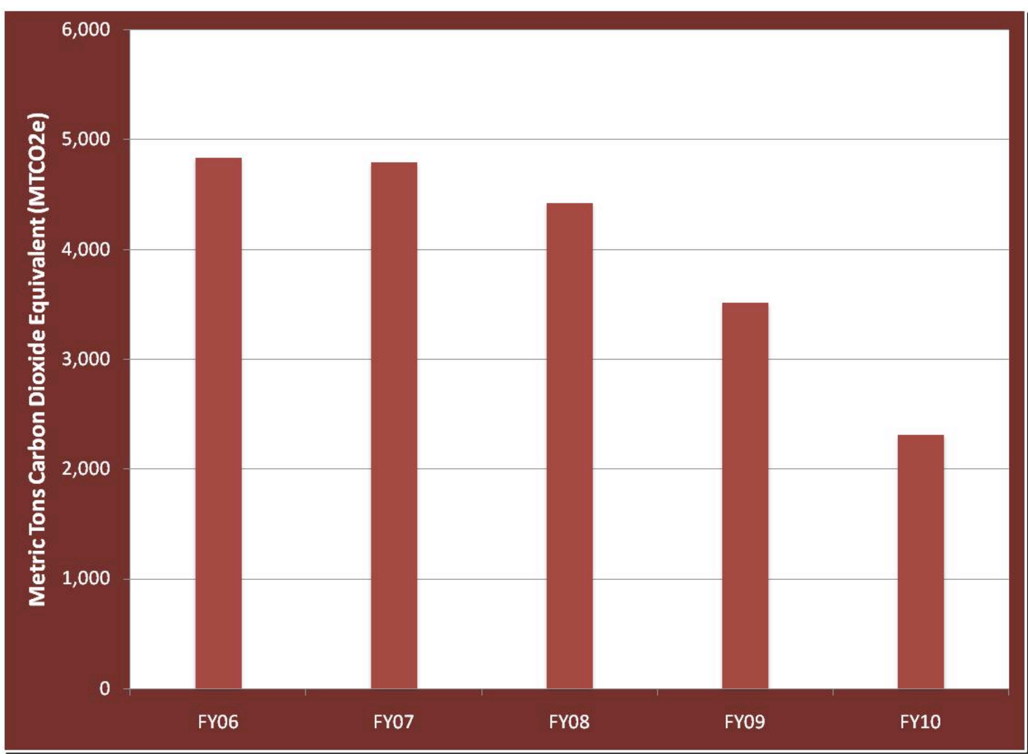


Figure 1: Bennington Net Greenhouse Gas Emissions

Following ACUPCC guidance, Bennington's inventory includes all direct, or Scope 1, emissions from on-campus stationary fuel combustion and vehicle fleet operations. Bennington does not use fertilizers for campus landscaping, nor does it participate in animal husbandry, so these sources were omitted. Refrigerant use on campus is considered to be *de minimis* and is not included in this inventory. Indirect energy emissions, or Scope 2 emissions, from electricity purchases are included. Other indirect emissions, or Scope 3 emissions from directly financed air travel, student commuting, and faculty/staff commuting are also included, but only in the fiscal year 2009 and 2010 inventories because data are lacking in earlier years. Even with the addition of commuting emissions, the increase in the use of woody biomass to replace fuel oil on campus completely offset the commuting emissions and contributed to the net emission decrease in 2009 and 2010. Other Scope 3 emissions, including Study Abroad/Field Work Term travel and transmission and distribution losses from Scope 2 emissions were not included in this inventory as they are not required by the ACUPCC guidance. The contribution of all included emissions sources to Bennington's fiscal year 2010 inventory are depicted in Figure 2.

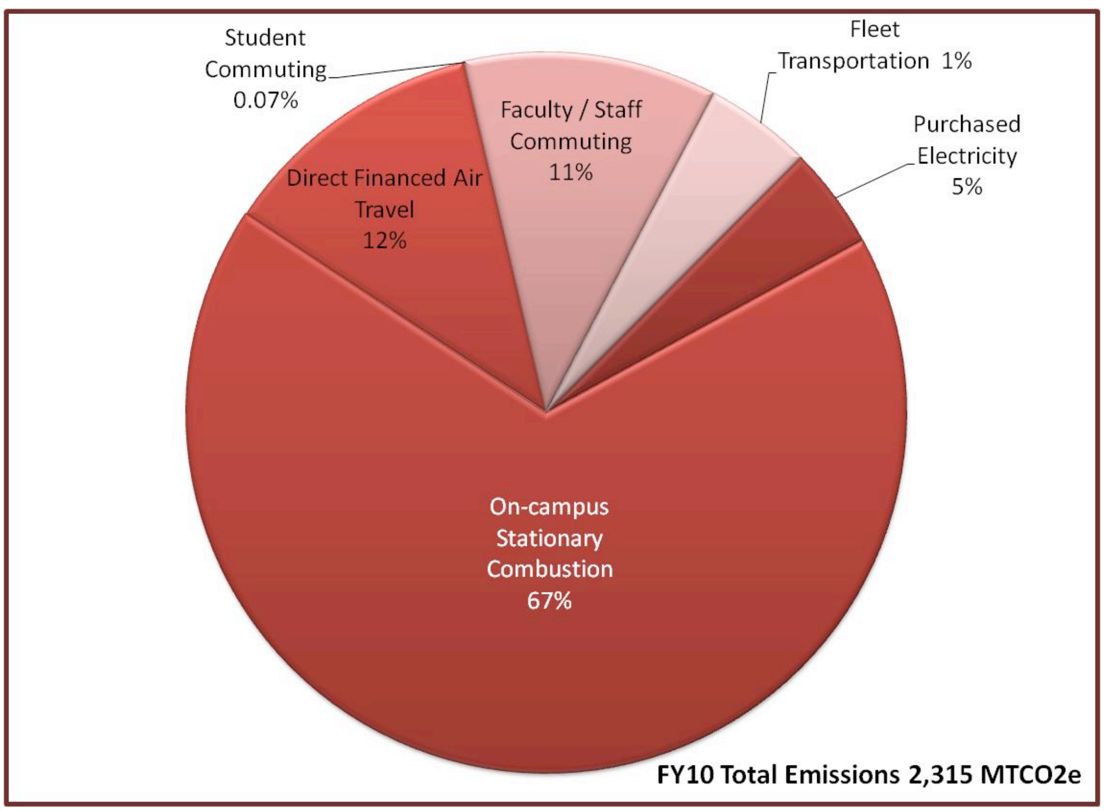


Figure 2: FY10 Greenhouse Gas Emissions Sources

This Climate Action Plan considers Bennington's projected emissions and identifies potential reduction and mitigation strategies between fiscal years 2010 and 2050, with climate neutrality being achieved in 2030. The business-as-usual forecast of emissions is primarily driven by increases in the intensity of electricity consumption in existing buildings, about 1 percent annually, through 2015, based on historical trends. This increase represents minimal contributions to the overall emissions at Bennington and is not expected to significantly affect business-as-usual emissions. Currently there are no major renovations or new construction projects planned at Bennington that would greatly increase energy use in the built environment on campus.

The more significant impact on future emissions at Bennington is the anticipated change in fuel mix for the College's electricity supply. Currently, nuclear makes up almost 50 percent of Central Vermont Public Service's (CVPS) total fuel mix. It is anticipated that the contract for this fuel source will not be renewed and will be replaced with a combination of hydro power and natural gas fuel sources. For the purposes of this analysis, the most conservative and emissions intensive scenario of complete replacement by natural gas was assumed. This assumption allows Bennington to prepare for the scenario that could most significantly impact its ability to achieve climate neutrality. In addition to the switch from nuclear to natural gas, CVPS is also expected to increase its renewable energy supplies by 4 percent, slightly decreasing the emissions impacts of its fuel mix. Both of these activities are anticipated to occur in fiscal year 2012 for the purposes of this plan, explaining the significant spike in emissions under the business-as-usual condition presented in Figure 3.

This plan establishes a set of reduction and mitigation strategies that would be gradually phased in over the next four decades. The strategies were developed based on input from the Sustainability Committee as well as general assumptions regarding the ease and duration with which various strategies can be implemented. As depicted in Figure 3, these strategies are projected to reduce Bennington's net emissions to climate neutral by approximately 2030. Between 2030 and 2047, Bennington must rely on offsets to achieve climate neutrality. Starting in 2048, offsets will no longer be needed and Bennington will become a net negative emitter. As an intermediate goal along this trajectory, Bennington aims to achieve 15 percent reduction over 2012 emission levels by 2015 as well as pre-CVPS Fuel Mix Change emissions by 2017.

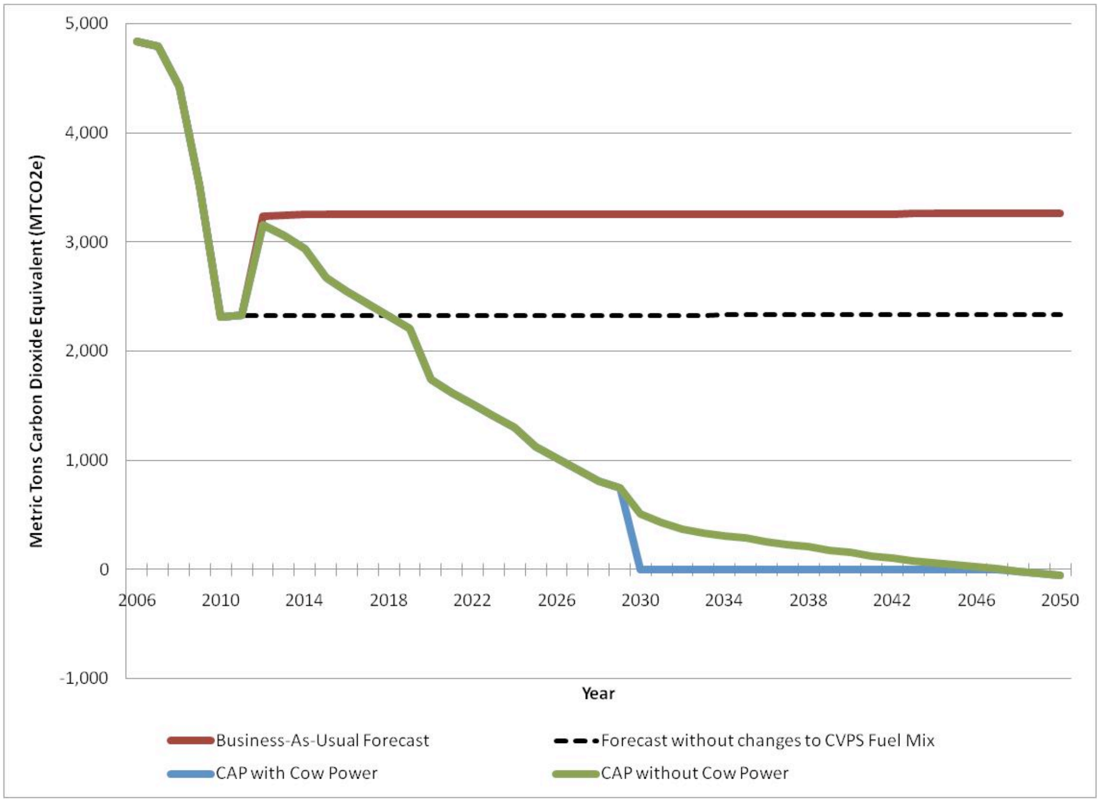


Figure 3: Bennington College Business-as-Usual Emissions Trajectory and Climate Action Plan

3. Education, Research, and Community Outreach Efforts

Bennington College has undertaken several curricula and co-curricula initiatives to foster intellectual growth about sustainability issues within the College community and beyond. In 2009 Bennington College launched the Environmental Studies Program to bring together faculty from diverse areas of the College to advance the environmentally and sustainability-based course offerings available at Bennington. Several new courses in the natural and social sciences, humanities and arts have been added to the curriculum. In tandem with the curricula initiative, the College has launched programs in Student Life to develop student leaders in sustainability education and living practices, public lecture series, social media, informal gatherings, and research internships to foster education, awareness and a sense of community about sustainability. These efforts are have sprung from a spirit of collaboration between the Environmental Studies Program, the Sustainability Committee and various offices on campus that are interested in furthering the Colleges sustainability goals.

Goal 1: Continue development and growth of the Environmental Studies Program

Strategies:

- Seek outside funding opportunities to further expand and advance program offerings.
- Develop multi- and interdisciplinary nature of program activities across campus through involvement of faculty from diverse areas of the College and connections to new curricula initiatives.
- Develop multi- and interdisciplinary nature of program activities through shared events and activities with cross-campus academic institutions such as the Crossett Library, Field Work Term, Academic Services, and Student Life.
- Develop student opportunities to take positions of leadership and active involvement in campus and community sustainability projects.

Goal 2: Make sustainability literacy a central theme for the entire Bennington College community, including students, faculty, and staff.

Strategies:

- Continue and expand current co-curricular program offerings and activities such as the Eco Reps, and the Environmental Studies Forum to ensure that all students are aware of and understand the importance of sustainability in day-to-day life.

- Through orientation and residential-life programming, provide all newly enrolled students with knowledge about sustainability and resilience thinking in society at large and here on campus.
- Devise feasible and effective faculty development opportunities to expand the conversation on sustainability beyond traditionally associated disciplines such as environmental studies and science.
- Develop and provide professional development and educational opportunities for staff on issues relevant to sustainability.
- Provide institutional incentives for individuals and offices to adopt more sustainable behaviors.
- Expand conversation on sustainability efforts and goals within and between campus communities.

Goal 3: Expand ties and conversation related to sustainability between Bennington College and its surrounding community.

Strategies:

- Expand public events offerings related to topics of relevance to sustainability and increase promotion of such events.
- Increase communication with relevant community leaders, institutions and sustainability organizations to identify topics of shared interest with regard to sustainability.
- Expand sustainability-related service options for annual community service events.
- Encourage participation of the College community in off-campus sustainability-related events.
- Expand sustainability-related options and encourage student participation in the Local Field Experience (LFE) for Field Work Term.

4. Reduction and Mitigation Strategies

The following sections identify a number of proposed greenhouse gas reduction and mitigation strategies for fulfilling the Climate Action Plan's goal of making progress toward climate neutrality. These strategies build upon existing activities on the Bennington campus as well as input from the Sustainability Committee.

Mitigation strategies roughly fall into four categories:

Energy Use in Buildings

- Building Energy Efficiency
- Outreach, Smart Metering, and Behavioral Changes
- Re-commissioning and Retro-commissioning
- High-Performance New Construction

Renewable Energy

- Fuel Oil Phase-Out
- Net Metered Solar Facilities
- Micro-Hydro

Transportation

- Fleet Fuel Consumption and Source
- Commuting

Offsets/Other

- Carbon Sequestration in Forests
- Cow Power
- Emerging Technologies

Each section below summarizes the context for each strategy and provides projections of greenhouse gas emission reductions and costs. Cost estimates include the following:

- One-time or first capital cost for implementing the strategy, annual operations, and maintenance cost
- Annual cost savings based on current utility rates
- Simple annual return on investment (net annual cost savings/one-time cost)
- Net lifetime effectiveness (net lifetime savings/cumulative lifetime CO_2e reductions).

Cost and savings estimates were taken from many sources including those listed below:

- Input from Bennington faculty and staff

- Industry contacts and rules-of-thumb
- Case studies from similar projects (colleges/universities, communities, K-12 schools)
- Professional experience of the project team
- Available reference materials

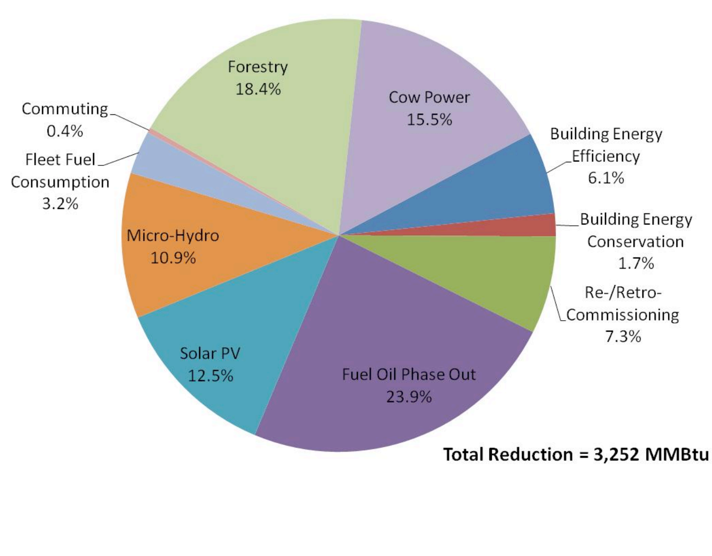
For the purposes of this planning document, only a high level cost/benefit analysis was conducted. Given the high level of these estimates as well as the duration and phasing of this plan, Bennington should conduct a more detailed analysis before implementing each of the strategies. Collecting more detailed data at the time of implementation will allow Bennington to better understand the costs and benefits of a given project.

Figure 4 provides a summary of the percent contribution of each strategy to total GHG reductions at Bennington in 2030. Figure 5 provides a summary of estimated greenhouse gas reductions by strategy type.

For each strategy the annual GHG savings at full implementation were calculated and then phased in linearly per the implementation rates outlined in this report. For example, if a strategy was calculated to have 100 $MTCO_2e$ annual savings at full implementation and was to be phased in over four years, in year one it would provide 25 $MTCO_2e$ savings, 50 $MTCO_2e$ in year two, and so on, realizing the full 100 $MTCO_2e$ savings in year four and beyond.

The net lifetime effectiveness of each strategy was calculated by subtracting the total cumulative costs (one-time implementation and annual) over the assumed project lifetime from the total cumulative cost savings over that same period and dividing by the total cumulative GHG savings. Annual costs and savings were converted to a cumulative value by multiplying the calculated annual savings by the assumed project lifetime for that strategy. The project lifetime varies for each project and is not the same as the implementation phasing/schedule. For example, a strategy may be implemented over 15 years but have a 25 year estimated lifetime. In the results presented in this report, positive net lifetime effectiveness means that when spread over the lifetime of that strategy there will be a cost savings for each $MTCO_2e$ saved, whereas a negative value means there is a net cost for implementing that strategy.

Figure 4: 2030 Greenhouse Gas Reductions, Percent Contribution by Strategy



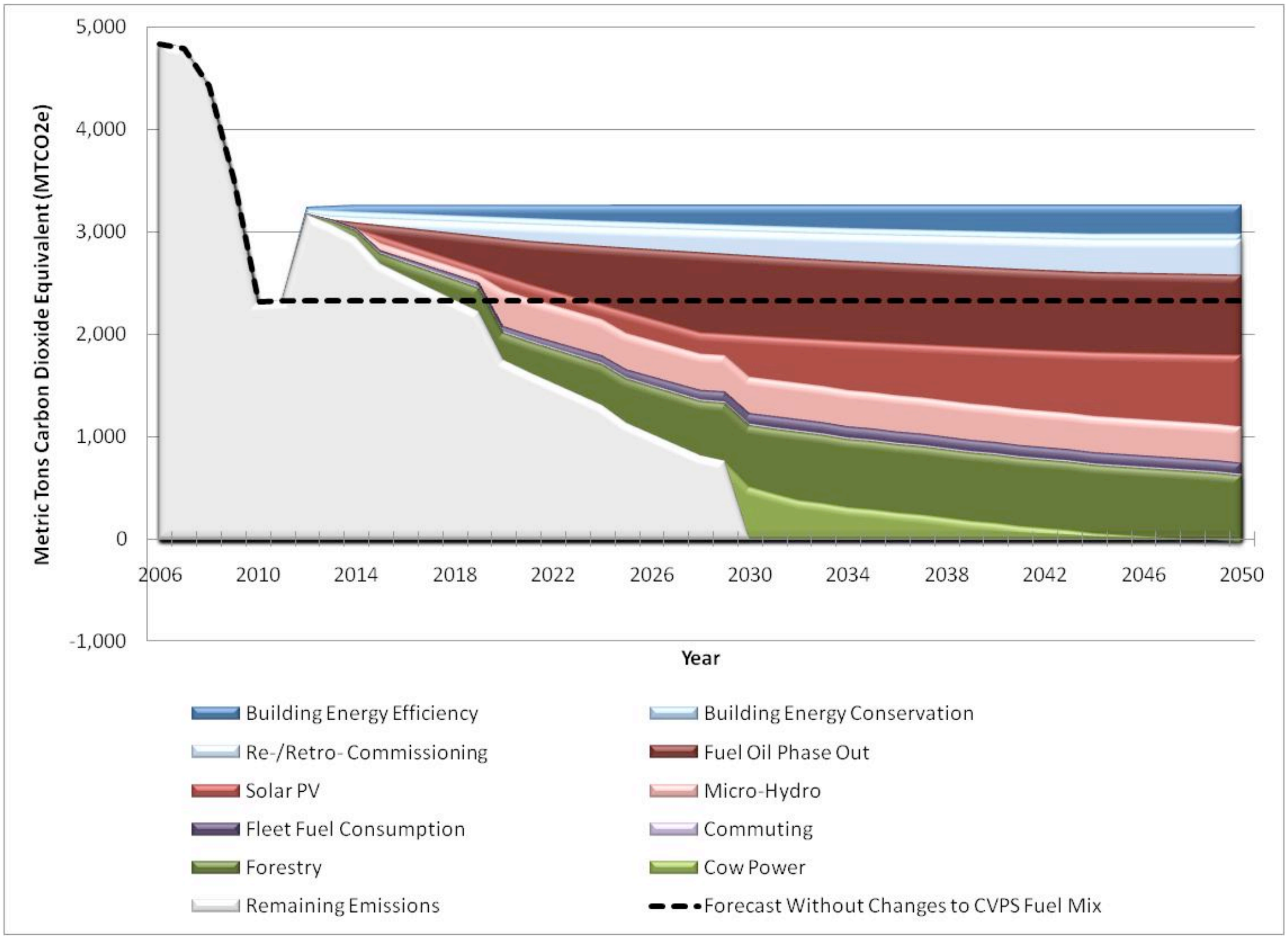


Figure 5: Greenhouse Gas Reduction Contributions by Strategy Type

4.1. Energy Use in Buildings

Term	Projected FY30 $MTCO_2e$	Percentage of Net FY30 Emissions	One-time Cost	Annual Cost	Annual Cost Savings	Annual ROI	Net Lifetime Effectiveness [Net Savings/ Cumulative $MTCO_2e$ Savings]
Building Energy Efficiency	(200)	6%	$175,000	$0	$55,000	31.4%	$190
Outreach, Smart Metering, and Behavioral Change	(60)	2%	$8,000	$10,000	$17,000	87.5%	($20)
Re-commissioning	(240)	7%	$908,000	$0	$66,000	7.3%	($110)

Table A: Summary of strategies to Reduce Energy Use in Buildings

Building Energy Efficiency

Through the Efficiency Vermont program, Bennington has already started to implement efficiency improvements throughout many of its facilities, including:

- Efficiency improvements in the CAPA facility construction
- Lighting upgrades and controls throughout campus (the Barn, Student Houses, Visual and Performing Arts Center)

This strategy focuses on implementing the remaining efficiency projects on campus that have not already been addressed through the Efficiency Vermont program. Remaining projects include additional lighting upgrades, controls upgrades, equipment replacements, building insulation and window replacements, and other projects that can be identified through building assessments. For the purposes of this analysis, it is assumed that all remaining efficiency projects will be implemented by 2014, with continuing rounds of efficiency improvements every 10 years.

Increasing energy efficiency in campus buildings saves both natural resources and money by decreasing electricity and fuel oil/biomass use and thus reducing environmental consequences. As mentioned earlier, buildings are the leading energy users in the country, accounting for more than $280 billion in annual energy costs. Colleges and universities control a large number of buildings, including offices, housing, classrooms, labs, and athletic facilities, and must pay for energy use in all of them. Straightforward retrofits to windows, insulation, electrical, lighting, or heating systems can yield large energy cost savings. Such retrofits not only save money and reduce greenhouse gas emissions; they also lead to increased productivity by students, faculty, and staff who use the buildings.

Outreach, Smart Metering, and Behavioral Change

While this plan identifies many strategies addressing specific topic areas, such as energy efficiency and renewable energy, its successful implementation will ultimately hinge on the Bennington community's awareness and willingness to learn, change behaviors, and take action. Research indicates that education alone can result in 5 percent to 30 percent energy savings[1]. Bennington has already started to evaluate the option of installing smart meters in student housing. Smart meters would allow students to understand more about the energy they use in order to encourage conservation. Incentives, such as housing competitions, are also being considered to provide additional encouragement for reducing energy consumption on campus.

Re-Commissioning and Retro-Commissioning

Re- or retro-commissioning may include testing energy-efficiency and thermal/environmental performance of a building's automatic control, heating, cooling, and refrigeration systems. It can also include lighting and daylighting controls (e.g., sensor calibrations) and building envelope systems. The commissioning process can be particularly valuable where internal loads and space layouts have changed. The purpose of testing, adjusting, and rebalancing heating, ventilation, and air conditioning (HVAC) systems is to assure that a system is providing proper airflow with maximum occupant comfort at the lowest energy cost possible. Instrument calibration and reporting can also help to optimize operations that affect energy consumption that might go unnoticed. All savings realized for building commissioning are assumed to be over and above what can be realized for any steps taken as part of the building energy efficiency strategy discussed above.

Commissioning is a quality assurance process that takes place after construction of a new building is complete, while re-commissioning essentially consists of a tune-up of an existing building's mechanical and control systems. Commissioning verifies that building systems are performing as intended. Retro-commissioning, or commissioning of existing buildings for the first time (as opposed to re-commissioning), optimizes building systems so that they operate efficiently and effectively, resulting in reduced energy use and increased occupant comfort.

One successful model for implementing commissioning programs is to assemble an in-house multi-disciplinary team (e.g., engineer, HVAC, and controls technicians) that continually works through the existing building stock, starting over once commissioning of all buildings has been completed

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[1] Doppelt, Bob and Markowitz, Ezra M. (2009) Reducing Greenhouse Gas Emissions through Behavioral Change: An Assessment of Past Research on Energy Use, Transportation and Water Consumption. Climate Leadership Initiative Institute for a Sustainable Environment, University of Oregon, Eugene, OR.

based on a multi-year cycle. A 10-year cycle is proposed for Bennington as part of this plan. This continuous commissioning model insures that savings are maintained over the long term and new opportunities are realized as building uses change and equipment ages.

4.2. Renewable Energy

Term	Projected FY30 $MTCO_2e$	Percentage of Net FY30 Emissions	One-time Cost	Annual Cost	Annual Cost Savings	Annual ROI	Net Lifetime Effectiveness [Net Savings/ Cumulative $MTCO_2e$ Savings]
Fuel Oil Phase-Out	(780)	24%	$2,665,000	$0	$174,000	6.5%	$90
Net Metered Solar Facilities	(410)	13%	$5,000,000	$0	$196,000	3.9%	($10)
Micro-hydro	(350)	11%	$0	$14,000	$0	n/a	($40)

Table B: Summary of renewable energy strategies to reduce emissions

Fuel Oil Phase-Out

Currently, a large portion of the Bennington campus is served by a central biomass plant; however, fuel oil is still used as a backup supply for the central plant as well as the main energy supply for portions of the campus that are not served by the central plant. Because of the significant impact the remaining fuel oil use has on Bennington's emissions, this strategy recommends phasing out all fuel oil use on campus over a 15-year period, starting in 2014. For the purposes of this analysis, it is assumed that a majority of the current fuel oil use on campus will be replaced with biomass, while less than 5 percent will be replaced with heat pumps for the more distant portions of campus not on the central system (Orchard). Heat pumps were not implemented for a larger portion of this strategy due to the higher CVPS fuel mix assumed in this plan. At the assumed CVPS fuel mix, heat pumps, which rely on electricity for their energy source, are more carbon intensive than the fuel oil currently being used. However, if the CVPS fuel mix does not shift to the more carbon intensive sources assumed in this plan (natural gas), heat pumps will be a viable solution.

One thing that is uncertain is whether using the existing biomass facility for this strategy is a feasible alternative. To address this uncertainty in using the existing plant, higher implementation costs were used, assuming a new biomass plant would need to be built or significant retrofits would be required at the existing facility. This approach was taken to be conservative and present the higher end of cost range for this strategy. If the use of biomass is not a realistic option, other options such as heat pumps (assuming a favorable CVPS fuel mix) should provide the same benefit at less cost[2]. All options and their emissions implications should be reevaluated as Bennington begins to implement this strategy.

Biomass is typically more cost effective than fuel oil and is also effective in achieving lower greenhouse gas emissions by displacing the need for fossil fuel-based energy sources and reducing the number of dead or dying trees burned during wildfires or prescribed burning.

The wood chips for Bennington's biomass boiler are sourced directly from local forestry management waste material, providing a renewable fuel supply for Bennington. It takes approximately 1,000 forest management acres to provide a year's supply of wood chips for Bennington. Burning biomass recycles atmospheric carbon that was absorbed during its growth cycle and does not add significantly to greenhouse gas emissions.

Net Metered Solar Facilities

Net metering is a policy that allows owners to take full credit for the cost of the electricity that their solar energy system produces and thereby reduces the amount of electricity that the array owner has to purchase from the grid and the emissions associated with that electricity.

This strategy includes 1 megawatt (MW) of total capacity implemented in four different phases as outlined below:

- Phase 1 (2015): 200 kilowatt (kW) array on VAPA rooftop
- Phase 2 (2020): 200 kW array
- Phase 3 (2025): 200 kW array
- Phase 4 (2030): 400 kW array

There has already been a study to assess the potential for a photovoltaic (PV) array on the VAPA building, so it is being recommended as the location for the first phase of this project. The location for all other phases will be determined as the strategy is implemented.

A portion of the electricity generated by the arrays will be used to reduce Bennington's use of grid supplies for electricity; however, a portion of the generated power will be exported to the grid. If Bennington elects to keep the renewable energy credits (RECs) for the solar arrays, the exported power could be used to offset some of the transportation emissions that cannot be reduced directly.

As will be discussed in the Section 5 (Financing), one option for funding larger capital investment projects, such as solar PV, is third-party financing in which the PV arrays are owned and operated by

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[2] The implementation cost used for heat pumps in this analysis was $742/kW (L.D. Danny Harvey, Handook on Low-Energy Buildings and District-Energy Systems, Table 5.6)

a private entity. If this type of financing is used, Bennington would not be able to realize the environmental benefit of these projects until the third-party ownership contract expires, at which time Bennington could take ownership of the arrays and the associated RECs.

Micro-Hydro

There are several potential micro-hydro sites near the Bennington campus that are being considered for development and as part of this plan, Bennington is considering purchasing power from the largest of these sites once it is developed. This site is planned to house a 320-kW hydro facility. In this plan, it is assumed that Bennington will purchase 20 percent of the power generated from this site starting in 2015, increasing to 100 percent of the full generating capacity in 2020.

4.3. Transportation

Term	Projected FY30 $MTCO_2e$	Percentage of Net FY30 Emissions	One-time Cost	Annual Cost	Annual Cost Savings	Annual ROI	Net Lifetime Effectiveness [Net Savings/ Cumulative $MTCO_2e$ Savings]
Fleet Fuel	(100)	3%	$0	$0	$4,000	n/a	$30
Commuting	(10)	<1%	TBD	TBD	TBD	-	-

Table C: Summary of Transportation Strategies to Reduce Emissions

Fleet Fuel Consumption and Source

This strategy focuses on reducing the emissions from Bennington's vehicle fleet by converting all vehicles to biodiesel as new vehicles are needed. There is a farm in the town of Bennington that processes biodiesel from oil crops. As part of this strategy, Bennington will grow sunflowers and/or rapeseed on campus and partner with the local farm Stateline Farm for processing. Currently the estimated amount of finished fuel per acre of oil crop is 50-75 gallons at a rate of $3.25-$3.50 per gallon. If the scale of the operation were to increase enough, the price might come down to $2 per gallon. Using biofuels will significantly decrease the emissions generated by Bennington's fleet. For the purposes of this plan it has been assumed that Bennington could replace its entire fleet over a 20-year period.

Additionally, this strategy includes opportunities to reduce the Bennington campus fleet's fuel consumption by 15 percent through a number of measures, including purchasing more efficient vehicles when existing vehicles are replaced and using bicycles as security vehicles.

Commuting

This strategy is focused on reducing single-occupancy vehicle commuting by the Bennington College community by 5 percent. Alternatives to single-occupancy vehicle commuting can reduce greenhouse gas emissions, contribute to good air quality, and encourage healthy walking and cycling habits.

Currently Bennington runs a shuttle into town for the campus community and last fall the Green Mountain Express, a bus service run by the Green Mountain Community Network, starting running a route that stops on campus. Additionally, improvements in federal standards for vehicle fuel economies and increased adoption of telecommuting options will support this goal of reducing greenhouse gas emissions caused by commuting and perhaps allow for even more aggressive reductions in the future.

Colleges and universities around the nation and internationally have adopted policies and programs to support single-occupancy vehicle commute-trip reductions from which Bennington can draw. Some of these ideas are presented below:

- Promote car-sharing programs and off-campus carpool programs that provide incentives for faculty and staff to carpool.
- Provide additional priority parking by creating reserved parking spots for carpoolers, provide subsidized or free parking passes, and create carpool ride boards or online databases where faculty and staff commuting from similar locations can communicate.
- Provide infrastructure and incentives for faculty, staff, and students who bike or walk to campus, such as bike racks and locker facilities.
- Encourage pedestrian and bike traffic when redesigning sites.
- Develop policies for faculty and staff that encourage telecommuting when feasible.
- Provide incentives for faculty, staff, and student owners and operators of low-emissions vehicles.

4.4. Offsets/Other

Term	Projected FY30 $MTCO_2e$	Percentage of Net FY30 Emissions	One-time Cost	Annual Cost	Annual Cost Savings	Annual ROI	Net Lifetime Effectiveness [Net Savings/ Cumulative $MTCO_2e$ Savings]
Reforestation	(600)	18%	Minimal	Minimal	$0	n/a	$0
Cow Power	(510)	15%	$0	$34,000	$0	n/a	($70)

Table D: Summary of Offsets and Other Strategies

Carbon Sequestration in Forests

This strategy considers sequestering lands on the Bennington campus that are available for reforestation and potentially using this opportunity to offset at least a portion of the emissions generated by other activities on campus, including emissions generated by the biomass facility as well as transportation emissions. For the purposes of this plan, a total of 100 acres throughout the Bennington campus was assumed to be available for reforestation and this project will be implemented over a 20-year period. The land being targeted for this strategy is currently managed as a meadow.

Terrestrial carbon sequestration is the process through which CO_2 from the atmosphere is absorbed by trees, plants, and crops through photosynthesis and stored as carbon in biomass (tree trunks, branches, foliage, and roots) and soils. The term "sinks" is also used to refer to forests, croplands, and grazing lands and their ability to sequester carbon. Agriculture and forestry activities can also release CO_2 to the atmosphere. Therefore, a carbon sink occurs when carbon sequestration is greater than carbon releases over some time period. Carbon sequestration rates vary by tree species, soil type, regional climate, topography, and management practice. In the U.S., fairly well-established values for carbon sequestration rates are available for most tree species. For the purposes of this study, a sequestration rate of 2 tons of carbon per year per acre of land reforested was assumed, which considers natural succession and no management for biomass accumulation. Bennington students will be doing a more detailed study during the summer of 2011 to refine this rate for Bennington. It was also assumed that the cost for this opportunity, assuming natural succession, will be minimal.

Because the land being considered for this strategy is currently being managed as a meadow, allowing it to naturally convert back to forest is assumed to be a change in land management practices that meets the additionality requirements outlined by ACUPCC. According to the World Resources Institute, additionality is defined as:

> *A criterion often applied to GHG projects, stipulating that project-based GHG reductions should be quantified only if the project activity "would not have happened anyway," that is, that the project activity (or the same land-use or management practices it employs) would not have been implemented in its baseline scenario and/or that the project activity GHG removals are greater than the baseline GHG removals.*

Cow Power

To address any remaining emissions that have not been addressed by the strategies outlined above, specifically the remaining transportation related emissions (financed travel and commuting), Bennington will purchase offsets. For the purposes of this analysis all proposed offsets will be purchased through the CVPS Cow Power program, which partners with local farms to generate electricity from methane. This is a preferred offset program for Bennington because it is local and direct to campus operations. Other less expensive (and less direct or local) offset options could also be explored by Bennington. This plan only shows offset purchases in 2030 in order to help Bennington reach climate neutrality in that year. No Cow Power purchases are included in this plan prior to 2030, however, Bennington may elect to purchase Cow Power offsets at any time as it begins to implement this plan and refine its approach to achieve climate neutrality.

Emerging Technologies

As a living document, this plan will undergo regular reviews, and the opportunities to include new technologies will be many. A myriad of technologies on the horizon may become viable within the timeframe of this plan and alter the course of Bennington's path to climate neutrality.

5. Financing

Term	Projected FY30 $MTCO_2e$	Percentage of Net FY30 Emissions	One-time Cost	Annual Cost	Annual Cost Savings	Annual ROI	Net Lifetime Effectiveness [Net Savings/ Cumulative $MTCO_2e$ Savings]
Building Energy Efficiency	(200)	6%	$175,000	$0	$55,000	31.4%	$190
Outreach, Smart Metering, and Behavioral Change	(60)	2%	$8,000	$10,000	$17,000	87.5%	($20)
Re-commissioning	(240)	7%	$908,000	$0	$66,000	7.3%	($110)
Fuel Oil Phase-Out	(780)	24%	$2,665,000	$0	$174,000	6.5%	$90
Net Metered Solar Facilities	(410)	13%	$5,000,000	$0	$196,000	3.9%	($10)
Micro-hydro	(350)	11%	$0	$14,000	$0	n/a	($40)
Fleet Fuel	(100)	3%	$0	$0	$4,000	n/a	$30
Commuting	(10)	<1%	TBD	TBD	TBD	-	-
Reforestation	(600)	18%	Minimal	Minimal	$0	n/a	$0
Cow Power	(510)	15%	$0	$34,000	$0	n/a	($70)
TOTAL	**(3,300)**	**100%**	**$8,756,000**	**$58,000**	**$512,000**	**5.2%**	**$70**

Table E: Summary of Overall Strategies

The costs and savings projected in the previous strategies are based on conservative assumptions, such as all-cash funding coming from Bennington College and no escalation in current utility rates. Other financing mechanisms, such as bonding and third-party financing, could be used to reduce the capital requirements associated with climate neutrality and to level out the cost of this plan.

Furthermore, many of the strategies proposed in this plan result in positive net cash flows and can be largely self-funding. This projection is based on today's utility rates, and the positive cash flow associated with utility savings will increase with increasing utility rates.

One option for funding is to focus on low and no-cost strategies, such as education programs, and those with very favorable paybacks that can help to finance the cost of later measures through their savings. Additionally, ACUPCC provides a helpful resource for learning about financing options for sustainability projects on campus (http://www.presidentsclimatecommitment.org/financing).

Bennington can also explore several opportunities to help fund implementation of the plan's measures:

- **Utility rebates** through Efficiency Vermont
- **Federal and state incentives and grants**
    - Vermont Small Scale Renewable Energy Incentive Program[3]
    - Vermont Department of Public Service (check for various funding sources)[4]
- **Lease-purchases or other financing mechanisms**, leases structured where the full cost of the project assets is amortized over the lease period and the lessee may take title to the assets upon execution of the agreement[5]
- **Performance contracting**, a contractual and financing mechanism through which building owners can undertake comprehensive energy efficiency retrofits with minimal financial exposure and risk[6]
- **Capital campaigns**, time-limited fund raising efforts, to fund a specific project
- **Revolving loan funds**, providing capital for projects that create some level of return or cost savings. Some portion of the return/cost savings is used to repay the fund until the full project cost is repaid. As the fund is replenished it can finance more projects.[7]

As part of this climate action planning effort, Bennington will stay appraised of the latest funding opportunities. This is a fast-changing landscape where legislation, incentives and rebates, and maturing technologies can rapidly improve the financial options around plan strategies.

Figure 6 presents the annual net cost savings for all strategies outlined in this CAP to aid Bennington in planning efforts to secure the proper funding for implementation and/or adjust its implementation schedule as needed for financing purposes.

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[3] http://www.rerc-vt.org/incentives/index.htm

[4] http://publicservice.vermont.gov/energy-efficiency/energy-efficiency.html

[5] http://www.presidentsclimatecommitment.org/node/6567

[6] http://www.presidentsclimatecommitment.org/resources/eebrp/toolkit

[7] http://www.presidentsclimatecommitment.org/node/6566

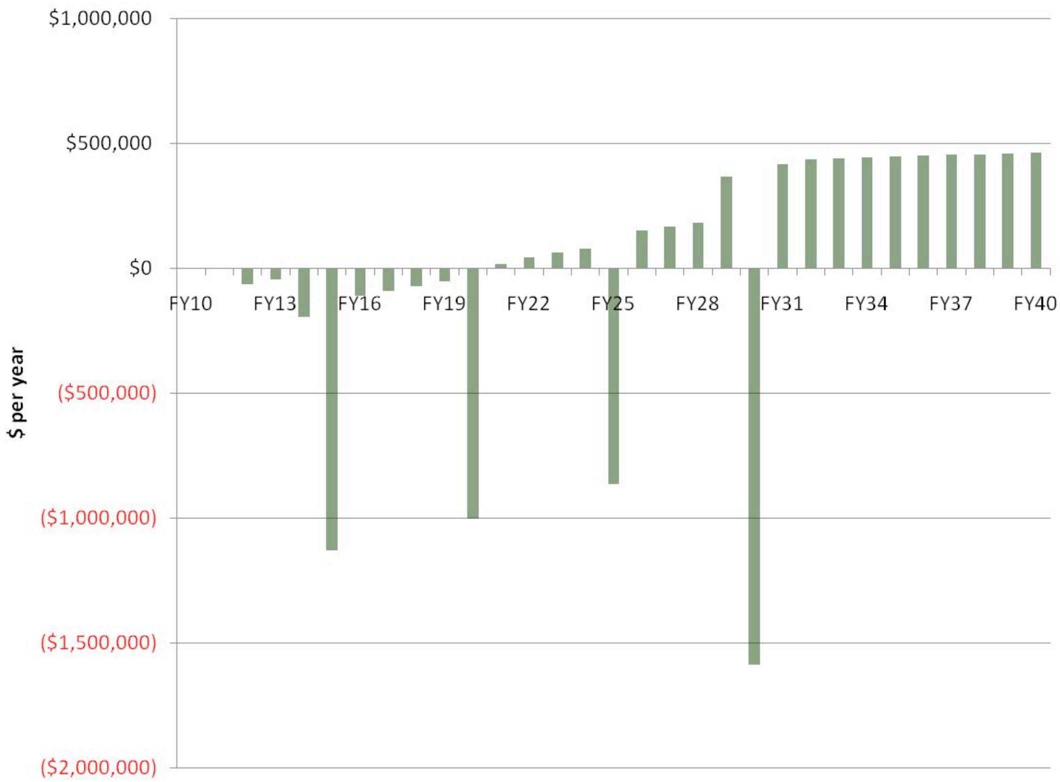

Figure 6: Annual Net Cost Savings

6. Uncertainty

This Climate Action Plan is considered the first version of what will be a living document subject to further review and revision on a 2-year cycle as strategies are implemented, new technologies and strategies develop and mature, progress is monitored, and intermediate goals are revisited.

The ACUPCC requires biennial updates of the greenhouse gas inventory and the Climate Action Plan in alternating years (e.g., inventory in 2011 and action plan in 2012). Bennington intends to update the greenhouse gas inventory annually to improve, and ensure continuity in, organizational practices around gathering information for the inventory. Updating the inventory annually also ensures more accurate tracking of progress toward emissions reduction goals.

Considering the many uncertainties in forecasting growth, greenhouse gas emissions, and the realities of implementing the strategies in this plan, it is apparent that the biennial updates to this living document will be pivotal to maintaining its relevance and ensuring that Bennington is establishing a trajectory toward climate neutrality. Rather than attempting an exhaustive forecast of potential scenarios, this plan recognizes some key uncertainties that could significantly alter the trajectory of Bennington's greenhouse gas emissions or the financials associated with this plan:

- **CVPS fuel mix and other legislation** – One of the main drivers of this plan for Bennington is the future of the fuel mix for CVPS. Additionally, federal legislation that may affect the price of carbon, as well as statewide renewable energy requirements, may affect emissions at Bennington into the future.
- **Growth rates** – Currently growth at Bennington is projected to be relatively flat. However, the plan is very sensitive to these trends and any changes could significantly impact Bennington's efforts to achieve climate neutrality.
- **Utility rates** – The potential cost savings associated with most of the strategies in this plan are sensitive to utility rates. Accurately projecting utility rates through 2050 is an impossible task and subsequently dependent on the cost of fuels and the cost of carbon in a potentially monetized carbon future. It is generally safe to assume that the cost of utilities will be increasing and any estimated savings will only increase under future rates.
- **Financing mechanisms** – Legislation, tax credits, renewable energy standards, and community goals can drive the introduction of new financing mechanisms that could enable Bennington to achieve some of these strategies with less up-front capital than is modeled in this plan.
- **Changing technologies and associated costs** – The technological picture with respect to the built environment, renewable energy generation, and transportation is changing rapidly, particularly with the current focus on development in these areas. There are likely to be

existing technologies that become increasingly viable and new technologies that will be introduced into future iterations of this plan.

7. Implementation and Measuring Success

Developing this Climate Action Plan is a major step toward reducing Bennington's greenhouse gas emissions, pursuing climate neutrality, and furthering campus sustainability.

Collaboration among the members of the campus community will benefit the implementation of the plan. A next step in implementing the strategies in this plan is to identify who will be responsible for implementing them and who can play a supporting role. The diverse nature of the strategies in this plan provides an opportunity for broad collaboration across the Bennington community. It is recommended that working groups be established around each of the plan's strategies and that each proceed independently and in parallel while regularly reporting results. These working groups could come out of the Bennington Sustainability Committee. The committee as a whole will be responsible for contributing to the plan's goals, keeping the independent working groups moving forward, consolidating reporting of progress, communicating status to the campus, and updating the inventory and the living document. Partnerships with local entities that can influence and impact the plan will also be important.

While this plan sets a long-term goal of climate neutrality, achieving interim milestones will help demonstrate tangible progress toward this goal over time. As discussed earlier in this plan, an interim goal has already been established to track progress.

Certain strategies contained in the plan can be implemented in a fairly short period of time while others will need to be phased in over time. Establishing specific timelines for implementing various strategies will ensure that there is enough time to complete them before the target goal year is reached.

Finally, implementation of strategies should be documented for future reference and reporting to the community and to decision makers. For instance, what was the actual cost of the strategy and when was it implemented? Who was involved and what were their tangible indications of success, such as number of participants, number of buildings retrofitted or kilowatt hours (kWh) of electricity reduced? This type of information can be used to celebrate success, adjust strategies, or develop new strategies.

With the strong commitment of students, faculty, and staff, Bennington has a great opportunity to implement this plan and begin to realize the local and global benefits of setting a trajectory for climate neutrality.