Climate Action Plan

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Bard College

Authorized by:

Bard College Sustainability Council

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Cover Photo:
Bartlett Field Solar Array, Hudson River, & Catskills.
(by Daniel Smith, 2015)

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APPENDICES

ACRONYMS

ACUPCC	American Colleges and Universities Climate Commitment
AASHE	Assoc. for the Advancement of Sustainability in Higher Education
BCEP	Bard Center for Environmental Policy
B&G	Buildings and Grounds Department
BOS	Bard Office of Sustainability
CACP	Clean Air – Cool Planet
DOSA	Dean of Student Affairs Office
EIA	Energy Information Administration
EUS	Environmental and Urban Studies
GHG	Greenhouse gas
LEED	Leadership in Energy Efficiency Design
NYSERDA	New York State Energy Research & Development Authority
RCx	Recommission
S&S	Safety and Security Department
STARS	Sustainability Tracking & Rating System
TDM	Transportation Demand Management

1. INTRODUCTION

> **American College & University Presidents Climate Commitment**
>
> We, the undersigned presidents and chancellors of colleges and universities, are deeply concerned about the unprecedented scale and speed of global warming and its potential for large-scale, adverse health, social, economic and ecological effects. We recognize the scientific consensus that global warming is real and is largely being caused by humans. We further recognize the need to reduce the global emission of greenhouse gases by 80% by mid-century at the latest, in order to avert the worst impacts of global warming and to reestablish the more stable climatic conditions that have made human progress over the last 10,000 years possible.

1.1. Bard's Climate Commitment

***Carbon Commitment*:** In January 2008, President Botstein signed the American College and University Presidents' Climate Commitment, now called the Carbon Commitment. In doing so, Bard College pledged to make climate change aversion an institutional priority, and to restructure operations to achieve carbon-neutrality by 2035. The College conducts yearly greenhouse gas (GHG) emissions inventories using the Carbon Calculator and has created this Climate Action Plan (CAP), a roadmap document that describes the actions and developments needed to achieve carbon-neutrality. In Fiscal Year 2016/2017, Bard generated roughly 15,102 metric tons of carbon dioxide equivalent of greenhouse gases (tCO_2e).

The boundary and scope of the Carbon Commitment pertains to the 550-acre Main Campus in Annandale, NY, and to Montgomery Place, the historic 380-acre estate located south and abutting the Annandale campus, acquired in January 2016. Future intentions are to continue to extend the Commitment to encompass other satellites within the College's sphere of influence, including Bard College at Simon's Rock[1] and the Longy School of Music in Massachusetts.

Resilience Commitment: The College has begun to feel the effects of climate change, particularly in the greater frequency of intense weather events, and believes that mitigation and adaptation are complementary strategies for addressing climate risks and identifying opportunities to flourish. Therefore, the Sustainability Council will provide a recommendation as to whether we can increase our public pledge by taking the Climate Commitment which includes "The Resilience Commitment." Appendix A: Climate Change & Resiliency Planning at Bard provides a preliminary look at how the College might proceed.

[1] For Simon's Rock CAP Summary, see Appendix B.

1.2. The Path to Carbon-Neutrality: 2035

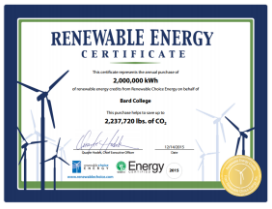
The path to carbon-neutrality is an ongoing process, comprised of short-, medium-, and long-term goals and strategies. Bard's CAP is intended to be an evolving document, as milestones are reached, new ideas and stakeholders take hold, and global economic, technological, and environmental forces reshape society and the world. Institutionalizing the CAP with administrative and academic oversight will ensure that mitigation strategies are actively pursued, and that the goal of carbon-neutrality permeates the Bard community.

While changing policy and behavior is critical to this process, achieving carbon-neutrality will ultimately rely on a considerable financial investment by Bard in the upgrade of its facilities to offset energy consumption (roughly 50% of Bard's emissions are related to its energy use). It will also rely on external factors such as changes in government regulations and new developments in technology and economy (e.g. widespread availability of electric vehicles and charging infrastructure). For these reasons, in January 2010 the Bard Climate Commission selected the year 2035 as an ambitious deadline to achieve carbon-neutrality— a quarter-century in which to reshape Bard operations— recognizing the pace and severity of global climate change while remaining logistically and economically feasible.

1.3. Milestones at Bard

1992	• Recycling Program established • 1st geothermal system installed at the original Ravine Dormitories	
1995	• Campus Composting Program established	
1997	• Community Garden opens.	
2000	• Resnick Commons Dorm Complex (Phase 1, buildings A thru I) opens, utilizing geothermal heating and cooling.	
2002	• Richard B. Fisher Center for the Performing Arts opens, utilizing geothermal heating and cooling.	
2004	• Bard Free Use Store opens • Re-usable material collection added to recycling and trash stations	
2005	• EcoRep program begins (BERPs) • Bard becomes a US EPA Energy Star ™ partner	
2007	• Bard first participates in Recyclemania, the national recycling competition • Operation Save New York, Bard begins participation in energy Demand Response Program to curb energy use during peak power events.	
2008	• President Botstein signs the American College and University Presidents Climate Commitment (ACUPCC) • US EPA WasteWise Partner • Recyclemania: 2nd Place in Food Scrap Contest • Focus the Nation on Climate Change conference • Bard begins a relationship with Old Saw Mill Farms to bring local Hudson Valley fruits and produce to campus. • First Earth Day celebrated at Bard, highlighting local food and farms, and focused on *reducing* Energy/ Water / Paper	

2009	• Bard Climate Commission established • Prepares first Greenhouse Gas inventory • Conducts campus-wide energy audit • Clean Air Campus participant • Recyclemania: 1st Place in Food Scrap Contest • Campus-wide *350* Campaign • Dining Services partners with the cooperative dairy farm: Hudson Valley Fresh • Kline Commons Dining Hall goes *tray-less* (saving water, food waster, and energy)	
2010	• Bard Sustainability Council established (replaces the Climate Commission) • Bard Climate Action Plan released • Solar thermal systems installed at Tremblay and Keene Dorms • National Teach-In on Global Warming Solutions • Princeton Carbon Mitigation Initiative Wedge Workshop • Bard Dining increases local veggie purchases by 30%	
2011	• Bard earns a Silver Rating from STARS – Sustainability Tracking, Assessment & Rating System. • Car-share program arrives on campus • Over $150,000 is spent on locally produced products in dining facilities. • Gluten Free Awareness Program launched with a gluten free product line and options for students at the Green Onion Grocer.	
2012	• Kickstarter Campaign organized for 1.25 acres. This becomes the Bard College Farm. • 6,046 pounds of food grown by the Bard College Farm is consumed by the Bard Community and served by Bard Dining in its first year. • Recyclemania: 1st Place in Food Scrap Contest • Phase-out of bottled water deliveries, start of in-line filtration units. • Princeton Carbon Mitigation Initiative Wedge Workshop	
2013	• Single-stream recycling begins • Bartlett 280kW Solar Array project goes on-line • Salamander Migration Community Project begins • Students and faculty create Bard EATS (eating awareness	

	transforms society) council which becomes the umbrella term for all that is happening with the Bard Farm, the Real Food Challenge, and the College's commitment to sustainability around food • Real Food Challenge is signed by President Leon Botstein and VP of Finance, Jim Brudvig • Dining Services switches all oil (except for frying oil) to Grapeseed Oil (no trans-fats, non-GMO) • 5.1% of Bard's food purchased is 'Real Food' (meets local, fair, ecological, and humane standards) • 15,402 lbs. of food from the Bard College Farm's harvest is gleefully devoured by the Bard community. • Partnership with Winter Sun Farms - a local food hub dedicated	
2014	• Regional Demonstration Project in Green Infrastructure at Olin Parking Lot renovates the compacted gravel lot into stormwater management project, with pervious pavement, reconstructed wetland, and bioswales. • Recyclemania: 1st Place Food Scrap Contest • Top Ten in Campus Conservation Nationals • Soda machine is removed from the all-you-can-eat servery in Kline Commons. • New Composting bins are placed in Kline to highlight the 25% of the post-consumer food waste that is composted (utilized by Bard College Horticulture Department). • 20,486 lbs. of food is harvested from the Bard College Farm and served to the community. The farm also builds a barn with cold storage abilities. • The 4th annual Food Day Celebration	
2015	• Bard receives a Gold rating from STARS • Purchase of Renewable Energy Credits representing 10% electricity offsets • Reforming the Energy Vision Campus Challenge Achiever • Resnick Commons Dorm Complex complete with 14 geothermal buildings • Bard Dining reaches 22% 'Real Food,' five years ahead of the Real Food Challenge Campus Commitment. • Bard Dining has purchased a total of 60,000 pounds of fresh produce from the Bard Farm since its conception. • Bard Eats creates an elected position in student government • A student club organizes a food donation program linking	

	Bard Dining and a soup kitchen in Kingston, NY. • Bard participates in regional Food Waste Audit to strategize food waste reduction efforts. • Bard Celebrates Food Days, expanding food sustainability programming to an entire week including participation in NY's Campus Crunch event.	
2016	• Bard purchases historic 380-acre Montgomery Place Estate (includes apple orchard and greenhouse) • NYSERDA Energy to Lead Micro Hydropower Award, to study implementation of electricity generation at small to medium dams at Bard and across NY. • Bard contracts a herd of local goats to "mow" the Blithewood vistas. • Saw Kill Watershed Community established • 1st Place in Chartwell's "Carbon Footprint" challenge for increasing plant-based menu engineering and reducing carbon emissions associated with food production • Created student-chosen meals program • Bard celebrates Earth Days, expanding food sustainability programming to an entire week including participation in Bard's Teach-In. • Student Council purchases the Urban Cultivator to produce microgreens for Down the Road Cafe • Bard Farm produces 22,000 pounds of produce that is served in the dining hall. • Harvest of the Month Program is created to increase seasonal produce offerings.	
2017	• Bard achieves Gold Rating from STARS • College hires Supervisor of Food & Agricultural Programs • Sustainability Starter kits are given to every first year student • The mobile teaching kitchen is created to teach students how to cook. • Green Onion grocer eliminates plastic bags and begins to offer bulk food and beverages. • DOE Better Buildings Challenge: Bard enters Richard B. Fisher Center for the Performing Arts as showcase building	

2. GREENHOUSE GAS INVENTORY & PROJECTIONS

2.1. Overview

GHG emissions from Bard operations come from a variety of direct and indirect sources, which are categorized into three scopes:

Scope 1: All direct GHG emissions from on-site fuel combustion and fleet operations.

Scope 2: Indirect GHG emissions from consumption of purchased energy (utility electricity, district heating/cooling).

Scope 3: Other indirect emissions, such as commuting activities in vehicles not owned or controlled by the reporting entity, upstream electric and fuel distribution losses, outsourced activities, waste disposal, refrigerant leaks, etc.

Figure 2.1 depicts the range of possible sources of Scope 1, 2, and 3 emissions to be accounted for when conducting a GHG inventory, based on the type of direct and indirect activities undertaken by a company or institution.

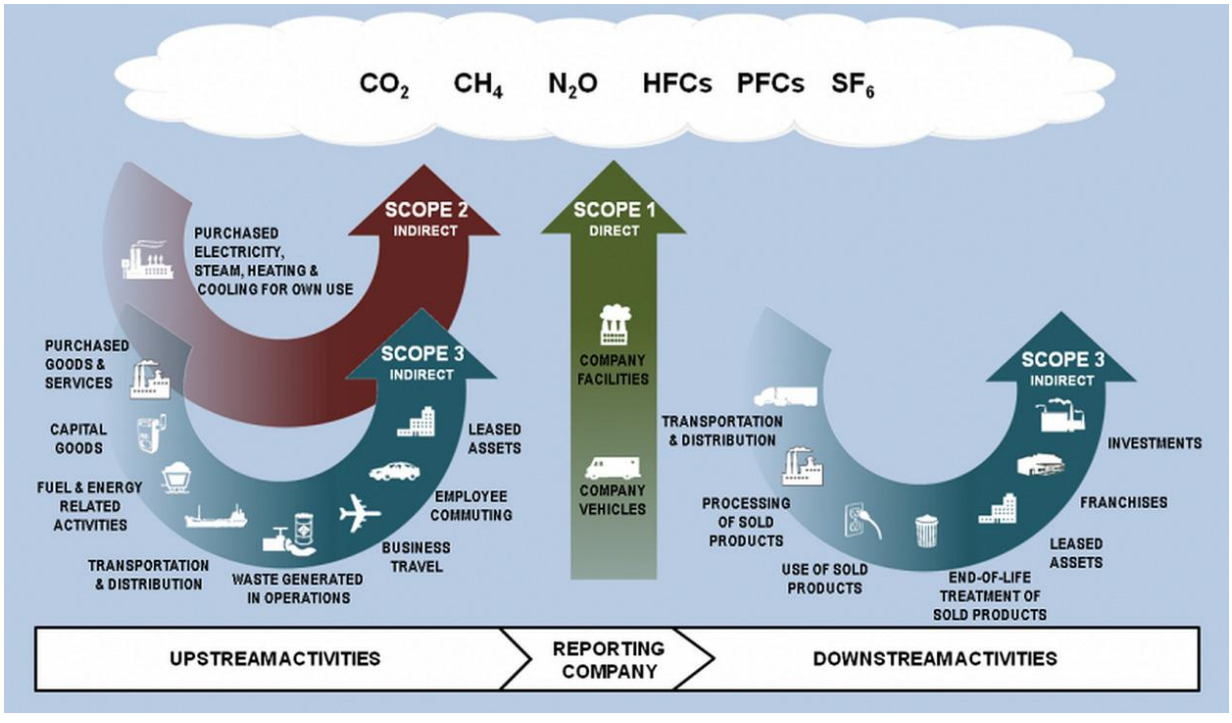


Figure 2.1 Possible sources of direct and indirect Scope 1, 2, and 3 greenhouse gas emissions.

(SOURCE: Greenhouse Gas Protocol Initiative, www.ghgprotocol.org, 2016)

2.2. Inventory Details & Inputs

Reporting Period	July 1st, 2016 to June 30th, 2017 (Bard Fiscal Year 2016/2017)
Methodology	Clean Air-Cool Planet Campus Carbon Calculator Ver. 9.0
Reporting Boundary	Main Campus & Montgomery Place – Annandale, NY
Inputs	
Assumptions	• Electricity and fuel consumption compiled from utility billing records. • Commuting miles estimated from on-campus surveys. • Air travel miles estimated from Bard travel purchase records (FY14). • Solid waste & waste water estimated from Bard service records. • Paper weightage from Bard purchasing records. • Refrigerant leakage estimated from Bard purchasing records.
Institutional	**Building area (ft2)** 1,248,230 **Campus Population** • Full-time students 2,069 • Part-time students 83 • Faculty 292 • Staff 692
Scope 1	**Stationary Combustion (gallons)** • #2 Fuel Oil 205,545 • Kerosene 79,908 • Propane 132,862 • Diesel (generators) 12,084 **Fleet Operation (gallons)** • Gasoline 44,014 • Diesel 10,122
Scope 2	**Purchased Electricity (kWh)** 19,118,112

Scope 3

Faculty / Staff Commuting (travel miles)	
• Automobile	5,661,311
• Bus	10,665
• Commuter Rail	126,312
• Carbon-free Modes	37,316

Student Commuting (travel miles)	
• Automobile	1,779,332
• Bus / Bard Shuttle	515.424
• Commuter Rail	0
• Carbon-free Modes	658,485

Air Travel (passenger miles)	7,554,500

Landfilled Waste (short tons)	
• CH4 Recovery & Flaring	409

Wastewater (gallons)	
• Central Treatment System (Aerobic)	37,288,323

Paper Purchases (lbs.)	
• 0% Recycled	10,988
• 30% Recycled	11,040
• 100% Recycled	1,190

Offsets & RECs	
• On-site Composting (short tons)	214
• Renewable Energy Credits (kWh)	2,000,000

2.3. Results

Figure 2.2 presents the GHG inventory results for the 2016/17 fiscal year. Bard operations produced total gross emissions of 15,102 metric tons of CO_2 equivalent (tCO_2e), not accounting for any carbon offsets. **Table 2.1** shows the tabulated net results from the inventory, including 439 tons in carbon offsets, for total net emissions of 14,662 tCO_2e.

Excluded from this assessment are emissions associated with food production and procurement by Chartwells, the College's food service provider. Using the CarbonMap™ software, Chartwells estimated the emissions from menu engineering for 2016 at an additional 1104 tCO_2e. While currently not included in the GHG inventory figures, Bard recognizes this as legitimate source of emissions to be integrated into future inventories and CAP planning.

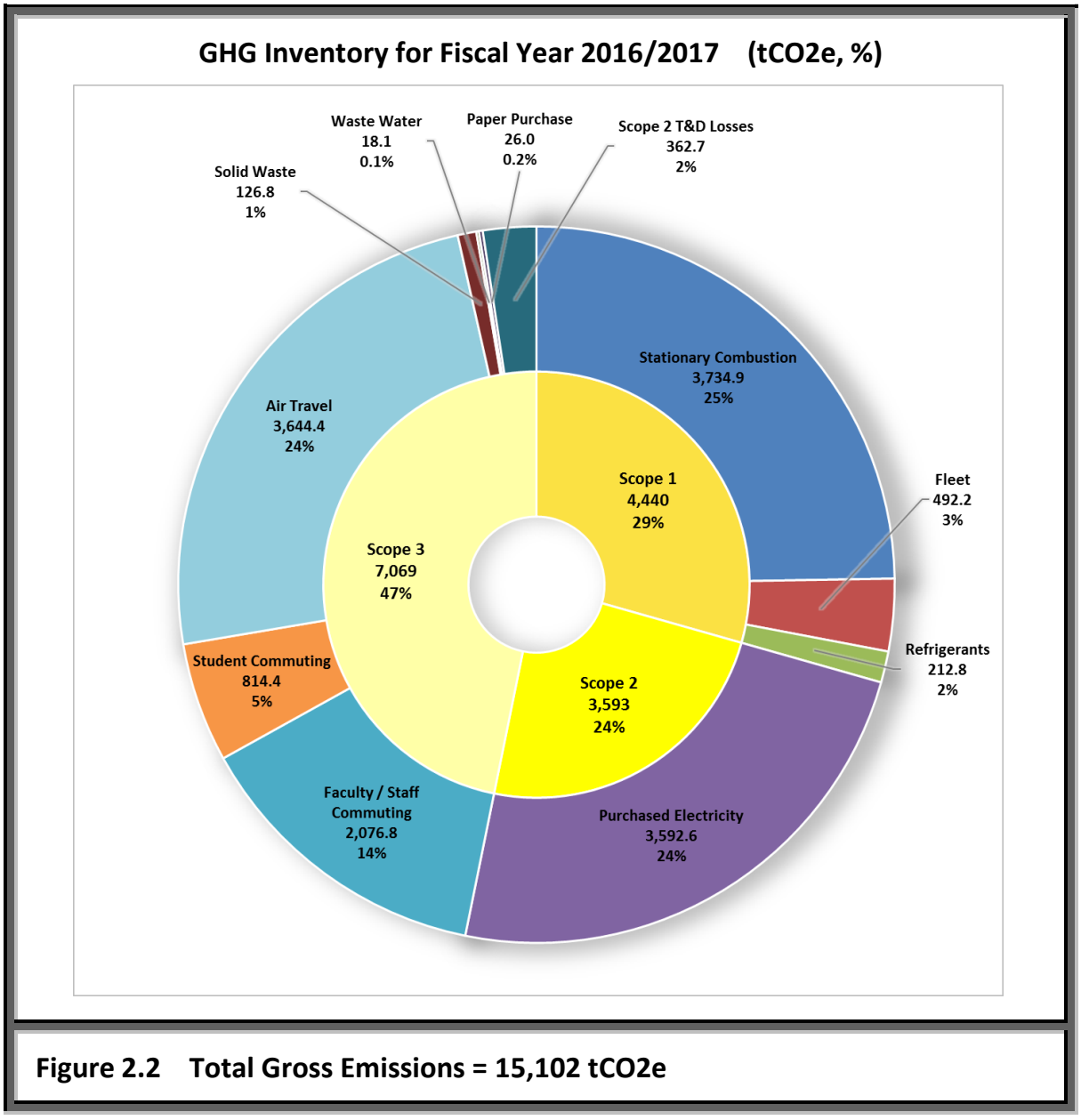


Figure 2.2 Total Gross Emissions = 15,102 tCO2e

Table 2.1 Net GHG Emissions for Fiscal Year 2016/17		
Emissions Source	**tCO_2e**	**%**
Scope 1		
Stationary Combustion	3,734.9	24.7
Fleet	492.2	3.3
Refrigerants	212.8	1,4
Sub-total	**4,439.9**	**29.4**
Scope 2		
Purchased Electricity	3,592.6	23.8
Sub-total	**3,592.6**	**23.8**
Scope 3		
Student Commuting	814.4	5.4
Faculty / Staff Commuting	2,076.8	13.8
Air Travel	3,644.4	24.1
Solid Waste	126.8	0.8
Waste Water	18.1	0.1
Paper Purchasing	26.0	0.2
Scope 2 T&D Losses	362.7	2.4
Sub-total	**7,069.3**	**46.8**
Carbon Offsets		
On-site Composting	- 62.9	- 0.4
Renewable Energy Credits	- 375.8	- 2.6
Sub-total	**- 438.7**	**- 2.9**
Net Total	**14,663.0**	**97.1%**

2.4. Emissions Projection

Figure 2.3 presents Bard's GHG inventory projected from 2017 through 2035 under a Business-As-Usual (BAU) scenario, using net emission totals from the 2016/17 GHG inventory as the starting value. BAU does not assume the development of new technologies, regulations, or other major changes in consumption patterns that are difficult to forecast. **Table 2.2** provides the details and assumptions used in the projection.

In summary, Bard as an institution is expected to remain roughly constant in size, population, and operational scope, with near-, mid-, and long-terms plans for moderate increases in building area in the lead up to 2035. Under this BAU scenario, annual emissions produced from Bard operations are expected to grow from 15,102 tCO_2e in 2017, to 15,603 tCO_2e by 2035, roughly a 500 ton, or 3.3%, increase in annual emissions.

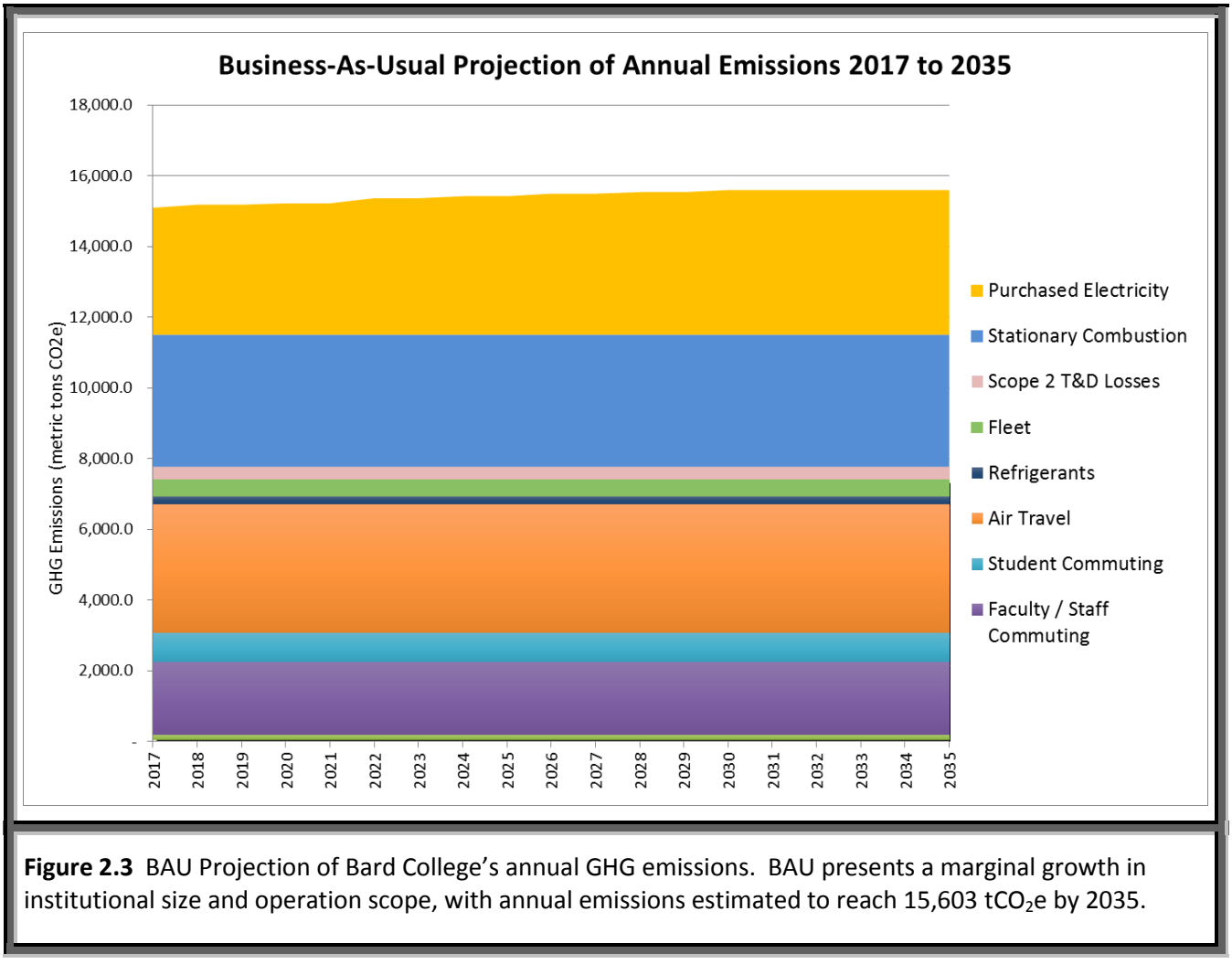


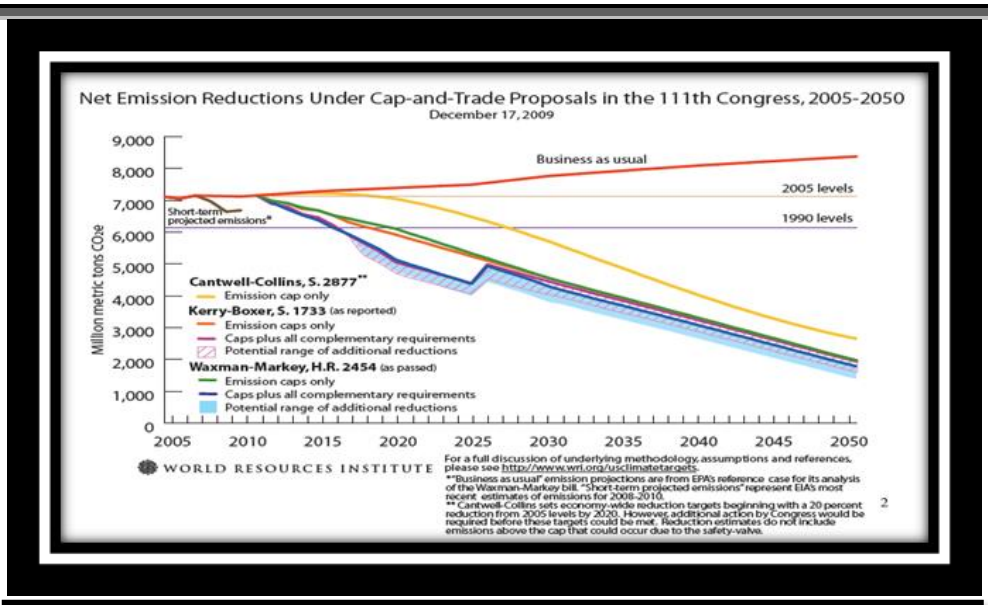
Figure 2.3 BAU Projection of Bard College's annual GHG emissions. BAU presents a marginal growth in institutional size and operation scope, with annual emissions estimated to reach 15,603 tCO_2e by 2035.

Table 2.2 Details and Assumptions for Growth Projection 2017 - 2035

<table>
<tr><td>Building Area Growth</td><td>
<table>
<tr><th>Period</th><th>Notes</th><th>Growth</th><th>Area Added (ft^2)</th><th>Total Area (ft^2)</th></tr>
<tr><td>2016</td><td>Main Campus</td><td>---</td><td>---</td><td>1,204,980</td></tr>
<tr><td>2016/17</td><td>Acquisition of Montgomery Place Estate.</td><td>3.6 %</td><td>43,250</td><td>1,248,230</td></tr>
<tr><td>2018 – 2025</td><td>Near-term plans for new construction include:
- New Science Center
- Kline Addition
- Gym Addition
- Library Addition</td><td>9.1 %</td><td>140,000</td><td>1,362,230</td></tr>
<tr><td>2026 – 2035</td><td>Mid- to long-term plans include several proposed new buildings</td><td>4.4 %</td><td>60,000</td><td>1,422,230</td></tr>
</table>
</td></tr>
<tr><td>Population</td><td>• The number of students, faculty, and staff is expected to remain roughly constant through to 2035, with marginal growth. All population-related emissions metrics (e.g. commuting, waste output, energy demand, air travel, etc.) are expected to remain stable.</td></tr>
<tr><td>Energy Consumption</td><td>• Energy consumption growth is proportional to increases in building square footage.
• All new construction is defaulted to electric heat pump heating & cooling (e.g. geothermal, air-to-air, etc.), therefor any increase in energy consumption is expected to be for electricity only (i.e. no growth in oil or gas consumption).
• Fleet size is expected to remain stable.</td></tr>
</table>

2.5. Financial Exposure to Potential GHG Regulation

The future of GHG regulation is uncertain. Legislation and financial mechanisms used to curb emissions could affect colleges and universities, and make GHG emissions a financial liability. Analysis performed by the World Resources Institute[2] can provide an example scenario for the annual cost of purchasing carbon allowances (or offsets) through 2050. It forecasts the impact of recent legislative initiatives to cut emissions, summarized in **Figure 2.4**. Price scenarios for carbon allowances under H.R. 2454 compiled by the World Resource Institute (**Figure 2.5**) show a wide range in possible cost-per-ton of emissions.



Percent change from 2005 emissions

	2010	2012	2020	2030	2040	2050
Business as usual emissions	0	1	4	9	14	18
Short-term projected emissions	-6					
S. 2877 Emissions caps only		1	-1	-20	-44	-63
H.R. 2454 Emissions caps only		-2	-14	-36	-54	-72
H.R. 2454 Caps plus all complementary requirements		-2	-28	-40	-57	-75
H.R. 2454 Potential range of additional reductions		-2	-33	-46	-63	-81
S. 1733 Emissions caps only		-2	-17	-36	-54	-72
S. 1733 Caps plus all complementary requirements		-3	-29	-37	-55	-73
S. 1733 Potential range of additional reductions		-4	-34	-43	-60	-78

Figure 2.4 World Resources Institute analysis of net emission reductions under current Cap-and-Trade proposals, shown in graphical and tabulated form.

[2] World Resources Institute, 2009. "Emission reductions under cap-and-trade proposals in 111th Congress." Retrieved 12/29/09 from http://pdf.wri.org/usclimatetargets_2009-12-17.pdf

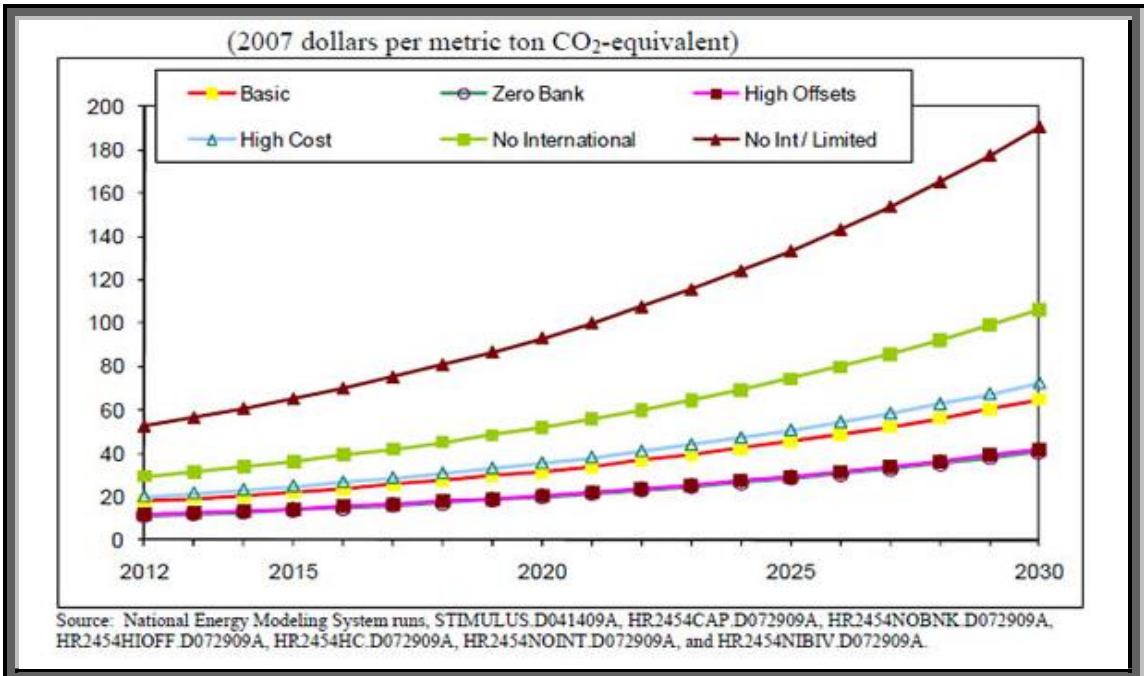


Figure 2.5 Carbon Allowance Price Projection Scenarios. For a complete description of scenario assumptions and methodology, visit webpage:

http://pdf.wri.org/usclimatetargets_2009-12-17.pdf

Assuming that colleges and universities will become regulated and must comply with reduction benchmarks, the following parameters were used to estimate a potential cost for Bard's GHG emissions through 2050:

- Regulations and costs will kick-in as early as 2020.
- A BAU scenario for growth of Bard's annual emissions over time (see **Figure 2.3**).
- A reductions timeline as under Waxman-Markey H.R. 2454 with emissions cap only (see **Figure 2.4**).
- Prices for carbon allowances under H.R. 2454 follow the "basic" scenario (see **Figure 2.5**).
- The composition (%-mix) of grid electricity coming from renewable sources follows the New York State growth scenario (see **Section 4.7.2**).

This baseline cost scenario is depicted in **Figure 2.6**, for which the present value cost of purchasing allowances to meet reduction benchmarks accumulates to roughly $3.06 million through 2050.

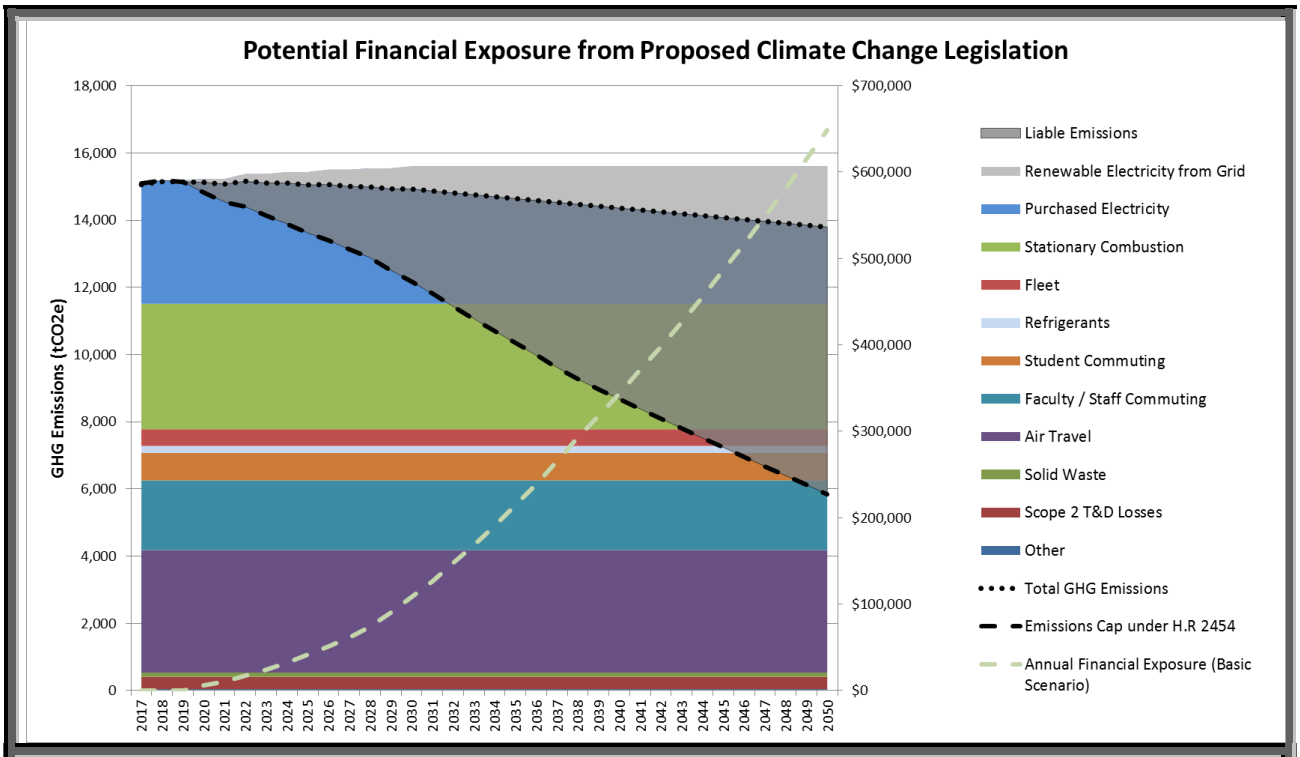


Figure 2.6 Potential Financial Exposure from Proposed Climate Change Legislation. The present value cost of purchasing allowances to comply with reductions benchmarks accumulates to roughly $3.06 million through 2050.

2.6. Overview of Mitigation Strategies

Averting or mitigating global climate change may be the greatest challenge humanity has ever faced. It will require a significant allocation of time, effort, and resources, and pursuit of multiple mitigation strategies on an accelerated timeline. The task is, no doubt, daunting; but by taking integral steps, building upon success, and continually resetting the goals for greater emissions reductions, reaching carbon-neutrality, at an institutional and global scale, is possible.

To date, Bard has had success in completing major initiatives, including the establishment of the Bard Sustainability Council (2010) and participation in STARS (rated Silver in 2011, and Gold, 2014 and 2017), completing large energy efficiency and renewable energy projects, and integrating sustainable practices into campus life and academic curriculum. Some strategies have yet to be fully explored; however, continued collaboration between the Bard Office of Sustainability, Operations, Sustainability Council, and Administrative and Academic Departments continue to investigate new technologies, vet proposals, and develop new projects will ensure a "full hopper" of initiatives to pursue.

Table 2.3 defines the major categories into which individual mitigation strategies are grouped, while **Table 2.4** summarizes, by category, a comprehensive list of near-, mid-, and long-term strategies to be implemented by Bard to reduce Scope 1, 2, and 3 emissions. The following chapters and subsections are laid out in this order, and address the status of each strategy in detail.

Table 2.3 Mitigation Strategies by Category

Institutional	• Integrate CAP goals into fabric of Bard operations & academic life
Facilities	• Reduce building energy consumption and waste streams
Fleet	• Reduce emissions from Bard-operated vehicles
Commuting	• Transportation demand management to alter commuter behavior
Air Travel	• Reduce or offset emissions from Bard-funded air travel
Purchase Offsets	• Purchase carbon offsets & renewable energy credits

Table 2.4 Summary of Mitigation Strategies

Institutional Actions (Scope 1, 2, & 3)

- Continue to support efforts of the Sustainability Council (est. 2010), a mixed-body of students, faculty, and staff tasked with implementing sustainability initiatives and to continually review and update CAP goals.
- Restructure academic curriculum to embody CAP goals
- Institute sustainability as an intrinsic part of student life and Bard Community
- Adopt a Green Building Standard for new construction & major renovations.

Facilities Actions (Scope 1 & 2)

- Implement energy conservation measures in all existing facilities, including:
  - Systematic energy audits and recommissioning of facilities
  - Weatherize and insulate building envelopes
  - Upgrade HVAC and controls systems
  - Install energy efficient lighting
  - Install energy sub-metering
- Invest in renewable energy systems, including:
  - On-site solar photovoltaic or solar thermal
  - Off-site solar photovoltaic (Remote Net Metering)
- Fuel switch from fossil fuels to electric and carbon-neutral biofuels
- Reduce waste streams
- Develop refrigerant and fugitive emissions reduction measures
- Purchase renewable electricity from grid

Fleet Actions (Scope 1)

- Utilize renewable biofuels where possible.
- Systematically upgrade fleet to low- and no-emissions vehicles

Commuter Actions (Scope 3)

- Implement Transportation Demand Management (TDM) policy that encourages students, faculty and staff to use alternative forms of transportation to commute to, from, and about campus, including busing, carpool, bicycling or walking.
- Switch to electric vehicles and increase availability of charging infrastructure.

Air Travel Actions (Scope 3)

- Create centralized system for booking air travel to track expenses and emissions
- Increase telecommunication and reduce amount of approved flights
- Purchase carbon offsets

Additional Actions (Scope 1, 2, & 3)

- Purchase carbon offsets and RECs

2.6.1. Mitigation Strategy Wedges

Figure 2.7 displays a list of mitigation strategies and their estimated emissions reductions under a BAU scenario. Following the 2035 deadline, all remaining emissions must be accounted for by purchasing carbon offsets or other reduction measures

Each "mitigation wedge" may include a host of actions or developments, internal and external to Bard, and is based on a reasonable expectation of future developments. For instance, we assume that low/no carbon vehicles and alternative fueling infrastructure will be completely phased in by 2035. Likewise we can expect that New York State will achieve the goals stated in its 2015 Energy Plan[3], including 40% reduction in GHG emissions, 50% grid electricity from renewables, and 23% building energy efficiency by 2030, and that Bard can follow suite. If Bard continues at its current rate of project and policy implementation, it seems reasonable that campus-wide carbon-neutrality will be achieved by 2035.

The details and underpinnings of the wedges and their foreseeable reductions are provided in the sections dealing with those topics.

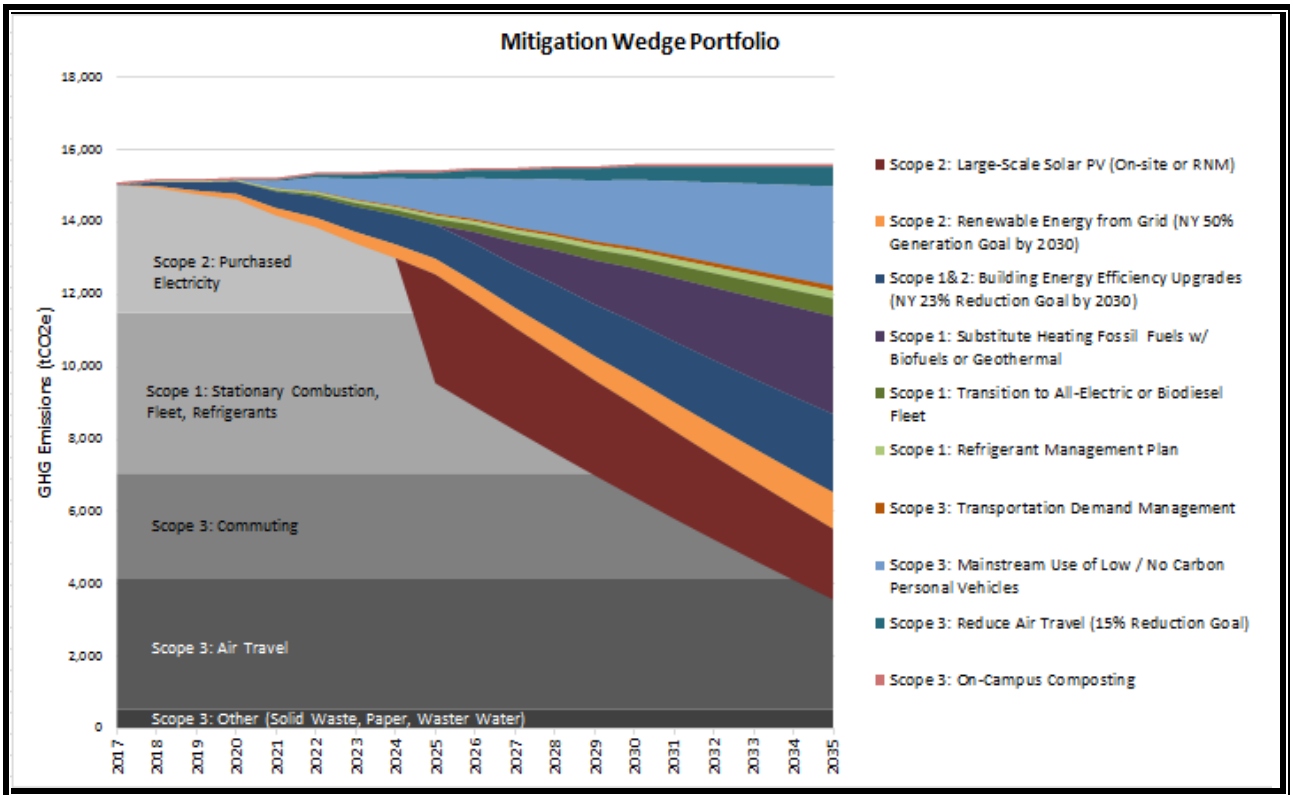


Figure 2.7 Mitigation Wedge Portfolio. These GHG emission "mitigation wedges" are a reasonable estimate of future developments. Following the 2035 deadline, all remaining emissions must be accounted for by purchase of carbon offsets or other reduction measures.

[3] https://energyplan.ny.gov/

2.6.2. Funding Mitigation Strategies

Bard has several means of funding carbon-reducing projects, particularly energy-saving projects. Each year, Bard allocates a large portion of its operating budget toward an A-list of large capital projects, and chooses several projects to implement that year. Generally, a few of the chosen projects have energy-saving attributes (e.g. upgrades to lighting, HVAC, envelope and fenestration, etc.). Likewise, the Building & Grounds Department will spend a portion of its annual budget on small- to medium-size projects with attributable energy savings.

BOS has had success in leveraging government and utility incentive programs to offset the costs of implementation and shorten paybacks. NYSERDA programs provide cost-share for technical studies, commissioning, and implementation, while Central Hudson Utility has provided rebates for high-efficiency lighting and equipment, at times reducing costs by 50% or more. For example, strategic use of NYSERDA incentives and a pre-paid Power Purchase Agreement funded development of the 280kW-DC solar array on the Bard campus (see **Section 4.3.1**).

The Green Fund is an account funded by annual parking registrations fees, revenue from participation in grid demand response programs, and other various sources. BOS and B&G use this money to fund energy studies and small sustainability projects, as well as to support projects with a funding boost to help secure a more sustainable outcome.

A rough tally of Bard's investment in energy-saving projects is $1.95M from 2010-2016, securing roughly $787,000 in incentives and an estimated $301,000 in annual energy cost-savings.

Other future funding opportunities include:

- Self-financing energy performance contracts
- Revolving funds that are replenished by savings generated by conservation measures
- Grants from government, foundations or business partners
- Alumni donations and other fundraising
- Student activity fees and graduating class gifts

3. INSTITUTIONALIZING THE CAP:

3.1. Establishing a CAP Oversight Committee

In Fall 2010, Bard established the Sustainability Council: a mixed-body of staff, faculty, students, and administrators, who meet regularly to discuss all manner of sustainability topics and to coordinate related efforts. The student position is elected by the student body. One faculty position is nominated by the Environmental & Urban Studies Program. As part of its mission, the Sustainability Council (SC) helps review and develop sustainability-related programs and projects (including research, coordinating events, and spearheading initiatives), and oversees the college's participation in STARS and other rating systems.

3.2. Metrics and Tracking Progress: STARS

To establish a method of evaluating and tracking progress towards carbon-neutrality and Sustainable living, Bard participates in STARS – the Sustainability Tracking, Assessment and Rating System. Launched by AASHE, STARS is a voluntary, self-reporting framework for colleges and universities to gauge their progress in sustainability. The STARS reporting system is robust and covers a wide variety of topics, including energy and operations, dining services and food sourcing, academic curriculum, and institutional investments. The guidelines and metrics provide a solid platform for institutions to evaluate their "level of sustainability" and to track progress without having to invent their own methodology. Although a major undertaking, the reporting requirements force an institute to take stock of its carbon footprint in a broad sense, to track success, and learn where to improve.

Bard achieved STARS Silver in 2011, Gold in 2014, and Gold in 2017,

3.3. New Construction & Renovations: Aiming for Net-zero Energy

By designing new construction and renovations projects to maximize energy efficiency from the onset, Bard can physically grow as an institution while stabilizing and eventually reducing its energy and carbon footprints. To date, Bard has had success with incorporating "green building designs" into new construction and renovations, including high-efficiency insulation, lighting, and HVAC systems. Bard has successfully adopted a de facto standard for using geothermal technologies for new construction (roughly 40% of total building square footage uses the technology), and uses the NYSERDA Technical Assistance and New Construction Programs to help identify and implement energy-saving measures during design and construction phases.

While "net-zero energy" for a building can be difficult to achieve, especially for existing buildings, it is attainable. To ensure that Bard is on the path to achieving net-zero energy in new construction, and maximizing energy efficiency in existing buildings, Bard should formally adopt a "green building standard and design protocol" to incorporate into all major projects. For instance, use of the US Green Building Council's LEED (Leadership in Energy Efficiency

Design) programs for new construction, renovations, and operation and maintenance, can help provide guidance, metrics, and checklists to ensure a high-performance building.

Bard's energy efficiency goals are largely supported by New York's progressive energy code and building regulations. With its construction code previously updated to 2012 IECC standards, in October 2016, New York again updated its minimum standards to the 2015 IECC and ASHRAE 90.1-2013, with all changes demanding even greater efficiency in buildings and equipment.[4] Furthermore, the state is currently undergoing state-wide reform in energy policy, the New York State Reforming the Energy Vision (REV) program. Two of the overarching strategies include driving construction practices toward Zero Net Energy and on-site renewable solutions to reduce fossil fuel consumption. Bard will actively pursue the benefits offered by assistance programs in these areas. The College's recent agreement to participate in the DOE Better Buildings Challenge (to achieve 20% building energy efficiency within 10 years of signing commitment) and REV Campus Challenge will assist in these efforts.

3.4. Restructure Curriculum & Research Efforts to Embody CAP Goals

American College & University Presidents Climate Commitment

(…continued from Section 1)

We believe colleges and universities must exercise leadership in their communities and throughout society by modeling ways to minimize global warming emissions, and by providing the knowledge and the educated graduates to achieve climate neutrality. Campuses that address the climate challenge by reducing global warming emissions and by integrating sustainability into their curriculum will better serve their students and meet their social mandate to help create a thriving, ethical and civil society. These colleges and universities will be providing students with the knowledge and skills needed to address the critical, systemic challenges faced by the world in this new century and enable them to benefit from the economic opportunities that will arise as a result of solutions they develop.

Bard Sustainability Council has developed, and has oversight responsibility on, a planning document that integrate sustainability in the curriculum and research efforts of the college ("**Sustainability in Curriculum and Research Plan**"). Climate goals will be made explicit in that document. To help carry out the goals, all staff, faculty and students have access to Sustainability Council Green Fund mini grant assistance to develop sustainability courses and research projects

The following are specific places to integrate climate in the currciulum and research:

4 https://www.energycodes.gov/adoption/states/new-york

- Undergraduate Curriculum: Environmental and Urban Studies, Language & Thinking First Year Seminar, Citizen Science, and other academic programs offer programming and courses for all students.
- Graduate programs, includings the Bard Center for Environmental Policy connect environmental policy graduate students to undergraduate campus, especially through monthly policy calls and courses
- Bard Departments and Campus Committees create a living learning environment that enhance the student co-curricular educational experience around climate and sustainability issues
- Outside Groups: relationships with outside organizations and institutes including the local municipal governments, Environmental Consortium of Hudson Valley Colleges & Universities, Rockefeller University, and Cary Institute offer opportunities for students to volunteer, work and study in fields related to climate and sustainability.

3.4.1. Undergraduate Curriculum

In recognition of the importance of sustainability in liberal arts education, Bard offers over 70 courses related to the three prongs of sustainability: economic, social, and environmental. Many of these courses are offered or cross-listed by the Environmental and Urban Studies program (EUS), which draws on courses from all four divisions—Social Studies, Science, Arts, and Language & Literature. This currently represents 16% of the Bard curriculum, with a goal to reach 20% of courses relating to sustainability.

Bard's Engaged Liberal Arts and Sciences (ELAS) courses are designed to link coursework and critical thinking skills developed and practiced by Bard undergraduates in the classroom with civic and other forms of engagement activities that contextualize course materials and enhance learning. A significant portion of the learning takes place outside of the classroom: students learn through engagement with different geographies, organizations, and programs in the surrounding communities or in the national and international venues in which Bard is involved. ELAS courses challenge students to develop creative approaches to social, cultural and scientific issues. Students are exposed to an array of perspectives and contexts and given the opportunity to apply theory to practice.

Engaged liberal arts and sciences classes may involve a variety of activities, but emphasize reflective learning. Community engagement is not based on "service," but on respect and reciprocity. Such an emphasis encourages open exchanges, collaboration, and the potential to produce new forms of knowledge. There is a particular opportunity to systematically incorporate sustainability into ELAS courses.

Environmental & Urban Studies

EUS—the standard-bearer for sustainability curriculum at Bard College—is a transdisciplinary program that examines the interdependence of human societies and the physical environment. The program strives to ensure that majors have a solid background in the physical sciences, the humanities, economics, and policy—and understand what sustainability means in the real world.

EUS aims to enhance students' understanding of the complexities of environmental and urban issues and their awareness of interrelationships between built and "natural" environments.

The Hudson River forms a laboratory for an integrated understanding of local and global social, economic, and environmental transformation. EUS professor Dr. Eli Dueker initiated the Saw Kill Watershed Community (SKWC) to bring the college and community together to protect our local watershed. The SKWC builds on previous EUS initiatives working with the NYS DEC Hudson River Estuary Program (HREP) such as the American Eel Monitoring Project, Day in the Life of the Hudson River, and the Amphibian Migration project. EUS professor Dr. Bruce Robertson is the director of the Bard Field Station on the shore of the Hudson's Tivoli Bays Wildlife Management Area. EUS collaborates with Hudsonia, Riverkeeper, Hudson River Sloop Clearwater, Hudson River National Estuarine Research Reserve, Scenic Hudson, and the Cary Institute for Ecosystem studies to provide enhanced educational and research opportunities for students.

EUS works with the Center for Civic Engagement to provide students volunteer, internship, and study abroad opportunities. This includes an internships newsletter, collaboration on the Bard Globalization and International Affairs Program in New York City (BGIA), and a rich variety of internship and junior-year abroad programs.

Students also draw on resources at the Bard Center for Environmental Policy (Bard CEP). Bard CEP offers graduate courses to advanced undergraduates, research opportunities on Asia & the Environment, and a 3+2 program.

The EUS Colloquium, open to all students, faculty and staff, (1) exposes students to disciplinary and trans-disciplinary research and thinking in environmental and urban studies, especially by our own faculty; (2) enhances faculty members' awareness of one another's work, with a view to developing a coherent and integrated EUS program; and (3) provides a forum for EUS students to present their own work and to develop their rhetorical and collaborative skills via presentations initiated and designed by themselves. Recent examples have covered environmentalism, agriculture, and climate change.

The EUS Practicum is open to all students and is intended to (1) expose students to local, real-world problems, (2) expose students to local sustainability organizations, and (3) give students experience in solving problems through collaboration with peers and local experts. Recent examples have covered sea-level rise in the Hudson River, sustainable trail design, environmental education, disaster management, strengthening the on campus food system and sustainable urban/regional development.

EUS will work with BOS to address on campus problems in the Practicum and through independent student projects.

Curricular Goals, Programs and Projects in Development

The Office of the Dean of the College (DOC) sponsors speakers that encourage multi department collaborations, runs three First Year student experiences—Language & Thinking (L&T), Citizen Science, and First Year Seminar (FYSEM), as well as the Institute for Writing and Thinking

(IWT). The DOC has shown commitment to sustainability goals in the Plan through service to the Sustainability Council and support of sustainability funding. In 2011, the DOC worked with EUS to secure funding from the Mellon Foundation to enhance the EUS curriculum. The Mellon Grant helped bring in environmental scientist Dr. Eli Dueker (see SKWC below), helped hire experienced Hudson River environmental educator Tom O'Dowd (Master of Science) as Executive Administrator, and helped enhance EUS courses (such as the colloquium and practicum), EUS internships, and EUS senior projects.

In addition to expanding on existing programs and department efforts, the following measures remain under evaluation in order to integrate an environmental literacy requirement into the college curriculum.

- The College is assessing whether we can establish an environmental institute to serve as a coordinating structure for faculty, staff, students and the outside community that will catalyze new research, outreach and teaching efforts
- Establish a January term course for all students to tackle global scientific issues that require sustainable solutions.
- Modify existing successful models already in place at the college including Language & Thinking requirement and First Year Seminar to incorporate sustainability and climate theme
- Incorporate sustainability and climate projects into existing classes to solve campus problems
- Create an incentive program for faculty members who adapt their curricula to include an element of climate and sustainability literacy
- Consider revisions to tenure review process that reward interdisciplinary work
- Coordinate guest lecture series across programs/departments/graduate/undergraduate groups
- Develop multi-disciplinary course, team-taught, and open to non-EUS majors, offered each semester
- Establish a campus 'curricular trail' with content contributed by each Division
- Provide a campus sustainability project reference list for EUS 101 term projects or for use in other classes
- Re-inventory courses to again identify those with sustainability components, and get keyword 'sustainability' or other code in course descriptions. Use this inventory to identify patterns of exposure to theme with a goal of filling gaps
- Evaluate revision to the College's mission statement to include climate commitment
- Insert new "sustainability" language in job postings
- Identify a common reading or readings (Pope's Encyclical on the Environment was added to L&T for FY18)

3.4.2. Graduate Programs in Sustainability: MS, MBA, M.Ed

Prior to 20010, undergraduate contact with CEP had taken place informally through campus-wide teach-ins (Focus the Nation, 2008 and the Global Warming Teach-In, Spring 2009. Interactions with the undergraduates and campus life were made more formal through the

leadership of the new Graduate Programs in Sustainability Director, including via a 350 conference (Fall 2009) and the Global Warming Teach-In (Spring 2010), bimonthly climate calls, a speaker series, term projects for first year students and internship position with BOS and BardEATS.

BardCEP will work with BOS to address on campus problems in the Practicum and through independent student projects. Examples include the implications of converting from fuel oil to biofuels versus propane, carbon reduction associated with menu engineering, etc.

The Center for Environmental Policy (CEP) offers graduate degrees, sponsors national policy initiatives, and provides a forum for interactions with the undergraduate community. Academic programs offered include: M.S. in Environmental Policy, M.S. in Climate Science and Policy, M.S./ J.D. dual-degree with Pace Law School in Environmental Policy/ Environmental Law, Peace Corps Master's International (M.I.) Program in Environmental Policy, M.S./M.A.T. dual-degree with the Bard College Master of Arts in Teaching Program, and a Professional Certificate in Environmental Policy. In conjunction with the M.A.T., CEP intends to begin offering an M.Ed. in Environmental Policy beginning Fall 2017. Bard undergraduates may pursue a 3+2 degree through CEP, earning an M.S. degree in five years

The Bard MBA Program is one of a select few programs worldwide that fully integrates sustainability into a core graduate business curriculum. Based in New York City, the low-residency structure combines weekend-intensive in-person classes supplemented by on-line instruction.

Bard's Graduate Programs in Sustainability sponsored the following initiatives with public impact:

Bard Center for Environmental Policy

Power Dialog: The week of April 4th, 2016, The Power Dialog will support 10,000 students to engage in face-to-face dialog with state-level regulators in all fifty states. The topic: Implementing the Clean Power Plan, requiring 32% cuts in global warming pollution by 2030. How will it work? Hundreds of faculty will take their classes on coordinated field trips to their state capitols. www.powerdialog.net

C2C Fellows Program: Since the end of 2011, more than 500 young leaders have participated in our intensive weekend workshops focused on leadership skills such as public speaking and fundraising, geared towards the achievement of high-impact careers in sustainable business, policy and politics. In 2015, a training for 50 more undergraduates and recent graduates was held in NYC. http://www.bard.edu/cep/c2c/

National Climate Seminar: Twice-monthly dial-in conversations with leading climate scientists, policy makers, economists, artists, film-makers and others. Conversations are all available as podcasts.
http://www.bard.edu/cep/programs/climateseminar/archive/index.php?year=2015

Asia-Environment Student Research Conference: With support from the Henry Luce Foundation, Bard CEP hosted the first annual student research conference on Asia and the Environment, with forty undergraduate and graduate students from across the country presenting their research. http://www.bard.edu/cep/blog/?p=6964

Hudson Valley Food Systems Conference: This day-long conference convened business and NGO leaders from the regional food sector for an exploration of how Bard's faculty and student research resources could better support the needs of a sustainable food system.

Bard MBA in Sustainability

Sustainable Business Fridays: Twice-monthly, student hosted dial-in conversations with top business sustainability leaders, with the transcripts published regularly in GreenBiz.com. Conversations are all available as podcasts. http://www.bard.edu/mba/publicprograms/sbfridays/

3.4.3. Curricular collaborations with Bard Departments and Campus Committees

The integration of Sustainability in the curriculum is supported via multiple departments and committees. The Bard Office of Sustainability (BOS) assists with the College's STARS rating, which includes a measurement of how climate and sustainability are incorporated into classroom and research efforts. Both BOS and the Horticulture Department have helped make campus a living laboratory, through educational signage and demonstration projects that have been incorporated into classes. Both departments collaborate with faculty to support opportunities for independent study, tutorials and/or internships, as well as provide course contributions through guest appearances.

The Landscape and Arboretum Program is charged with promoting tree conservation and preservation on the Bard campus, and offers horticultural education, outreach, and research. Bard considers landscape as the intersection of place and people; natural areas that are part wild, yet defined by humans. Noncredit, adult education courses—offered at the College through the New York Botanical Garden—are open to the public and to members of the Bard community. Other events sponsored by the program include an annual Arbor Day tree celebration, campus garden tours, and lectures. Additionally, the Arboretum offers a summer internship and work-study positions to several undergraduate students each year. http://inside.bard.edu/arboretum.

BOS is situation within Buildings & Grounds (B&G). This relationship facilitates the incorporation of sustainability work into that department. Progress is made during weekly meetings as BOS collaborates on the daily operations of the College. The Horticulture department, also part of B&G, has pledged to increase use of electric-powered landscaping equipment from 0 to 5% during 2017. Bard produces its own water from the Saw Kill. The Water Plant B&G operator tracks gallons purchased from the Town of Red Hook as well as gallons processed. He achieves yearly reductions in usage on campus through leak detection.

The Supervisor of Plumbing and HVAC contributes to these goals through upgrades of faucets, toilets and waterless urinals. Efforts are tracked through service requests.

3.4.4. Collaborate with Outside Institutions

Bard is a member of the Environmental Consortium of Hudson Valley Colleges & Universities, an intercollegiate association established to more fully engage its member institutions in the region's environment. The mission of the Consortium is to help shape the future of the regional and global environment through collaboration, education, and research.

The College has a MOU with the Cary Institute for Ecosystem Studies to offer courses and research opportunities for graduate and undergraduate students. The collaboration draws on our combined strengths in the fields of environmental studies, environmental policy, and ecosystem studies. A tie-in to climate and sustainability issues presents itself through the weekly Seminar Series.

College representatives participate regularly in Red Hook Together meetings that "blend endeavors in culture, agriculture, education, business, and tourism in order to create a sustainable community."

The College will reach out to affiliated institutes such as the Bard summer program in New Orleans and The Bard Rockefeller Semester in Science to incorporate climate goals. The College has two collaborative programs with Rockefeller University. The "Bard-Rockefeller Summer Undergraduate Research Fellowship Program" offers students the opportunity to take courses and work in Rockefeller research laboratories on subjects related to biology and medicine. The "Bard-Rockefeller Semester in Science" provides advanced science students an intensive one-semester program in New York City at Rockefeller and Bard Hall.

3.5. Sustainability and Climate as an Intrinsic Part of Campus Life

We recognize that fostering ecologically literate citizens requires that our students' experiences outside the classroom be consistent with what they're being taught inside them. Likewise, the constructs of the workplace influence the faculty and staff experience. We would like to foster a dialogue about how our climate neutrality policy statements can be implemented through innovative policy. For example, the historic purchase of Montgomery Place offers a chance to create a "low carbon" community or a "zero waste" or "low emission" region. .

The mission of BOS is to enhance the sustainability of the College in its operations, academics, and outreach, while making Bard carbon neutral by 2035. We seek to enhance our environmental, social, and economic capital while operating within the limits of the ecosystem. Our primary work areas involve efficient transportation, flow of goods, and energy use. We foster dialogue among community members, assess new technology and industry best practices, coordinate projects, develop policy, and market programs. We believe all community members have a part in furthering sustainability carries out campus wide sustainability initiatives that reach across all students. Campus wide recycling, re-use programs, energy curtailment projects,

an amphibian migration program, movie screenings, talks, contests and renewable energy projects offer visible reminders of sustainability efforts at the college.

The Bard Center for Civic Engagement involves students in green volunteer opportunities and internships. With an entrepreneurial spirit and a sense of civic duty inspired by social consciousness, the Center for Civic Engagement creates and sustains reciprocal programs and relationships locally, nationally, and globally

The Trustee Leader-Scholar Program supports undergraduate and leadership development in the context of hands-on, student-initiated community engagement projects. Students propose, design, and implement civic engagement projects based on their own passionate interests, and provides a place for students with climate and sustainability interest to channel their energy into a real world project.

"Wellness" at the College includes combined efforts of a student club and a part time staff member, to provide Bard students, faculty and staff with wellness-oriented events for bettering mental and physical health. Climate collaborations are implemented when themes overlap, such as promoting the walkability of campus.

BardEATS (Education Advocacy Transparency Sustainability) is a collaborative partnership between Bard students, dining services, faculty and staff, and functions as an umbrella for Bard's food sustainability initiatives on campus and beyond. It is committed to increasing food purchasing transparency, reducing waste, decreasing our carbon footprint, promoting food access, and supporting local farms and sustainable products. The group makes food-related decisions and is comprised of leadership from the Bard Farm, Bard Dining, the Environmental and Urban Studies Department, the Office of the Vice President, the Office of Sustainability and Bard Student Government Representatives. In March 2013, Bard College signed a commitment to purchase 20% "real food" (food that is local/community-based, fair, ecologically sound, or humane as defined by the Real Food Challenge) by 2020. Bard's baseline value was 5%. In fiscal year 2017, Bard reached an average of 23% Real Food and met our goal 5 years early. Bard Dining buys directly from the Bard Farm (1.25 acres located on campus), and during the 2016 growing season, purchased over 22,000 pounds of fresh produce.

Harvesting greens at the Bard Farm (www.bard.edu/bardeats/, 2017)

The Horticulture Department has made campus a living learning laboratory by initiating the College's Landscape & Arboretum Program. Its mission is to preserve and enhance the natural and landscaped resources of the Bard campus and to promote knowledge and appreciation of horticulture and conservation. It aims also to provide a campus rich in horticultural diversity and beauty that can be readily enjoyed by the College and surrounding community.

The sustainability ethos at Bard is enhanced by the network of EcoReps. EcoReps are student volunteers in the residence halls, coordinated through BOS, who encourage sustainable behavior. They embody the concept that role modeling and creating social norms around sustainable behavior is the most effective way to create a community of connected, ecological citizens, who strive to make sustainability second nature. The EcoReps are creating a document to commemorate their responsibilities in furthering the mission of the Climate Action Plan. Their draft goals include renewable energy and building efficiency targets, and assistance with integrating climate change and sustainability into the curriculum for all students through the Citizen Science program. They are also codifying a promise to host events with a climate focus.

There were over 200 student clubs at Bard in 2017. The management of the clubs is largely through Student Government, including substantial budgets. Clubs represents a clear opportunity to enhance our climate and sustainability goals. The Sustainability Council will evaluate ways to codify these going forward.

There is generally a club with a sustainability or environmental theme, and activity levels vary by year. A Sustainability Engagement Intern position is funded yearly through BOS; the goal for this position is to support the continuity of a student sustainability club as well as advise the EcoReps.

The Bard Farm and Community Garden connects students to the land. Since 1997, the Bard College Community Garden has been a haven for agricultural enthusiasts from Bard and beyond. People gather in the circular garden for weekly potlucks and work parties during the growing

season and help to maintain its fruit, vegetable, and flower crops. The student-initiated Bard Farm, established in 2012, is located behind Ward Manor on the North Campus. The 1.25-acre farm allows students to grow food in ways that are ecologically sound, demonstrate the methodologies for sustainable food production, and be responsive to the latest scientific and agricultural practices for growing diversified crops.

The Dean of Student Affairs Office (DOSA), as part of the Office of Student Affairs, and has pledged to formally integrate sustainability into its departmental missions; where in the past informal activities have been the norm. DOSA's environmental mission statement reads:

> *"Sustainability is achieved when all people on earth can live well without compromising the quality of life for future generations." Rolf Jucker, 2003*
>
> *The Dean of Student Affairs Office recognizes that we have a responsibility to future generations to slow the process of global warming. Student Services can equip and encourage students to participate in building a socially diverse, just, and sustainable society. We will work to integrate environmental literacy and sustainability into student life through our practices and programming.*
>
> *We seek to incorporate environmental principles and environmentally responsible practices as fundamental and integrated components of our programming. Our fundamental principles are to*
>
> - *Incorporate environmental concerns as significant priority in decision-making*
> - *Seek alternative practices and procedures to minimize negative impacts on the environment*
> - *Consider the social, economic, and environmental impacts of our purchasing decisions*

The Socially Responsible Investment Committee (SRIC) provides an important check on institutional investments. In addition to annual phonathons for our Social Choice Fund (an ESG screened endowment option for gifts); the Socially Responsible Investment Committee (SRIC) is charged with reviewing and voting all proxy votes for the College. Additionally, the SRIC chosen four-six companies annually to review for shareholder engagement over issues of concern. This translates into a minimum of one shareholder resolution and/or engagement campaign each calendar year.

3.5.1. Proposed and Ongoing Measures

Bard continues to develop and codify departmental commitments to incorporate sustainability across the college. Some of these efforts include:

CAMPUS LIFE & EVENTS

- Civic Action Plan under development by the Center for Civic Engagement to codify sustainable engagement with measurable outcomes
- Continued funding for Sustainability Engagement Intern for BOS
- Continued participation in climate themed teach-ins (Focus the Nation (2008), Global Warming Teach-In (2009), 350 (2009) Princeton's Carbon Wedge Workshop (2010, 2012), and other nationally recognized events that promote sustainability like Recyclemania (2007-date)
- Promotion of pre-college sustainability shopping checklist
- Incorporate sustainability into First Year Orientation events during L&T
- Sustainability Pledges (First Year and Transfer (existing) Graduation (proposed))
- Information in New Hire packages, Administration/Staff Benefit Programs, including promotion of $10,000 off a 2017 Nissan Leaf for faculty, staff, students and alum.
- Insert sustainability language in work-study positions throughout the college
- Institutionalize modifications to Residence Life
    - Hall programming (Fall – MoveIn; Spring- Recyclemania, MoveOut)
    - Creation of sustainability in residence hall, particularly surrounding 17 UN Sustainable Development Goals
    - Model spaces: Green Kitchen, Green Room
    - Upgrades to EcoRep program
- Add sustainability component to Alumni Weekend, Parents Weekend
- Promote sustainability themed opportunities through Career Development Office
- Office EcoAmbassador program in administrative and academic buildings.
- Water Saving educational signage installed at the Athletic Center to reduce shower times
- Propose ballot initiative to fund sustainability projects
- Expand service opportunities at Community Garden
- Measure attitudes towards re-use culture at FreeUse with before and after surveys at five DIY events
- Create wellness connection using campus grounds with Wellness Committee
- Reframe issue (including DOSA pledge bullet 2) – from "being less bad" to "doing good"

FOOD & AGRICULTURE

- Increase infrastructure to increase sustainable food procurement for all dining halls
- Increase Teaching Kitchen Program Outreach and Engagement
- Have the Bard Farm increase sales to become self-sustaining
- Integrate Montgomery Place Orchards into Dining options
- Reducing our pre- and post- consumer food waste and donating food when able
- Working toward enhancing current systems as the technology and resources are available (ex. Compost, transportation systems etc.)
- Ensuring health and wellness in menu engineering

- Promoting in-season, house-made, and local foods
- Providing educational opportunities for students and staff in regards to eating
- Increasing transparency in our purchasing habits, as well as tracking and expanding Bard's "Real Food" percentage
- Investing and divesting in food companies based on research

3.5.2. Community Outreach & Engagement

Because ecological, social and economic issues cross political and geographic boundaries, we seek, create and react to opportunities to work beyond our physical border, particularly with the Town, Villages, County, State and Federal government and associations. BOS, with the support of the Center for Civic Engagement (CCE), offers a focal point for these connections.

Bard contributes in kind labor and letters of support for a diverse range of community projects. Current collaborations include:

Energy

- Solarize Northern Dutchess – facilitating adoption of solar energy
- Community Distributed Generation (CDG) multi stakeholder project for Red Hook
- Advisory Board, Department of Energy Rooftop Solar Challenge , with CUNY and Town of Red Hook – NY Solar Smart Partner, Permitting & Interconnection Workforce (2014-2017)
- NYSERDA Cleaner, Communities – Energy Plan for Dutchess County focusing on organics recycling (June 2015-June 2016)
- Assist Town and Village of Tivoli in their pledge to be Climate Smart Communities

Land Use and Water

- Greenway Conservancy Trails Program grant for development of a town-wide trails plan (June 2015-June 2016)
- Habitat Connectivity Pilot Project, Cornell
- Amphibian Migrations (ongoing)
- Saw Kill Watershed Community Project, Hudson River Estuary Program

Transportation

- Bike Pedestrian Task Force, Dutchess County Planning (ongoing)
- Transportation Alternative Program (TAP) grant for Town/Village sidewalk (March 2015-March 2017)
- DOT Upper Route 9G Corridor Management Plan, 2015

Resiliency

- Town of Red Hook emergency Preparedness Committee and Planning, 2015

Other Opportunities

- Support service learning projects on climate change and sustainability through the Trustee Leader Scholars program

The College will continue to coordinate and participate in events in the greater Red Hook Community, especially in collaboration with CCE and including Red Hook Clean Up Day, Red Hook Recycles Day, and local climate change events such as movie screenings, forums, seminars and conferences.

We will continue to connect Bard interns with community organizations and governmental committees. Specifically, Town of Red Hook Conservation Advisory Council has needed assistance implementing the Town Energy & Climate Action Plan, the 10% Challenge and the Town's status as a New York State Climate Smart Community.

We hope that through our strategy to maintain good communication with multiple stakeholders, to have an "open door" policy for new ideas and initiatives, and to stay up-to-date with best practices, we will keep Bard positioned at the forefront of sustainability efforts. This in turn can create an atmosphere of hope on campus for our diverse community and a positive vision for the future.

4. FACILITY EMISSIONS

4.1. Overview

According to the GHG inventory for FY 2016/17, roughly half of Bard's emissions are attributable to energy consumed by campus facilities, totaling 7,690 tCO_2e. **Figure 4.1** presents the breakdown of energy-related emissions, including stationary combustion (Scope 1), purchased electricity (Scope 2) and electricity transmission and distribution loses (Scope 3). Reducing facility emissions is likely to be the most challenging obstacle to carbon-neutrality, given the considerable time, effort, and investment needed to retro-commission existing buildings and upgrade old systems.

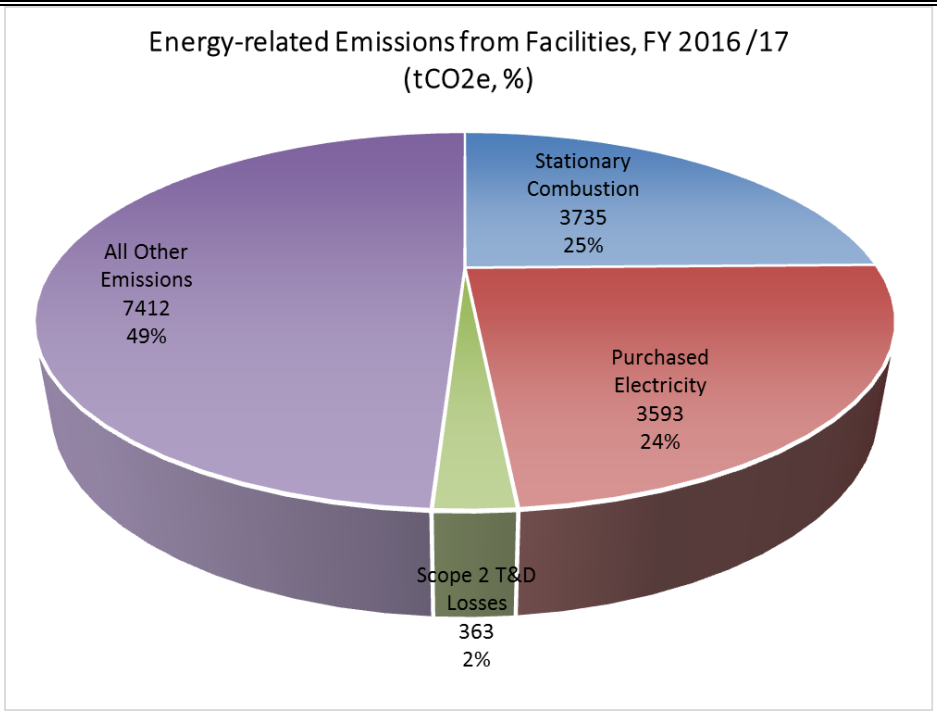


Figure 4.1 Breakdown of energy-related emissions from facilities in FY2017, totaling 7,690 tCO2e from direct consumption (electricity & stationary combustion) and indirect Scope 2 T&D losses.

4.2. Energy Conservation Measures in Existing Facilities

To reduce Scope 1 & 2 emissions, Bard will continue its efforts to identify and implement cost-effective energy conservation measures (ECM) in existing facilities, including:

- Weatherize and insulate building envelope
- Upgrade and recommission HVAC and controls automations
- Install energy sub-metering
- Install high-efficiency lighting

In 2008, a campus-wide audit performed by Johnson Controls identified ECM projects equivalent to an emissions reduction of 2810 tCO2e, or roughly 36% reduction in energy-related emissions. Subsequent audits and energy studies conducted by BOS continue to identify energy-saving opportunities. Each year, it is anticipated that one or two big projects, or several small projects, will be completed, with the hope that Bard can match the reduction goals declared in the NY 2015 Energy Plan and achieve 23% energy efficiency in buildings, relative to 2012 levels, by 2030, and continue that trend to 2035 and onward. Implementation of ECM measures by BOS and the Operations Team is an ongoing process; however, Bard touts a growing list of successful projects.

4.2.1. Milestones and Completed Projects

Campus-wide Lighting Upgrades

In Summer 2013, Bard upgraded nearly 6,200 indoor fixtures, including roughly 5,000 florescent fixtures (i.e. old T12 to T8 bulbs to high-efficiency T8s, and old magnetic and electronic ballasts to high-efficiency electronic ballasts) and 1,200 LEDs to replace old incandescent and CFL technology. With a total project cost of $520,000, Bard took advantage of incentives and discounts from the Central Hudson Utility's Commercial Lighting Program to reduce the overall cost by 51%. In addition to reducing maintenance costs, the project was calculated to save over 1,000,000 kWh annually and reduce Bard's power baseline by 224kW.

In Summer/Fall 2015, Bard upgraded 783 exterior fixtures to LED technology, including 219 exterior building lights and 565 street and path lights. The total project cost of $127,000, Bard took advantage of incentives from Central Hudson Utility and NYSERDA rebates to reduce the overall cost by $36,600 (~29%). In addition to reducing year-to-year maintenance costs, the project is expected to save roughly 375,000 kWh annually and reduce Bard's power baseline by 82.4 kW.

In addition to the large, campus-wide lighting upgrades, Bard has also focused on a variety of small- to medium-size projects, where certain applications require special design considerations (i.e. gallery and theater lighting, lecture halls, science center, etc.). Likewise, as existing fixtures and bulbs fail, they are replaced with LED through routine maintenance, and over 2000 fixtures have been converted to LEDs in this way.

Building Envelop Projects: Insulation, Weatherization, and Window Upgrades

Since 2011, Bard has undertaken a number of insulation, weatherization, and window upgrades, especially on some of the oldest residential buildings is owns (namely, 100+ year-old, single-family homes annexed to campus over the decades). Energy savings from these projects typically reduce building's energy consumption from 15 - 40%.

Projects to-date include:

- Dubois House, Center for Civic Engagement (Spring 2012)
  - Insulate exterior walls (full interior demo, 3 ½" sprayfoam)
  - Attic insulation (6" sprayfoam)
  - Various air sealing, insulate rim joist

- Hopson Cottage, Admissions Center (June, 2012):
  - Attic insulation (8" dense-pack cellulose)
  - Crawlspace insulation (2 ½" rigid foamboard)
  - Wall insulation on addition (3 ½" dense-pack cellulose)
  - Programmable thermostats

- Bostwick House, Daycare Center (June, 2012)
  - Attic insulation (12" blown-in cellulose)
  - Crawlspace insulation (rigid foamboard + sprayfoam)
  - Programmable thermostats

- Gahagen House (Fall 2013)
  - Insulate exterior walls (full strip, 3 ½" sprayfoam)
  - Attic insulation (6-10" sprayfoam)
  - Various air sealing, insulate rim joist
  - Programmable thermostats

- Tewksbury Hall (Summer 2014)
  - Full window and door replacement of 20,000 ft^2 dormitory
  - Replace old oil boiler with high-efficiency gas condensing boiler

- South Hall (Summer 2014)
  - Attic insulation (combo blown-in cellulose and sprayfoam)
  - Install new 9kW solar PV system

- Cedar Hill House (Summer 2015)
  - Insulate exterior walls (full strip, 3 ½" sprayfoam)
  - Attic insulation (6-10" sprayfoam)
  - Crawlspace insulation (sprayfoam)
  - Various air sealing, insulate rim joist

Building Automation and Equipment Upgrade Projects:

BOS and Bard Operations also implement small- to large-size projects that are cost-effective with regards to energy savings and reducing maintenance costs, usually with paybacks in the 2-3 year range. Often these projects greatly improve building functionality and performance.

- **Whole-building Automation Controls** upgrades, allowing for HVAC systems to respond to occupancy conditions and schedule setbacks, and greater ability to diagnose problems in the system. Whole-building upgrades include:
    - Stevenson Gymnasium (Summer 2011)
    - Kline Commons Dining Hall (Summer 2012)
    - Olin Humanities (Summer 2013)
    - Tewksbury Hall (Summer 2014)
    - Fisher Center for Performing Arts (Winter 2016/17)

- **New Dishwashing Flight Machine** (Spring 2012)) for the main dining services hall, reducing water consumption by 80% and energy use by 50% compared to the old unit.

- **Heat Recovery Ventilation** (Spring 2012) at the gymnasium indoor pool, to reduce energy from ventilating fresh air as well as help control indoor humidity and air pressure.

4.3. Renewable Energy Systems

While energy conservation measures will help to reduce the energy footprint of Bard facilities, they cannot completely offset all demand for energy. Investment in on- and off-site renewably energy systems can help to fill this gap, and provide other benefits such as security from energy price fluctuations and resilience in emergencies.

4.3.1. On-site, Large-Scale Solar Photovoltaic Systems

In 2013, Bard completed the installation of a 280 kW-DC solar PV array on campus in Bartlett Field and the adjacent athletic field. The system generates about 300,000 kWh annually, or about 1.5% of Bard's total electricity consumption. The project was financed utilizing a Power Purchase Agreement, with Bard as the host-site and committing to purchase all generated electricity. The system was originally planned for 1MW capacity (or 5.4% of energy needs), but budget restrictions and encroaching archeological sites resulted in a scaled-back project. Expansion of the array is possible, though would first require archeologic investigation, for which the costs and uncertainty of a "full stop" make the project risky and less likely to proceed.

Solar arrays at Bartlett Field (top) and Ferrari Athletic Field (left) (*Dan Smith, 2015)*

To estimate the potential impact and feasibility of large-scale solar PV on Bard grounds, a 2009 graduate study[5] conducted by the Bard CEP identified two plausible scenarios that could supply roughly 10% or 20% of Bard's 2009 electricity needs. Scenario 1 develops Bartlett Field to its full extent, while Scenario 2 develops Bartlett Field and also Robbins Field on north campus. Although such systems would have a notable impact on Bard's renewable energy composition, the use of limited campus land in this way may not be the best return on investment and would critically impact the future of land development at Bard.

By contrast, the development of large off-site solar PV (i.e. remote-net-metering developed on a brownfield) shows much greater promise to partially or fully provide Bard with electricity from renewable sources.

Satellite image of Bartlett and Athletic Fields, showing solar arrays. (*Google Maps, 2015)*

[5] Bard CEP, 2009. "Exploring On-site Photovoltaic Options for Achieving Carbon-Neutrality at Bard College."

4.3.2. Small-scale Solar Photovoltaic Systems

Distributed small-scale solar PV installations on or near individual buildings are estimated to have a marginal impact on displacing energy and emissions; likewise, the majority of Bard building stock is not ideal for roof mounted systems. However, their presence provides an important signal to the Bard Community about sustainability.

In Summer 2014, a 9kW roof-mount array was installed on the South Hall Dormitory, and roof areas at the Physical Plant and Stevenson Athletics Center could potentially support 60kW and 120kW systems, respectively. Combined, it's possible such systems could produce a rough total of 200,000 kWh, or about 1.0% of Bard's electricity consumption.

South Hall Dorm with 9kW solar PV array (*Dan Smith, 2014)*

4.3.3. Large- & Small-scale Solar Thermal Hot Water

In 2010, small-scale solar thermal hot water systems were installed at Tremblay Hall and Keene dormitories as demonstration projects. The systems continue to operate, but present only a marginal displacement of the buildings' total energy consumption (less than 1%). Because of this marginal impact, and the maintenance requirements the systems present, it is unlikely that Bard will pursue any additional small, decentralized systems on existing buildings. However, it's possible that a large-scale system, installed at a facility with a large, year-round thermal demand, could be viable return-on-investment. Currently, the only building on campus that meets such conditions is the Stevenson Athletic Center, which has hot water needs all year long (e.g. indoor pool, showers, laundry facilities, etc.). The economics and feasibility of such a project are currently under development.

4.3.4. Remote-Net-Metering: Off-site, Large-scale Renewable Systems

Currently, the greatest opportunity to completely offset Bard's electricity consumption with renewable alternatives is through off-site Remote-Net-Metering (RNM). Because the development of Bard's limited acreage for on-site systems is in conflict with other needs of the College, such as green spaces, view sheds and agriculture, the development off-site resources is an attractive proposition. Such a system could exist elsewhere in the region, and be placed over an inactive landfill, brownfield, or marginal area where there is less conflict over land use.

4.3.5. On-site, Micro-hydroelectric generation

The acquisition of Montgomery Place in 2016 put the Saw Kill Creek and its two dams in the hands of the College. Historically a small-scale hydroelectric turbine was in place at the lower dam; some remnants are still in place. This is the first artificial barrier on the creek, after a natural water fall at the mouth of the creek. A pre-feasibility study of estimated hydroelectric production (based on direct observation and hydro engineering algorithms) indicates the possibility of a 40 kW system. The second dam is located upstream on River Road and has the potential for a 12 kW system. Both projects are currently in the feasibility stage.

Dam on the lower Saw Kill, showing remnants of the penstock that provided water to the hydroelectric turbine near the mouth of the creek.
(*Laurie Husted, Fall 2015)*

4.4. Alternative Fuels for Heating and Back-up Generation

ECMs and renewable energy systems will help to reduce the energy footprint of Bard facilities, but it is unlikely that they will be able to offset all demand for fossil fuels needed for space and water heating and back-up power generation. In FY 2016/17, Bard facilities consumed 297,537 gallons of distillate fuel oil (#2, kerosene, and diesel) and 132,862 gallons of propane. On-site combustion of these fuels generated 3,735 tCO2e, or 24.7% of Bard's total annual emissions. Finding a viable, carbon-neutral substitute for any or all of these fuels would create a significant reduction in Bard's carbon footprint.

BOS has investigated several options for feasibility, including:

- Biodiesel to use in diesel-based generators
- Refined waste vegetable oil as a substitute for distillate fuel oil for boilers
- Synthetic oil from lumber industry bio-waste as a substitute for distillate fuel oil

It appears as if the "age of alternative fuels" is nearly here; however, lack of market maturity has so far limited these options. Issues with project size/scale, supply chains, equipment compatibility and warranties, and other economic barriers have stymied attempts to develop a demonstration or full-scale project. Ultimately, the ability to offset all fuel demands will largely depend on the growth and maturity of regional markets to provide a consistent quantity and quality of alternative biofuels at cost-effective prices.

4.5. Reduce Waste Stream Emissions

A 2009 audit estimated that solid waste and construction and demolition emissions amount to < 1% of the overall emissions. Nevertheless, solid waste operations are a visible part of the college's greenhouse gas generating activities. A campus-wide recycling and re-use program contributed to a 10% reduction in our solid waste production from 2008 to 2009. Recycled materials include commingled plastic, paper, cardboard, metal, wood scrap, electronics, light bulbs, ink jet and toner cartridges. The College operates a FreeUse store where clothes and other materials are sent for re-use across campus.

4.5.1. Solid Waste Costs

In 2015, the College spent approximately $90,000/ year on solid waste and recycling; a decrease of about 15% since 2008.

4.5.2. Reducing Solid Waste

Solid waste and C&D debris go to the Ontario County Landfill, approximately 250 miles from the College.

Robust composting operations at our main dining hall have enabled Bard to be a top ten finisher in the Food Service Organics category of the national Recyclemania contest 2008-2015 with three first place finishes (2009, 2012 and 2014). The Food Scrap on-site composting program equates to a greenhouse gas offset of (-63 tons or -0.4% of overall emissions for FY 2016/17).

Kline Commons food scraps become the compost pile. (*Laurie Husted, 2014)*

To reduce paper waste, the Bard IT department created a "pay to print" policy, as well as default double-sided printing on all student printers (Library, Henderson Labs, Campus Center, Language Lab, Shafter House, Saw Kill), that reduced paper consumption by up to 25% or over one million pages, as well as decreased ink consumption.

The Bard Bartering Facebook site has 1700 members and has contributed to the culture of reuse on campus and in the surrounding community. Our FreeUse MoveOut process diverts significant materials from our May waste stream, as well as during the regular school year.

4.5.3. Possible Future Demonstration Projects

- "Green Rooms" – establish a model for more sustainable office, residence hall room or kitchen.
- Contractor Outreach
    - Barnes & Noble Bookstore: offer reusable bags (existing program) and charge a small fee for a disposable bag
    - Chartwells: Reusable to-go containers rather than disposables
- Organize Green Vendor Fair
- Online presence for FreeUse

4.6. Refrigerant and Fugitive Emissions

Refrigerant and fugitive emissions represent less than 1.5% of total emissions. Because they derive from leaks in equipment and other difficult-to-detect sources, developing effective mitigation strategies may be difficult, though not unattainable. Systematic upgrade or repair of refrigeration equipment, and adoption of substitute refrigerants and chemicals with a lower GHG impact, can help to mitigate emissions from these sources. Bard should devise a Refrigerant Management Plan to coordinate the upgrade of equipment and phase-out of old types of refrigerants over time.

4.7. Purchase Renewable Electricity from Grid

The purchase of renewable electricity from the grid can be accomplished in two ways: (1) directly, by purchasing renewable electricity through an Energy Service Company (ESCO), and (2) indirectly, as the grid acquires a greater percentage of electricity from renewable sources.

4.7.1. Direct Purchase of Renewable Electricity through an Energy Service Company

With the deregulation of utilities in New York State, it is possible for Bard to negotiate the price and fuel-mix of the electricity they purchase. By partnering with an ESCO or energy broker, Bard can choose from to purchase electricity generated from a mix of renewable and "cleaner" non-renewable sources. This option is currently in development, and could partially or fully offset Bard emissions from electricity consumption.

4.7.2. Indirect Purchase of Renewable Electricity as Grid Becomes Greener

As renewable power generation continues to grow in the Unites States, the fuel-mix of the grid will gain a larger proportion of renewable sources. In 2005, New York State set a Renewable Portfolio Standard (RPS) benchmark to increase the proportion of electricity generated from renewable sources from 2005 level of 19.3% to 24% by 2013, an average annual growth of 0.6%[6], outpacing the projected annual national growth of 0.3%.[7] New York surpassed that goal, and in its 2015 Energy Plan declared a goal of 50% grid electricity from renewable sources.

Bard has benefited from this effect (as well as many regional power plants converting to natural gas), and has seen its calculated Scope 2 emissions fall despite electricity consumption remaining stable. If trends continue and New York goals are met, Bard could see a nearly 1000 tCO_2e reduction in its Scope 2 emissions by 2035.

[6] DSIRE (2009), New York Renewable Portfolio Standard. Retrieved 12/22/09 from http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=NY03R&state=NY&CurrentPageID=1

[7] EIA (2009), Annual Energy Outlook 2010 Early Release Presentation. Retrieved 12/22/09 from http://www.eia.doe.gov/neic/speeches/newell121409.pdf

4.8. Strategy Wedges and Timeline

Reducing all emissions from facilities will rely on considerable financial investments in energy efficiency and renewable energy projects between now and 2035. Table 4.1 offers summary of mitigation strategy wedges to reduce emissions from facilities, relative to 2035 annual emissions projected under a BAU scenario for Bard growth.

Table 4.1 Facility Emissions Reduction Wedges

Time Period	Wedge Description	Emissions Reduction (tCO2e)	Emissions Reduction (% of total)
2017 – 2035	**Building Energy Efficiency Upgrades (Scope 1&2)** 23% reduction in energy consumed by buildings by 2030 (as per NY 2015 Energy Plan) and continue trend thru 2035	2,161	13.8%
	Renewable Energy from Grid (Scope 2) 50% of grid-bought electricity from renewable sources by 2030 (as per NY 2015 Energy Plan) and continue trend thru 2035	1,017	6.5%
	Large-scale Solar PV Array (Scope 2) On-site or Remote Net Meter solar array to cover remaining eletricity needs.	1,947	12.5%
	Substitute Heating Fossil Fuels w/ Biofuels or Geothermal (Scope 1) Covert all fossil fuel based heating systems to carbon-neutral biofuel or geothermal	2,704	17.3%
	Refrigerant Management Plan (Scope 1) Implement plan to fix refrigerant leaks and phase-out old types with low-impact substitutes.	213	1.4%
	Total Reductions by 2035	8,041	51.5%
	Total Emissions by 2035	15,603	100.0%
	Remaining Emissions	7,561	48.5%

5. FLEET VEHICLE EMISSIONS

5.1. Overview

Bard operates a fleet of 126 vehicles for use by Buildings & Grounds, Safety & Security, Transportation, and other Departments. In FY 2016/17, fleet operation consumed 44,014 gallons of gasoline and 10,112 gallons of diesel, and generated 492 tCO_2e, or about 3.3% of Bard's total annual emissions. Table 5.1 summarizes the use of vehicles by department.

To date, Bard has experimented with a handful of low/no-carbon vehicles, including: an electric-diesel hybrid shuttlebus, (2) all-electric vans, (2) electric-gas hybrid cars, and (2) high-efficiency gasoline trucks. The College also supports a small student-run biodiesel production system. Results have been mixed, with some technology needing to mature before it can be successfully integrated into fleet operations; however, the potential of low/no carbon vehicles in the near future is clear.

Some fleet emissions can be avoided with good fleet management (e.g. no idling policy, replacing the oldest, least fuel-efficient vehicles, etc.); however, completely offsetting fleet emissions will rely primarily on traditional market factors and government regulation over time to increase the fuel economy of new vehicles and the availability of alternative fuels.

Table 5.1 Fleet Vehicles by Department (2017)

B&G Vans and trucks	71
B&G Mowers and Dozers	15
Transportation (including shuttle)	13
TLS Program	5
Administration, Pres./VPs.	4
Safety & Security	4
Center for Civic Engagement	3
IT & AV	3
Biology	2
Archaeology	1
Athletics	1
Bard Farm	1
BPI project	1
Field Station	1
Levy Institute	1
TOTAL	**126**

5.2. Fleet Management & Upgrades

Some emissions from fleet operation can be avoided with good fleet management, namely:

- "No Idling" Policy for B&G vehicles.
- Efficient fleet size (i.e. not too many or few vehicles to match worker demand and limit the number of cross-campus trips)
- Systematically upgrade the fleet by replacing the oldest, least efficient vehicles with newer models with better fuel economy.

Bard administrators and directors should periodically confer with departments to assess vehicle needs, and whether vehicle sharing, reductions or replacements are possible.

When attempting to replace vehicles with low/no carbon models, at present, the primary challenges are market based. Depending on vehicle type or application, there may not yet exist an alternative vehicle that is:

- Cost-effective, including availability of parts and repair service
- Compatible with existing infrastructure
- Suitable for a particular application (i.e. long-range use, mowing/plowing/dumping, shuttle transport, etc.)

However, as with all new technology, as markets mature and prices for low/no-carbon vehicles and fuels drop, it will become easier to adopt a green fleet.

5.3. Alternative Fuels

BOS has investigated the potential of several alternative fuels, including biodiesel, grease, ethanol, electricity, and compressed gas. So far, the costs and logistics of fuel-switching are prohibitive, although Bard has experimented with the purchase of a few all-electric and hybrid-electric vehicles that are currently service. In Bard's experience, the main barriers to adopting an alternative low/no carbon fuel are:

- Cost of alternative fuel is greater than conventional fuel
- Prohibitive cost of upgrading alternative fuel infrastructure
- Unreliable supply chain for biofuels
- Issues with availability of parts and repair services
- Voiding of vehicle warranties (i.e. using biodiesel concentrations of B5 thru B100)

As the markets for low/no carbon fuels and vehicles mature, over time Bard can reasonably expect to adopt new technologies and convert its fleet to 100% carbon-neutral fuels by 2035.

5.4. Strategy Wedges and Timeline

Based on current market trends and the increasing availability of alternative vehicles and fuels, Bard can reasonably expect to transition to a carbon-neutral fleet gradually between now and 2035. The transition will rely heavily on traditional market- and regulation-based drivers, the emergence of new technology, and affordable prices. Table 5.2 offers summary of mitigation strategy wedges to reduce fleet emissions, relative to 2035 annual emissions projected under a BAU scenario for Bard growth.

Table 5.2 Fleet Emissions Reduction Wedges

Time Period	Wedge Description	Emissions Reduction (tCO2e)	Emissions Reduction (% of total)
2017 – 2035	**Transition to carbon-neutral fleet (Scope 2)** 100% fleet emissions offset from the gradual transition to higher-efficiency vehicles and low/no carbon fuels.	492	3.2%
	Total Reductions by 2035	492	3.2%
	Total Emissions by 2035	15,603	100.0%
	Remaining Emissions	15,110	96.8%

6. COMMUTING EMISSIONS

6.1. Overview of Commuting Behavior at Bard

Based on results from a 2016 Commuting Behavior Survey of the Bard community, it is estimated that commuting by students, faculty, and staff contributes 2,891 tCO_2e, or about 19%, to Bard's total annual emissions. Faculty and staff commuting contributed the majority of these emissions, 2,077 tCO_2e, or 13.8% of total emissions, while student commuting contributed about 814 tCO_2e, or 5.4% of total emissions.

Reducing emissions from commuting will be a challenge, as these mobile sources are generally beyond Bard's control and reflect the choices of many individuals, including vehicle type, commuting distance, and personal driving habits. Table 6.1 shows the number of vehicles registered at Bard for FY 2016/17 obtained from S&S records; however, community noncompliance with vehicle registration is an issue. When compared to known campus populations and visible conditions, these records likely underestimate the actual number of vehicles on campus, underscoring the challenge of managing commuter behavior.

By implementing a set of practical policies geared toward altering commuter behavior, generally known as a Transportation Demand Management (TMD) program, Bard can use incentives and restrictions to reduce driving and parking congestion on campus and increase the use of bicycles, walking, and shuttle services.

Table 6.1 Number of Registered Vehicles in FY16/17 [8]

Freshman	96
Sophomore	116
Junior	113
Senior	87
Graduate	53
STUDENT TOTAL	***465***
Life Learning Institute	236
Faculty/ Staff	343
Staff	617
BARD TOTAL	1,661

[8] Obtained from S&S 2017 vehicle registration records.

6.1.1. Assessment of Student Commuting Behavior at Bard

BOS has conducted Commuter Behavior Surveys in 2008, 2013, and 2016, and will continue to conduct periodic assessments of modes of travel on campus. The format of the survey has been refined over the years to reflect the input parameters of the Clean Air-Cool Planet Campus Carbon Calculator to capture the number of commuter miles made each week and the modal split (i.e. proportion of each choice mode of transportation, including walking, bicycling, driving, etc.).

The April 2016 survey had 241 complete respondents, with the majority (151) living with 1 mile of campus center, 78 between 1 to 4 miles, and the remaining 12 commuting a distance of 6 miles or more. Figure 6.1 shows the average modal split across all respondents. While survey results are confounded by missing and imperfect data and potentially other biases, they are a useful estimate.

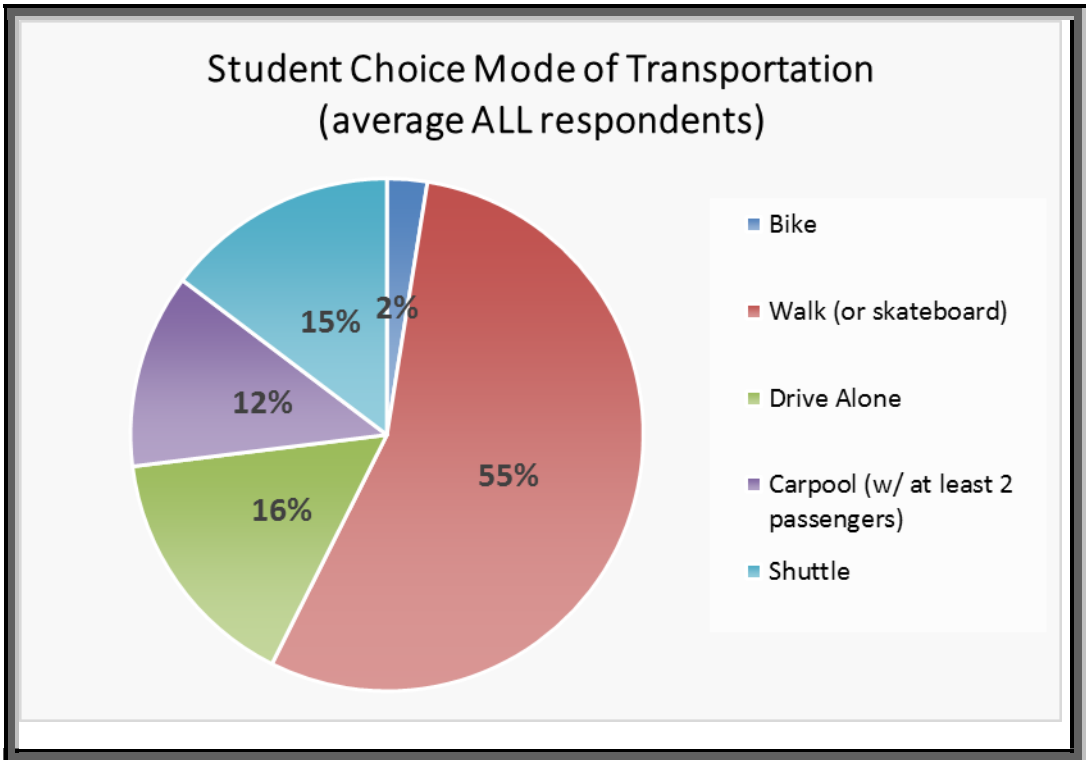


Figure 6.1 Modal split of students from April 2016 survey, calculated from the total miles traveled using each mode of transportation.

The results generally show what one would expect— students living on or close to campus tend to choose carbon-free modes of transport more often (walk, bike, etc.), and students living farther away tended use the shuttle more, or, most frequently, drive alone in a personal vehicle. Understandably, the farther from campus a student resides the greater the need to use a car. However, the concerning

trend is the frequent use of personal vehicles for on-campus or very close travel, pointing to students using cars to make short trips around campus.
This undesirable commuting pattern, also called "lot hopping", can be partially explained by following generalizations, captured by survey comments and by informal student interviews:

- Unrestricted use of parking lots make it convenient for students to hop from lot to lot to cover short distances (for example, from Robbins lot to Kline Commons lot)
- Limitation in shuttle capacity and run-times.
- Not enough passing time between classes to walk between destinations (note: passing time was increased from 15 minutes to 20 minutes as a result of student feedback).
- Nuisance of congested bike racks and lack of bike storage.

6.1.2. Assessment of Faculty/Staff Commuting Behavior at Bard

Based on results from a faculty/staff commuter behavior survey conducted in April 2016 of 52 faculty and 139 staff respondents, on average they commute 15.7 miles roundtrip to Bard, and make roughly 4.8 round trips per week. Nearly all commute to Bard in a personal vehicle—the vast majority drive alone (90%) or by carpool (3.6%). The remaining (who presumably live on or close to campus) will walk (5%), bike (1.3%) or ride the bus/shuttle (0.4%). Because faculty/staff are decentralized, living across the surrounding region (compared to a centralized student population) and generally 10 miles or mile from campus, organizing alternative forms of transportation for faculty/staff commuters can be difficult.

6.2. Transportation Demand Management at Bard

A Transportation Demand Management (TDM) program is a complimentary set of policy tools that encourage students, faculty and staff to use alternative forms of transportation— busing, carpool and vanpool, bicycling or walking – to commute to and around campus. The size of Bard campus is well suited for walking and biking, with most buildings within 0.5 mile radius of the central campus (see Figure 6.2 for map); however, the campus' rural locale and distance from surrounding towns and commercial centers can create a strong incentive for students to want a vehicle. Every time a student chooses to walk, bike, or use the shuttle rather than a car to make short trips around campus will displace 2-3 miles of driving and 0.0011 tCO_2e per round trip, which can add up.

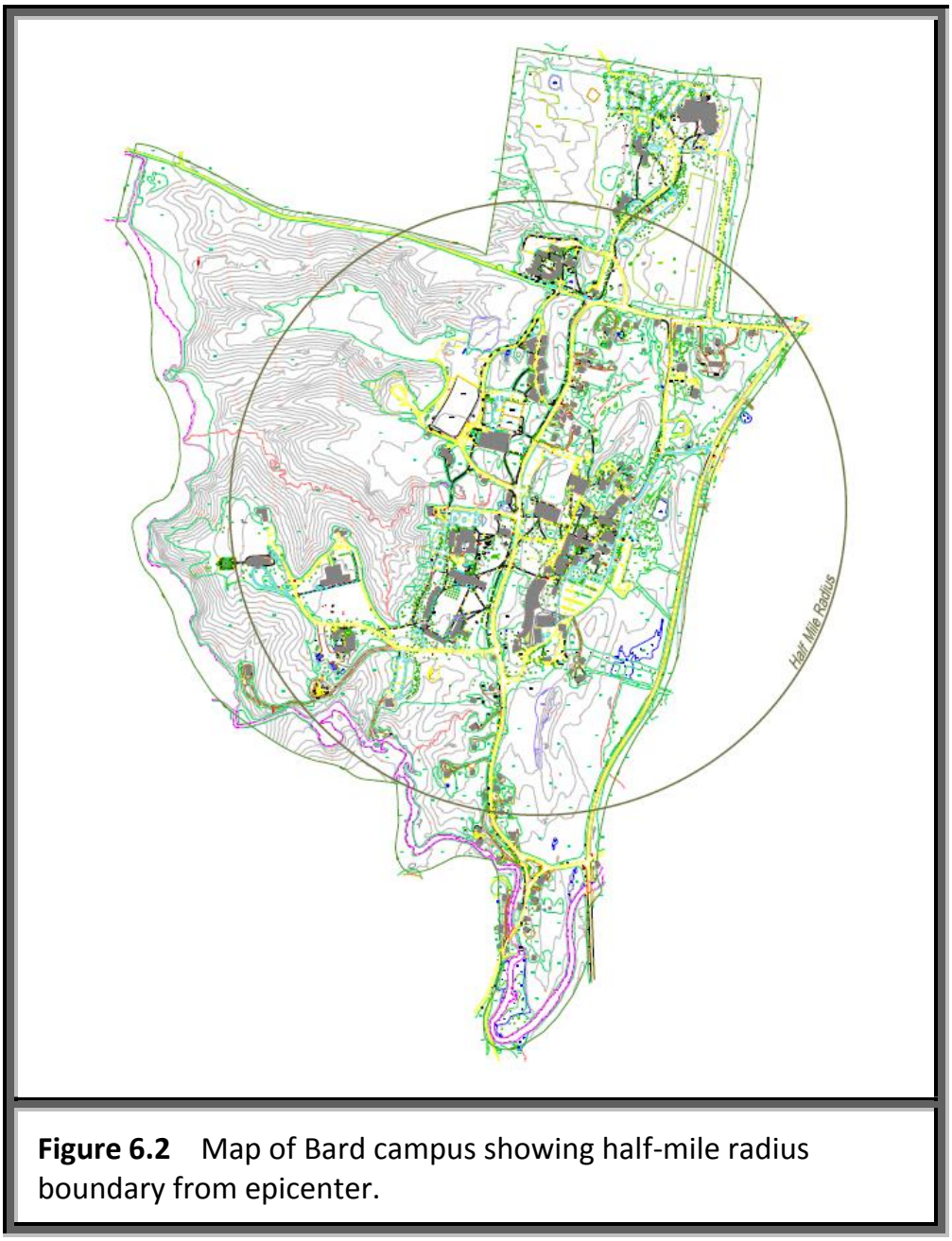


Figure 6.2 Map of Bard campus showing half-mile radius boundary from epicenter.

Some TMD policies can be implemented independently (e.g. raise parking fees, create bike co-op), while others are interdependent and need to be implemented simultaneously to work properly and avoid intended side effects. For example, increasing parking fees and restricting lots to encourage biking without increasing the number of bike racks for new demand would create bike parking congestion. Table 6.2 provides a list of recommended TMD policies to be implemented or expanded at Bard. This list should evolve as feedback and new ideas become available.

Table 6.2 TDM Program Recommendations

- Changes to parking fees.
- Restrict parking lots and increase lot enforcement.
- Optimize shuttle service and reliability.
- Expand Bard Bike Co-op.
- Expand Bard BikeShare program.
- Focus efforts on making campus "bike friendly".
- Promote independent ride-sharing resource such as 511NY.
- Continue to provide car-sharing program ZIPCar on campus.
- Continue to check AASHE Resource Center and learn about new ideas and efforts at other institutions.

6.3. Parking Fees and Rebates

6.3.1. Student Parking Fee

Based on simple economic theories of supply and demand, increasing parking fees should reduce the number of student vehicles on campus. In Fall 2009, Bard enacted a $100 annual parking fee for student vehicles. This fee was increased to $200/year in 2015. While it is uncertain to what extent parking fees reduce student vehicles, effects can be maximized by making walking, bicycling, and shuttle service more desirable modes of transportation.

6.3.2. Faculty and Staff Parking Fee

Currently, there is no faculty/staff parking fee, but Bard may wish to consider a discounted fee to help absorb the environmental costs of faculty/staff vehicles.

6.3.3. Parking Fee Rebate

Currently, Bard has parking spaces at Robbins lot reserved for fuel-efficient vehicles. Bard may wish to investigate the option to expand this program and offer parking fee rebates for students or faculty/staff who register fuel-efficient vehicles.

6.4. Restrict Parking Lots and Increase Lot Enforcement

Restricting parking lots can reduce lot congestion and ensure spaces are available for commuters who need them, and prevent students from driving short distances across campus (aka "lot hopping) while increasing the incentive to walk, bike, and use the shuttle. However, lot restrictions should be planned carefully to avoid isolating students, and be supported by enforcement measures (e.g. actively check stickers and issue tickets). A pilot program at the newly renovated Olin Lot has restricted use for commuters only. Additional changes to parking policy would be useful; however, enforcement is a hurdle.

Olin Parking Lot, Bard's 2015 permeable asphalt parking lot designated for Commuters only, with reconstructed wetland and drainage system. (*LRC Associates, 2015)*

6.4.1. Restrict Freshmen Vehicles

Bard currently does not restrict freshmen from having a vehicle on campus. However, many other colleges do and have had success with reducing the number of vehicles on their campuses. The College should weigh the pros and cons of such a policy, and account for the mobility needs of freshmen and account for the rural conditions and distance from commercial centers

6.4.2. Long-term Parking Lot

Designating a long-term parking lot and offering students a discounted parking fee for not parking elsewhere on campus, will provide an incentive to reduce "lot hopping". Another possibility is to create residential lots and commuter lots with different associated fees.

6.5. Optimize Shuttle Service and Reliability

The size of Bard campus is well suited for walking and biking, with most buildings located within 0.5 mile radius of the central campus (see Figure 6.2); however, the removed nature of campus from surrounding towns and commercial centers can create a strong incentive for students to have vehicles. The Bard Shuttle service is a unique offering for such a relatively small institution as Bard, and provides on- and off-campus students with a mode of mass transportation adapted to their commuting and excursion needs. Therefore, optimizing shuttle service and reliability to overcome the need for student vehicles is a crux of TDM at Bard.

Based on feedback, including responses from the Fall 2008 transportation survey, a handful of actions have been implemented to optimize shuttle service:

- Existing shuttle schedule matches classroom passing times
- Existing shuttle schedule no longer has an extended "dinner time" gap; instead it has (3) one-hour gaps (noon-1pm, 4pm-5pm and 8pm-9pm)
- Main Shuttle runs 7 days/week, 18 hours/day.
- Service has expanded to include a 14 passenger van that goes to the Village of Rhinebeck and Rhinecliff train station Fridays noon-7pm

The recommendation to make a campus only loop that adds stops near Olin, Rose/Hegeman, and RKC buildings has been implemented during Citizen Science during the morning and afternoon only.

6.6. Encourage Bike Use

Every time a student chooses to use a bike rather than a car to make short trips around campus can displace 2-3 miles of driving and 0.001 tCO_2e per round trip, which can add up. Increased use of bikes will also help to reduce traffic and parking congestion on campus. To help make owning a bike on campus easier, where available Bard has created designated areas in dorms for day-to-day storage, as well as designated long-term storage in Tremblay for students to safely store bikes during school breaks. Bike rider-ship at Bard is notable, but more can be done to make campus more "bike-friendly" and boost bike ridership.

1st-year students gather for L&T "Bike to the Village" ride (*Laurie Husted, 2014)*

6.6.1. Expand Bike Co-op at Bard

Students have organized a Bike Co-op and created a space where students can congregate to share cycling information, find and exchange parts, and perform tune-ups and repairs. BOS continues to support the Bike Co-op by hiring students to run the BikeShare and Pedicab programs.

6.6.2. Bike Programs

At the end of each academic year, the College retrieves abandoned bicycles and offers a bicycle raffle to students, faculty and staff. About 100 bikes have been redistributed annually since 2013. In 2017, 25 bicycles were donated to local charities, including the Boys & Girls Club of Hudson and the Alliance for Immigrants and Refugees. To help make bikes more accessible to students, since 2012 Bard has collected a small fleet of bikes that it can lend to students for a $25 deposit. About twelve bikes are placed into the BikeShare program each year.

6.6.3. Make Campus More "Bike-friendly"

A handful of projects can be easily implemented to help make campus more bike-friendly, including:

- Increase number of bike racks at social hubs: currently, racks at certain social hubs become overloaded, especially at peak hours, leading to bike overflow to student's locking bikes on lamp posts and trees.
- Build covered structures for bike racks: students have given feedback that bikes are often exposed to the elements, making biking to destinations less desirable.
- Work with Dutchess County to enhance Annandale Road's safety. Currently, flashing signals and reduced speed signs are at either end of campus is in place.
- Paint streets to designate bike lanes or shared roadway (sharrows), where possible.
- Continue to check AASHE Resource Center and for more ideas.

6.7. Promote Walkability of Campus

The Bard main campus has a radius of roughly 0.5 miles from the center to the edges of campus, or roughly a 7 -15 minute walking distance. Based on comments collected from the Fall 2008 transportation survey and informal student interviews, Bard increased the 15-minute passing time to 20 minutes, to give students more time to:

- Have quick after-class exchange sometimes necessary between students and/or professor
- Walk distances between buildings at s moderate pace, at times having to ascend/descend floors (especially noted for 1+ mile distance from main campus to Fischer Center)
- Be seated and prepared as class begins

It is hoped that this extra time will promote the choice to walk (or bike, skateboard, etc.) amongst students as a more effective way to traverse campus than "lot hopping" in personal vehicles.

To increase connectivity to the local and regional area, the Office of Sustainability and Landscape & Arboretum Program participate in Bard, town, village, county and state efforts to enhance trails in the region.

6.8. Mitigation Strategy Wedges & Timeline

Table 6.3 summarizes the timeline for neutralizing emissions from commuting. While implementing a TMD program can improve the campus environment and can make it easier for commuters to choose carbon-free modes of transportation, this is likely to have only a marginal impact on commuting emission. Unfortunately, Bard policies cannot displace all demand for commuting or preference for use of personal vehicles, and reducing emissions from commuting will ultimately rely on traditional market drivers and regulations to steer the vehicle industry toward carbon-neutrality. In the long-term, it seems reasonable that low/no-carbon models will become widely available and affordable to individuals, gradually reducing commuting emissions in the lead up to 2035.

Table 6.3 Commuting Emissions Reduction Wedges

Time Period	Wedge Description	Emissions Reduction (tCO2e)	Emissions Reduction (% of total)
2017 – 2035	**Transpotation Demand Management (Scope 3)** Implement policies that reduce demand for personal vehicles, and increase incentive to walk, bike, and use mass transit.	TBD	TBD
	Mainstream Use of Low/No Carbon Personal Vehicles (Scope 3) 100% emissions offset from the gradual transition to higher-efficiency vehicles and low/no carbon fuels.	2,747	17.6%
	Total Reductions by 2035	2,747	17.6%
	Total Emissions by 2035	15,603	100.0%
	Remaining Emissions	12,856	82.4%

7. AIR TRAVEL EMISSIONS

7.1. Overview of Air Travel at Bard

Each year, Bard uses funding to book hundreds of flights for academic trips and other institutional business, equating to millions of miles of air travel. However, it is difficult to estimate emissions related to air travel funded by Bard. Although Bard makes use of two 3rd-party travel booking services to track costs and miles, many flights are booked by individuals (who are then reimbursed) or department credit cards, which are often not tagged as air travel alone, or kept in records that are easy to search.

To estimate air travel miles for the 2013/14 fiscal year, BOS workers reviewed several filing cabinets of travel receipts to tag and tally air travel costs. Since travel miles are not usually included on receipts, a metric of $0.143/mile was used to estimate roughly 4,000,000 miles. The 3rd-party travel booking services reported an additional 3,544,000 miles, for a total of nearly 7.55 million miles. This remains the best estimate of Bard-funded air travel miles, until another record audit can be completed and combined with the 3rd-party reported miles.

Air travel funded by Bard is therefore estimated to generate 3,644 tCO_2e, or 24.1% of total annual emissions. This represents a significant portion of Bards total annual emission— roughly as much as the entire Scope 2 emissions from purchased electricity. Understandably, the College needs to be able to fly staff, faculty, and students, domestic and abroad, for academic enrichment or institutional business. It seems unlikely that Bard will be able to reduce its demand for air travel by any significant amount in the near future. Short of major advancements in aviation or alternative fuels to render air travel carbon-neutral, Bard will likely have to offset air travel emissions in other ways.

7.2. Reducing Air Travel

Reducing air travel can lead to considerable cost-savings and emissions reductions. The average round-trip flight approved by Bard in FY 2015/16 in was roughly 2,800 miles, and therefore every trip that is avoided can potentially save $400 and roughly 1 tCO_2e.[9] The following measures could be taken to eliminate trips and to increase the efficiency of necessary air travel.

7.2.1. Create a Centralized System for Booking Flights

For the past several years, the College has utilized two 3rd-party travel services for booking domestic flights and some international flights. However, it is estimated that roughly half of all Bard-funded air travel is booked using Bard credit cards or by individuals who are reimbursed, making it difficult to track all air miles and costs, and potentially underreporting emissions. Creating a fully centralized flight booking process or system can lead to better management, and provide analysis for ways to reduce air travel or coordinate using the same flights for multiple travelers.

[9] Based on metric of $0.143/mile and estimated Bard-funded air miles.

7.2.2. Telecommunicating

Telecommunicating is a cost-effective and increasingly valid means of conducting business without traveling. Bard policy should be developed to exhaust all options to telecommunicate before allowing faculty and staff to book air travel.

7.2.3. Use Alternative Transportation for Short-haul Trips

Short-haul trips of around 250 miles (about 4 hours driving) or less may be able to utilize alternative transportation, such as railroad, bus, or use of the Transportation Department's electric hybrid cars.

7.3. Air Travel Emissions Reduction Timeline

By reducing the number of approved flights each year, Bard can hope to reduce costs and emissions. However, air travel is a necessity to conduct business and support academic programs, and it may prove difficult for Bard to reduce its demand for air travel. Therefore, to allow for emissions generate by air travel and still achieve carbon-neutrality goals, Bard will likely have to purchase carbon offsets. With regional carbon offsets selling at around $3 to $8 per tCO_2e [10], under a BAU scenario this would cost Bard between $10,000 and $30,000 annually to completely offset all air travel emissions, with future prices for offsets unknown. Table 7.1 displays a preliminary plan to reduce emission from air travel through 2035.

Table 7.1 Air Travel Emissions Reduction Wedges

Time Period	Wedge Description	Emissions Reduction (tCO2e)	Emissions Reduction (% of total)
2017 – 2025	Increase use of telecommunicating and reduce amount of approved flights (Scope 3) Reduce number of approved flights by 15%.	547	3.5%
2026 – 2035	Continue to reduce # of flights: TBD Purchase carbon offsets: TBD	TBD	TBD
	Total Reductions by 2035	547	3.5%
	Total Emissions by 2035	15,603	100.0%
	Remaining Emissions	15,056	96.5%

[10] Regional Greenhouse Gas Initiative (July, 2017) www.rggi.org/market/co2_auctions/results

8. ADDITIONAL MITIGATION ACTIONS

8.1. Purchase Carbon Offsets and RECs

If mitigation strategies cannot account for total emissions reductions by 2035, for Bard to fulfill its goals and promises, remaining emissions must be accounted for via the purchase of carbon offset and renewable energy certificate (RECs).

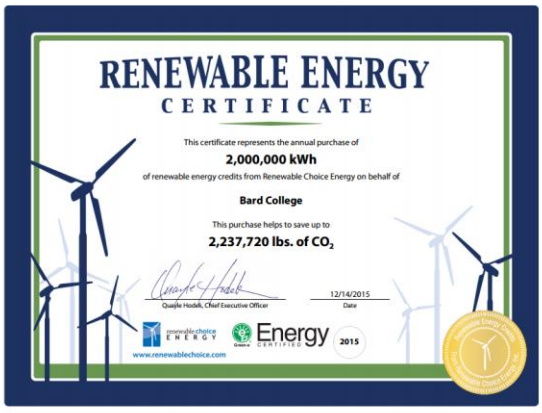
8.1.1. Carbon Offsets

A single carbon offset represents one ton of carbon emissions abated, which is claimed by the owner of the offset. There are a variety of offsets available on the market, which vary by price ($2 - $15/ton) [11] and in the standards deemed "acceptable" for sources of offsets (for instance, reforestation vs. trash incineration for energy). Further research is needed to vet vendors and to determine which standards are appropriate for Bard.

8.1.2. Renewable Energy Credits (RECs)

A single REC represents one MWh of energy generated by a renewable source, which is claimed by the owner of the certificate and may be used to offset a MWh of electricity from a dirty grid mix. Similarly to carbon offsets, RECs types vary by price and regulatory standards, and further research is needed to determine the extent to which purchasing RECs in the future is appropriate and cost-effective for Bard. However, in 2016 and past years, Bard has purchased RECs equivalent to 2,000,000 kWh of renewable electricity, enough to offset roughly 10% of Bard's electricity production.

Bard has purchased Renewable Energy Credits (RECs) to offset 10% of its electric emissions.



[11] General price can be found at Regional Greenhouse Gas Initiative auction market webpage (see Annual Reports). https://www.rggi.org/market/market_monitor

8.1.3. Estimated Cost to "Buy-our-way-out" under BAU Scenario

To estimate the potential cost of completely "buying-our-way-out" of reducing all emissions in 2035 using only offsets, we assume the following:

- BAU Growth Scenario for Bard (see Figure 2.3)
- Carbon offsets are chosen over RECs as the most cost-effective means to offset emissions
- An average offset price of $12/certificate, remaining constant over time
- The presence of a "greener" electricity grid (see Section 4.7.2, New York renewable growth scenario)

Figure 8.1 shows a simple projection of the annual cost of "buying-our-way-out" starting at the neutrality date of 2035 through 2050. Under these assumptions, Bard could be paying around $200,000 annually (2017 dollars), with a total present value cost of purchasing offsets over 15 year period (from 2035 to 2050) would accumulate to more than $1.1 million.

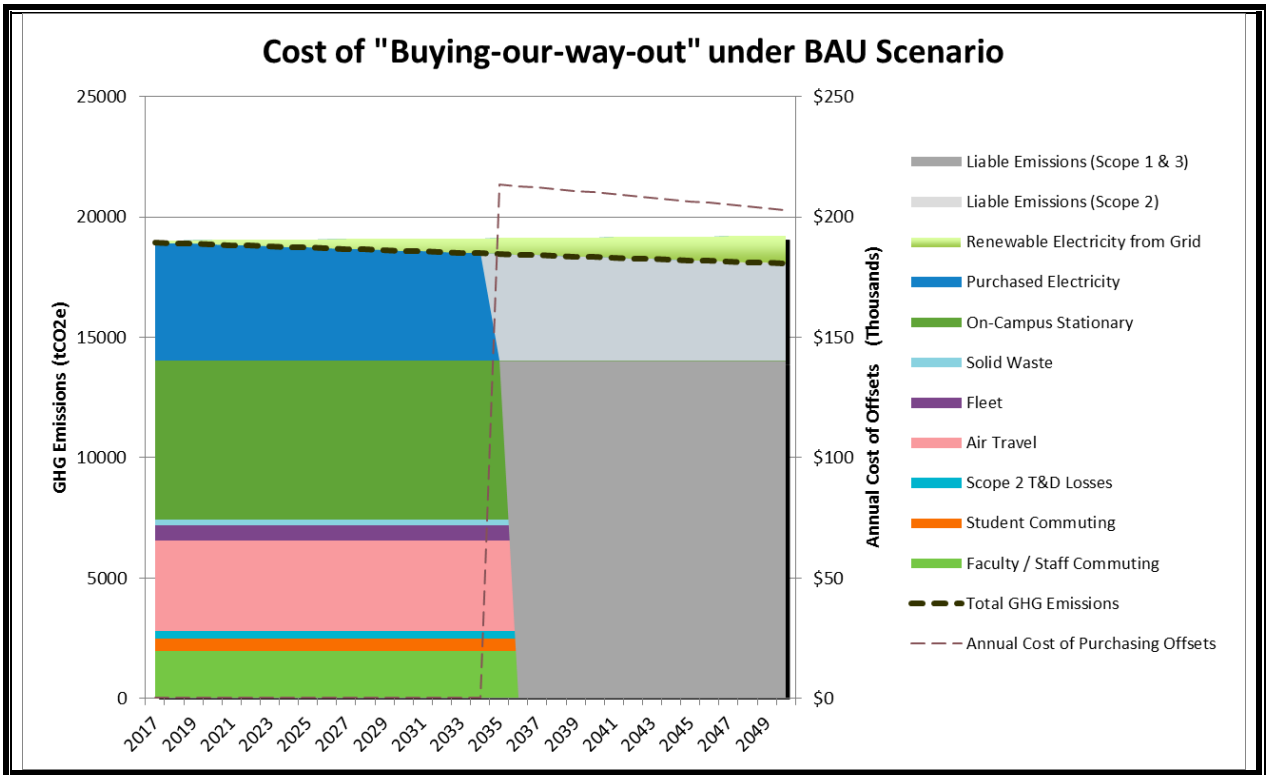


Figure 8.1 Cost of completely "Buying-our-way-out" by purchasing carbon offsets. Under these assumptions, the present value cost of purchasing offsets for the 15-year period from 2035 to 2050 would accumulate to more than $1,100,000.

8.2. Carbon Sequestration with Forest Management

Regionally, climate change is making forests more vulnerable by contributing to an increased number of weakened trees and invasive species, more disease susceptibility, and decreased regeneration. A healthy forest provides carbon sequestration, biodiversity, pest resistance, and is a source of bio fuel.

The roughly 550-acre Annandale main campus and 380-acre Montgomery Place property are heavily forested, including approximately 300 acres of the Annandale campus and the South Woods, an 80-acre native forest at Montgomery Place (additional woods border the Saw Kill Creek). Bard's forests are not actively managed, except in certain landscaped and trail areas. Locally, invasive insects are contributing to a loss of hemlock and nearly all ash trees. Maple and oak trees may be next.

According to Cornell University, "The annual carbon sequestration rate on 9,500 acres of Cornell forest land is approximately 11,260 tons of CO2; through active management practices, it is possible to significantly increase the carbon sequestration rate of these lands. If the university does not actively plant new trees and manage its mature forest stands, the carbon abatement capacity of these lands will diminish over time."

In a November 16th, 2015 letter to the White House, and as part of Bard's Climate Leadership Commitments, President Botstein pledged to enhance the resiliency of the region by maintaining at least 30% of Bard land as forest, wetland and/or river frontage. Bard aims to study how to refine this pledge by calculating the carbon capture potential of its land, which could involve creating a Forest Management Plan. Bard's Landscape & Tree Care Guidelines, Standards & Considerations Manual currently describes reforestation guidelines for disturbed areas of the campus and is an appropriate location to codify future updates.

APPENDIX A

Climate Change and Resiliency Planning at Bard

1.0 Introduction

Resilience is - according to Second Nature's definition - "the ability of a system or community to survive disruption and to anticipate, adapt, and flourish in the face of change."

Such a broad concept could be used as a guiding principle of any number of planning processes; one could easily imagine crafting resilient transportation systems, economic development strategies, or agricultural policies. However, resilience is a particularly useful principle to build into our strategies for surviving global climate change.

1.1 Climate Change, Global and Local

The Fifth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) - specifically the Summary for Policymakers (https://www.ipcc.ch/pdf/assessment-report/ar5/wg3/ipcc_wg3_ar5_summary-for-policymakers.pdf) - outlines the prospects for future climate change, predicting "changes in all components of the climate system" through the end of the century and beyond, including:

- Global average temperatures will continue to increase, with the potential for increases in excess of 2^0C by 2100.
- An increase in precipitation in "wet" regions, with a decrease in precipitation in currently "dry" regions.
- An increase in the severity of weather events of all types: rainfall, drought, heat waves, etc.
- An increase in global average sea level rise.

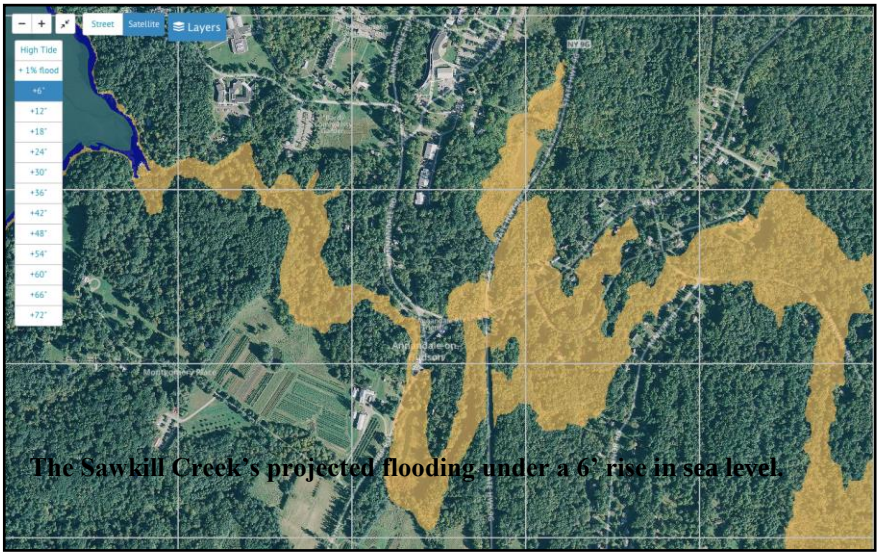
It is important to note that while global averages are useful, we do not live in a globally average world, and regional impacts will vary widely.

Scenic Hudson's Sea Level Rise Mapper (http://www.scenichudson.org/slr/mapper) is an excellent resource on sea level rise in the Hudson River Valley.

The Hudson River Estuary Program has several documents summarizing the likely impacts of climate change on our region:

- Climate Change in the Hudson Valley: A Summary for the Public (http://www.dec.ny.gov/docs/remediation_hudson_pdf/ccinthehvms.pdf)
- Climate Projections in the Hudson River Estuary: A Fact Sheet for the Public (http://www.dec.ny.gov/docs/remediation_hudson_pdf/cphv.pdf)

In the Hudson Valley, for instance, (as with most of the mid-latitudes) we can expect to be impacted by an increased number of precipitation events as well as more precipitation per event. This has significant impacts on flooding and agriculture. According to the National Climate Assessment, the Northeast has already seen a 71% increase in extreme precipitation events since 1958.



The Sawkill Creek's projected flooding under a 6' rise in sea level.

Sea level rise will affect low-lying communities along the Hudson River Estuary. Bard College itself will be directly affected by projected sea level rise over the coming century, as the Sawkill Creek (which serves as the campus' water supply) floods its current banks as the Hudson rises with the sea. On-campus flooding of low-lying areas will also likely increase.

1.2 Resilience and "Second Nature"

It is clear that climate change will cause large-scale disruptions for which we must be prepared. The manner in which we prepare now - before many of the major impacts become reality - is of critical importance. Adding a resilience framework to our existing adaptation and mitigation planning gives the resulting institutions a greater chance of being able to respond fluidly and effectively to the accelerating rate of change in the regional climate over the coming century.

While there are many strategies available, and many plans being written, integrating a resiliency framework will quite simply allow those strategies and plans to change more quickly, by building the capacity for change into those plans from the ground up.

Second Nature (http://secondnature.org) - a nonprofit organization dedicated, "to help build a sustainable and positive global future through leadership networks in higher education." - offers a suite of climate-related planning tools and coordinated national higher education commitments related to resilience and climate change.

1.3 The Carbon Commitment and Climate Action Plan

Second Nature provides three separate "Commitments" (pledges to undertake certain actions on a predetermined timetable); a Carbon Commitment, a Resilience Commitment, and a Climate Commitment, combining the former two. In 2009, Bard College signed Second Nature's Carbon Commitment, thereby joining the Climate Leadership Network and beginning the process of drafting the Bard College Climate Action Plan.

2.0 Resilience and Existing Bard Planning

While well suited to climate change responses, resilience as a planning concept fits well with other plans, and should be incorporated wherever possible. Such plans should include not only Bard-specific efforts, but local municipal and regional plans, such as the Town of Red Hook Master Plan (http://www.redhook.org/PDFs/Planning/Comprehensive-MasterPlan.pdf) and the Hudson Valley Regional Council's or Northern Dutchess Alliance'e economic development plans.

Second Nature encourages the use of existing infrastructure and plans in order to inform a larger process of resilience planning. Urged not to reinvent the wheel, there are already several plans in place which fit with a resilience planning model.

2.1 Examples of Existing Plans

There are several plans, both internal to Bard College and part of larger regional planning efforts, which could be used to inform the resilience planning process required of colleges which adopt the Climate Commitment.

The following are a few examples of existing or in-process plans that could easily inform a resiliency planning process, a necessary component of Bard's adopting the Second Nature Climate Commitment.

2.2 Bard College Climate Action Plan

The Bard Climate Action Plan (CAP), subtitled "Achieving Carbon Neutrality by 2035", was written to meet the criteria for Bard's Carbon Commitment. As the name implies, this CAP is focused on a) a greenhouse gas inventory, and b) a suite of strategies to reduce/mitigate those emissions to achieve carbon neutrality.

This plan can act as a foundation for an expanded CAP which includes resilience and a broader plan to anticipate and deal with a more varied array of impacts than simply greenhouse gas emissions. Regular updates of the CAP (required every five years) provide a good opportunity to revisit both carbon reduction and resilience goals holistically.

2.3 Bard College Emergency Management Plan

While nothing formal currently exists, a draft is being prepared. Given the increased need for emergency response under many climate change scenarios, such a plan would by its nature increase the resilience of emergency response for both Bard College and the surrounding communities (on whose emergency services Bard relies). Bard currently works closely with emergency services and surrounding communities and agencies in its disaster preparedness planning.

2.4 Northern Dutchess Alliance, "Blueprint for Economic Development"

The Northern Dutchess Alliance's Blueprint (http://www.northerndutchess.org/images/NDABlueprintWeb.pdf) is an example of collaborative planning on a regional scale that could fit within the resilience model. The NDA, according to the *Blueprint*, "supports a local economy that raises the wellbeing of all residents where to the greatest extent possible:

- Local needs are met local suppliers
- Dollars spent locally are circulated throughout the community
- Encourage the development of value adding industries for local products which complement the community's character, and
- The community's uniqueness is preserved and enhanced"

The product of extensive public outreach, NDA's "Blueprint" is one example of a regional planning effort that dovetails with a resiliency approach. The "Blueprint" could be taken in whole as the economic development section of a larger resiliency planning effort

3.0 Resilience into the Future

Having signed the Carbon Commitment and joined the Climate Leaders Network, the next step for Bard is to either a) sign the Resilience Commitment, or b) sign the Climate Commitment. Given that the Climate Commitment is a combination of the Carbon Commitment and Resilience Commitment, adopting the Climate Commitment is essentially the only step forward.

While Second Nature's program is a good one, and one Bard should continue to support, the concept of resilience is larger than any one program. As Second Nature recommends, existing plans (see above) and relationships may have already laid some of the groundwork in increasing the resilience of the Bard community.

3.1 The Second Nature Climate Commitment

The Second Nature Climate Commitment requires a series of steps be undertaken, some of which Bard has already begun.

From the formal agreement found on Second Nature's website:

- Develop a Climate Action Plan.
- Within two months, create internal structures to guide the process Bard has created the Sustainability Council to oversee these efforts.
- Within one year, complete a Greenhouse Gas Inventory. This has already been completed; in 2009, Bard commissioned a GHG Inventory from the firms of Econergy and Johnson Controls. Bard has continually updated its' inventory since 2009.
- Within two years, complete an initial resiliency assessment, to include both initial identification of indicators and an assessment of current vulnerability. Second Nature offers a "Commitments Implementation Guide", as well as a more detailed "Sustainability Planning and Climate Action Guide". These support materials provide a blueprint and best practices advice on running a vulnerability and resilience assessment.
- Within three years, complete the Plan in collaboration with campus-community structures. The completed Plan must include:
    - A carbon neutrality target date. Bard has already set this as 2035.
    - Resilience thresholds target date. This would be a result of the resiliency planning process.
    - Interim target dates for both carbon neutrality and resilience.
    - Defined mechanisms to track progress.
    - Defined actions to incorporate carbon neutrality and resilience into the College's curriculum. This is already a goal of Bard's current Climate Action Plan.
    - Defined actions to expand research into both carbon neutrality and resilience.
    - Evaluate progress annually
    - Complete a formal, annual progress review.
    - Submit all action plans, evaluations and updates to Second Nature's reporting system.

3.2 Funding

Adding a resilience component to Bard's existing carbon neutrality-focused Climate Action Plan is an extensive undertaking, requiring cooperation between intra- and extra-campus agencies over the course of three years (or less, given that Bard has begun the process).

It is recommended that Bard pursue grant funding in order to hire additional staff/consultants to oversee this planning process and bring it into the classroom. A long-term, thorough participatory process cannot be undertaken and managed using existing resources.

3.3 Existing Campus-Community Structures

Second Nature recommends "creat[ing] joint campus-community structure to have agreement on joint approaches, metrics for success, joint capacity building. Several such structures exist already, some more formal than others. These include:

- Faculty relationships or research projects. Some of the Departments and programs that may be interested in collaborating include:
    - Human Rights,
    - Science, Technology & Society,
    - Environmental and Urban Studies,
    - Center for Environmental Policy
- City resilience/sustainability/climate committees and higher education working groups. These are some of the organizations which Bard currently participates in in order to plan for a more resilient future locally.
    - Red Hook Together,
    - Red Hook Disaster Preparedness Committee
    - Northern Dutchess Alliance
    - Recovery and Resiliency Coalition of Dutchess County.
- Existing coordination or joint projects. These are projects currently underway which Bard is actively participating in, often working with local partners, all of which increase resiliency and could be used to inform a resiliency planning process:
    - Solarize Northern Dutchess,
    - SawKill Watershed Community,
    - Engagement (MLK Day),
    - Startup NY

4.0 Resiliency Case Studies

Resiliency is a broad concept, and a concept which can be applied to planning, adaptation and mitigation equally well. Second Nature offers a very well-developed way to organize resiliency planning and implementation, but other institutions are also integrating resiliency into their efforts.

4.1 Second Nature Resilience Indicators

As part of a larger resiliency planning process, Second Nature recommends collaboratively identifying certain Indicators, which are helpful in both defining vulnerabilities and planning responses. One potential Indicator is given for each category as an example.

- **Social Indicator** may be the need the demographic diversity, as might be overseen by the Bard College admissions department and college diversity programs.
- **Natural Indicator** may be protection/restoration of the Sawkill Creek, as is currently being undertaken by the "Sawkill Creek Community", a newly formed watershed protection organization.
- **Human Indicator** may be community health and wellness. Such an indicator may be acted upon by a study such as Dutchess County's comprehensive "Community Health Analysis, 2010-2013".
- **Financial Indicator** may be a grassroots regional economic study, such as that undertaken by the Northern Dutchess Alliance mentioned above.
- **Physical Indicator** may be the need for a multimodal transportation system, taking into account reducing automotive traffic while increasing public transit, bicycle and pedestrian opportunities.

Clearly, there are any number of indicators that could be used and particular issues may fit more than one indicator category; the precise constellation of indicators explored depends on the makeup of stakeholder groups, the priorities of participating organizations and public input. In addition, more or fewer indicators may be used depending on the level of detail a resilience assessment uses.

5.2 Cornell University

Home to the Northeast Regional Climate Center (http://www.nrcc.cornell.edu), Cornell itself is a cornucopia of up to date information about the latest research into the impacts of climate change in our greater region.

Cornell has undertaken a comprehensive 'climate adaptation' program, with the stated goal to:

> *educate students and staff on campus about climate change impacts, engage faculty in climate adaptation research and demonstration projects, and help reduce future climate-related risks to the Cornell and Ithaca community through appropriate upgrades to campus infrastructure and protocols.*

While not explicitly using the phrase "resilience", Cornell is the first major US university to include adaptation in their Climate Action Plan, and their distinction between a flexible adaptation system and standard mitigation measures fits well within a resilience framework.

5.3 ClimAid Climate Adaptation Guidebook

Cornell staff - in conjunction with Columbia University, Hunter College and NYSERDA – has developed a statewide report, *Responding to Climate Change in New York* (called "ClimAid) in order to guide adaptation strategies for communities and campuses (http://www.nyserda.ny.gov/climaid). Cornell used ClimAid to mark a pathway to including adaptation in their Climate Action Plan. It is recommended that Bard explore the use of ClimAid as a supplement to fulfilling the already in-progress Second Nature Commitments.

5.4 Sustainability, Education and Economic Development (SEED) Center

The SEED Center, in collaboration with the American Association of Community Colleges (AACC) has published a report entitled, *A Guide to Climate Resilience and the Community College (*http://theseedcenter.org/Resources/SEED-Resources/SEED-Toolkits/AACC-Report--A-Guide-to-Climate-Resiliency---The-C/Resiliency-Report/COWSSEED_ResiliencyReport_1014_web.pdf*)*.

The report states that:

> *Resiliency itself is a poorly defined indicator but a useful concept that moves beyond the mortality rates and economic loss of any given disaster, and looks at how individuals and communities survive – even flourish – in the aftermath of an extreme shock.*

Focusing on community colleges, the SEED Center *Guide* offers several case studies of resiliency in different social and economic sectors. The *Guide* also offers a section titled, "Towards a Resiliency Agenda for the 21st Century Community College", providing a suite of dozens of policy recommendations in three separate categories:

- In Programming, for example integrating resilience into curricula.
- On Campus, for example align adaptation and hazard mitigation plans with local efforts.
- With Community, for example prepare the campus to serve as an operational base during a disaster.

APPENDIX B

Bard College at Simon's Rock
December 2009

Climate Action Plan To Achieve Carbon Neutrality

Bard College at Simon's Rock, in support of our President's commitment to the American College & University Presidents' Climate Action Plan, has developed this plan to achieve carbon neutrality.

Mary B. Marcy, Provost and Vice President of Bard College at Simon's Rock, has charged employees and students of the College with a special interest in environmental issues to work together as a "Green Team" to identify campus issues related to environmental sustainability.

Following the report from the team in January 2010, Provost Marcy will establish a College **Climate Action Committee** consisting of senior administrators, faculty, staff and students. This team will be charged with the task of integrating the goal of eventual carbon neutrality into all College academic, operational and community outreach initiatives.

We believe a coordinated and comprehensive approach will be necessary to achieve the goal of carbon neutrality by the year 2040. This action plan details our efforts to date, our ongoing work and future projects that we envision at this time. This action plan will be revised and updated on a regular basis to keep pace with new technology and new opportunities to further reduce our carbon dependency. It is also assumed that to reach the goal of 100% carbon neutrality there will be some requirement to either invest in Renewable Energy Certificates (REC) or to purchase Carbon Offsets.

Action Plan:

Completed actions to achieve carbon neutrality

- Fisher Science Center; installation of a 5 kilowatt solar powered roof top power grid.
- Kilpatrick Athletic Center; installation of a gas fired 75 kilowatt co-generation system. Surplus heat is used to heat domestic water and reduce boiler heating demand by 20%.
- Kendrick House dormitory renovation: installation of 95% to 98% efficient gas-fired boilers with Trane Air Handler Energy Recovery unit. Complete Andover Energy Management automation including interior / exterior lighting control. Green technology principles incorporated through out the construction and commissioning of the building. Estimated overall energy reductions of about 20%.
- Daniels Art Center; installation of a gas-fired high efficiency burner and integration of the buildings energy recovery unit into the Andover Energy Management controls. This upgrade and recovered heat provided by an energy recovery unit allowed the new gas burner to be reduced by 25%.
- Campus-wide; conversion from conventional incandescent lighting to CFL lighting, where possible. Modification of exiting lighting units to accept CFL fixtures is on-going.
- Study of the working condition and efficiency of all campus heating and cooling equipment conducted by Lindgren & Sharples M.E.P. Engineering of Springfield, MA.

Current actions to achieve carbon neutrality

- The Climate Action Committee is working with a College-wide team of students, faculty and facilities and technology staff members to develop a more complete initial understanding and benchmark of the College's existing carbon emissions. Existing energy usage and data collected to date is being incorporated into the Bard College at Simon's Rock Clean Air-Cooled Planet Calculator.
- The College "Green Team" is working to create recommendations to improve our recycling efforts, promote educational awareness of green initiatives and develop challenges to involve students in recycling and carbon reduction.
- The College is in the process of updating the completed Campus Master Plan. Sustainability and facility improvements to reduce the College's carbon emissions are a priority of this planning project.

Future actions to achieve carbon neutrality

- Renovation of Crosby House and Dolliver House dormitories are in the development phase. Initial engineering and conceptual plan development has been completed. The project will include replacement of boilers with high-efficiency gas units. Installation of new heat distribution systems will be controlled by Andover Energy Management controls and estimated energy use is projected to decrease by 20%.
- Future Foster House dormitory renovations will include super-insulated technology and air to air heat or cool recovery technology. Estimated energy use will be reduced by an estimated 65%.
- Preliminary plans to test the viability of installing a 1.5 megawatt wind turbine on the upper campus. According to Sustainable Energy Development Inc., it appears we have enough wind to generate electricity here on campus. The payback period for this proposed project would be about 10 to 13 years. A wind turbine would provide all electricity required for the existing campus and any surplus power could be sold as Renewable Energy Credits at the current ISO New England market rate of $.03 per kilowatt over 10 years to offset the campus non-electrical energy use.