



Annual Greenhouse Gas Emissions Inventory Update for FY 2017 (September 20, 2017)

Background and Overview

Bowdoin College committed to become “carbon-neutral” by the year 2020 and released a detailed implementation plan to achieve that goal in the fall of 2009.¹ This year Bowdoin College renewed this commitment to the ACUPCC by signing the “We Are Still In” pact with 180 other climate-committed institutions. The plan focused primarily on an ambitious goal of reducing “own-source” emissions by at least 28% over the 12 years between 2008 and 2020, with the understanding that the College would need to purchase carbon offsets in 2020 to achieve the ultimate goal of carbon neutrality.

This document serves as the Annual Greenhouse Gas Emissions Inventory Update for Fiscal Year (FY) 2017. Bowdoin's greenhouse gas emissions (GHG) in FY 2017 were 12,671 metric tons of carbon dioxide equivalent (CO₂e), which is 34% lower than the FY 2008 baseline total of 19,153 metric tons. Own-source emissions for FY 2017 were 11,620 metric tons CO₂e, or 29%, lower than the 2008 baseline. The balance of this update provides a more detailed explanation of the College's inventory.

Summary of FY 2017 Bowdoin College Greenhouse Gas Emissions

Bowdoin categorizes emissions into three scopes. Scope 1 includes onsite combustion of fuels, College vehicle use, and fugitive refrigerants. Scope 2 encompasses purchased electricity. Scope 3 includes travel by College faculty and staff, daily employee commuting, transmission line losses from electricity usage, and waste disposal. Bowdoin's own-source emissions are comprised of both Scope 1 and Scope 2 emissions.

The College has the most control over Scope 1 and 2 emissions, and has made progress in this area, as fuel-switching, Green Building standards for new construction, and weatherization programs for existing buildings have increased campus-wide energy efficiencies. However, yearly fluctuations in winter

¹ In 2007, the College became a signatory to the American College and University Presidents' Climate Commitment—a pledge by leaders of more than 640 colleges and universities to move their campuses toward carbon neutrality and build new academic pathways for addressing sustainability issues. To achieve this goal, the College developed a Climate Neutrality Implementation Plan in 2009. As part of that plan, the College tracks and reports annually on its greenhouse gas (GHG) emissions relative to the Fiscal Year (FY) 2008 baseline year. The plan is revisited and updated every two years so that Bowdoin community members can measure the effectiveness of strategies, evaluate the financial feasibility of specific projects, and incorporate new technological advances. The 2009 plan can be reviewed at <https://www.bowdoin.edu/sustainability/pdf/2009-implementation-plan.pdf> and the most recent update can be reviewed at <https://www.bowdoin.edu/sustainability/pdf/2014-implementation-plan.pdf>.

temperatures – colder winters require higher heating fuel usage –can be another key driver either augmenting or diminishing the impacts of efficiency projects.

Scope 1

Onsite fuel combustion, College vehicle use, and fugitive refrigerants

Scope 1 emissions were 4% lower in FY 2017 than in FY 2008, a decrease of 323 metric tons.

Scope 1 emissions have decreased as a result of reduced on-site fuel combustion for space heating at the central heating plant and satellite locations. This decrease was partially offset by annual increases in vehicle use and fugitive refrigerants in FY 2017.

Stationary, on-site fuel combustion was measured at 8,092 metric tons of CO₂e for 2017. This is among the lowest measurements for this category since 2008. This decrease in on-site fuel combustion is likely a result of a relatively warm winter and the continued success of fuel conversions and efficiency projects, which have driven emissions down despite an increase in heated square footage on campus. As measured by heating degree days, FY 2017 was 4% warmer than 2008.² Bowdoin's heating use intensity, measured as British thermal units per square foot (Btu/sf) was about the same as 2016, and remains 7% lower than this same measure in 2008, which demonstrates an improvement in efficiency. Notably, Bowdoin used less heating oil than ever before, only 4,279 gallons, which represents a 96% decrease since 2008, resulting primarily from fuel conversion projects.

Partially offsetting the reduced emissions from onsite fuel consumption were increases in College vehicle use and fugitive refrigerants. Gasoline and diesel fuel use in College vehicles rose 30% (102 metric tons) compared to FY 2008. The increase in College vehicle use has been, in large part, due to a change in the College's fleet vehicle usage policy. Instead of renting vehicles to accommodate academic field research or community service trips, departments are now encouraged to use College-owned vehicles. The use of College-owned vehicles allows the College to better track and control emissions and costs resulting from vehicle use.

Projects completed in the last year that aim to reduce Bowdoin's Scope 1 emissions include:

- Multiple efficiency projects at Farley Field House, Burton-Little House, and Pickard Field House, with a focus on energy recovery, CO monitoring and air destratification.
- Converting five satellite locations from no. 2 oil and propane burners to natural gas.

Insulating steam and domestic hot water piping in mechanical rooms at Watson Arena.

Scope 2

Purchased electricity

Scope 2 emissions were 60% lower in FY 2017 than in FY 2008, a 4,383 metric ton reduction.

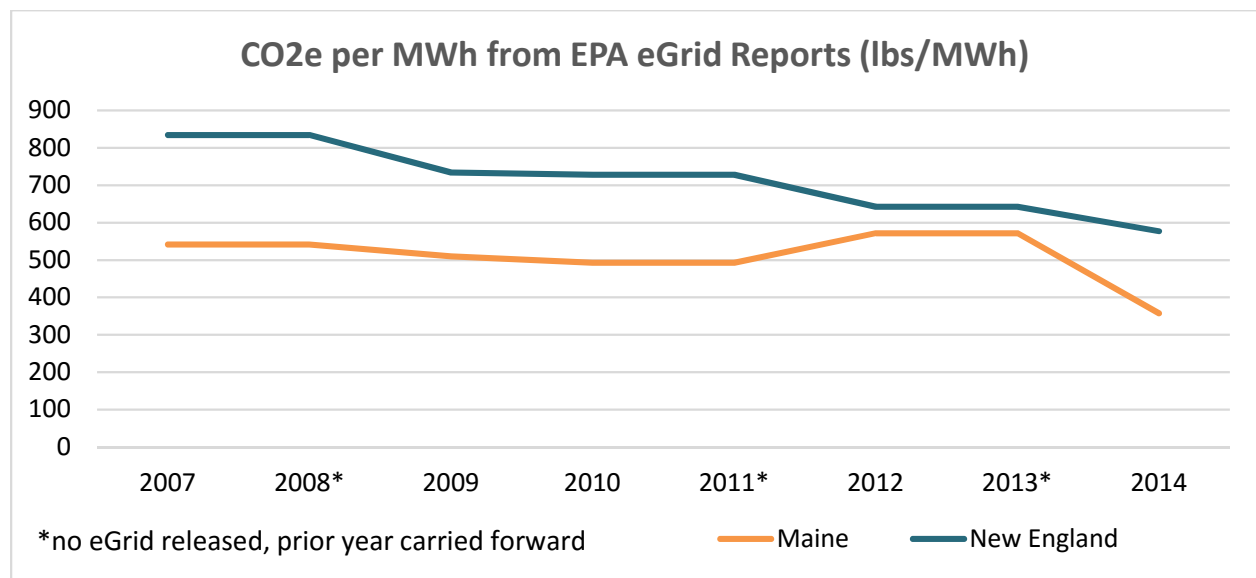
Over the past three years, Bowdoin's electricity usage has been relatively consistent, in the 17,500,000 kWh range. This represents roughly a 13% reduction in total usage since 2008. This reduction has been significantly magnified by the improvements in CO₂e per MWh as reported by the EPA's eGrid numbers. This is the reason why, despite a slight increase in usage, Bowdoin experienced a 37% decrease in year-

² Heating degree days (HDD) are a rough measure of the amount of energy needed to heat buildings in a certain location. HDDs are derived from measurements of outside air temperature. One HDD indicates that the average outside temperature for a single day was one degree below 65 degrees Fahrenheit.

over-year Scope 2 emissions. Taken together, reductions in usage and improvements in the grid have driven Bowdoin’s primary source of emissions reductions.

Driving the sustained reduction in annual usage are the College’s investments in efficient lighting and electrical systems, as well as its cogeneration system – a 630 kW backpressure turbine that was installed in February of 2012. In FY 2017 this turbine produced 921,738 kWhs, which is lower than the prior year’s production of 1,134,405 kWhs. The decrease is attributed to a late turbine startup due to heating plant project work.

Bowdoin has also benefited from using state-level eGrid factors for reporting. Maine’s CO2e per MWh has decreased by 34% versus the 2008 baseline. While the New England regional eGrid number has a higher CO2e per MWh, it has similarly decreased by 31% since 2008. The primary driver behind this trend has been a transition away from coal and oil and an influx of new natural gas and wind generation.



Continuing to focus on energy-efficiency projects and raising awareness about conservation measures among students, faculty, and staff will be paramount in decreasing overall electricity consumption beyond the reductions already made. Notable accomplishments in FY 2017 included:

- Replacement of metal halide light fixtures at the Farley and Watson parking lot with LED bulbs
- Two energy conservation competition were held during the 2016-2017 academic year spanning a total of 12 weeks. The competitions provide an opportunity to raise awareness about what individuals can do to help Bowdoin reduce greenhouse gas emissions in an engaging and fun manner. Bowdoin students conserved over 38,000 kWhs last year during the two competitions.
- The installation of variable frequency drives on circulating pumps at Chamberlain Hall.

Note that in FY 2013 Bowdoin discontinued purchasing RECs in the voluntary market to offset Scope 2 emissions. Though this offset was never claimed in emissions inventories, the funds previously used for this purchase have been dedicated to expanding on-campus efficiency and renewable projects.

Scope 3

Travel by College faculty and staff, daily employee commuting, transmission line losses from electricity usage, and waste disposal

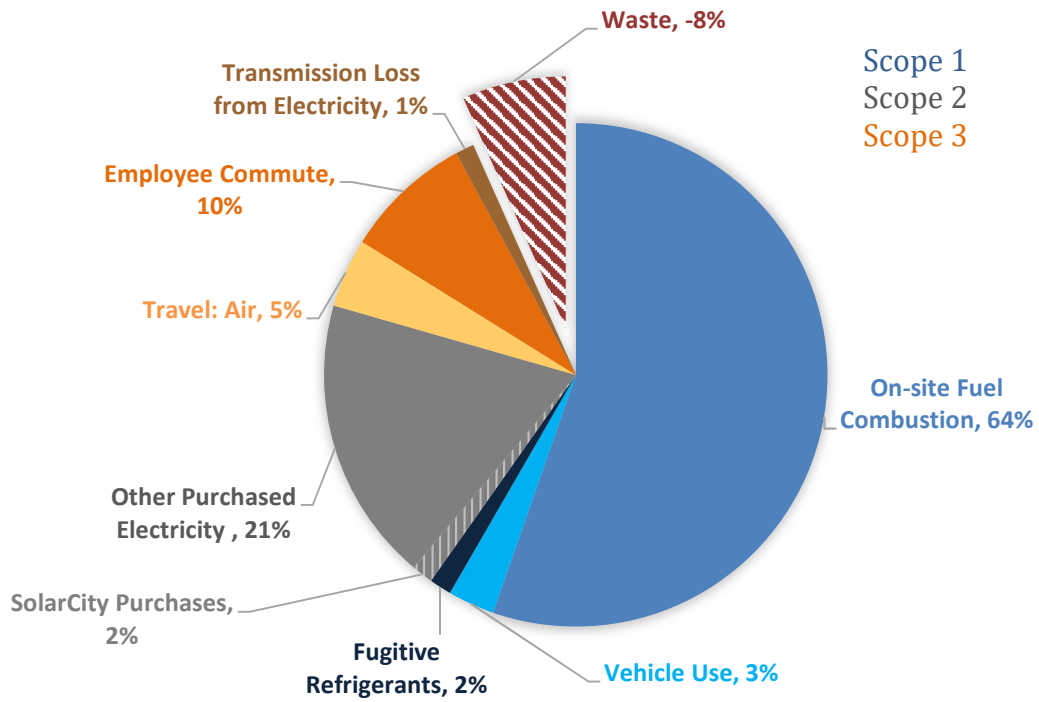
Scope 3 emissions decreased by 63% in FY 2017 compared to FY 2008, a 1,777 metric ton decrease.

Emissions associated with College travel were up 20%, an increase of 112 metric tons of CO₂e from FY 2008. Emissions related to employee commuting were down 30%, or 513 metric tons, compared to FY 2008. Employee commute emissions were estimated based on the part-time and full-time job classifications of each employee, cross referenced with the employee's zip code. This total was then reduced based on a 2015 survey of faculty and staff which showed that 22% of respondents in the greater Brunswick area use carpooling, biking, or walking as their primary mode of transportation. Another employee commute initiative not reflected in these numbers is the use of two electric vehicle charging stations available to the campus community.

Scope 3 also contains electricity line loss-related emissions, which were 63%, or 291 metric tons, lower compared to FY 2008. This, like the Scope 2 reduction, can be attributed to a cleaner electricity grid.

Bowdoin's waste-related emissions decreased by 1,006% in FY 2017 or 1,086 metric tons compared to FY 2008. The College sends a significant portion of its non-recycled waste to a facility that uses waste to generate electrical power. Compared to landfills with no energy recovery, waste-to-energy facilities have a much smaller GHG impact. The electricity produced by these waste-to-energy facilities displaces generation from other power plants that primarily burn natural gas – resulting in a carbon credit. As of FY 2017 Bowdoin has begun tracking composting numbers, which also results in an additional slight carbon credit in GHG accounting. A change in modeling since FY 2008 that assigns waste to its final destination accounts for the majority of this decrease and the negative overall impact on Bowdoin's emissions.

A breakdown of the estimated 12,671 metric tons of CO2e emissions for FY 2017 is shown by major category in the following chart.

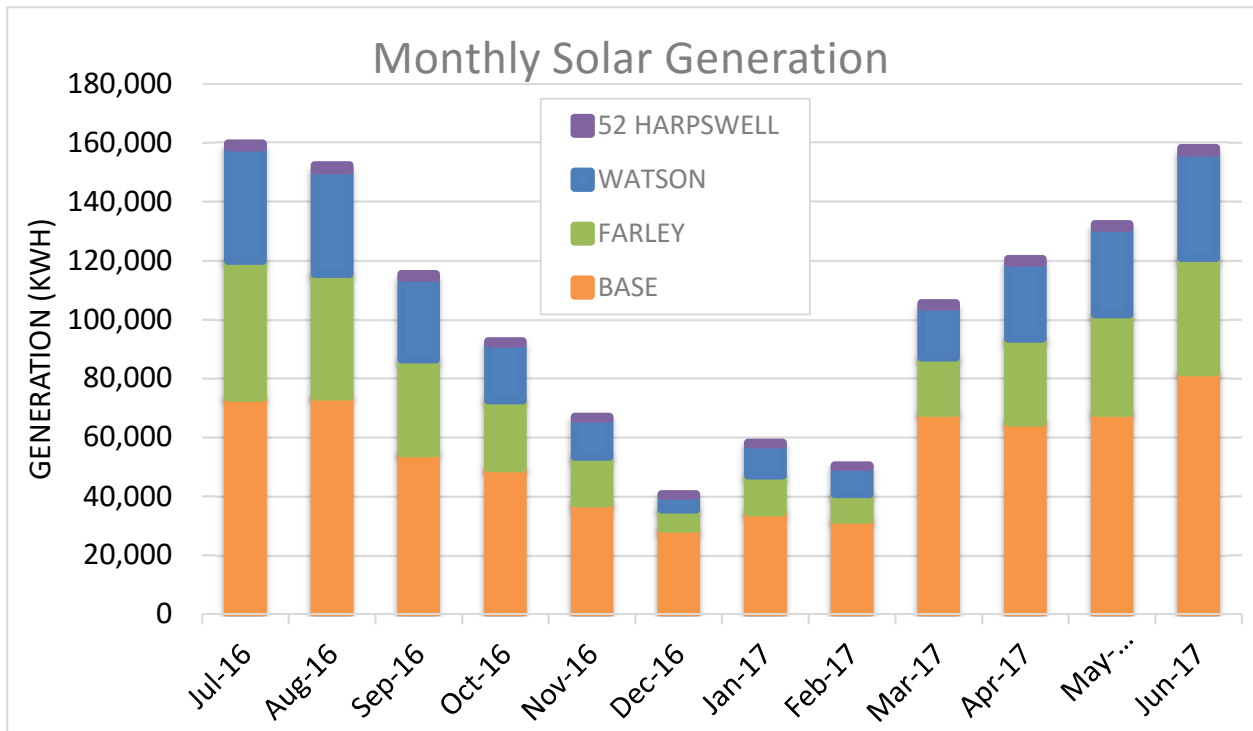


Solar Update

In collaboration with SolarCity Corp. in 2014, Bowdoin installed 1.2MW of Solar PV capacity at Farley Field House, Greason Pool, Watson Arena, 52 Harpswell Road, and the former Naval Air Station property. These panels collectively provided about 7% of the College’s electricity in FY17, generating about 1,255,000 kWhs. **Combined with the electricity produced by the cogeneration turbine at the heating plant, approximately 12% of the College’s electricity is now generated on site from renewable or efficient sources.**

While Bowdoin is responsible for initiating the solar project, the College is not currently able to claim carbon reduction benefits from the solar generation. This is due to the fact that SolarCity retains (and likely sells) the RECs associated with the generation during the term of its power purchase agreement with the College.

Solar generation at Bowdoin since the project’s completion is shown in the following chart.



Conclusion

Bowdoin's GHG emissions were 34% lower in FY 2017 compared to the base year of Bowdoin's carbon reduction plan. Moreover, Bowdoin's own-source emissions saw a 29% decrease in FY 2017 with respect to the 2008 baseline and the College is well ahead its goal of a 28% reduction by 2020.

However, achieving full carbon neutrality is not an easy task. While we can celebrate progress and evaluate setbacks each year, reducing campus greenhouse gas emissions will require ongoing action by everyone on campus. This is especially true as many of the "low hanging fruit" have been picked and the College will have to continue to press forward in finding new ways to reduce emissions and become more efficient.

In FY 2017 Bowdoin completed several previously mentioned efficiency projects. Additional projects that are slated for FY 2018 include:

- Building the Roux Center for the Environment to LEED platinum standards, with a strong focus on energy conservation and green power.
- Extensive weatherization projects at Baxter House and Burnett House that include air sealing and roof insulation throughout.
- Continual switch to LED lighting across campus including the replacement of metal halide lighting over the ice surface of Watson Arena with LED lighting.
- Replacement of old and leaking steam line between South Street and Farley Field House.
- An increase in Security bike patrol at Bowdoin. With half of Bowdoin security officers becoming International Police Mountain Bike Association certified during the summer of 2017, this should help reduce miles driven over the year.
- With service beginning in August 2017, Bowdoin is contributing funds to a two-year pilot project to bring the public transportation, Metro Breeze, from Portland to Falmouth, Yarmouth, Freeport and Brunswick. The College hopes faculty, staff and students will take advantage of the service to reduce individual car trips between Portland and Brunswick.

Other projects under consideration for FY 2018 include:

- Continued pipe insulation in mechanical rooms across campus.
- Installation of destratification fans in campus locations with particularly high ceilings, like the ones already installed in Farley Field House, Daggett Lounge and the Atrium of Druckenmiller Hall.
- Continued conversion of remaining satellite locations from no. 2 oil and propane burners to natural gas.

As we have seen since the early years of implementation, the collective efforts of Bowdoin's students, faculty, and staff will be critically important to achieving carbon neutrality by 2020.

Prepared by the Staff of the Sustainability Implementation Committee

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