



Annual Greenhouse Gas Emissions Inventory Update for FY 2018 (October 12, 2018)

Background and Overview

In the fall of 2009, Bowdoin joined Second Nature’s Climate Commitment, a national effort within higher education to address climate change. As part of this effort Bowdoin committed to increasing research, education, and awareness of climate change within our community, and declared to becoming “carbon neutral” by the year 2020 and released a detailed implementation plan to achieve that goal.¹ 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 comprehensive goal of carbon neutrality. In April 2018, Bowdoin achieved carbon neutrality two years ahead of schedule through investment in carbon offsets and the purchase of renewable energy credits (RECs). As part of this achievement, in the spring of 2018, Bowdoin also announced a partnership with four New England colleges to partially fund the development of a 75-megawatt solar project located in Farmington Maine. Building on this achievement, Bowdoin is currently in the development process of a 2030 Climate Action Plan, scheduled to be released in 2020.

This document serves as the Annual Greenhouse Gas Emissions Inventory Update for Fiscal Year (FY) 2018. Bowdoin's greenhouse gas emissions (GHG) in FY 2018 were 13,087 metric tons of carbon dioxide equivalent (CO₂e), which is 32% lower than the FY 2008 baseline total of 19,153 metric tons. Own-source emissions for FY 2018 were 11,914 metric tons CO₂e, or 27%, lower than the 2008 baseline. The balance of this update provides a more detailed explanation of the College's inventory.

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>. In FY 2017 Bowdoin College renewed this commitment to the ACUPCC by signing the “We Are Still In” pact with 180 other climate-committed institutions, signifying these institutions commitment to the Paris Climate Agreement.

Summary of FY 2018 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 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 refrigerants²

Scope 1 emissions were 2% higher in FY 2018 than in FY 2008, an increase of 222 tons.

Scope 1 emissions have increased slightly because of annual increases in vehicle use and fugitive refrigerants in FY 2018. On-site fuel combustion for space heating at the central heating plant and satellite locations, largely driven by winter weather fluctuations, has been trending slightly downward year over year, but increased in FY 2018 compared to usage in FY 2016 and FY 2017.

Since FY 2008 there have been consistent increases in emissions associated with the College's vehicle use and fugitive refrigerants. Emissions from gasoline and diesel fuel use in College vehicles rose 34% (115 metric tons) compared to FY 2008. The increase in vehicle use has been shaped by a change in the College's fleet vehicle usage policy. Instead of renting vehicles to accommodate academic field research or community service trips—as was done before 2011—departments are 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.

In the summer of 2017, half of Bowdoin security officers became International Police Mountain Bike Association certified. Along with the social, health, and professional efficacy benefits for Security, this shift reduce miles driven and the associated emissions.

Emissions associated with fugitive refrigerants rose 312% (192 metric tons) compared to FY 2008.

Emissions from stationary, on-site fuel combustion was measured at 8,575 metric tons of CO₂e for 2018. This represents a 1% decrease in emissions from stationary, on-site fuel combustion compared to the baseline set in FY 2008. This is within the range of emissions generated by previous years' stationary, on-site fuel combustion. This increase in on-site fuel combustion compared to FY 2017 is likely a result of a

² Fugitive refrigerants are emissions from equipment or processes that release GHG directly into the atmosphere. The chemical emissions directly from an air conditioning unit, for example, are considered fugitive refrigerant emissions, whereas the electricity to run the air conditioning unit would fall under Scope 2 emissions.

relatively cold winter. Despite the cold winter, as measured by heating degree days, FY 2018 was 3% warmer than 2008.³ Bowdoin's heating use intensity, measured as British thermal units per square foot (Btu/sf) was about the same as 2016 and 2017, and remains 5% lower than this same measure in 2008, which demonstrates an improvement due to fuel conversions and campus efficiency projects.

Bowdoin heating oil consumption increased from 4,279 gallons in FY 2017 to 55,478 gallons in FY 2018. Despite this year over year increase, it still represents a 54% decrease since 2008. The increase in heating oil was due to using heating oil as an alternative fuel during a stretch of very cold winter days, when the limited natural gas pipelines in New England are most stressed and make natural gas less available and much more expensive. The increase in heating oil, as a more carbon-intensive fuel, partially offsets some of the efficiency gains Bowdoin has implemented.

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

- Extensive weatherization projects at Baxter House, Burnett House and MacMillan House that included air sealing and roof insulation throughout.
- Replacement of old and leaking steam line between South Street and Farley Field House.
- Continued pipe insulation in mechanical rooms at Lubin Squash and Farley Field House mechanical rooms.
- Installation of destratification fans in the high ceilings at Sargent Gymnasium.

Scope 2

Purchased electricity

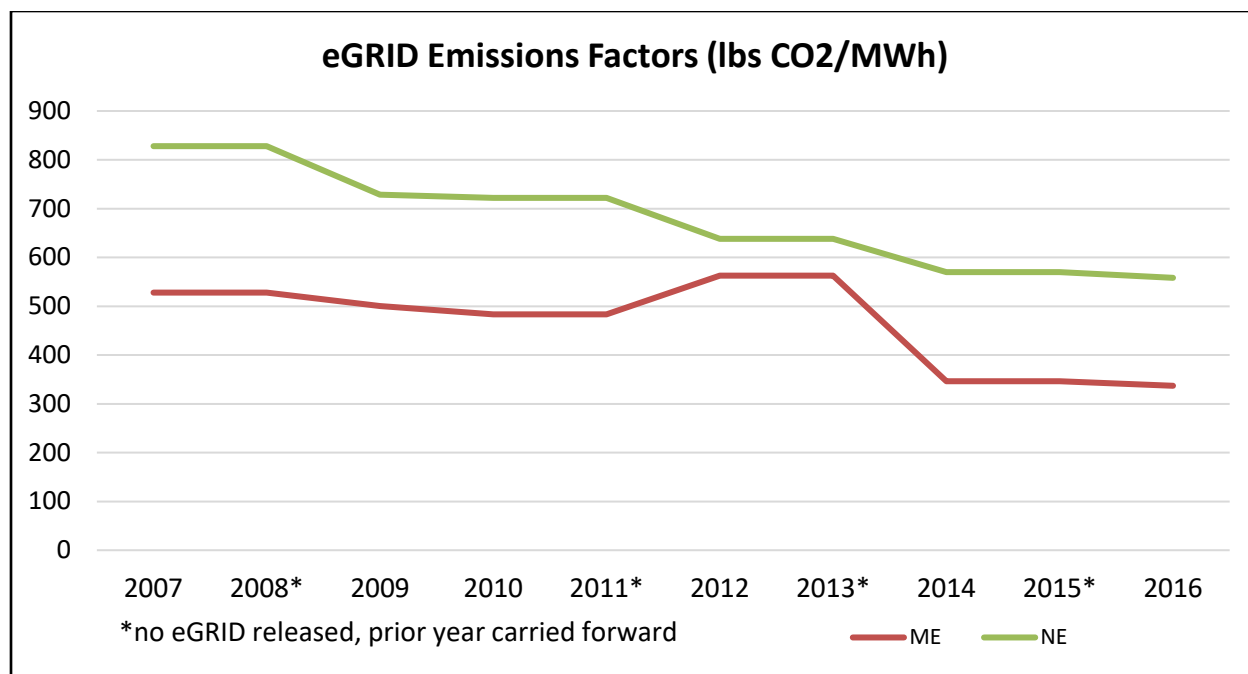
Scope 2 emissions were 64% lower in FY 2018 than in FY 2008, a 4,634 metric ton reduction.

In FY18, Bowdoin's electricity usage was 16,664 MW, a decrease compared to a plateau in the 17,500 MW range observed in the past three years. This represents roughly an 18% reduction in total usage since FY 2008. This reduction has been significantly magnified by the improvements in CO₂e per MWh as reported by the EPA's eGRID numbers. Taken together, reductions in campus usage and statewide 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 2018 this turbine produced 1,118,626 kWhs, which was the turbine's second-best year of production, in part because of the extreme cold weather in January.

Bowdoin has also benefited from using state-level eGRID factors for reporting. Maine's CO₂e per MWh has decreased by 36% versus the 2008 baseline. While the New England regional eGRID number has a higher CO₂e per MWh, it has similarly decreased by 33% since 2008. The primary driver behind this trend has been a transition away from coal and oil and an influx of new, efficient natural gas and wind generation.

³ 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.



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 2018 included:

- Continual switch to LED lighting across campus including the replacement of metal halide lighting over the ice surface of Watson Arena with LED lighting.
- The 24/7 lights in the restrooms of the six first year brick dorms were replaced with LED fixtures that are operated by occupancy controls so that the lights would not remain on at full power twenty-four hours per day.
- Two energy conservation competitions were held during the 2017-2018 academic year spanning a total of 8 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 32,000 kWhs last year during the two competitions.

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 59% in FY 2018 compared to FY 2008, a 1,655 metric ton decrease.

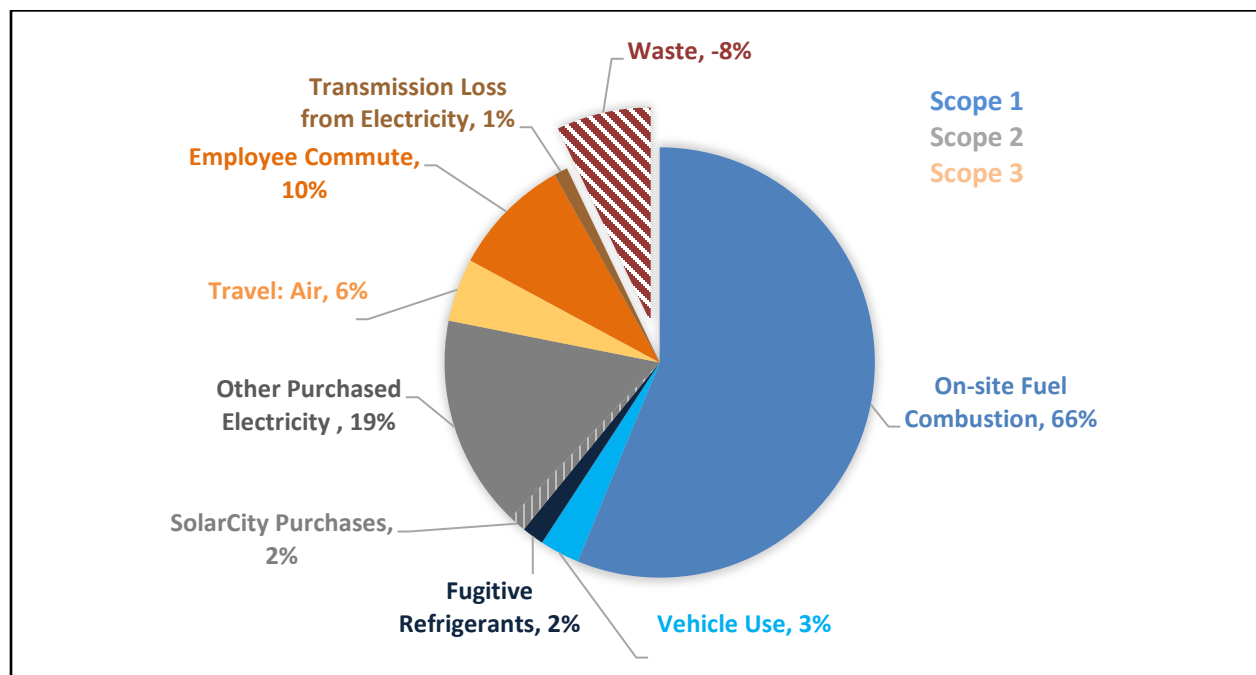
Emissions associated with College travel were up 35%, an increase of 190 metric tons of CO₂e from FY 2008. Emissions related to employee commuting were down 20%, or 348 metric tons, compared to FY 2008. Employee commute emissions were estimated based on the part-time and full-time job classifications 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. Two employee commute initiatives not reflected in these numbers is the use of two electric vehicle charging

stations available to the campus community, and the College’s support of a two-year pilot of the Metro Breez commuter bus service between Portland and Brunswick with stops in Yarmouth and Freeport.

Scope 3 also contains electricity line loss-related emissions, which were 66%, or 306 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 1,102% in FY 2017 or 1,190 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. This practice has continued through FY 2018. 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 13,087 metric tons of CO2e emissions for FY 2018 is shown by major category in the following chart.

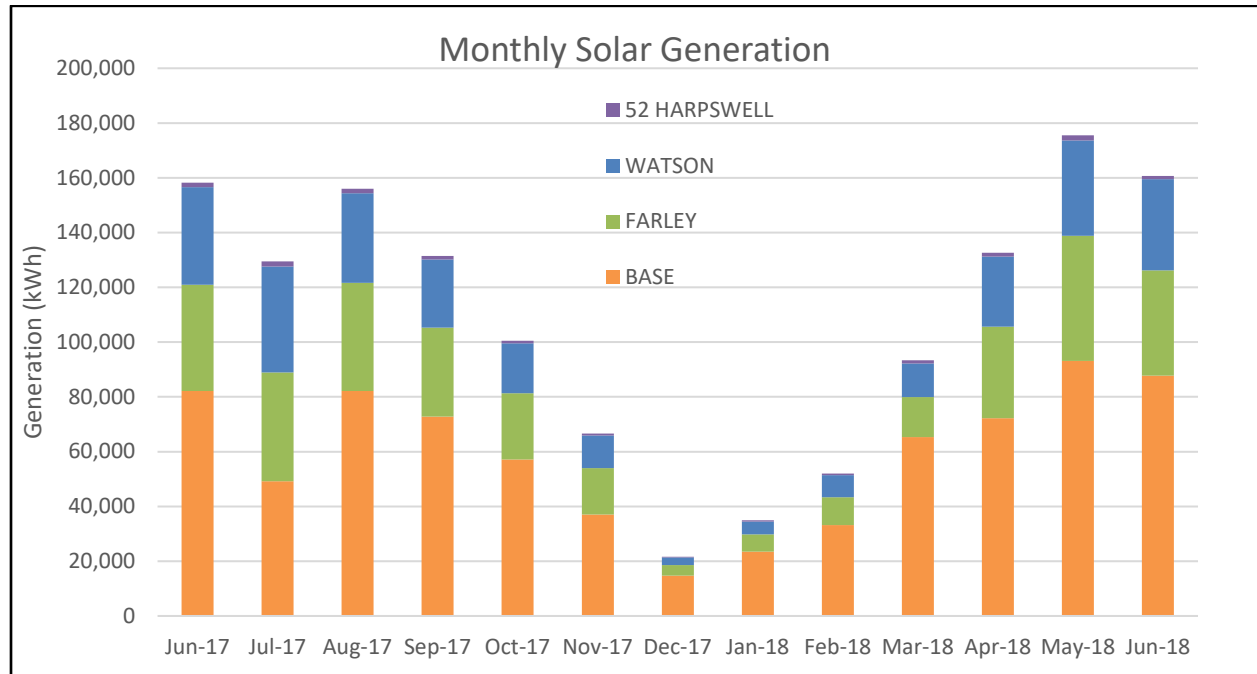


Solar Update

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 8% of the College’s electricity in FY18, generating about 1,264,000 kWhs. Combined with the electricity produced by the cogeneration turbine at the heating plant, approximately 13% of the College’s electricity is now generated on site from renewable or efficient sources.

Although Bowdoin initiated the solar project and purchases the electricity from the installation, due to the terms of the power purchase agreement between the College and SolarCity, SolarCity retains the RECs and carbon reduction benefits associated with the generation.

Solar generation from the panels in FY 2018 is shown in the following chart.



Conclusion

Bowdoin’s GHG emissions were 32% lower in FY 2018 compared to the base year of Bowdoin’s carbon reduction plan. Moreover, Bowdoin’s own-source emissions calculations saw a 27% decrease in FY 2018 with respect to the 2008 baseline. With the majority of the specified projects from the 2009 Climate Action Plan complete, and Bowdoin emissions hovering around the original own-source reduction goal of 28%, the College recognized it was time to complete the 2020 climate plan and embark on a new road map for further carbon reductions. In FY 2018 the College purchased the necessary additional RECs and carbon offsets to achieve the 2020 carbon neutrality goal, two years ahead of schedule.

This achievement drives Bowdoin towards the exciting opportunity of developing a new Climate Action Plan and setting goals for additional greenhouse gas reductions as part of a comprehensive sustainability plan on campus. The need for further action is clear, and the path ahead will be challenging, as Bowdoin has addressed many of the most obvious and cost-effective emission-reducing projects through wise renovations, investments, and maintenance over the last decade. In exploring how to increase energy efficiency and decarbonize our operations, we recognize that reducing campus greenhouse gas emissions will require ongoing action by everyone on campus, and that creating a sustainable college campus involves more factors than emissions alone. As we have seen in reaching our goals from the first climate action plan, the collective efforts of Bowdoin’s students, faculty, and staff will be critically important to continue our push for further reductions in own-source emissions and sustainability at Bowdoin.

As we work on the next iteration of a Bowdoin Climate Action Plan, we have several energy efficiency projects slated for FY 2019, including:

- An extensive weatherization project at Boody-Johnson House.
- Replacement of the Supply and Return Air Fan Coil at Greason Pool.
- Increasing the amount of natural daylight in Farley Field House with the replacement of the Kalwall ceiling. The older Kalwall ceiling had darkened and thickened over its lifetime, which reduced the natural daylight in the space. The replacement ceiling allows for more natural light.
- Continued pipe insulation in mechanical rooms across campus.
- Continued switch to efficient LED lighting.

In addition to these on campus efforts, we eagerly monitor the progress and development of the 75 MW solar project in Farmington, of which Bowdoin has contracted with 8,000 MWhs of the renewable energy generation.

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