



Annual Greenhouse Gas Emissions Inventory Update for FY 2015 (11/11/2015)

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 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) 2015. Bowdoin's greenhouse gas emissions (GHG) in FY 2015 were 14,477 metric tons of carbon dioxide equivalent (CO₂e), which is 24% lower than the FY 2008 baseline total of 19,153 metric tons. Own-source emissions for FY 2015 were 2,847 metric tons CO₂e, or 17%, lower than the 2008 baseline. The balance of this update provides a more detailed explanation of the College's inventory.

¹ This initiative was formally launched in 2007, when President Barry Mills signed the American College and University Presidents' Climate Commitment. 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>.

Summary of FY 2015 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 emissions and has made significant 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 – may offset the positive impact of these emissions-reducing initiatives in a given year.

Scope 1

Onsite fuel combustion, College vehicle use, and fugitive refrigerants

Scope 1 emissions were 5% higher in FY 2015 than in FY 2008, an increase of 488 metric tons.

Scope 1 emissions have increased as a result of greater fuel combustion and vehicle use in FY 2015. Stationary, on-site fuel combustion was measured at 9,111 metric tons for 2015. This is the second highest measurement for this category since 2008, and is above the 2008-2014 average of 8,590 metric tons. This large increase in on-site fuel combustion resulted from a cold winter and the subsequent increased demand for heating fuel, as well as an increase in heated square footage on campus. As measured by heating degree days, FY 2015 was 3% colder than 2008.² Due to fuel-switching efforts and favorable prices, Bowdoin burned the most natural gas on record in 2015 – a total of 166,188 MMBtu and a 23% increase from the 2008 baseline. As a result, Bowdoin burned a near all-time low of heating oil, which equated to an 83% reduction in heating oil combustion from 2008. In sum, stationary, on-

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.

site fuel combustion accounted for 92% of the scope 1 emissions increase seen in FY 2015.

The remaining increase in Scope 1 was a result of increased College vehicle use. Gasoline and diesel fuel use in College vehicles rose 28% (95 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.

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

- The renovation of the former Stevens Home located at 52 Harpswell Road into an energy-efficient student residence hall. This was the College's first LEED-certified renovation, which received LEED Gold certification from the U.S. Green Building Council. The building envelope was upgraded to provide a comfortable and more energy efficient environment. The project added insulation throughout the building, provided new double-paned windows to minimize drafts, and added two energy recovery ventilators that pre-heat incoming outside air. The mechanical systems were also upgraded for efficiency – including the replacement of an oil fired hot water boiler with a high efficiency natural gas boiler and the delivery system was converted from steam to a fin tube hot water system. The residence also includes a 12 kW solar photovoltaic (PV) system on the roof.
- Weatherization of faculty housing at 18 Cleaveland Street consisted of substantial insulation in both the attic and basement areas, including extensive work around the chimney and bulkhead. Weather stripping as well as rigid and expanding foam were used to insulate and seal up walls and other gaps throughout the building.
- The conversion of 42 and 44 Harpswell from No. 2 oil to natural gas. The conversion of buildings not served by the Central Heating Plant from oil to natural gas has been an ongoing project that will be completed prior to the 2016-17 heating season.

Scope 2

Purchased electricity

Scope 2 emissions were 46% lower in FY 2015 than in FY 2008, a 3,335 metric ton reduction.

For the fifth consecutive year we have been able to decrease electricity use, despite a slight increase in square footage. A large factor in the continued decrease in emissions relating to purchased electricity is the use of the College's cogeneration system. A 630 kW backpressure turbine that generates electricity by lowering the steam pressure was installed at the central heating plant and began making power in February 2012. The turbine produced 1,135,935 kWhs during FY 2015 (up 8% from FY 2014). This year-over-year increase in production was due to a technical difficulty experienced in FY 2014.

Also contributing to the decrease in Scope 2 emissions were the ongoing focus on energy-efficiency projects and efforts to raise awareness about conservation measures among students, faculty, and staff. Notable accomplishments included:

- The continued switch from higher wattage lighting fixtures to LED fixtures and the installation of occupancy controls resulted in considerable electrical savings. Numerous lighting projects were completed in an effort to save a combined 600,000 kWhs annually. Locations included Hawthorne-Longfellow Library, Chamberlain Hall, Druckenmiller Hall, Watson Arena, Hatch Science Library, Searles Science Building, and Farley Field House.
- Upgrades to the energy system of Howell House, where an energy efficient circulation pump was installed.
- Two month-long energy conservation competitions last year, one in the fall and one in the spring. The new spring competition saw 21 Bowdoin residence halls competing against 21 Colby residence halls for the first time, which generated a lot of enthusiasm and a Bowdoin victory. Bowdoin students conserved over 20,000 kWhs last year between the two competitions.

Bowdoin has chosen to discontinue its purchase of renewable energy credits (RECs) from Maine renewable electricity generators in the voluntary market to offset 100% of its Scope 2 emissions. These credits have never been factored into the GHG emissions inventory, but it should be noted that the money previously used to purchase renewable energy credits is being put towards expanding efficiency and renewable energy projects going forward.

Scope 3

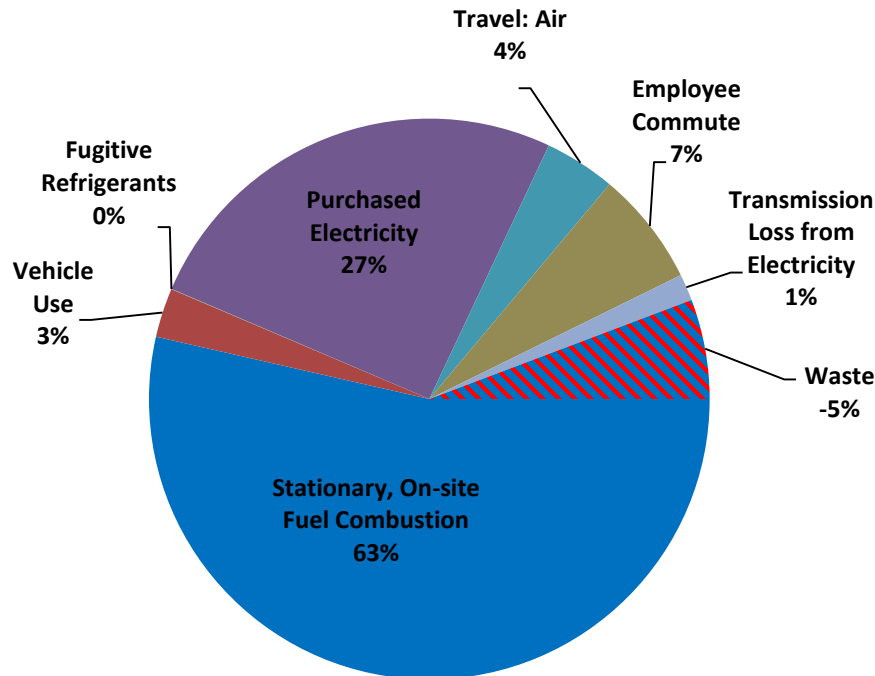
Travel by College faculty and staff, daily employee commuting, transmission line losses from electricity usage, and waste disposal

Scope 3 emissions decreased by 65% in FY 2015 compared to FY 2008, a 1,831 metric ton decrease.

Emissions associated with College travel were up 18%, an increase of 96 metric tons of CO₂e from FY 2008. Emissions related to employee commuting were down 41%, or 708 metric tons, compared to FY 2008. Employee commute is based on the job classification of each employee (ranging from full-time/year-round to part-time/academic-year) cross referenced with the employee's zip code. Our current calculations do not take into account employees who are using alternative transportation. A recent survey of faculty and staff, with 510 valid responses, showed that 22% of respondents use carpooling, biking, or walking as their primary mode of transportation. Electricity line loss-related emissions were 49%, or 228 metric tons, lower compared to FY 2008.

Bowdoin's waste-related emissions decreased by 918% in FY 2015 or 991 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. A change in modeling since FY 2008 that correctly assigns waste to its final destination accounts for the majority of this decrease.

A breakdown of the estimated 14,477 metric tons of CO₂e emissions for FY 2015 is shown by major category in the following chart.



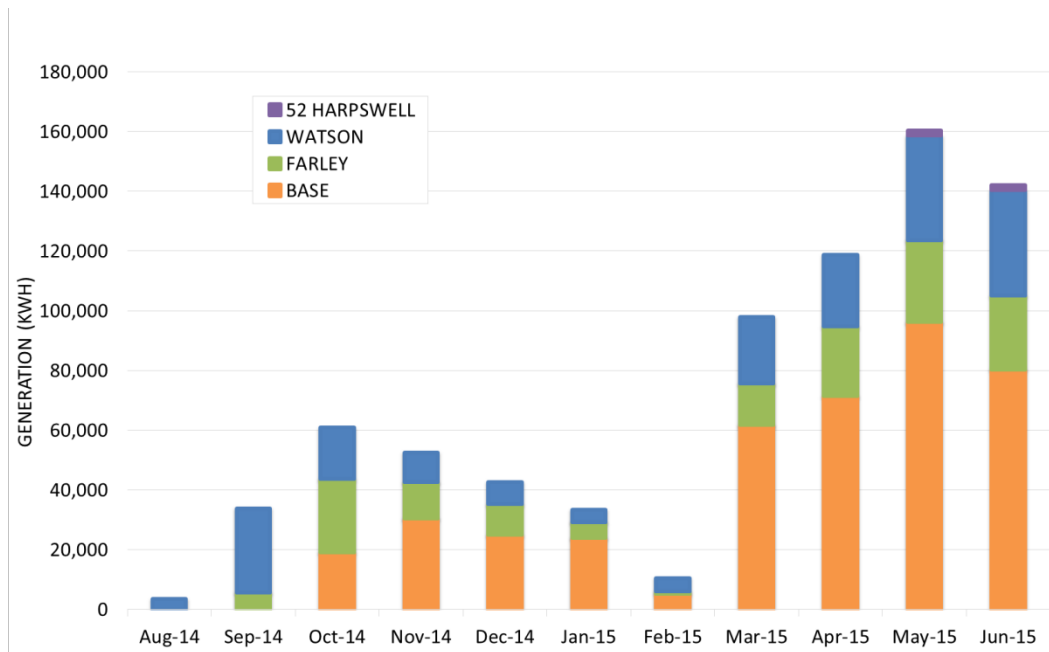
Solar Update

In collaboration with SolarCity Corp., 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 will provide about 8% of the College's electricity each year. During FY 2015, a partial year of generation, the system produced about 760,000 kWhs.

Combined with the electricity produced by the cogeneration turbine at the heating plant, approximately 16% of the College's electricity is now generated on site from renewable or efficient sources.

While Bowdoin played an integral part in developing the solar project, the College is not able to claim carbon reduction benefits from the solar generation. This is due to the fact that SolarCity retains the RECs associated with the generation.

Solar generation at Bowdoin during FY 2015 is shown in the following chart.



Conclusion

Bowdoin's GHG emissions were 24% lower in FY 2015 compared to the base year of Bowdoin's carbon reduction plan. Moreover, the College achieved a reduction of 1,696 metric tons of CO₂e in comparison to FY 2014. Additionally, Bowdoin's own-source emissions saw a 17% decrease in FY 2015 with respect to the 2008 baseline and the College is on track to meet its goal of a 28% reduction by 2020.

However, achieving 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.

In FY 2015 Bowdoin completed several previously mentioned major lighting projects and furthered its efforts to switch from No. 2 heating oil to lower carbon natural gas. Projects that are slated for FY 2016 include:

- Insulating steam and domestic hot water piping in mechanical rooms and steam tunnels across more than a dozen campus locations.
- Replacement of a steam line near the intersection of Coffin Street and Longfellow Avenue.

- Continued increases in lighting efficiency by implementing more LED lighting conversions and adding more occupancy controls. Locations for FY 2016 include the Bowdoin College Museum of Art, Studzinski Recital Hall, and Pickard Theater.
- Continued progress on switching the remaining satellite buildings from No. 2 heating oil to natural gas.

As we have seen in 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.

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