

Annual Emissions Report

2018 Report 10/11/2018 17:47

Bowdoin College

5600 College Station
Brunswick, ME 04011



Contact: Ted Stam & Keisha Payson
 Industry Type: Education
 NAIC Code: 611310
 SIC Code: 8221
 Number of Students (FTE): 1,790
 Building Square Footage: 2,080,505
 Annual Revenue: \$162,524,000
 Description: "Bowdoin is an independent, nonsectarian, coeducational residential, undergraduate liberal arts institution founded in 1794. It is located in Brunswick, Maine, a town of 22,000 on the Maine coast. Study at Bowdoin leads to a bachelor of arts degree in one of over 40 departmental and interdisciplinary majors. Bowdoin enrolls approximately 1,800 students from across the country and around the world."
 Source: www.bowdoin.edu

Emissions Information

Reporting Year: 2018
 Reporting Scope: Maine
 Reporting Protocol: Scope 1, Scope 2, and Scope 3 emissions

Baseline Emissions	(2008)	CO ₂ e	/FTE	/MM Sq Ft	/MM \$ Rev	Unit
Own Source:		16,326	9.50	7,947	139	metric tons
Scope 3:		2,828	1.64	1,376	24	metric tons
Total:		19,153	11.14	9,323	163	

Reporting Year Emissions	(2018)	CO ₂ e	/FTE	/MM Sq Ft	/MM \$ Rev	Unit
Own Source:		11,914	6.66	5,726	73	metric tons
Scope 3:		1,173	0.66	564	7	metric tons
Total:		13,087	7.31	6,290	81	

Change from Baseline		CO ₂ e	/FTE	/MM Sq Ft	/MM \$ Rev	Unit
Own Source:		-27%	-29.9%	-27.9%	-47.1%	% change
Scope 3:		-59%	-60.2%	-59.0%	-70.0%	% change
Total (weighted):		-32%	-34.4%	-32.5%	-50.5%	

Report Information

Author: Competitive Energy Services, LLC
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 (207) 772-6190
 Comments: General Notes:
 Report compiled based on FY18 data provided.



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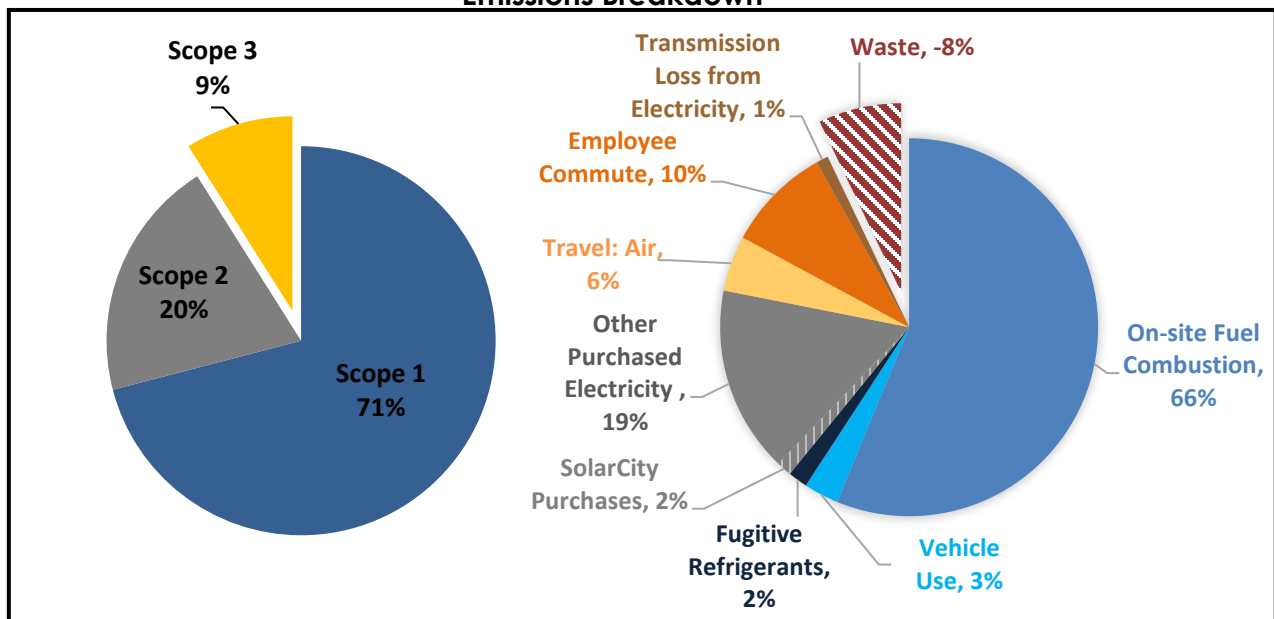
Scope 1	CO ₂ e	CO ₂	N ₂ O	CH ₄	HFCs	PFCs	SF ₆	Unit
Stationary, On-site Fuel Combustion	8,575	8,564	0.0197	0.1734				metric tons
Steam/Electricity from Cogeneration	0	0	0.0000	0.0000				metric tons
Vehicle Use	455	453	0.0050	0.0288				metric tons
Fugitive Refrigerants	254				0.13			metric tons
Agriculture (only N ₂ O applies)	0		0.0000					metric tons
SCOPE 1 TOTAL	9,284	9,018	0.02	0.20	0.13	0.00	0.00	metric tons

Scope 2	CO ₂ e	CO ₂	N ₂ O	CH ₄	HFCs	PFCs	SF ₆	Unit
Purchased Electricity (State Emissions Factors)	2,630	2,547	0.1739	1.2396				metric tons
Purchased, District Cooling	0	0.00	0.0000	0.0000				metric tons
SCOPE 2 TOTAL	2,630	2,547	0.17	1.24	0.00	0.00	0.00	metric tons

Scope 3	CO ₂ e	CO ₂	N ₂ O	CH ₄	HFCs	PFCs	SF ₆	Unit
Travel: Air	724	717	0.0228	0.0198				metric tons
Travel: Vehicle	0	0	0.0000	0.0000				metric tons
Employee Commute	1,373	1,367	0.0155	0.0689				metric tons
Student Commute	0	0	0.0000	0.0000				metric tons
Transmission Loss from Electricity	158	153	0.0104	0.0744				metric tons
Transmission Loss from Cogeneration	0							metric tons
Transmission Loss from District Cooling	0	0	0.0000	0.0000				metric tons
Waste (only calculated in MTCO ₂ e)	-1,082							metric tons
SCOPE 3 TOTAL	1,173	2,236	0.05	0.16	0.00	0.00	0.00	metric tons

2018 Emissions Totals	CO ₂ e	/FTE	/MM Sq Ft	/MM \$ Rev	Unit
Own Source	11,914	6.66	5,726	73	metric tons
Scope 3	1,173	0.66	564	7	metric tons
Total	13,087	7.31	6,290	81	metric tons

Emissions Breakdown



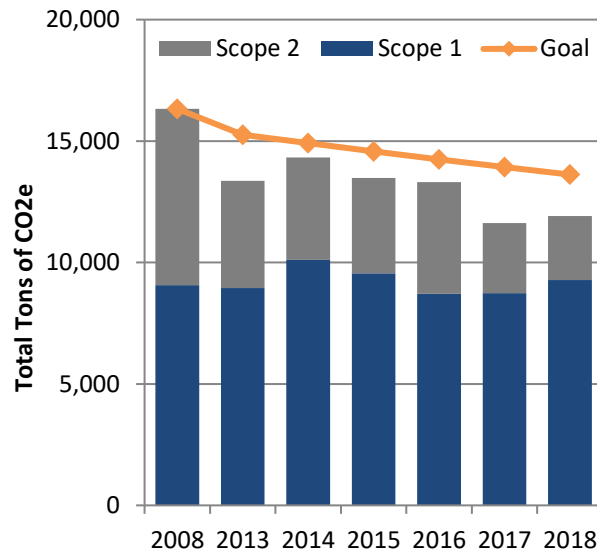
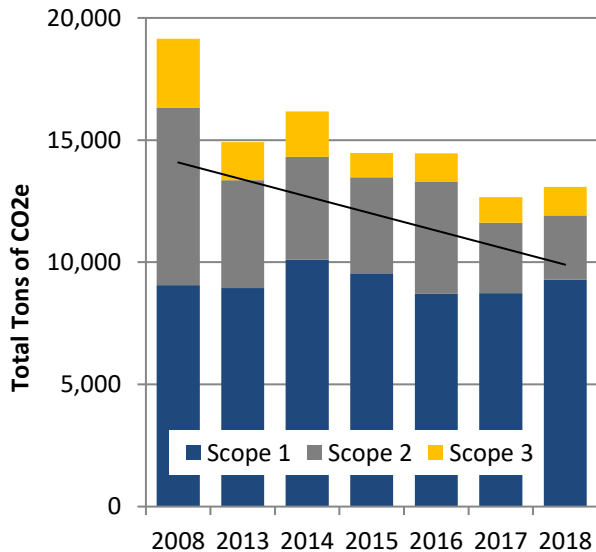
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Annual Trends



Historical Data and Future Goals								
Scope 1	2008	2013	2014	2015	2016	2017	2018	Units
Stationary, On-site Fuel Combustion	8,660	8,402	8,646	9,111	7,984	8,092	8,575	metric tons
Vehicle Use	340	399	429	435	445	442	455	metric tons
Fugitive Refrigerants	62	148	1,032	4	276	205	254	metric tons
SCOPE 1 TOTAL	9,062	8,949	10,107	9,550	8,705	8,739	9,284	metric tons
Scope 2								
Purchased Electricity	7,264	4,411	4,213	3,929	4,600	2,881	2,630	metric tons
SCOPE 2 TOTAL	7,264	4,411	4,213	3,929	4,600	2,881	2,630	metric tons
Scope 3								
Travel	534	546	520	630	696	646	724	metric tons
Employee Commute	1,722	1,114	1,517	1,014	1,243	1,209	1,373	metric tons
Transmission Loss from Electricity	464	265	253	236	276	173	158	metric tons
Waste	108	-365	-437	-883	-1,058	-978	-1,082	metric tons
SCOPE 3 TOTAL	2,828	1,560	1,853	997	1,157	1,051	1,173	metric tons
TOTALS	19,153	14,920	16,173	14,476	14,461	12,671	13,087	metric tons
OWN-SOURCE TOTAL	16,326	13,360	14,320	13,479	13,304	11,620	11,914	metric tons
OWN-SOURCE GOAL	16,326	15,253	14,911	14,577	14,251	13,932	13,620	metric tons

Emission Goals: See Bowdoin's Blueprint For Carbon Neutrality In 2020 Dated October 16, 2009



Emissions Definitions

Global Warming Potential (GWP):	Each chemical has a different impact on global warming. For example, once in the atmosphere, some chemicals last for longer periods of time or are better at reflecting heat. In order to account for these varying effects, a unique GWP is assigned to each chemical such that more harmful chemicals are given higher values. Carbon dioxide serves as a reference, with a GWP of 1. These values are international standards, taken from the Fourth Assessment Report by the Intergovernmental Panel on Climate Change.
CO ₂ :	Carbon dioxide, GWP = 1. CO ₂ is the most common type of carbon emission. It comes mostly from fossil fuel combustion.
N ₂ O:	Nitrous oxide, GWP = 298. Industrial production and the energy industry typically have the most significant nitrous oxide emissions.
CH ₄ :	Methane, GWP = 25. Most methane emissions are the result of waste management and agriculture processes.
HFCs:	Hydrofluorocarbons, GWP varies by type. HFCs are a family of different chemicals defined by carbon chains saturated with multiple bonds to hydrogen or fluorine. Mostly used as refrigerants, HFCs have a strong impact on the atmosphere with GWPs that range from 12 to 12,000.
PFCs:	PFCs are a family of different chemicals defined by carbon chains saturated exclusively by fluorine molecules. The semiconductor and aluminum production industry account for the majority of PFCs, and virtually all emissions come from industrial sources. While PFC emissions are small, they have GWPs from 5,700 to 22,200.
SF ₆ :	Sulfur hexafluoride, GWP = 23,900. Mostly used in magnesium production, SF ₆ is also widely used as a dielectric in high voltage systems.
CO ₂ e:	Carbon dioxide equivalents. This value represents the amount of each emission multiplied by its GWP. Carbon dioxide equivalents allow for potentially different emissions to be compared by using a single value that accounts for the weighted impact of each emission type.
Unit:	A metric ton is 1000 kilograms, approximately 2,204.62 pounds.

Modeling Assumptions

Emissions from distillate oil use were calculated using emissions factors from data of No.2 oil.

In some cases, mobile fuel combustion was reported in dollars. If so, the dollar amount was divided by the average fuel price of the given year and region to determine the physical amount of fuel consumed.

Bowdoin provided gasoline/diesel usage for college owned vehicles. This number was directly converted to CO₂ emissions. Employee commuting distances were first found by comparing workplace location to paycheck zip code and dividing this distance by national carpooling averages. Emissions from college sponsored air travel was determined via the dollar amount spent on airline tickets.

Emissions factors for alternative fuels vary considerably by fuel type and engine. For ethanol and biodiesel mixes, the percent ethanol and biodiesel is assumed to contribute no net CO₂ from combustion. CNG data came from DOE studies "Barwood Cab Fleet Study" and "Super Shuttle CNG Fleet Study." Ethanol data came from DOE study "Ohio's First Ethanol Powered Fleet."

Waste emissions were calculated using factors from EPA's WARM model. The WARM model's emissions factors take into account the life-cycle emissions associated with waste materials, thus all of the emissions are not necessarily contained within the current inventory period. Additionally, because in some cases waste sequesters carbon that might normally be released into the atmosphere, negative emissions factors were employed. This is consistent with the EPA's model.

Emissions from purchased, electrical power were calculated using state emissions factors in EPA eGRID.

Emissions Categories

Emissions were divided into three scopes, using guidelines from California Climate Action Registry, General Reporting Protocol. An organization is most responsible for Scope 1 emissions because their own activities directly cause these. Scopes 2 and 3 are still significant sources of emissions, however, these emissions often are the physical consequence of a third party obligated to the college in some way. For example, a college's use of electrical energy does not generate any direct, on-site emissions if electricity is purchased from a utility. However, the production of energy does produce significant emissions, and the ultimate consumer has some accountability for these production emissions.

Although almost every major reporting scheme requires that Scope 2 emissions be reported, Scope 3 emissions are oftentimes optional for the sake of expediency and accounting difficulty.

References

- California Climate Action Registry "General Reporting Protocol" v3.1, found online at <<http://www.climateregistry.org/tools/protocols/>>.
- EPA's "United States Greenhouse Gas Inventory," including reporting years 1990-1997, 1990-2000, 1990-2013, found online at <http://www.epa.gov/climatechange/emissions/usgginv_archive.html>.
- "Barwood Cab Fleet Study" and "Super Shuttle CNG Fleet Study," found online at <http://www1.eere.energy.gov/vehiclesandfuels/avta/light_duty/afv/emissions_description.html>.
- EPA's "Waste Reduction Model," Version 13 (March 2015) found online at <<http://www3.epa.gov/warm/index.html>>.
- Airlines for America "Fares Per Mile" found online at <<http://airlines.org/data/a4a-monthly-passenger-and-cargo-yield-fares-per-mile/>>.
- NREL's "Ohio's First Ethanol Fuel, Light Duty Fleet," found online at <<http://www.eere.energy.gov/afdc/pdfs/ol>>.