Annual Emissions Report

2019 Report 12/17/2019 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):	1,814
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:	2019
Reporting Scope:	Maine
Reporting Protocol:	Scope 1, Scope 2, and Scope 3 emissions

Baseline Emissions	(2008)	CO_2e	/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	(2019)	CO_2e	/FTE	/MM Sq Ft	/MM $ Rev	Unit
Own Source:		13,011	7.17	6,254	80	metric tons
Scope 3:		1,059	0.58	509	7	metric tons
Total:		**14,070**	**7.76**	**6,763**	**87**	

Change from Baseline	CO_2e	/FTE	/MM Sq Ft	/MM $ Rev	Unit
Own Source:	-20%	-24.5%	-21.3%	-42.3%	% change
Scope 3:	-63%	-64.5%	-63.0%	-72.9%	% change
Total (weighted):	**-27%**	**-30.4%**	**-27.5%**	**-46.8%**	

Report Information

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Comments: General Notes:
Report compiled based on FY19 data provided.

Annual Emissions Report

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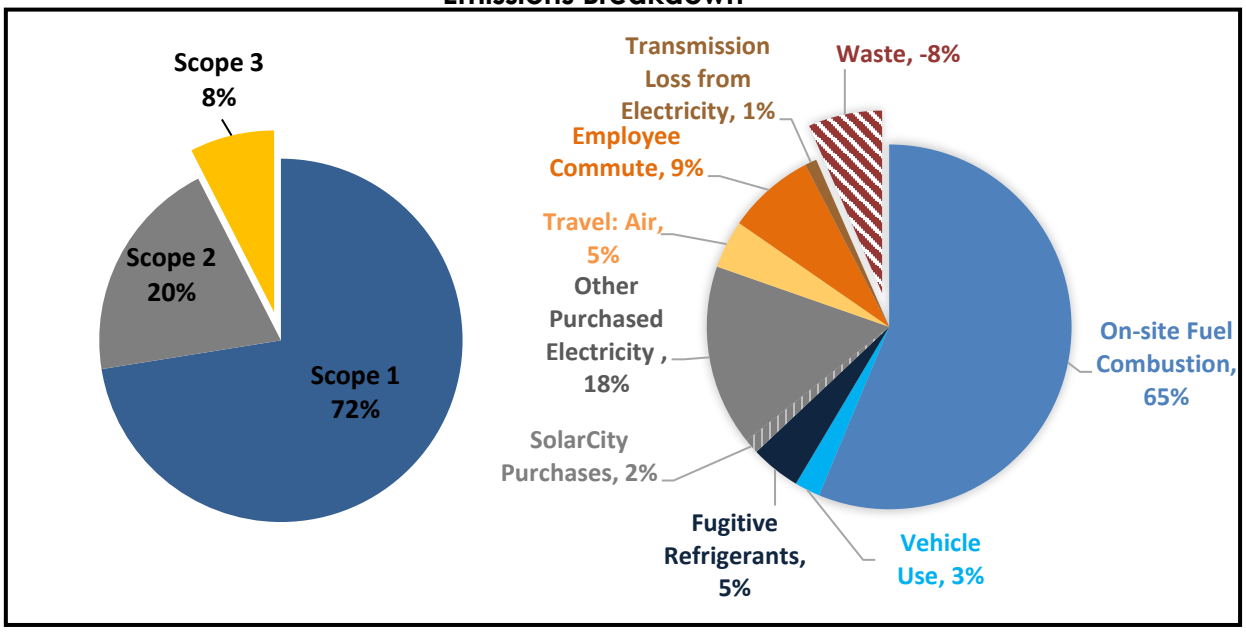
Scope 1	CO_2e	CO_2	N_20	CH_4	HFCs	PFCs	SF_6	Unit
Stationary, On-site Fuel Combustion	9,112	9,103	0.0181	0.1725				metric tons
Vehicle Use	367	365	0.0041	0.0212				metric tons
Fugitive Refrigerants	717				0.36			metric tons
SCOPE 1 TOTAL	**10,197**	**9,468**	**0.02**	**0.19**	**0.36**	**0.00**	**0.00**	**metric tons**

Scope 2	CO_2e	CO_2	N_20	CH_4	HFCs	PFCs	SF_6	Unit
Purchased Electricity (State Emissions	2,815	2,728	0.1862	1.3278				metric tons
SCOPE 2 TOTAL	**2,815**	**2,728**	**0.19**	**1.33**	**0.00**	**0.00**	**0.00**	**metric tons**

Scope 3	CO_2e	CO_2	N_20	CH_4	HFCs	PFCs	SF_6	Unit
Travel: Air	692	685	0.0218	0.0190				metric tons
Travel: Vehicle	0	0	0.0000	0.0000				metric tons
Employee Commute	1,259	1,253	0.0142	0.0632				metric tons
Transmission Loss from Electricity	169	164	0.0112	0.0797				metric tons
Waste (only calculated in $MTCO_2e$)	-1,061							metric tons
SCOPE 3 TOTAL	**1,059**	**2,102**	**0.05**	**0.16**	**0.00**	**0.00**	**0.00**	**metric tons**

2019 Emissions Totals	CO_2e	/FTE	/MM Sq Ft	/MM $ Rev	Unit
Own Source	13,011	7.17	6,254	80	metric tons
Scope 3	1,059	0.58	509	7	metric tons
Total	**14,070**	**7.76**	**6,763**	**87**	**metric tons**

Emissions Breakdown

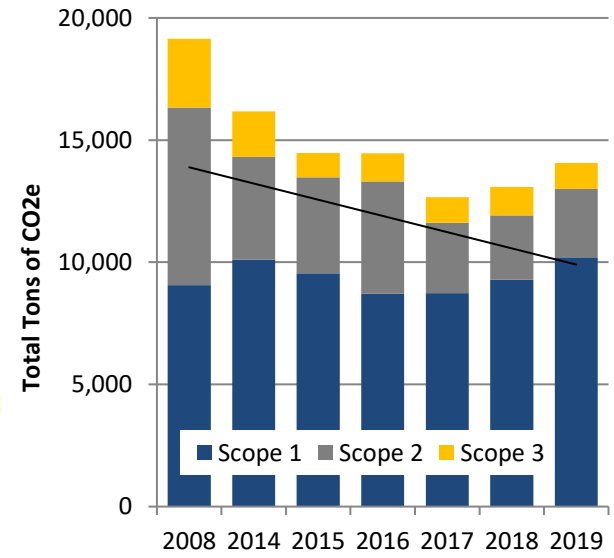


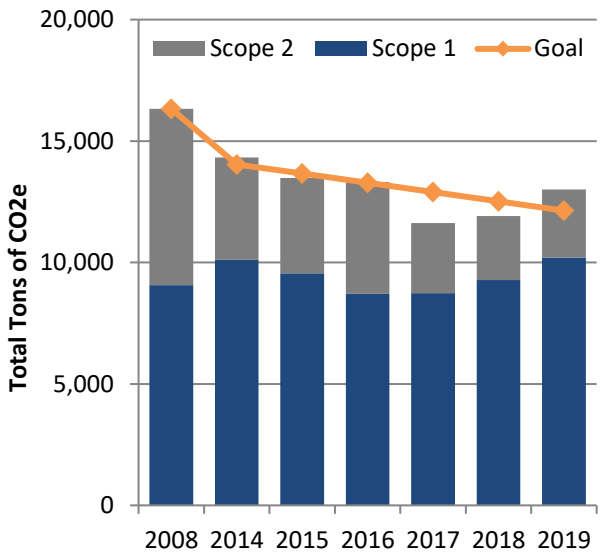
Annual Emissions Report

2019 Report 12/17/2019 17:47

Bowdoin College

Annual Trends





Historical Data and Future Goals

Scope 1	2008	2014	2015	2016	2017	2018	2019	Units
Stationary, On-site Fuel Combustion	8,660	8,646	9,111	7,984	8,092	8,575	9,112	metric tons
Vehicle Use	340	429	435	445	442	455	367	metric tons
Fugitive Refrigerants	62	1,032	4	276	205	254	717	metric tons
SCOPE 1 TOTAL	9,062	10,107	9,550	8,705	8,739	9,284	10,197	metric tons
Scope 2								
Purchased Electricity	7,264	4,213	3,929	4,600	2,881	2,630	2,815	metric tons
SCOPE 2 TOTAL	7,264	4,213	3,929	4,600	2,881	2,630	2,815	metric tons
Scope 3								
Travel	534	520	630	696	646	724	692	metric tons
Employee Commute	1,722	1,517	1,014	1,243	1,209	1,373	1,259	metric tons
Transmission Loss from Electricity	464	253	236	276	173	158	169	metric tons
Waste	108	-437	-883	-1,058	-978	-1,082	-1,061	metric tons
SCOPE 3 TOTAL	2,828	1,853	997	1,157	1,051	1,173	1,059	metric tons
TOTALS	**19,153**	**16,173**	**14,476**	**14,461**	**12,671**	**13,087**	**14,070**	metric tons
OWN-SOURCE TOTAL	**16,326**	**14,320**	**13,479**	**13,304**	**11,620**	**11,914**	**13,011**	metric tons
OWN-SOURCE GOAL	**16,326**	**14,040**	**13,659**	**13,278**	**12,897**	**12,516**	**12,135**	**metric tons**

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

Competitive Energy SERVICES

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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 Fifth 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_20:	Nitrous oxide, GWP = 265. Industrial production and the energy industry typically have the most significant nitrous oxide emissions.
CH_4:	Methane, GWP = 28. 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_2e:	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 kilgorams, 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 CO_2 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 <hhttp://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/oh