

OREGON STATE UNIVERSITY
Greenhouse Gas Inventory
Fiscal Year 2016

Leticia Cavazos
Sustainability Program Specialist

Brandon Trelstad
Sustainability Officer

OSU Sustainability Office
March 2017



ACKNOWLEDGEMENTS.....2

DEFINITIONS OF KEY TERMS.....3

EXECUTIVE SUMMARY.....5

BACKGROUND.....8

METHODOLOGY.....8

BOUNDARIES..... 10

FINDINGS AND ANALYSIS 11

FUTURE ACTION 17

FINDINGS TABLE 19

GRAPHS AND DATA TABLES 27

Acknowledgements

Due to the broad scope of this inventory, a large number of people from many departments, businesses and organizations were involved. We would like to thank them here.

Oregon State University

- Athletics: Jacques Bruns, Garret Haldeman, Brian Daviscount
- Agriculture Experiment Stations: Kathleen Dumont, Shelley Hughes, Sue Hansell, Carol Tollefson, Katie Ralls, Ilea Bouse, Debbie Burroughs, Willie Riggs, Tracy Burner, Jan Jones, Maria Schramm, Peggy Carr, Petrina White, Arthel Ambrose, Kim McKague, Mandy Seals, Peter McPartlin, Jack Breen, John Feldsher, David Bohnert
- Animal and Rangeland Sciences: Otila Zuschlag, Seth Spencer
- OSU-Cascades: Kira Luek, Terri Libert
- Extension Service: Roxie Applebee, Vicky Krenz, Samantha Clayburn, Kim Heber, Holly Lyons, Reaza Mansur, Ladene Hurd, Joanne Kiyokawa, Debbie Burroughs, Tracy Brunner, Jeanine Hite, Liz Olsen, Michele Webster, Donita Godwin, Patricia East, Julie Baker, Diana Leslie, Sandy Macnab, Lisa McKibbin, Shevon Hatcher, Margie Vaughn, Brenda Snow, Kelli Watcherson, Shevon Hatcher, Carol Waggoner
- Finance and Administration: Bezunesh Abebe, Justin Fleming, Kristi Gienger, Diane Johnson, Andrea Norris, Karen Meador, Steve Nash, Stephanie Smith, Julie Stratton, Les Walton, Fritz Wilhelm, Alex Sims, Lissa Perrone, Charlotte Rooks, Eric Smith, Gillian Yu, Jonathan, Champney, Michelle Barnes, Bill Coslow, Andrew Kenst
- Hatfield Marine Science Center: Chelle Boswell, Maryann Bozza
- Institutional Research: Terence Merritt
- Ship Operations: Monita Cheever

Businesses and Consultants

- Amerigas: Roquel Herman
- Azumano Travel, Corvallis: Jean Comstock
- Carson Oil: Dace Phearson
- Teel's Travel, Corvallis: Wendy Woolsey
- Central Lincoln PUD: Brandon Hignite



Definitions of Key Terms



1. **“Carbon dioxide” (CO₂)** means the chemical compound containing one atom of carbon and two atoms of oxygen.
2. **“Carbon dioxide equivalent” (CO₂e)** represents the quantity of a greenhouse gas multiplied by a Global Warming Potential (GWP) factor, relative to CO₂. This is the “standard unit” used to quantify various greenhouse gasses.
3. **“Global Warming Potential factor” (GWP)** means the radiative forcing impact of one mass-based unit of a given greenhouse gas relative to an equivalent unit of carbon dioxide over a given period of time. For instance, methane (CH₄) has a GWP of 23, meaning that every gram of methane will trap 23 times as much solar radiation as a gram of CO₂.
4. **“Radiative Forcing Index” (RFI)** is a multiplier designed to account for the effects on climate an emission source will cause in addition to the release of fossil carbon. The RFI is most commonly used for aviation emissions, where it accounts for the effects of releasing greenhouse gases at altitude. The Intergovernmental Panel on Climate Change (IPCC) has [estimated the RFI](#) multiplier for aviation at 2.0-4.0.
5. **“Greenhouse gas” (GHG)** is any gas that contributes to anthropogenic global warming including, but not limited to, carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride.
6. **“Metric ton, tonne, or metric tonne” (t)** means one metric tonne (1000 kilograms) or 2204.62 pounds.
7. **“Total emissions”** is the calculated sum of GHGs emitted due to OSU-related activities.
8. **“Net emissions”** is the calculated sum of GHGs emitted minus renewable energy certificates, composting activities and carbon offsets.
9. **“Renewable energy source”** means any source of energy that is replenished rapidly by natural processes. Renewable sources may include, but are not limited to, wind, solar, hydroelectric, biomass, geothermal, tidal or sea currents etc.
10. **“Statewides”** refers to the inventory that analyzes emissions from statewide, legislatively-mandated OSU entities, specifically the Agricultural Experiment Stations (AES), Extension Services and the Forest Research Laboratories (FRL).
11. **“Renewable Energy Certificate” (REC)** is a tradable certificate that represents a unit of energy produced by renewable energy sources. The owner of a REC can claim that they are using renewable energy equal to the amount of RECs owned.



12. “**Bonneville Environmental Foundation (BEF)**” is a Portland, Oregon based non-profit that specializes in carbon offsets, mainly renewable energy certificates (RECs). These credits increase the volume of clean, renewable energy that enters the electrical grid. OSU purchases RECs from BEF as part of the student renewable energy fee.
13. “**Renewable energy fee**” refers to the student-approved initiative that directs \$8.50 per term per student towards the purchase of RECs. These RECs offset a large percent of OSU’s electrical consumption with additions of clean, renewable energy to the electrical grid.
14. “**World Business Council for Sustainable Development (WBCSD)**” is a global association of business representatives that deals exclusively with business and sustainable development.
15. “**Greenhouse Gas Protocol (GHGP)**” is an internationally-used accounting tool that allows business and governmental leaders to understand, quantify and manage greenhouse gas emissions. It provides a framework for nearly every greenhouse gas standard and program in the world. The WBCSD was an original partner in drafting and creating the GHGP.
16. “**Intergovernmental Panel on Climate Change (IPCC)**” is a scientific body established to provide policymakers with an objective source of information on climate change. The IPCC performs no research nor does it monitor climate data; it instead offers analysis of research and climate data as an objective body with a broad range of views, expertise and wide geographical coverage.
17. “**Campus Carbon Calculator (CCC)**” is a carbon calculator used by many campuses for calculating greenhouse gas emissions. Originally developed by the former non-profit Clean Air – Cool Planet and the Sustainability Institute at University of New Hampshire (UNH), it is now owned and managed by the Sustainability Institute at UNH.
18. “**American College and University Presidents Climate Commitment (ACUPCC) or “Carbon Commitment”**” is an effort to encourage commitments from institutions of higher learning to neutralize greenhouse gas emissions and prioritize the research and education efforts aimed at stabilizing earth’s climate. In October 2015, the ACUPCC was renamed and rebranded as the Carbon Commitment.

Definition Sources

Oregon Department of Environmental Quality: www.deq.state.or.us
Bonneville Environmental Foundation: www.greentagsusa.org
World Business Council for Sustainable Development: www.wbcsd.org
Greenhouse Gas Protocol: www.ghgprotocol.org
Intergovernmental Panel on Climate Change: www.ipcc.ch
Clean Air-Cool Planet: <http://www.cleanair-coolplanet.org/>
Carbon Commitment: <http://secondnature.org/climate-guidance/the-commitments/>

Executive Summary

Oregon State University (OSU) aspires to be among the top 10 colleges and universities in the United States recognized for excellence in sustainability. OSU consistently places among the top 25 for sustainability efforts and this Fiscal Year 2016 (FY16) OSU Greenhouse Gas (GHG) Inventory helps track progress toward that goal. Since OSU President Ed Ray's April 2007 signing of the American College and University Presidents Climate Commitment (ACUPCC), now known as the Carbon Commitment, OSU has made partial progress toward an ambitious goal of becoming carbon neutral by 2025. However, enrollment and square footage growth in recent years have made continued GHG reductions challenging.

This report is an update and expansion of the [FY07-FY15](#) OSU GHG inventories, which themselves are expansions of a [CY04 inventory](#) commissioned by the Oregon University System (OUS).

The FY16 report provides:

1. A snapshot of OSU emissions: quantified greenhouse gas emissions resulting from OSU-related activities for the fiscal year ending June 30, 2016.
2. Comparison with prior OSU inventories and those from other schools: a comparative analysis with FY07-FY15 emissions.
3. Guidance for future inventories: the methodology, successes, challenges and rationale of this expanded report provides a framework for future OSU reports.

Findings in Brief

- The emissions for the past five fiscal years (FY11-FY15) changed considerably with this new version of the Campus Carbon Calculator, the inventory tool provided free of charge by University of New Hampshire (UNH) and used by most higher education institutions. In previous versions, the factor utilized to calculate emissions from purchased electricity with a custom fuel mix, was not updated since FY10 to match each year's actual fuel mix. This error was recently corrected by UNH, resulting in higher emissions than previously reported for FY11-FY15.
- OSU's FY16 **gross emissions** were 136,365.70 metric tonnes (t) carbon dioxide equivalent (CO₂e), a **2.1% increase** from FY15. This increase was mainly due to:
 - Increased student enrollment and total building square footage, including energy-intensive research and laboratory space.
- **Net emissions** were 135,458.0 t CO₂e, a **1.6% increase** from FY15.
 - Sources for this increase are the same as those noted above for gross emissions, but this increase is slightly lower due to the purchase of offsite renewable energy.
- **Gross emissions per full-time equivalent (FTE) student** were 5.13 t CO₂e, a **0.4% decrease** from FY15.
 - Increased student enrollment resulted in decrease in per student emissions, in spite of higher overall university emissions levels.
- **Gross emissions per 1000 square feet** were 13.09 t CO₂e, a **0.2% increase** from FY15
 - More accurate square footage accounting relative to past GHG reports, plus an increase in energy intensive building space, resulted in a modest increase in per square foot emissions.

FY16 OSU COMPREHENSIVE GREENHOUSE GAS GROSS EMISSIONS

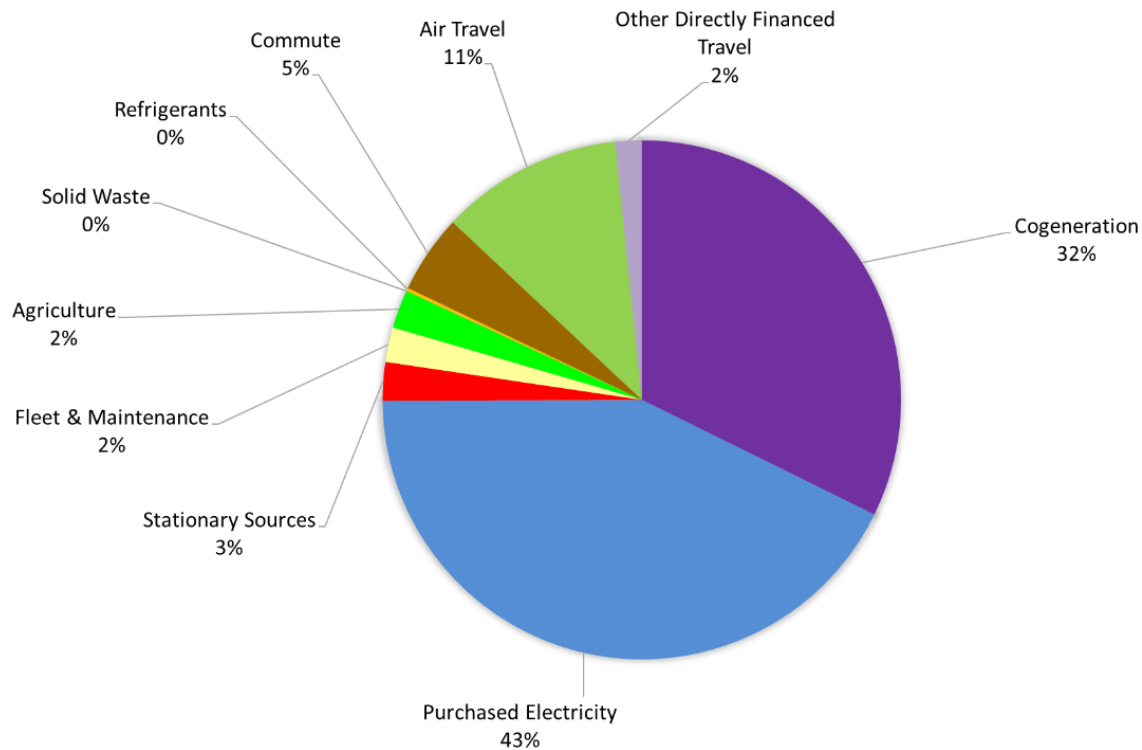


Figure 1. OSU Comprehensive Greenhouse Gas Gross Emissions by Source

OSU Comprehensive Greenhouse Gas Gross Emissions

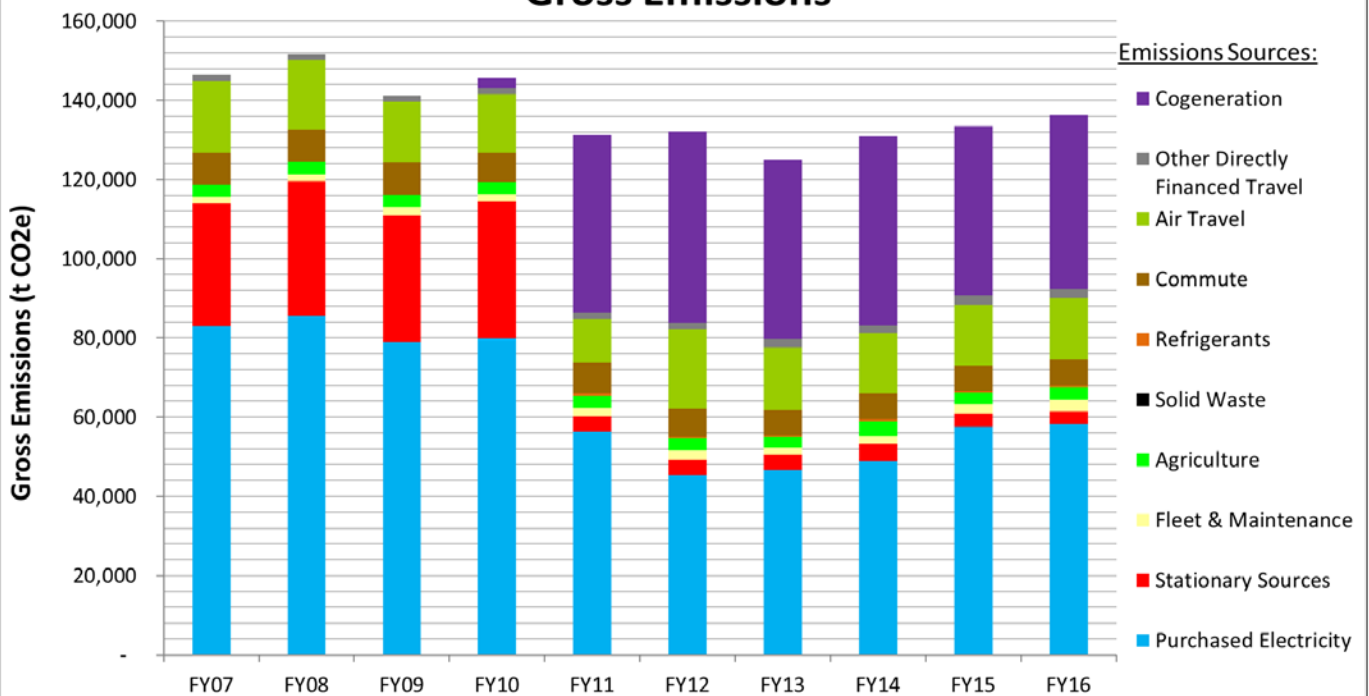


Figure 2. OSU Comprehensive Greenhouse Gas Gross Emissions

OSU Emissions per Student and per Square Foot

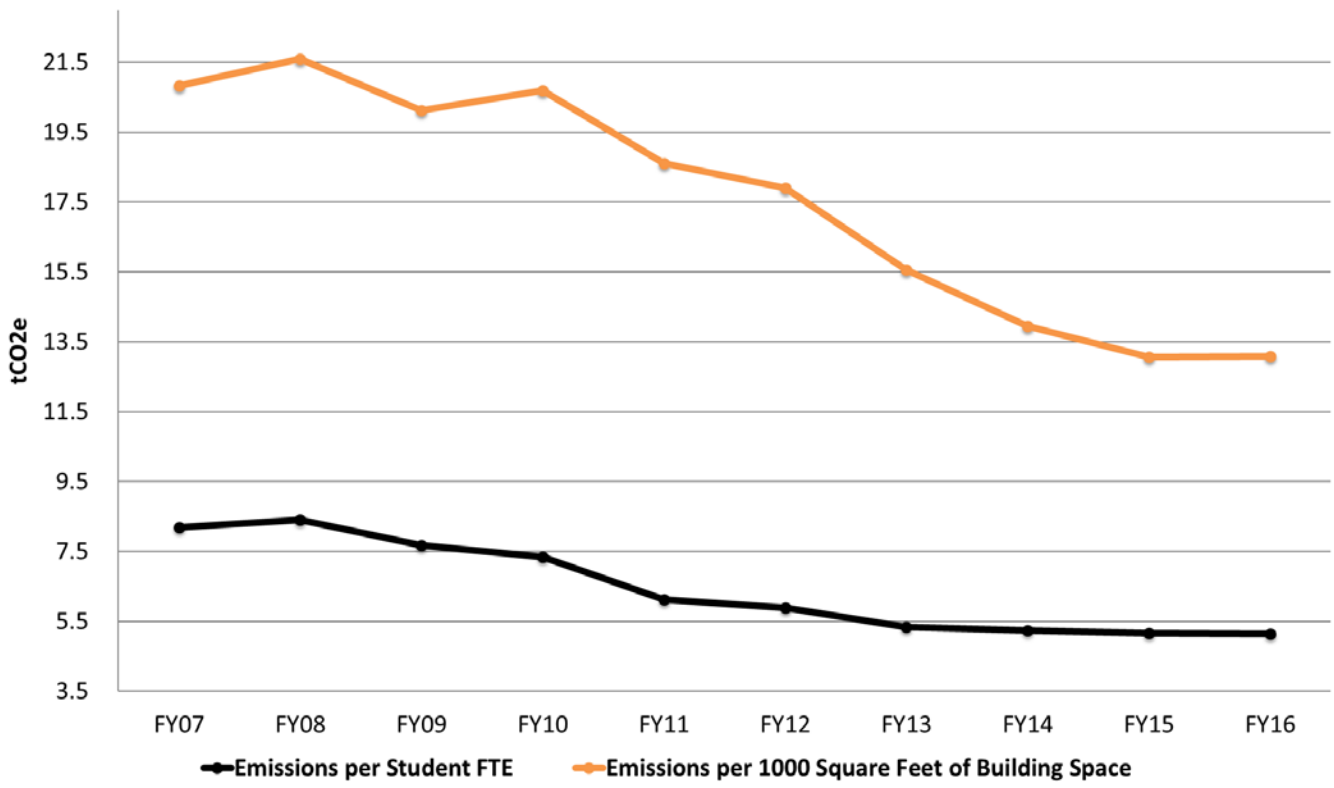


Figure 3. OSU Emissions per Student and per Square Foot

Background

Oregon State University's eighth annual comprehensive greenhouse gas inventory again reflects a continual improvement of data collection methods and analyses. This report includes several changes since the previous annual report issued for Fiscal Year 2015. Although not reflected in this shorter report, constructing an inventory with this level of detail is now, more than ever, a monumental task.

In an effort to streamline the report format, the OSU Sustainability Office has moved to a reporting structure that highlights changes in methods from year to year. Rather than include text that largely remains static, the authors will, when appropriate, direct readers to past reports for specific details and references.

As was the case for the FY15 report, the science and methods behind best-practice greenhouse gas inventory work is ever-evolving, making year-to-year comparisons complex. GHG measurement is an increasingly important global issue. OSU's inventory processes exceed (with a comfortable margin) the strictest regulatory requirements. Feedback is appreciated on this document and the processes used to create it. Please visit our [Emissions Measurement and Reporting Website](#) for details and updates.

Methodology

Overview

With operations as broad and far-reaching as Oregon State University's, the largest task in creating this FY16 inventory was data collection. Extensive data was gathered from central sources and from OSU entities across the state. Most large sources of GHG emissions are accounted for in their entirety. Omissions are described in the [Boundaries](#) section of this document. This is the most complete inventory of OSU's GHG emissions performed to date.

The CCC calculator was chosen again for FY16 due to its focus on university and college campuses, ease of comparison with past inventories and its endorsement by the Carbon Commitment, of which OSU is a charter signatory. Other reasons for selecting this tool are found on page 12 of the [FY08 report](#). The FY16 report has been created using CCC's version 9 calculator.

Scope and Boundaries

Identifying scope and boundary issues is a critical step in emissions reporting. While some connections to emissions sources – like electrical consumption – are direct, others, such as employee commuting or student air travel to and from the university, are not. In an effort to measure all emissions resulting from OSU activity, the boundaries were drawn to be fairly broad: any emissions from an entity over which OSU has financial and/or operational control were included.

FY16 essentially mirrors the methodology and reporting structure of FY15; a brief history of past reporting structures and the rationale for changes can be found on page 13 of the [FY09 report](#).

Unless otherwise noted, data comparing fiscal years and university-wide totals are drawn from the OSU Comprehensive inventory. Emissions sources like air travel and rental cars were attributed to OSU Corvallis unless otherwise noted.

Inventories

In order to account for and differentiate between all emissions of [OSU's operations across the state](#), this report is comprised of four different inventories: Corvallis Campus, OSU-Cascades, Hatfield Marine Science Center (HMSC), and The Statewide Public Services, or "Statewides." All locations are considered vital facets of the university. Key aspects of each location pertinent to this report are below.

OSU Corvallis

The main Corvallis campus produces the vast majority of the university's GHG emissions. At over 400-acres, OSU Corvallis hosts 29,576 students and 6,088 faculty and staff.

OSU Cascades

Cascades is the only branch campus of OSU. Located in Bend, Oregon, the 56-acre campus specializes in degrees like Accountancy, Natural Resources, Tourism and Outdoor Leadership, Hospitality Management, Energy Sciences Engineering and many other programs. Ground was broken in FY15 for the first of several new campus buildings. 1,122 students enrolled at OSU Cascades in FY16.

Hatfield Marine Science Center (HMSC)

OSU's primary coastal operation and base for oceanographic research are located 50 miles west of Corvallis. Originally established as a marine laboratory for Oregon State University, HMSC currently hosts collaborative research and education programs from seven OSU colleges and six state and federal agencies on its 49-acre campus.

Statewides

As part of OSU's designation as the state's land, sea, space and sun grant institution, OSU's Statewide Public Service Programs identify emerging community issues, discover new research-based solutions, and apply new discoveries through engaged learning. The Statewides consist of three divisions, with operations in all 36 Oregon counties:

- The **OSU Extension Service** connects Oregonians to research-based knowledge for economic development, healthy and productive life choices, and sustainable ecosystems.
- The Oregon **Agricultural Experiment Station** is Oregon's principal research engine related to food, agriculture, and natural resources.
- The **Forest Research Laboratory** is a dynamic source of knowledge about the science and management of forests, the connections of people to forests, and the use of renewable materials to benefit businesses, communities, and quality of life in Oregon.

Data Gathering and Management

As Oregon's land, sea, space and sun grant institution, OSU facilities spread throughout the state, requiring data from a large number of sources. Not all data was readily available or in a useable format. The need to balance timeliness with attaining trivial data resulted in some intentional omissions. Other emissions sources were omitted because of incomplete data and a limited ability to reliably extrapolate. Rationale for these omissions is discussed in further detail in the [FY08 report](#).

Past Inventory Comparison

An important function of this FY16 inventory is to monitor emissions trends over time. Data presented in this report reflects changes in emissions between FY15 and FY16, based on use of the highest quality data and best calculation practices available. In an effort to present the best data using the latest calculation methods, past, current and future inventories may not be absolutely comparable for all sources. Issues of comparison over time will continue to be noted in these reports.

Boundaries

Overview

The scope and boundaries of this greenhouse gas inventory aim to be comprehensive, expanding beyond what is typically required of organizational inventories. Using terminology common to greenhouse gas reporting, most inventories at minimum examine a “Scope 1,” which includes all direct emissions from sources owned or directly controlled by the subject organization. “Scope 2” sources, which cover GHG emissions that result from importing or buying electricity, steam, heated or chilled water, are also often included. “Scope 3” includes all other indirect sources of GHG emissions that result from organization activities from sources not owned or controlled by the organization. These scopes are defined by the World Business Council for Sustainable Development (WBCSD) and are used to ensure consistency and prevent double-counting or double-crediting. The Carbon Commitment requires that signatories mitigate emissions only from Scope 1 and 2 sources, as well as commute and air travel from Scope 3. Most OSU peer institutions focus on these boundaries. Our inventory aims to document all OSU emissions for which data exist, regardless of our mitigation responsibilities. Total emissions that OSU is required to mitigate by the Commitment will be specifically identified throughout the report.

Omitted Emissions Sources and Credits

It was not possible to precisely inventory every emissions source or credit due to diverse university operations across the state and existing business practices and accounting methods not well suited for reporting the types of data needed. Those intentional omissions are discussed below. If emissions from a source are expected to contribute more than 1% to total emissions the source is considered significant; those that are expected to contribute less than 1% are considered negligible and not included in this analysis.

Omitted sources are shown in Table 1:

Table 1. Omitted Sources	
Omitted Source	Expected Impact
Water treatment and distribution	Significant
Long-distance student travel (travel abroad, to/from home)	Significant
<u>Additional</u> biological sequestration	Significant
Lifecycle/embodied emissions*	Significant
Off-campus vehicle use	Negligible
Recycled materials (transportation and processing)	Unknown

*A [lifecycle greenhouse gas analysis](#) was performed for the Oregon University System by [Good Company](#) in August 2009 based on the Carnegie Mellon Economic Input-Output Life-Cycle Assessment (EIO-LCA) model. Quantifying emissions using FY08 expenditures for food, construction, retail goods, computers, paper, lab equipment and much more, **Good Company found that OSU’s emissions from the procurement of goods and services were estimated at nearly 85,000 t CO₂e, or more than 73% of FY08 gross emissions.**

Findings and Analysis

Findings

Total gross and net emissions for each scope are shown in Table 2 below.

Table 2. OSU Comprehensive Emissions by Scope (t CO ₂ e)					
	FY12	FY13	FY14	FY15	FY16
Scope 1					
Gross Emissions	57,989.6	54,121.8	58,179.7	51,814.5	53,762.7
Net Emissions	57,840.5	53,164.5	57,918.8	51,632.3	53,580.5
Scope 2					
Gross Emissions	42,645.6	44,121.6	46,040.2	54,113.3	54,627.6
Net Emissions	35,138.7	43,777.3	46,028.6	54,028.9	53,902.3
Scope 3					
Gross Emissions	31,327.2	27,113.7	26,831.8	27,629.1	27,975.4
Net Emissions	31,327.2	27,113.7	26,831.8	27,629.1	27,975.4
Total					
Gross Emissions	132,373.4	125,357.1	131,051.7	133,556.9	136,365.7
Net Emissions	124,702.0	124,055.5	130,779.2	133,654.7	135,458.0

- Scope 1 emissions are mainly from fossil fuel combustion, refrigerants and agriculture; Scope 2 emissions are from purchased electricity; Scope 3 emissions include air travel, other university financed travel (personal mileage reimbursement, Athletics bus travel, etc.), commute, solid waste, and losses due to transmission and generation of electricity. Under the requirements of the Carbon Commitment, OSU is responsible for mitigation of emissions from Scope 1 and Scope 2, as well as emissions from commute and air travel.
- OSU is required by the Carbon Commitment to mitigate *net* emissions of 132,827.3 tCO₂e.
- Gross emissions from operations in Corvallis represent 95.38% of total university emissions.

Total gross and net emissions for each inventory are shown in the Table 3 below.

Table 3. Emissions by Inventory (t CO2e)					
	FY12	FY13	FY14	FY15	FY16
OSU Corvallis					
Gross Emissions	126,235.3	118,647.3	123,940.1	127,331.2	130,069.6
Net Emissions	119,101.0	117,345.7	123,667.6	127,429.0	129,161.9
Statewides					
Gross Emissions	4,413.6	4,891.7	4,947.3	4,011.4	4,082.1
Net Emissions	4,413.6	4,891.7	4,947.3	4,011.4	4,082.1
OSU Cascades					
Gross Emissions	837.1	1,040.2	1,185.4	1,260.7	1,398.7
Net Emissions	300.0	1,040.2	1,185.4	1,260.7	1,398.7
HMSC					
Gross Emissions	887.4	777.9	978.9	953.6	815.3
Net Emissions	887.4	777.9	978.9	953.6	815.3
OSU Comprehensive					
Gross Emissions	132,373.4	125,357.1	131,051.7	133,556.9	136,365.7
Net Emissions	124,702.0	124,055.5	130,779.2	133,654.7	135,458.0

Total FY16 gross and net emissions by source category are displayed in Table 4.

Table 4. FY16 OSU Comprehensive Emissions by Emissions Source						
Emissions Sources	FY16 Gross Emissions (t CO2e)	% of Gross Emissions	% Change in Gross Emissions from FY15	FY16 Net Emissions (t CO2e)	% of Net Emissions	% Change in Net Emissions from FY15
Purchased Electricity	58,197.3	42.7%	1.0%	57,472.0	42.4%	-0.2%
Stationary Sources	3,268.6	2.4%	-0.1%	3,268.6	2.4%	-0.1%
Fleet & Maintenance	2,941.2	2.2%	16.3%	2,941.2	2.2%	16.3%
Agriculture	3,254.3	2.4%	19.0%	3,071.9	2.3%	20.3%
Solid Waste	(31.5)	0.0%	6.4%	(31.5)	0.0%	6.4%
Refrigerants	251.3	0.2%	-40.9%	251.3	0.2%	-40.9%
Student and Faculty/Staff Commute	6,692.0	4.9%	2.7%	6,692.0	4.9%	2.7%
Air Travel	15,500.2	11.4%	1.9%	15,500.2	11.4%	1.9%
Other Directly Financed Travel	2,245.0	1.6%	-6.2%	2,245.0	1.7%	-6.2%
Cogeneration	44,047.3	32.3%	2.8%	44,047.3	32.5%	2.8%
Total	136,365.7	100.0%	2.1%	135,458.0	100.0%	1.6%

Potentially significant emissions sources not included:

- Lifecycle/embodied emissions of purchased goods and materials
- Long-distance student travel, including study abroad travel
- Transportation and processing of materials to be recycled
- Water treatment and distribution
- Solid waste, commuting and fleet emissions for Statewides, HMSC and OSU-Cascades
- Some OSU Athletics team travel
- Emissions from fertilizer from all OSU locations
- Some stationary fuel purchases

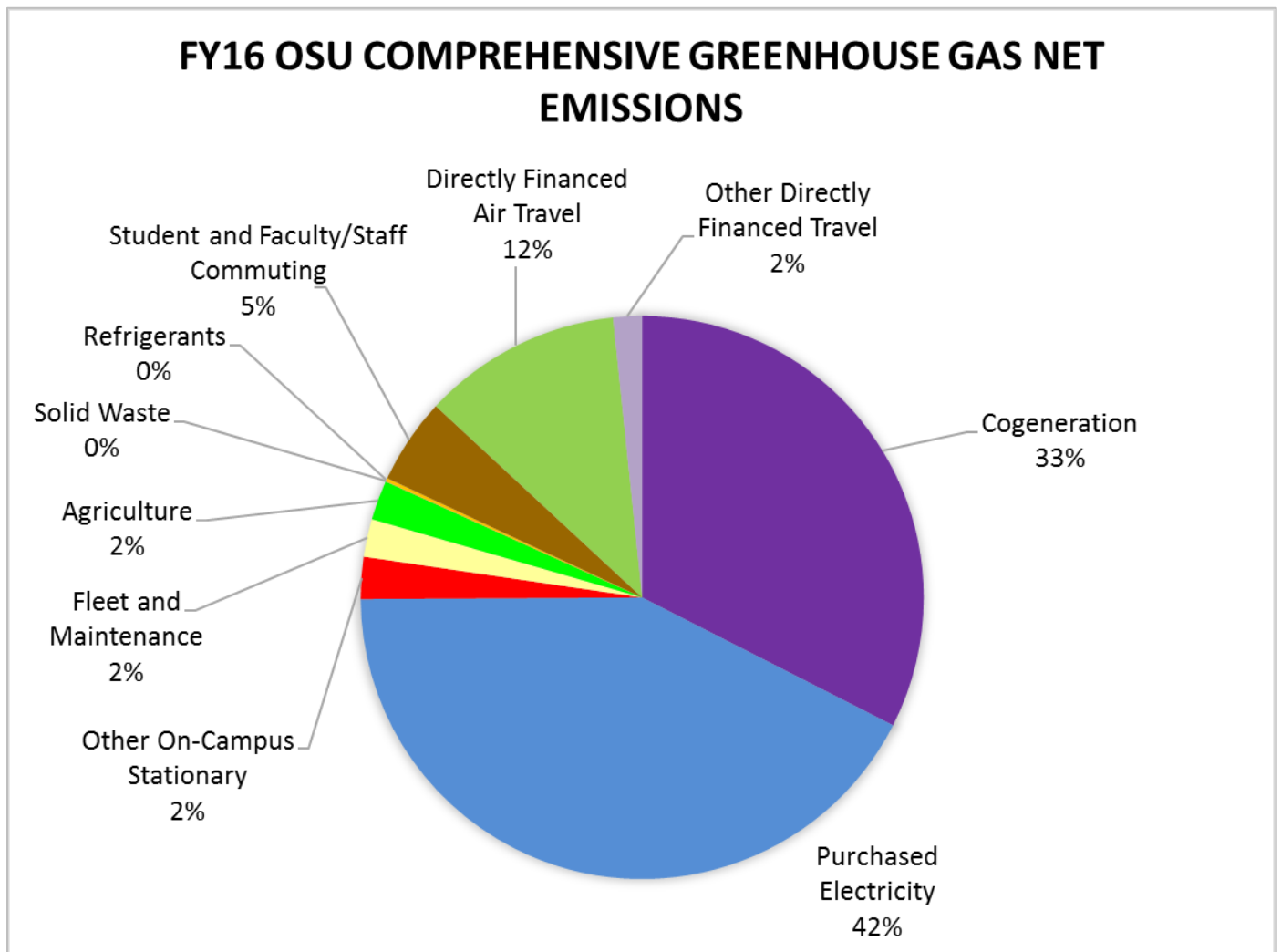


Figure 4. FY16 OSU Comprehensive Greenhouse Gas Net Emissions by Source

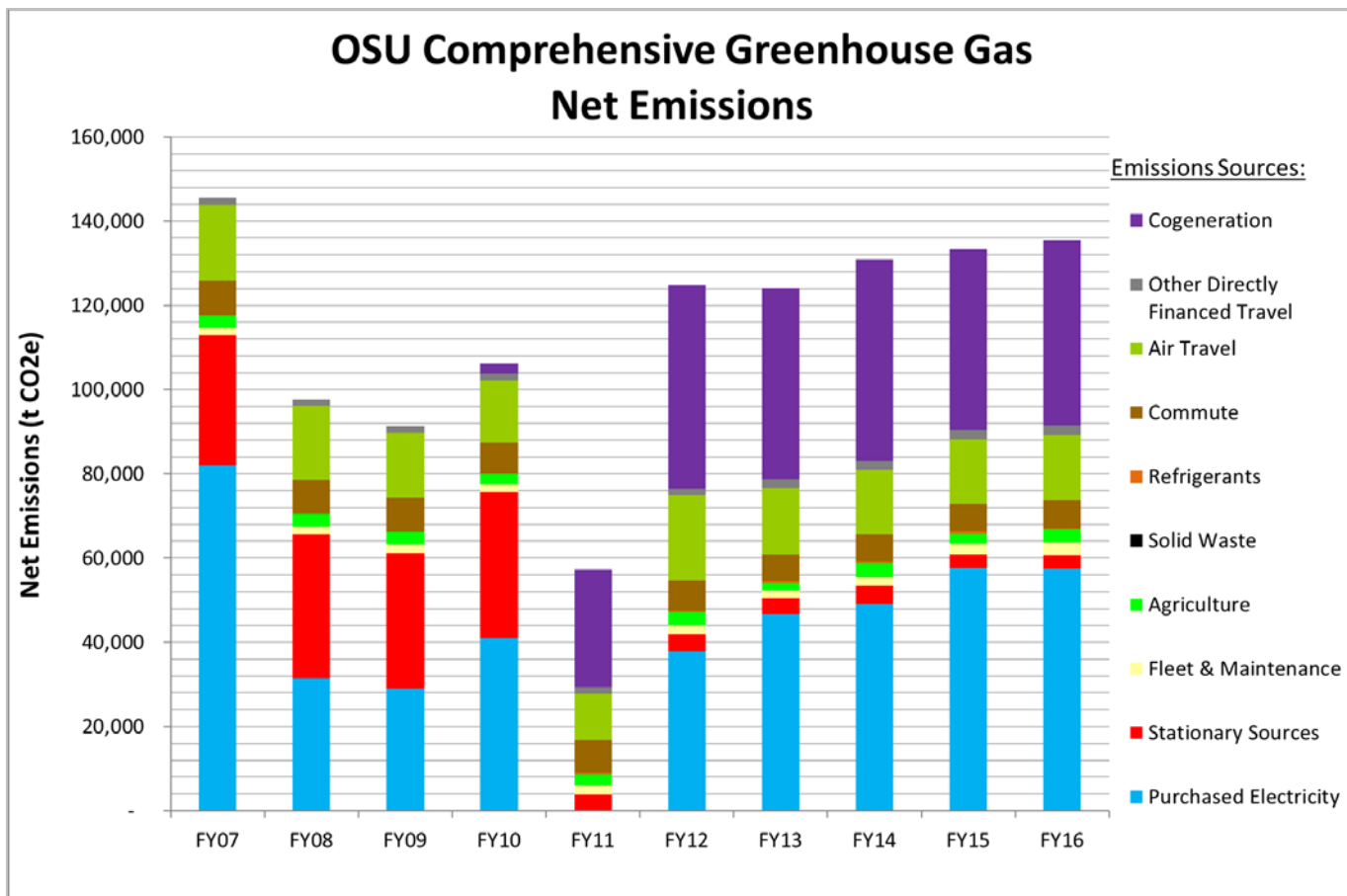


Figure 5. OSU Comprehensive Greenhouse Gas Net Emissions

Changes since the FY15 Inventory

- Methodology to calculate emissions from purchased electricity with a custom fuel mix changed. Emissions from FY11-FY15 changed.

Please see the [Analysis of Data and Results](#) section for more details regarding these changes.

Table 6 details offsets related to composting activities and purchase of renewable energy certificates (RECs). Wind power represents the majority of the source of RECs, which also include some biogas and biomass.

Table 5. OSU Offsets by Fiscal Year (t CO ₂ e)					
Offset Type	FY12	FY13	FY14	FY15	FY16
Composting	149.1	957.3	260.9	182.2	182.4
Renewable Energy Certificates (RECs)	7,443.2	3.4	2.1	2.4	724.8

Comparative Analysis

The following comparative data are drawn from the [Carbon Commitment Reporting System website](#). Several of OSU's comparable institutions have not published their FY16 data as of February 2017.

Table 6. Comparison of OSU Emissions Metrics with Peer Universities									
	'16 OSU Comprehensive	'15 OSU Comprehensive	'14 OSU Comprehensive	'13 OSU Comprehensive	'14 Cornell University	'15 The Ohio State University	'14 Utah State	'13 UC Davis	'15 Washington State - Pullman
Gross emissions per FTE enrolled (t CO ₂ e)	5.1	5.2	5.2	5.3	10.7	13.5	4.3	9.5	7.3
Gross emissions per 1000 square feet (t CO ₂ e)	13.1	13.1	14.0	15.6	14.2	28.2	11.4	14.7	12.0

Analysis of Data and Results

Table 7. Analysis of Data Changes and Uncertainty	
Emissions Source	Analysis
Purchased Electricity	<p><u>Source data changes for FY16:</u> None.</p> <p><u>Methodology changes for FY16:</u> In the CCC, the factor utilized to calculate the emissions from purchased electricity with custom fuel mix was wrong for FY11- FY15. The factor used for these fiscal years was the one previously used for FY10. This error has been corrected, and the factor used in each fiscal year now corresponds to each year's fuel mix. Because of this oversight in the CCC, the emissions values for all 5 fiscal years changed.</p>
Commute-Faculty/Staff	<p><u>Source data changes for FY16:</u> Metrics used to calculate emissions in this category were based on the FY15 Campus Travel Survey.</p> <p><u>Methodology changes for FY16:</u> None.</p> <p><u>Uncertainty Analysis for FY16:</u> While the new survey provides current data from a significant % of participants, factors such as total commute days and mileage are estimates in the CCC. Additional factors are reported on at page 19 the FY09 report.</p>
Commute-Students	<p><u>Source data changes for FY16:</u> Metrics used to calculate emissions in this category were based on the FY15 Campus Travel Survey</p> <p><u>Methodology changes for FY16:</u> None.</p> <p><u>Uncertainty Analysis for FY16:</u> See above.</p>
Directly Financed Travel	<p><u>Source data changes for FY16:</u> None.</p> <p><u>Methodology changes for FY16:</u> None.</p> <p><u>Uncertainty analysis:</u> Improved data collection has continued to provide more accurate data from vendors, some minor emissions may go unreported, with an estimated impact of less than 5% of the category total.</p>
Solid Waste	<p><u>Source data changes for FY16:</u> None.</p> <p><u>Methodology changes for FY16:</u> None.</p> <p><u>Uncertainty Analysis:</u> Data is not collected for off-campus sites. It is likely that solid waste emissions are 10-15% higher than reported.</p>

Analysis of Data Quality

Due to varied data quality and completeness, assumptions and extrapolations were used for the following areas: mission-related air travel, student and faculty/staff commuting for the Corvallis campus, gasoline and diesel fleet and Enterprise rental car mileage.

Areas requiring further investigation and enhanced recordkeeping include: long-distance student travel (to/from home and school); auto mileage and commute information that includes Extension, Ag. Experiment Stations, the FRL, OSU-Cascades and HMSC; backup generator fuel consumption; propane use; fertilizer use; solid waste and composting.

Future Action

OSU Climate Plan

As awareness and demand for action around global climate change continues to grow, requests and requirements have come from the campus community, the community at-large, and local, state and federal governments. To respond to this increasing attention and to meet the requirements of the Carbon Commitment, the OSU Sustainability Office created the [OSU Climate Plan](#) in September 2009. The Plan developed goals, frameworks and strategic steps necessary for OSU to achieve net carbon neutrality (no net emissions) by 2025.

While the 2009 Plan set a goal and vision for carbon neutrality and started some productive actions and conversations, it did not set a clear implementation mechanism. This has resulted in underutilization of the Plan and a 2025 goal that the university is not on a trajectory to meet. To address these issues, the Sustainability Office and several campus partners in 2016 launched a [Carbon Planning Toolkit](#). This Toolkit is intended to help academic colleges and administrative divisions create college and division (unit) level carbon plans that reduce carbon emissions and integrate sustainability and climate change education across curriculum and research efforts. The goal is to increase and standardize practices that help reach OSU's aggressive carbon emissions reduction target and support OSU's Strategic Plan.

Unit level carbon planning is adaptive to unit needs. OSU's intent is to inspire individual actions at the unit level related to operations, curriculum and research that reduce global carbon emissions through unit level education, assessment and conversation.

Creating a 1990 Baseline

Creating an organizational baseline, or reference emissions level, is critical to goal-setting and tracking progress over time. Although detailed measurement like those in this report didn't begin at OSU until 2007, it is still possible to create a rough baseline for years past.

Determining an appropriate baseline year is both critical and challenging. OSU selected Fiscal Year 1990 as its baseline year due to the prevalence of 1990 as a baseline for many state, federal and international climate initiatives.

However, using 1990 as a baseline year imposes considerable challenges, including low data quality and availability. Much of the data central to emissions calculations are simply not available for this time period. When data are available, quality and scope are often questionable. IPCC emissions from sources like electricity and air travel from that time period are difficult to calculate. The combination of these factors makes estimating a 1990 baseline difficult.

OSU's 1990 baseline was calculated after analyzing a number of factors that correlate with emissions. They were: student enrollment FTE; faculty/staff FTE; gross square footage (GSF); natural gas use; and electricity use. Using a blend of historical data and estimations, FY90 emissions levels were calculated based on the rates of change of these factors.

Upon analysis of these factors, it was determined that emissions from electricity were best suited to use as a proxy for 1990 emissions. This is due to a number of reasons:

- Emissions from electricity represent a significant portion of OSU's gross emissions
- Prior to the cogeneration capability at the OSU Energy Center, the rate of consumption of natural gas and other heating fuels has closely mirrored the increase in electricity consumption; also, together, these sources accounted for nearly 75% of OSU's gross emissions
- The calculated emissions for 1990 based on electricity were "middle of the road" when compared with the other analyzed factors as well as other baseline estimations.

OSU's FY90 emissions are estimated to be 110,977 t CO₂e from all major sources now included in recent GHG inventories.

In the summer of 2009, OUS contracted with [Good Company](#) to provide an estimate of 1990 emissions from buildings (essentially all Scope 1 & 2 emissions) for the seven public university campuses in Oregon. Using campus square footage, estimated emissions coefficients for the electrical grid in 1990, and energy intensity of buildings (based on a multi-year report for the Western United States), OSU's 1990 emissions from buildings were estimated at 49,855 t CO₂e.

Due to its limited scope, the Good Company estimate could not stand alone as the 1990 emissions baseline; no Scope 3 emissions (air travel, waste, commute, etc.) were included, and some Scope 1 and 2 sources (refrigerants, fleet, etc.) were also missing. However, it does provide some assurance that the 1990 baseline calculated by the OSU Sustainability Office is reasonable.

While a relatively sound estimate for 1990 emissions is important, an exact value for 1990 emissions cannot be calculated. The value of the 1990 baseline is to set a reference point for institutional emissions reductions goals.

Findings Table

Energy

Table 8. Findings - Energy

Purchased Electricity (Scope 2)

OSU Corvallis purchased electricity usage for FY16 was 64,719,293 kWh.

The 14 Agricultural Experiment Stations (AES) consumed 3,956,183 kWh.

County Extension offices used 1,534,904 kWh.

Hatfield Marine Science Center used 1,616,880 kWh.

OSU-Cascades consumed 1,154,460 kWh.

Four Extension offices (in Aurora, Hood River, Hermiston and Central Point) are covered in the AES data, as they are combined units of both Extension and AES and share facility space.

The CCC calculator allowed for a grid mix specific to the electric utility. Using information from Pacific Power the following utility grid mix was used for the OSU Corvallis and OSU-Cascades. Since Statewides use a more diverse electricity resources, the utility grid mix for Statewides was determined from [EPA eGrid](#) data for the Northwest Power Pool (NWPP) utility grid mix.

Pacific Power Grid Mix	
Fuel	% of total
Coal	63.0%
Natural Gas	14.7%
Hydro	8.3%
Wind	3.6%
Geothermal	0.4%
Biomass	1.1%
Other	9.4%

NWPP Subregional Grid Mix	
Fuel	% of total
Coal	31.3%
Natural Gas	14.3%
Hydro	43.6%
Wind	4.8%
Geothermal	0.7%
Biomass	1.2%
Nuclear	3.4%
Oil	0.3%
Other	0.1%

Central Lincoln PUD reported the following utility grid mix for HMSC.

Central Lincoln PUD Grid Mix	
Fuel	% of total
Hydro	84.5%
Nuclear	9.9%
Other	5.6%

Total FY16 purchased electricity usage for OSU: 73,368,599,92 kWh.

On-campus Cogeneration

In July 2009, the \$40 million Energy Center, a cogeneration facility, began producing steam from its two boilers. In June 2010, it began producing electricity under non-test conditions.

	As a cogeneration facility, the Energy Center consumed 8,284,280 therms of natural gas. It produced 531,299,407 pounds of steam and 40,569,180 kWh of electricity.
Natural Gas (Scope 1)	<p>OSU Corvallis consumed 427,152 therms of natural gas in FY16 not including use at the OSU Energy Center. Most of this was used for space and water heating in buildings not served by steam from the Energy Center.</p> <p>The Agricultural Experiment Stations used a combined 54,050 therms.</p> <p>The Extension Service county offices used a total of 36,203 therms.</p> <p>Hatfield Marine Science Center consumed 5,520.6 therms.</p> <p>Cascade campus used 26,047 therms.</p> <p>Total FY16 consumption of natural gas, excluding use at the Energy Center: 548,672.1 therms or 54,867.21 MMBtu</p>
Steam and Chilled water purchased	N/A – no steam or chilled water is purchased from non-OSU sources.
Residual oils (#5, #6) and Distillate oils (#1, #2, #3, #4) (Scope 1)	<p>OSU Corvallis used 8,000 for backup generators.</p> <p>Agricultural Experiment Stations used 3,691.9 gallons of diesel #2 for heating.</p> <p>Extension Service consumed 7,063.7 gallons of diesel #2.</p> <p>Total FY16 consumption of distillate oil #2 (diesel) for non-transportation uses was: 18,577.6 gallons</p>
Propane (Scope 1 & 3)	<p>Total documented propane use at OSU Corvallis was 11,710 gallons, used mainly for heating, backup generator priming and forklifts. Purchasers of propane are scattered throughout campus and there is no centralized recordkeeping.</p> <p>Agricultural Experiment Stations used 12,219 gallons of propane for heating, forklifts and backup generators.</p> <p>The Extension Service used 6,677 gallons.</p> <p>Total FY16 consumption of propane: 30,606 gallons.</p>
Incinerated Waste	The Research Animal Isolation Lab (RAIL) reported 7,961 pounds of incinerator waste for FY16.
Coal	N/A – no coal is directly consumed by OSU.
Solar / Wind / Biomass / Human Power	During FY11, three new ground mounted photovoltaic (PV) systems were installed on OSU properties around the state. These systems are in addition to Kelley Engineering Center, Salmon Disease Lab, Research Animal Isolation Lab, and the OSU Solar Trailer. HMSC has a PV system as well. The estimated FY16 output from all sites was 2,628,046 kWh. This amount was not applied to this inventory because the energy produced reduced the buildings' electricity use.

Data sources: Les Walton, Energy Operations Supervisor; Facilities Services; Carson Oil; Travis Feldsher, RAIL; Terri Libert, OSU-Cascades; Amerigas; Chelle Boswell, HMSC Office Specialist; numerous staff contacts at Extension county offices and Ag. Experiment Stations.

Transportation

Table 9. Findings - Transportation

<p>Fleet and Maintenance (Scope 1)</p>	<p>Gasoline Fossil fuels used in transportation are reported separately from fuels used in stationary sources. OSU has a fuel pump located at the Motor Pool that fills maintenance and fleet vehicles. There is also a credit card system that allows individuals on business trips to fill fleet vehicles wherever needed. Total volume from these sources in FY16 was 284,138.55 gallons.</p> <p>OSU also received deliveries of 2,652 gallons of gasoline from Carson Oil. This fuel was primarily used in landscape equipment and vehicles.</p> <p>Corvallis Farm Unit received 2,667 gallons of gasoline in FY16. The fuel was primarily used in farm vehicles.</p> <p>The shuttles used 8,971 gallons of gasoline in FY16.</p> <p>Hatfield Marine Science Center used 12,500 gallons of gasoline for their fleet.</p> <p>Diesel In Corvallis, diesel is primarily used in the small diesel fleet run by the Motor Pool as well as in the Campus shuttles. The shuttles are fueled off-campus by First Student, a contracted service provider.</p> <p>Reported diesel use at the campus Motor Pool filling station and the Motor Pool credit card system was 21,792 gallons.</p> <p>The shuttles used 1,458 gallons of diesel in FY16.</p> <p>HMSC also uses diesel for their research vessels and fleet vehicles. The only ship fuel information available was for the R/V Pacific Storm. Total FY16 diesel consumption for HMSC was 8,312 gallons.</p> <p>Total gasoline in FY16: 296,638 gallons</p> <p>Total diesel used in mobile sources: 31,562.9 gallons.</p>
<p>Data sources: Justin Fleming, Motor Pool Manager; Gillian Yu; Chelle Boswell, HSMC Office Specialist; Carson Oil</p>	<p>Fleming, Motor Pool Manager; Gillian Yu; Chelle Boswell, HSMC Office Specialist; Carson Oil</p>
<p>Directly Financed Travel (Scope 3)</p>	<p>In FY16, 3.23 million miles were reimbursed by Travel Reimbursement.</p> <p>Mileage reimbursed to accounts outside of TRES totaled 112,128 miles.</p> <p>OSU also contracts rental cars through Enterprise Rent-a-Car. Enterprise reported OSU accounts driving 2,304,735 miles in FY16.</p> <p>Mileage driven in non-contracted vendor rental vehicles totaled 266,762.14 miles in FY16. These values were based on charges and reimbursements,</p>

and used data given by Enterprise to extrapolate a mileage total. Travel on non-contracted vendor rental vehicles is assumed to be the same as Enterprise.

OSU Athletics charters buses to provide short- and long-distance transportation to its teams. Using a medium-length route with a known distance and typical cost, an extrapolation was made using bus charter payment information.

A one-way trip to Portland Airport from the Corvallis Campus is 98 miles. The standard one-way rate to the airport is \$440 per bus. Total bus expenditures were calculated to be \$1,250,328. Assuming this rate of \$4.49/mi is representative of all chartered bus travel, Athletics' chartered buses drove 278,469 miles in FY16.

In FY16, a reported 5,911,083.20 car miles were directly financed by OSU.

Data sources: Justin Fleming, Motor Pool Manager; Stephanie Smith, Fiscal Coordinator Business Affairs; Michelle Barnes, Enterprise Rent-a-Car; Garrett Haldeman, OSU Athletics; Teel's Travel; Azumano Travel.

**Commute
(Scope 3)**

It is assumed each person made one trip to campus per day. Students and staff/faculty were counted separately in the calculator. Institutional Research reports 146 teaching days per year (excluding summer) and that number was used for commuting days for students. Staff and faculty commuting days were determined by dividing the number of regular and overtime payroll hours for classified staff and faculty by the FTE of the respective classification. This method yielded 233 working days for classified staff and 245 for faculty.

An average commute distance of 5 miles was used for personal vehicle travel and based jointly on the 2003 OSU commute survey, and a 2003 Portland State University GHG inventory estimated commute distance of 7.5 miles. While Corvallis is a much smaller community, many students commute from outside the area. More accurate information on commuting distances is needed to definitively determine commute emissions. This estimated distance was also applied to the OSU-Cascades. While the estimation is reasonable, further commuting studies should be performed to better model commute patterns there.

An average commute distance of 3 miles was used for bus travel. This reflects the likelihood of bus commuters traveling shorter distances, as the majority of the transit system is based around Corvallis.

Staff and faculty FTE provided by Institutional Research include OSU-Cascades, AES, Extension and the FRL. Commute distance and mode splits are most likely different from those of Corvallis Campus, yet no reliable commute data exists for these auxiliaries.

Summer students were included in commute calculations for the first time in FY13.

Data sources: Terence Merritt, Institutional Research; Steve Nash, Payroll Manager; Rebecca Houghtaling, Senior Planner Campus Operations.

**Air Travel
(Scope 3)**

OSU used two travel agents in FY15: Teel's Travel Planners and Azumano Travel. Travel Solutions was a third travel agent used by OSU in previous years. All provided significant amounts of information, as well as advice and guidance. Air travel is also reimbursed by OSU's Travel Reimbursement office.

Azumano Travel provided a report detailing all OSU activity booked through their firm and included mileage, number of trip segments and cost. Teel's Travel provided total number of trip segments booked by their firm for OSU groups. OSU Travel Reimbursement provided a similar list. All of these reports included non-packaged, non-tour Athletics travel.

Since Azumano had a complete report of mileage and number of segments, and both Teel's and Travel Reimbursement provided number of segments, we can extrapolate using Azumano's mileage information.

The extrapolation and calculation are:

Company	# of flight segments	% of total
Azumano	16,182	65.4%
Teel's	5,390	21.8%
Travel Reimbursement	3,162	12.8%
Total	24,734	100.0%

Azumano booked 19,787,831 miles for OSU.

$$\begin{array}{rcl}
 20,889,360 \text{ Azumano miles} & & \text{x total miles} \\
 16,182 \text{ Azumano flight segments} & = & 23,667 \text{ total flights segments} \\
 & & \\
 & \text{x} & = 30,551,754 \text{ total miles}
 \end{array}$$

Both Teel's and Azumano stated that approximately 5% of flights will not appear in their records due to the way a couple of airlines (notably JetBlue and Southwest) ticket. One final extrapolation is needed:

$$\text{Total OSU air mileage} = (1/0.95) * 30,551,754 = 32,159,741 \text{ miles}$$

In addition, non-TRES reimbursements accounted for 62,461 miles (based on reimbursement amounts). This brings total mileage to 32,222,202 miles.

All air travel emissions were applied to the OSU Corvallis inventory due to lack of specific data for non-Corvallis sites.

Assumptions: Travel booked through Azumano is representative of all OSU travel.

For each away game, the OSU Football team charts an Airbus 320 to take the team from Eugene, OR to the game destination. Using the fall 2015 football schedule at <http://www.osubeavers.com/> and Webflyer.com, an airport distance calculator, the calculated distance flown by chartered football jets was 8,444 miles.

The European Environmental Agency¹ has fuel burn rates for numerous jetliners. It is estimated that for a 2,482 mile flight, an A320 will burn 11,608 kg of jet fuel.

The following calculations were made separate from the CCC calculator, as it is not equipped to accurately calculate emissions resulting from a dedicated jet flight:

$$\frac{11,608 \text{ kg fuel}}{2482 \text{ mi}} \times \frac{1 \text{ gal jet fuel}^2}{3.06 \text{ kg fuel}} \times \frac{21.095 \text{ lb CO}_2^2}{1 \text{ gal jet fuel}} \times \frac{1 \text{ t}}{2205 \text{ lbs}} = \frac{0.0146 \text{ t CO}_2}{\text{mi}}$$

$$\frac{0.0146 \text{ t CO}_2}{\text{mi}} \times 4,974 \text{ miles} = 123.28 \text{ t CO}_2 \times 2.8 \text{ RFI} = 345.19 \text{ t CO}_2\text{e}$$

$$345.19 \text{ t CO}_2\text{e} \times 0.90718474 \text{ MT} = 3 \text{ MT CO}_2\text{e}$$

Emissions resulting from chartered football air travel are reported under the Directly Financed Travel category.

Data sources: Teel’s Travel Planners; Enterprise; Azumano Travel; Stephanie Smith. Webflyer.com; ¹ - European Environmental Agency Emission Inventory Guidebook <http://www.eea.europa.eu/publications/EMEPCORINAIR4> ; ²- Energy Information Agency <http://www.eia.doe.gov/oiaf/1605/coefficients.html>

Other Major Sources

Table 10. Findings – Other Major Sources

Solid Waste (Scope 3)	<p>Total weight of solid waste sent to Coffin Butte Landfill in FY16: 3.47 million lbs. (1,732.49 tons).</p> <p>Coffin Butte recovers methane and produces power, but it is unknown how much methane produced could be attributed to OSU waste.</p> <p>No solid waste information was available for the Statewides, HMSC or OSU-Cascades.</p>
------------------------------	---

Data source: Andrea Norris, Campus Recycling

Animals and Agriculture (Scope 1)	<p>Animals</p> <p>Animals are raised and cared for at several OSU facilities. Their totals are displayed in the table below.</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Type</th> <th>Animal Science</th> <th>Union Station</th> <th>Burns Station</th> <th>Vet Med</th> <th>Soap Creek</th> <th>Total</th> </tr> </thead> <tbody> <tr> <td>Dairy Cows</td> <td>216</td> <td>-</td> <td>-</td> <td>1</td> <td>-</td> <td>217</td> </tr> <tr> <td>Beef Cattle</td> <td>17</td> <td>223</td> <td>674</td> <td>1</td> <td>165</td> <td>1,080</td> </tr> <tr> <td>Horses</td> <td>14</td> <td>-</td> <td>3</td> <td>14</td> <td>1</td> <td>32</td> </tr> <tr> <td>Poultry</td> <td>300</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>300</td> </tr> <tr> <td>Sheep</td> <td>160</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>160</td> </tr> <tr> <td>Swine</td> <td>12</td> <td>-</td> <td>-</td> <td>-</td> <td>-</td> <td>12</td> </tr> </tbody> </table>	Type	Animal Science	Union Station	Burns Station	Vet Med	Soap Creek	Total	Dairy Cows	216	-	-	1	-	217	Beef Cattle	17	223	674	1	165	1,080	Horses	14	-	3	14	1	32	Poultry	300	-	-	-	-	300	Sheep	160	-	-	-	-	160	Swine	12	-	-	-	-	12
Type	Animal Science	Union Station	Burns Station	Vet Med	Soap Creek	Total																																												
Dairy Cows	216	-	-	1	-	217																																												
Beef Cattle	17	223	674	1	165	1,080																																												
Horses	14	-	3	14	1	32																																												
Poultry	300	-	-	-	-	300																																												
Sheep	160	-	-	-	-	160																																												
Swine	12	-	-	-	-	12																																												

Goats	14	-	-	-	-	14
-------	----	---	---	---	---	----

The College of Veterinary Medicine provided the number of treatment days for each type of animal. This annual total was divided by 365, giving a yearly equivalent for each type. One category, 'large animals' was determined to be mostly llamas and alpacas. Because the Clean Air-Cool Planet calculator had no category or emissions factor for camelids, these animals were categorized as sheep because of their size and type of digestion system.

Emissions from animals kept at the Burns and Union stations were reported under the Statewides inventory. Emissions from Animal Science and Vet Med were reported under the OSU Corvallis Campus inventory.

Location	Weight (lbs)	% Nitrogen
Burns	16,540	100%
Union	0	0%
Corvallis grounds	6,700	20%
Soap and Berry Creek	37,500	46%
Ag. Exp. Stations	190,295	23%
Total	251,035	28%

Fertilizer

Fertilizer application on OSU grounds inadequately tracked. Even so, this emissions source is likely small. Emissions from fertilizer applied to Burns, Union and AES grounds were reported in the Statewides inventory. Emissions from the Dairy, OSU Corvallis grounds and the Soap Creek and Berry Creek cattle ranches were reported in the OSU Corvallis inventory.

Data sources: Seth Spencer, Farm Superintendent; Tim DelCurto, Superintendent, Union Station; Bill Calender, OSU Landscape; Mandy Seals, Coordinator Client Service Vet Med.

Refrigerants (Scope 1)

Refrigerants can be powerful greenhouse gases and their tracking is required by the EPA. Small amounts can escape during typical equipment use or in cases of equipment failure. The following table outlines the type and amount of refrigerants used in FY16 and their 100-year global warming potential (GWP). OSU is currently in the planning stages for creating a system to become more compliant with legal requirements for tracking refrigerants.

Refrigerant	Weight (lbs)	GWP (100 year)
R-12	7.625	2,400
R-22	287.375	1,780
R-404A	6.0625	3,260
R-409A	4.1875	1,585
R-508B	1.25	13,396

Data source: Jonathan Champney, Facilities Services

Renewable Energy Certificates (RECs)
Total REC purchases for the OSU Corvallis campus were 903 MWh.

Offsets (green tags, RECs, composting etc.)

Total offsets for FY16: 903 MWh. Offsets with Additions

Approximately 620.28 tons of waste are composted by various campus entities. The Republic Services wood drop box, Organic Growers Club, Crop and Soil Sciences Department and the Student Sustainability Initiative compost dairy solids, pre- and post-consumer food waste from campus dining centers and landscape debris. OSU-based waste composted offsite by a third party, such as Republic Services, will not be counted as an offset by OSU. The benefit of this type of composting is instead realized in the reduced reported weight of landfill solid waste.

MODULE	Comprehensive FY16 Summary						
WORKSHEET	Overview of Annual Emissions						
UNIVERSITY	Oregon State University						
2016		Energy Consumption	CO ₂	CH ₄	N ₂ O	eCO ₂	% change from FY15
		MMBtu	kg	kg	kg	Metric Tonnes	
Scope 1	Co-gen Electricity	353,151.3	18,722,507.3	1,673.5	37.0	18,775.4	11.0%
	Co-gen Steam	475,346.3	25,200,745.3	2,252.5	49.8	25,271.9	-2.6%
	Other On-Campus Stationary	72,429.7	3,258,443.9	308.8	8.1	3,268.6	-0.1%
	Direct Transportation	40,055.1	2,869,358.5	571.3	193.2	2,941.2	16.3%
	Refrigerants & Chemicals	-	-	-	-	251.3	-40.9%
	Agriculture	-	-	109,949.4	1,696.5	3,254.3	19.0%
Scope 2	Purchased Electricity	248,833.9	54,193,653.5	7,264.6	846.5	54,627.5	-5.2%
Scope 3	Faculty / Staff Commuting	43,314.0	3,092,494.6	662.9	222.0	3,175.2	2.9%
	Student Commuting	47,933.0	3,427,832.4	709.3	238.6	3,516.7	2.5%
	Directly Financed Air Travel	77,421.5	15,099,516.5	149.7	172.0	15,500.2	1.9%
	Other Directly Financed Travel	30,612.5	2,187,427.3	460.7	154.6	2,245.0	-6.2%
	Solid Waste	-	-	(1,260.6)	-	(31.5)	6.5%
	Scope 2 T&D Losses	16,219.8	3,541,289.7	474.6	55.2	3,569.6	1.0%
Offsets	Additional					(182.4)	0.1%
						(724.8)	30101.9%
Totals	Scope 1	940,982.4	50,051,054.9	114,755.5	1,984.5	53,762.6	3.8%
	Scope 2	248,833.9	54,193,653.5	7,264.6	846.5	54,627.0	0.9%
	Scope 3	215,500.8	27,348,560.4	1,196.6	842.5	27,975.2	1.3%
	All Scopes	1,405,317.2	131,593,268.9	123,216.8	3,673.5	136,364.9	2.1%
	All Offsets					(907.2)	391.4%
Net Emissions:						135,458.0	1.6%

Table 11. Comprehensive FY16 Summary

FY16 OSU COMPREHENSIVE GREENHOUSE GAS NET EMISSIONS

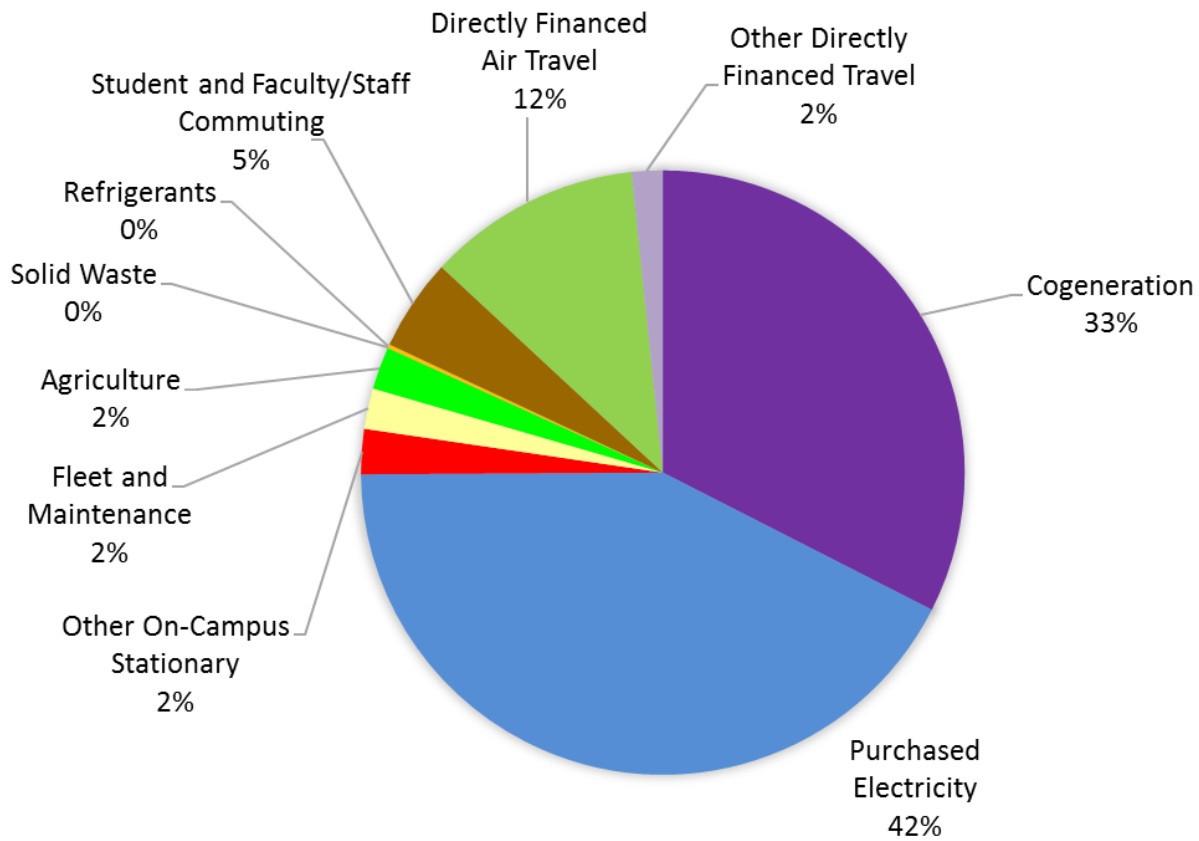


Figure 6. OSU Comprehensive Greenhouse Gas Net Emissions

MODULE		Corvallis FY16 Summary					
WORKSHEET		Overview of Annual Emissions					
UNIVERSITY		Oregon State University					
2016		Energy Consumption	CO2	CH4	N2O	eCO2	% change from FY15
		MMBtu	kg	kg	kg	Metric Tonnes	
Scope 1	Co-gen Electricity	353,151.3	18,722,507.3	1,673.5	37.0	18,775.4	11.0%
	Co-gen Steam	475,346.3	25,200,745.3	2,252.5	49.8	25,271.9	-2.6%
	Other On-Campus Stationary	54,150.3	2,406,818.9	222.2	5.2	2,413.9	-4.9%
	Direct Transportation	37,407.5	2,677,467.6	543.3	183.2	2,745.6	27.3%
	Refrigerants & Chemicals	-	-	-	-	251.3	-32.6%
	Agriculture	-	-	57,820.7	659.3	1,642.0	31.7%
Scope 2	Purchased Electricity	220,663.1	51,546,137.9	6,904.9	780.2	51,951.3	1.1%
Scope 3	Faculty / Staff Commuting	41,934.8	2,993,773.0	642.9	215.2	3,074.0	2.7%
	Student Commuting	45,292.7	3,238,832.4	671.0	225.7	3,322.9	1.4%
	Directly Financed Air Travel	74,911.1	14,609,915.2	144.8	166.5	15,008.8	7.4%
	Other Directly Financed Travel	30,612.5	2,187,427.3	460.7	154.6	2,245.0	-6.2%
	Solid Waste	-	-	(1,260.6)	-	(31.5)	6.5%
	Scope 2 T&D Losses	14,437.2	3,372,476.0	451.8	51.0	3,399.0	1.1%
Offsets	Additional					(182.4)	0.1%
	Non-Additional					(724.8)	30101.9%
Totals	Scope 1	920,055.3	49,007,539.0	62,512.2	934.5	51,100.1	3.8%
	Scope 2	220,663.1	51,546,137.9	6,904.9	780.2	51,950.8	1.1%
	Scope 3	207,188.4	26,402,423.9	1,110.6	813.1	27,018.2	1.0%
	All Scopes	1,347,906.8	126,956,100.8	70,527.8	2,527.8	130,069.1	2.2%
	All Offsets					(907.2)	391.4%
Net Emissions:						129,161.9	1.7%

Table 12. Corvallis FY16 Summary

FY16 OSU-Corvallis Greenhouse Gas Emissions

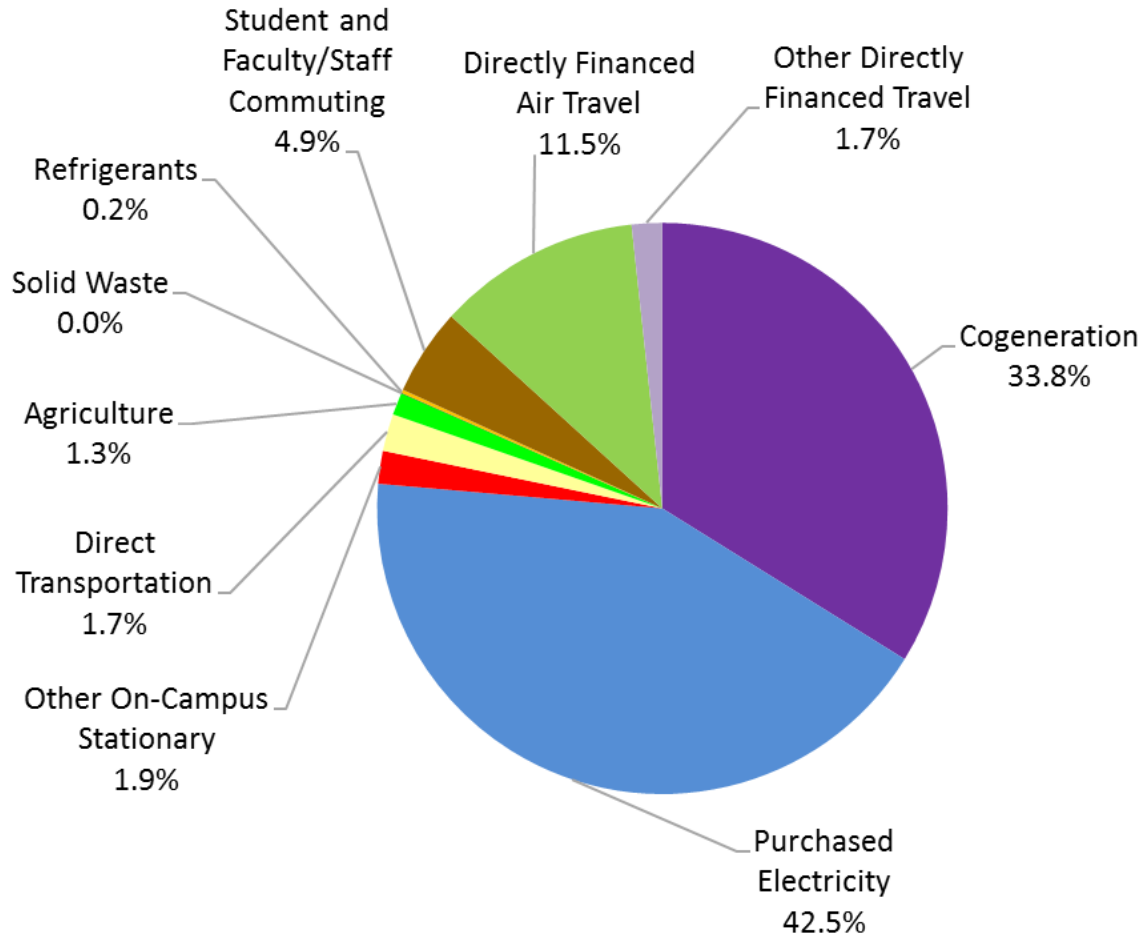


Figure 7. OSU Corvallis Greenhouse Gas Net Emissions

MODULE		OSU Cascades FY16 Summary					
WORKSHEET		Overview of Annual Emissions					
UNIVERSITY		Oregon State University					
2016		Energy Consumption	CO2	CH4	N2O	eCO2	% change from FY13
		MMBtu	kg	kg	kg	Metric Tonnes	
Scope 1	Other On-Campus Stationary	2,604.7	138,101.2	12.3	0.2	138.5	22%
Scope 2	Purchased Electricity	3,936.1	947,359.4	123.2	14.6	954.8	7%
Scope 3	Faculty / Staff Commuting	633.0	45,312.5	9.2	3.1	46.5	21%
	Student Commuting	2,640.3	189,000.0	38.3	12.9	193.8	27%
	Scope 2 T&D Losses	268.3	64,585.8	8.4	1.0	65.1	7%
Totals	Scope 1	2,604.7	138,101.2	12.3	0.2	138.5	22%
	Scope 2	3,936.1	947,359.4	123.2	14.6	954.8	7%
	Scope 3	3,541.7	298,898.4	55.8	17.0	305.4	21%
	All Scopes	10,082.5	1,384,358.9	191.4	31.9	1,398.7	11%
Net Emissions:						1,398.7	10.9%

Table 13. Cascades FY16 Summary

FY16 OSU-Cascades Greenhouse Gas Emissions

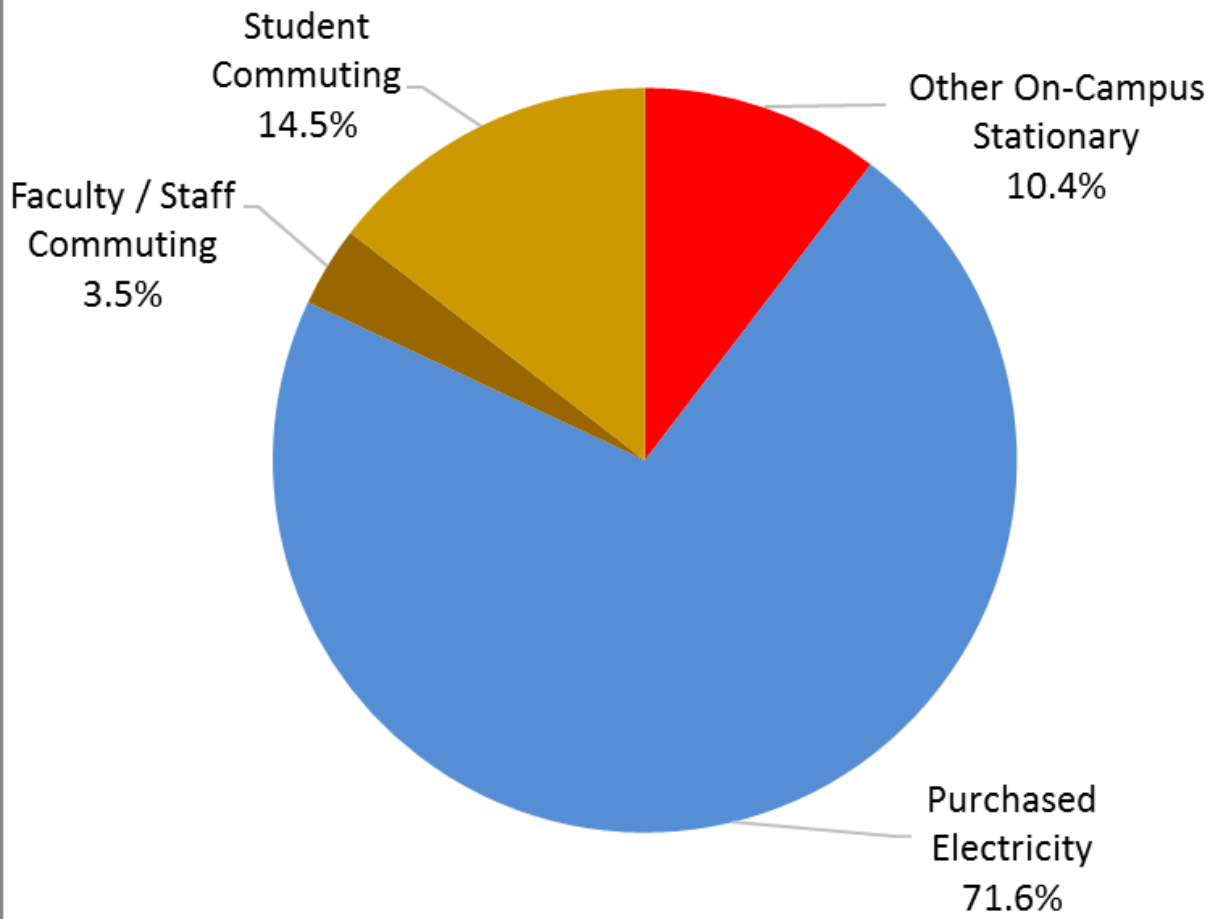


Figure 8. OSU Cascades Greenhouse Gas Net Emissions

MODULE		HMSC FY16 Summary					
WORKSHEET		Overview of Annual Emissions					
UNIVERSITY		Oregon State University					
2016		Energy Consumption	CO2	CH4	N2O	eCO2	% change from FY13
		MMBtu	kg	kg	kg	Metric Tonnes	
Scope 1	Other On-Campus Stationary	522.0	27,676.4	2.5	0.0	27.8	53.6%
	Direct Transportation	2,647.6	191,890.9	28.0	9.9	195.6	-47.5%
Scope 2	Purchased Electricity	5,512.8	41,953.2	3.1	2.4	42.8	5.9%
Scope 3	Faculty / Staff Commuting	746.1	53,409.1	10.8	3.6	54.8	-0.1%
	Directly Financed Air Travel	2,510.4	489,601.3	4.9	5.6	491.4	5.7%
	Scope 2 T&D Losses	369.2	2,809.7	0.2	0.2	2.9	6.1%
Totals	Scope 1	3,169.6	219,567.3	30.5	10.0	223.3	-42.8%
	Scope 2	5,512.8	41,953.2	3.1	2.4	42.8	5.8%
	Scope 3	3,625.7	545,820.1	15.9	9.4	549.0	5.1%
	All Scopes	12,308.1	807,340.6	49.5	21.8	815.3	-14.5%
Net Emissions:						815.3	-14.5%

Table 14. HMSC FY16 Summary

FY16 Hatfield Marine Science Center Greenhouse Gas Emissions

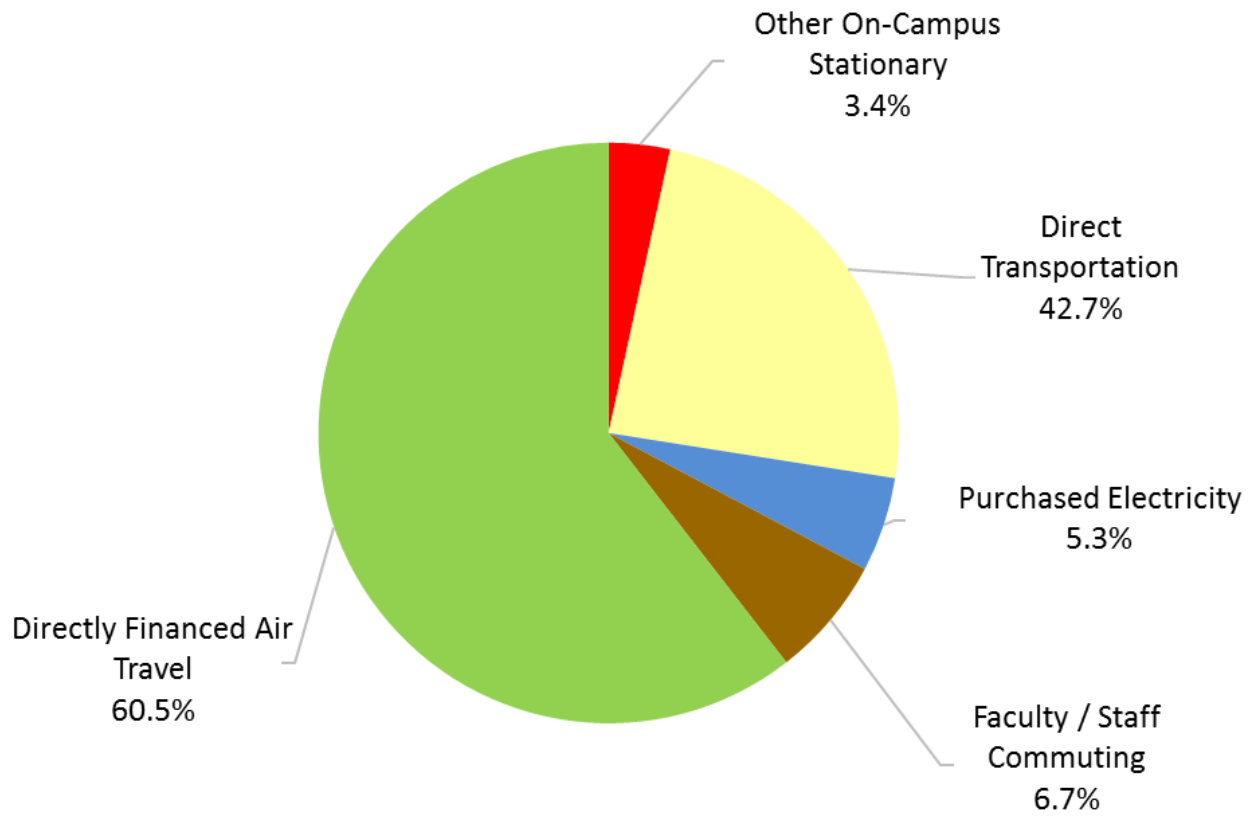


Figure 9. OSU HMSC Greenhouse Gas Net Emissions

MODULE		Statewides FY16 Summary					
WORKSHEET		Overview of Annual Emissions					
UNIVERSITY		Oregon State University					
2016		Energy Consumption	CO2	CH4	N2O	eCO2	% change from FY13
		MMBtu	kg	kg	kg	Metric Tonnes	
Scope 1	Other On-Campus Stationary	15,152.7	685,847.4	71.8	2.6	688.4	14.2%
	Agriculture	-	-	52,128.6	1,037.2	1,612.3	8.3%
Scope 2	Purchased Electricity	18,721.9	1,658,203.1	233.4	49.2	1,678.7	-7.2%
Scope 3	Scope 2 T&D Losses	1,145.1	101,418.1	14.3	3.0	102.7	-7.3%
Totals	Scope 1	15,152.7	685,847.4	52,200.5	1,039.8	2,300.7	10.0%
	Scope 2	18,721.9	1,658,203.1	233.4	49.2	1,678.7	-7.2%
	Scope 3	1,145.1	101,418.1	14.3	3.0	102.7	-7.3%
	All Scopes	35,019.7	2,445,468.6	52,448.1	1,091.9	4,082.1	1.8%
Net Emissions:						4,082.1	1.8%

Table 15. Statewides FY16 Summary

FY16 OSU Statewides Greenhouse Gas Emissions

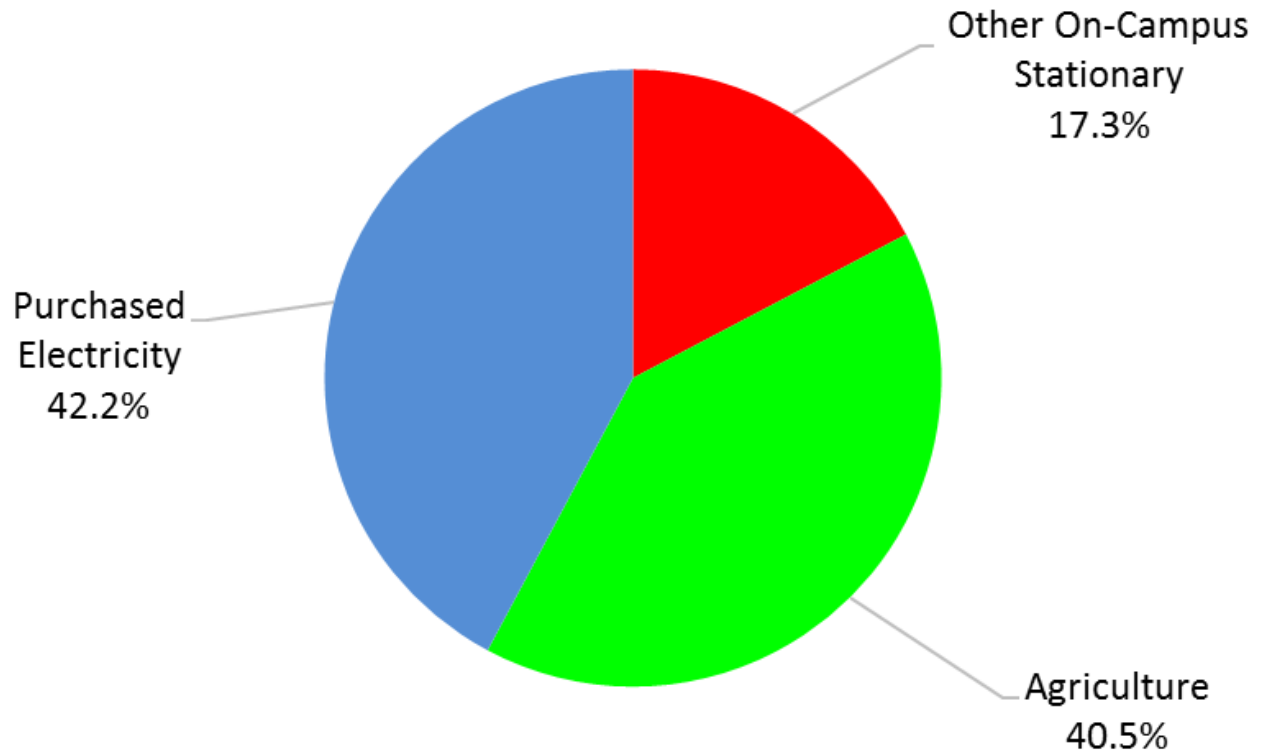


Figure 10. OSU Statewides Greenhouse Gas Net Emissions