Oregon State University

Fiscal Year 2008 Greenhouse Gas Inventory

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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) estimates the RFI multiplier for aviation at 2-4.

(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" (mt)** 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 Service and the Forest Research Laboratory (FRL).

(11) "**Renewable Energy Credit"** (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-based non-profit which specializes in carbon offsets, mainly renewable energy credits (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) "**Clean Air-Cool Planet**" (CA-CP) is a non-partisan, non-profit organization that aims to find and promote solutions to global climate change. Their carbon calculator is used by many campuses for calculating emissions.

(18) "**American College and University Presidents Climate Commitment"** (ACUPCC) 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.

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/
American College and University Presidents Climate Commitment: http://www.**presidentsclimatecommitment**.org/

Executive Summary

Oregon State University (OSU) has demonstrated regional leadership and received national attention for sustainability-related activities and initiatives in the past two years. Part of the basis for this recognition is OSU President Ed Ray's April 2007 signing of the American College and University Presidents Climate Commitment. In part, the Climate Commitment requires inventorying greenhouse gasses every two years. OSU will perform the inventories annually. The Fiscal Year 2008 OSU Greenhouse Gas (GHG) Inventory is an update and expansion of the FY2007 OSU GHG inventory, which itself expanded on the methodology of a CY2004 inventory commissioned by the Oregon University System.

The FY08 inventory provides:

1. A snapshot of OSU emissions: quantified greenhouse gas emissions resulting from OSU-related activities for the fiscal year ending June 30, 2008.
2. Comparison with the prior OSU inventory: a comparative analysis with FY07 emissions.
3. Expanded scope and new sources: inventories detailing emissions from Hatfield Marine Science Center (HMSC), OSU-Cascades Campus and the OSU Extension Service. Previously undocumented emissions sources are now reported.
4. Guidance for future inventories: the methodology, successes, failures and rationale of this expanded inventory provides a framework for future OSU inventories.

Findings in Brief

- Total *gross* emissions of 170,197 metric tonnes CO2e, a **2.3% increase** from FY07.
    - This increase was largely due to higher natural gas consumption. Small increases in electricity consumption and air miles flown also contributed.

- *Net* emissions of 117,210 mt CO2e, a **29.6% decrease** from FY07.
    - Much of this decrease was due to a student-funded purchase of renewable energy certificates.

- Per full-time equivalent (FTE) student net emissions of 5.9 mt CO2e, an **11% decrease** from FY07 (based on FY07 scope and boundaries).

- Per 1000 square foot net emissions of 16.7 mt CO2e, a **22% decrease** from FY07 (based on FY07 scope and boundaries).

- Total gross and net (in parenthesis) emissions from
    - Scope 1 sources: 38,814 (38,814) mt CO2e, mainly from fossil fuel combustion, refrigerants and agriculture;
    - Scope 2 sources: 77,435 (24,453) mt CO2e, entirely purchased electricity;
    - Scope 3 sources: 53,948 (53,942) mt CO2e, which includes air travel, personal mileage reimbursement, commute and solid waste.

- A 140% increase in air travel emissions; nearly all of which was due to a change in emissions calculation.

- Significant emissions sources include purchased electricity (27.4% of net emissions), combustion of natural gas and other stationary sources (29.5%), mission-related air travel (30.4%) and student, staff and faculty commute (7.8%).

Analysis in Brief

- Approximately 98% of the 140% increase in air travel emissions is due to the Clean Air-Cool Planet calculator's implementation of a 2.8 radiative forcing index (RFI) for air travel. Please see the Analysis of Data and Results section for more details

- Potentially significant emissions sources not included are:
    - Long-distance student travel, including study abroad
    - Lifecycle emissions
    - Transport of recycling
    - Water treatment and distribution
    - Solid waste and fleet emissions for Statewides, HMSC and OSU-Cascades
    - Non-contract car rental
    - Reimbursed athletics travel

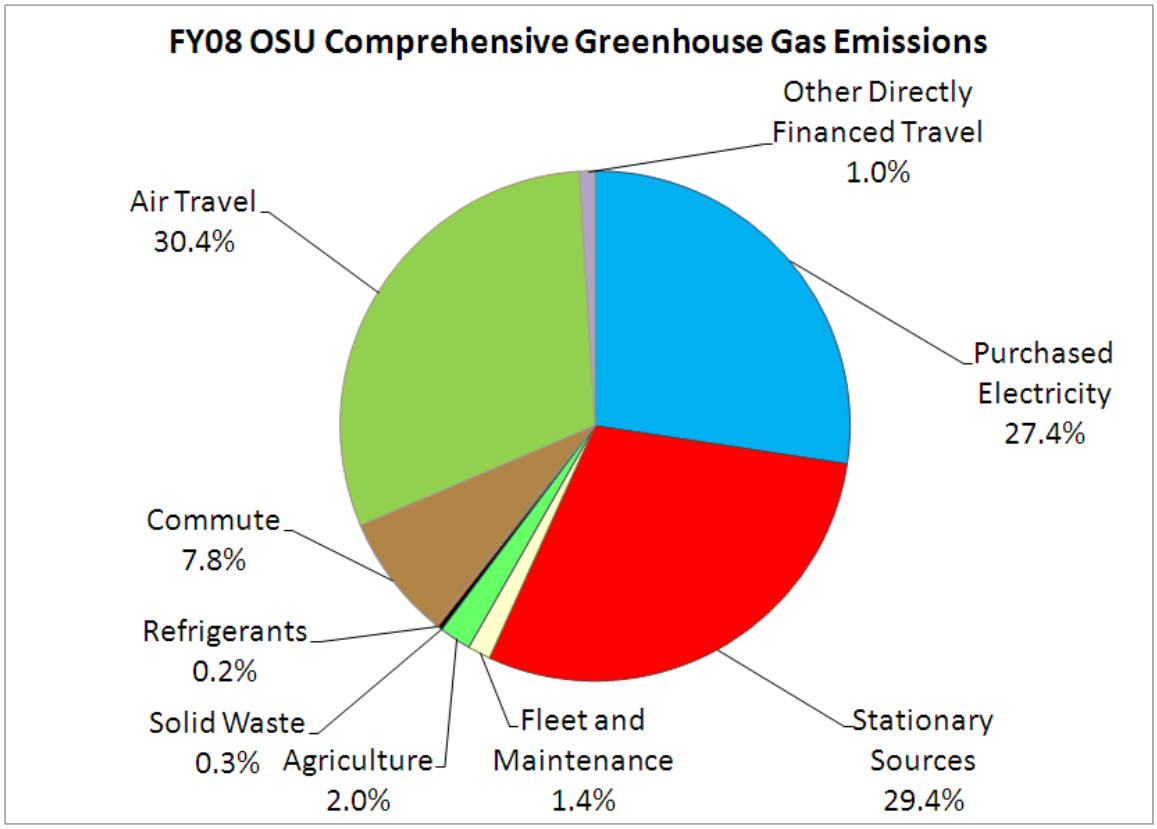
Changes Since the FY2007 Inventory

- Emissions sources included for the first time in FY08 are:
    - OSU-Cascades Campus utilities and commute
    - OSU Extension Service county utilities
    - Hatfield Marine Science Center
    - Contracted rental car (Enterprise) mileage
    - Athletics-chartered air and bus travel
    - Animal science propane use
    - RFI for high-altitude emissions
    - OSU Campus shuttle emissions

- Ship Operations (Newport)

Please see the Analysis of Data and Results section for more details regarding these sources.

Within the Analysis of Data and Results section, an uncertainty analysis has been added for significant emissions sources with uncertainties in the calculation of emissions. This section describes those uncertainties and attempts to quantify an uncertainty range.



Introduction

In the one year since Oregon State University's first attempt at a comprehensive greenhouse gas inventory, much has changed, both in a global scientific sense and in efforts to advance sustainability at Oregon State University. Constructing an inventory and report with the level of detail that follows is a large task. One difficulty is moving targets: the science and methods behind best-practice inventory work is ever-evolving, making year-to-year comparisons complex. Nonetheless, it is the core work of the Sustainability Office: to make campus operations more efficient and support the academic, research and student communities, while effectively communicating these efforts to external stakeholders.

In addition to growing public awareness and scientific certainty about human impact on climate, local efforts in Corvallis and Oregon shine light on the importance of accurate GHG measurement. New state and regional requirements are met and exceeded with this report, an added benefit of signing the American College and University Presidents Climate Commitment (ACUPCC) and instituting a robust measurement protocol early. 2009 and 2010 will see unprecedented levels of collaboration within the Oregon University System and with Oregon community colleges. Hopefully, this document will prove useful in all these contexts. Feedback is appreciated from any stakeholder on this document and the process used to create it. Please visit http://oregonstate.edu/sustainability/energy/climate.html for details and updates.

Methodology

Overview

With operations as broad and far-reaching as Oregon State University's, this inventory relied heavily upon numerous data sources. Since the inventory infrastructure, which includes choosing and verifying the CA-CP calculator, determining emissions sources, data collection sources and data management methodology, was set during the FY07 GHG Inventory, the largest task was again data collection. With the expanded scope of this Fiscal Year 2008 inventory, data gathering was an immense task and relied on information not just from central sources, but also 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. This is the most complete inventory of OSU's GHG emissions performed to date.

The CA-CP calculator was chosen again for FY08 due to its focus on university and college campuses, ease of comparison with the FY07 inventory and its endorsement by the ACUPCC, of which OSU is a signatory. Additionally, CA-CP is a calculator that is consistent with international GHG inventorying and

reporting protocols and standards. CA-CP updates its resources using periodic reviews and will likely be maintained and continuously improved. A growing number of institutions performing GHG inventories, whether ACUPCC signatories or not, use the CA-CP calculator, which streamlines institutional comparisons.

Scope and Boundaries

Much consideration and planning went into determining accurate scope and boundaries for 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.

In the FY07 inventory, OSU emissions were aggregated in a single inventory. For FY08, there are essentially six inventories, separated in order to strengthen the methodology and make long term reporting more accurate and meaningful. Boundaries used for FY08 more closely resemble financial and operational distinctions within the comprehensive university operation. The six distinct inventories are named as follows:

- OSU Comprehensive
- OSU Corvallis main campus,
- OSU-Cascades Campus (Bend),
- Hatfield Marine Science Center (HMSC) (Newport),
- Statewide Public Services ("Statewides") which include Agricultural Experiment Stations (AES), Extension Service and the Forest Research Laboratory (FRL) across the State of Oregon
- OSU Comparative

By making these distinctions, emissions can be more easily partitioned and carbon mitigation efforts better directed. Emissions sources like air travel and rental cars were attributed to OSU Corvallis unless otherwise noted.

OSU Comparative used scope and boundaries similar to the FY07 inventory. Unless otherwise noted, comparative figures are drawn from the OSU Comparative inventory. Data reported as a university-wide total are drawn from OSU Comprehensive, which aggregates the other six inventories. The OSU Comprehensive inventory has no Clean Air-Cool Planet calculator of its own.

For ongoing reporting, it is intended that this same array of inventories be performed every year, with the exception of OSU Comparative inventory, which is planned to be discontinued after this year. Since other inventories' boundaries better mirror financial and operational realities of the university and no large

realignment in OSU operations is expected, OSU Comparative will become unneeded.

Two additional items are worth noting. First, the Sustainability Office will soon begin the task of creating past baselines (a 1990 baseline, for starters). These efforts, while using past source data, will use existing boundaries which, because they have been carefully chosen, also mesh well with past institutional configuration. Second, as best practices and improved data availability facilitate inclusion of emissions sources not counted in the current scope and boundaries (i.e., purchased goods), they will be added into the appropriate "slot" within the set of boundaries used here.

Even with the boundaries discussed above, it's important to remember that greenhouse gas emissions are neither local to the institution nor geographically confined. Rather, they are global emissions. For example, electricity consumption in Corvallis results in CO2 emitted in Colorado and Utah from coal-fired power plants. Once released, CO2 travels freely, without regard for political or geographical boundaries.

Data Gathering and Management

As Oregon's land, sea, space and sun grant institution, OSU facilities are spread throughout the state. This wide operation required gathering data from a large number of sources. A list of contacts was maintained during the inventory process. Contact information, date of information request, date of follow-up, date of information delivery, comments and other relevant material were recorded.

Not all data were readily available or in a useable format. The need to balance timeliness with attaining minutiae 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 below.

Once all attainable data had been gathered, they were entered into totaling spreadsheets and then into the appropriate calculator. Emission totals were then calculated. Some emissions factors and coefficients were adjusted to provide a more realistic picture of OSU's emissions. These steps are discussed in detail later in this report.

Past Inventory Comparison

An important function of this FY08 inventory is the ability to compare with the previous FY07 inventory. As discussed earlier in Scope and Boundaries, this FY08 inventory uses different and more inclusive methods to derive a greenhouse gas inventory more reflective of this institution's actual emissions.

Of the six inventories performed for FY08, comparisons can be made using only OSU Comparative, which used scope and boundaries similar to the FY07 OSU Inventory. While the structure remained constant, changes in data availability, quality, and calculation do not make for easy comparison with data reported in the FY07 inventory. Instead, data presented in the FY08 OSU Comparative inventory reflects changes in emissions between FY07 and FY08 using the highest quality data and best practices in calculation. For example, the FY08 OSU Comparative Inventory notes a 1.8% increase in air travel emissions from FY07 to FY08. Using the emissions data presented in the FY07 OSU inventory, the increase would be 140%. This difference is due to significant changes to air travel emissions and air mile calculations made by Clean Air-Cool Planet in the period between inventories. In an effort to present the highest-quality data using the latest climate science, variations in current and future inventories may not be absolutely comparable to past inventories.

For the FY2009 inventory, the OSU Comparative inventory will not be performed as comparisons can be made between the past versions of each of the other five inventories.

Boundaries

Overview

In order to create the most realistic, accurate greenhouse gas inventory possible, FY08 scope and boundaries expand beyond what is typically included in organizational inventories. Using terminology common to greenhouse gas reporting, many inventories examine a "Scope 1," which includes all direct emissions from sources owned or directly controlled by the subject organization. Typically included are "Scope 2" sources which cover GHG emissions that result from importing or buying electricity, steam, heat or chilled water. "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). The President's Climate Commitment requires that signatories mitigate emissions only from Scope 1 and 2 sources, as well as commute and air travel from Scope 3. Our benchmarking with peer institutions reveals that most inventories focus on these prescribed emissions sources. Our inventory aims to document all OSU emissions, regardless of our mitigation responsibilities.

The three scopes were originally defined to prevent double-counting or double-crediting. As this FY08 inventory was intended to calculate OSU's total carbon footprint, all three scopes are included. Anticipating future regulations and other entities' efforts to accurately account for their emissions (such as under a regional, national or global cap and trade system) OSU has the capacity to

change portions of its scope at any time. If, for instance, an Oregon statewide inventory is performed, OSU can avoid double-counting purchased electricity if the electricity supplier counts those emissions.

It can be argued that many Scope 3 emissions are not under OSU control and should therefore be excluded. If employees or students drive alone in a car rather than biking to campus should the university plan to mitigate those emissions? While this type of action may seem unreasonable now, it is important to be able to accurately account for all emissions resulting from university existence. Additionally, OSU has some ability to influence infrastructure and incentivize personal behavior.

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 for greenhouse gas reporting. 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 not expected to contribute more than 1% are considered negligible and not included in this analysis.

Recycled materials: While recycling may create a reduction of GHG emissions relative to harvesting virgin or raw materials, there are still significant emissions resulting from transportation and processing recycled materials. Thanks to Campus Recycling, data for OSU recycled materials are readily available and organized. However, the CA-CP calculator provides no module to calculate emissions from recycled materials due to double-counting problems in earlier calculator versions. After further conversation with CA-CP and the EPA WAste Reduction Model (WARM) program, recycled material emissions are excluded. The only emissions factors available would have yielded *negative* emissions as recycling negates the harvest of virgin materials and therefore is a net emissions reducer. No emissions factors would allow for calculation of emissions resulting from the transport and processing of recyclable materials. **The inventory impact of omitting recycled materials is unknown.**

Incinerated Waste: OSU has a small incinerator that is used to dispose of animal and other agriculture-related waste. The CA-CP calculator only accepts data for incinerators that produce energy. Because the OSU facility is used only for disposal, the data collected for this incinerator cannot be used with the CA-CP calculator. Because of the small size and processed tonnage of the existing OSU incinerator, **this is thought to be a negligible source.**

Long-distance student travel: While a notable source of emissions, student travel during breaks and for other non-scholastic activities is not under university control. Indeed, OSU prides itself in its diverse enrollment from every state and numerous countries. In the future OSU may elect to take some action to mitigate the GHG emissions resulting from long distance student travel. But at this time, there are no data to support accounting, let alone university mitigation. Confidentiality requirements restrict the availability of data that could be used to create emissions estimates. As **this may be a significant source of emissions**, future inventories will include these sources when and if data become available.

Lifecycle Assessment: Determining the emissions of a product over its lifetime is extremely complex; profiles must be generated for the emissions during resource extraction, production, distribution and disposal. Notable lifecycle emissions include embodied emissions in purchasing and construction. While the University has no direct control over the lifecycle of an item, it can be held responsible for the resulting emissions. While no accepted standards for calculating lifecycle emissions currently exist, there is an effort to develop them. The World Business Council for Sustainable Development, the United Nations Environment Programme (UNEP) and the Society for Environmental Toxicology and Chemistry (SETAC) launched an International Life Cycle Partnership, known as the Life Cycle Initiative, to enable users around the world to put life cycle thinking into effective practice. Though insufficient data inhibit our ability to calculate lifecycle emissions, we must acknowledge **this source as likely being significant.**

The University of California-Berkeley estimated lifecycle emissions for purchases, campus construction and off-site electricity plant construction and maintenance in their 2006 inventory. These lifecycle emissions effectively doubled the reported emissions of their GHG inventory. No reporting protocol requires that lifecycle emissions be counted and few, if any, inventories attempt to calculate them.

Biological sequestration: OSU is a land-, sea-, space- and sun-grant institution, with large holdings of agricultural and forest land. These lands and forests absorb carbon, acting as a sink and may seem like a potential offset for university carbon emissions. It is not appropriate, however, to include this existing biological sequestration because it does not occur as a result of *additional* university actions to reduce or mitigate carbon emissions. The issue of *additionality* is core to accurately accounting for emissions and offsets. The Climate Trust defines *additionality* here:

> The term comes from describing carbon offset emission reductions as those that occur *in addition* to business-as-usual.

Biological sequestration on OSU-owned lands would occur if the university did not exist, and therefore, the university cannot be credited for its occurrence.

Water Treatment and Distribution: A large amount of energy and resources are required to provide clean, fresh drinking water. Emissions resulting from the filtering, distribution and treatment of municipal water are largely uncounted at this time. The CA-CP calculator does not currently include this emissions source. In the coming years emissions from this source may be calculable. **This is likely a significant source of emissions.**

Off-campus vehicle use and solid waste**:** At this time, the decentralized nature of statewide entities does not allow for calculation for these sources. Statewides' vehicle use will hopefully be captured in the coming years. Emissions from solid waste produced by statewide entities are estimated to be relatively small, considering that emissions from the Corvallis Campus represent a fraction of a percent of total emissions for that location. If and when data become available for these emissions sources, they will be included. **This is likely a negligible source of emissions.**

Miscellaneous directly financed travel: While many sources of financed travel are captured, a few sources are not. Emissions from non-contracted (non-Enterprise) rental cars and personal reimbursement for Athletics personnel are prominent among this group. Data availability and time requirements for analysis were two factors that rendered this source an omission. **This is likely a significant source of emissions.**

Findings and Analysis

Findings in Brief

OSU Comprehensive

- Total gross emissions were 170,197 mt CO2e for FY08.

- Net emissions totaled 117,210 mt CO2e.

- Total gross and net (*net* in parenthesis) emissions from
    - Scope 1 sources: 38,814 (38,814) mt CO2e;
    - Scope 2 sources: 77,435 (24,453) mt CO2e;
    - Scope 3 sources: 53,948 (53,942) mt CO2e.

OSU Corvallis

- Total gross emissions were 163,464 mt CO2e, 96.0% of total OSU emissions.

- Net emissions totaled 110,478 mt CO2e.

Statewide Public Services

- Total gross emissions were 4,878 mt CO2e, 2.9% of total OSU emissions.

Hatfield Marine Science Center

- Total gross emissions were 1,295 mt CO2e, 0.8% of total OSU emissions.

OSU-Cascades

- Total gross emissions were 584.5 mt CO2e, 0.3% of total OSU emissions.

OSU Comparative

- Total gross emissions were 167,875 mt CO2e for FY08, an increase of 2.3% from FY07.

- Net emissions were 114,888 mt CO2e for FY08, a decrease of 29.6% from FY07.

Purchased electricity was the single greatest source of GHG emissions (OSU Comprehensive), totaling 85,093 mt CO2e and 50% of total GHG emissions.

- Because of the student-funded purchase of renewable energy certificates, **net** emissions from purchased electricity were 32,112 mt CO2e, representing 27.4% of net emissions.

Direct emissions from burning fossil fuels (natural gas, distillate oil #2 (diesel) and propane) account for 29.5% of net GHG emissions. Together with the emissions of purchased electricity, these two sources account for 56.9% of net emissions.

- Direct emissions increased by 8.5% from 2007 to 2008.

Mission-related air travel accounted for 30.3% of net emissions and increased by 1.8% from FY07.

- Emissions from mission-related air travel increased by 140% from the value reported in the FY07 OSU GHG Inventory. This is due to a change in calculation of emissions coefficients. For a more detailed explanation of this increase, see the Analysis of Results subsection of this section.

Institutional Comparison of Key Metrics

	'08 OSU Comprehensive	'07 OSU Expanded	'08 Cornell University	'07 UC Davis	'07 Washington State	'07 Utah State	'07 University of Idaho	'07 University of Vermont
Net emissions per FTE enrolled (mt CO2e)	5.9	6.6	15.6	13.2	5.9	7.3	3.6	4.6
Net emissions per 1000 square feet (mt CO2e)	16.7	21.3	20.7	25.2	12.3	19.8	10.7	10.5

Comparative metrics from peer institutions are not readily available and obtaining consistent comparative data is problematic. More inventories can be found at the Association for the Advancement of Sustainability in Higher Education website.

All comparative data are drawn from reports submitted by the institutions to the ACUPCC Reporting System website.

Analysis of Data and Results

Air Travel:

New sources for FY08: Added to the FY08 inventory were emissions from chartered air travel by the OSU football team. Total emissions from this source were 368 mt CO2e or 0.2% of total OSU emissions.

Calculations/Data changes since FY07: Total emissions from air travel increased by 1.8% between FY07 and FY08 when using updated calculation and data collection methods. However, compared to air travel emissions reported in the FY07 inventory, emissions increased by 140%. Nearly all of this increase was due to the implementation by Clean Air-Cool Planet of a radiative forcing index (RFI) value of 2.8 in their current calculator. The previous value was 1.0. The RFI multiplies 'standard' emissions from air travel to account for the impact of emissions of GHGs at altitude and jet contrails. The IPCC has set a RFI value range of 2.0-4.0.

There was also a change in the way air miles were calculated in the FY08 inventory. A small extrapolation error resulted in an overestimation of air miles for FY07. This was corrected for the FY08 inventory and when applied to FY07, total air miles decreased by 15.1% for that year. This correction explains why total emissions did not increase by more than 180% (which would represent the change from a RFI of 1 to 2.8 plus increased air travel) from FY07 to FY08.

Uncertainty Analysis**:** There is significant uncertainty for the calculation of air travel, due mostly to the unknown effects of emissions at altitude (represented by the RFI). The RFI of 2.8 chosen by CA-CP is aggressive, but their rationale was to be cautious given the potential impact of these emissions. CA-CP also calculates all air travel emissions using the Greenhouse Gas Protocol's data for short-haul flights, which are those less than 500 km in distance, and more carbon intensive per km. Compared to other air emissions calculators, CA-CP estimates are at the high end of the range. Depending on future calculation methodology, it is possible that OSU emissions from air travel will decrease, relative to miles flown, by as much as 25%. For this inventory, an aggressive, yet scientifically-based, estimation was considered prudent.

Commute - Student:

New data sources for FY08: Emissions from student commuting at the OSU-Cascades Campus were included for FY08. These emissions totaled 109.7 mt CO2e or 0.06% of total OSU emissions.

Calculations/Data changes from FY07: Commute emissions reported in the FY07 inventory mistakenly represented a one-way trip, instead of a round-trip, for each commuter. This was changed for FY08. Actual emissions between FY07 and FY08 increased by 2.2%

In the FY07 inventory, student headcount information came from the Oregon University System. However, for most OSU-related statistics and reports, data from the OSU Office of Institutional Research are more commonly used. Accordingly, student headcount for the FY08 and future inventories will be based on OSU Institutional Research data.

Uncertainty Analysis: Commuting may be the source with the greatest uncertainty as models cannot accurately predict commute patterns. Assumptions were made to simplify data collection and calculations. Efficiency of student commuters' cars is unknown; the calculator used the US fleet average of 22.1 mpg.

Student headcount rather than FTE (both full-time and part-time students) more accurately represents commute patterns. Using the CA-CP methodology, full-time students are estimated to go to and from campus once per day. Part-time students are given the commute equivalent of one-half a full-time student. Clearly, this basic structure cannot possibly mimic the complex nature of student schedules. It is unknown whether actual emissions lie above or below the emissions reported here, but emissions from student commute could vary by ±20%. Future, more frequent and far-reaching commute and survey data, if available, may decrease this uncertainty.

Mode split information collected in a 2003 survey describes the likely method in which commuters get to and from campus. These splits were used to calculate student commute emissions. However, there is a large portion of students living on campus who are not represented in the survey data. A sister survey was performed that gathered data on intra-campus travel but due to the structure of the calculator, mode splits cannot be differentiated for on and off-campus commuters. It is likely that emissions from student commute are lower than what is represented here by up to 20%.

Commute - Faculty/Staff:

New sources for FY08: Emissions from staff and faculty commute at the OSU-Cascades Campus were included this year. Emissions totaled 15.8 mt CO2 or 0.01% of total OSU emissions.

Uncertainty Analysis: Assumptions were made to simplify data collection and calculations. As with student commuting, estimated emissions from faculty and staff commute could change by ±10% depending on the actual efficiency of the fleet.

The CA-CP calculator does not allow for full-time and part-time headcount numbers to be added. Instead, FTE was used for faculty and staff. Both groups are estimated to make one trip to campus 235 days a year. Knowing the variety of schedules of staff and faculty (especially faculty), the range of uncertainty for this emission source is around ±20%.

Staff and faculty FTE information provided by Institutional Research includes the Statewide Public Services. However, commute distance and mode splits are most likely different than those for the Corvallis Campus. No reliable commute data for these entities exist. Emissions from staff and faculty commute could change by as much as ±15%.

Directly Financed Travel (excluding Air Travel):

New sources for FY08: Emissions from Athletics bus travel was included in the FY08 inventory. It was estimated that Athletics-chartered buses drove 35,846 miles. Emissions from this new source were estimated to be 9.1 mt C02e or 0.005% of total OSU emissions. Also included in the FY08 inventory were emissions from Enterprise Rent-a-Car, OSU's contracted rental car agency. OSU personnel drove 724,129 miles in Enterprise vehicles, with resulting emissions of 292 mt C02e or 0.2% of total OSU emissions.

Calculations/Data changes since FY07: To more accurately align OSU's emissions with the GHG Protocol guidelines, emissions from personal vehicle reimbursement are now counted as a Scope 3 source, instead of Scope 1 as it was in FY07. These emissions are not from University-owned equipment and therefore should not be counted as Scope 1 sources.

Uncertainty analysis: There are still a number of emissions sources that are uncounted in this category. Emissions from non-Enterprise car rentals and car, air and personal mile reimbursement for Athletics are significant unreported sources. Currently uncounted sources may increase emissions from this category by up to 30%.

Electricity:

New sources for FY08: Sources of emissions from electricity consumption not included in past inventories were Hatfield Marine Science Center, OSU-Cascades Campus, OSU Extension Service county offices and Ship Operations, located in Newport. These sources used a combined 4,576,992 kWh or 4.5% of total OSU electricity use. Emissions from these sources totaled 2,433.7 mt CO2e or 1.4% of total OSU emissions.

Calculations/Data changes since FY07: For the FY08 inventory, emissions resulting from electricity generation and emissions from transmission and distribution (T&D) were separated, to follow the scope convention set by the GHG Protocol. Emissions from electricity generation are considered Scope 2, while those resulting from T&D are Scope 3.

Compared to emissions reported for FY07, emissions from electrical generation, transmission and distribution from a similar scope (Comparative Inventory) were down by 9.1%, while consumption increased by 1.2%. This resulted from a change in how emissions from a unique on grid mix (X% coal, X% natural gas, X% renewable etc.) are calculated. After the calculation had been normalized, emissions from electricity increased by 1.2% between FY07 and FY08.

Uncertainty Analysis: While most OSU entities reported their utility information for the FY08 inventory, there were still a few outstanding groups that had not. Along with unknown sources, it is estimated that these groups comprise no more than 5% of total OSU emissions from electricity.

The Pacific Power grid mix relies heavily on carbon-intensive fuels, with around 75% of OSU electricity coming from coal in Wyoming and Utah. Using the regional or national grid mix for calculating emissions is less accurate than directly linking power consumption and production. Corvallis and OSU-Cascades campus electricity consumption results in increasing demand from largely non-renewable (coal) power plants.

Fertilizer:

New sources for FY08: Sources of fertilizer emissions not included in past inventories were Ag. Experiment Stations, Corvallis Campus grounds, the Soap Creek and Berry Creek cattle ranches. These sites applied 177,890 lbs of 45%N fertilizer in 2008, representing 88.3% of total fertilizer applied. Emissions from these sources totaled 333.4 mt CO2e or 0.2% of total OSU emissions.

Uncertainty analysis: There are still a number of known fertilizer sources that were not included in the FY08 inventory. Together with unknown sources, emissions resulting from fertilizer application could increase by 20% or more.

Fleet:

New sources for FY08: Emissions from transportation fuel use from Hyslop Field and Research Lab, Hatfield Marine Science Center and the OSU shuttle were included in the FY08 inventory. These new sources consumed a combined 23,180 gallons of diesel (91.1% of total OSU diesel for transportation) and 5,987 gallons of gasoline (6.1% of total). Emissions from these sources totaled 287.1 mt C02e or 0.16% of total OSU emissions.

Calculations/Data changes since FY07: In the FY07 inventory, emissions from personal mileage reimbursement were attributed to Fleet emissions. In keeping with the GHG Protocol-prescribed Scope system, emissions resulting from this source are now being counted as part of Directly-financed travel, a Scope 3 source, instead of Fleet, a Scope 1 source.

Uncertainty Analysis: A number of sources of Fleet emissions, mostly from the Statewides, are uncounted. Emissions from these sources could increase emissions from the OSU fleet by 10-15%.

Propane:

New sources for FY08: Sources of emissions resulting from the use of propane not included in past inventories are OSU Extension Service, Hatfield Marine Science Center and the Swine Center, Poultry Center and Dairy Center. These sources used a combined 23,690 gallons of propane or 50.0% of the OSU total. Resulting emissions totaled 128 mt CO2e or 0.08% of total OSU emissions.

Uncertainty Analysis: The purchasing of propane by OSU departments is decentralized and no complete record exists. While most large consumers are likely captured here, there is uncertainty in how many consumers were not captured. It is estimated that if all consumption of propane were to be recorded, total emissions from propane could increase by 25% or more.

Solid Waste:

Uncertainty Analysis**:** Since no solid waste information was collected for any other entity besides OSU Corvallis, mainly due to data availability issues, this emissions source will undoubtedly increase as information becomes available. It is likely actual emissions from solid waste are 10-15% higher than reported here.

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 and OSU-Cascades campuses; gasoline and electric fleet; Enterprise rental car mileage; animal information for Veterinary Medicine. Weights of waste loads are not recorded by the university or the solid waste hauler. Continuous recordkeeping would help reduce the need for assumptions and extrapolations.

Areas requiring further investigation and enhanced recordkeeping include: mission-related air travel; Athletics travel; student/staff/faculty commuting; long-distance student travel (to/from home and school); auto mileage and commute information that includes Extension, Ag. Experiment Stations, the FRL, OSU-Cascades Campus and HMSC; backup generator fuel consumption; propane use; fertilizer use; car rentals that did not use Enterprise Rent-A-Car Company.

OSU Emissions Source Alternatives Matrix

		Relative mitigation availability by emissions source		
		High availability	Moderate Availability	Low Availability
Relative significance by emissions source	High significance (>5% of total)	•Purchased electricity •Heat plant fuel •Directly financed travel (including air travel)	•Lifecycle emissions	•Student and staff commute
	Moderate significance (1-5% of total)		•Athletics travel	•Long-distance student travel •Water treatment and distribution
	Low significance (<1% of total)	•Solid waste •Fleet	•Refrigerants •Animal agriculture and fertilizer	

Future Action

As awareness and demand for action around global climate change continues to grow, requests and requirements will come from the campus community, the community at-large, and local, state and federal governments. Potential actions might be divided into three categories: more complete reporting of GHG emissions, on-site reduction of emissions and, off-site reduction of emissions/offsets. Information listed below is not a complete set of expectations or activities in each category, but a highlight of some significant possible actions.

Reporting and Goal-setting

Department of Environmental Quality (DEQ) reporting requirements: A proposed rule to take effect in 2010 calls for suspected large emitters of greenhouse gases to report calendar year direct emissions. Subsequently, as the requirement and implementation rollout evolves, more emissions reporting will be required. The scope and boundaries of this inventory satisfies and exceeds current and expected requirements.

House Bill 3543, passed in the 2007 Legislative Session, requires that emissions growth is arrested by 2010; is 10% lower than 1990 levels by 2020; and 75% lower than 1990 levels by 2050. Additional funding and rule-making will be required for OSU to meet or exceed these targets.

In keeping with the ACUPCC requirements, in February 2009 OSU began a planning process to attain climate neutrality. From this process, institution specific goals will be developed that are in alignment with state and regional requirements.

Expanded scope and reporting: Many known emissions sources were omitted in this inventory for a variety of reasons previously discussed. These, along with currently unknown sources should eventually be included in order to calculate a higher-certainty emissions inventory. Efforts should be maintained to obtain the most accurate and current information available.

Conservation and Efficiency

A major strategy in GHG reduction is to decrease activities that lead to emissions (energy conservation) and/or lower their impacts (energy efficiency). Specific strategic approaches combining conservation and efficiency actions are usually first and best steps for organizations interested in reducing GHG emissions. This is also true for OSU facilities around the state. While many efforts to conserve energy and use it more efficiently have been made in recent years, this work must be accelerated if OSU is to maintain a leadership position with respect to sustainability and climate action.

Encouraging carpooling and transit use, adjusting computer power management settings and heating/cooling setpoint adjustment are conservation examples. Lighting retrofits, heating/cooling equipment upgrades and increasing electric vehicle use are all examples of efficiency measures.

On-site Renewable Energy

Another major strategic approach to reducing OSU's climate impact is fuel switching from distant, carbon-intensive sources to local, renewable energy sources. These sources could include solar photovoltaic, solar hot water, biomass and biogas, and even human kinetic energy from exercise equipment. Additionally, wind, wave and geothermal sources may be options for non-Corvallis university operations.

Off-site Renewable Energy

In support of wise land use decision-making, OSU – along with many other college campuses and urban areas – has chosen to grow up, not out, on the main Corvallis Campus. While preventing sprawl and supporting alternative transportation, this development greatly increases the energy density of university infrastructure, reducing the portion that can be operated using on-site generated renewable energy. Outside sources of energy will be needed for the foreseeable future.

To that end, OSU students have supported a large purchase of off-site renewable energy in the form of renewable energy certificates (RECs). The approximate composition of the REC is currently 40% wind, 40% biogas and 20% biomass; these averages fluctuate because of weather, market forces and varying load conditions. Additional fuel-switching activities will be explored in the coming years. Partnerships with renewable energy developers and public and/or private landowners may be necessary to meet OSU's energy needs unless reliance on mechanisms like RECs is increased.

Carbon Offsets

Even with the strategies mentioned above, OSU may not be able to realistically achieve climate neutrality within a desired timeframe. Offsets will likely play a role in addition to more direct mitigation measures.

Carbon offsets in the currently deregulated market have generated a fair amount of controversy in recent years. If OSU should choose to rely on carbon offsets in the near future, it will – in the absence of government regulation – need to assure stakeholders that the offset purchases are resulting in real net reductions to global carbon emissions. Various certification and assurance methods will likely get stronger and become more necessary, unless government standards are enacted. If purchasing carbon offsets, OSU will make certain, as it did with renewable energy certificates, that the purchased offsets meet prescribed quality criteria according to the best reasonable assurance mechanisms available.

Findings Table

Energy

Purchased Electricity (Scope 2)

Corvallis Campus electricity usage for FY 2008 was 92,423,484 kWh.

The 14 Agricultural Experiment Stations (AES) consumed 4,905,902 kWh.

County Extension offices used 1,559,674 kWh.

The Forest Research Lab at Peavy Arboretum used 111,451 kWh.

Hatfield Marine Science Center used 2,219,078 kWh.

OSU-Cascades Campus consumed 402,720 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 CA-CP calculator allowed for a grid mix specific to the electric utility. Using information from Pacific Power, the following grid mix was entered and used for the Corvallis Campus and the OSU-Cascades Campus:

Fuel	% of total
Coal	73.6%
Natural gas	17.5%
Hydro	8.7%
Wind	0.3%

The Statewides and HMSC inventories used the Pacific Northwest regional grid mix; the Statewides utilize a number of different utilities each with a different grid mix. The regional mix is the best way to account for this diversity. In future inventories, HMSC will attempt to determine the grid mix of its electrical utility.

Total FY08 electricity usage for OSU: 101,622,309 kWh

Natural Gas (Scope 1)

The Corvallis Campus consumed 6,057,116 therms of natural gas in FY08. Most of this was used at the central steam plant.

The Agricultural Experiment Stations used a combined 76,731.4 therms.

The Extension Service county offices used a total of 31,187 therms.

The Forest Research Lab at Peavy Arboretum used 1001.8 therms.

Hatfield Marine Science Center consumed 5,970 therms.

Cascade campus used 20,289 therms.

Total FY08 consumption of natural gas for OSU was: 619,229 MMBtu

Steam and Chilled water purchased	N/A – no steam or chilled water is purchased from outside sources.
On-campus cogeneration (Scope 1)	The new Energy Center cogeneration facility is currently under construction and is expected to be cogenerating in 2009. Its effect on GHG emissions will be accounted for starting with the GHG inventory of FY10.
Residual oils (#5, #6) and Distillate oils (#1, #2, #3, #4) (Scope 1)	The Corvallis Campus used 131,678 gallons of distillate oil #2 (diesel) primarily at the central steam plant when natural gas supply was curtailed. Backup generators accounted for 4,149 gallons of the total, though this figure may be incomplete. Further recordkeeping is necessary. Agricultural Experiment Stations used 5,182 gallons of diesel #2 for heating. Extension Service consumed 7,644 gallons of diesel #2. HMSC used 1,311 gallons. Total FY08 consumption of distillate oil #2 (diesel) for non-transportation uses was: 144,504 gallons
Propane (Scope 1 & 3)	Total documented propane use at the Corvallis Campus was 19,937 gallons, used mainly for heating, backup generator priming and forklifts. Purchasers of propane are scattered throughout campus and there is no centralized recordkeeping. Animal Sciences was responsible for 17,899 gallons, with the vast majority of the rest coming from the filling tank located at the Motor Pool. Student health services and the Radiation Center used small amounts of propane. Agricultural Experiment Stations used 21,620 gallons of propane for heating, forklifts and backup generators. The Extension Service used 5,766 gallons. HMSC used 24 gallons of propane. Total FY08 consumption of propane: 47,347 gallons
Incinerated Waste	The Veterinary Medicine Animal Isolation Lab (VMAIL) facility on the Corvallis Campus incinerated 23,594 lbs of waste in FY08. VMAIL was not included because the CA-CP calculator is set up only for incinerators producing electricity.
Coal	N/A – no coal is directly consumed by OSU.
Solar / Wind / Biomass	For the period in question, Kelley Engineering Center is the only location on the Corvallis Campus with photovoltaic (PV) solar generation. The estimated FY08 output was 2300 kWh. This amount was not applied to this inventory as the energy produced reduced the building's electricity use.
	Data sources : Roger Admiral, Director of Forestry Operations; Mac McGuire, Landscape Machinery Maintenance; Facilities Services; Carson Oil; Lisa Plagmann, VMAIL.

Transportation

Fleet and Maintenance (Scope 1)	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. Total volume dispensed from the tank in FY08 was 92,217 gallons. There is also a credit card system that allows individuals on business trips to fill fleet vehicles wherever they wish. The credit card system recognized 79,227 gallons in purchases. OSU also received deliveries of 1,159 gallons of gasoline from Carson Oil. This fuel was primarily used in landscape equipment and vehicles. Hyslop farms received 1,880 gallons of gasoline in FY08. The fuel was primarily used in farm vehicles. Hatfield Marine Science Center used 2,948 gallons of gasoline for their fleet. On the Corvallis Campus, 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, the contracted service provider. Reported diesel use in the fleet was 2,273 gallons. The shuttles used 5,017 gallons of diesel in FY08. 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 FY08 diesel consumption for HMSC was 14,122 gallons. Total gasoline in FY08: 177,431 gallons Total diesel used in mobile sources: 25,453 gallons.
	Data sources: Justin Fleming, Motor Pool Manager; Brian Maxwell, First Student; Carson Oil; Ken Hall, HSMC.
Directly Financed Travel (Scope 3)	In FY08, 2.1 million miles were reimbursed by Travel Reimbursement. OSU also contracts rental cars through Enterprise Rent-a-Car. Enterprise reported OSU accounts driving 724,129 miles in FY08. 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 $160,943. Assuming this rate of $4.50/mi is representative of all chartered bus travel, Athletics' chartered busses drove 35,846 miles in FY08. In FY08, a reported 2,820,670 car miles were directly financed by OSU. A reported total of 35,846 bus miles were financed by OSU.
	Data sources: Justin Fleming, Motor Pool Manager; Stacie Carey, Enterprise Rent-a-Car; Jacque Bruns, OSU Athletics.

Commute (Scope 3)

This inventory relied on a 2003 commute survey commissioned by OSU. Data from the Travel Survey Report offer the following mode split:

Mode Split	% of total
Bike	10%
Walk	25%
Bus	3%
Single occupancy vehicle (SOV)	56%
Carpool	5%
OSU shuttle	2%

It is assumed each person made one trip to campus per day. Students and staff/faculty were counted separately in the calculator. The Registrar's office indicated there are 146 teaching days per year (excluding summer) and that number was used for commuting days for students. Staff and faculty were counted at 235 commute days per person per year.

An average commute distance of 5 miles was used 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 Campus. While the estimation is reasonable, further commuting studies should be performed to better model commute patterns there.

Staff and faculty FTE provided by Institutional Research include OSU-Cascades Campus, 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 not included in commute calculations.

Data sources: Robert Monasky, Campus Planner, Facilities Services; Patty McIntosh, Planning Manager, Facilities Services; Steve Edwards, Institutional Research

Air Travel (Scope 3)

OSU primarily uses two travel agents: Teel's Travel Planners and Azumano Travel. Both provided significant amounts of information, as well as advice and guidance. Air travel is 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 could extrapolate using Azumano's mileage information.

Company	# of flights	% of total
Azumano	5,871	38.5%
Teel's	7,865	51.6%
Travel Reimbursement	1,508	9.9%
Total	15,244	100.0%

The extrapolation and calculation are as follows:

Azumano booked 16,641,032 miles for OSU.

$$\frac{5,871}{16,641,032} = \frac{15,244}{x}$$

$$x = 43,208,294 \text{ miles total}$$

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:

Total OSU air mileage = (1/.95)*43,208,294 = 45,482,414 miles

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

Assumptions: Azumano travel is representative of all OSU travel.

For each away game, the OSU Football team charters an Airbus 320 to take the team from Eugene, OR to the game destination. Using the 2007 schedule and Webflyer.com, an airport distance calculator, the calculated distance flown by chartered Football jets was 8,990 miles.

The European Environmental Agency[1] 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 CA-CP calculator, as it is not equipped to accurately calculate emissions resulting from an dedicated jet flight:

$$\frac{11,608 \text{ kg fuel}}{2482 \text{ mi}} \times \frac{1 \text{ gal jet fuel}^2}{3.06 \text{ kg fuel}} \times \frac{21.095 \text{ lb } CO_2^2}{1 \text{ gal jet fuel}} \times \frac{1 \text{ mt}}{2205 \text{ lbs}} = \frac{0.0146 \text{ mt } CO_2}{\text{mi}}$$

$$\frac{0.0146 \text{ mt } CO_2}{\text{mi}} \times 8,990 \text{ miles} = 131.5 \text{ mt } CO_2 \times 2.8 \text{ RFI} = 368.1 \text{ mt } CO_2e$$

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

Data sources: Brad Teel, President, Teel's Travel Planners; Tony Fuerte, Corporate Accounts Manager, Azumano Travel; Julie Stratton, Business Affairs; 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

Solid Waste (Scope 3)

Total weight of solid waste sent to Coffin Butte Landfill in FY08: 4.45 million lbs. (2,225 tons).

Coffin Butte recovers methane and produces power, but it is unknown how much methane produced could be attributed to OSU waste.

No solid waste information was available for the Statewides, HMSC or OSU-Cascades Campus.

Data source: Justin Fleming, Motor Pool Manager, and previous Campus Recycling Coordinator

Animals and Agriculture (Scope 1)

Animals

Animals are raised and cared for at several OSU facilities. Their totals are displayed in the table below.

Type	Animal Science	Union Station	Burns Station	Vet Med	Total
Dairy Cows	238	0	0	0	238
Beef Cattle	172	240	344	0.23	756
Horses	26	4	3	7.51	41
Poultry	1729	0	0	0	1729
Sheep	909	0	0	2.41	911
Swine	11	0	0	0.02	11
Goats	0	0	0	0.08	0

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.

Fertilizer

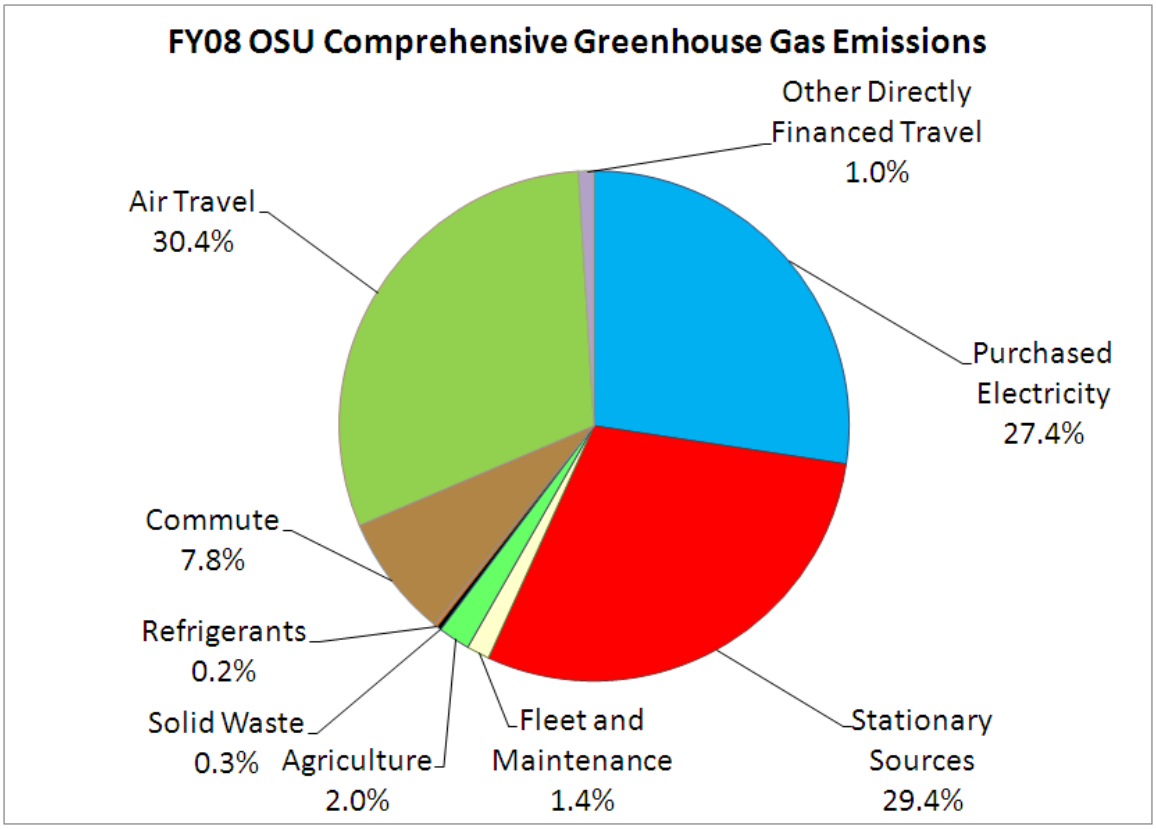
Location	Weight (lbs)	% Nitrogen
Burns	800	45%
Union	7,800	45%
Dairy	15,000	45%
Corvallis Grounds	6,150	20%
Soap and Berry Creek	11,700	45%
Ag. Exp. Stations	160,040	45%
Total	201,490	44%

Fertilizer application on OSU grounds in inadequately tracked. Even so, this

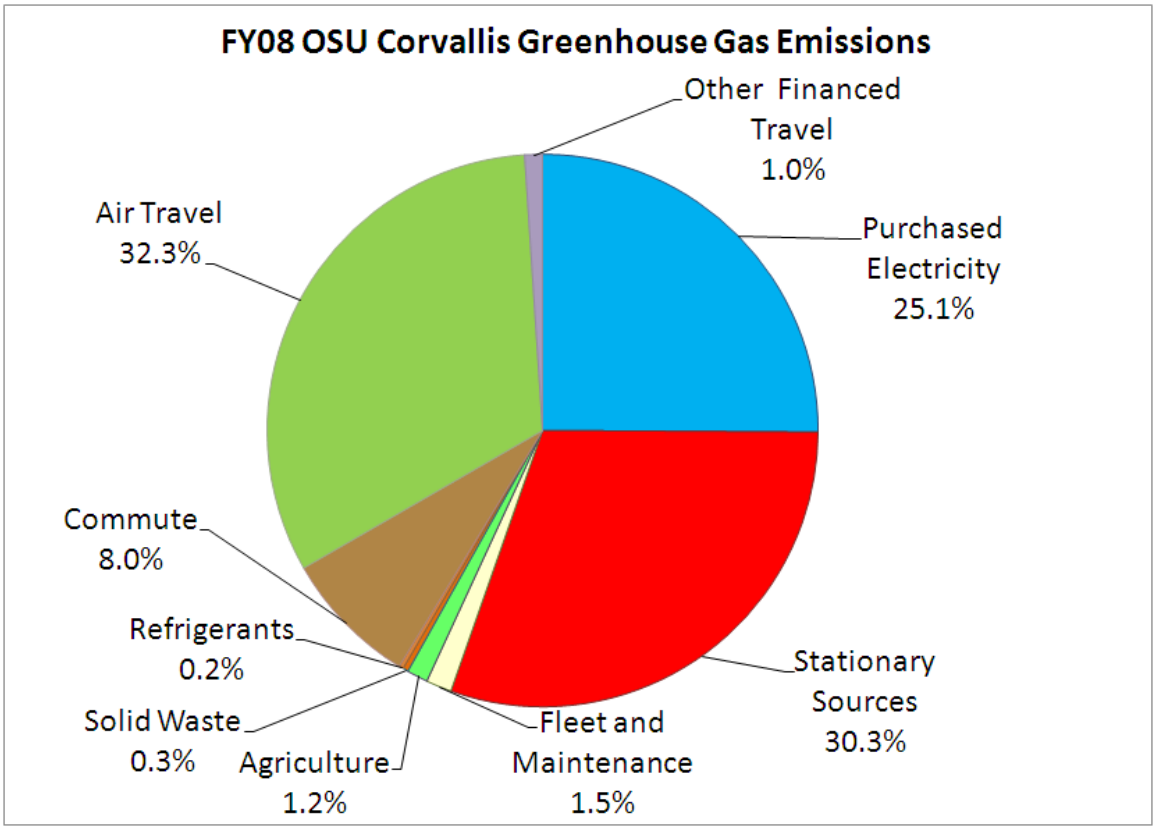
<table>
<tr><td></td><td>emissions source is likely small. Emissions from fertilizer applied to Burns, Union and AES grounds were reported in the Statewides inventory. Emissions from the Dairy, Corvallis Campus grounds and the Soap Creek and Berry Creek cattle ranches were reported in the OSU Corvallis Campus inventory.</td></tr>
<tr><td></td><td>Data sources: Nora Ross, Asst. to the Chair, Animal Science Dept.; Debrah Rarick, Asst. to the Dean, College of Veterinary Medicine; Tim DelCurto, Superintendent, Union Station; Norm Brown, OSU Landscape;</td></tr>
<tr><td>Refrigerants (Scope 1)</td><td>Refrigerants can be powerful greenhouse gases and are required to be tracked. 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 for FY08:
<table>
<tr><th>Refrigerant</th><th>Weight (lbs)</th></tr>
<tr><td>CFC-12</td><td>15</td></tr>
<tr><td>HCFC-22</td><td>227</td></tr>
<tr><td>HFC-404A</td><td>11</td></tr>
<tr><td>R-409A</td><td>15</td></tr>
<tr><td>HP-81</td><td>1</td></tr>
</table>
</td></tr>
<tr><td></td><td>Data source: Greg Riutzel, Refrigeration Mechanic, Facilities Services</td></tr>
<tr><td>Offsets (green tags, RECs, composting etc.)</td><td>Total offsets for FY08: 66,680 MWh. RECs were purchased with student fee and self-directed public purpose charge money. All offsets were applied to the OSU Corvallis inventory.

Approximately 15 tons of waste is composted by various campus entities. The Organic Growers Club, Crop and Soil Sciences Department and the Student Sustainability Initiative compost dairy solids, pre-consumer food waste from campus dining centers and landscape debris. OSU's waste hauler, Allied Waste, has indicated intent to accept greater amounts of food waste from the dining centers.</td></tr>
</table>

MODULE	FY08 OSU Comprehensive						
WORKSHEET	Emissions Summary						
UNIVERSITY	Oregon State University						
	2008	Energy Consumption	CO2	CH4	N2O	eCO2	% of total
		MMBtu	kg	kg	kg	Metric Tonnes	
Scope 2	Purchased Electricity	974,057.9	77,074,412.5	905.8	1,147.2	77,434.8	20.9%
Scope 1	Stationary Sources	643,251.9	34,366,828.7	3,519.9	80.5	34,471.6	29.4%
	Fleet	25,376.9	1,657,989.2	323.4	112.9	1,698.8	1.4%
	Refrigerants	-	-	-	-	273.3	0.2%
	Agriculture	-	-	80,352.3	1,764.7	2,370.5	2.0%
Scope 3	Faculty / Staff Commuting	35,329.1	2,478,678.7	489.4	168.7	2,539.9	2.2%
	Student Commuting	91,689.3	6,433,156.0	1,269.0	437.6	6,591.9	5.6%
	Air Travel	179,200.7	35,183,814.9	346.5	398.2	35,652.6	30.4%
	Other Directly Financed Travel	15,972.4	1,120,270.2	222.8	76.7	1,148.1	1.0%
	Solid Waste	-	-	15,539.7	-	357.4	0.3%
	Scope 2 T&D Losses	96,335.4	7,622,744.1	89.6	113.5	7,658.4	6.5%
Offsets	Additional (composting)					(5.8)	-
	Non-Additional (RECs)					(52,981.4)	-
Totals	Scope 1	668,628.8	36,024,817.9	84,195.6	1,958.2	38,814.2	33.1%
	Scope 2	974,057.9	77,074,412.5	905.8	1,147.2	77,434.8	20.9%
	Scope 3	418,526.9	52,838,663.9	17,957.0	1,194.7	53,948.2	46.0%
	All Scopes	2,061,213.6	165,937,894.3	103,058.4	4,300.1	170,197.2	100.0%
	All Offsets					(52,987.2)	-
					Net Emissions	**117,210.0**	-

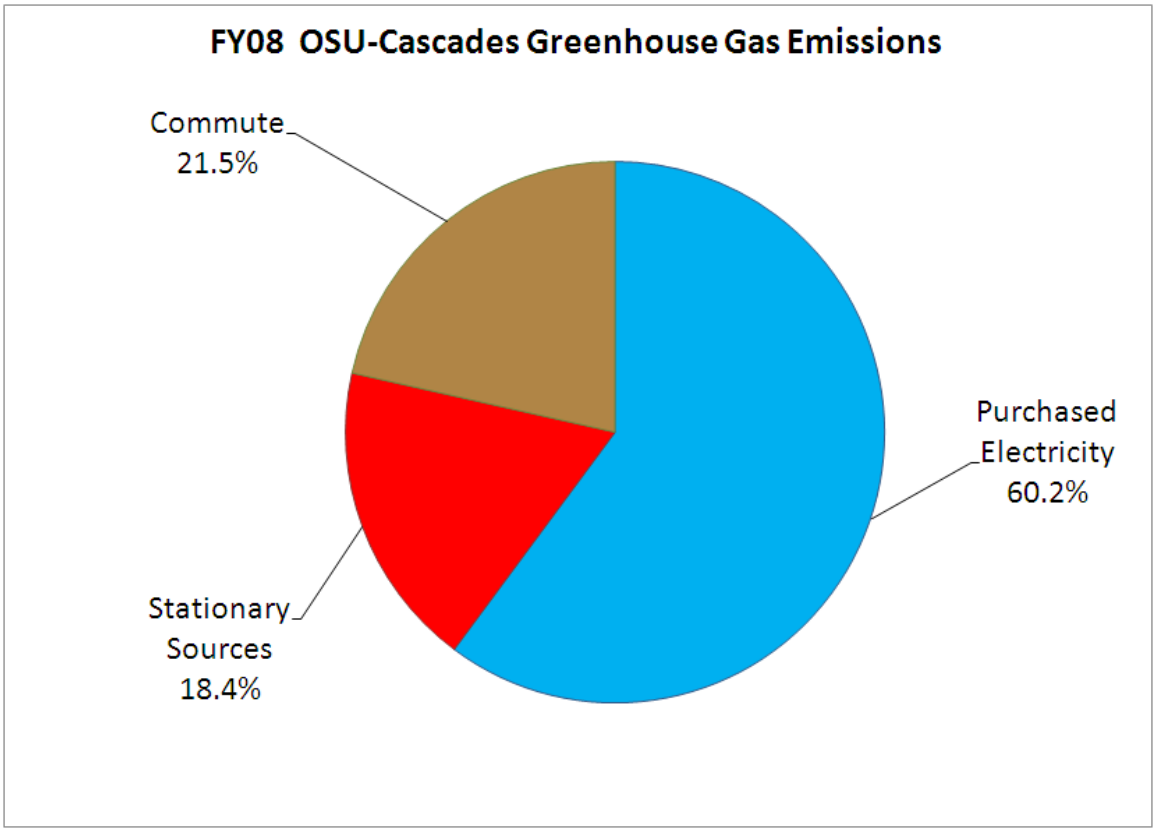


MODULE	FY08 OSU Corvallis					
WORKSHEET	Emissions Summary					
UNIVERSITY	Oregon State University					
	2008	Energy Consumption	CO2	CH4	N2O	eCO2
		MMBtu	kg	kg	kg	Metric Tonnes
Scope 2	Purchased Electricity	924,862.3	73,080,913.1	888.8	1,128.7	73,435.5
Scope 1	Stationary Sources	625,601.6	33,377,529.5	3,405.0	76.5	33,478.5
	Fleet	23,047.7	1,619,229.1	309.6	107.2	1,658.1
	Refrigerants	-	-	-	-	273.3
	Agriculture	-	-	53,220.5	491.9	1,369.7
Scope 3	Faculty / Staff Commuting	32,638.9	2,290,026.1	451.7	155.8	2,346.5
	Student Commuting	90,163.6	6,326,108.3	1,247.9	430.3	6,482.2
	Air Travel	179,200.7	35,183,814.9	346.5	398.2	35,652.6
	Other Directly Financed Travel	15,972.4	1,120,270.2	222.8	76.7	1,148.1
	Solid Waste	-	-	15,539.7	-	357.4
	Scope 2 T&D Losses	91,469.9	7,227,782.6	87.9	111.6	7,262.8
Offsets	Additional (composting)					(5.8)
	Non-Additional (RECs)					(52,981.4)
Totals	Scope 1	663,276.5	36,021,579.3	57,144.0	730.1	36,779.5
	Scope 2	924,862.3	73,080,913.1	888.8	1,128.7	73,435.5
	Scope 3	393,597.7	51,036,756.2	17,674.2	1,096.1	53,249.6
	All Scopes	1,981,736.5	160,139,248.6	75,707.0	2,955.0	163,464.6
	All Offsets					(52,987.2)
					Net Emissions	**110,477.4**

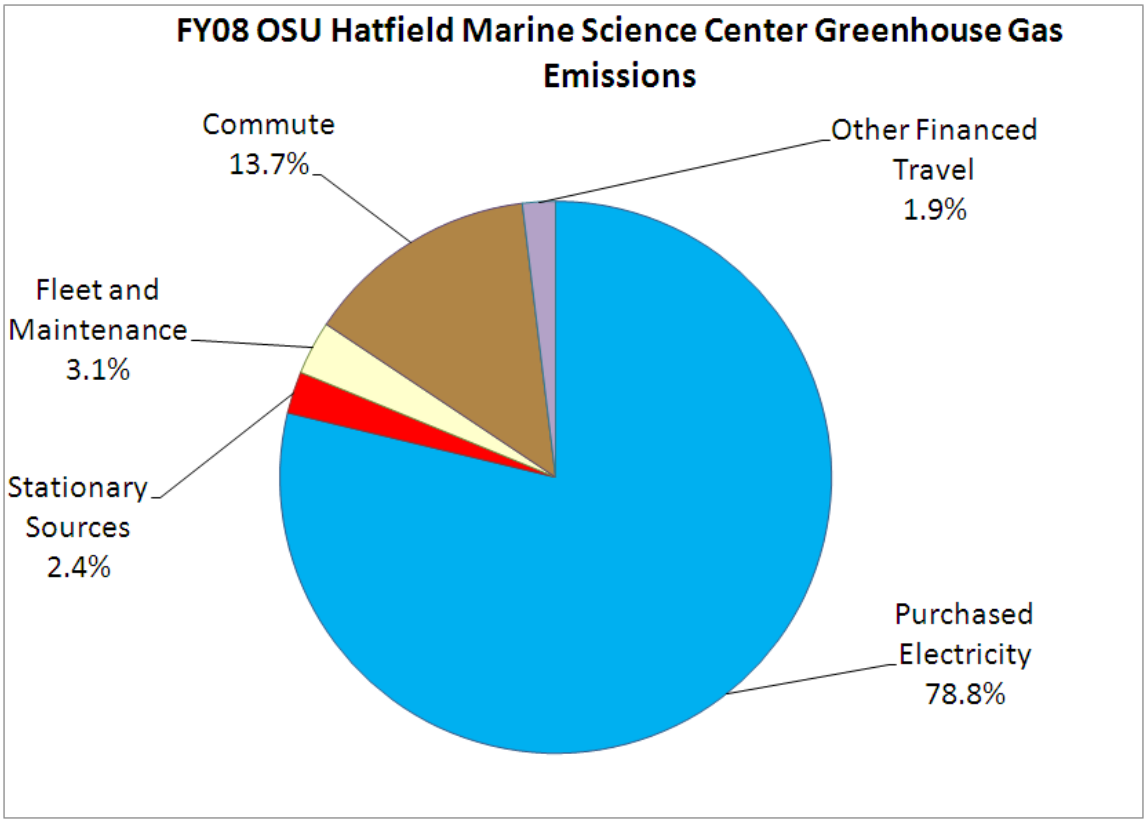


MODULE	**FY08 OSU-Cascades**
WORKSHEET	**Emissions Summary**
UNIVERSITY	**Oregon State University**

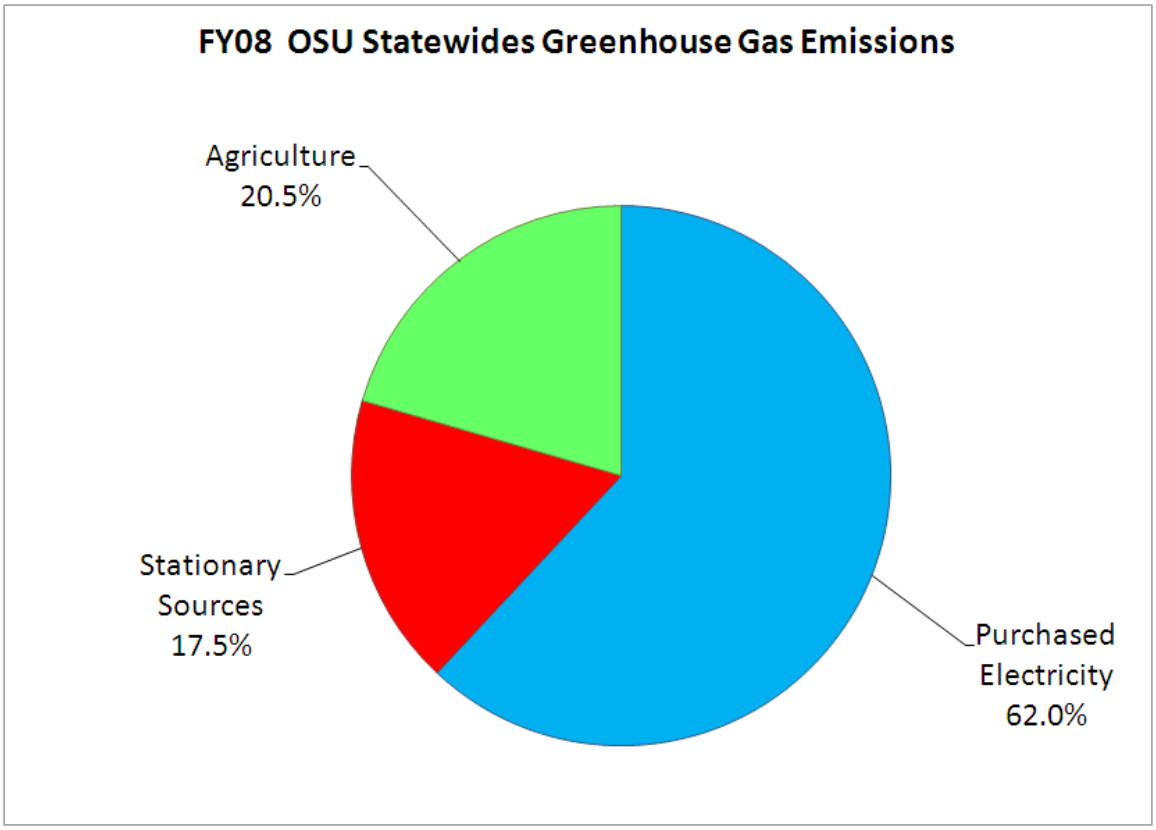
	2008	Energy Consumption	CO2	CH4	N2O	eCO2
		MMBtu	kg	kg	kg	Metric Tonnes
Scope 2	Purchased Electricity	4,029.9	318,438.0	3.9	4.9	320.0
Scope 1	Stationary Sources	2,028.9	107,036.1	10.7	0.2	107.3
Scope 3	Faculty / Staff Commuting	220.4	15,463.1	3.1	1.1	15.8
	Student Commuting	1,525.7	107,047.7	21.1	7.3	109.7
	Scope 2 T&D Losses	398.6	31,493.9	0.4	0.5	31.6
Totals	Scope 1	2,028.9	107,036.1	10.7	0.2	107.3
	Scope 2	4,029.9	318,438.0	3.9	4.9	320.0
	Scope 3	2,144.7	154,004.7	24.6	8.8	157.2
	All Scopes	8,203.5	579,478.7	39.1	14.0	584.5
					Net Emissions	**584.5**



MODULE	FY08 OSU Hatfield Marine Science Center					
WORKSHEET	Emissions Summary					
UNIVERSITY	Oregon State University					
	2008	Energy Consumption	CO2	CH4	N2O	eCO2
		MMBtu	kg	kg	kg	Metric Tonnes
Scope 2	Purchased Electricity	11,394.4	927,143.1	3.3	3.4	928.2
Scope 1	Stationary Sources	599.1	31,624.8	3.2	0.1	31.7
	Fleet	2,329.2	38,760.1	13.9	5.7	40.8
Scope 3	Faculty / Staff Commuting	2,469.9	173,189.5	34.6	11.9	177.5
	Other Directly Financed Travel	349.4	24,501.9	4.9	1.7	25.1
	Scope 2 T&D Losses	1,126.9	91,695.5	0.3	0.3	91.8
Totals	Scope 1	2,928.2	70,384.9	17.1	5.8	72.5
	Scope 2	11,394.4	927,143.1	3.3	3.4	928.2
	Scope 3	3,946.2	289,386.8	39.9	13.9	294.4
	All Scopes	18,268.8	1,286,914.9	60.2	23.2	1,295.2
					Net Emissions	**1,295.2**



MODULE	FY08 OSU Statewides					
WORKSHEET	Emissions Summary					
UNIVERSITY	Oregon State University					
	2008	Energy Consumption	CO2	CH4	N2O	eCO2
		MMBtu	kg	kg	kg	Metric Tonnes
Scope 2	Purchased Electricity	33,771.3	2,747,918.3	9.8	10.1	2,751.1
Scope 1	Stationary Sources	15,022.4	850,638.3	101.0	3.8	854.1
	Agriculture	-	-	27,131.7	1,272.8	1,000.8
Scope 3	Scope 2 T&D Losses	3,340.0	271,772.1	1.0	1.0	272.1
Totals	Scope 1	15,255.8	867,006.8	27,236.0	1,277.7	1,854.8
	Scope 2	33,771.3	2,747,918.3	9.8	10.1	2,751.1
	Scope 3	3,340.0	271,772.1	1.0	1.0	272.1
	All Scopes	52,367.2	3,886,697.2	27,246.9	1,288.8	4,878.1
					Net Emissions	**4,878.1**



MODULE	FY08 OSU Comparative						
WORKSHEET	Emissions Summary						
UNIVERSITY	Oregon State University						

	2008	Energy Consumption	CO2	CH4	N2O	eCO2	% Change from FY07
		MMBtu	kg	kg	kg	Metric Tonnes	
Scope 2	Purchased Electricity	971,112.0	76,735,479.7	933.2	1,185.2	77,107.7	1.2%
Scope 1	Stationary Sources	634,239.7	33,848,753.9	3,455.1	77.9	33,951.3	8.5%
	Fleet	33,380.5	2,341,364.6	465.1	160.2	2,399.5	-1.3%
	Refrigerants	-	-	-	-	273.3	-63.3%
	Agriculture	-	-	80,352.3	585.6	2,021.5	-9.2%
Scope 3	Faculty / Staff Commuting	32,638.9	2,290,026.1	451.7	155.8	2,346.5	1.5%
	Student Commuting	90,163.6	6,326,108.3	1,247.9	430.3	6,482.2	2.2%
	Air Travel	179,200.7	35,183,814.9	346.5	398.2	35,309.7	1.8%
	Solid Waste	-	-	15,539.7	-	357.4	-5.7%
	Scope 2 T&D Losses	96,044.0	7,589,223.3	92.3	117.2	7,626.0	1.2%
Offsets	Additional (Composting)					(5.8)	200.0%
	Non-Additional (RECs)					(52,981.4)	5160.0%
Totals	Scope 1	667,620.2	36,190,118.4	84,272.5	823.7	38,645.5	5.3%
	Scope 2	971,112.0	76,735,479.7	933.2	1,185.2	77,107.7	1.2%
	Scope 3	398,047.2	51,389,172.6	17,678.1	1,101.5	52,121.8	1.7%
	All Scopes	2,036,779.4	164,314,770.7	102,883.8	3,110.4	167,875.0	2.3%
	All Offsets					(52,987.2)	5150.5%
					Net Emissions	**114,887.8**	-29.6%