Fiscal Year 2007
Greenhouse Gas Inventory

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June 18, 2008

Acknowledgments

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

- **Agriculture Experiment Stations:** Valerie Lieuallen, Leta Morton, Sue Hansell, Carol Cole, Arthel Ambrose, Kim Verhelst, Maria Schramm, Marcia Sailer, Mary Mosier, Jan Jones, Debbie Burroughs, Jack Breen, Tim DelCurto

- **Facilities Services:** Les Walton, Mac McGuire, Patty McIntosh, Robert Monasky, Greg Riutzel, Jennifer Hill

- **Business Affairs:** Julie Stratton, Bezunesh Abebe, Rose Hamilton

- **Business Services:** Justin Fleming, Manuel Balesteri

- **Extension Administration:** Mary Mann, Laura Frye

- **Radiation Center:** Shirley Campbell

- **Student Health Services:** George Voss

Local Businesses

- **Good Company, Eugene:** Joshua Skov

- **Teel's Travel, Corvallis:** Brad Teel

- **Azumano Travel, Corvallis:** Tony Fuerte

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 given greenhouse gas multiplied by a Global Warming Potential (GWP) factor.

(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 a much solar radiation as a gram of carbon dioxide (CO2).

(4) **"Greenhouse gas"** is any gas that contributes to anthropogenic global warming including, but not limited to, carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride.

(5) **"Metric ton, tonne, or metric tonne"** means one metric tonne (1000 kilograms) or 2204.62 pounds.

(6) **"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.

(7) "**OUS Method**" refers to the inventory for FY07 that is similar in methodology to the OUS inventory for CY04 performed by Good Company. One notable exception is mission-related air travel, which instead draws upon **Expanded** methodology for calculation of airline mileage.

(8) "**Expanded**" refers to the inventory for FY07 that uses more accurate methodology and calculation, and expanded scope and boundaries than that of the **OUS Method**.

(9) "**Bonneville Environmental Foundation (BEF)"** is a Portland-based non-profit which specializes in carbon offsets, mainly from 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.

(10) "**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.

(11) "**World Business Council for Sustainable Development (WBCSD)"** is a global association of business representatives that deals exclusively with business and sustainable development.

(12) "**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.

(13) "**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

Sources:

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;

Executive Summary

Global climate change may represent the single greatest social and environmental threat human civilization has faced. According to the Intergovernmental Panel on Climate Change, a growing scientific consensus indicates anthropogenic emissions play a significant role in global climate change, the effects of which could include sea-level rise, dramatic fluctuations in flood/drought cycles, more frequent and more powerful storms and changes in ocean currents. Because of the severity and inequity of these effects, a call for action has resonated around the globe.

Oregon is a hotspot of climate change awareness and action. In 2007, the Oregon University System (OUS) commissioned the first greenhouse gas inventory for the system and its seven institutions, inventorying emissions from Calendar Year 2004. To perform the inventory, OUS hired Good Company, a Eugene research and consulting firm that helps clients measure, manage, and market their social and environmental performance.

In April 2007, Oregon State University (OSU) President Ed Ray signed the American College and University Presidents Climate Commitment. In part, the Climate Commitment requires inventorying greenhouse gasses every two years. This Fiscal Year 2007 OSU Greenhouse Gas (GHG) Inventory is an update of the OUS inventory and uses similar but expanded and altered methods and boundaries that more accurately count OSU's true greenhouse gas emissions.

The FY07 inventory provides:

1. A snapshot of OSU emissions: quantified greenhouse gas emissions resulting from OSU and OSU-related activities for the fiscal year ending June 30, 2007.
2. Comparison with the prior OUS inventory: apples-to-apples comparisons with the CY04 OUS inventory. Plus a new, more comprehensive *expanded* scope that builds from the OUS inventory.
3. 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 emissions of 151,287 metric tonnes CO2-equivalent (mt CO2e), an increase of 9.4% from Calendar Year 2004.

- Significant emissions sources include purchased electricity (61.6% of total emissions), combustion of natural gas (20.7%), mission-related air travel (9.8%) and student, staff and faculty commute (3.0%).

- *Per capita* emissions of 6.61 mt CO2e, which equates to emissions of 37 mt CO2e per *full time equivalent (FTE) employee*; per square foot emissions of 21.5 kg CO2e and; per research dollar emissions of 0.79 kg CO2e.

Analysis in Brief

- OSU has a high level of control over emission sources that account for approximately 90% of total GHG emissions.

- Approximately half of the 9.4% increase in total emissions is due to a change in the methodology of calculating mission-related air travel. Although actual air travel may have increased, most of the increase can be attributed to the change in calculation.

- Emissions sources partially included or not included are Extension county offices, Cascade Campus and Hatfield Marine Science Center, Athletics chartered travel, long-distance student travel, embodied emissions of purchases and, mission-related air travel.

Methodology

Introduction

With operations as broad and far-reaching as Oregon State University's, this inventory relied heavily upon centralized data sources. A first step during this first university-produced inventory was to confirm the applicability of tools used in the Calendar Year 2004 inventory commissioned by the Oregon University System. After confirming the protocols and calculator from Clean Air-Cool Planet (CA-CP) – the same tool used for the CY04 inventory – a list of emissions sources and data collection points was created. With the expended scope of this Fiscal Year 2007 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. This is the most complete inventory of OSU's GHG emissions performed to date.

Tools

A first step was confirming the CA-CP calculator as the analytical tool of choice. Protocols and a calculator created by CA-CP were used in the OUS inventory for CY04. After a brief analysis of alternative calculators, CA-CP was chosen again for FY07 due to its focus on university and college campuses, ease of comparison with the CY04 inventory and its endorsement by the Climate Commitment, 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.

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. The previous inventory had two emissions categories, "core" emissions and "additional documented" emissions. This grouping system has been eliminated, instead tallying in one category all emissions within this report's scope and boundaries.

It's important to remember that greenhouse gas emissions associated with university activities are neither local to the institution nor geographically confined. Rather, they are global emissions. For example, electricity consumption in Corvallis results in carbon dioxide (CO_2) emitted in Colorado and Utah from coal-fired power plants. Once released, CO_2 travels the globe, without regard for political or even geographical boundaries.

Data Gathering

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 master list of contacts was created and 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 here.

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 the CA-CP calculator and emission totals were tallied. 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 FY07 inventory is the ability to compare with the previous CY04 inventory. As discussed earlier in Scope and Boundaries, this FY07 inventory uses different and more inclusive methods to derive a greenhouse gas inventory more reflective of this institution's actual emissions. In light of the need for apples-to-apples comparisons and the change in scope and boundaries, two snapshots are provided for FY07. These can be thought of as two separate inventories: **OUS Method** and **Expanded**. In future inventories starting with FY08, only the Expanded methodology will be used.

Again, **OUS Method** was calculated using similar scope and methodology as the OUS CY04 inventory. The **Expanded** inventory extended the boundaries and calculated emissions from existing sources in more realistic, accurate terms. Comparisons using these two methods are found in Findings and Analysis later in this report.

Boundaries

In order to create the most realistic, accurate greenhouse gas inventory possible, FY07 (*Expanded methodology*) scope and boundaries expand beyond what has traditionally and historically been 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. "Scope 2" covers sources of 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 original drafter of the Greenhouse Gas Protocol (GHG Protocol)**.**

The three scopes were originally defined to prevent double counting or double crediting. As this FY07 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's direct 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. In order to accurately reflect university impacts, Scope 3 emissions are counted in this FY07 inventory, but this does not mandate mitigating action from the university.

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 here:

OSU Extension Service: Decentralized and inaccessible data for the county offices made reporting Extension emissions impractical within the required timeframe. Some data are processed through OSU Business Affairs but multiple attempts to acquire those data proved fruitless. In preparation for the FY08

inventory, the Sustainability Office will work with Extension Administration and, if needed, directly with the county offices to create reporting methods that work for everyone, and are not unduly time consuming. Extension will be included in future greenhouse gas inventories. **The inventory impact of omitting Extension emissions in this FY07 inventory is estimated to be less than 4% of total Expanded emissions.**

OSU Athletics chartered travel: A common finding during this process was that financial costs were recorded, while data more conducive to GHG emissions were not (kilowatt hours of electricity, car and airline mileage, etc.). *Most* Athletics air travel is reported as OSU air travel. However, bus, van and *chartered* air travel are not, due to the decentralization of records. In working with Athletics, it may be possible to account for emissions from chartered travel in the FY08 inventory. **The inventory impact of omitting Athletics chartered travel emissions is estimated to be less than 1% of total Expanded emissions.**

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 to OSU's satisfaction with CA-CP, as well as 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. Other methods will be used in the FY08 inventory to accurately account for GHG emissions from incineration. Because of the small size and processed tonnage of the existing OSU incinerator, **the inventory impact of omitting incinerated waste is estimated to be negligible.**

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 notable source of emissions**, future inventories will include these sources *when and if data become available*.

Embodied emissions of purchases: Embodied emissions refers to the greenhouse gasses emitted in the resource extraction, production, distribution, and disposal of material items purchased by an institution. Researching and calculating these emissions from a consumer standpoint is a monumental task for even a few items, let alone all purchases of an institution the size of OSU. But efforts within the business and international communities to begin tracking and accounting for these emissions will likely yield emissions profiles for some products within the next several years. 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. At this time, OSU does not have reasonably accessible information or resources to sufficiently analyze this emissions source. **The inventory impact from embodied emissions of purchases are likely significant.**

Biological sequestration: OSU is a land-, sea-, sun- and space-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.

Findings and Analysis

Findings in Brief

Total emissions were 151,287 mt CO2e (in the **Expanded** inventory).

- This represents an increase of 9.4% from CY04 (using **OUS Method**)

Purchased electricity was the single greatest source of GHG emissions, totaling 93,167 mt CO2e and 61.6% of total GHG emissions (in the **Expanded** inventory).

- Emissions from purchased electricity increased by 5.9% from 2004 to 2007 (using **OUS Method**).

Direct emissions from burning fossil fuels (natural gas, distillate oil #2 (diesel) and propane) account for 20.7% of total GHG emissions. Together with the indirect emissions of purchased electricity, these two sources account for 82.3% of total emissions (in the **Expanded** inventory).

- Direct emissions increased by 7.2% from 2004 to 2007 (using **OUS Method**).

Mission-related air travel accounted for 9.8% of total emissions (in the **Expanded** inventory).

- Emissions from mission-related air travel increased by 101.3% from 2004 to 2007 (using **OUS Method**). Note: this is likely a result of data analysis methodology rather than an absolute increase.

If OSU purchased all of its electricity from carbon-free renewable sources, total emissions would fall by nearly 61.6%. It's important to note that thanks to the student renewable energy fee, as of January 2008 75% of OSU's electricity comes from renewable sources. Since this is outside the examination timeframe of this FY07 inventory, it is not included.

Per capita (students, faculty and staff; using **OUS Method**) at OSU, 6.61 mt CO2e are emitted. This compares to 5.1 mt CO2e from the OUS CY04 inventory. According to the CY04 inventory, the University of Oregon had per capita emissions of 1.29 mt CO2e, while Portland State University had per capita emissions of 1.52 mt CO2e. Lower emissions at UO and PSU are largely attributable to the lower carbon intensity of the electricity sources for the other campuses.

Per square foot, OSU emits 21.5 kg CO2e. This compares to Pennsylvania State University's emissions of 27.1 kg CO2e/sq. ft and Utah State University's emissions of 19.7 kg CO2e/sq. ft.

Per FTE employee, OSU emits 37 mt CO2e. Utah State per employee emissions equal 31.8 mt CO2e.

Per research dollar at OSU, 0.79 kg CO2e are emitted. The University of Illinois-Chicago per research dollar emissions are 0.92 kg CO2e. Utah State emitted 0.851 kg CO2e per research dollar spent. Penn State emitted 0.64 kg CO2e per research dollar.

All comparative data from Pennsylvania State University are from CY 2006 and can be found within their publicly available GHG report. Comparative data from Utah State University are found within their CA-CP calculator for 2007. It is not known whether the data are based in CY or FY. Comparative data from the University of Illinois-Chicago are from FY 2007 and can be found within their publicly available GHG report.

Analysis of Results

In the apples-to-apples comparison, total emissions rose 9.4%. Increases of purchased electricity and natural gas were factors. However, much of the increase was a result of increased *accounted* mission-related air travel. Accounted emissions from this source nearly doubled, primarily due to the methodology used in determining miles flown. A more comprehensive methodology was used, including more accurate airline mileage received from a major travel agent. Since it would have provided no real benefit by using the **OUS Method**, this approach was not performed. More details regarding the exact extrapolation of air mileage can be found in the Findings Table section.

Institutional Control of Emissions

The university has some control of the sources of the majority of GHG emissions. Electrical purchases and central heat plant fuel type are directly controllable. Mission-related air travel is controllable as well. The following emissions sources are categorized by plausible level of OSU control. Note: because even the **Expanded** inventory may not account for all of OSU's GHG emissions, the estimates below exceed 100% of FY07 emissions.

High-level of control: approximately 84% of calculated total emissions
- Purchased electricity
- Fuel for central heat plant
- Refrigerants
- Solid waste

Moderate-level of control: approximately 5-25% of estimated total emissions
- Athletics travel
- Fleet travel
- Mission-related air travel
- Embodied emissions of purchases

Low-level of control: approximately 5-10% of estimated total emissions

- Long-distance student travel
- Employee and student commute

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 and; backup generator fuel consumption. Weights of waste loads are not recorded by the university or the solid waste handler. 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); Extension county office utility data; statewide auto mileage that includes Extension, Ag. Experiment Stations; car rental mileage; backup generator fuel consumption; propane use; fertilizer use; Cascade Campus; and Hatfield Marine Science Center (HMSC).

Guidance for future inventories

General guidance for future OSU greenhouse gas inventories:

- Use existing inventories, such as this one, as a baseline and framework
- Contact relevant personnel who hold general information first, then find more specialized individuals; seek out people who hold centralized data for the organization
- Maintain a contact list, noting data required, contact information, date of contact and follow up, date of received information and comments
- Begin making contacts well in advance of due date of inventory; be persistent with contact, utilizing telephone and face-to-face visits when necessary

Future Action

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

Reporting

Department of Environmental Quality (DEQ) reporting requirements: A proposed rule to take effect in 2010 calls for likely 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 of this inventory satisfies and exceeds the proposed rule's requirements.

Expanded scope and reporting: Several sources of greenhouse gas emissions were omitted in this inventory for a variety of reasons previously discussed. These sources should be included in order to calculate a high-certainty emissions inventory. Also, for data that are included, efforts should be maintained to obtain the most accurate information available to avoid extrapolation and estimation.

Reductions

Conservation and Efficiency Projects:

Energy Center: A cogeneration facility will replace the existing steam plant and will reduce total GHG emissions by up to 38%. Efficiency gains are due to on-site production of electricity, as well as use of waste heat to create steam. Rooftop solar hot water further increases efficiency of the system.

Small energy conservation projects: incandescent bulbs replaced with compact fluorescents (CFLs); incandescent bulbs in exit signs replaced with LEDs; installation of lighting controls; HVAC upgrades and cleaning; building sustainability audits, focusing on occupant-control and education.

Large energy conservation projects: full-building system upgrades. For example, Bexell Hall lighting retrofit in summer 2008 will cut lighting energy use by about half.

Renewable Energy:

Large-scale solar: In summer 2008, using a third-party ownership model OSU aims to install 100 kW of solar electric capacity on roofs. Third parties install, own and maintain systems for a contract period of 5-20 years, during which OSU purchases the locally produced, renewable electricity. OSU takes ownership of the systems after the contract period. These types of arrangements result from federal and state tax credits, but may be limited to 2008 depending on congressional renewal of federal incentives.

Solar hot water: Dixon Recreation Center or other suitable buildings will receive a large solar hot water system in late 2008 or early 2009. Funded by a grant from Bonneville Environmental Foundation, a $50,000-75,000 system will heat pools and domestic hot water.

Offsets

Although not a true carbon offset, OSU purchases about 75% of its electricity from renewable sources via renewable energy certificates (RECs). In spring 2007, the renewable energy fee was passed by 70% of voting students who imposed upon themselves an $8.50 per student per term fee. For FY 2008, this student contribution resulted in about 66,680,400 kWh of REC's purchased.

Findings Table

Energy

Purchased Electricity	Corvallis Campus electricity usage for FY 2007 was 90,807,301 kWh. The Forest Research Lab at Peavy Arboretum used 104,947 kWh. The station is heated by electricity. The 14 Agricultural Experiment Stations (AES) consumed 4,987,942 kWh. County Extension offices were not included as the data were inconsistent or unavailable. 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 (sharing 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: Coal 73.60% Natural gas 17.50% Hydro 8.65% Wind 0.26% Total FY07 electricity usage for OSU: 95,900,190 kWh
Natural Gas	The Corvallis Campus consumed 5,518,003 therms of natural gas in FY07. Most of this was used at the central steam plant. The Agricultural Experiment Stations used a combined 64,166 therms of natural gas. Total FY07 consumption of natural gas: 551,800 MMBtu
Steam and Chilled water produced off campus	N/A – no steam or chilled water is purchased from outside sources.
On-campus cogeneration	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)	The Corvallis Campus used 162,079 gallons of distillate oil #2 (diesel) primarily at the central steam plant when natural gas supply was curtailed. Backup generators likely used a significant amount, but the only recorded data were from a power outage in February 2007, which consumed 32,000 gallons. Further recordkeeping is necessary. Agricultural Experiment Stations used 4,244 gallons of diesel #2 for heating. Total FY07 consumption of distillate oil #2 (diesel): 166,323 gallons

Propane	Total documented propane use at the Corvallis Campus was 150 gallons, used mainly for backup generator priming and forklifts. Purchasers of propane are scattered throughout campus and there is no centralized recordkeeping. Motor Pool has a new propane filling station, so it is likely that future accounting for propane use at the Corvallis Campus will be more accurate. Agricultural Experiment Stations used 17,372 gallons of propane for heating, forklifts and backup generators. Total FY07 consumption of propane: 17,522 gallons
Incinerated Waste	The Veterinary Medicine Animal Isolation Lab (VMAIL) facility on the Corvallis Campus incinerated 12,216 lbs of waste in FY07. 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 FY07 output was 2300 kWh.
Offsets (green tags, RECs etc.)	Total offsets for FY07: 1270 MWh, RECs purchased with self-directed public purpose charge money.
	Data sources : Roger Admiral, Director of Forestry Operations; Mac McGuire, Landscape Machinery Maintenance; Facilities Services

Transportation

Fleet, Maintenance and mission-related personal vehicle miles	OSU has a fuel pump that fills maintenance and motor pool vehicles. There is also a credit card system that allows individuals on business trips to fill Motor Pool vehicles wherever they wish. This also allows tracking of mileage. In FY07, personal vehicles used 170,588 gallons of gasoline for mission-related driving. This is based on 3.66 million miles reimbursed and 22.1 average mpg. The Motor Pool pump filled a total of 96,800 gallons. The credit card system recognized 78,600 gallons in purchases. Total gallons of gasoline in FY07: 345,988 Total gallons of diesel in FY07: 2,000
	Data sources: Justin Fleming, Motor Pool Manager

Commute

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

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 accounted 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.

Summer students were not included in commute calculations. Little reliable data exist.

Data sources: Robert Monasky, Campus Planner, Facilities Services; Patty McIntosh, Planning Manager, Facilities Services

Air Travel

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.

The extrapolation and calculation are as follows:

Company	# of flights	%
Azumano	4,720	33.2
Teel's	8,199	58.3
Travel Reimbursement	1,194	8.5
	14,113	100

	Azumano booked 16,718,774 miles for OSU. $\frac{4,720}{16,718,774} = \frac{14,113}{x}$ x = 49,989,842 miles total Both Teel's and Azumano stated that approx. 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)*49,989,842 = 52,489,334 miles **Assumptions**: Azumano travel is representative of all OSU travel.
	Data sources: Brad Teel, President, Teel's Travel Planners; Tony Fuerte, Corporate Accounts Manager, Azumano Travel; Julie Stratton, Business Affairs

Other Major Sources

Solid Waste	Total weight of solid waste sent to Coffin Butte Landfill in FY07: 4.72 million lbs (2,360 tons). Coffin Butte recovers methane and produces power, but it is unknown how much methane produced could be attributed to OSU waste.
	Data source: Justin Fleming, Motor Pool Manager, and previous Campus Recycling Coordinator

Animals and Agriculture

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	250				250.00
Beef Cattle	246	286	356	0.22	888.22
Horses	10	4	2	18.83	34.83
Poultry	1665				1665.00
Sheep	932			4.22	936.22
Swine	13			0.14	13.14
Goats				0.25	0.25

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.

Fertilizer

Location	total (lbs)	% nitrogen
OSU - main campus	N/A	N/A
Burns	3600	45
Union	7200	45
Sheep Center	1980	45
Dairy	15000	45
	27780	

Fertilizer application on OSU grounds in inadequately tracked. Even so, this emissions source is like small.

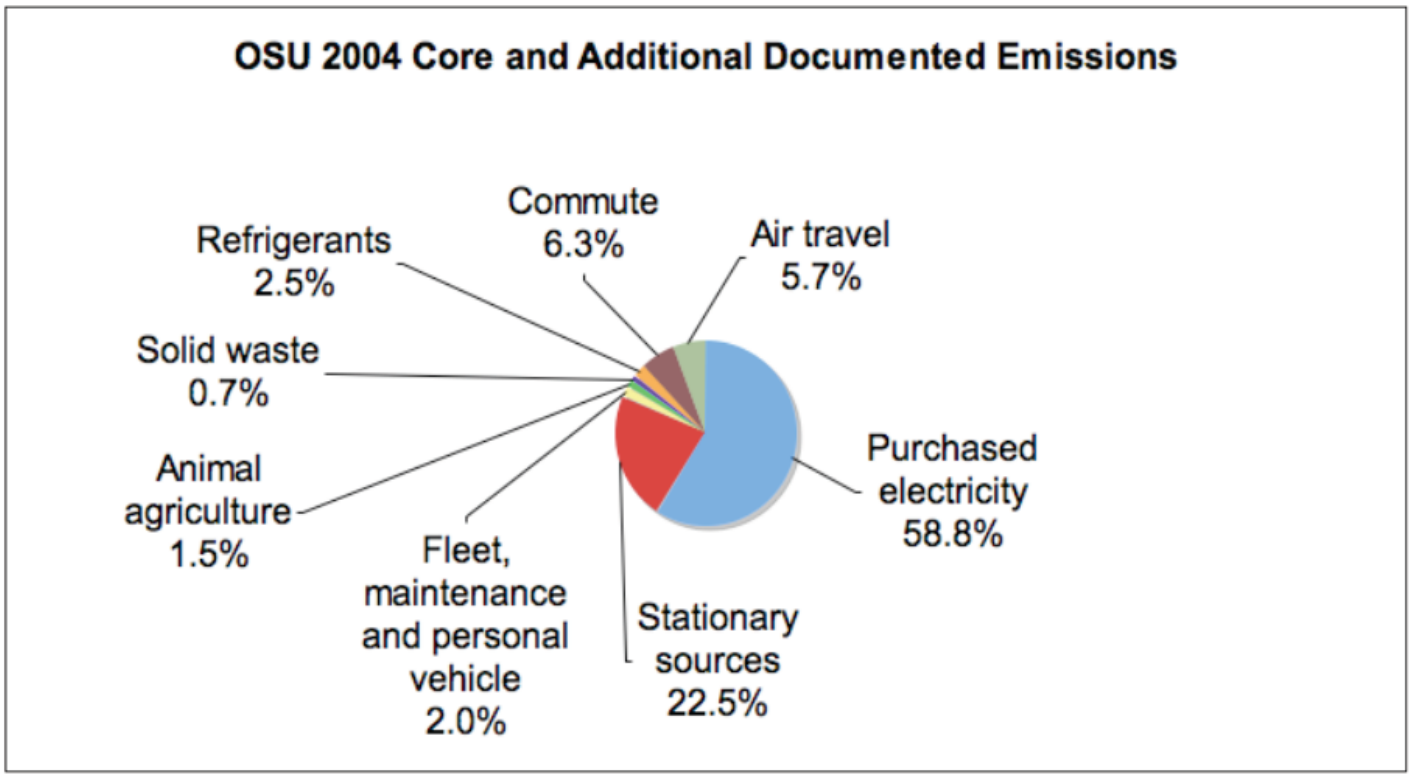
Data sources: Nora Ross, Asst. to the Chair, Animal Science Dept.; Debrah Rarick, Asst. to the Dean, College of Veterinary Medicine; Tim DelCurto, Superintendent, Union Station

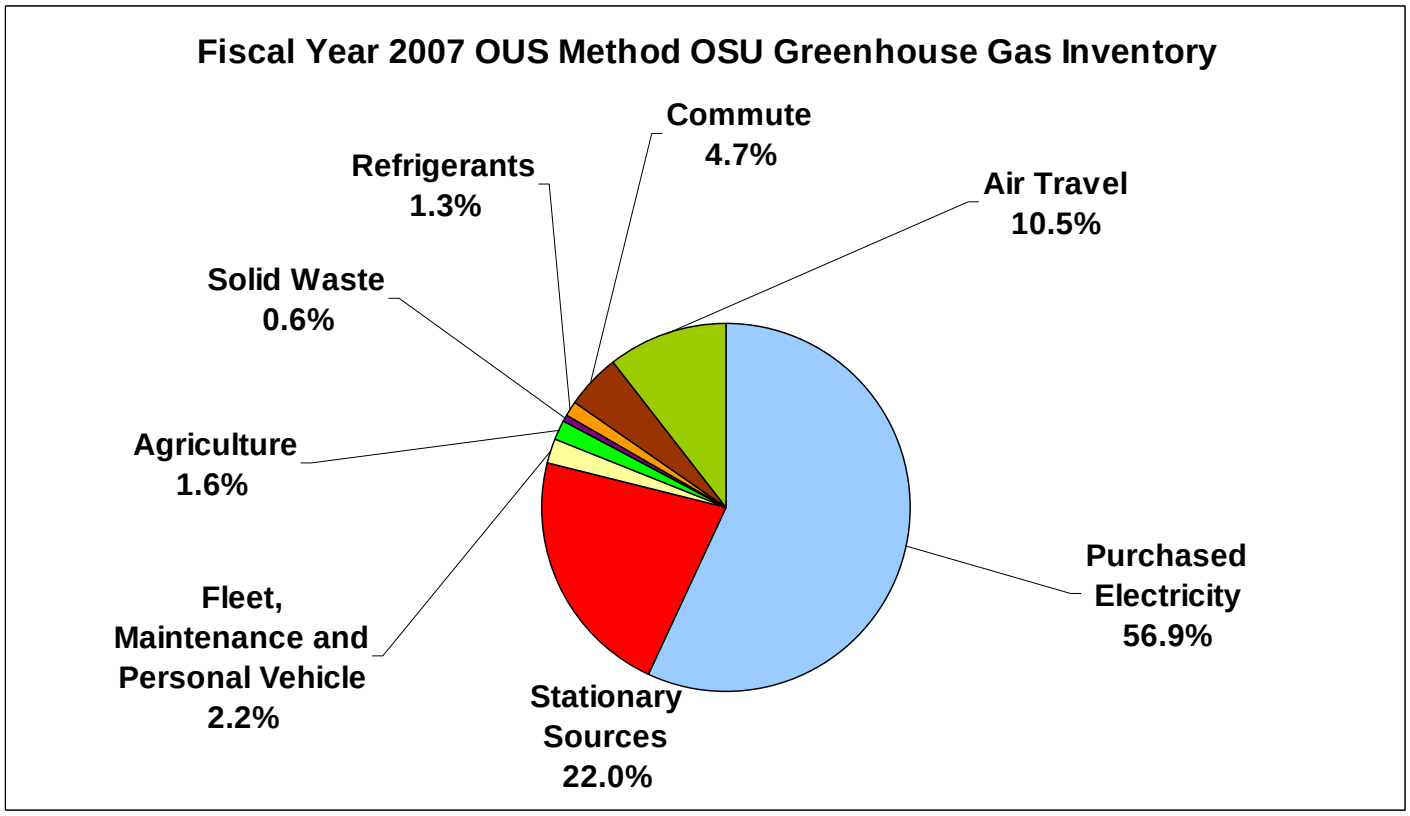
Refrigerants

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 FY07:

Type	Total LBS
CFC-12	78
HCFC-22	366.7
HFC-404A	48
R-502	6

Data source: Greg Riutzel, Refrigeration Mechanic, Facilities Services


OSU 2004 Core and Additional Documented Emissions
Refrigerants 2.5%
Commute 6.3%
Air travel 5.7%
Solid waste 0.7%
Animal agriculture 1.5%
Purchased electricity 58.8%
Fleet, maintenance and personal vehicle 2.0%
Stationary sources 22.5%


Fiscal Year 2007 OUS Method OSU Greenhouse Gas Inventory
Commute 4.7%
Refrigerants 1.3%
Air Travel 10.5%
Solid Waste 0.6%
Agriculture 1.6%
Purchased Electricity 56.9%
Fleet, Maintenance and Personal Vehicle 2.2%
Stationary Sources 22.0%

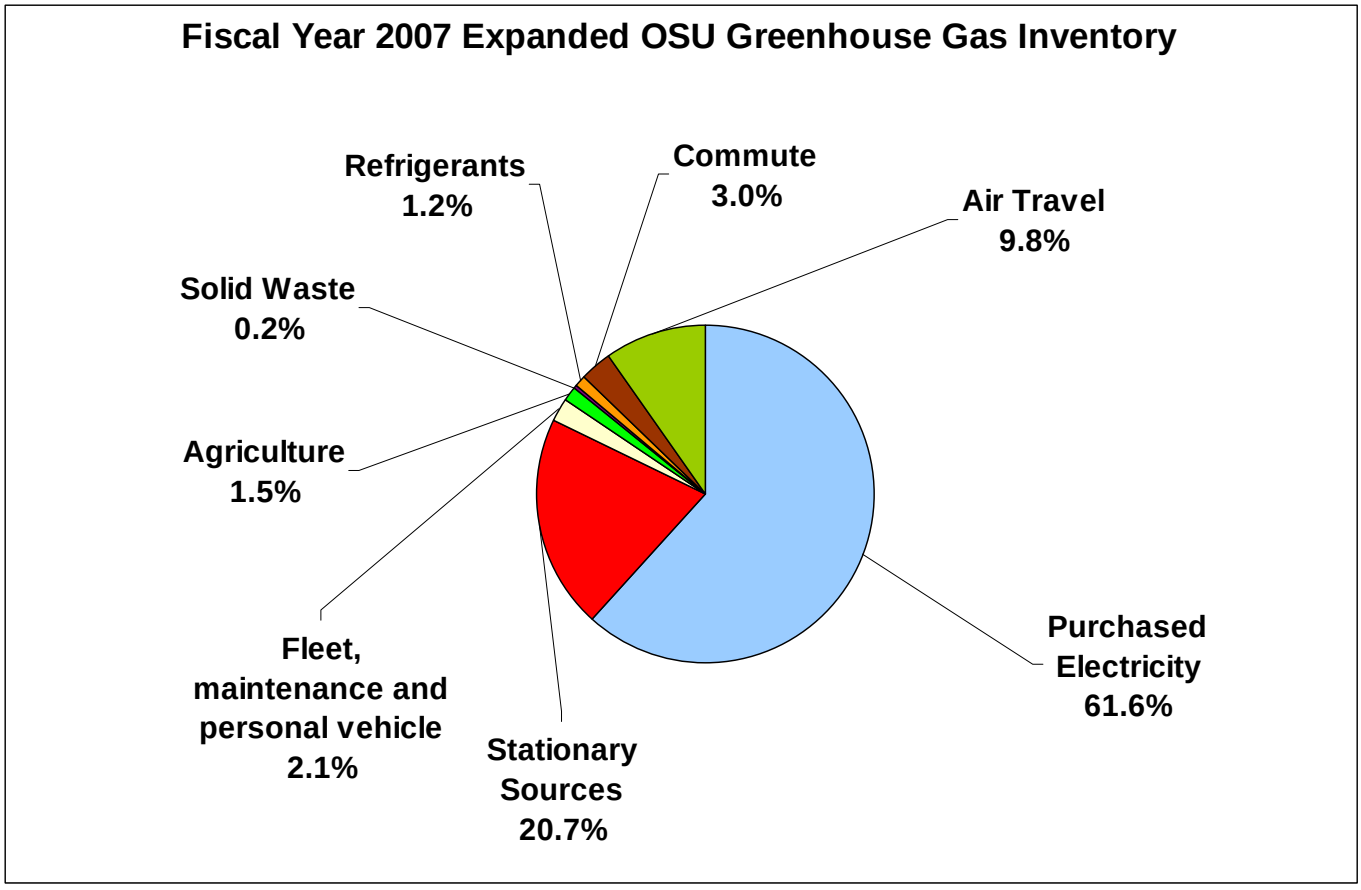
Oregon State University 2004 Greenhouse Gas Inventory

Overview of Emissions						
Oregon State University						
Year	**2004**	Energy Consumption	CO2	CH4	N2O	CO2e
		MMBtu	kg	kg	kg	Metric tonnes
Purchased electricity		349,012	75,236,256	128	132	**75,278**
Stationary sources		542,882	28,684,293	2,868	59	**28,768**
Transportation total		250,971	17,615,594	2,271	943	**17,947**
	Fleet	35,652	2,503,064	500	172	**2,566**
	Commute	111,858	7,852,935	1,571	541	**8,049**
	Air travel	103,460	7,259,595	200	230	**7,332**
Animal agriculture		-	-	76,495	409	**1,881**
Solid waste		-	-	40,009	-	**920**
Refrigerants (specific GHGs not represented in this table)						**3,207**
Total		**1,142,864**	**121,536,143**	**121,771**	**1,543**	**128,001**
Offsets						**-**
	'Green' electric credits					-
	Composting					-
Net Emissions						**128,001**

Oregon State Univeristy GHG Inventory FY 2007

OUS Method

Year	2007	Energy Consumption	CO_2	CH_4	N_2O	CO_2e	% of Total	% Change from '04
		MMBtu	kg	kg	kg	Metric Tonnes		
Purchased Electricity		940,137	79,714,868	1	1	**79,715**	**56.9%**	**5.8%**
Stationary Sources		574,180	30,750,890	3,148	72	**30,845**	**22.0%**	**7.2%**
Transport Total		281,014	24,101,634	2,149	969	**24,438**	**17.5%**	**36.2%**
	University Fleet	43,318	3,043,669	604	208	**3,119**	**2.2%**	**21.6%**
	Commute	91,131	6,401,473	1,262	435	**6,559**	**4.7%**	**-18.5%**
	Air Travel	146,565	14,656,492	283	326	**14,759**	**10.5%**	**101.3%**
Agriculture Total		-	-	91,709	490	**2,254**	**1.6%**	**19.8%**
Solid Waste		-	(671)	38,918	-	**894**	**0.6%**	**-2.8%**
Refrigerants						**1,845**	**1.3%**	**-42.5%**
Total		**1,795,331**	**134,566,721**	**135,924**	**1,533**	**139,992**	**100%**	**9.4%**
Offsets						**(1,235)**		
	'Green' Electric Credits					(1,234)		
	Composting					(1)		
Net Emissions						**138,757**		



Oregon State Univeristy GHG Inventory FY 2007

Expanded Method

Year	2007	Energy Consumption	CO_2	CH_4	N_2O	eCO_2	% of Total
		MMBtu	kg	kg	kg	Metric Tonnes	
Purchased Electricity		991,718	93,166,134	1	1	**93,167**	**61.6%**
Stationary Sources		582,680	31,226,003	3,372	74	**31,326**	**20.7%**
Transport Total		252,468	22,096,133	1,755	833	**22,383**	**14.8%**
	University Fleet	43,318	3,043,669	604	208	**3,119**	**2.1%**
	Commute	62,585	4,395,972	868	299	**4,504**	**3.0%**
	Air Travel	146,565	14,656,492	283	326	**14,759**	**9.8%**
Agriculture Total		-	-	88,397	637	**2,222**	**1.5%**
Solid Waste		-	(671)	15,049	-	**345**	**0.2%**
Refrigerants						**1,845**	**1.2%**
Total		**1,826,866**	**146,487,598**	**108,574**	**1,545**	**151,287**	**100%**
Offsets						**(1,235)**	
	'Green' Electric Credits					(1,234)	
	Composting					(1)	
Net Emissions						**150,053**	