Sustainability: The Next Step
Estimating the University of Wisconsin – Green Bay's Carbon Footprint

Chapter 1
Scope 1 – Direct sources of GHG emissions from sources that are owned or controlled by the university

University of Wisconsin – Green Bay
Seminar in Environmental Science and Policy
Capstone Course
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Introduction

This report represents one portion of an integrated project to develop a greenhouse gas (GHG) emissions inventory for UW-Green Bay. The project was the result of discussions by the fall 2007 Seminar in Environmental Science and Policy capstone course. The discussion began in response to a Declaration and a Commitment that would require the University to make the UW-Green Bay campus more sustainable while addressing the issue of global warming through the neutralization of its own GHG emissions. The Seminar class realized that the extensive nature of a project like this coupled with the limited time frame of a semester long course was a large task. But in the end, the opportunity to help UW-Green Bay take another step toward sustainability was too good to pass up. This report describes the Scope I Team contributions towards the development of the overall GHG emissions inventory for UW-Green Bay.

The American College & University Presidents Climate Commitment (ACUPCC) defines Scope 1 as a category of greenhouse gas emissions from fossil fuels, fertilizers and refrigerants combusted and consumed on campus. This includes combustion of natural gas for heating and cooling and for laboratory equipment, use of fuel oil in generators, gasoline and diesel fuel for grounds-keeping and fleet vehicles, propane usage, and hydro-fluorocarbons (refrigerants) for food services and air conditioning. Hence, Scope 1 Team collected all on-campus energy usage records as specified by the campus carbon calculator input tab (Appendices VIII-XI). The objectives of the Scope 1 Team were to access UW-Green Bay records of on-campus fossil fuel consumption, grounds fertilizer, and refrigerant replacement for fiscal years 2001 through 2007 (June start, July end) and to convert these yearly totals for entry into a calculator for reporting purposes.

Methodology

The Seminar class used the Clean Air-Cool Planet Campus Carbon Calculator v5.0 ("calculator") to perform UW-Green Bay's greenhouse gas inventory calculation and analysis. When necessary, data from UW-Green Bay energy consumption records were converted to units of measurement specified by the calculator; for instance, units of natural gas consumed were converted from Therms into MMBtu (million British thermal units). For a more in-depth discussion on the calculator used, please see Chapter 5 of the overall project, or visit the Clean-Air Cool Planet website. Scope 1 data collection involved contacting several UW-Green Bay departmental directors to access energy usage records. Data requests were structured to match the format of input categories in the Clean Air-Cool Planet Campus Carbon Calculator spreadsheets. The sections of this chapter also mirror the Calculator's input categories format; namely, *On Campus Stationary Sources, Transportation, Agriculture,* and *Refrigerants.*

On-Campus Stationary Sources

The Scope 1 Team's first contact was Mr. Chris Hatfield, Director, UW-Green Bay Facilities Management and Planning. Mr. Hatfield confirmed that UW-Green Bay does not have an on-campus cogeneration plant and only generates power in cases of emergency. But, he provided the Team with natural gas expenses/usage for FY 2001 through FY 2007 for ten academic buildings, the University Union, the Weidner Center for the Performing Arts, the concourse system on campus, and for two natural gas-powered university fleet vehicles (figure1.1). The natural gas consumed specifically by the two vehicles could not be separated

out of the grand total natural gas usage, but the percentage of the grand total used by these vehicles is quite small (Hatfield 2007a).

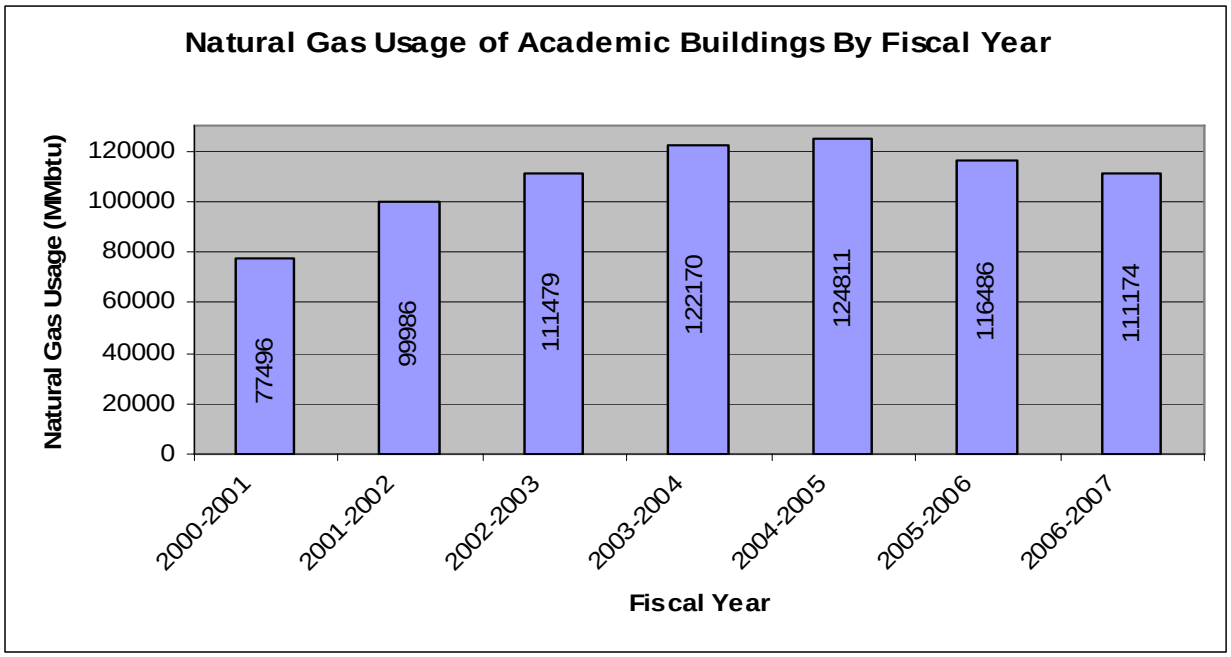

Figure 1.1 Total natural gas usage by campus academic buildings and natural gas powered fleet vehicles by fiscal year.

Natural gas data for other campus buildings includes the golf course pro shop, the Language House, the Chancellor's house, the University Union, and the Lambeau House (Fig.1.2). It should be noted that the amount of natural gas consumed by the other facility buildings is quite small compared to the academic buildings, as the scale used in the graph of other buildings is one tenth of that used for the academic buildings.

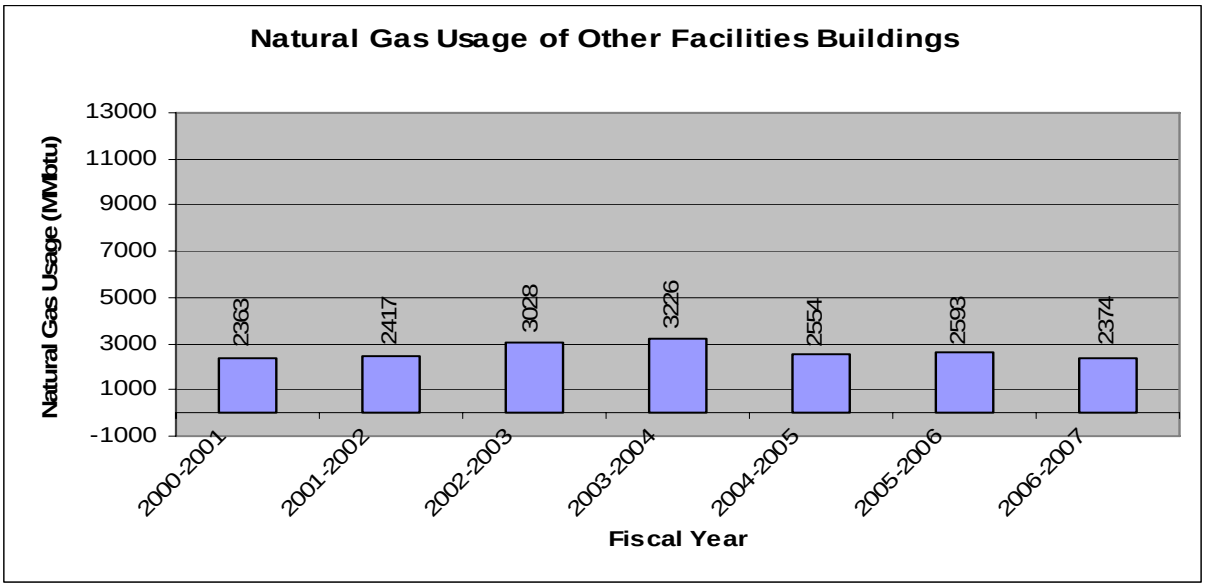

Figure 1.2. Natural gas usage of other facility buildings by fiscal year

To obtain data regarding natural gas consumption in UW-Green Bay Residence Life buildings, Scope 1 Team contacted Mr. Steve Gering, Assistant Director of Facilities Operations. The University has two major Residence Life Complexes: dorms (Fig.1.3) and traditional apartments (Fig.1.4). Residence Life also maintains three other campus buildings (Fig.1.5). Again, it should be noted that when compared to natural gas usage in campus academic buildings, the amount used in the dorms and apartments is quite small, as the scale on the y-axis of the graph for both dorms and apartments is one tenth of that used in the academic buildings graph. Furthermore, the amount of natural gas used by the 'other residence life buildings' is almost negligible, as the y-axis on the graph is one tenth of that used for the dorms and apartments or one one- hundredth of that used for academic buildings.

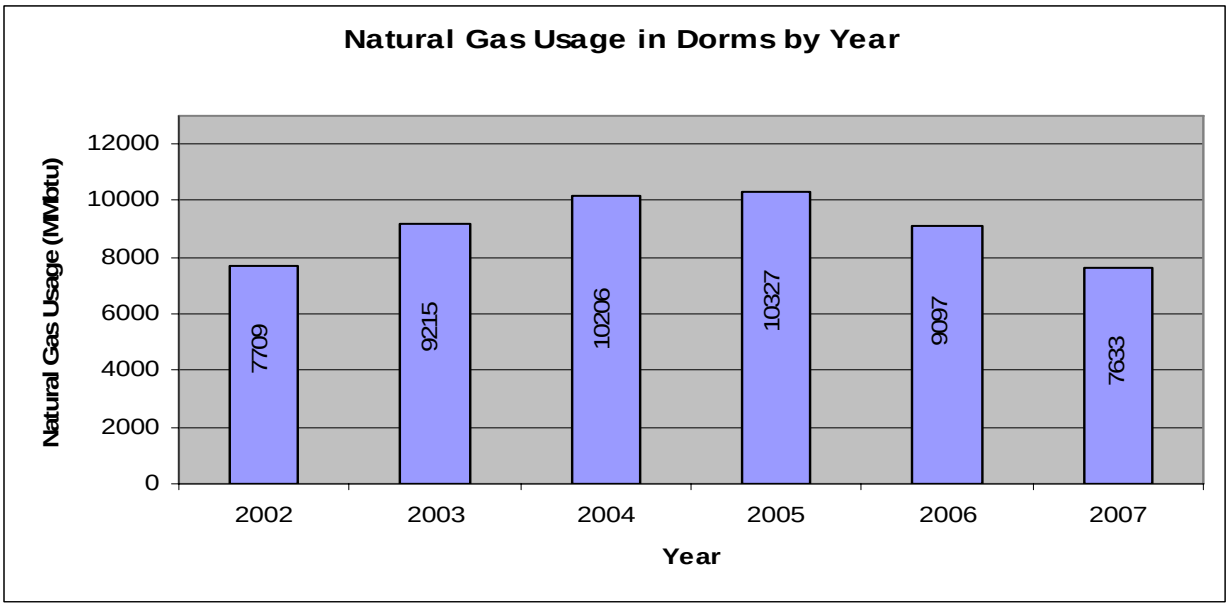

Figure 1.3 Total natural gas usage in campus dorms per fiscal year.

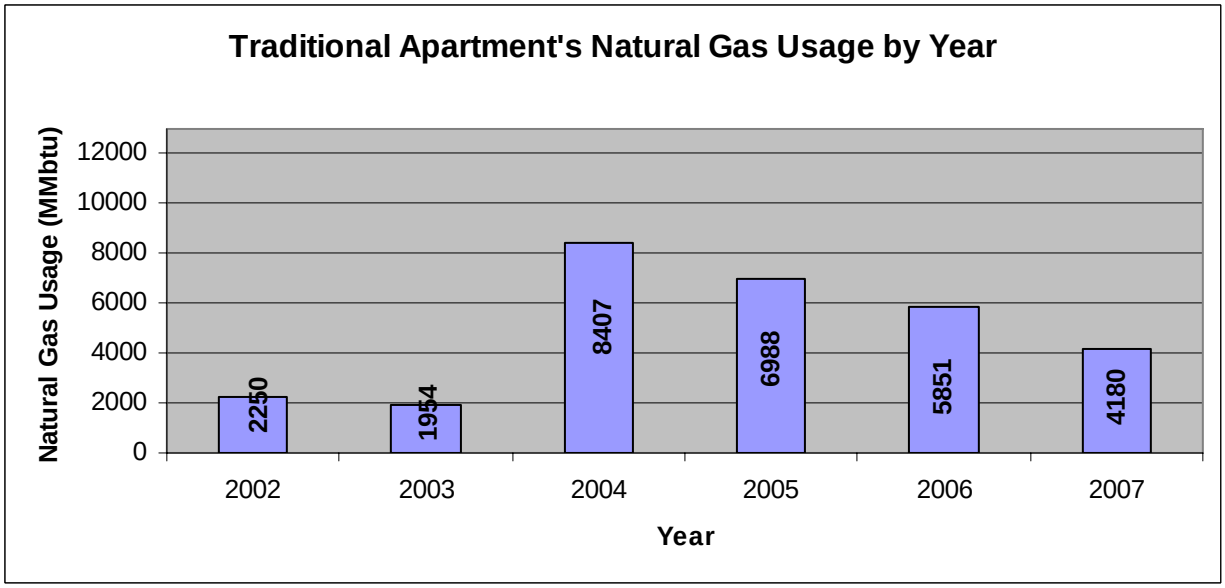

Figure 1.4 Total natural gas usage in campus apartments per fiscal year.

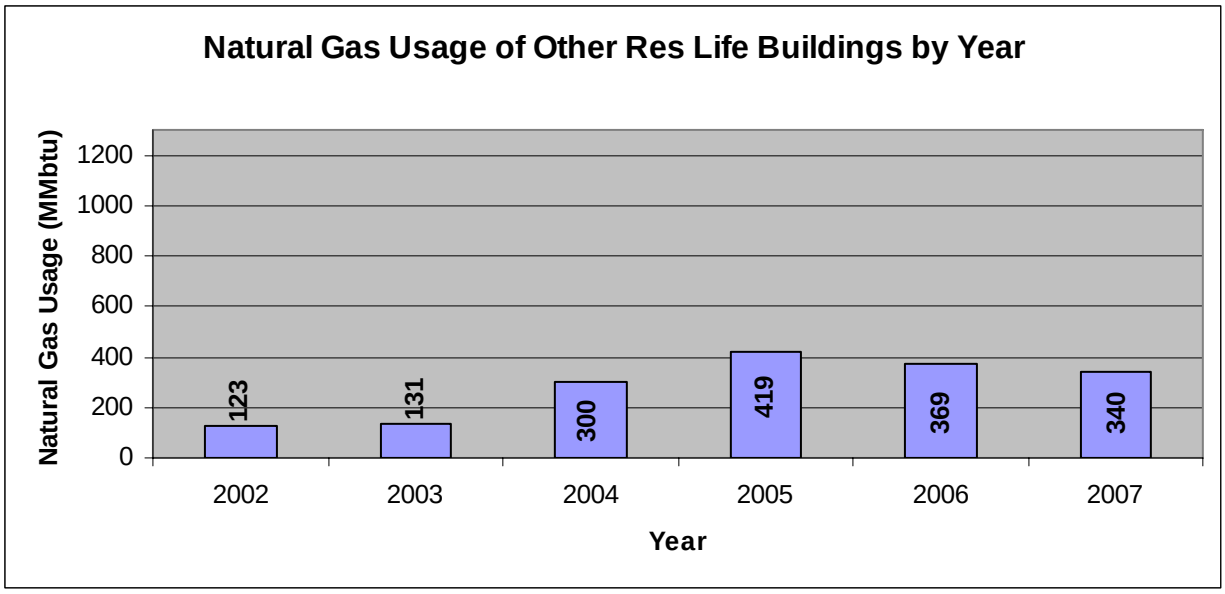

Figure 1.5 Total natural gas usage of all other residence life buildings per year.

The University does not use residual oil as specified by the Calculator. Figure 1.6 shows the data provided on the small amount of numbers 1 & 2 distillate oil used by UW-Green Bay (Hatfield 2007a).

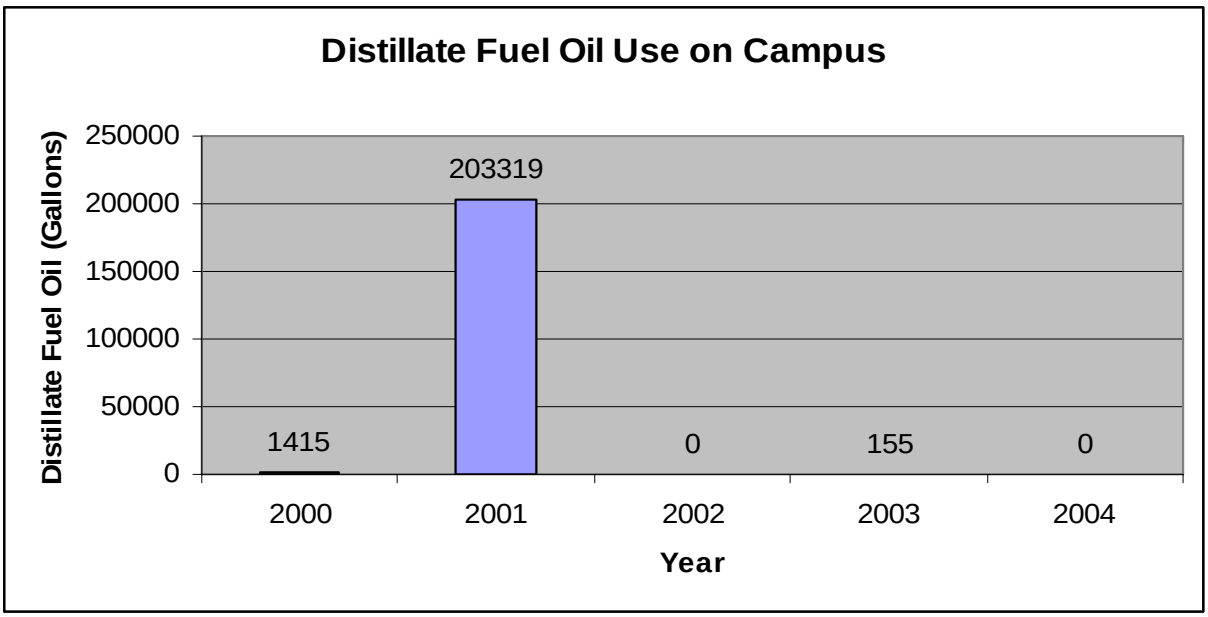

Figure 1.6 Total distillate fuel usage on campus per year.

The Carbon Calculator provides for inclusion of solar energy as a variable in calculation of the total carbon emissions equivalent. UW-Green Bay operates two separate solar energy technology stations. Solar panels provide heat to the swimming pool in the Phoenix Sports Center. The energy supplied by these solar panels is calculated in the following manner: Wisconsin Public Service, the energy utilities provider for UW-Green Bay, calculates the cost of equivalent energy supplied by standard fossil fuel processes and charges the University this dollar amount; payment is then passed on to the company that installed and serviced the solar panels for the University; however, this company failed in January, 2007, and since then, the University has paid nothing. Unfortunately, the solar panels began malfunctioning, so they have been shut down since the summer of 2007 pending maintenance. Solar energy produced for heating of the swimming pool during fiscal years 2005 through 2007 are 366.8, 462.6, and 70.8 MMBtu, respectively. Also, photovoltaic cells have provided approximately 17,000 KWh per year to Mary Ann Cofrin Hall since they were installed in 2001 (Hatfield 2007b).

Transportation

Mr. Hatfield also provided the team with gasoline and diesel consumption records for vehicles assigned under Facilities Management, including gas-powered machines such as lawn mowers; however, available data covered only fiscal years 2005 through 2007 (figure 1.7) (Hatfield 2007a). It should be noted that gasoline for the University fleet has contained 10 percent ethanol since 2004. Mr. Rick Warpinski, Director of the University Union and Shorewood Golf Course provided records for gasoline consumed by vehicles assigned to the UW-Green Bay Shorewood Golf Course during FY 2007 (Warpinski 2007).

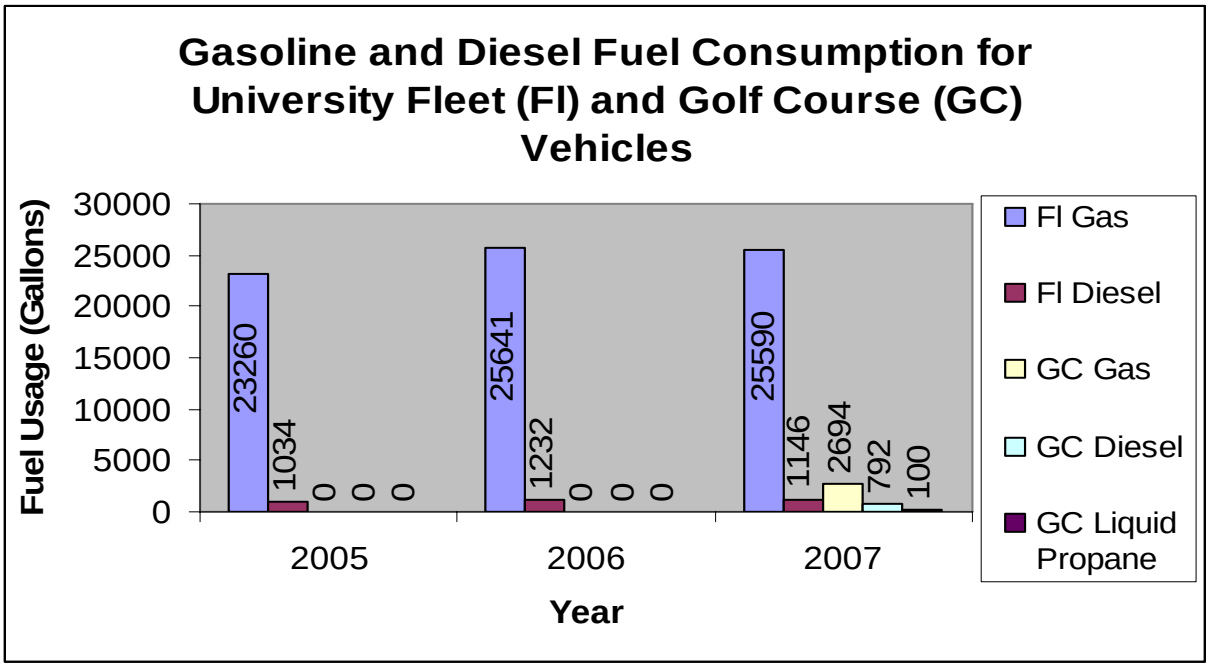

Figure 1.7 Gasoline and diesel fuel consumption for fiscal years 2005-2007.

Agriculture

The University does not keep any of the animals listed under the Agriculture Section in the Campus Carbon Calculator. However, due to the off gassing of nitrous oxide after the application of fertilizers containing nitrogen, fertilizer use data was requested by Scope I Team. Data for fertilizer application on UW-Green Bay land holdings was available only for FY2007. Approximately 13,050 pounds of fertilizer containing 24 percent nitrogen were applied to campus athletic fields, the chancellor's residence, and several other UW-Green Bay land holdings (Van Lanen 2007). Approximately 14,312 pounds and 16 gallons of fertilizer, containing various percentages of nitrogen, were applied to the Shorewood Golf Course grounds (Warpinski 2007). Total weight of nitrogen in the fertilizers applied to the golf course grounds, based on percentages listed in the data was approximately 3,065 pounds.

Because the Seminar class determined to run the calculator for FY 2001 through FY 2007, data was needed for each category within the reporting period. With three years of

University fleet fuel records, we formulated an average that we entered into the calculator for the missing years; this process is noted in the Carbon Calculator. With only one year of data on fertilizer use, even an average is unobtainable. However, FY 2007 fertilizer data and information is provided in this report in anticipation of future efforts to estimate UW-Green Bay carbon emissions. Total weight of fertilizers applied to UW-Green Bay land-holdings in FY 2007 (27,362 pounds with an average nitrogen content of 22.6%) is entered into the Campus Carbon Calculator for each of the seven years—FY 2001 through FY 2007—that the Seminar class chose to estimate.

Refrigerants

Refrigerants data were obtained from UW-Green Bay records of both refrigerant leaks and replacement purchases. One 200-pound leak of the hydro-fluorocarbons (HFC) R-134a from the #1 chiller in the campus Heating & Cooling plant was recorded on March 10, 2006 (Bailey 2007). A leak of the hydro-fluorocarbons (HCFC) R-22 was discovered and repaired in August of 2006; although the amount of R-22 emitted from this leak was unavailable, a list of replacement purchases was provided to the Scope 1 Team (Kinjerski 2007). Total gallons of refrigerant replaced due to leakage/use during fiscal years 2005-2007 can be seen in figure 1.8.

Refrigerants are included in the UW-Green Bay GHG emissions calculation because of the Global Warming Potential (GWP) of HCFC and HFC greenhouse gases. The GWP of R-134a is 1,300. In other words, one pound of R-134a is equivalent to 1,300 pounds of CO_2. The GWP of R-22 is 1,700; one pound of R-22 released into the atmosphere is equivalent to 1,700 pounds of CO_2.

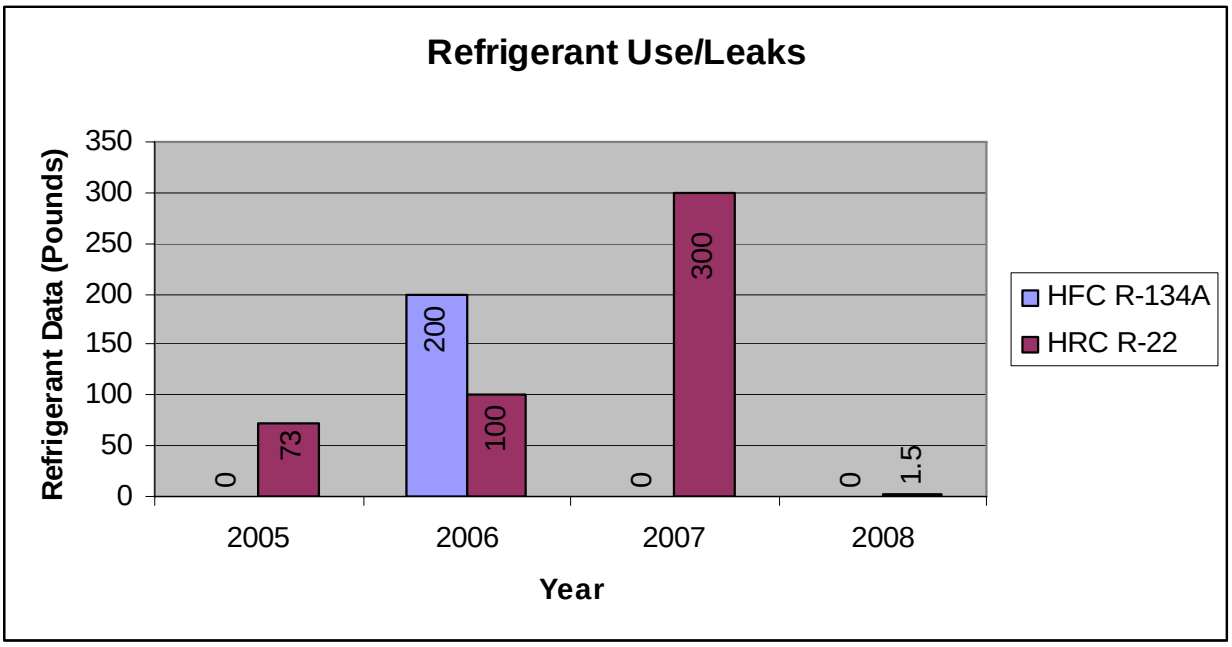

Figure 1.8 Total gallons of refrigerant replacement due to use/leakage for fiscal years 2005-2007.

Other

Finally, there are additions to Scope 1 of data that are actually classified as belonging to the Scope 3 indirect emissions category. The Seminar class chose to assign this particular portion of Scope 3 emissions data to Scope 1 since the goal of this first attempt to estimate carbon emissions of UW-Green Bay was to gather as much data as possible while preserving accuracy. The Seminar class was able to access Scope 3 indirect emissions data regarding

energy for drinking water supply and wastewater treatment from FY 2001 through FY 2007. However, the calculator did not provide an input category for fossil fuel emissions resulting from water pumping or wastewater treatment. So, where natural gas or distillate oil was used for water supply or treatment, data was estimated and the emissions data was added into the Scope 1 category. Also, where electricity was used for water supply or treatment, data was again estimated and the emissions data was added into the Scope 2 category. For a further explanation of the assignment of Scope 3 indirect emissions data, refer to Chapter 3 and its report on Scope 3 indirect emissions.

Results

The results provided are derived from the final version of the UW-Green Bay Fall 2007 Greenhouse Gas Emissions Inventory developed with the use of the Clean Air-Cool Planet Campus Carbon Calculator v5.0. All of the results provided are presented as metric tons of eCO_2. An eCO_2 is the international standard unit used to compare the amount of emissions from various greenhouse gases based upon the amount of CO_2 that would have the same global warming potential (CA-CP v5.0).

Figure 1.9 shows the annual amounts of UWGB emissions broken down by the three different scopes. This is provided to give a reference point for the amount of eCO_2 emissions of scope I compared to the other scopes. For more specific discussions on the emissions of scope 2 & 3, please see chapters 2 & 3 respectively.

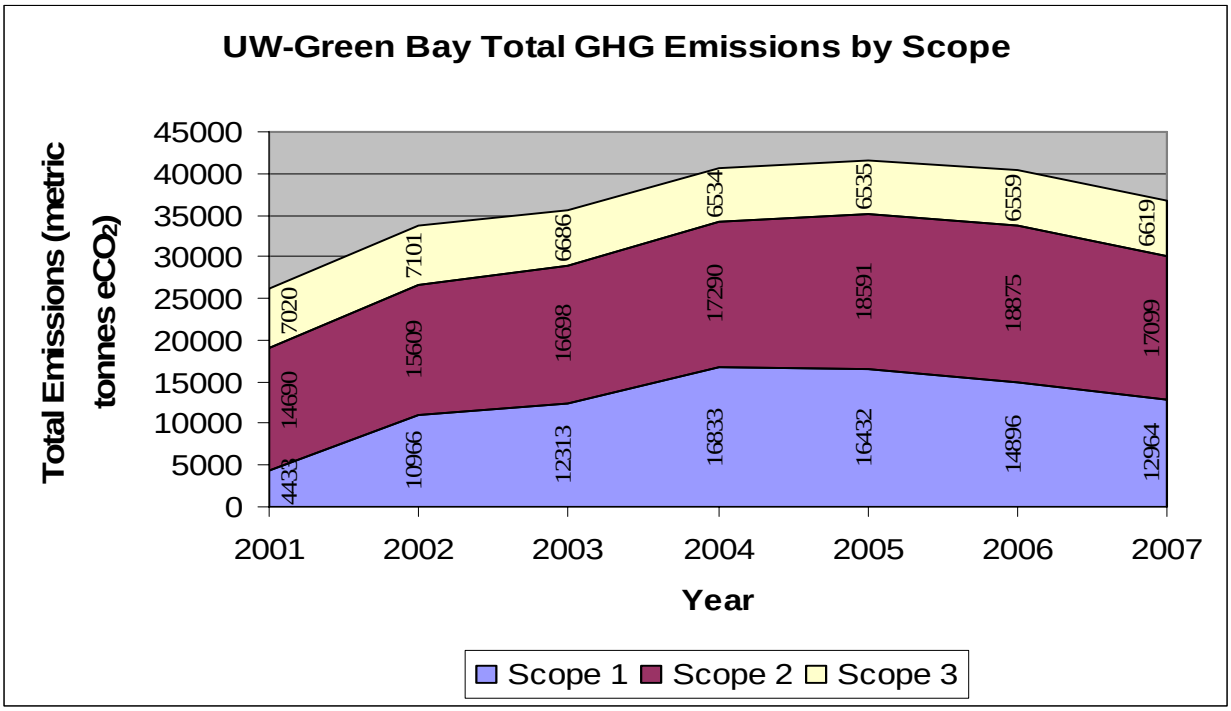

Figure 1.9 Annual amounts of emissions in eCO_2 for UWGB by scope.

Figure 1.10 provides a listing of the final total amounts of on-campus stationary and mobile sources of GHG emissions. With the available data for scope I sources, there is a noticeable increasing trend between FY2001 and FY2004. Once this trend ends, there is a trend downward for eCO_2 emissions. Fiscal years 2003 and 2007 both show a similar amount of eCO_2 being emitted.

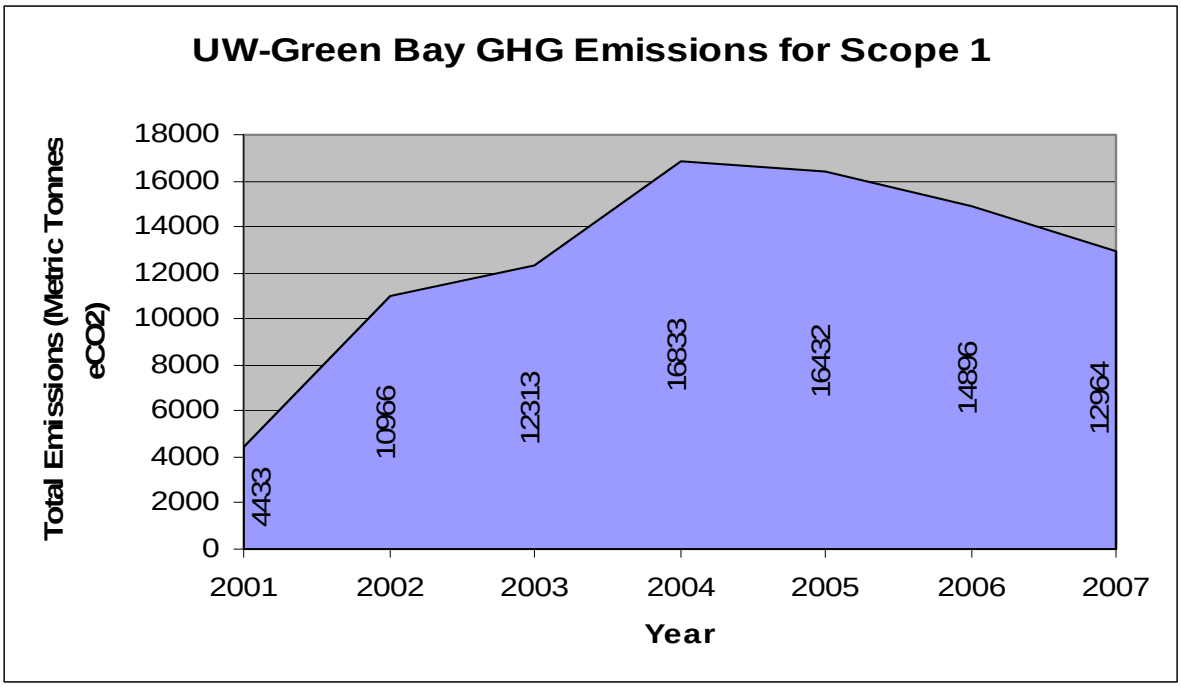

Figure 1.10 Total scope 1 emissions in eCO_2 per fiscal year.

Discussion

For Scope I Team, the most difficult area of the project was developing an understanding of both emission sources and the UW-Green Bay administrative structure that monitored the source data. In many instances, the helpfulness of UW-Green Bay staff and faculty enabled our success. While there are categories in which data are incomplete, the available data provide a starting point, or at the very least, a snap shot in time. Even with incomplete data, however, several interesting trends are noticeable when the existing data are coupled with information regarding campus energy management policies.

One of the more distinctive and telling trends is related to individual levels of accountability for emissions. In Figure 1.4 we see an almost 77% increase in the amount of natural gas used in the Apartments between 2003 and 2004. This increase in natural gas consumption correlates with the removal of natural gas meters that had recorded usage per

individual apartment and the switch to a flat rate for natural gas that is now included in student housing fees (Gering 2007). With this change in billing procedures, a feedback mechanism that very likely hindered exploitative use of natural gas by individual residents is no longer available.

Another area where we see an increase in natural gas consumption is during periods of expansion. UW-Green Bay has continued to grow, and several new structures have been added to the Residence Life complexes. The increase in square footage of building space has, of course, meant an increase in consumption of natural gas. Figure 1.5 shows a steady increase from FY2002 to FY2005 in natural gas consumption in the residence life buildings. Interestingly, Mr. Gering points out that education of resident students in energy use habits, as well as improvements in energy technologies has resulted in a subsequent decrease in energy consumed per capita; this reduction is evident in the natural gas usage tables which can be found in this chapters appendix.

Conclusions and Recommendations

In conclusion, the following recommendations provide what the Scope I Team feel are the next steps necessary in continuing the development of further refined UW-Green Bay GHG emissions inventories. "The Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard"(WRI 2004) can be a useful tool for guiding the development of specific UWGB internal policies for collecting, quantifying, maintaining and reporting GHG emissions inventory data. The Scope I Team provides the following recommendation for the Campus Sustainability Committee.

- Develop internal policies within UWGB administrative structure to more easily capture all data necessary for future emissions inventory updates. Specifically:
    - Official designation of responsibility and notification to all UWGB administrative and faculty departments of the Campus Sustainability Committee's responsibility and authority to collect these data along with suitable deadlines for compilation.
    - Development of a reporting format in conjunction with the faculty in charge of data collection. Dialogue regarding reporting requirements and formats would facilitate working relationships between the parties involved and reduce the likelihood of wasted efforts due to requests for non-existent or useless data sets. The appendices contain the "input" worksheets used to collect the current data and are a suitable and consistent format to use.
- Specific recommendations per sub-category in scope I emissions include:
    - Under On-campus Sources; natural gas usage should be inventoried not only per building, but also per unit as well as the cost per unit. This could assist in identifying where best to begin reduction efforts.
    - Under Transportation; fleet vehicle information should include vehicle mpg/ fuel type/ miles traveled. Because fleet size was recently reduced and there is a heavier reliance on privately owned vehicles for carrying out University business, an electronic tracking system for reimbursement forms is needed. Specific information that could be included for the reimbursement forms would be the same as the fleet vehicles.
    - Under Refrigeration and other Chemicals; more information should be gathered and/or preserved regarding the types of refrigerants and other chemicals used on

campus, the current procedures for disposal of these refrigerants and chemicals, and the potential eCO_2 emissions resulting from the use, leakage, or disposal of each respective refrigerant, chemical, or possible substitute.

Citations

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