Report on Greenhouse Gas Emissions during Fiscal Year 2007

Summary: Williams' greenhouse gas emissions were approximately 22,800 metric tonnes eCO_2 in fiscal year 2007, down from approximately 29,700 metric tonnes eCO_2 in fiscal year 2006, a decrease of 23%. Williams' target of 10% below 1990 levels equals 19,178 metric tonnes eCO_2 (Fig. 1).

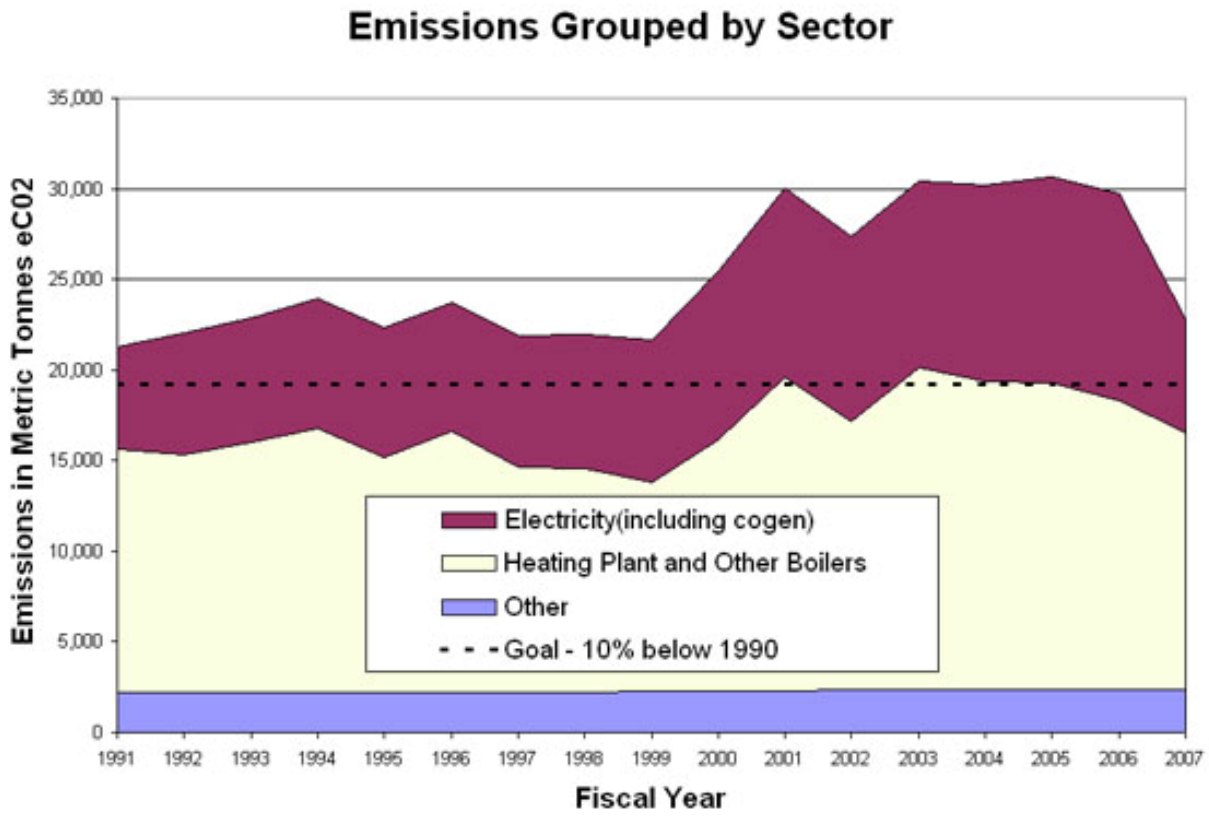

Figure 1. Greenhouse Gas Emissions 1990-91 to 2006-07
Other includes: estimated emissions associated with fertilizers, faculty/staff commuting, etc.

Sources of Reduction:

1. **Electricity Purchase**: Starting in the spring of 2006, Williams purchased electricity from Transcanada, an electricity provider that uses a substantial portion of large-scale hydro power. We estimate that the purchase of the Transcanada electricity accounted for approximately **60%** of the reduction.
2. **Conservation at the heating plant and other boilers:** The central heating plant required less energy input per unit of heat produced than in previous years. Part of that decrease was due to increased monitoring and fine tuning of building heating systems, and part was due to increased efficiency in how the central plant boilers themselves were run. The decreased energy needs at the heating plant accounted for about **17%** of the total reduction.
3. **Use of additional natural gas at the heating plant:** Williams' central heating plant can burn either natural gas or residual oil. Natural gas emits less greenhouse gas per heating unit than residual oil, but is often more expensive. In the past, Williams' decision on whether to burn natural gas or residual oil has been based primarily on cost and permitting requirements (Williams is restricted in what time of the year it can burn residual oil). In fiscal year 2007, however,

Williams burned a higher percentage of natural gas than usual, which reduced emissions. This switch accounted for about **12%** of the overall reductions.

4. **Electricity Conservation:** Electricity use decreased significantly in several large buildings on campus, as well as in many smaller office buildings and most dorms. Dorms overall were down approximately 7% from the previous year, showing the impact of student conservation efforts. The largest decreases in electricity use in non-residential buildings came from efficiency improvements in the central chiller (which cools many campus buildings north of route 2) and the heating plant, which saw decreases of 20% and 6%, respectively. Installation of energy efficient lighting and lighting controls in Hopkins Hall, Sawyer Library, and Thompson Chapel contributed to decreases of 9%, 32%, and 33%. Behavioral changes by staff have also had significant impacts; custodians have been turning off lights in Chandler Athletic Center (10% decrease in use) and Lansing Chapman rink (16% decrease in use), and staff in Mears and Vogt (both 6% decrease) have worked hard to turn off lights and computers at the end of work days. Electricity in general accounts for a smaller percentage of campus emissions than the heating plant and other boilers, so reductions in electricity use have a smaller impact than reductions in heating plant energy use, but they still accounted for about **6%** of overall emissions reductions.

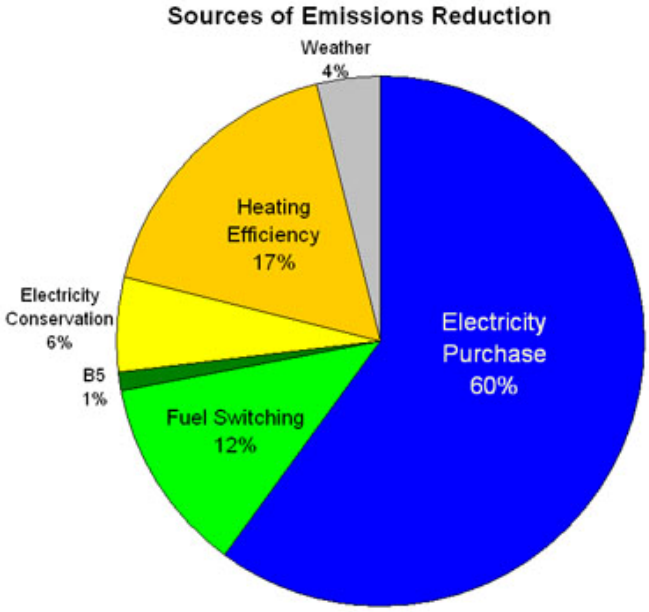

Figure 2: Sources of Emissions Reductions as a Percentage of Total Reductions from Business as Usual 2007 to Actual 2007

5. **Weather effects:** Fiscal year 2007 was warmer during the winter and cooler during the summer than average, which reduced heating and cooling requirements. We roughly estimate that the weather accounted for around **4%** of overall reductions.
6. **Use of B5 in place of distillate fuel oil:** Most buildings on the Williams campus are heated by steam supplied by the central heating plant. Some buildings that are far from the center of campus have their own individual boilers, and all buildings have small boilers to provide hot water during the summer when the heating plant is shut down. All of the individual boilers normally burn distillate oil (normal home heating oil). In fiscal year 2007, Williams burned B5 in all of those individual boilers. B5 is a 5%/95% mix of biodiesel and distillate oil. It can be burned in place of distillate oil with no changes in equipment, though it does cost more than plain distillate oil and tends to require more frequent filter changes. The switch to B5 accounted for approximately **1%** of the overall reductions.

What we did well this year, and challenges for the future:

While the reduction in greenhouse gas emissions is exciting and commendable, a large portion of the decrease came from Williams' purchase of electricity from Transcanada, a provider that uses a high percentage of large scale hydro power compared to other providers in the region. Those emission reductions are less reliable in the future and less direct in the present than reductions as a result of actual decrease in energy use. The purchase of that electricity sends a message to the market that renewable

electricity is viable, and indirectly encourages the development of new renewable energy, but doesn't directly help to develop new renewable electricity or decrease energy consumption.

Student and staff attention to energy conservation made a clear difference in electricity use in many buildings, most notably in dorms, athletic facilities and small office buildings. The challenge in such buildings will be in maintaining the lower levels of energy use over time. Decreasing energy use in large public spaces, such as the Center for Theatre and Dance, the Paresky Center, and Morley Science Center will likely prove much more challenging for a variety of reasons: (1) they are more technically complex; (2) they support a variety of activities in common or public spaces; (3), there are expectations of near round-the-clock operations; (4), there is a less direct perception of responsibility for energy consumption than in housing or smaller offices, and (5) any policy and technical changes affecting such spaces will need to involve more people.

The Facilities department found many opportunities for energy efficiency improvements that were relatively inexpensive, easy to implement and largely invisible and non-disruptive to the campus at large, most notably at the central chiller and the heating plant. However, those improvements were some of the "low hanging fruit" and such gains in efficiency may be difficult to achieve in the future. Future projects may involve more capital investment or require more changes to campus lifestyle or culture.