Report on Greenhouse Gas Emissions during Fiscal Year 2011

Summary: As of FY11, Williams is nearly 75% of the way toward reaching our greenhouse gas emissions goal of 10% below 1990's level by 2020.

These emissions were approximately 20,400 metric tonnes eCO_2 in 1990/91. They increased to approximately 33,000 metric tonnes in FY05 due to added buildings and increased energy use in existing buildings. Concerted efforts to reduce energy consumption and emissions starting in FY07 have lowered annual emissions to 23,600 tonnes in FY11.

Emissions in FY11 were down approximately 1% from the previous year and 29% from peak emissions in FY05. See Figures 1 and 2 and Table 1. In Figure 2, Scope 1 includes all direct emissions from the central heating plant and other campus boilers. Scope 2 includes indirect emissions from purchased electricity, and Scope 3 includes other indirect emissions (mostly from car travel by faculty, staff and students). Williams does not include air travel in our Scope 3 calculations at this time.

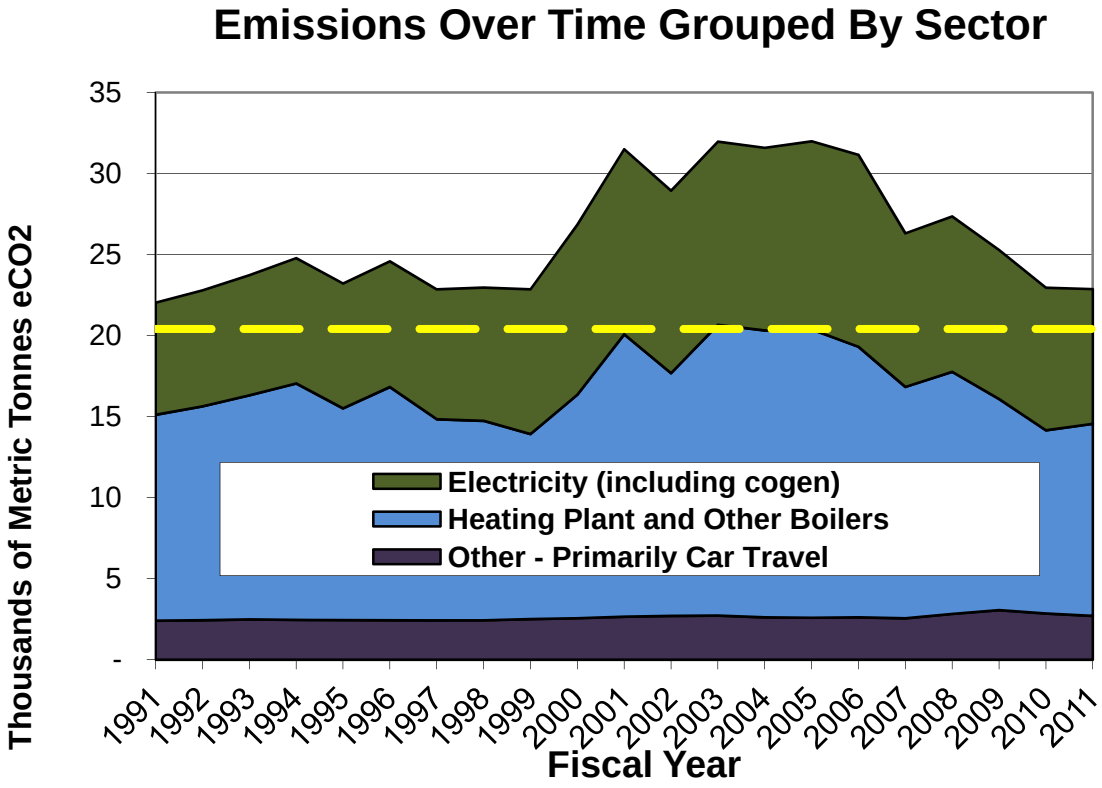

Figure 1: Greenhouse Gas Emissions from fiscal year 1991 through 2011

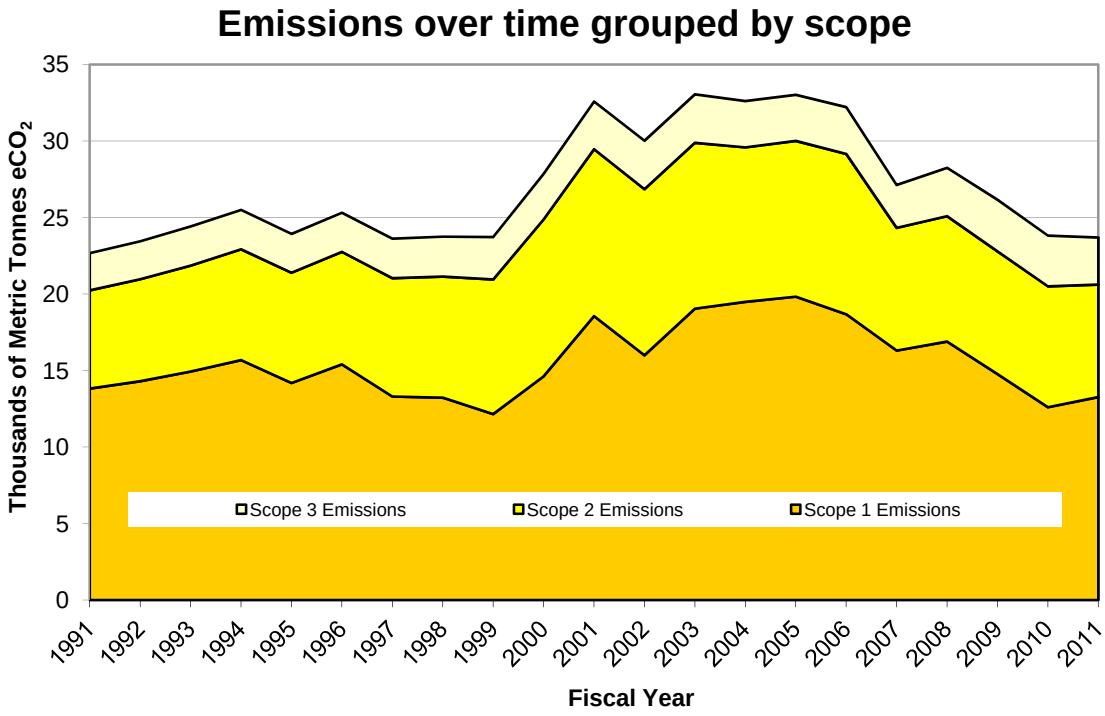

Figure 2: Greenhouse gas emissions by scope from fiscal year 1991 to 2011

Fiscal Year	Total Emissions (metric tonnes $eC0_2$)	% Decrease from Previous Year	% Decrease from Peak in FY05
2005	33,000		
2006	32,195	-2.4%	-2.4%
2007	27,108	-15.8%	-17.9%
2008	28,165	3.9%	-14.7%
2009	26,079	-7.4%	-21.0%
2010	23,737	-9.0%	-28.1%
2011	23,600	-0.6%	-28.5%

Table 1: Total emissions and percentage decreases by fiscal year

Figure 3, Emissions and Effects of Actions on Business as Usual, (below) highlights the results of emissions reduction initiatives. The solid black line (above the yellow wedge) is our best estimate of what emissions would have been had we not taken action – our "business as usual." Each wedge represents the effects of a different category of initiatives. Actual emissions are indicated by the solid pink line.

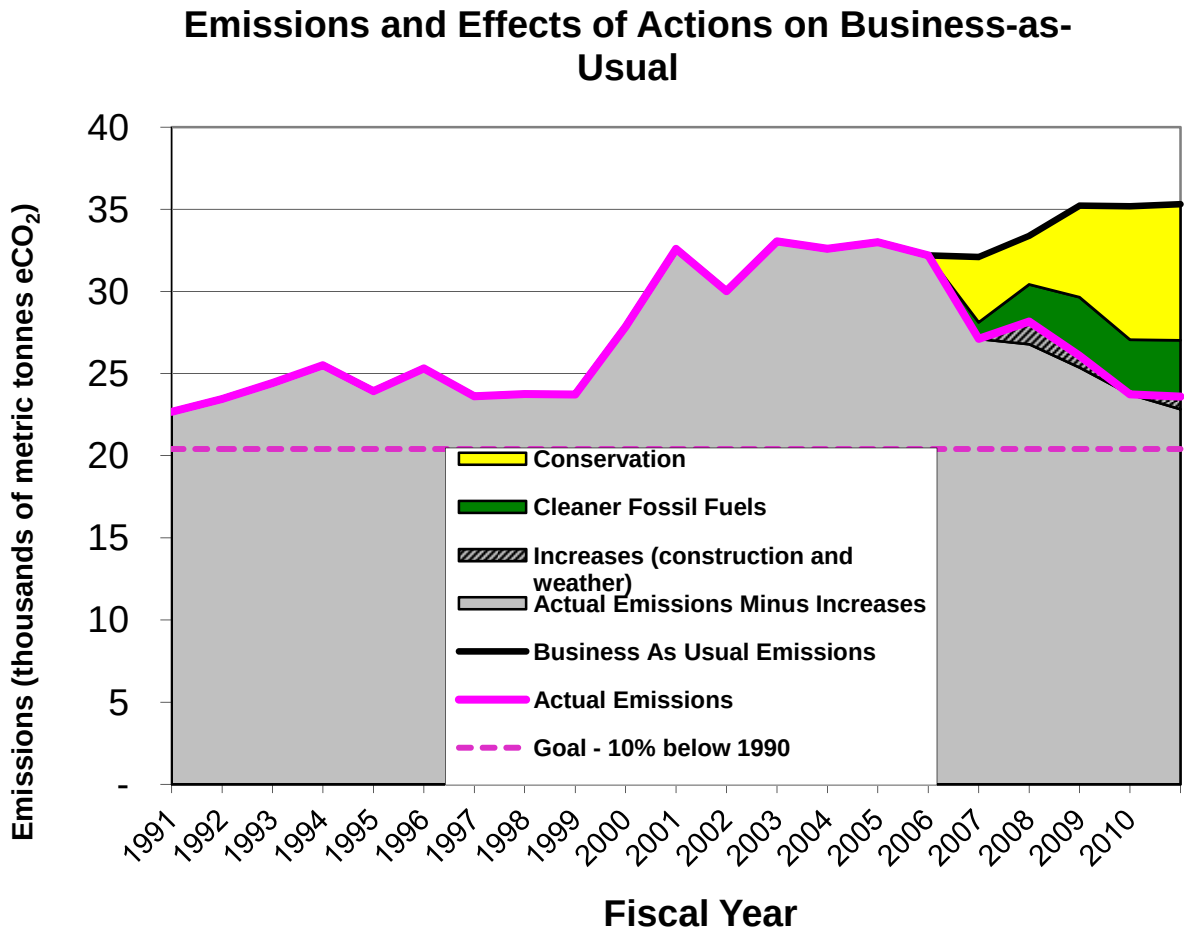

Figure 3: Emissions from Fiscal Year 1991 to 2011, showing effects of reductions measures on business-as-usual.

Fiscal Year	Total Emissions (metric tonnes $eC0_2$)	Business as Usual emissions (metric tonnes $eC0_2$)
2007	27,108	32,098
2008	28,165	33,377
2009	26,079	35,221
2010	23,737	35,184
2011	23,600	35,308

Table 2: Total emissions and Business as Usual Emissions by fiscal year

Sources of Reduction:

1. **Cleaner Fossil Fuels (green wedge):** Using more natural gas at the central heating plant accounted for approximately 30% of total emissions savings in FY11 while the switch to B10 oil accounted for 1%.

a. **Use of additional natural gas at the heating plant:** The central heating plant can burn natural gas or residual oil. Natural gas emits about 35% less greenhouse gas per heating unit than residual oil, but is often more expensive. In FY11, 95% of heating fuel used was natural gas, compared to 43% in FY07.
b. **Use of B10 instead of distillate oil (home heating oil):** Most buildings on 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 many 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. In FY11, Williams burned B10 in all of those individual boilers during some months of the year. B10 is a 10%/90% 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 ordinary distillate oil and tends to require more frequent filter changes.

2. **Conservation Projects (yellow):** In FY11, energy conservation measures accounted for approximately 75% of total emissions reductions. Total campus energy use has decreased 17% from the peak in FY05. Conservation efforts continued in Morley Science Laboratories and Bronfman Science Center. See Figure 4 for decrease in annual electricity use. Steam from the campus heating plant is the other major source of energy used in those buildings, and while steam meters are now in place, we do not have historical data to compare in the same way we have electric data.

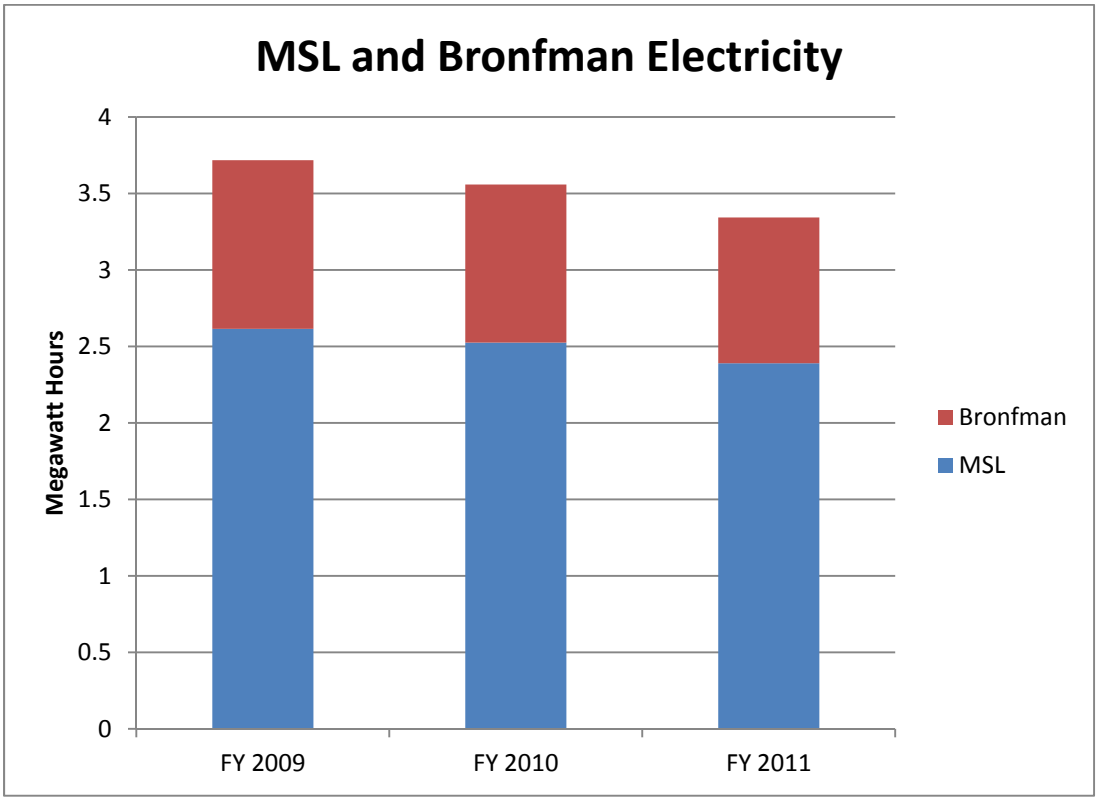

Figure 4: Annual electricity use in Morley Science Laboratories and Bronfman Science Center.

Sources of increase:
Winter was colder and summer was warmer in FY11 than the ten year average, which lead to increased emissions (represented by the grey dashed section of Figure 3).

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

The start of the construction of the new library put additional demands on the time of project managers in Facilities, causing a reduction in the energy conservation projects implemented in FY11, compared to previous years. Todd Holland joined the Zilkha Center as an Energy Efficiency Project Engineer starting in February 2011, with a focused mission of implementing energy conservation projects and programs. The project cycle frequently takes a full year or more from identification to design to implementation, so we will likely start to see further decreases in energy use next fiscal year.

The increased proportion of natural gas used at the heating plant continues to represent a large portion of the decrease in emissions. Similar (or lower) levels of emissions from the heating plant (whether through burning of natural gas or some other relatively clean fuel) are necessary in future years if Williams is to meet our goal.

Only a small portion of Williams' total energy (<1%) comes from renewable sources. One or more large-scale renewable energy projects will likely be necessary to reach the emissions goal. As we approach that goal, established in FY07, Williams may wish to consider whether deeper emissions reductions are warranted.