Davidson College Climate Action Planning Process
Greenhouse Gas Emissions Primer

Greenhouse Gases

What are greenhouse gases?

Greenhouse gases are a group of gases present in the atmosphere both naturally and due to human activity. Greenhouse gases include water vapor, carbon dioxide (CO_2), methane, ozone, nitrous oxide, and chlorofluorocarbons (CFCs).

How do they affect the temperature of the Earth's atmosphere?

When the sun's rays enter the Earth's atmosphere some of the solar radiation is reflected back into space, some of it is absorbed by the Earth's surface, and some of it is absorbed by greenhouse gas molecules in the atmosphere. Solar radiation that is absorbed by greenhouse gases is converted to heat energy. The naturally occurring greenhouse gases are responsible for the temperature of the Earth. Without them, the Earth would be too cold to sustain life.

When did human activity start to increase greenhouse gas levels?

In the mid-1700s, with the onset of industrialization, the amount of greenhouse gases in the atmosphere began to rise. The activities that release greenhouse gases include the burning of fossil fuels for heat and energy, deforestation, livestock waste management, refrigeration systems using CFCs, and the use of chemicals in agriculture. With the spread of industrialization, greenhouse gas levels have continued to rise.

Why is it important to reduce greenhouse gas emissions?

As the levels of greenhouse gases increase, so does the temperature of the Earth's atmosphere. Eleven of the last twelve years have been among the twelve hottest years on record. Rising global temperatures are having profound effects on the environment, including sea level rise, species extinctions, increasing intensity of weather events, acidification, and many more. Continued increases in global temperatures carry unknown consequences, and scientists warn that immediate and aggressive action is necessary to abate greenhouse gas emissions.[1]

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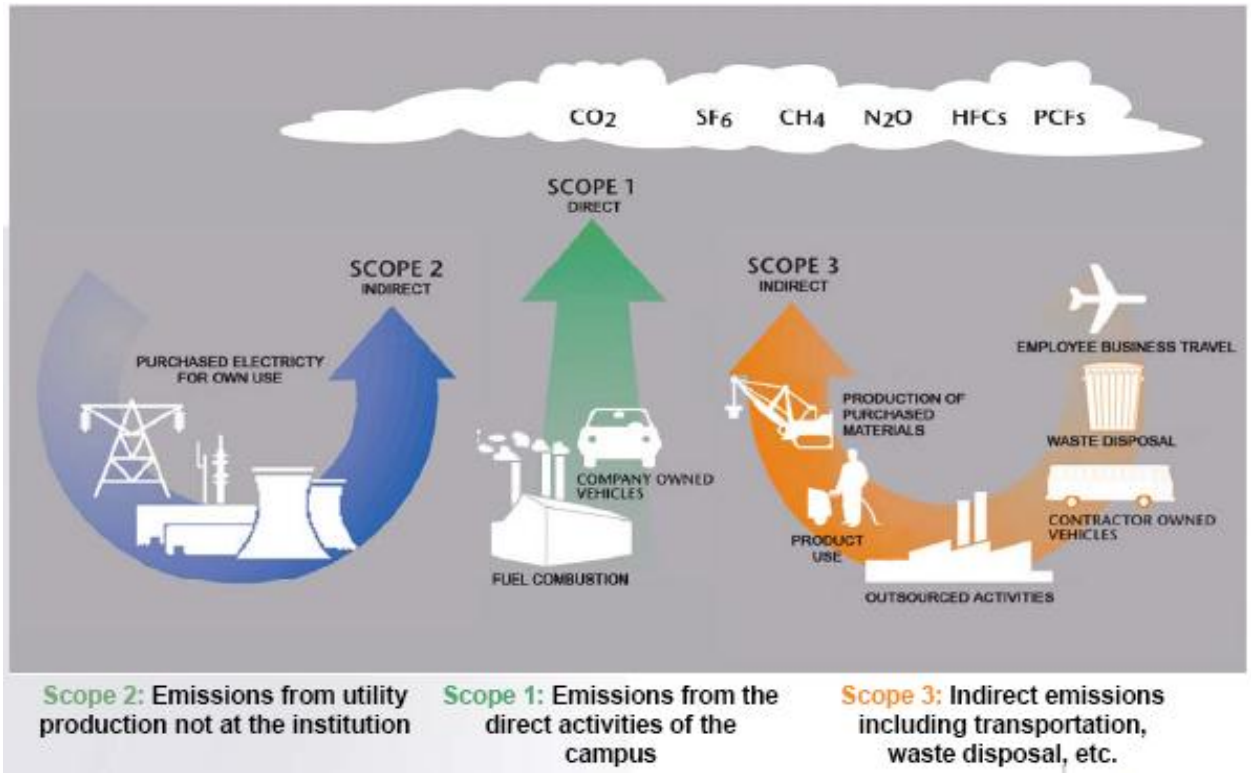
[1] " Climate Change 2007: Synthesis Report" (PDF). By the IPCC. Retrieved on 2009-6-3. < http://www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4_syr.pdf>

The American Colleges and Universities Presidents' Climate Commitment

In November 2007, President Ross signed the American Colleges and Universities Presidents' Climate Commitment (ACUPCC), pledging that Davidson would strive toward carbon neutrality. This commitment, now with more than 600 signatories, promotes greenhouse gas emissions reductions directly through a commitment to climate neutrality and indirectly through the education of students, faculty, and staff about the effects of daily activities on the environment.

One requirement of the ACUPCC is the public submission of a greenhouse gas emissions inventory. Davidson completed its inventory and submitted it to the ACUPCC on January 15, 2009. This inventory is publicly available at http://acupcc.aashe.org/ .



There are three categories of emissions: Scope 1 are direct emissions released on campus, such as burning natural gas for heat; Scope 2 are indirect emissions created by the electricity we purchase; Scope 3 are indirect emissions created by other processes, such as waste disposal, business travel, commuting, and product use. These categories are used so that emissions are not "double-counted." For example, say Duke Energy decides to report their greenhouse gas emissions. The generation of electricity would be a Scope 1, direct emission for

them, because they produce it at their facility. We report the greenhouse gases from the electricity we purchase from Duke Energy as Scope 2, so they are not counted as direct emissions.

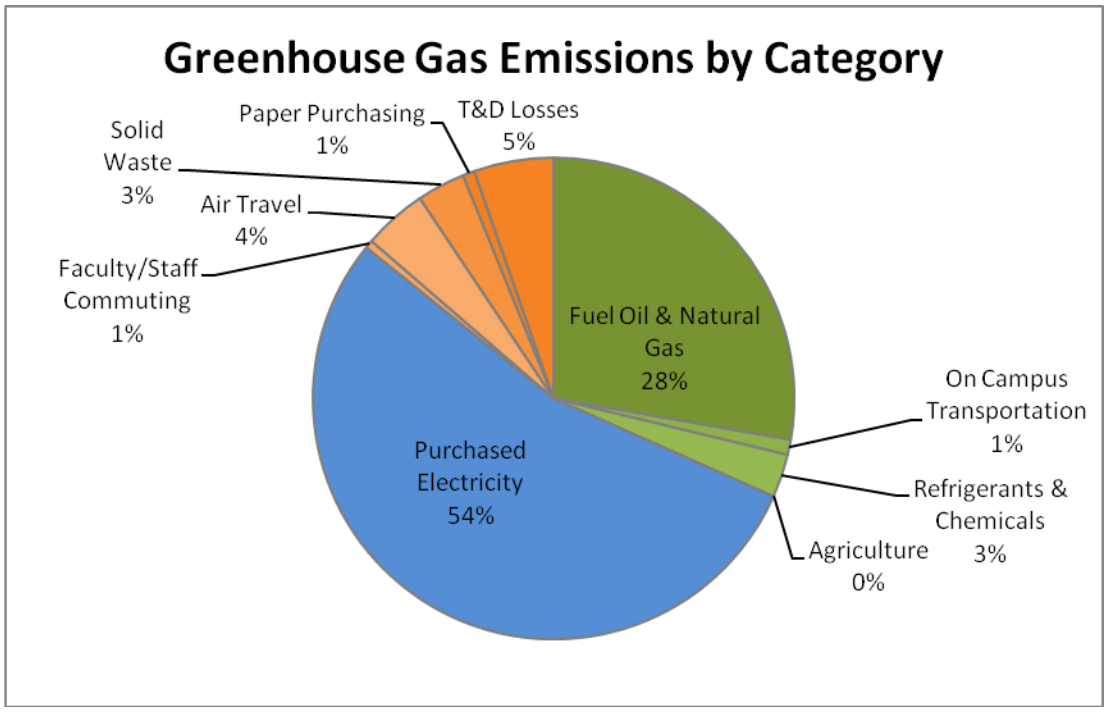
To conduct our greenhouse gas emissions inventory, we used the Clean Air-Cool Planet Campus Carbon Calculator. This tool is recommended by the ACUPCC, and is used by most ACUPCC schools. Below is an example of the spreadsheet we worked with to determine our greenhouse gas emissions. The sources of greenhouse gases that were reported are fuel oil, natural gas, campus vehicles, refrigerants, fertilizer, electricity, commuting, college-supported air travel, solid waste disposal, and paper use.

	--- Scope 1 Emissions Sources ---									
Fiscal Year	On-Campus Stationary Sources			Direct Transportation Sources		Refrigerants & Chemicals				
	Other			University Fleet		Refrigerants & Chemicals				
	Residual Oil (#5-6)	Distillate Oil (#1-4)	Natural Gas	Gasoline Fleet	Diesel Fleet	HFC-134a	HFC-404a	HCFC-22	HCFE-235da2	HG-10
	Gallons	Gallons	MMBtu	Gallons	Gallons	Pounds	Pounds	Pounds	Pounds	Pounds
2007		969	103,899	23,662	1,162	43	14	570	10	5
2008			105,818	21,412	1,939	34	11	364	27	56

The greenhouse gas emissions inventory shows that Davidson's net emissions are 22,225 metric tons of CO_2 equivalent[2] ($MTCO_2e$). The largest source of emissions is purchased electricity, accounting for 54% of emissions. Davidson's electricity provider, Duke Energy, generates more than 60% of its electrical mix from coal, so significant emissions reductions in this category will necessitate changes in the way Duke Energy generates electricity.

Currently, Davidson is pursuing several avenues to reduce greenhouse gas emissions from electricity through increasing efficiency. A campus-wide lighting retrofit has been completed, with 90% of lights now using either compact fluorescents or other energy efficient lighting. An energy-star procurement policy has also been adopted for all new appliances. Finally, Advanced Energy has completed an energy audit of Davidson's campus. This project, funded by The Duke Endowment, will help Davidson identify areas in which energy efficiency can be increased.

[2] Greenhouse gas emissions are converted to $MTCO_2e$ to put all emissions on an even playing field. Some greenhouse gases are more harmful than CO_2, others less. It is an international convention to convert all emissions to $MTCO_2e$. This allows for comparison between emissions.



Natural gas accounts for 28% of Davidson's greenhouse gas emissions, the campus' next largest source. Natural gas is burned to produce heat and hot water for buildings. To reduce natural gas consumption, an energy management program monitors temperature and occupancy in buildings across campus. Davidson strictly sets thermostats to heat buildings between 68 and 72 degrees in the winter and cool them between 74 and 78 degrees in the summer. Additionally, the equipment in the campus boiler plant is currently being replaced with more energy efficient models, which will lead to further reductions in natural gas usage.

The third largest contributor of greenhouse gases, transportation, is responsible for 6% of Davidson's campus emissions. This category includes air travel, faculty and staff commuting, and campus fleet vehicles. Davidson is currently researching a variety of ways to reduce transportation-based greenhouse gas emissions, from increased parking restrictions to a Zip Car program.

Greenhouse gas emissions vary between institutions based on electricity generation mix, the average commuting distance of faculty, staff, and students, the purchase of carbon offsets, and many other factors. As this graph shows, Davidson emits more carbon per student than most of its peers. The national reported average of carbon emissions per student for undergraduate institutions is 9.17 metric tons CO_2 equivalent, about 35% lower than Davidson's per student emissions.

Compared to Davidson's peer schools, Davidson's net emissions are about average. However, when comparing based on $MTCO_2e$ per student, Davidson is on the higher end of the spectrum. Part of this is based on Davidson's geographic location. As mentioned earlier, Davidson relies mostly on coal for electricity, whereas universities in other parts of the country may have less carbon-intensive energy generation.