

Clark University Greenhouse Gas Emissions Update: 2012

Clark University on Track for Carbon Reduction and Carbon Neutrality Goals

Background

In June 2007 President Bassett signed the American College and University Presidents Climate Commitment (ACUPCC), making Clark University a charter signatory to an exciting initiative aimed at mobilizing the resources of colleges and universities in efforts to reduce greenhouse gas emissions. The core goal of the commitment is to achieve climate neutrality with net zero greenhouse gas emissions, also known as carbon neutrality. The Clark University Environmental Sustainability Task Force (CUES) accepted the task of developing a Climate Action Plan to lead the University toward its goal of climate neutrality.

In December of 2009 Clark University released the Climate Action Plan, detailing strategies for the University to reduce its greenhouse gas emissions while strengthening many of its existing sustainability practices. The plan sets two goals: an interim goal of reducing emissions to 20 percent below 2005 levels by 2015. The second goal is to achieve climate neutrality (net zero greenhouse gas emissions) by the year 2030. Making progress toward this ambitious goal requires a willingness on the part of all members of the Clark University community to make this a priority for many years to come.

Strategies within the Climate Action Plan to reduce emissions include the following:

- Study and manage building and energy systems, such as increased efficiency of lighting, heating and cooling systems;
- Consideration of strategic fuel use choices;
- Manage the physical campus "footprint" by using existing space more efficiently and designing new and renovated buildings with improved use of energy resources;
- Manage information technology and equipment purchasing;
- Seek ways to reduce travel by Clark employees and students, encouraging green commuting practices and video- and teleconferencing;
- Promote social and behavioral awareness and innovation within and outside the classroom and among faculty and staff.

Greenhouse Gas Emissions Inventory

In order to effectively manage carbon footprint and emission reduction strategies, a Greenhouse Gas (GHG) Emissions Inventory has been conducted annually utilizing the Campus Carbon Calculator from Clean Air-Cool Planet, a leading non-profit organization in the field.

In the Inventory, inputs are recorded for Scope 1 sources (on-site combustion, such as boilers and vehicle use); Scope 2 sources (off-site combustion, such as purchased electricity) and certain Scope 3 sources (other combustion such as commuting) according to ACUPCC guidelines. The six greenhouse gases inventoried are those included in the Kyoto Protocol: carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), hydro fluorocarbons (HFCs), perfluorocarbons (PFC), and sulfur hexafluoride (SF₆). Of these six, CO₂ (produced during the combustion of all fossil fuels) and HFCs (gases that are used in refrigerants and air conditioners) have been shown to be the primary gases emitted on campus. For ease of understanding and comparison, all inventoried greenhouse gases are converted to a common measure: carbon dioxide. The Campus Carbon Calculator multiplies fuel use and other inputs by updated emissions factors to determine the amount of metric tons of carbon dioxide equivalent (MT CO₂e) added to the atmosphere by campus operations. The results of past inventories have been reported to ACUPCC and shared with University administration.

Greenhouse Gas Emissions Inventory Update: 2012

As of the calendar reporting year 2012 Clark University is on track to meet and exceed its interim goal of a 20 percent reduction over 2005 emissions levels by 2015, and therefore closer to the ultimate goal of climate neutrality by 2030.

Revised Carbon Equivalencies; Updated Campus Carbon Calculator

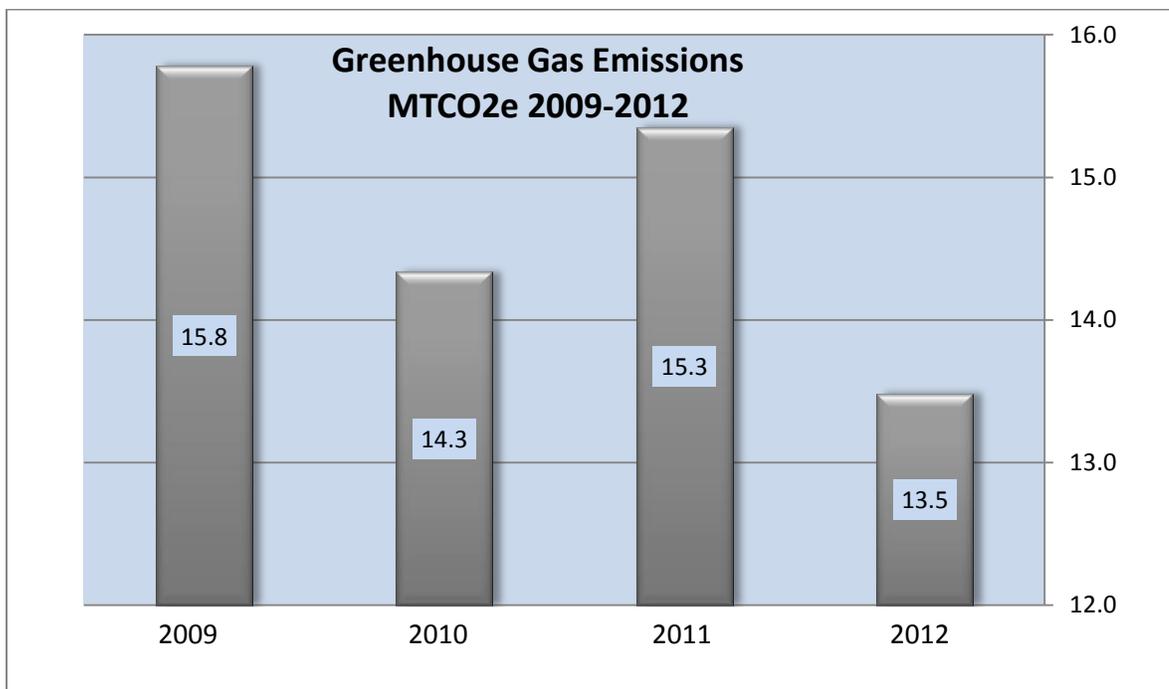
Over forty updates took effect in 2012's Campus Carbon Calculator (CCC) version 6.85 to align with IPCC, EPA, DOE and other agency standards as the science of calculating emissions and carbon equivalencies continually improves. Many standards are retroactive and almost all of Clark's past data stored in the CCC was affected by the updates, so emissions reported on previous Clark University Greenhouse Gas Emissions Updates do not match current numbers. The most significant update re-calculates oxidation factors and impacts data retroactive to 2006. Although it's a small percentage change, it can add up to tons of estimated emissions. In 2011 CCC version 6.7 included EPA revisions from 2007 for certain emissions-producing activities which impacted CO₂ equivalency calculations retroactive to 2007. These have been further updated in version 6.85 of the CCC.

The full list of CCC updates is available here: <http://campuscarbonblog.org/changes-to-v6-85/>.

Clark's interim Climate Action Plan goal for 2015 was based on 2005 emissions and the standards at the time, as were the benchmarks and mitigation strategies; the interim goal therefore remains unchanged at 16,357.4 MTCO₂e.

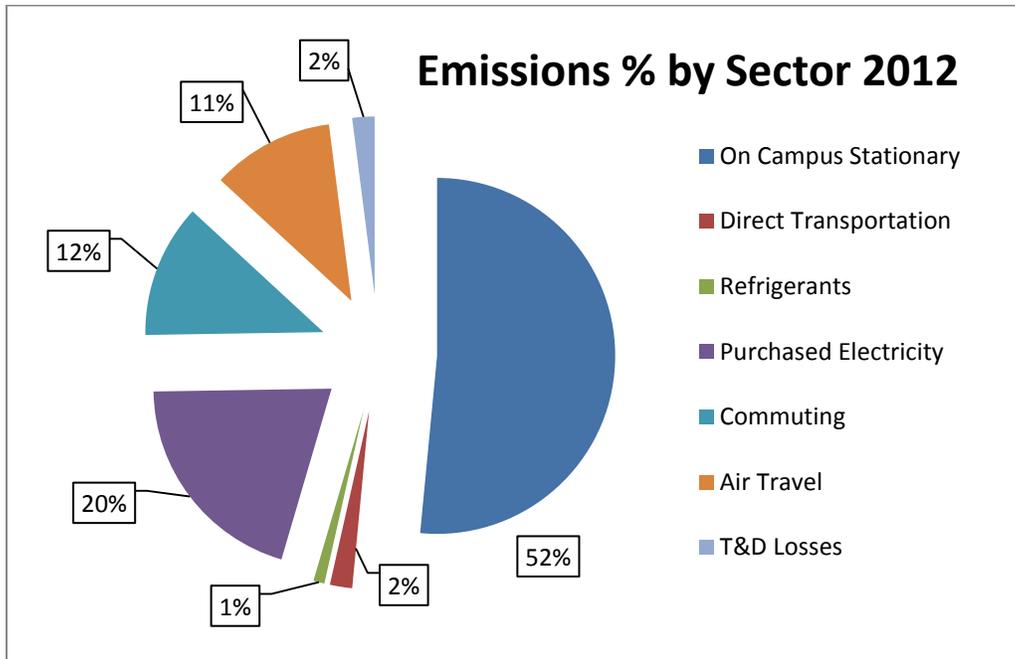
Total Greenhouse Gas Emissions in Metric Tonnes of Carbon Dioxide Equivalencies (MT CO₂e)

Total GHG emissions in 2012 were 13,469.2 MT CO₂e. This represents a 12.2% decrease from total 2011 GHG emissions of 15,338.3MT CO₂e. Net GHG emissions in 2012, after offsets, were 13,482.6 MT CO₂e. The Explanations section below details some of the probable causes for the decrease.



Sources of Greenhouse Gas Emissions on Campus

As in prior GHG inventories, the major source of Clark's greenhouse gas emissions is Scope 1: fuel consumed to produce heat and electricity by the cogeneration engine, and to produce heat in both the central boilers and 'satellite' locations not served by the central heating system. This sector is termed On-Campus Stationary Combustion and comprised 52.5% of all emissions in 2012; in 2011 the same sector accounted for 65% of total emissions. Scope 2 emissions result from the operations of the electric utility which supplies Clark's demand for electricity beyond that which is produced on-site by the cogeneration plant. This sector is termed Purchased Electricity and comprised 19.9% in 2012, compared to only 7% of emissions in 2011 (prior years have also averaged 20%). The third contributor is found in Scope 3 emissions and was largely comprised of fuel used in transportation (including commuting and air travel); this sector comprised 23% of all emissions in 2012, similar to 2011. Smaller sources of emissions included refrigerant leakage, utility-based transmission and distribution losses, and campus fleet direct transportation, all 2% or less.



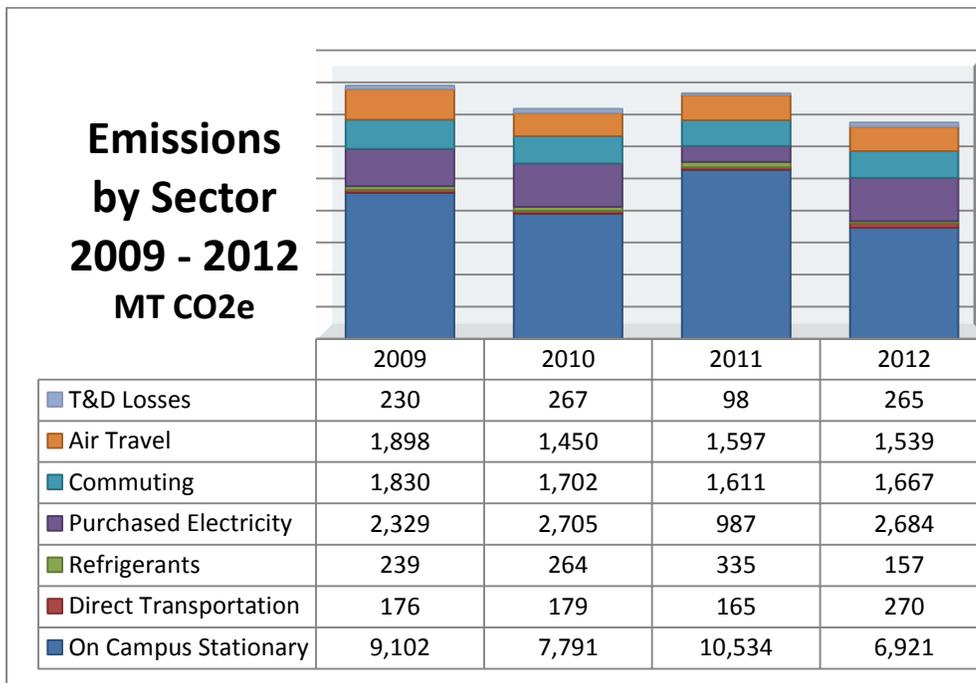
Explanations

Implementing the carbon management strategies of the Climate Action Plan will produce continual decreases in all recorded emitting sectors and gases. Each annual greenhouse gas inventory will also reflect year-to-year changes in weather and other uncontrollable conditions. For example, in 2012 we experienced an unseasonably warm winter and cool summer, enabling reduced use of fuel for heating and electricity for cooling.

Campus operations are another factor that impact GHG emissions. In May 2012 the cogeneration engine was dismantled to be replaced with a more efficient, larger model. To supply campus electrical demand Clark purchased electricity for 8 months of 2012. In 2012, the cogen supplied only 39% of campus electricity demand, versus 2011 when the cogeneration plant operated throughout the year and produced 77% of campus electricity demand. The cogeneration plant switched to natural gas as the primary fuel in 2010. Natural gas is cleaner burning than other fossil fuels, however purchased electricity consists of a mix of fuel sources; some of them, such as biomass and hydropower, with zero emissions. By purchasing electricity Clark is able to take advantage of zero emissions fuel sources in our total emissions calculations, but loses the efficiency of cogenerating heat, hot water and electricity from the same fuel source.

Due to the cogen being out of service, the boilers in the heating plant were responsible for all of campus thermal (heat and hot water) demands from May-December 2012. The full-scale operation of the boilers required additional and secondary fossil fuel use (#6 fuel oil as well as natural gas) and impacted Scope 1 emissions.

Faculty and staff air travel remained relatively unchanged in 2012 versus 2011. Air travel produces a large amount of emissions due to the magnified effects of fuel combustion at high altitudes, so even a small increase in volume has a significant effect. Emissions from faculty and staff commuting also remained relatively constant, although full-time employees were counted more accurately in 2012 than in past years, impacting the total emissions. A survey was conducted in 2011 to determine average faculty and staff commuting mileage and emissions; previous inventories have used survey data from 2006. Both of these data sets use estimations and averages rather than actual recorded mileages. The percentage of total Scope 3 emissions remains closely similar year-to-year.



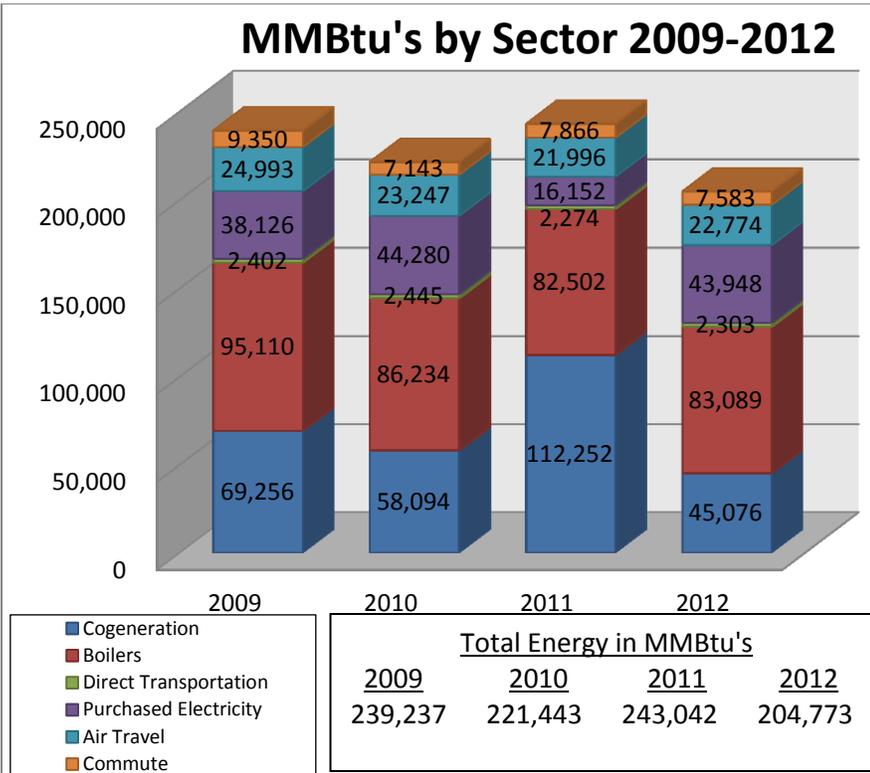
Energy Use on Campus

The goals of the Climate Action Plan are expressed in terms of metric tonnes of carbon dioxide equivalents (MT CO₂e). Our mitigation strategies, including energy management strategies, are also expressed in MTCO₂e. Energy management strategies such as improvements to lighting efficiency and systems upgrades will reduce emissions as they reduce energy consumption. The results of a number of energy and lighting improvements, completed throughout 2011, are reflected in full in the 2012 data. Actual electrical usage (produced and purchased combined) declined 17% from 12,825,735 kWh in 2011 to 10,613,389 kWh in 2012. In non-cogeneration heating applications (including ‘satellite’ locations), fossil fuel use (natural gas, oil) remained relatively constant between 2011 and 2012.

As there is a direct relationship between energy consumption and MT CO₂e produced, it is helpful to examine the inventory data in terms of a standard unit of energy measurement: therms. This is expressed in million British thermal units, or MMBtu’s. The calculations are based on EPA standards in use and derived from the CCC.

In the chart below, kWh, fossil fuel gallons and natural gas therms are all expressed in MMBtu’s to provide a comparative analysis of actual energy consumption across sectors and across time. Again, the cogeneration plant was not operative for much of 2012, causing an increase in purchased electricity versus 2011. It is clear that Clark’s energy use has decreased in line with our greenhouse gas emissions.

MMBtu's by Sector 2009-2012



Conclusion

It is clear from the 2012 data and examining the results of our annual Greenhouse Gas Inventories that Clark University is on track to meet or exceed its interim goal of reducing emissions 20 percent below 2005 levels by 2015. Additional energy management systems and a range of efficiency measures are currently being implemented or under investigation; the results of these strategic initiatives may be evident in future inventory calculations.

Clark's Climate Action Plan provides a roadmap to effectively achieve our interim goal, however there is still much to be accomplished that will require the commitment and ingenuity of the entire Clark community if we are to continue to reduce our emissions and lower our footprint – all the way to climate neutrality and net zero emissions by 2030.