Greenhouse Gas (GHG) Emissions Inventory

Fiscal Year 2015

Prepared by the Office of Sustainability for the

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Elon University’s Sustainability Master Plan (2015) includes an objective to “establish a carbon neutral university by 2037”, which carries over from the initial Sustainability Master Plan (2006-2007). Calculating the University’s greenhouse gas (GHG) emissions or carbon footprint is one of the essential steps in establishing a carbon neutral university. Elon’s first GHG inventory was conducted for fiscal year (FY) 2008 and serves as Elon’s baseline from which to measure reductions in emissions. A yearly GHG inventory is conducted to monitor progress toward Elon’s emission reduction goals.

Version 8.0 of the Campus Carbon Calculator was used to calculate Elon’s emissions for FY 2015. This Calculator includes up to date constants and emission factors. As with previous versions of the Calculator, it includes all of the primary components of a GHG inventory: Scope 1, 2 and 3 emissions as well as offsets and provides the total amount of carbon dioxide equivalent emissions (eCO2).

- **Scope 1** is direct emissions, such as production of electricity on campus and university vehicles.
- **Scope 2** emissions come from imported sources of energy, i.e., purchased electricity or steam.
- **Scope 3** is all other indirect sources of emissions, such as business travel, commuter travel and solid waste generation.
- An **offset** is a reduction of carbon dioxide or removal of carbon dioxide equivalent (eCO2) GHG emissions that is used to counterbalance or compensate for ("offset") emissions from other activities.

The data collection process for FY 2015 was conducted per the standard procedures initially documented in the summer of 2010 and updated each year. The standard procedures document outlines who to contact for each piece of information and any data analysis and conversion steps that are needed. As new methodologies and data collection techniques emerge, they are reviewed and adopted when appropriate. Once adopted, a new methodology or technique is applied to the current and previous years to allow for year to year comparisons.

The commuter habit survey data used for FY 2015 was collected in fall 2014. A commuter habit survey and GIS analysis are conducted every other year to collect changes in commuter travel patterns. This frequency will be re-visited as necessary to ensure changes in patterns are appropriately reflected.

The commuter habit survey was created and the results analyzed with the assistance of Rhonda Belton, Associate Director of Institutional Research. An email was sent to all faculty, staff and students that briefly explained the purpose of the survey and provided a link to complete the survey online. Paper surveys were provided for staff without regular computer access. Below is a summary of the commuter habit survey inputs used in the calculator tool:

- **Off Campus Students**
  - On average, off campus students make 10.7 round trips to campus each week
  - 9.4% of those trips are by bike
  - 33.6% of those trips are by walking
  - 35.2% of those trips are in a car alone
  - 12.2% of those trips are by carpooling
  - 9.6% of those trips are by bus
• Faculty
  o On average, faculty make 5.4 round trips to campus each week
  o 3.4% of those trips are by bike
  o 1.7% of those trips are by walking
  o 83.2% of those trips are in a car alone
  o 11.7% of those trips are by carpooling
  o 0% of those trips are by bus

• Staff
  o On average, staff make 6.1 round trips to campus each week
  o 0.6% of those trips are by bike
  o 0.6% of those trips are by walking
  o 93.2% of those trips are in a car alone
  o 5.6% of those trips are by carpooling
  o 0% of those trips are by bus

The GIS analysis was conducted by an Elon student, Eric Lagueruela (Environmental and Ecological Sciences Major, GIS Minor) and an Elon faculty member, Ryan Kirk (Geography and Environmental Studies), in the fall of 2014. Anonymous faculty and staff addresses as of September 2, 2014 were provided by Deirdre Lea in Human Resources. For the GIS analysis, commuting distances were calculated as the shortest travel route from the nearest road for each residence to the edge of the Elon campus property or as the shortest road distance to the intersection nearest the Law School campus as appropriate. Given this, all campus addresses were given a distance of zero. The mean travel distance to the Elon campus is 13.9 miles, and the median distance is 7.0 miles (Figure 1). The mean travel distance to the Law School campus is 10.2 miles, and the median distance is 5.7 miles (Figure 2). For both campuses, 45.2% of faculty and staff live within 5 miles, 57.0% within 10 miles, 79.8% within 25 miles and 97.1% within 50 miles. For data source consistency, the distances determined with the survey data were utilized in calculating commuting emissions. The GIS analysis continues to be conducted because it provides another source of useful information, as well as maps, to compare and identify trends in faculty/staff commuting distances and residence choice.
Figure 1: Elon Campus Faculty and Staff Commutershed
Faculty & Staff Commutershed, Elon University School of Law, 2014

A commutershed is the geographic area from which a workforce commutes to a workplace. This map illustrates the commutershed and density for Elon’s Law School.

Figure 2: Law School Campus Faculty and Staff Commutershed
Elon’s total and net GHG emissions for FY 2015 were 46,053 metric tons of carbon dioxide equivalents (MTCDE). There were no offsets due to yard waste composting because yard waste was not ground to create compost during the year. Per full-time equivalent (FTE) student net emissions were 7.2 MTCDE/student and per building square foot (ft²) were 0.0170 MTCDE/ft² or 17.0 MTCDE per 1,000 square feet. See Figure 3 for a percentage breakdown by category.

![Emissions Percentage by Category](image_url)

Figure 3: Emissions Percentage by Category

To facilitate a comparison across the eight years a GHG inventory has been conducted, the FY 2008 through FY 2014 inventories were updated (using the v8.0 Calculator). See Figure 4 for the category breakdown by metric tons of eCO2 for all eight years.
Elon’s GHG emissions increased 17% from FY 2008 to FY 2015 primarily from an increase in energy consumption, directly financed travel and study abroad. From FY 2014 to FY 2015, emissions increased 6.85%, primarily from an increase in energy consumption, study abroad and directly financed travel. Emissions increased from energy consumption accordingly based on the increase in purchased electricity and natural gas consumption from FY 2014 to FY 2015. This increase is likely the result of adding 115,846 square feet of building space. Study abroad emissions increased due to additional data being provided and more students studying abroad. The FY 2015 data included information from programs not previously included or not included as much in the past, such as non-Elon and Independent study abroad programs, iMedia and service trips. Having this information available and including it provides a more accurate representation of study abroad travel. The FY 2014 data represented the travel of 1325 students, while the FY 2015 data represented the travel of 1726 students. The increase in directly financed travel was due to additional Athletics travel, which is likely the result of changing athletic conferences.

Though Elon’s net GHG emissions have increased since FY 2008, it is important to consider the growth of the campus in terms of square footage and students during this time period. From FY 2008 to FY 2015, square footage increased 785,526 square feet, a 40.9% increase, while emissions per 1,000 square feet decreased 17%. See Figure 5 for the change in emissions per 1,000 square feet since FY 2008.
From FY 2008 to FY 2015, the number of FTE students increased 1027 students, a 19.3% increase, while emissions per FTE student decreased 1.9%. See Figure 6 for the change in emissions per FTE student since FY 2008.
Energy consumption (Purchased Electricity, Natural Gas/Propane and T&D Losses) remains the largest source of emissions accounting for 53.9% of total FY 2015 emissions. T&D Losses are transmission and distribution losses of purchased electricity. Reductions in direct emissions from energy consumption will likely come from continued campus energy efficiency and conservation projects as identified in the Climate Action Plan (CAP). The Sustainability Master Plan (SMP) includes objectives that will contribute to reduced energy consumption. Additional installations of renewable and alternative energy, such as solar thermal and geothermal, could also contribute to reductions in emissions from energy consumption. Elon has one geothermal system that provides the primary source of heating and cooling for five residence halls. Five solar thermal installations provide domestic hot water for a dining hall and four residence halls. These technologies will be monitored and compared with conventional technologies to determine effectiveness and appropriateness for other campus facilities (existing and new). Additional renewable energy installations, including solar photovoltaic panels, will be considered as appropriate and applicable as retrofits to existing facilities and/or a part of new facilities. A 15-acre 2.9 MW (DC power) solar farm project was recently completed on University land. The University is leasing the land to a third-party, who constructed the facility and will own and operate it for the initial 15 year lease term. Given the University does not own the solar farm itself, the system will not affect Elon’s emissions inventory, though it will benefit the region and reduce the need for fossil fuel based energy. The system is expected to provide approximately 4,500 MWh of electricity to the grid each year, which equates to removing over 2,100 MTCDE per year from the atmosphere or 450 cars from the road. In the future, Elon will likely have the opportunity to purchase the system. If the University purchases the solar farm in the future, it would then be able to claim the carbon reduction in the annual GHG emissions inventory, if the Renewable Energy Credits (RECs) are not sold with the power.

Study abroad travel represents 16.4% of Elon’s FY 15 emissions. Elon is ranked number one in the nation among master’s-level universities for study abroad programs by the Institute of International Education. Over 70% of Elon students study abroad at least once during their time at the University. Since FY 2008, study abroad emissions decreased in 2009 and 2010, likely due to the economic climate. Since FY 2011, study abroad emissions have been increasing due to additional students studying abroad and additional data as noted above. The number of students studying abroad will likely continue to increase as providing access to study abroad to 100% of Elon students is a priority in The Elon Commitment strategic plan. Strategies for reducing net emissions, such as offsets, from study abroad travel are included in Elon’s CAP.

Commuting and Directly Financed Travel account for a combined 20.7% of Elon’s GHG emissions. Strategies for increasing the use of alternative transportation, such as carpooling, using the Elon Bio-buses, walking and biking are included in the CAP. The SMP includes objectives to further support and enhance alternative transportation initiatives. Continuing and increasing the use of hybrid and other alternative fueled vehicles, web-conferencing, taking Amtrak when appropriate and combining trips through scheduling could also help reduce emissions from faculty and staff business travel and athletic team travel.

Solid Waste represents 6.7% of Elon’s FY 15 emissions. As noted in the CAP, reducing solid waste will require continuing the expansion of Elon’s recycling and composting programs, decreasing disposable materials and increasing efforts to reuse materials (when appropriate). The SMP includes objectives that will contribute to waste reduction.
The rest of the emissions categories combined (University Fleet, Refrigeration, Fertilizer and Wastewater) amount to less than 3% of total emissions. The strategies being used to reduce emissions in these categories (see the CAP for details) will continue and expand to keep them a small portion of Elon’s GHG emissions.

In addition to the projects and programs that can take place on campus, additional strategies, mainly offsets, will need to be considered to reduce Elon’s net GHG emissions. In years when yard waste is ground for compost, Elon reports offsets from yard waste composting. Additional offsets will need to be explored to reach the goal of carbon neutrality. There are different options for investing in offsets such as purchasing offset credits (retail or wholesale) from third-party providers, investing in projects directly (without a third-party provider) and developing projects independently. Offset options that seem more likely are purchasing retail offset credits and investing in projects directly. With whichever option is chosen, verified carbon offsets are the preference. They have been validated with a voluntary carbon standard such as the Verified Carbon Standard or Gold Standard. Validation and verification is a multi-step rigorous process to ensure the GHG emissions reductions are in fact real, additional, transparent, measurable, permanent and not double-counted. Ongoing monitoring and verification is required throughout the project life. However, utilizing offsets for all of Elon’s net GHG emissions would not be an effective use of financial resources. The intention is to utilize offsets only after reducing emissions on campus as much as possible.

The FY 2015 GHG inventory indicates emissions have increased since FY 2008. However, emissions per 1,000 square feet and FTE student have decreased since FY 2008, even though the campus’ square footage and FTE student population have increased. The initiatives and strategies implemented to reduce carbon emissions have slowed the rate of emissions growth in some categories. As noted in the CAP, the University’s growth is proving challenging to emissions reductions. Therefore, it is critical to continue implementation of the strategies identified in the CAP and objectives in the SMP to reduce emissions in the coming years. The CAP is a living, flexible document that will be revised as technology, research and incentives develop. A GHG inventory will continue to be conducted yearly to monitor progress toward Elon’s overarching goal of carbon neutrality.