2013 Campus Greenhouse Gas Inventory

gogreen.etsu.edu

Compiled by

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Introduction

“ETSU will create a university community that is aware of, engaged in, and committed to advancing sustainability.” – ETSU Strategic Plan, 2010 - 2015

The Campus Greenhouse Gas Inventory was conducted as a component of ETSU’s Sustainability, Assessment, Tracking, and Rating System (S.T.A.R.S.) initiative in which progress is monitored by the Association for the Advancement of Sustainability in Higher Education (A.A.S.H.E.). In 2011, ETSU was awarded S.T.A.R.S. Bronze and is currently seeking a Silver rating. In order to obtain this rating, certain criteria must be met including the completion of a greenhouse gas inventory and subsequent climate action plan.

Aside from seeking a Silver S.T.A.R.S. rating, ETSU strives to reduce its carbon footprint as much as reasonably possible to meet its commitment to advancing sustainability. In order to do this, a comprehensive inventory of net greenhouse gas emissions that ETSU is responsible for per fiscal year must be completed. This information is then used to develop a Climate Action Plan, or a plan to reduce overall net greenhouse gas emissions.

What are Greenhouse Gases and why are they important?

“Greenhouse gases act like a blanket around Earth, trapping energy in the atmosphere and causing it to warm. This phenomenon is called the greenhouse effect and is natural and necessary to support life on Earth. However, the buildup of greenhouse gases can change Earth’s climate and result in dangerous effects to human health and welfare and to ecosystems.” – U.S. Environmental Protection Agency (www.epa.gov)

Greenhouse gases are both natural and anthropogenic (caused by human activity). The most common greenhouse gas is carbon dioxide, or CO$_2$, which is naturally sequestered by trees and other plant life and transformed back into the atmosphere in the form of oxygen. Unfortunately, because of the massive amounts of CO$_2$ that are emitted into the atmosphere via power plants, motor vehicles, industries, etc. not all CO$_2$ can be naturally sequestered and much of it remains in the atmosphere. This process contributes to the greenhouse effect and is primarily responsible for accelerating climate change. Other common greenhouse gases include methane (CH$_4$), nitrous oxide (N$_2$O), and fluorinated gases (such as Freon).

General agreement within the scientific community holds that in order to achieve a safe concentration of CO$_2$ in the atmosphere, the amount of CO$_2$ must be reduced to 350 parts per million. Currently, according to the EPA, levels of CO$_2$ in the atmosphere are at about 400ppm.

ETSU is responsible for greenhouse gas emissions not only directly produced by the institution (scope 1) but also for emissions produced from generated electricity that the University
purchases (scope 2) and emissions that are indirectly related but would not be produced if the University was non-existent, such as emissions from daily commuter traffic (scope 3). Scopes 1, 2, and 3 are accounted for in this inventory.

In order to track emissions at ETSU, the Clean Air-Cool Planet Campus Carbon Calculator was utilized to turn raw data from various University Departments to overall metric tons of CO₂ that the University produces annually.

**Emission Factors**

Known greenhouse gases are measured by their global warming potential (GWP). For the purposes of comparison, gases such as fluorocarbons and nitrous oxide are measured in carbon dioxide equivalents (eCO₂) which is the GWP equivalent to CO₂ emissions.

**Emission Sources by Scope**

Scope 1
- On-campus Stationary Combustion (Coal, Oil, Natural Gas Usage)
- Campus Fleet (Motorpool) Fuel Consumption (Diesel, Gasoline, E85)
- Freon (R-22)
- Synthetic Fertilizer

Scope 2:
- Purchased Electricity

Scope 3:
- Student, Faculty, and Staff commuting
- Study Abroad Flight Mileage
- Solid Waste (landfilled & recycled)
Institutional Data Retrieved

Full-time Equivalency (FTE) Student Population

Full-time Faculty and Staff Population

Total Operating budget

University Physical Space

2009-2012 Annual Emissions by Scope

The following charts show the percentages of each emissions scope for four fiscal years.

<table>
<thead>
<tr>
<th>Year</th>
<th>Scope 1</th>
<th>Scope 2</th>
<th>Scope 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>21%</td>
<td>66%</td>
<td>13%</td>
</tr>
<tr>
<td>2010</td>
<td>14%</td>
<td>66%</td>
<td>20%</td>
</tr>
<tr>
<td>2011</td>
<td>20%</td>
<td>66%</td>
<td>14%</td>
</tr>
<tr>
<td>2012</td>
<td>18%</td>
<td>68%</td>
<td>14%</td>
</tr>
</tbody>
</table>
Purchased electricity (Scope 2) constitutes the majority of CO₂ emissions on the ETSU campus, averaging at about 66 percent of overall campus emission sources. Electricity at ETSU is sourced from the Tennessee Valley Authority (TVA).

Trends in each scope show various fluctuations. Scope 2 had the largest fluctuation while scope 3 had the smallest.

*Emissions Factors for SRTV (Tennessee Valley) eGRID changed from 0.698917 kg CO₂/kWh in 2008 to 0.6158471971 kg CO₂/kWh in 2009, resulting in lower Scope 2 figures through 2013. This is likely due to a reduction of coal as an energy source for TVA power plants around this time.
Stationary Combustion Emissions are those that are produced from coal, oil, and natural gas.

Stationary Combustion Emissions are also produced from refrigerant (R-22) leaks and synthetic fertilizer usage. The amount of coal that ETSU consumed has decreased tremendously from 2008 to 2013 while the amount of natural gas consumed has increased substantially in this same timeframe. ETSU generally used a very small amount of oil during this timeframe as well.

NOTE: Mobile Combustion Emissions are based on fleet fuel data and information prior to 2009 was unavailable. Fleet Fuel is purchased fuel for the University Motor Fleet and includes gasoline, diesel, and E-85 flex fuel. Electricity consumed by the electric fleet was lumped in with the University’s overall purchased electricity amounts.
While emissions from electricity were drastically reduced since 2008 due to emissions factors changing during this timeframe (see addendum to graph on page 4), the amount of electricity that the University purchased has increased significantly from 2008 to 2013.
The amount of purchased electricity per square foot at ETSU has stayed fairly consistent, with only a decrease of 1 kWh per square foot.
Scope 3 is the smallest scope; however it is still significant because it accounts for emissions from student, faculty, and staff daily commutes to and from the University. This is important because ETSU is considered a “commuter school” since the vast majority of the student body are considered commuters because they live off-campus. The amount of air travel that study abroad students perform constitutes carbon dioxide emissions as well.

Commuting Emissions are based on the overall student-faculty-staff population divided by the number of commuters in each category plus an estimated average of the mileage of each trip, then split between percentages of each mode of transportation.
Study abroad travel emissions are based on the estimated number of flights made and estimated mileages to each destination.

*Study Abroad data was unavailable for 2008 and 2013.

eCO2 is offset from the amount of landfilled waste that the University produces both by the on-campus recycling center and the methane-recovery and electrical generation systems in place at the Iris Glen Environmental Center (the regional landfill in which all of ETSU’s non-recycled waste is transported).
The major factor that contributed to the decrease in net eCO2 emissions is the emission factor changing for purchased electricity between 2008 and 2009, a factor that is outside the control of the University. Other significant emission decreases include the University’s decrease in coal use in favor of natural gas.

Sources and Methods

Scope 1:

On-campus Stationary Combustion (Coal, Oil, Natural Gas): ETSU usage spreadsheet, Lisa Odom, Facilities

Fleet Fuel Consumption (Diesel, Gasoline, E85): fuel usage spreadsheet, Lisa Odom, Facilities

Freon: EPA Compliance binder, Mike Barret, Dan O’brien; Annual purchased Freon, Pam Robinson, Facilities

Synthetic Fertilizer: Travis Watson, Grounds

Scope 2:

Purchased Electricity: Data Sheet, Lisa Odom, Facilities
Scope 3:

Student, Faculty, and Staff commuting: Commuting Survey, Parking Office, also personal calculations

Study Abroad Flight Mileage: Annual reports, Maria Costa, Study Abroad Office

Solid Waste (landfilled & recycled): Data Sheet, Kathleen Moore, Facilities

Institutional Data Retrieved

Full-time Equivalency (FTE) Student Population: ETSU Factbook 2012 Section 2 page 01 and ETSU Factbook 2008 section 2 page 01 (www.etsu.edu/opa/fact/factbooks.aspx)

Full-time Faculty and Staff Population: ETSU Factbook 2012 section 9 page 01 (www.etsu.edu/opa/fact/factbooks.aspx)

Total Operating budget: Budget Summaries, Margaret Pate, Budget and Financial Planning Office

Physical Space: Square Footages Data, Shawn Benson, Facilities OR refer to ETSU usage spreadsheet from Lisa Odom, Facilities

Software and other Information Technology Utilized

Clean Air-Cool Planet Web-based Carbon Calculator version 1.0

Campuscarbon.com

Ounces to Pounds (for Freon calculations): www.metric conversions.org

Estimated Travel distances: travelmath.com

Calculations:

Commuter Numbers: Full-time equivalent Student Population X number of one-way trips per week X number of commuting weeks per year / decimal percent of transportation mode

Freon: Amount of purchased R-22 per fiscal year minus Amount of recovered R-22 per fiscal year converted to pounds

Study Abroad Travel: Estimated miles to destination (from Charlotte, NC) X number of travelers to destination X 2