Champlain College GHG Inventory FY2017

Compiled by Jeff Murphy

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BURLINGTON, VERMONT

Included Emission Sources at Champlain College

Scope 1 – Direct

- On-Campus Stationary Combustion (Natural Gas)
- Vehicle Fleet
- Fertilizer
- Refrigerants

Scope 2 – Upstream

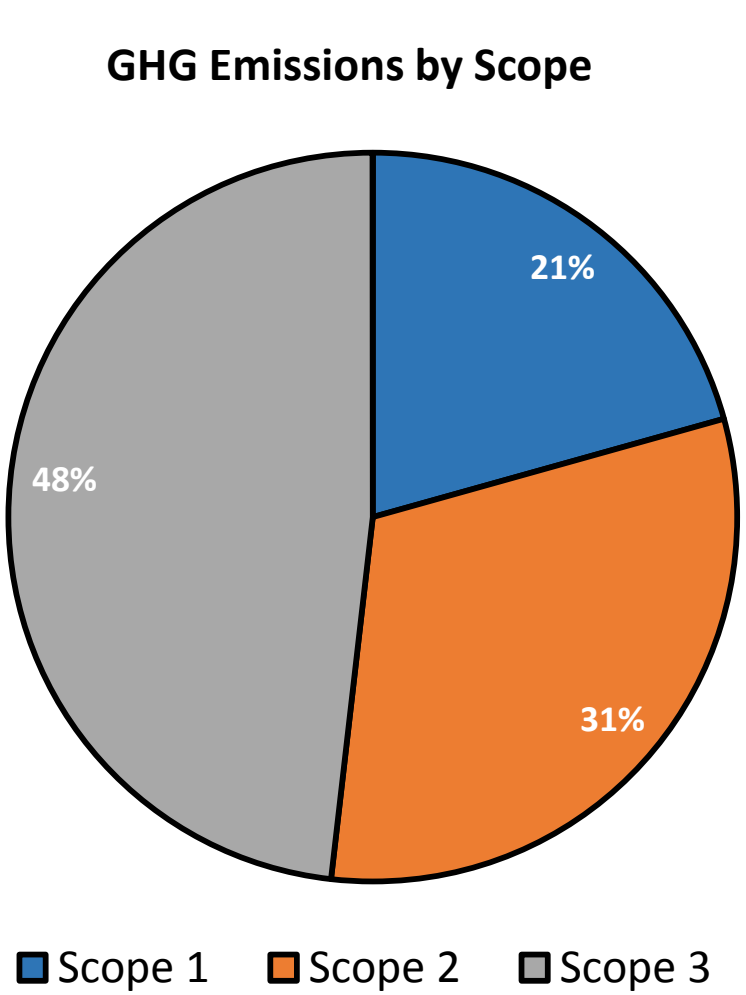
- Purchased Electricity

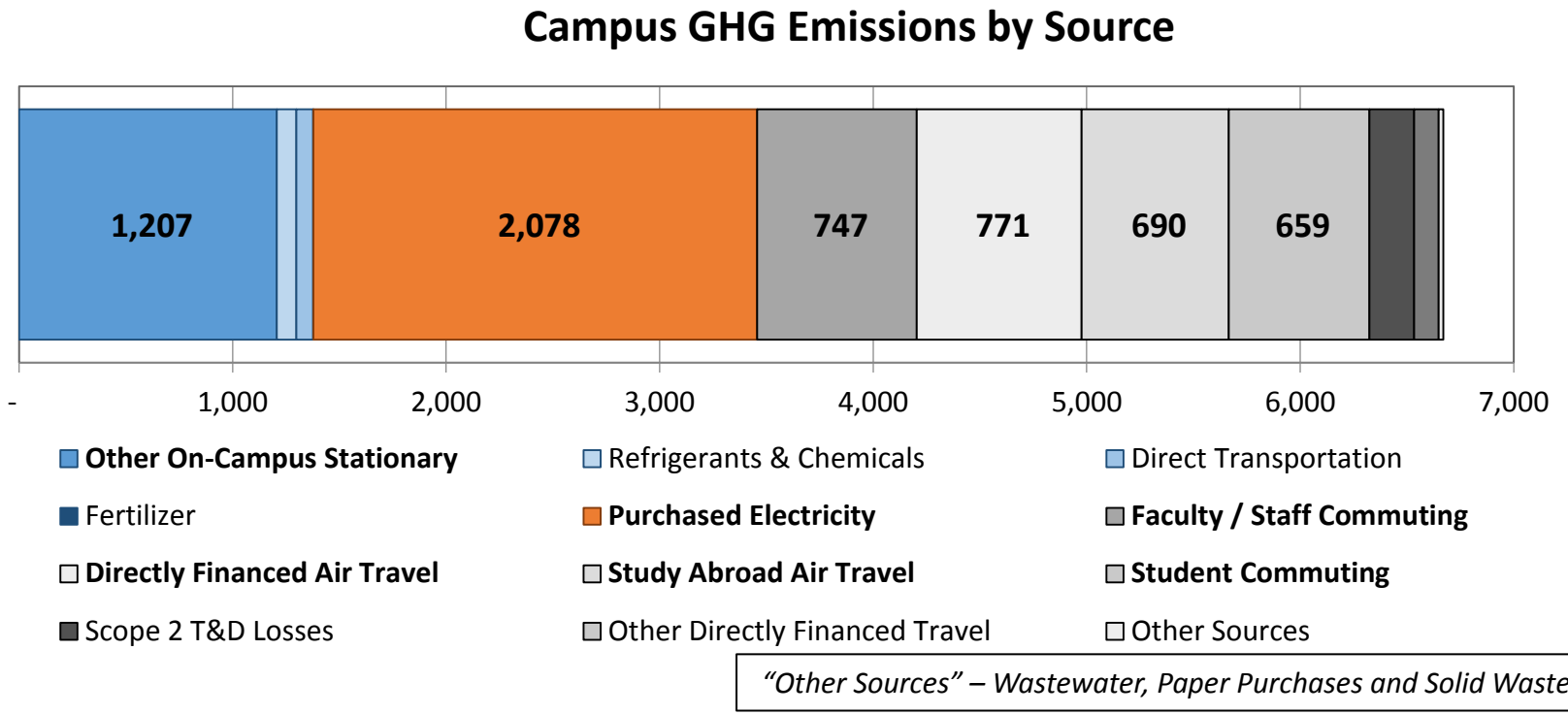
Scope 3 – Indirect

- Faculty/Staff/ Student Commuting
- Employee Air Travel & Student Study Abroad
- Shuttle Mileage & Personal Mileage Reimbursement
- Landfill Waste & Wastewater
- Purchased Paper
- Scope 2 Transmission & Distribution Losses

Increasingly Difficult to Control and Mitigate These Sources of Emissions

Summary of Champlain's GHG Emission Sources





"Other Sources" – Wastewater, Paper Purchases and Solid Waste

Champlain's plurality of emissions are from Scope 3 – Indirect to Campus Operations. This increases the difficulty of future reductions.

Emissions reduction efforts should prioritize major sources, those bolded above

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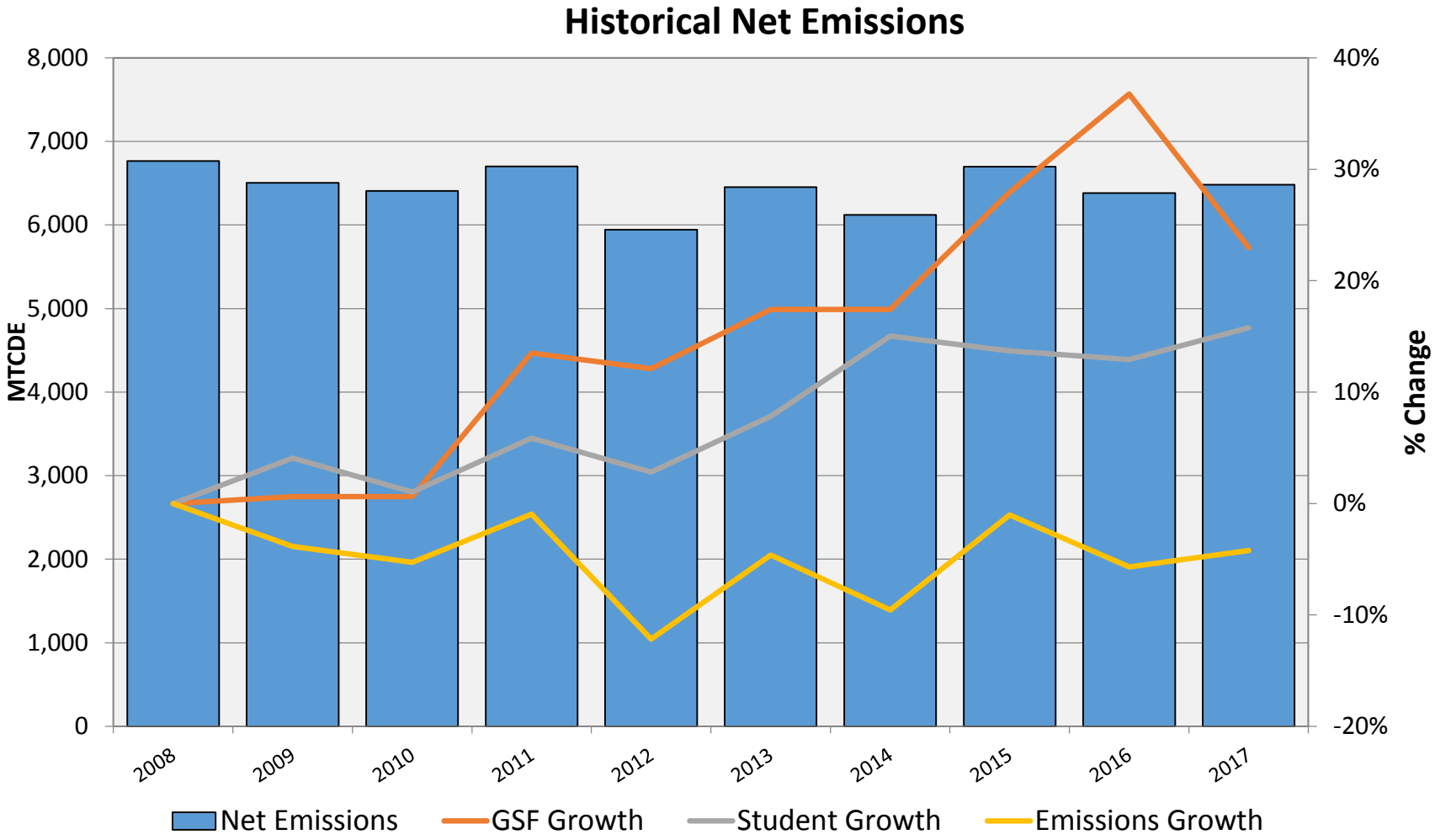
Emissions Growing at Slower Rate than Space & FTEs



Emissions have decreased by 4% since baseline 2008, while campus **space has grown by more than 20%** over the same time period

Emission typically track closely with space growth. **Due to how energy efficient the new construction is**, Champlain has been able to decouple those trend lines.

This is also reflective of the **significant role Scope 3 plays** in Champlain's emissions profile**.** A **unique feature for a liberal arts institution**

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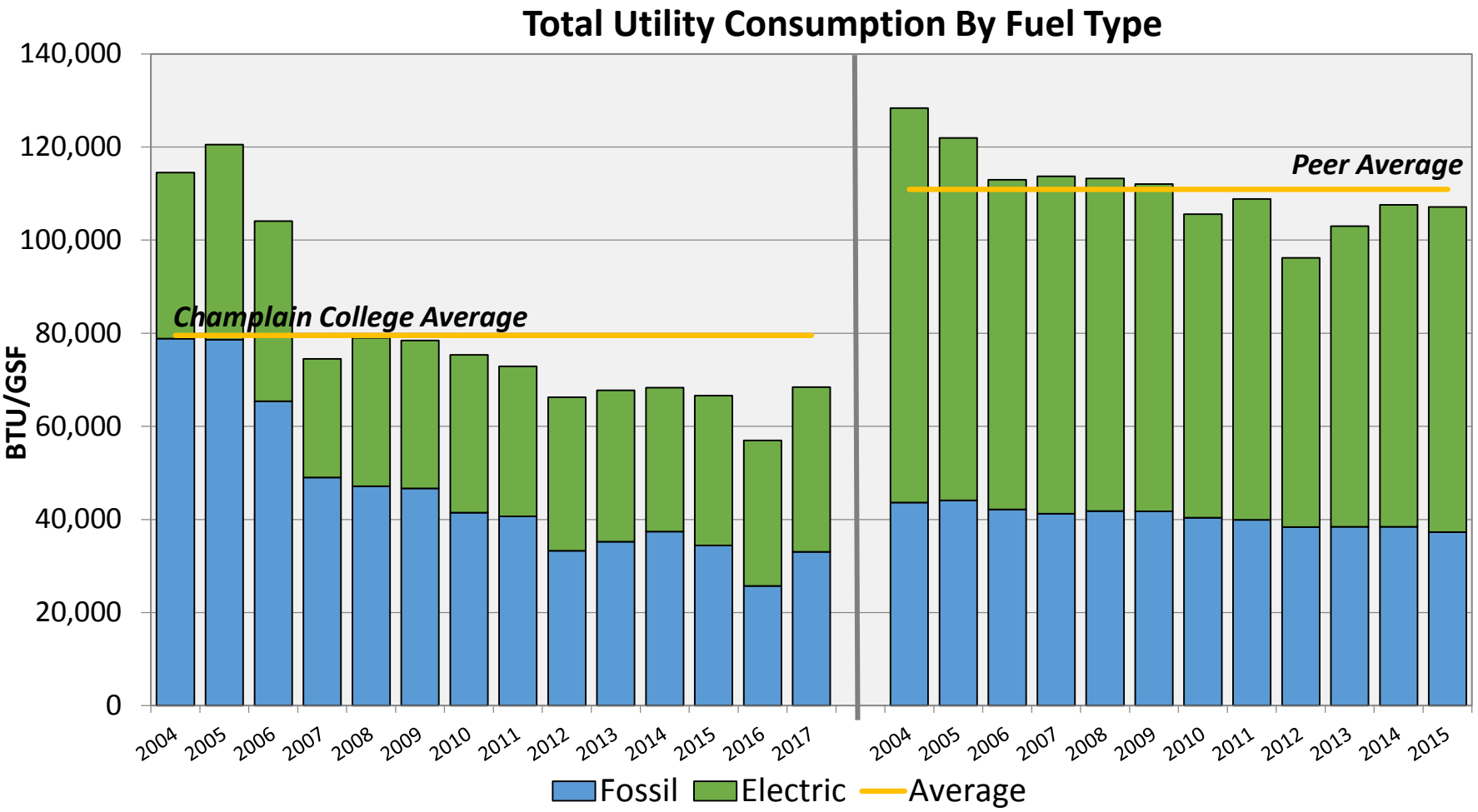
Energy Use Well Below Peers, But Increasing



Gas – 15% Increase Overall

Residential: 12% increase led by Butler, Adi/Lake & Juniper.

Acad/Admin: 7% increase led by MIC, Perry & Freeman

Electricity – 2% Increase Overall

Residential: 5% increase led by South, Whiting, Bader & Adi/Lake.

Acad/Admin: 3% increase led by Hauke/CCM, Physical Plant (the Generator) and the Chiller Plant

Sustainability Peers: Bentley University, University of Vermont, Boston College, Babson College, Siena College, Wesleyan University, Carleton College, Hamilton College, Hampshire College

Data from Sightlines ROPA+ Presentation November 2016

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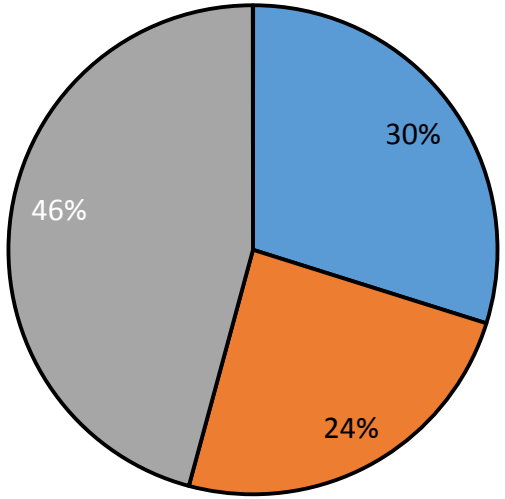
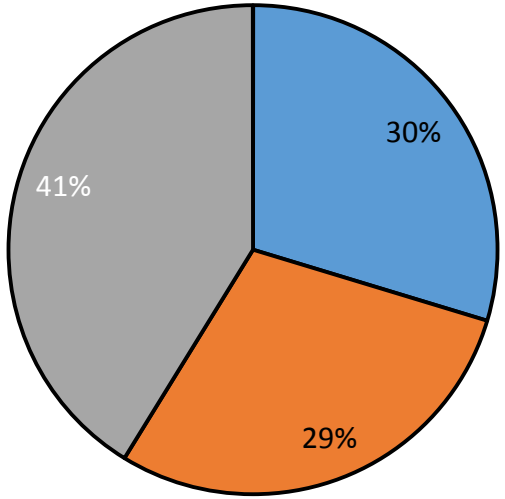
Comparing Energy Use by Source and Building Function

Champlain Square Footage

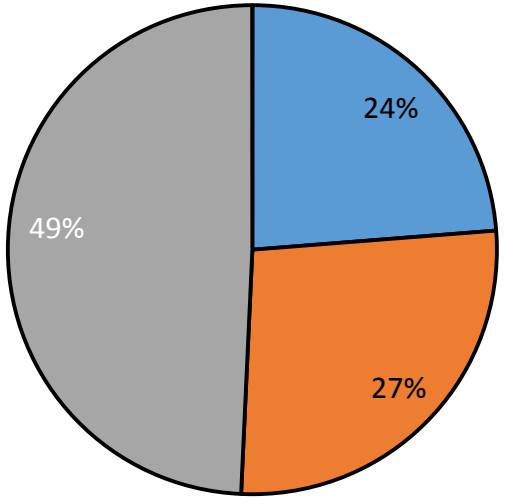


Champlain Total Energy Use

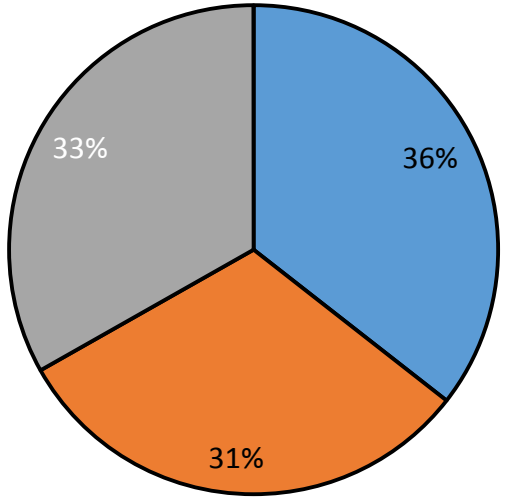


Acad/Admin Student Life Residential

Champlain Natural Gas Usage

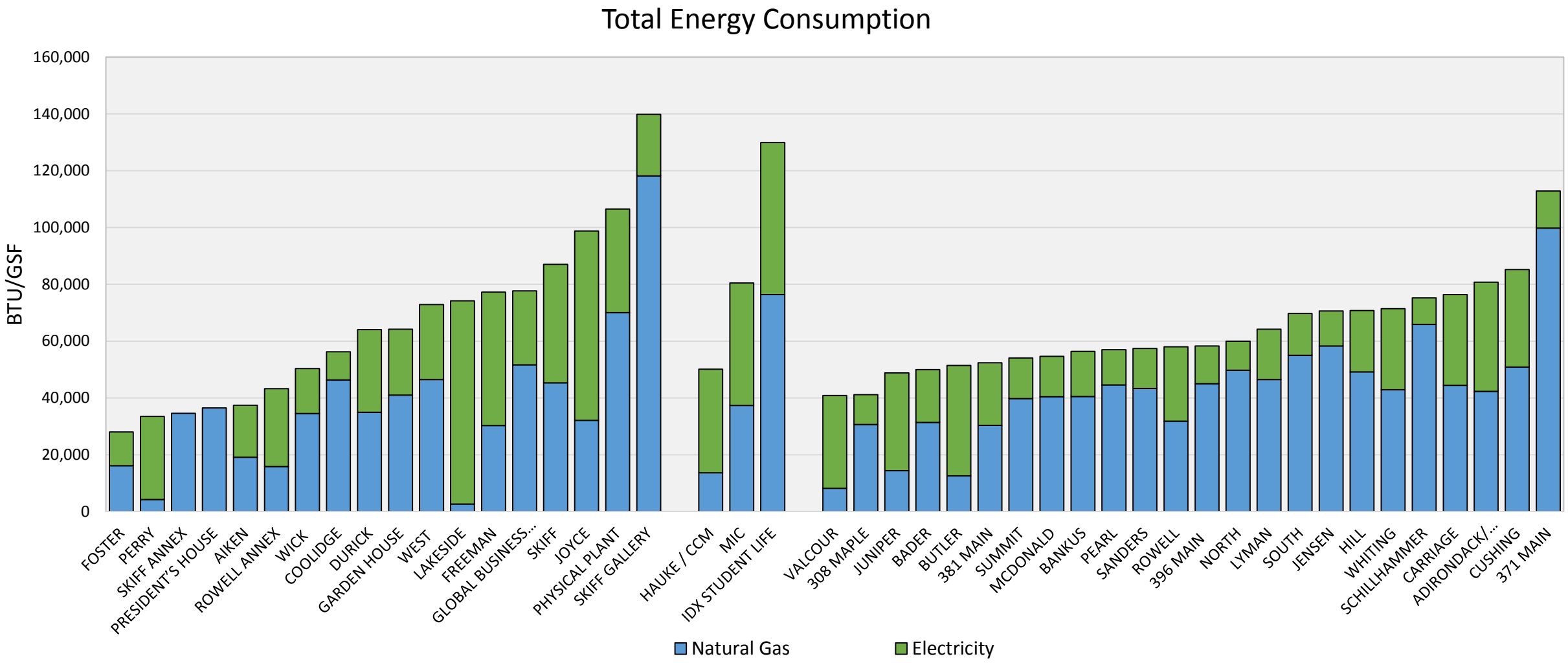


Champlain Electricity Usage

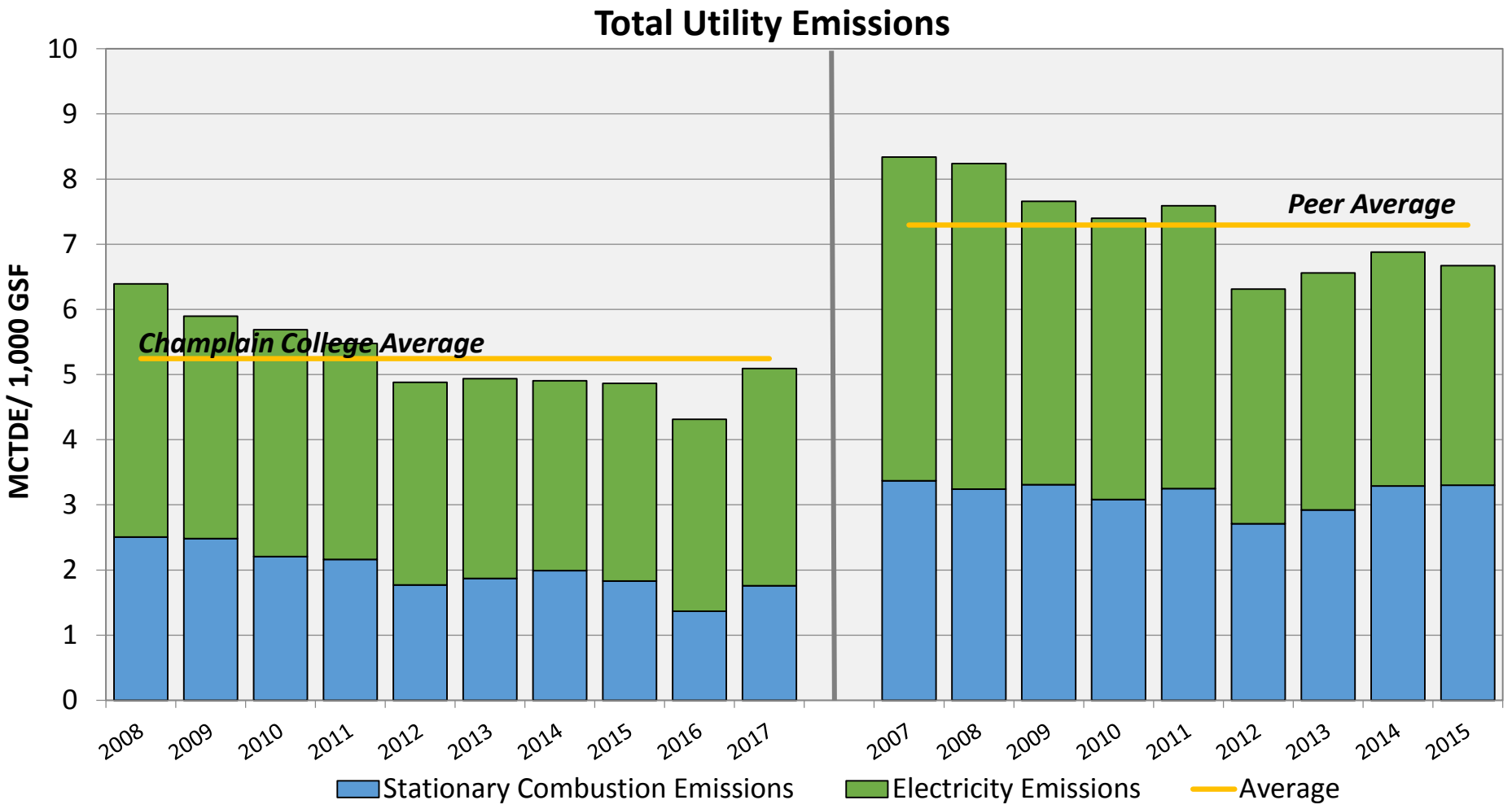


Student Life spaces are more energy intensive, especially on the electrical side.

Energy Consumption by Building



Like Consumption, Emissions Below Peers But Rising



Electricity consumption is more carbon-intense than natural gas combustion.

As a result, a small increase in campus electricity use is magnified when looking at utility emissions

Sustainability Peers: Bentley University, University of Vermont, Boston College, Babson College, Siena College, Wesleyan University, Carleton College, Hamilton College, Hampshire College

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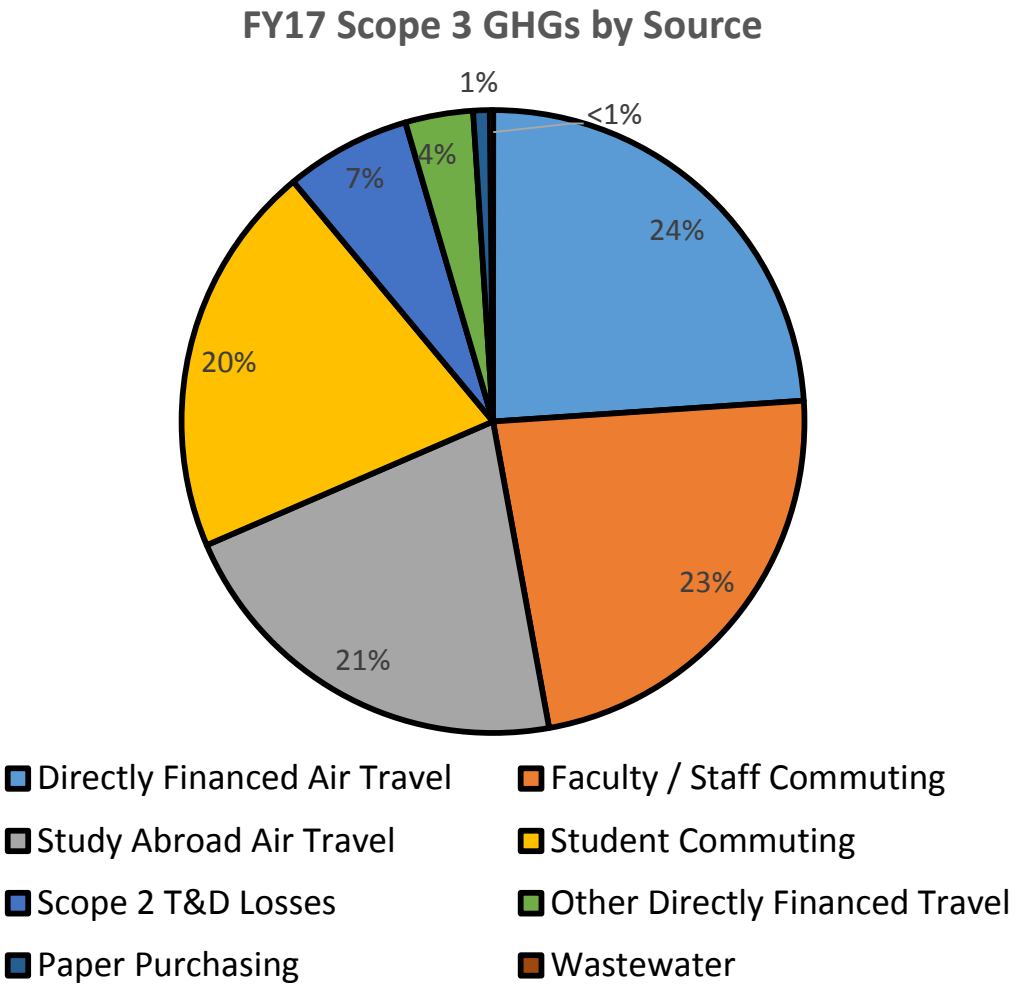
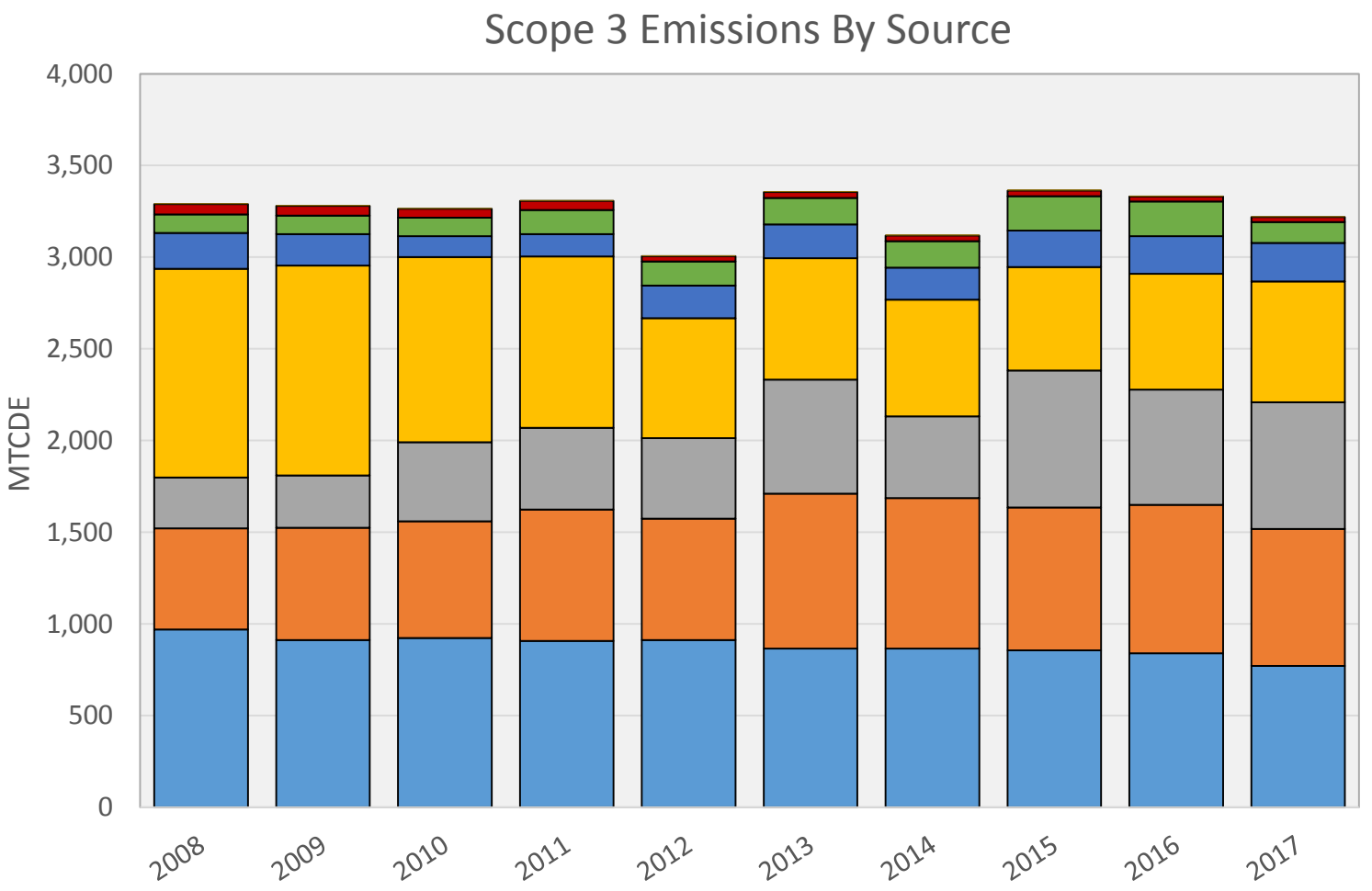
Air Travel & Commuting Are Top Four Sources





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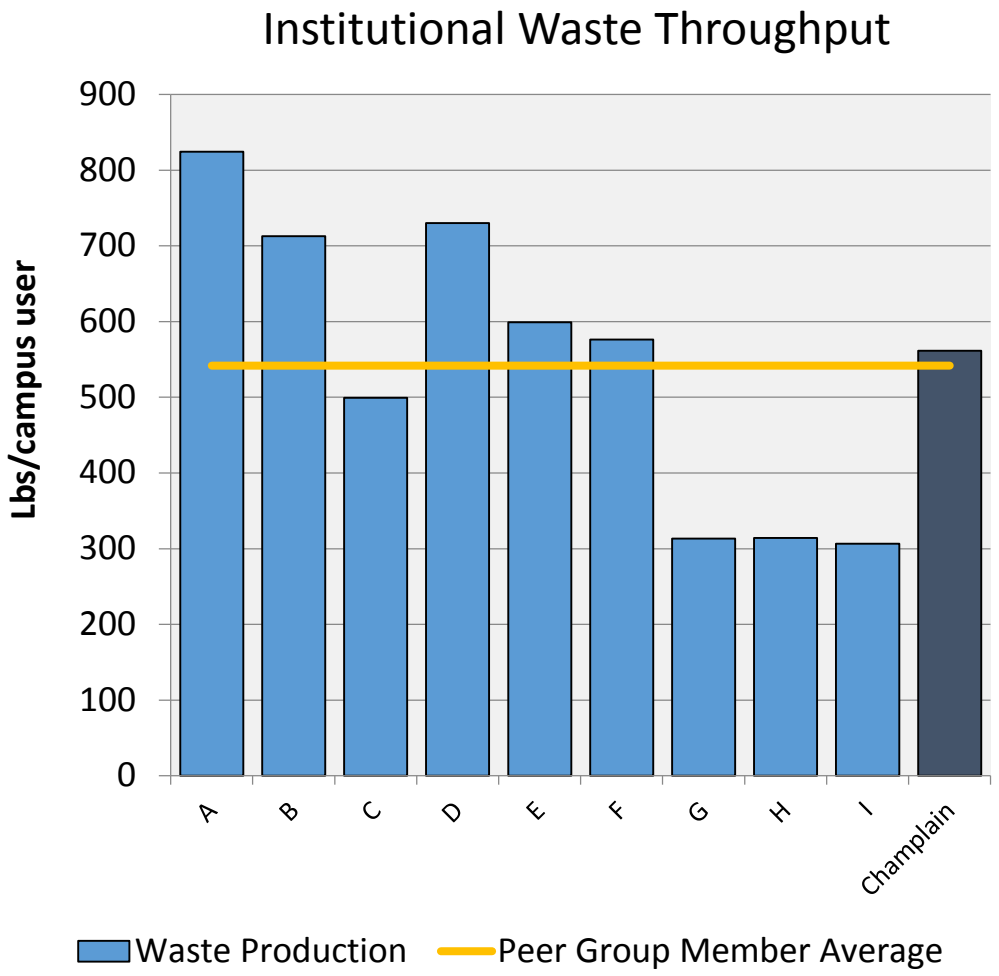
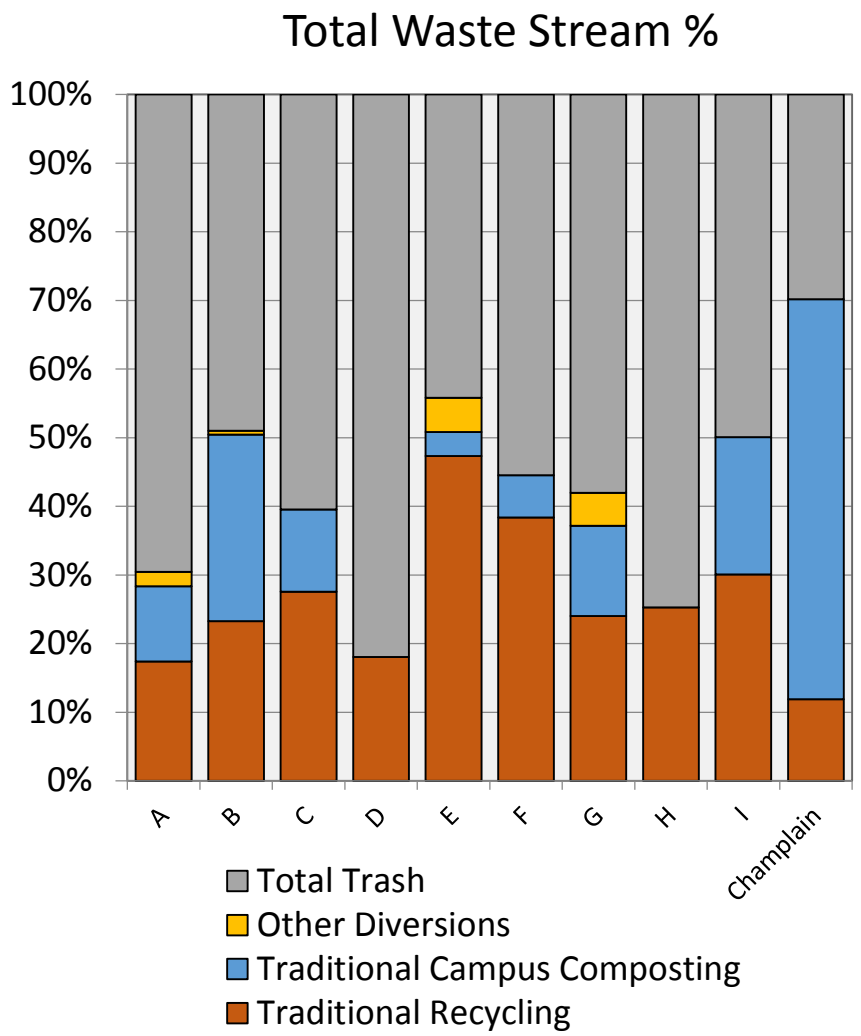
Generating as Much Waste, Diverting Much More





Increase in "Waste Throughput" is direct result of increased levels of composting.

Likely resulted in a corresponding decrease of trash, but due to calculation methodology (volume to weight estimates) this isn't reflected in throughput metric.

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Peer data from Sightlines ROPA+ Presentation November 2016

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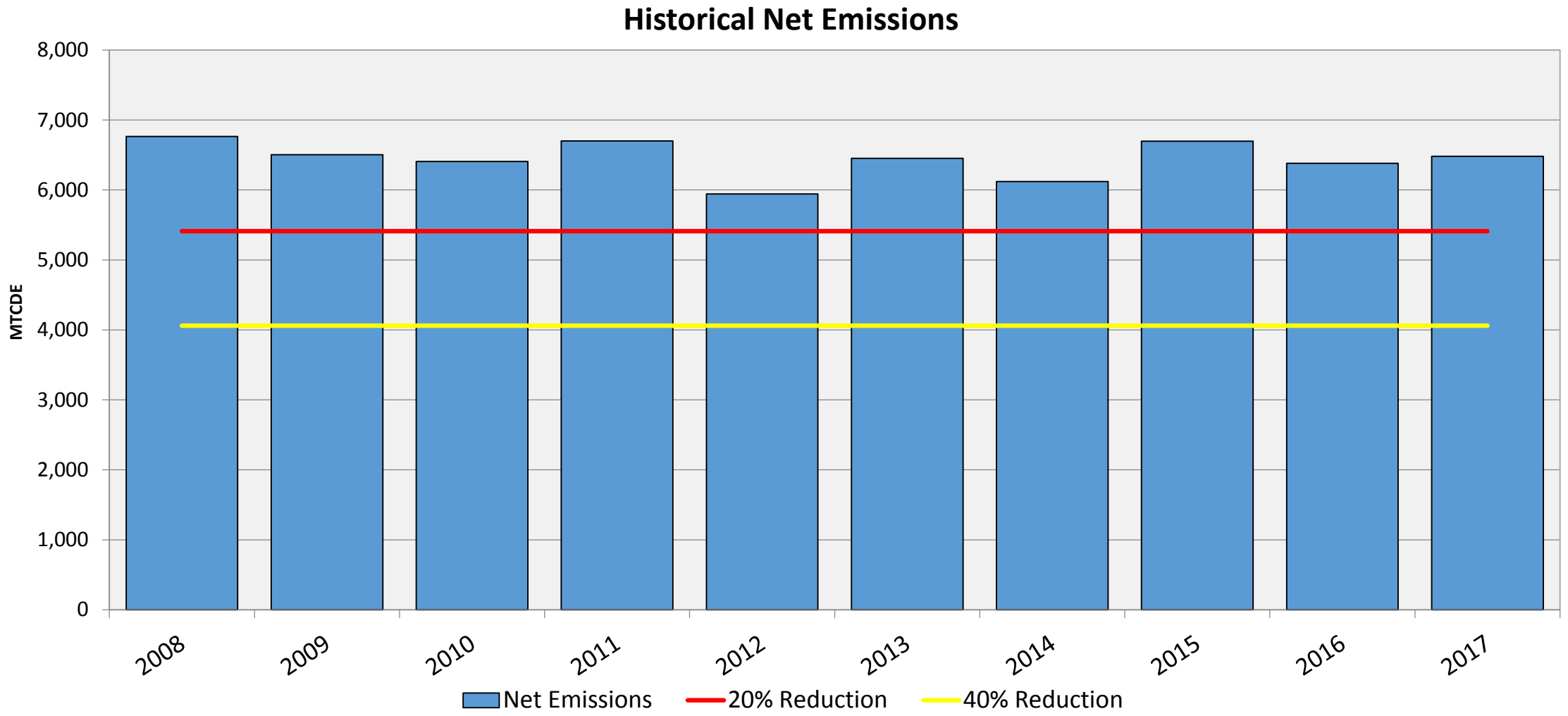
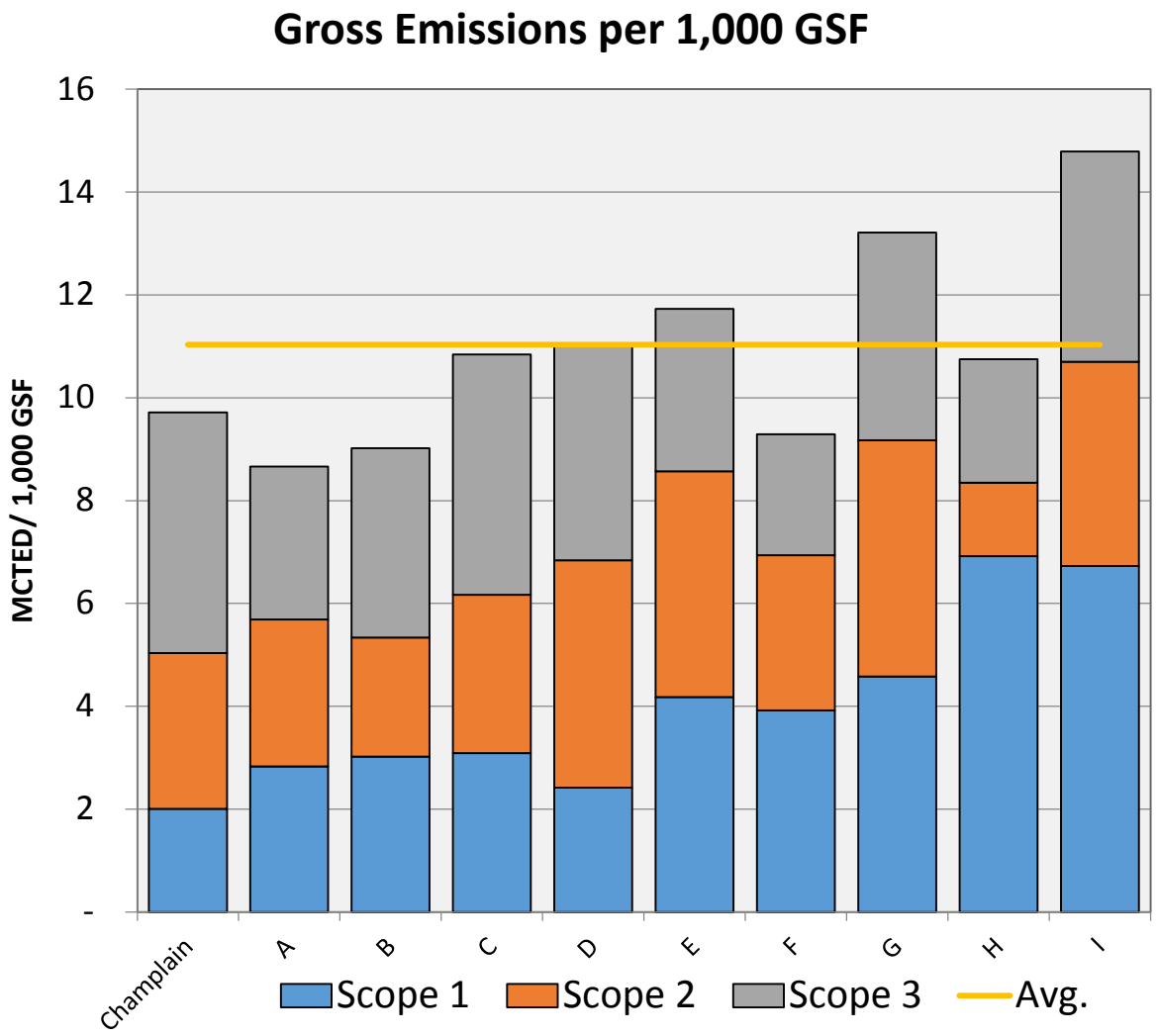
Net Emissions vs. Common Reduction Targets



Benchmarking Campus Emissions to Peers



Scope 1 & 2 emissions per GSF reflect the energy efficiency of campus buildings. Peer campuses are generally using natural gas like Champlain and are mostly located in the ISO New England region, so carbon-intensity of utilities are comparable.

Scope 3 emissions per GSF (mainly air travel and commuting) are exaggerated due to Champlain's much higher population density (i.e. more student tailpipe emissions divided by fewer square feet of building space).

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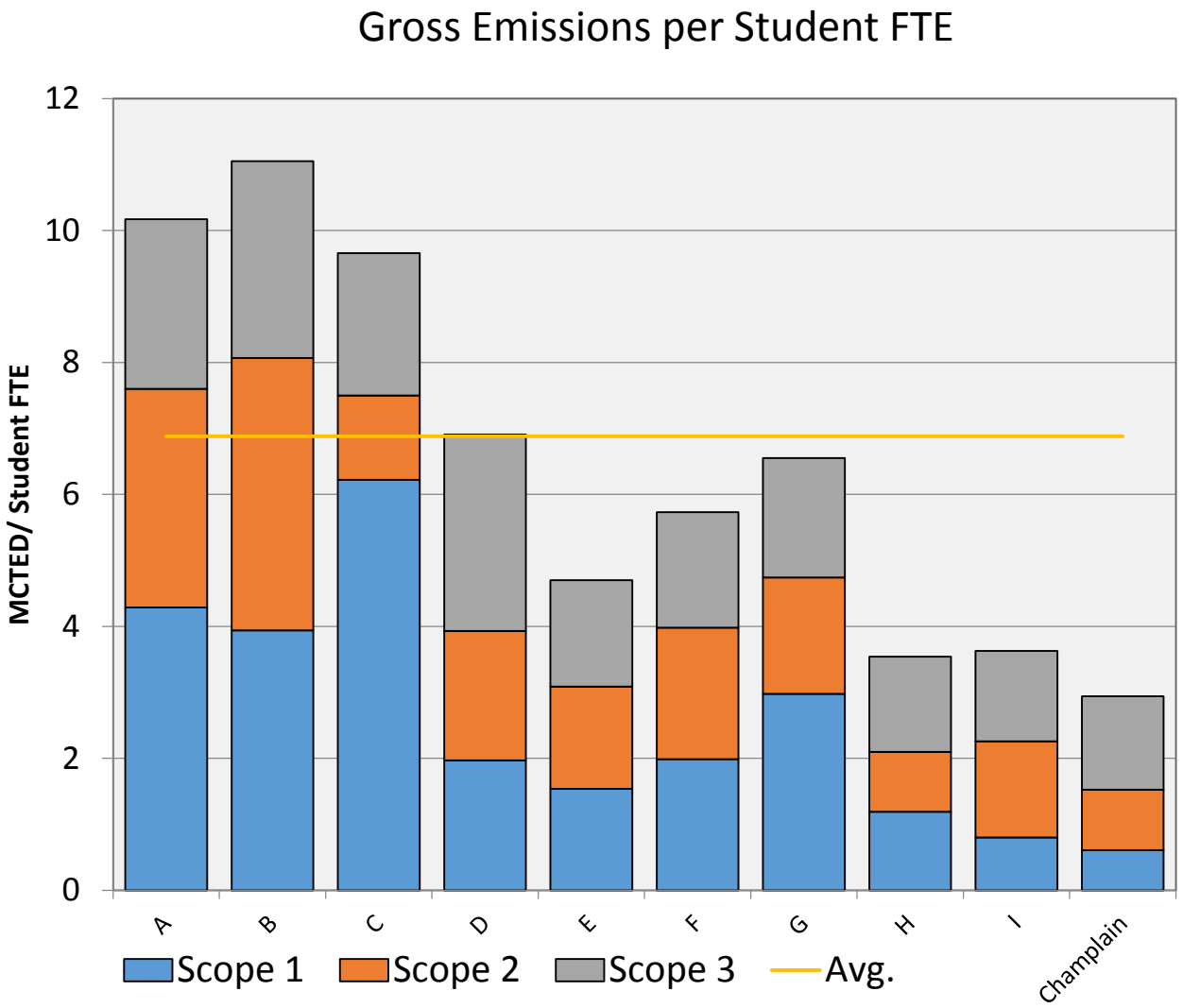
Benchmarking Campus Emissions to Peers



Champlain College's educational model generates approximately 57% less carbon emissions per student than the average peer institution. This is the result of a larger number of students utilizing less building space that is also more energy efficient.

Scope 3 emissions, on a per student basis, are well below peer institutions. This is a result of the large proportion of student and employee commuters that travel via bike and walk (43% and 21% respectively).

Sustainability Peers: Bentley University, University of Vermont, Boston College, Babson College, Siena College, Wesleyan University, Carleton College, Hamilton College, Hampshire College

Peer data from Sightlines ROPA+ Presentation November 2016

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Concluding Comments

- Champlain's emissions profile reflects a more energy efficient campus, with a higher population density, than the peer group used by Sightlines in 2016
  - This results in comparable performance on a per GSF basis and vastly superior performance on a per student basis

- Champlain has made strides to improve the accuracy of its carbon footprint by capturing the campus' directly financed air travel and refining the shuttle's emissions calculations. Other areas to focus on include:
  - **Boundary Definitions** – GSF and employee FTEs seems to have varying boundaries. Solidifying this methodology will make longitudinal analysis more accurate.
  - **Commuting** – Champlain should work with CATMA to adjust its surveying methods to improve the accuracy of student commuting emissions.
  - **Waste Generation and Diversion** - The current methodology assumes all containers are full, which likely overstates the waste generation of the campus.

Carbon Reduction Next Steps

- Champlain should continue to reinvest in existing buildings to further reduce energy use
  - Overall, Champlain is among the most energy-efficient campuses I've worked with. Therefore further reductions in energy consumption are likely to be incremental.

- Given this fact, Champlain should explore virtual net metering and other ways of sourcing green power
  - Virtual net metering and other forms of power purchase agreements can help reduce campus emissions while providing long-term budget certainty for electricity costs.
  - Few if any "drop-in" replacements/alternatives exist for natural gas – stay abreast of emerging technologies and consider the capital and operational implications of liquid fuels or centralizing utilities for a portion of campus

- Scope 3 emissions will continue to be a challenge to mitigate – success in this area is dependent more on community engagement than engineering controls or facilities investments

Appendix I

- **Notes on changes to historical data**
  - Faculty/Staff and Student Commuting
    - Updated historical student in residence calculation based on bed census data provided
    - Made FY14-16 modal splits and trip distances consistent with current calculation methodology
    - Reset trips per week to 10 as no data to suggest otherwise
  - Refrigerants
    - Reorganized refrigerant data to eliminate “Other” category which populates no emissions for refrigerant releases
  - Shuttle Bus
    - Reworked the CCC template to accept gallons of diesel for Shuttle Bus
    - Calculated approximate gallons of diesel based on prior year mileage and assumed 8 MPG as received by Mountain Transit
  - Paper Purchases
    - CCC received did not reflect the recycled content percentages provided, updated to match base data

Appendix II

- **Notes on changes to FY17 calculation methodologies**
  - Building Space
    - Excluding Owned Buildings: 270 S. Willard, 390 Maple, 436 Maple, 8 Browns Court and 10-12 Browns Court as no energy data for these buildings
  - Air Travel
    - Received Pcard data on air travel purchases – generated a pivot of city pairings and calculated one-way trip distances for all city pairings. Total came out slightly below the previously estimated amount (Sightlines database average of miles per faculty/staff).
  - Personal Mileage Reimbursement
    - Uncertainty about how this data was collected in previous years, assuming 20,000 miles annually per Victoria Gauvin. Need to make a decision about how to handle historical years.

Appendix II - continued

- **Notes on changes to FY17 calculation methodologies**
  - Student Commuting Modes
    - CATMA survey allows student to “Check all that Apply” for commuting modes – results in sum of modes > 100%
    - Includes “Shuttle” as one of the modes, which would double count those emissions
    - New modal calculation methodology excludes Shuttle responses and creates a weighted average of the “Check all that Apply” responses
  - Student Commuting Trips Distances
    - CATMA survey asks for time duration of commute, not mileage
    - Previously assumed 1 minute = 0.5 miles (30 MPH) – overstates mileage of those walking/biking
    - New trip distance methodology assumes 12 MPH for biking, 3 MPH for walking and 30 MPH for drive alone, carpool and bus