Sustainability Committee Meeting 14 March 2012, Sharples Room 4

Attending: Tom Cochrane, Debra Kardon-Brown, Linda McDougall, Eric Wagner, Carr Everbach, Clara Fang, Nicole Lewis, Marjorie Murphy, Erin Lowe, Alison Holliday, Maurice Eldridge

Tom Cochrane reported on the installation of occupancy sensors in two lecture halls, costing about $3600 apiece but saving 8kW when the lights are off. In addition, compact shelving has been installed in McCabe that saves space and electricity.

Clara reported on the current progress of the greenhouse gas inventory, extending the work of the Temple Ambler consulting group, which had covered 2005-2008. She hopes to have 2009, 2010, and 2011 finished by the end of May.

Clara conducted a survey on faculty/staff commutes, in order to better estimate the carbon used for people to get to work at Swarthmore. According to the ACUPCC formalism, we are responsible for reporting carbon from all College assets that are under operational control by the campus (directly burned fuels, refrigerants, vehicle fuels) – called Scope 1 assets, purchased electricity – called Scope 2 assets, and commuting by employees, study abroad travel, travel on college business – called Scope 3. Other items (Clara identified 9 of them) are Scope 4, and not yet tracked. These would include the carbon used to get students to/from campus, energy use in faculty housing owned by the College, and carbon offset by the Crum Woods.

Greenhouse gasses (GHG) are measured in metric tons of carbon-dioxide equivalent (CO_2e): in 2010, the College emitted 16,008 metric tons, for which an offset would be the sequestering from destruction of 159 acres of forest. For its students, faculty, and staff, that comes to 6.5 metric tons per year (2010>

There was a discussion of employee commute and air travel, based upon Clara's survey results (average commute 13 miles/day). Clara had applied the percentages in the responses received proportionally to the entire 932 employees (695 of whom are full-time), while some SusCom members thought that the sample was likely to be biased toward longer-distance commuters/travelers.

Purchased electricity is the largest component of College carbon emissions, because Pennsylvania is a coal-rich region in the power grid. On the other hand, purchasing wind and other low-carbon electricity will result in large carbon reductions.

Another large reduction was due to the College buring less Number 6 "bunker" fuel oil for campus heating during the winter, in favor of lower-carbon Natural Gas. However, our contract for natural gas requires that we submit to curtailment in the case of shortages, in which case we would be forced to burn more bunker fuel.

On gasoline use, Facilities vehicles use the most, Tri shuttle uses B20 biodiesel (1/3 of which is credited to Swarthmore's carbon emissions).

There was a general discussion of the Renewable Energy Credits that the college purchases as an offset for its electricity use. The College purchases these RECs in 1 MWh increments, offsetting a portion of the carbon it (indirectly) generates in electricity production. Nicole asked if the reductions Clara showed for 2010 were due to an abnormally warm winter. Carr pointed out that one can count heating degree days in winter, and cooling degree days in summer, and normalize to take into account our *relative* energy efficiency (also called energy intensity: kWh per square foot per degree day).Tom Cochrane noted that, on the contrary, it had been a snowy winter, with hot summers, and extra diesel use for snow plows in 2010-11. Therefore even without doing Carr's normalization, we are saving carbon better.

There was an extensive discussion of the carbon contributions that the new College Inn might make. Since the Inn will stand on College property and be managed by College administrators, it will have to be included directly in Scope 1, 2 and 3 emissions data. That could reduce our progress toward carbon reduction, depending upon how the design of the Inn is handled. Maurice said he thought it would be reasonable to interact with Stu Hain and the Inn architects in the Fall 2012 semester, after they have begun firming up the design.

Clara presented a long list of recommendations for the future, including conducting a comprehensive study of energy intensity of each building on campus (to find the slackers), implement a centralized system for tracking and reimbursing travel on College business, and increasing REC purchases to offset 100% of electricity emissions.

As for Scope 4 emissions, Clara suggested that SusCom address carbon from college-owned housing in its Fall 2012 semester. Each year, Associate Provost Marcia Brown conducts a survey of faculty needing/using College housing, and this survey could include information about energy use to heat/cool the units.

Alison pointed out that potential faculty find College housing a plus, even a draw, because they can walk to work, saving money and carbon.

We also discussed using local carbon offsets, such as the College's purchasing brownfields and re-foresting them, or buying landfill gas rather than fossil methane.

Clara's presentation is appended to this report.

Respectfully submitted,

Carr Everbach

Greenhouse Gas Inventory and Preliminary Recommendations of the Climate Action Plan

Clara Changxin Fang

March 14, 2012

Overview

- Temple University compiled inventory for 2005-2008
  - Included heat, electricity
  - Assumed values for employee commute and vehicle fleet
- 2009 and 2010 inventory
  - Includes heat, electricity
  - Survey values for employee commute, employee air travel
  - Real data on study abroad travel
  - Real data on department vehicles

Includes

- Scope 1
  - Natural gas (used in boilers and chiller)
  - Fuel oil #2 (boilers and generators)
  - Fuel oil #6 (boilers)
  - Refrigerants
  - Diesel and gasoline (burned in college owned vehicles)
- Scope 2
  - Purchased electricity
- Scope 3
  - Employee commute
  - Employee air travel
  - Study abroad air travel
  - Composting (offset)

Does Not Include

- Energy use in faculty housing
- Energy use by contractors
- Waste sent to the incinerator
- Carbon offset by Crum Woods
- Life cycle emissions of food or product purchases
- Student travel to campus and back home
- Student travel for research or short stays
- College reimbursed ground travel
- Visitors' travel to the college

Greenhouse Gases Measured

- Carbon dioxide - CO2
- Nitrous oxide - N2O
- Methane - CH4
- Hydroflurocarbons – HFCs

Results Measured in CO2e

- Global Warming Potential (GWP) factors represent the ratio of the heat-trapping ability of each greenhouse gas relative to that of carbon dioxide. For example, the GWP of methane is 21 because one metric ton of methane has 21 times more ability to trap heat in the atmosphere than one metric ton of carbon dioxide.

Table 1: GHG Global Warming Potentials

GHG	GWP
Carbon Dioxide (CO_2)	**1**
Methane (CH_4)	**21**
Nitrous Oxide (N_2O)	**310**
Hydrofluorocarbons (HFCs)	**Varies**
Perfluorocarbons (PFCs)	6,500-9,200
Sulfur Hexafluoride (SF_6)	23,900

Raw Data

Scope	Source	Quantity	Unit
1	Natural Gas	96,874	mcf
1	Fuel Oil #2	3,286	gallons
1	Fuel Oil #6	586	gallons
1	Vehicles - Diesel	5,446	gallons
1	Vehicles - Gas	24,589	gallons
1	Refrigerants	60	pounds
2	Purchased Electricity	13,838,931	kwh
3	Employee Commute	777	metric tons CO_2e
3	Admissions Air Travel	151,793	miles
3	President's Air Travel	36,258	miles
3	Employee Air Travel	2,687,622	miles
3	Study Abroad Air Travel	1,077,610	miles
3	Total faculty and staff air travel	2,875,673	miles
Offsets	Renewable Energy Certificates	6,417	mwh
	Composting	183	short tons

Emissions in 2010

- 16,008 metric tons
- Equivalent to:
  - Annual GHG emissions from 3,139 passengers cars
  - Emissions from burning 1,794,619 gallons of gasoline
  - Emissions from electricity use for 1,996 homes in a year
  - Carbon sequestered by 159 acres of forest saved from deforestation
  - Emissions avoided by recycling 6116 tons of waste

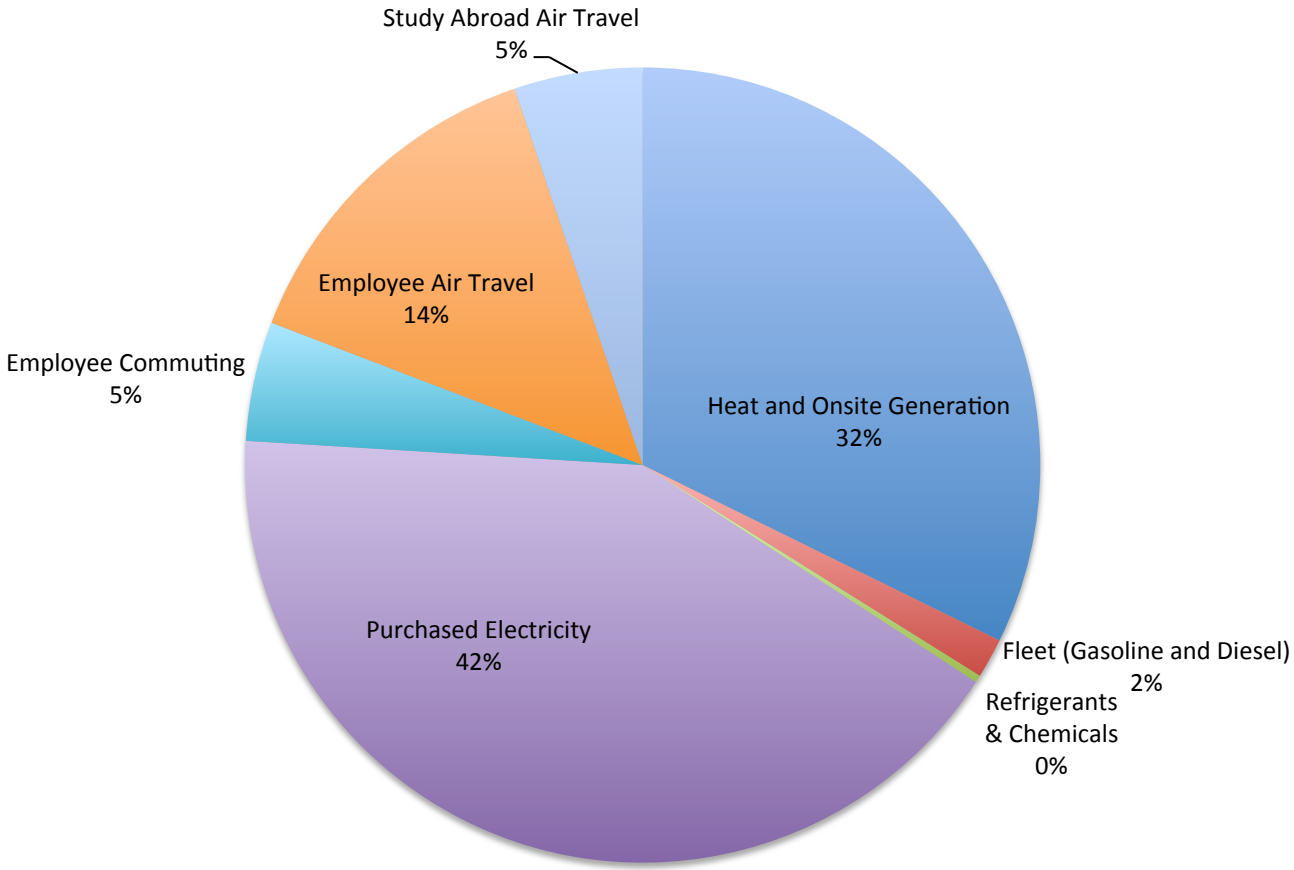
Per Capita Emissions

- CO2e per person: 6.5 metric tons a year
  - Students, faculty, staff
- CO2e per square foot: 10.8 kg a year
- Offset 3,172 metric tons
- Net emissions 12,835 metric tons

Emissions by Source

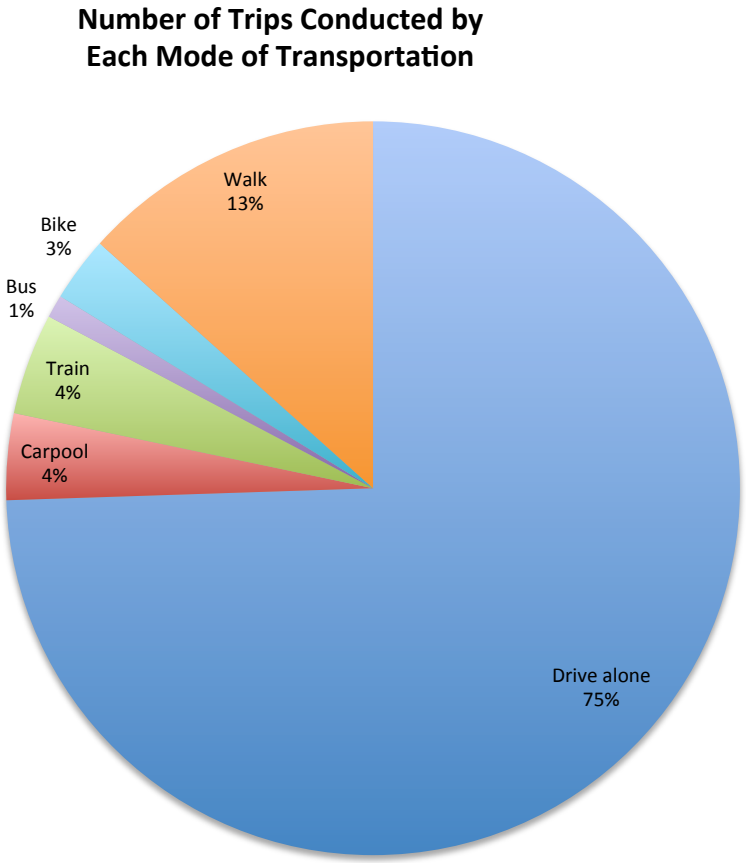
Scope	Source	Metric Tons CO2e
1	Heat and Onsite Generation	5,166.4
1	Fleet (Gasoline and Diesel)	259.4
1	Refrigerants & Chemicals	46.3
2	Purchased Electricity	6,689.2
3	Employee Commuting	777.1
3	Employee Air Travel	2,232.6
3	Study Abroad Air Travel	836.6
	Total Emissions	16,007.6
	Composting	*-70.4*
	Renewable Energy Credits	*-3,101.7*
	Net Emissions (Total - Offsets)	12,835.5

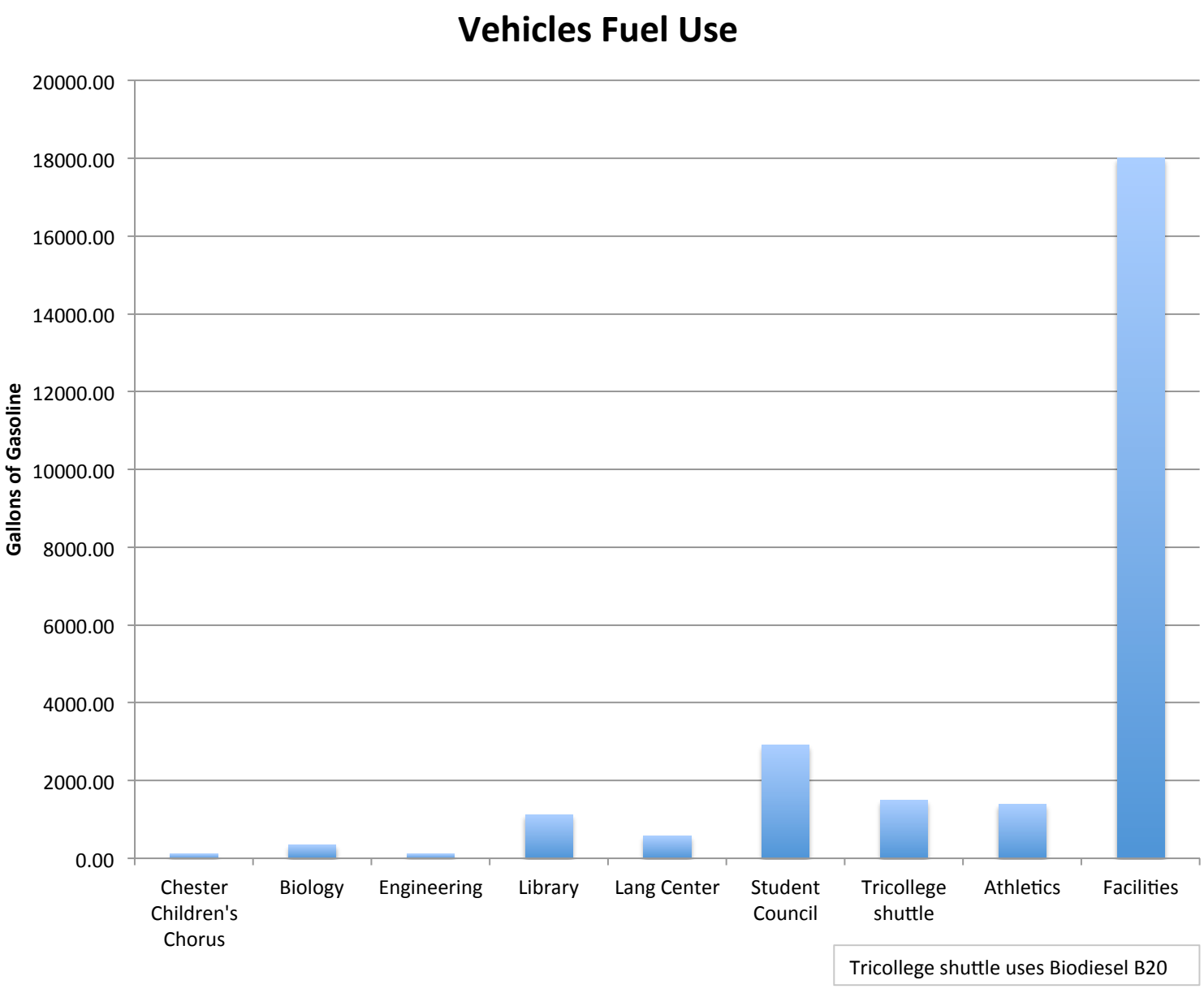
CO2e Emissions 2010



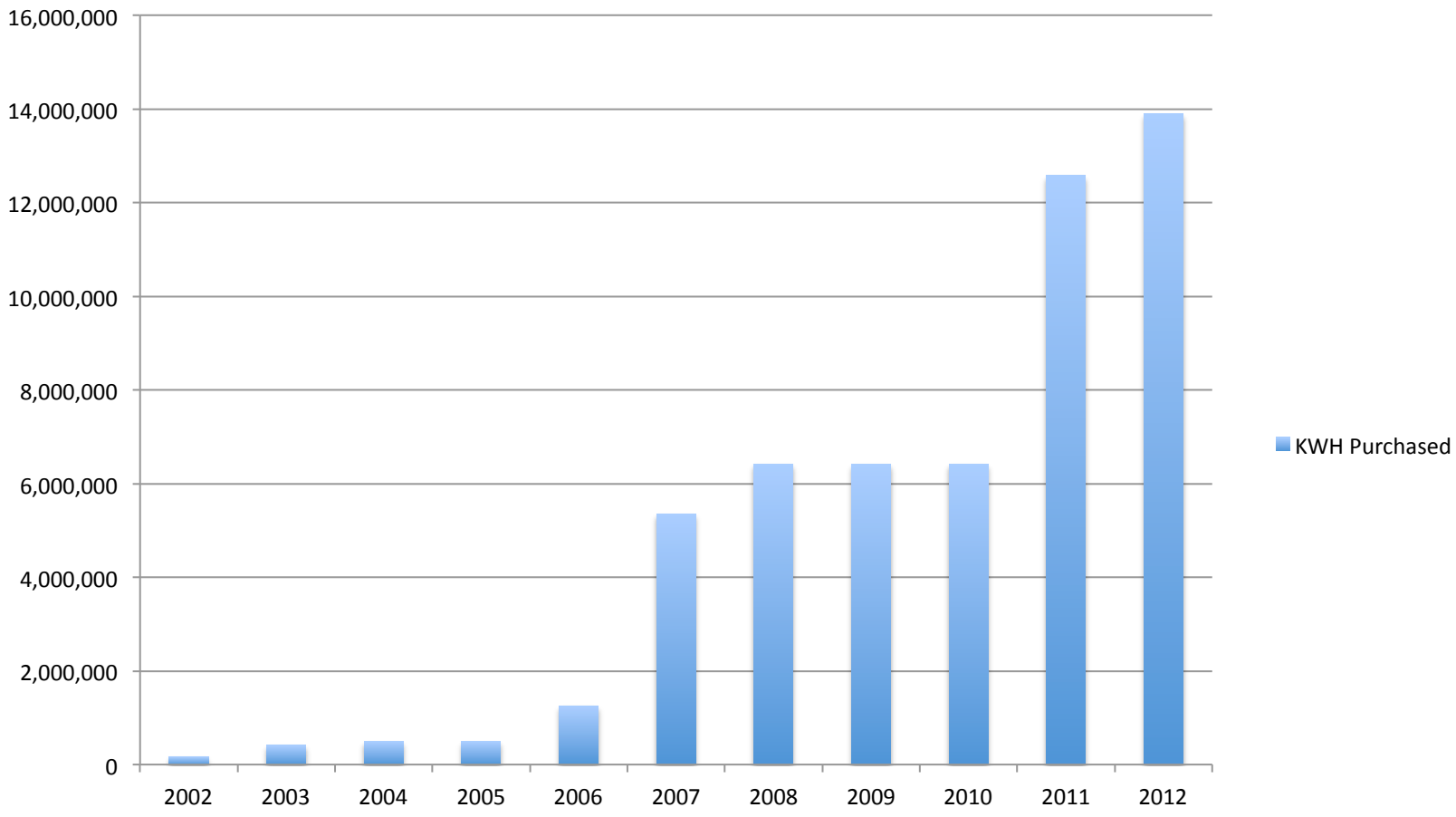
Employee Commute

- 791 metric tons
- 932 employees
- 695 full time
- Total commute: 2.5 million miles
- Average commute 13 miles a day

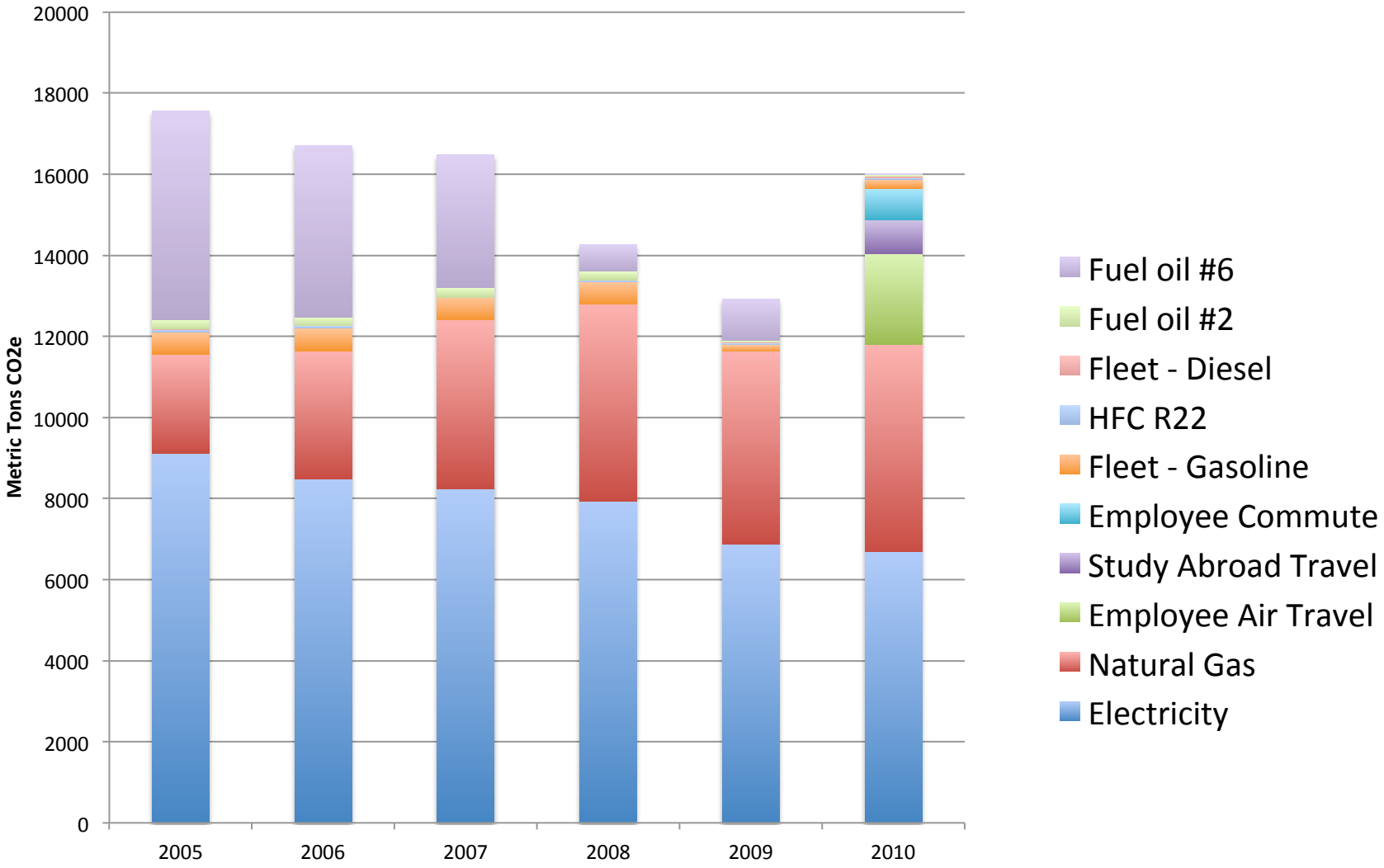



Vehicles Fuel Use
Gallons of Gasoline
20000.00
18000.00
16000.00
14000.00
12000.00
10000.00
8000.00
6000.00
4000.00
2000.00
0.00
Chester Children's Chorus
Biology
Engineering
Library
Lang Center
Student Council
Tricollege shuttle
Athletics
Facilities
Tricollege shuttle uses Biodiesel B20

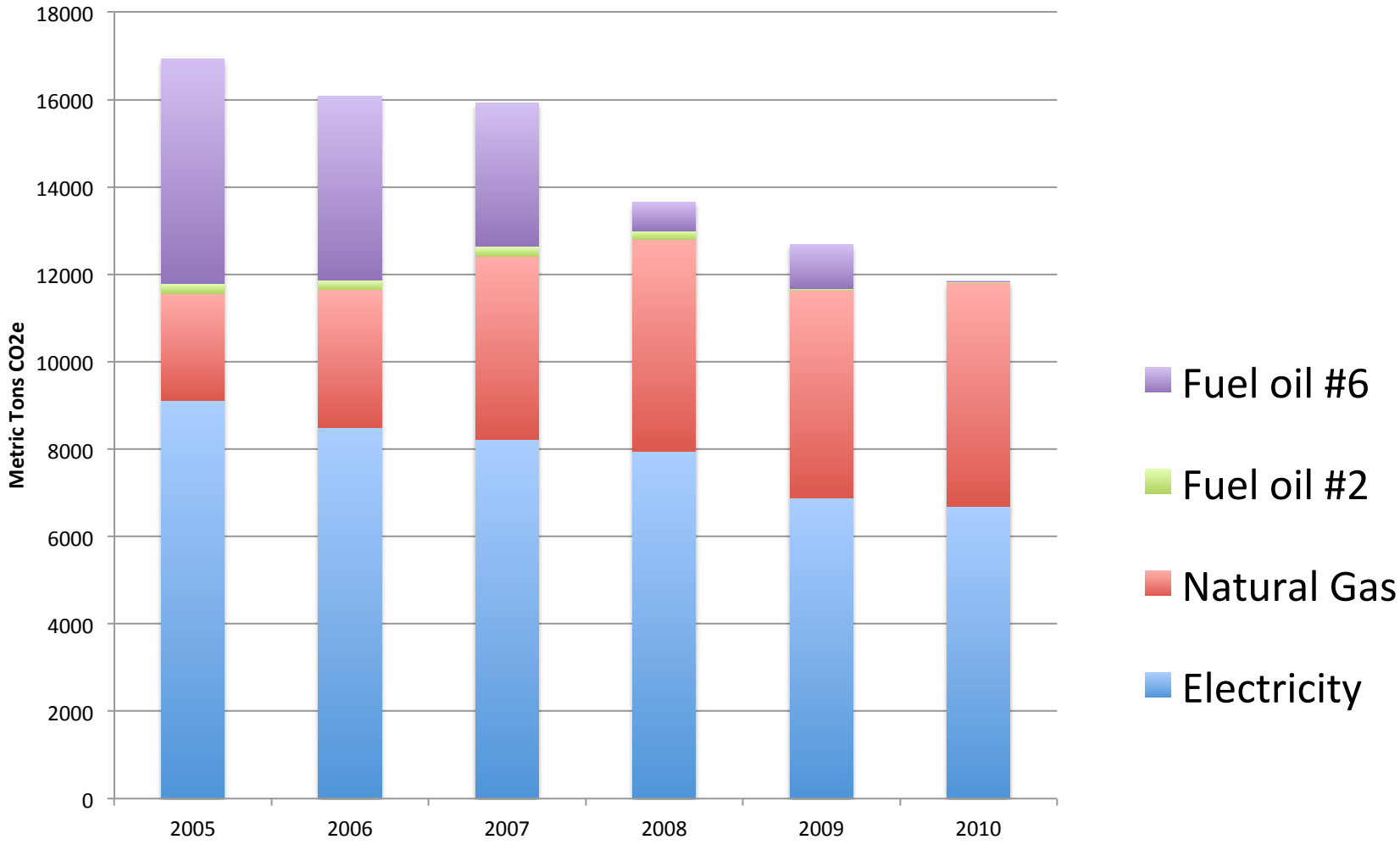
Renewable Energy Credit Purchases



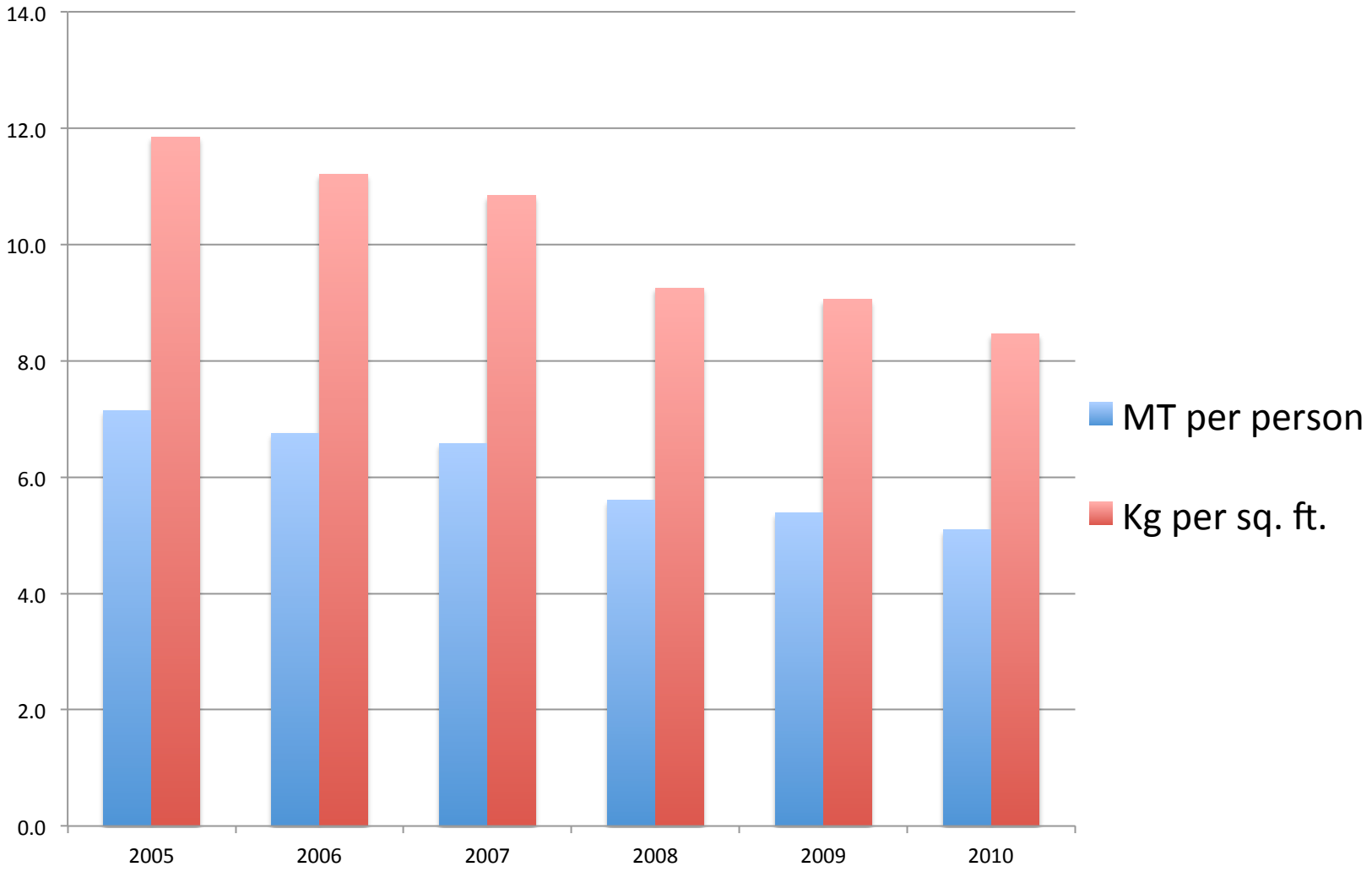
CO2e Emissions 2005-2010



CO2e Emissions from Heat and Electricity



CO2e Emissions from Energy Use per Person and per Square Foot



Conclusions

- Decline in net and per capita emissions reflect improvements in energy infrastructure and the choice to use less fuel oil.

- Declines will be increasingly difficult to maintain with planned expansion of the college

Buildings

- Conduct a comprehensive study of campus buildings and energy infrastructure.
- Optimize fuel use to minimize GHG emissions.
- Continue to perform lighting and equipment upgrades.
- Conduct all new construction and renovation be built to highest energy and environmental design standards.
- Encourage behavior change by implementing a paid Green Advisors program.
- Improve education and outreach on sustainability for employees.

Transportation

- Implement a centralized system for tracking and reimbursing all college funded travel.
- Consolidate the vehicle fleet and hire a transportation manager.
- Purchase alternative fuel vehicles whenever feasible.
- Provide incentives and tools for using alternative modes of transportation.
- Reduce and offset emissions from college funded air travel.

Carbon Offsets

- Increase renewable credit purchases to cover all CO2e emissions (5 times 2010 level).
- Investigate alternative carbon offset strategies.
- Investigate and implement onsite renewable energy systems.

Next Steps

- Fundraise for sustainability
- Establish an Office of Sustainability
- Track progress and improve data collection
- Work on sustainability's integration into the curriculum
- Prepare a Sustainability Plan

Questions? Comments?