College of Saint Benedict
St. Joseph, MN
Greenhouse Gas Emissions Inventory Report

1992-2008

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1. Summary

This report reviews the College of Saint Benedict's green house gas emissions using the Clean Air Cool Planet Carbon Calculator. This tool covers greenhouse emissions covered by the Kyoto Protocol, Including Carbon Dioxide (CO_2), Methane (CH_4), nitrous oxide (N_20), hydrofluorocarbons (HFC), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6).
The emissions report covers fiscal years 1992-2008.

The inventory process was completed in accordance with the American College & University Presidents Climate Commitment. Completing an emissions inventory is a primary step in defining the amount of emissions The College of Saint Benedict emits. By finding emissions data, The College of Saint Benedict is able to track their greenhouse gas emissions and come closer to ultimately achieving carbon neutrality.

2. Inventory Process

a. Clean Air-Cool Planet Campus Carbon Calculator

Clean Air-Cool Planet (CA-CP) is a nonprofit organization that provides a Microsoft Excel spreadsheet to calculate greenhouse gas emissions for participating corporations, communities, and campuses. It is currently in use by over 200 schools in North America. The spreadsheet allows for input of information into separate categories including institutional data, transportation, solid waste, and refrigeration. As data is input into the spreadsheet, CA-CP estimates total greenhouse gas emissions. The spreadsheet provides graphs and charts to illustrate trends in greenhouse gas emissions. To complete this inventory, version 5.0 was used.

b. Methodology

The Campus Carbon Calculator specifies seven categories of data in order to make its calculations. These categories include: Institutional Data, Purchased Electricity, Steam and Chilled Water, On Campus Stationary Sources of Energy, Transportation, Agriculture, Solid Waste, Refrigeration, and Carbon Offsets. Each category is broken into detailed subcategories. Not all categories are relevant to each organization.

c. Limitations

While conducting the inventory, data regarding transportation was difficult to gather. While completing the calculation of non-commuter vehicle miles traveled by students, faculty, and staff a survey was used to estimate miles traveled. This model has limitations since survey data is often unreliable and inaccurate. In the future, the institution may want to complete a more comprehensive survey for a more accurate model of non-commuter vehicle miles traveled.

Data was collected for air miles traveled based on corporate travel card charges. The reported data does not include travel expenses for reimbursement forms. In the future, the College is planning on requesting miles traveled on reimbursement forms for more accurate data.

d. Data Sources and Contacts

Institutional Data:

Budget:
Anne Oberman
Controller
CSB Business Office
Ext. 5999
aoberman@csbsju.edu

Population:
Data Source: Full-Time Students: CSB/SJU institutional data fact book
http://www.csbsju.edu/institutionalresearch/pdf/FactBook2007.pdf

Physical Size:
Jim Schumann
Interim Chief Physical Plant
CSB Mary Commons 127
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Data Source: http://www.csbsju.edu/csbfacilitiesmanagement/facilities/academic.htm

Purchased Electricity:

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Power Plant Director
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Transportation

Gasoline Fleet:
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Diesel Fleet:
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Transportation Director

CSB Maintenence Building
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Air Travel:
Faculty/Staff Business:
Anne Oberman:
Controller
CSB Business Office
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Commuter:
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Professor
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Data Source: Faculty/Staff Business: GIS coordinates and Survey

Agriculture:

Fertilizer Application:
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Grounds Supervisor
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Solid Waste:

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Refrigeration and other chemicals:

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Director of Environmental Health and Safety
CSB Main and PENGL 201
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3. Inventory Results

The objective for the inventory was to see previous emissions data for comparison in the future. There is not consistent data dating back to the 1992 fiscal year; certain data was only available for different years. Specifically, solid waste, fertilizer application, and student/faculty and staff commuter data was only available for the 2008 fiscal year.

- Annually, the College of Saint Benedict emits an average of 15212.81 metric tons green house gases in carbon dioxide equivalence.
- In 2008, the College of Saint Benedict emitted 21823.11 metric tons of green house gases in carbon dioxide equivalence. Figure one below details the sources of emissions in 2008.

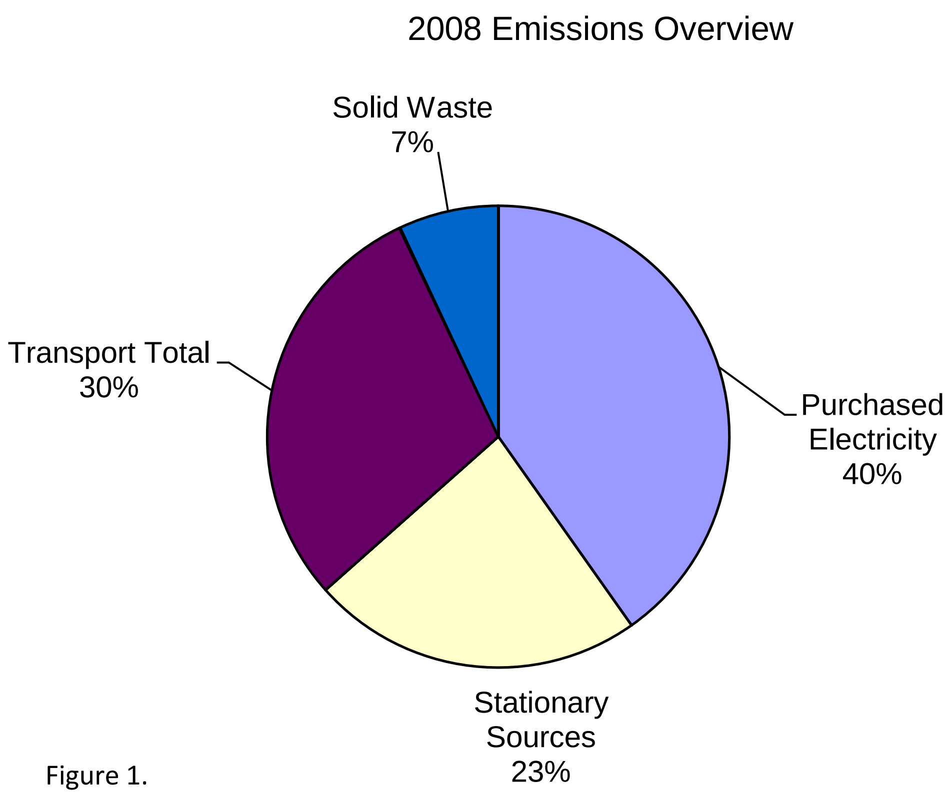

Figure 1.

Figure 2 below shows emissions by scope since the 1992 fiscal year. “Emissions by Scope” refers to the origin of the emissions. Scope one emissions refer to all emissions of greenhouse gasses from sources that are owned or controlled by The College of Saint Benedict. This includes emissions generated such as fuel used by campus vehicles and Hydrofluorocarbon leakage from refrigeration and/or air conditioning units on campus. Scope two emissions include emissions by power plants released producing electricity for the institution. Scope three emissions encompass all other indirect emissions. This includes emissions that result from institutional action but are from sources neither owned nor controlled by the institution. The sharp rise of scope three emissions in 2008 is due to the data that was only available for that fiscal year. At The College of Saint Benedict, Scope 2 emissions are the single largest contributor to green house gas emissions. Thus, electricity produced to for the institution contributes most green house gas emissions.

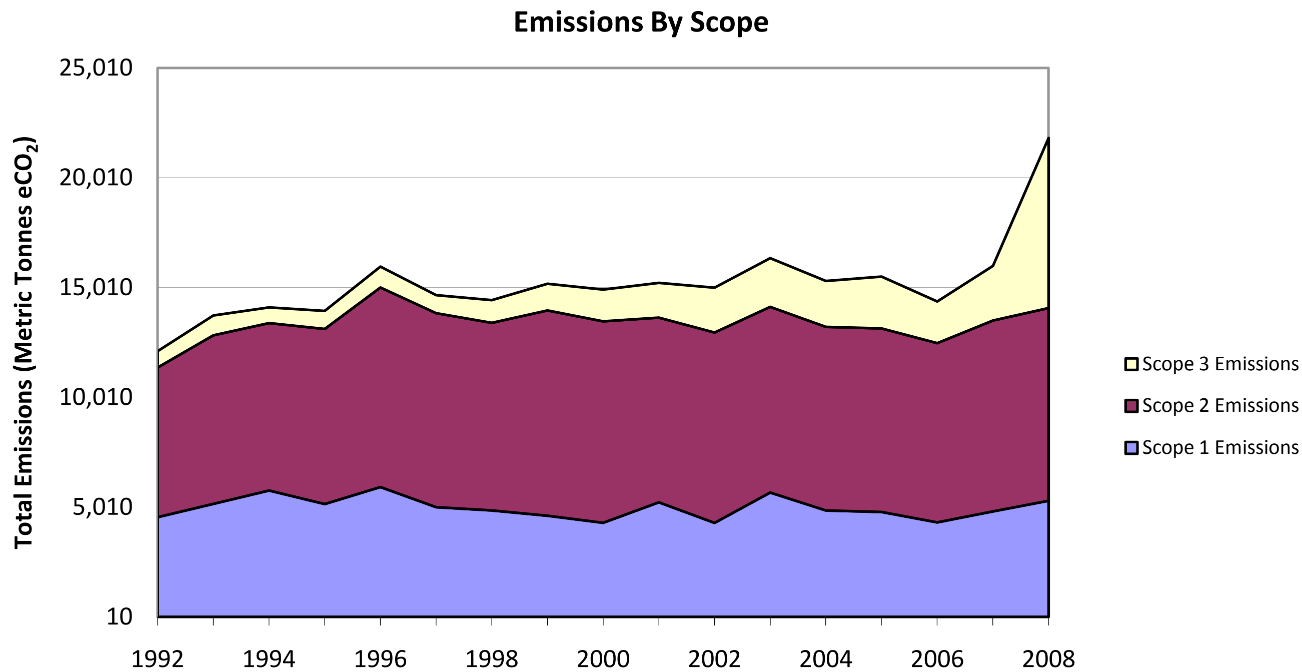

Figure 2.

Figure 3 below illustrates the metric tons of CO2 equivalent per full time students. This graph has approximately the same shape as that of the graph of total emissions.

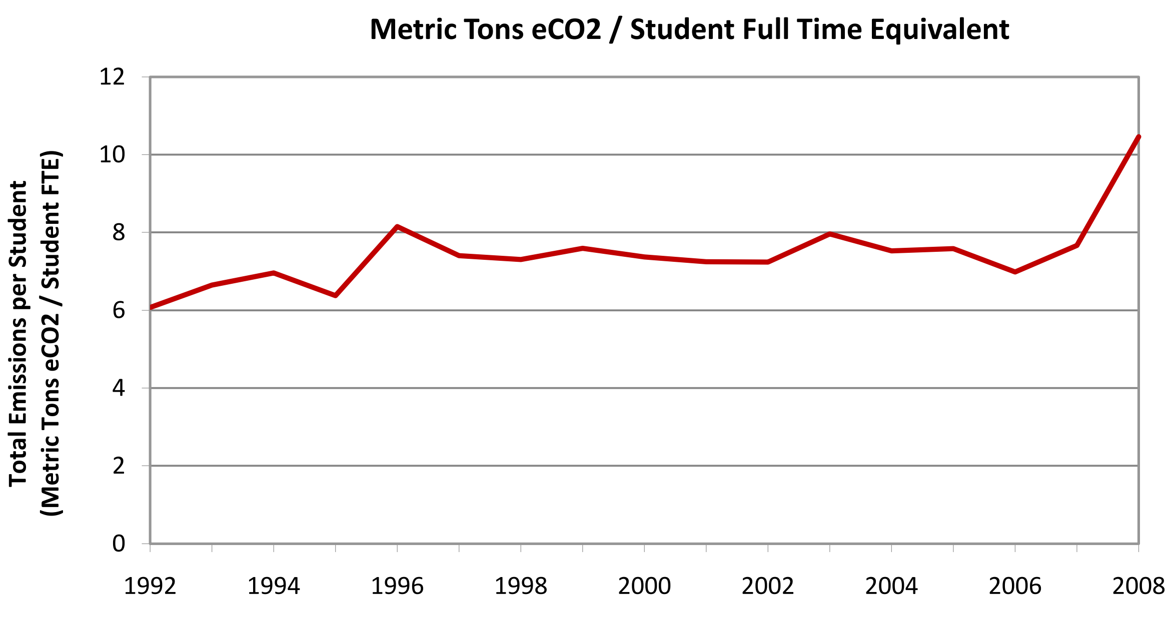

Figure 3.

Figure 4 below shows the trend between the addition of building space and total emissions. With additional space, total building efficiency has not increased. However, total emissions reached a low in 2006. This could be attributed to CSB doing lighting retrofitting to replace inefficient lighting with more efficient devices. In 2008, the total emissions per square foot of building space was 17.8.

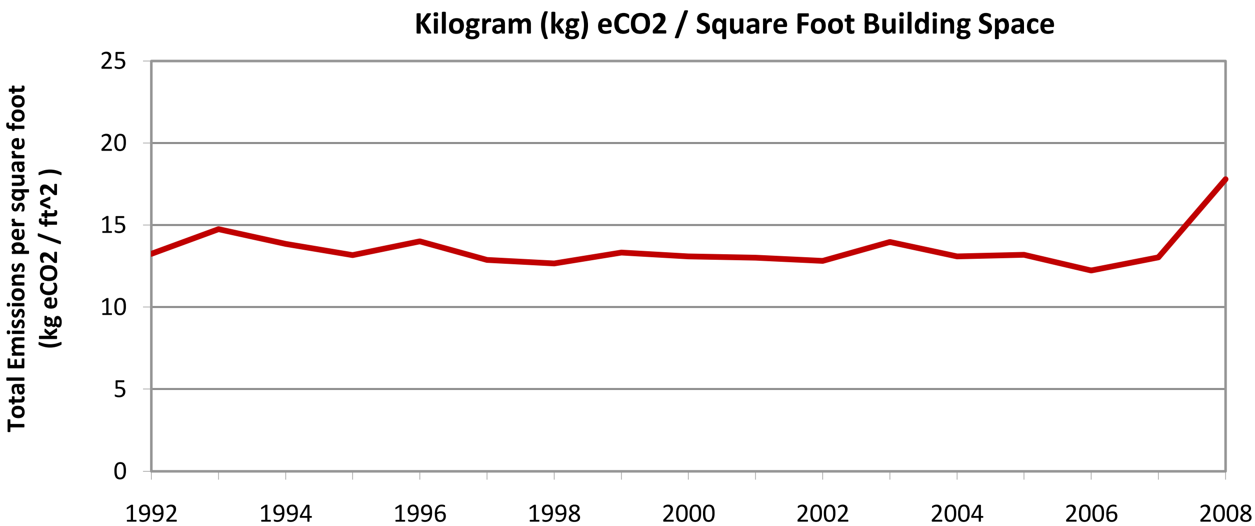

Figure 4.

Figure 5 shows the square footage of CSB from 1990-2008. The size of CSB steadily increased from 1990-1996 and leveled of until present. With the addition of the Gorecki Dining and Conference Center in 2007, the square footage increased. As the amount of square footage the campus has increases, the rise in carbon emissions can be attributed to the increased building space.

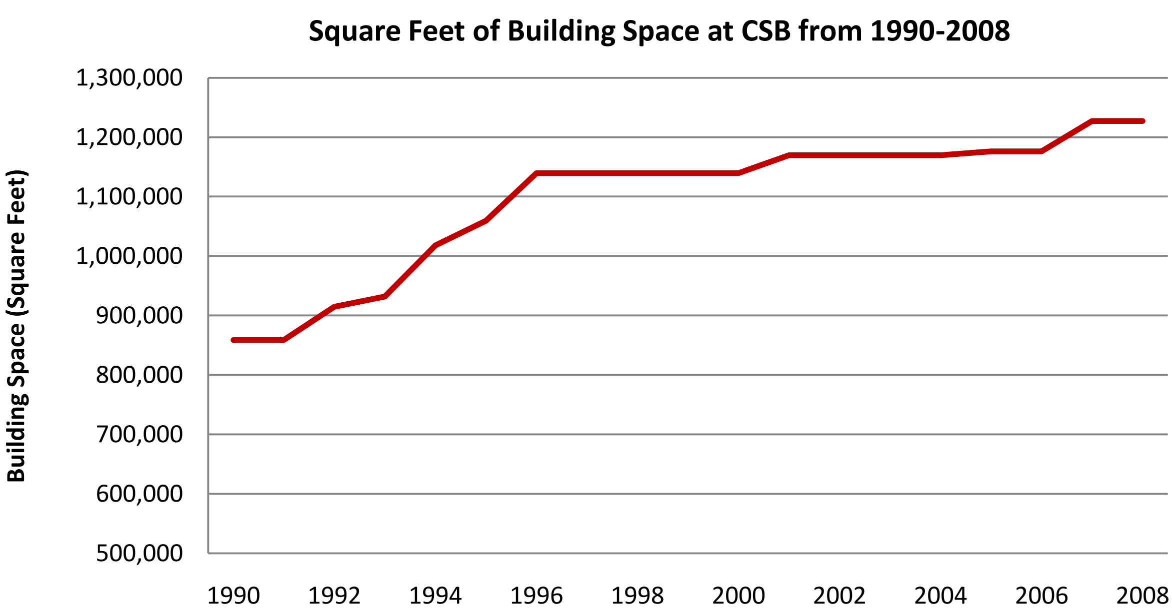

Figure 5.

4. Transportation

a. Introduction

Transportation fueled by the burning of gasoline, diesel, and jet fuel contribute considerably to carbon dioxide emissions. The Clean Air Cool Planet calculator showed that transportation is a minor contributor of green house gas emissions For CSB. Categories that were inventoried were:

- CSB Vehicle fleet
- Link Bus Service
- Air travel by faculty and staff
- Daily commute by students, faculty, and staff

b. Results

The CSB vehicle fleet is used for moving equipment around campus, maintenance of grounds, and other college related needs.

The link bus service, providing transportation from CSB to St. John's University, includes diesel used by college owned buses and contracted Trobec's Busing Service. Because The Link is a combined department between CSB and SJU, the amount total amount of diesel used by the Link was divided between the two campuses. The Link emits a yearly average of 185.3 Metric Tons of carbon dioxide.

The graph below shows the amount of diesel used by the Link from 2005-2008. As seen, there is a drop in the amount of diesel used in 2007. CSB stopped contracting as many buses from Trobec's Busing Service in 2007, which led to a decrease of mileage by about 5,202. The values used in the carbon calculator were half of what is seen in the graph because the amount of diesel used by the Link was split equally between CSB and SJU.

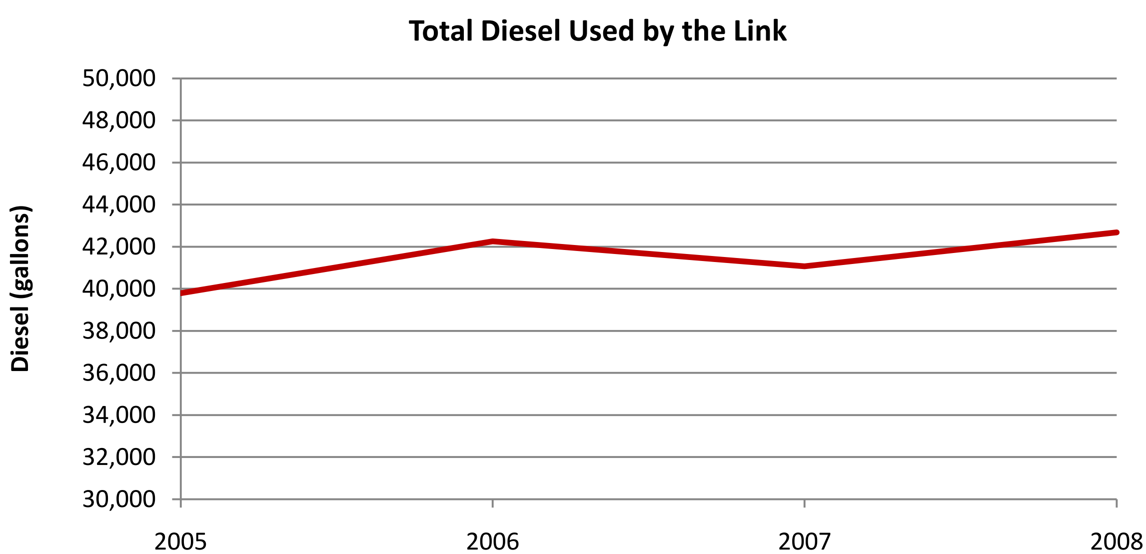

Figure 6.

The following graph shows the amount of students transported by the Link from 2005-2008. The amount of passengers on the Link has risen steadily since 2005. In 2008, the Link offered more bussing service, including busing service over breaks.

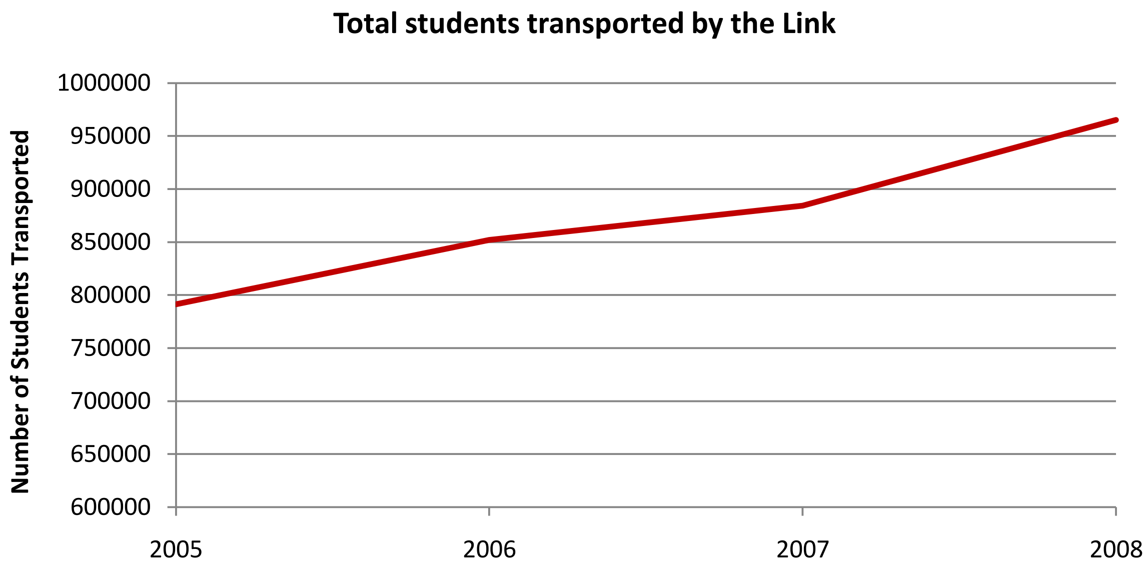

Figure 7.

The following chart shows the emissions given off by the link in carbon dioxide values. The chart follows the came basic trend as the amount of diesel used by the Link.

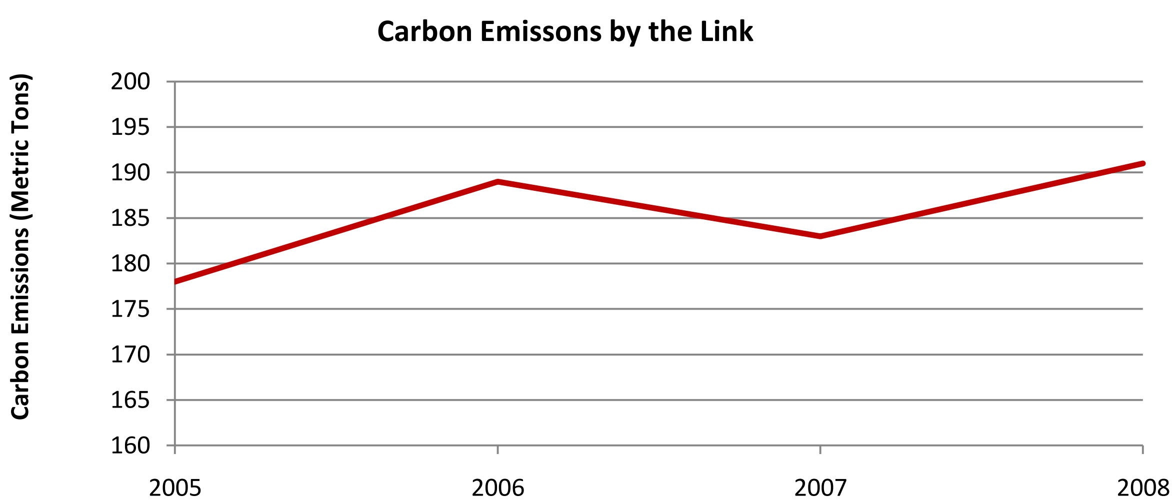

Figure 8.

For air travel information, data was collected for air miles traveled based on corporate travel card charges. Travel expenses one reimbursement forms are not included in the reported data. A formula was used to derive the amount of miles flown based on travel expenses, .25 = 1 mile traveled. In the future, the College is planning on requesting miles traveled on reimbursement forms for more accurate data. Student air travel miles were calculated for the number of miles students traveled on study abroad trips. Also included in the 2008 student air miles is the number of miles traveled in school sponsored alternative spring break trips. Data for these air miles were only available for the 2007-2008 fiscal year.

In order to figure out how far faculty and staff were commuting a mapping software program named Arcmap was used. A map of Minnesota zip codes and cities in Minnesota was used to point on the map roughly halfway between St. John's and St. Ben's. The program then calculated the center of each zip code polygon. Manually using the programs measuring tool, the centered to each zip code to the point between St. John's and St. Ben's was measured. Then, a round trip distance was approximated. Using the number of zip codes that were obtained, information on a per person basis was obtained. However, the number of zip codes that were used did not match up with the number of faculty and staff employed on campus. Thus, division was used to apply the data to the current numbers of faculty and staff. Through this, the distance of how far each faculty member was traveling per day was found. It was assumed each faculty member was driving alone and the majority of the faculty worked most weekdays throughout the year.

To find how often and how far students are driving survey results were used. The surveys had information on how often students were driving per week, how often they were alone when driving, how often they were with someone else when driving, approximations of how far they are driving, and an estimated fuel economy for their vehicle. Using this data, approximations were found based on how far each student was driving per week on average. This also provided information on how often students were alone or carpooling and gave an average fuel economy for the campus. Having all the numbers per student allowed the information to be applied to the entire campus through simple multiplication. The number of miles traveled by each student, each day was put into the carbon calculator. In order to determine the number of days per year each student is driving, the number of days and weekends that students are on campus was counted.

c. *Data sources and contact information*

Contact:

Mike Juntunen
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mjuntunen@csbsju.edu

Faculty/Staff Business Air Travel
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Controller
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5. Energy Emissions Inventory

a. Introduction

It is expected that energy emissions will contribute over 90% of emissions by CSB. Energy emissions are split up into on-campus stationary sources, off-campus electricity production, and off-campus steam production. On-campus stationary sources apply to fuel purchased by CSB other than gasoline or diesel fuel used in vehicles. CSB is heated using a combination of oil and natural gas. Off-campus electricity production refers to how much electricity was purchased by CSB. This includes electricity used for lighting, computers, cooking, and air conditioning. Greenhouse gases associated with energy include carbon dioxide and nitrous oxide during the combustion of fossil fuels and methane from natural gas.

The monastery is included in the total amount of energy used by CSB. The data for the college and the monastery is able to be separated dating back to 2001. However, separating subsequent to 2001 would cause an error in the long term trend of energy use.

b. Results

Figure 9 shows the overall total emissions at CSB. The numbers are relatively consistent from 1992 to 2006. The large spike between fiscal years 2007 and 2008 results from the added data from refrigerants and other chemicals and solid waste and more complete transportation data.

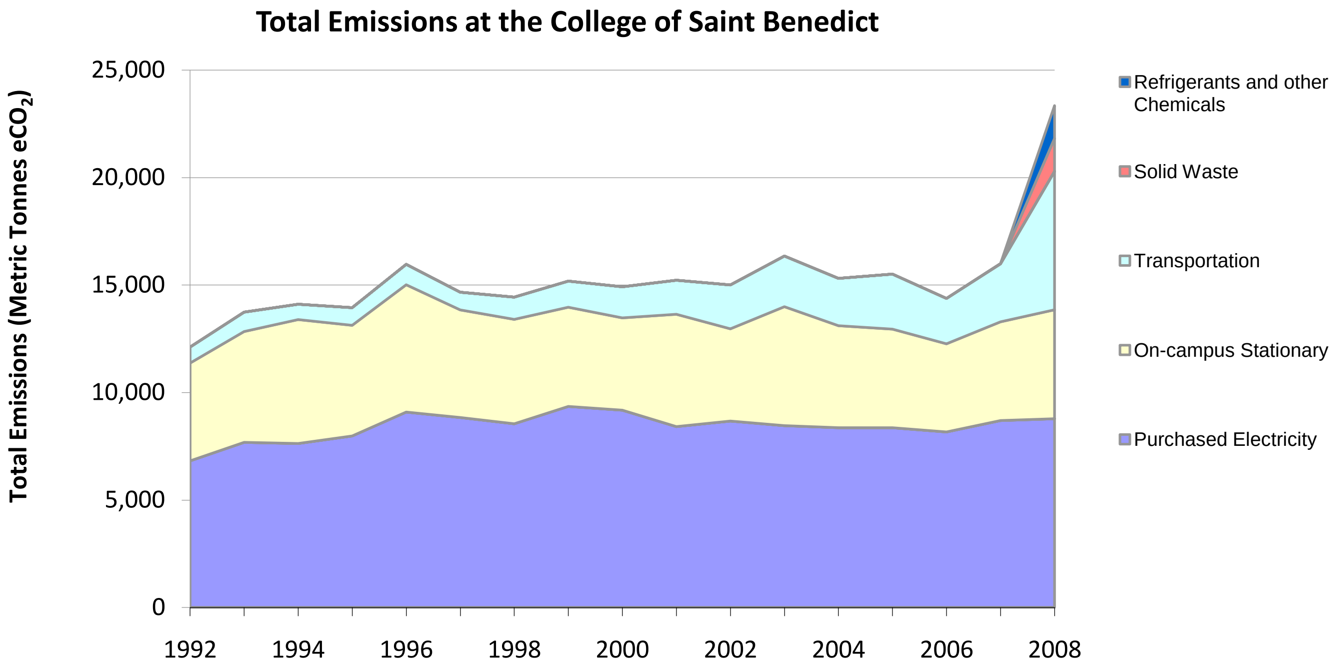


Figure 9.

The graph below displays the amount of purchased electricity consumed by CSB. The purchased electricity peaks during 1999-2000 at 10,258,000 kWh. In 2000, CSB installed the Central Chilled Water Plant and discontinued the use of individual units for all the buildings that used more electricity than the more efficient chiller plant. Also, starting in 2000, CSB has done lighting retrofitting to replace inefficient lighting with more efficient devices.

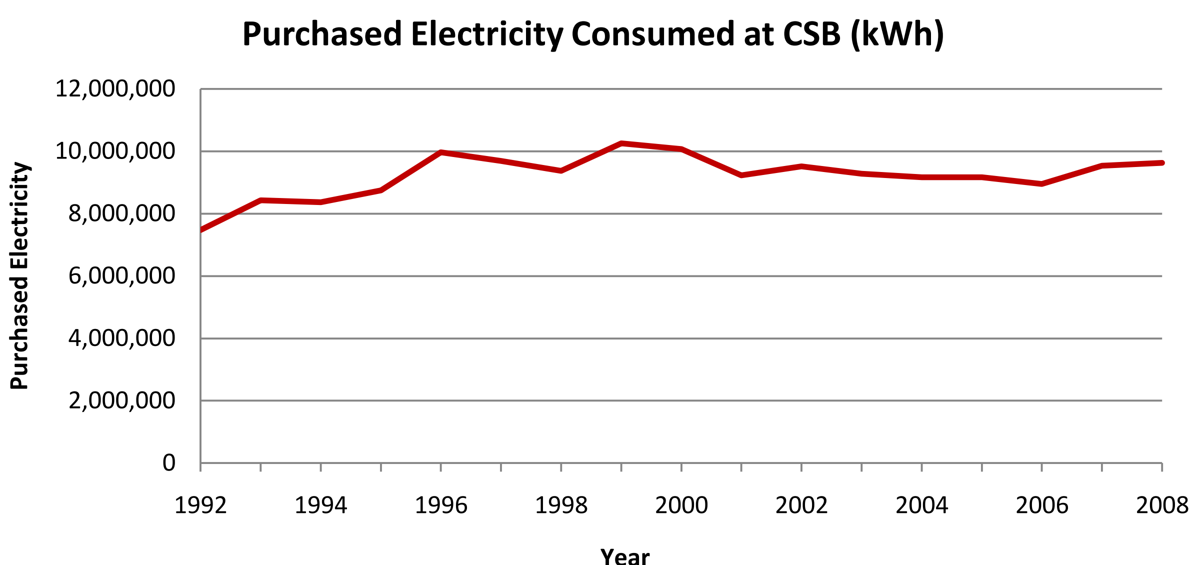


Figure 10.

Figure 11 below displays the amount of electricity consumed per student at CSB. As noted above, the amount of electricity peaks at 1996 and again in 1999. The amount of electricity consumed per student remains considerably even from 2001-2008.

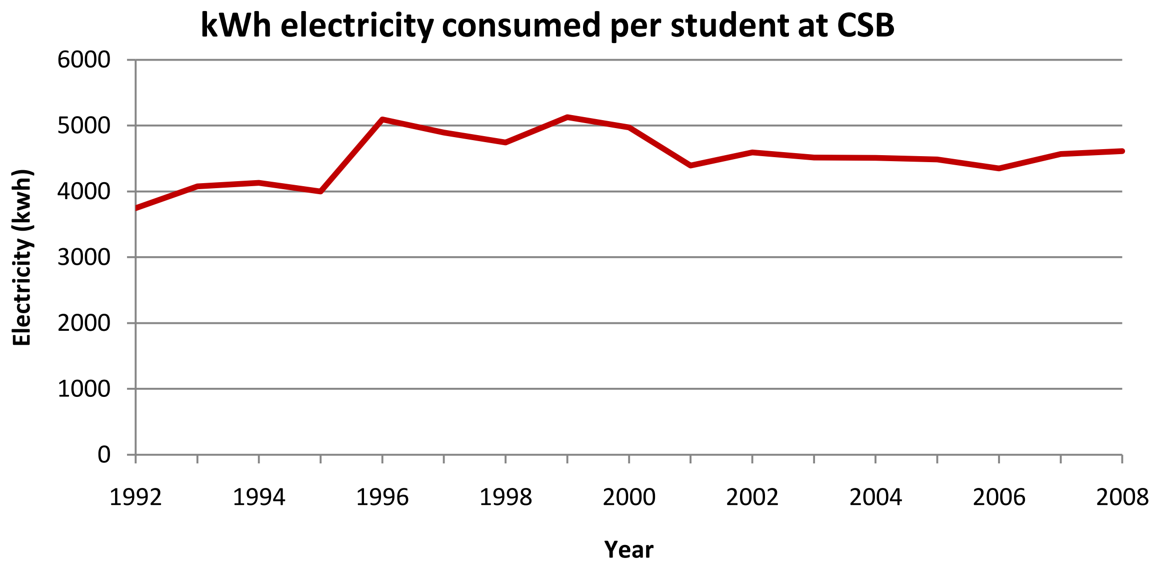


Figure 11.

Figure 12 displays the amount of carbon emitted per student from purchased electricity. This graph follows the same trend as the purchased electricity consumed at CSB, with rises in the graph due to the chilled water plant being installed in 2000.

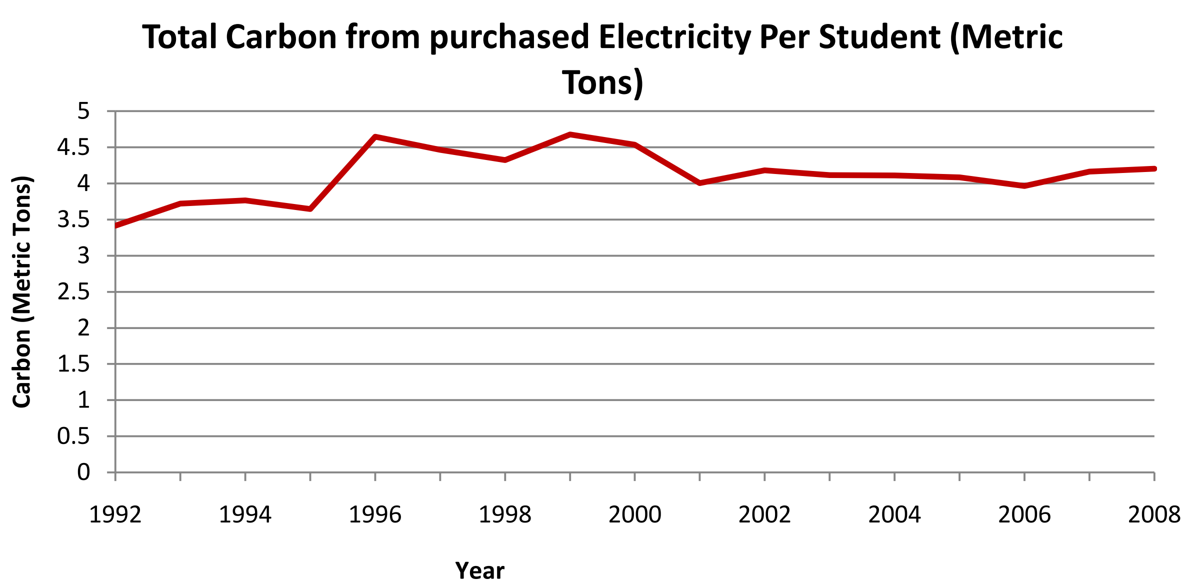


Figure 12.

Figure 13 below shows the temperature trends from 1990-2008 in St. Cloud, MN. The graph below shows the number of heating degree days per year (blue) in comparison to the average number of total degree days since 1990. In 2006 the number of heating degree days was lower than the number in the surrounding years. Fewer heating degree days means it would take less energy to heat buildings during that year. Trends in temperature can provide an explanation for variation in the amount of energy used.

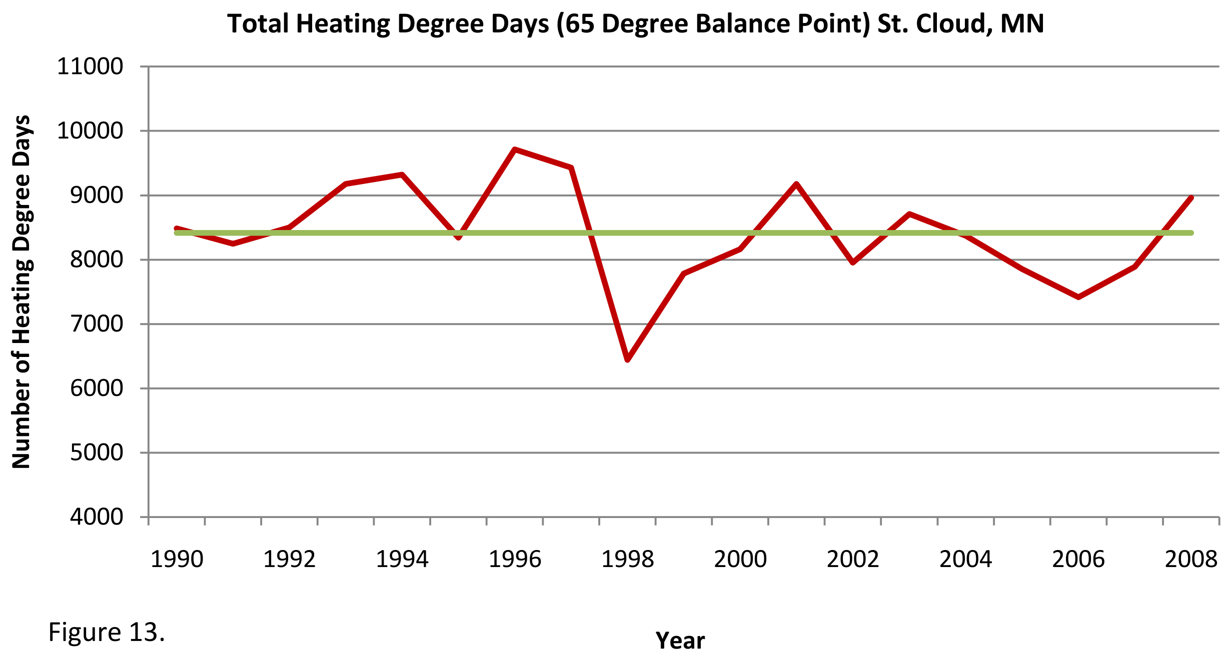
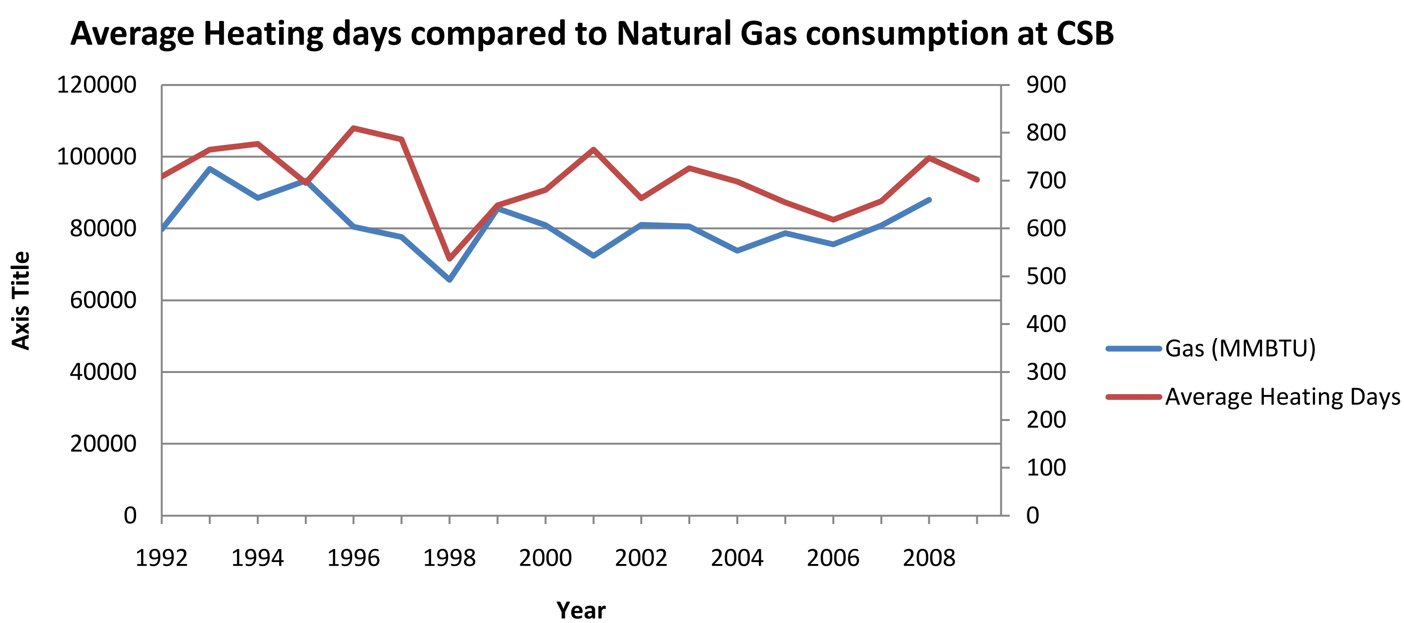


Figure 13.

The following graph displays the temperature trends from 1992-2008 and the average natural gas use in (MMBtu) consumed at CSB. As seen, the natural gas consumption and temperature follow the same general trend.



Fi gure 14.

The following graphs below illustrate the amount of natural gas and electricity be consumed by CSB and the estimated cost projections. As seen, the cost is expected to rise steadily. By 2020 CSB will be consuming 12,700,174 and spending $ 1,964,360 on electricity. For natural gas, by 2020 CSB will be consuming 113,881 MMBtu of natural gas and spending $595,935.

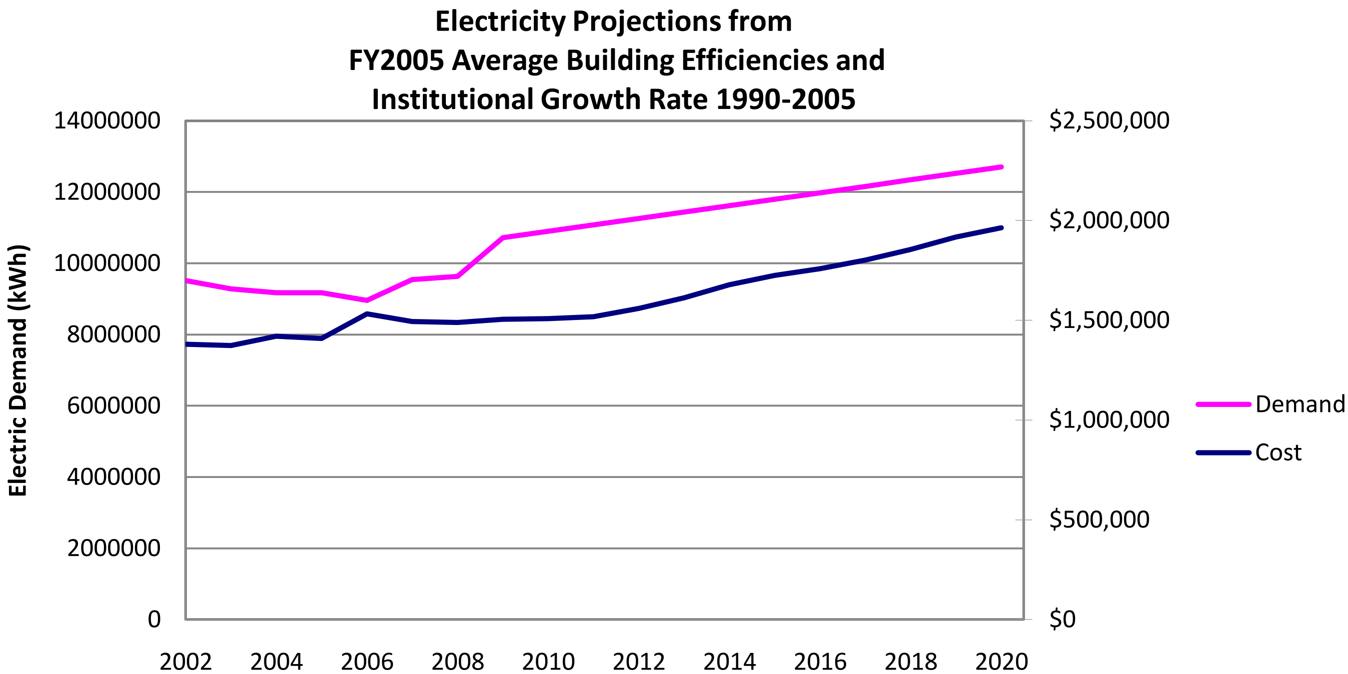


Figure 15.

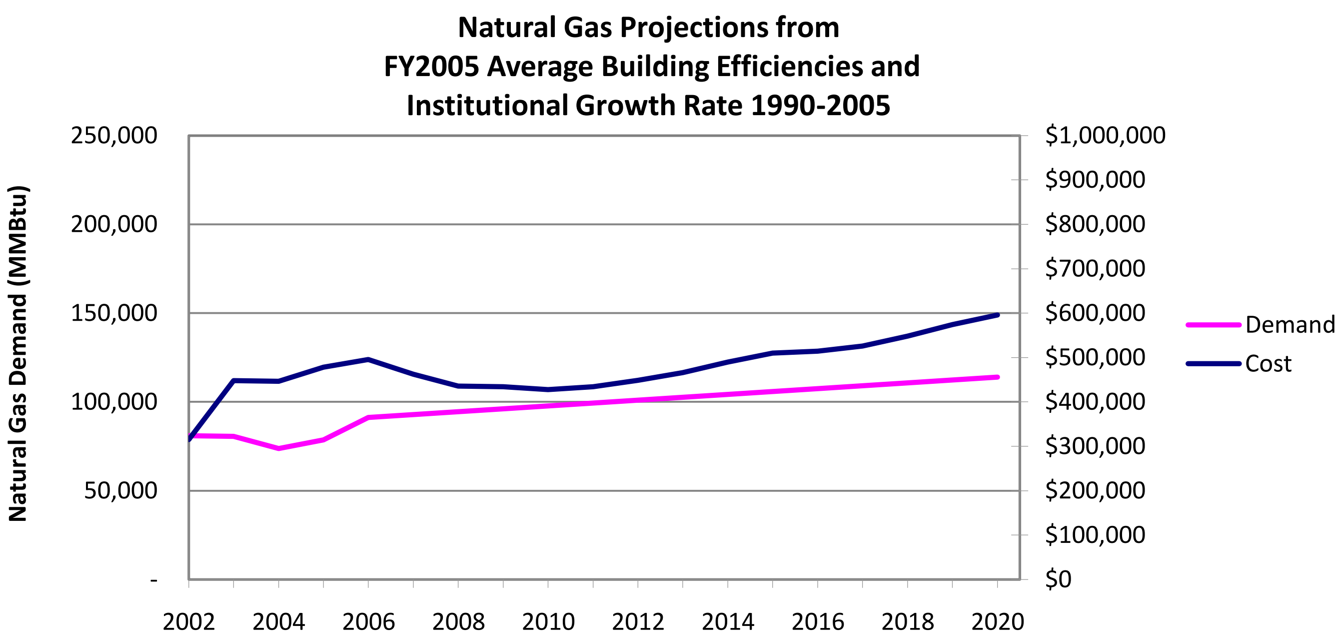


Figure 16.

c. *Data Sources and Contact Information*

Terry Loso
Power Plant Director
1411 Co Rd 134
St Joseph, MN 56374
ext. 5109
tloso@csbsju.edu

6. Agriculture and Landscape

a. *Introduction*

Agriculture and landscaping are major contributors of methane (CH_4) and nitrous oxide (N_2O) both of which are major greenhouse gases. Methane emissions commonly come from animals, especially dairy cows, in the form of bacteria in the gut of the cow and the decomposition of manure. Nitrous oxide is a gas given off by fertilizers after application. Synthetic fertilizers are labeled with three numbers representing their chemical make up. The numbers represent the percent nitrogen (N), phosphorus (P), and potassium (K); so a fertilizer labeled 15-15-10 is 15 percent nitrogen.

b. *Results*

The College of Saint Benedict does not have any livestock or agricultural practices and therefore does not need to worry about those emissions. Instead, this section concentrates on the fertilizer application on campus grounds. Records of past applications were not kept so only the fiscal year 2007 amounts were reported. The grounds around the president's house, the athletic fields, and the mall between the Haehn Campus Center and the Benedicta Arts Center, a total of 25 acres, used 5 tons of 30-0-15 fertilizer. The grounds around the Main, Library, and around the Benedicta Arts Center, a total of 15 acres, used 3 tons of 10-0-10 fertilizer. This calculated to a total of 8 tons of fertilizer with an average of 23 percent nitrogen.

The following graph shows the major contributors of nitrous oxide emissions. Even with only a single year of data it is visible that fertilizer can contribute greatly to the overall nitrous oxide emissions total. Purchased electricity is the only other emission source that contributes as greatly as landscaping. The spike in the graph is due to the fact that more data is available for fiscal year 2007 and 2008.

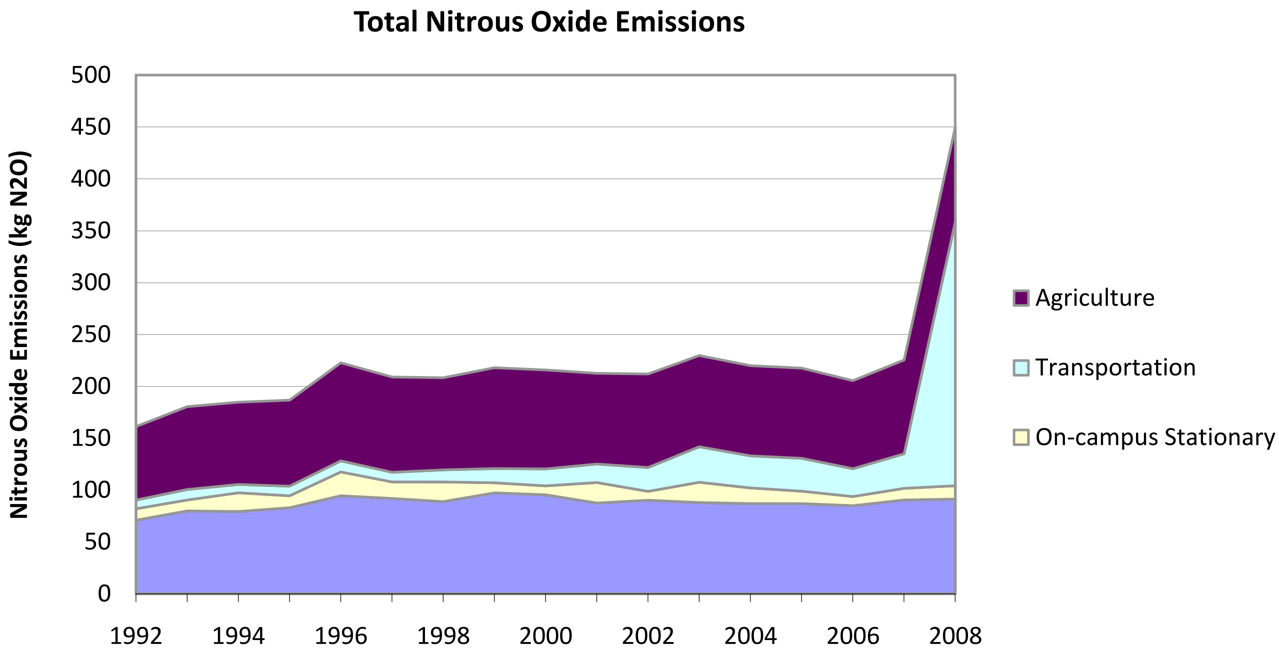


Figure 17

c. *Data sources and contact information*

A soil test was conducted by the University of Minnesota soil testing laboratory to determine the optimal ratio of nutrients for different areas of the campus. Campus Grounds at CSB then uses this information when deciding fertilizes to use on campus.

Contact:
Chris Brake
CSB Grounds Supervisor
CSB Maintenance Building
cbrake@csbsju.edu

7. Solid Waste

a. Introduction

Solid waste is disposed in one of two methods: incineration or landfills. Incinerated waste releases greenhouse gases when it is burned while waste that goes to landfills release methane as it decomposes. After the waste is picked up it is disposed of in one of several different ways ranging from simple incineration to a landfill that collects the methane emissions for electric generation. This calculator uses emissions from an "average" composition of waste.

b. Results

The College of Saint Benedict does not have good records of the amount of solid waste that is generated on campus. Only an estimate of one year, fiscal year 2008, was able to be calculated based on the size of the waste container and frequency of pickup. A calculation table was then used to calculate a rough estimate of the amount of solid waste produced. CSB generated around 1,529 tons of sold waste last year.

Solid waste is the only major contributor of methane (CH_4) on campus. CSB waste is sent to a landfill where CH_4 collection does not take place. It released close to 68,000 kg of CH_4 into the atmosphere.

c. Data Sources and contact information

To calculate an estimate of the amount of solid waste generated, a waste capacity calculation found on the city of Durham, North Carolina solid waste web page[1]. Again this is a rough estimate. In the future better record keeping will result in more reliable information.

8. Refrigeration and other chemicals

a. Introduction

Refrigerants such as hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs) are used as alternatives to chlorofluorocarbons (CFCs). Under the terms of the Montreal Protocol and the U.S. Clean Air Act, CFCs and other known harmful refrigerants are being phased out and being replaced by HFCs and PFCs. However, HFCs and PFCs are known to be strong greenhouse gases as well. Because CFCs are being phased out they do not need to be included in the inventory but all other refrigerants should be included.

b. Results

The College of Saint Benedict does not keep a record of how much refrigeration or other such chemicals it has on campus. This is because of the fact that no major leaks have been reported and because of the size of the school. St. Ben's is a small school and therefore does not have as big or as many appliances that would use refrigerants as a large university would. The amount of refrigeration and other chemicals on campus is a very small amount.

c. Data Sources and contact information

Contact:
Ganard Orionzi
Director of Environmental Health and Safety
Main Building G40 (CSB), PENGL 201 (SJU)

[1] *SWM Capacity Calculation Information*, http://www.ci.durham.nc.us/departments/solid/pdf/capacity_calculation.pdf (December 2005)

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9. Offsets

a. *Introduction*

Many institutions decide to offset some greenhouse gas emissions. Certain institution funded activities such as air travel are unavoidable and will inevitably produce some greenhouse gas emissions. These emissions can be offset in a number of ways, but one the most common is the purchase of Tradable Renewable Energy Certificates (TREC), also known as “Green Tags”. These certificates are created when electricity is created by some form of renewable energy, wind, solar, or small scale hydroelectric. Each credit represents one megawatt-hour of electricity was created by renewable energy. Prices for RECs range from $5 to $90. The energy created does not have to be on the same grid as the institution and therefore cannot just be subtracted from total electric emissions. Instead it must be added separately. Other offsets an institution may partake in include protecting a forest that acts as a carbon sink or composting.

b. *Results*

The College of Saint Benedict does not purchase any offsets to mitigate any of its greenhouse gas emissions.