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Fairfax County Public Schools
Greenhouse Gas Inventory Report
For
Calendar Year 2016

Fairfax County Public Schools

Office of Facilities Management

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This report was prepared by:

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2 Background

2.1 Fairfax County Public Schools Policy 8542 on Environmental Stewardship

On November 7, 2008 the Fairfax County School Board adopted policy 8542 on Environmental Stewardship. The policy purpose states:

“The world's leading scientists agree that human-induced greenhouse gas emissions are a significant contributor to global warming and that reducing those emissions is one of the most significant challenges confronting the world today. FCPS is committed to continue to take innovative and cost-effective steps to help our country achieve climate stabilization. This policy is intended to prioritize the practices to be developed and implemented by staff members in order to address global warming and to meet other important environmental stewardship initiatives.”

The policy further states:

“IV. CARBON REDUCTION

Carbon reduction is the most important environmental concern, and FCPS is committed to reducing energy consumption wherever possible both to take advantage of its benefits to the environment and to reduce energy expenses.”

Finally the policy includes:

“XII. PERFORMANCE MEASURES

Staff members shall create an inventory of greenhouse gas (GHG) emissions and implement policies, programs, and operations to further achieve measurable reduction and help contribute to regional reduction targets. Annual performance measures shall be instituted.”

2.2 What is a Greenhouse Gas Inventory?

A greenhouse gas (GHG) inventory is an accounting of the amount of greenhouse gases emitted to or removed from the atmosphere over a specific period of time (e.g., one year.) A greenhouse gas inventory also provides information on the activities that cause emissions and removals, as well as background on the methods used to make the calculations. Policy makers use greenhouse gas inventories to track emission trends, develop strategies and policies and assess progress. Operations managers use GHG

inventories to evaluate a project or program's impact and to prioritize projects. Scientists use greenhouse gas inventories as inputs to atmospheric and economic models.

2.3 Greenhouse Gas Inventory Protocols

The World Resources Institute (WRI) and the World Business Council for Sustainable Development developed "The Greenhouse Gas Protocol," an international framework to understand, quantify, and manage greenhouse gas emissions. The Climate Registry worked with the WRI GHG team to develop its "Local Government Operations Protocol," which provides a consistent framework for local governments across North America to measure and publicly report their greenhouse gas emissions.

3 FCPS Greenhouse Gas Emissions for Calendar 2016

Some highlights for calendar 2016 are:

- FCPS emitted 185,554 metric tons of CO₂e. This is a decrease in emissions from the 2015 inventory of 4.84%. This major decrease is partially due to the latest CO₂ generation output figures from DOE which are lower than 2015.
- GHG emissions decreased from 2015 to 2016 while decreasing in overall across the nine years since the first inventory was started for calendar 2008. From 2008 to 2016 GHG emissions have decreased 23.4%. This overall decrease has occurred even though the number of students, the total square footage of buildings, and the number of school buses has increased.
- FCPS had over 26 million square feet of brick and mortar building space and over 500 thousand square feet of modular building space where utilities were paid and controlled by FCPS. This is an increase of more than 59,000 square feet from 2015. Leased building spaces where utilities are included in the rent are not included in this inventory.
- The number of students in FCPS increased by 520 between 2014/2015 and 2015/2016 school year.
- 280.7 million kWhrs of electricity were used for lighting, heating and air conditioning, kitchen equipment, and plug loads such as computers, televisions, smart boards, and vending machines. This was a decrease in electricity use of 8.91 million kWhrs or 3.1% from that used in 2015.
- 5.08 million Therms of natural gas were used for heating, domestic hot water, kitchen equipment, and emergency power generation. This was a decrease of 1.83 million therms or 26.4% from the 2015 consumption due to warmer winter

weather. GHG emissions resulting from direct combustion has decreased by 26.4% from 2015.

- FCPS had 2,423 in 2016 down from 2,579 vehicles in 2015 that consumed fuel including 1,630 in 2016 down from 1,731 school buses in 2015 and 793 in 2016 down from 848 cars, trucks, non-road vehicles in 2015.
- FCPS school buses traveled 16,557,992 miles which is an increase of 426,517 miles or 2.6% compared to 2015
- FCPS school buses used 2.81 million gallons of diesel fuel in 2016 an increase of 28,387 gallons in 2015 or 1% more than in 2015
- Over 3.32 million gallons of fuel were used for transportation.
- FCPS Grounds Operations department at FCPS are replacing gasoline powered equipment with diesel powered equipment adhering to Tier 4 (T4) and interim T4 compliance when equipment is due for replacement

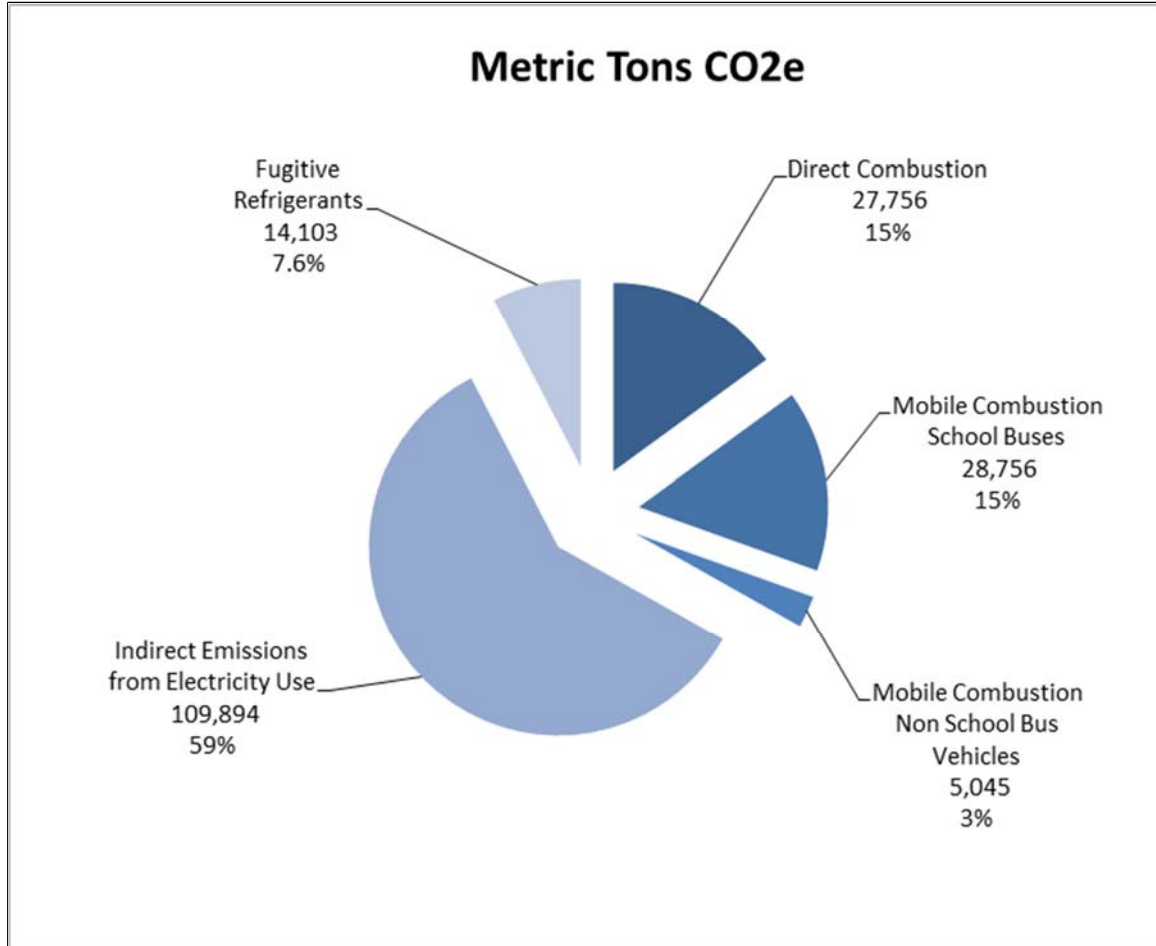
GHG emissions by major categories are shown in Figure 1, with percentages by category shown in Figure 2. Refer to Appendix 1 for scope category definitions.

Figure 1: CO2 2008-2016

FCPS Calendar 2008-2016 Greenhouse Gas Emissions		Metric Tons CO ₂ e								
	Source	2008	2009	2010	2011	2012	2013	2014	2015	2016
Scope 1 Emissions	Direct Combustion	38,761	39,045	35,860	35,142	31,162	37,800	40,112	37,462	27,756
Scope 1 Emissions	Mobile Combustion School Buses	28,981	28,306	28,231	28,234	28,486	29,069	29,095	28,466	28,756
Scope 1 Emissions	Mobile Combustion Non School Bus vehicles	4,969	4,679	4,977	4,985	4,971	4,965	4,662	4,686	5,045
Scope 2 Emissions	Indirect Emissions from Electricity Use	169,038	164,274	164,777	148,481	146,332	153,553	149,851	123,207	109,894
Scope 1 Emissions	Fugitive Refrigerants	498	1,027	1,602	1,183	1,507	2,067	1,071	1,163	14,103
Total Emissions		242,247	237,332	235,448	218,026	212,459	227,454	224,791	194,983	185,554

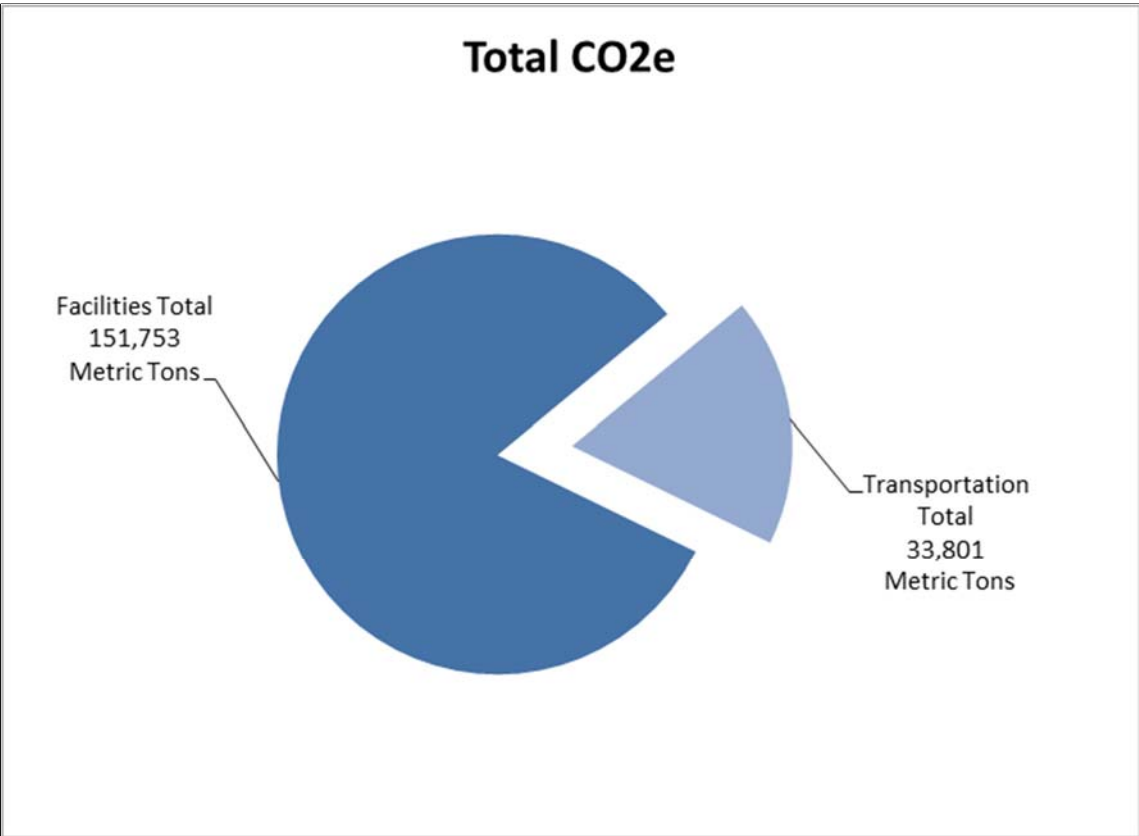
GHG emissions associated with buildings including schools, offices, and support facilities account for 82% of overall emissions. Facility related emissions are made up of indirect emissions from electricity use and direct emissions from burning fossil fuels and a certain amount of fugitive refrigerant leakage from air conditioning and kitchen equipment.

Figure 2:CO2 Breakdown



Burning fossil fuels for transportation accounts for 18% of overall emissions with school buses making the majority of the transportation related emissions. Even though FCPS school buses traveled more than 16.5 million miles in 2016, the amount of GHG emissions from transportation is small relative to emissions from facilities. The burning of coal and natural gas for electricity generation is by far the largest source of FCPS's GHG emissions.

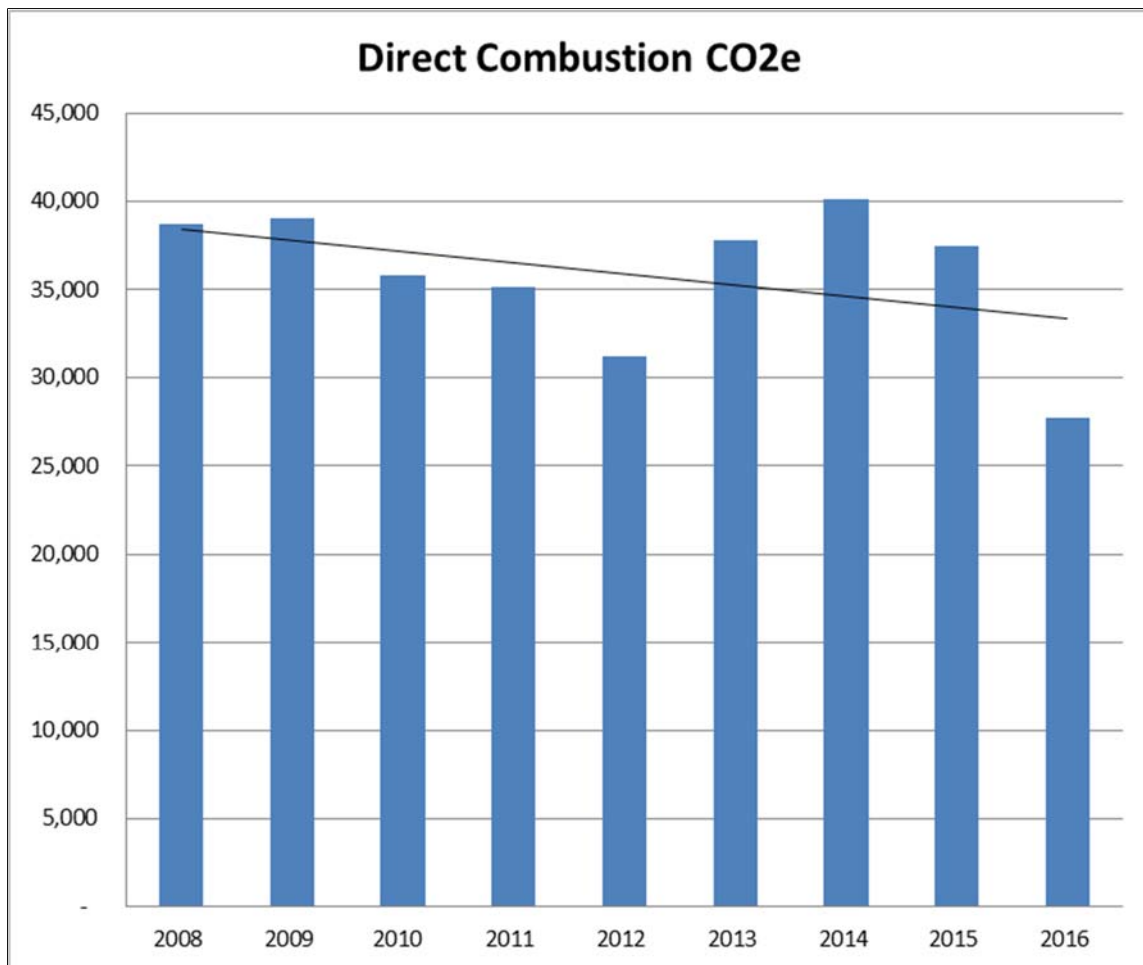
Figure 3: CO2 Facilities vs Transportation



4 FCPS Greenhouse Gas Emissions Nine Year Trend

Figure 4 shows the nine year trend for total GHG emissions for FCPS. GHG emissions decreased from 2015 to 2016. From 2008 to 2016 GHG emissions have decreased 23.4%. It is notable that student population, building space, and the size of the transportation fleet have all grown significantly during this six year period while emissions decreased. This demonstrates that FCPS has become more energy efficient and lowered its carbon footprint over this nine year period.

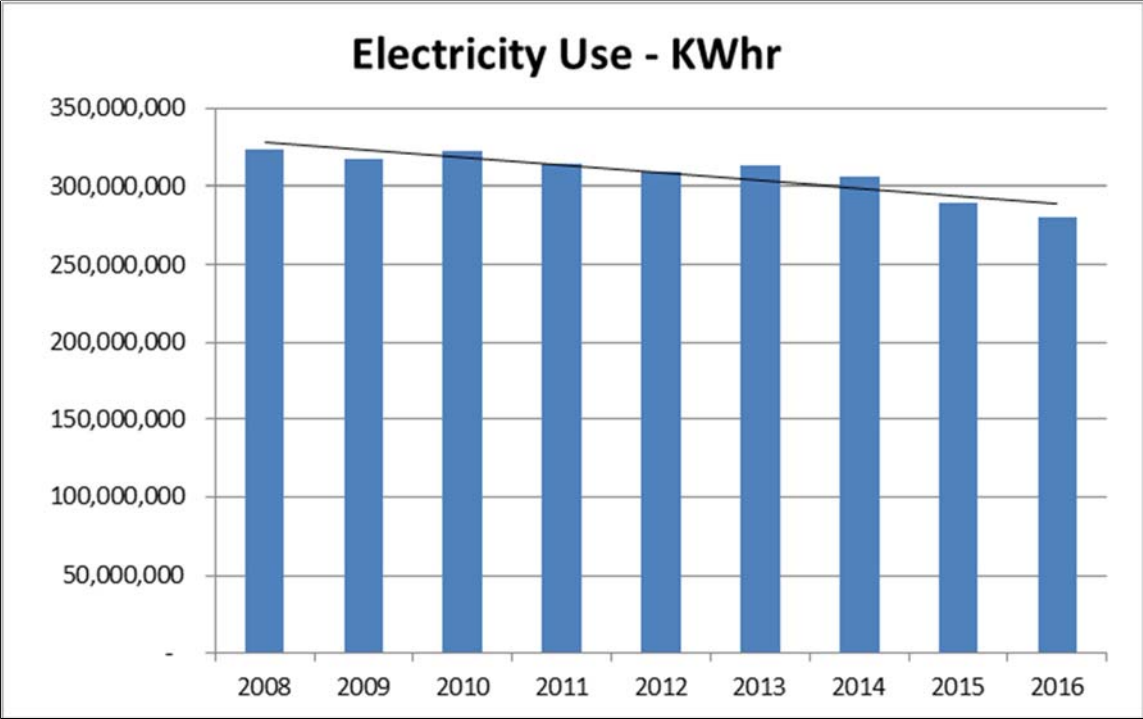
Figure 4: CO₂e Direct Combustion



The total GHG emissions shown in Figure 4 include Scope 1 direct emissions and Scope 2 emissions at electricity generation station as a result of FCPS's electricity consumption. The utility generation fleet has become less carbon intensive over this nine year period as utilities have increased using natural gas a fuel source and decreased using coal.

Figure 5 shows the total electricity consumption of all FCPS facilities. A portion of electricity use is dependent upon weather, especially seasonal summer temperatures. It is notable that student population and building space increased significantly during this nine year period and the summers of 2010, 2011, and 2012 were significantly warmer than any on record. 2015 and 2016 show a decrease due to additional energy conservation projects being implemented.

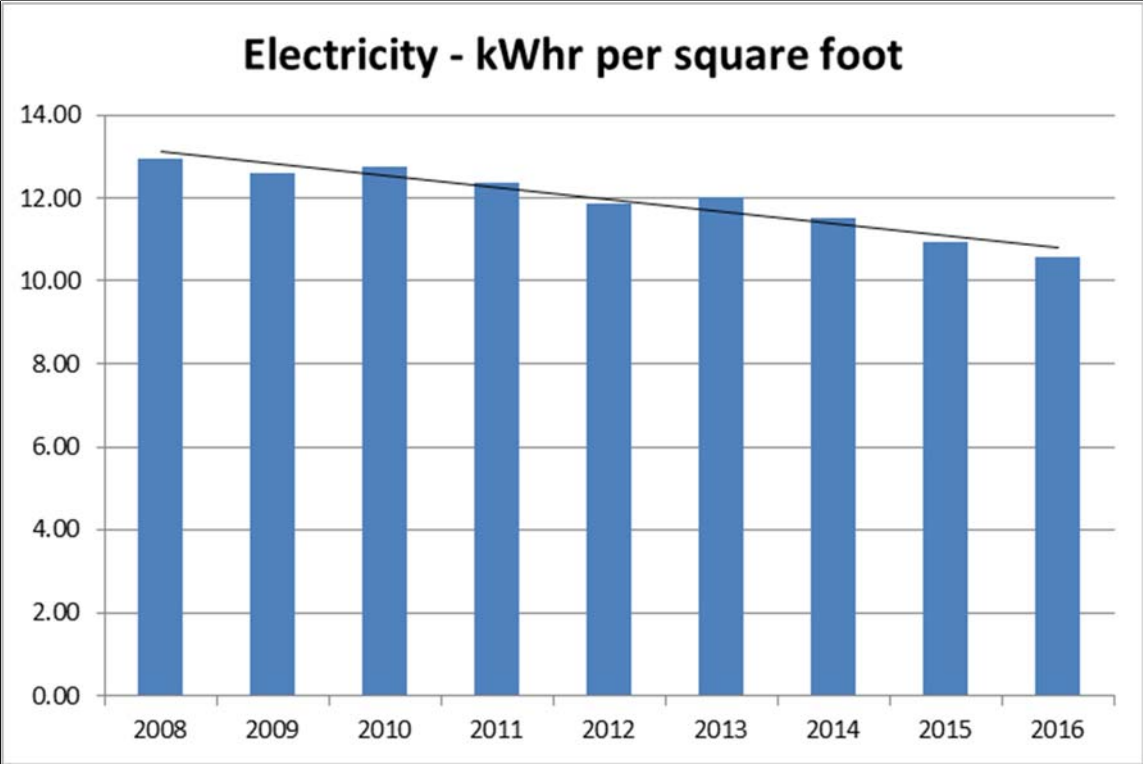
Figure 5: kWhr



The majority of electricity is used in FCPS buildings for heating, air conditioning, lighting, and cooking. The amount of consumption depends on the size of the building space, the occupancy schedule, and the weather. A portion of electricity is used for plug loads like computers, smart boards, photocopiers or vending machines. Electricity is also used for exterior parking lot, security and athletic field lighting.

Electricity use per square foot of building space, shown in Figure 6, is a good indicator of overall building energy efficiency. Even with increases in square footage and student population, site energy usage decreased from 2015 to 2016. This indicates that the FCPS buildings have become more energy efficient over this nine year period.

Figure 6: kWhr/sqft



Natural gas is used primarily for heating buildings with some small portions used for domestic hot water, cooking, and emergency generators. Natural gas use therefore, is highly dependent upon winter weather conditions.

Figure 7 shows that the total use of natural gas decreased in 2016 as unseasonably warm winter weather returned from a previous cold winter.

Figure 8 shows that natural gas per square foot of building space decreased in 2016 from 2014 and 2015.

Figure 7: Therms

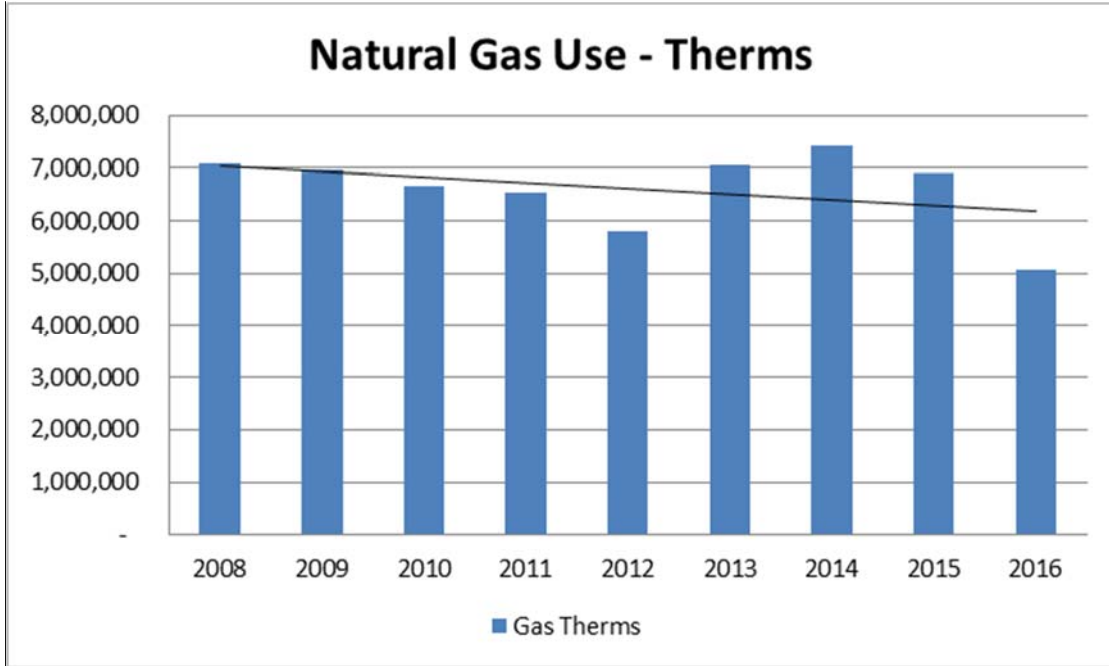
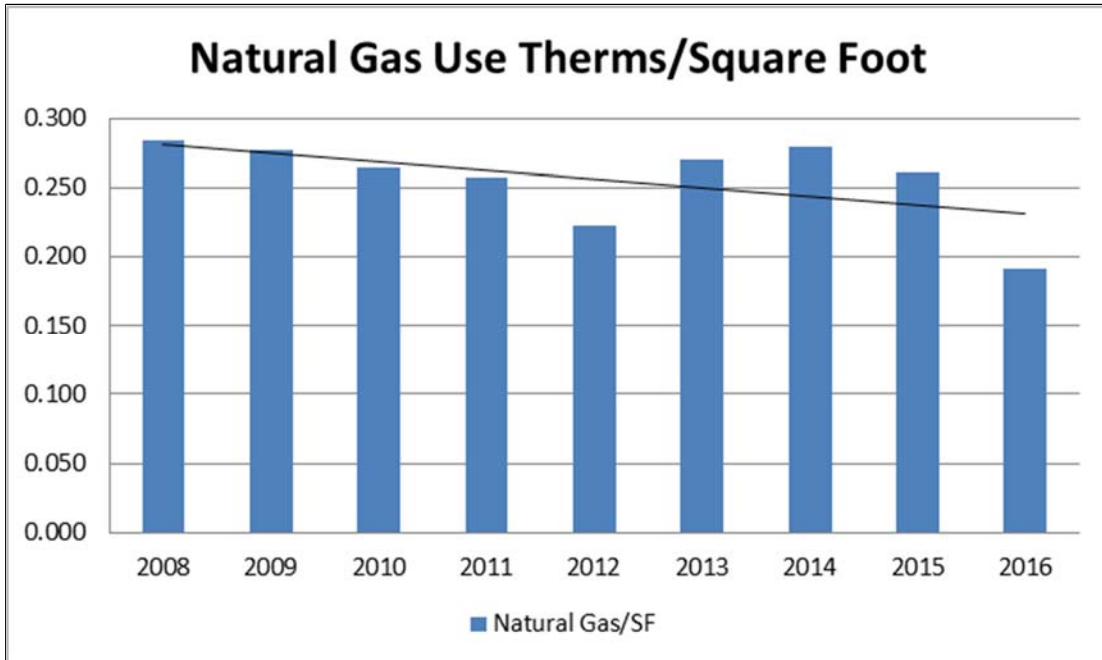


Figure 8: Therms/sqft



FCPS' building energy efficiencies are improving through design strategies and operational improvements. Continued improvements are dependent upon further capital investments in building renovations, infrastructure equipment replacements and energy saving projects. Investment and installation of mechanical and electrical equipment such as chillers, boilers, water heaters, variable refrigerant flow HVAC systems, high efficiency lighting with higher efficiency and energy ratings that significantly exceed minimum industry standards have led to substantial energy cost savings. ENERGY STAR rankings have improved significantly and a measurable increase in energy efficiency has been documented as a result of these building operation efficiencies.

Figure 9 shows that the building energy use per area has been steadily decreasing while the square footage has been steadily increasing.

Figure 9: KBTU/sqft

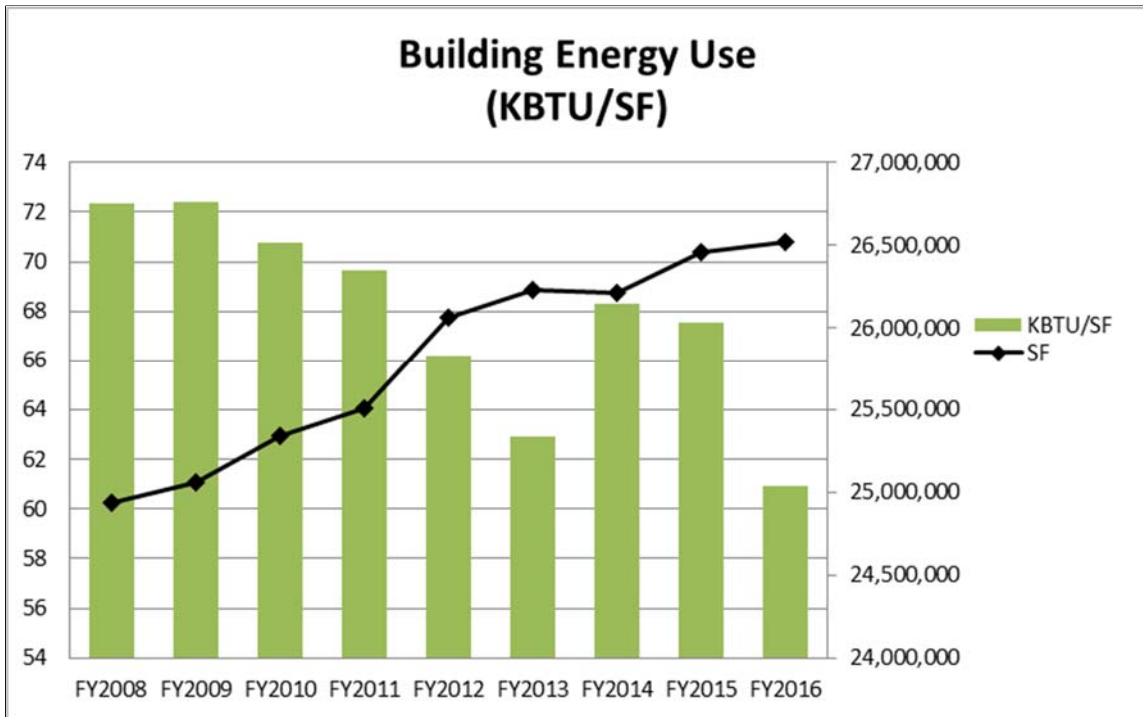
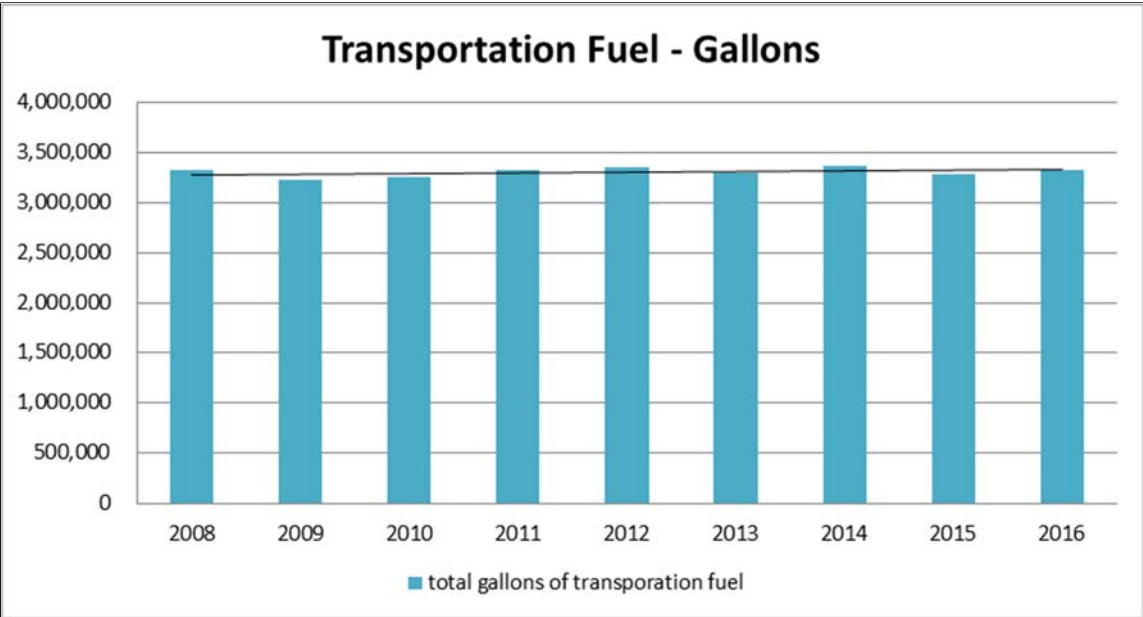


Figure 10 indicates the nine year trend for transportation fuels. Fuel use increased slightly in 2016. Total miles driven have slightly increased in 2016 from 2015; this is in part due to an escalation in student enrollment and altered traffic patterns as a result of FCPS' new school start times. Better bus routing and reduced transportation for summer programs have largely countered the increases associated with student population and later school start times.

Figure 10: Transportation Fuel



5 Appendix 1 – Climate Registry

This FCPS GHG emissions inventory for calendar year 2016 as well as the previous inventory for calendar years 2009-2015 were developed using the Climate Registry's "Local Government Operations Protocol" version 1.1 released May 2010. The report for calendar 2008 was based on the more generic Climate Registry "General Reporting Protocol" version 1.1. released May 2008.

Operational Boundaries and Scopes

The protocol categorizes GHG emissions into three "scopes":

- Scope 1: All direct GHG emissions from burning fossil fuels and from refrigerant leakage.
- Scope 2: Indirect emissions associated with the consumption of purchased electricity.
- Scope 3: All other indirect emissions not covered in Scope 2, such as upstream and downstream emissions, emissions resulting from the extractions and production of purchased materials and fuels, transportation related activities in vehicles not owned or reported by the reporting entity (e.g., employee commuting and business travel), use of sold products and services, outsourced activities, recycling used products, waste disposal, etc.

The Climate Registry's "Local Government Operations Protocol" requires reporting Scope 1 and Scope 2 emissions while Scope 3 is optional. This report only includes Scope 1 and Scope 2 emissions.

It should be noted that making operational changes to reduce Scope 3 emissions can be a good strategy to reduce overall GHG emissions from FCPS related activities. For example, a successful program that reduces the use of personal vehicles for students and staff to commute and instead carpool or taking a school bus would reduce GHG emissions. This, however, would not affect Scope 1 and Scope 2 emissions.

In general calculating Scope 3 emissions and the impact of changes is more subjective and difficult to accurately determine than Scope 1 and 2 emissions.

Reporting Into a Database

This GHG emissions inventory was prepared to meet the FCPS School Board policy 8542. There is currently no Federal or State rule or law concerning the emissions of GHG or a requirement to report on GHG emission inventories by FCPS. Reporting and registering GHG emission inventories have been done by organizations on a voluntary basis.

Reporting into the Climate Registry requires formal verification of the data for accuracy and methodology by a third party expert. This generally would be a paid consultant specializing in report verification.

Becoming members and reporting GHG emissions to a national database such as the Climate Registry is an option for FCPS or the entire Fairfax County Government. Because of the fluid nature of reporting and the cost of third party verification, not reporting to a database at this time is recommended. FCPS should continue to collect data and inventory GHG emissions annually in order to meet the goals and intent of policy 8542.

Adaptations required to report into the Climate Registry

Baseline year: The Local Government Operations Protocol requires reporters to select a baseline year. Once this baseline is selected, it should not be changed since progress in reducing GHG emissions are compared to this baseline. Since the intent of an inventory program is to track overall emissions, the baseline is not adjusted due to expansion such as an increased number of students, constructing new building space, or increasing the size of the vehicle fleet. This inventory report does not propose a baseline year. Any year could be selected provided that accurate energy use data is available.

Third party verification: Reporting into the Climate Registry requires the reporter to hire a third party expert to verify that the data is accurate and properly reported. This generally would be a paid consultant specializing in report verification.

Greenhouse Gases Reported

The protocol (Climate Registry “Local Government Operations Protocol” version 1.1, May 2010) requires reporting on the following gases:

- Carbon Dioxide (CO₂):
 - Direct combustion of fossil fuels such as:
 - Natural gas used for heating, cooking, domestic hot water, and emergency power generators power.
 - Fuel oil used for heating and emergency power generators.
 - Propane used for heating and emergency power generators.
 - Diesel and gasoline fuel used for transportation vehicles and grounds keeping equipment.
 - Indirect combustion from the use of electricity at generated at fossil fuel power plants.

- Methane (CH₄): Direct and indirect combustion of fossil fuels as listed above.
- Nitrous Oxide (N₂O): Direct and indirect combustion of fossil fuels as listed above.
- Hydrofluorocarbons (HFCs) – Fugitive emissions (leaks) from certain air conditioning and refrigeration equipment.
- Perfluorocarbons (PFCs) – not emitted from FCPS operations.
- Sulfur hexafluoride (SF₆) – not emitted from FCPS operations.