

MISCELLANEOUS COMBUSTION SOURCES SECTOR

Highlights

- Greenhouse gas (GHG) emissions from the sector decreased by two percent from 2011 to 2012.
- Food processing has been the highest emitting subsector in each year, accounting for 36% of GHG emissions from the sector in 2012.
- Natural gas was the predominant fuel used across this sector in 2010, 2011 and 2012. During 2012, natural gas provided an estimated 76% of the fuel used by this sector while contributing only approximately 64% of total GHG emissions.
- Approximately 3,000 combustion configurations were reported in this sector. A configuration is either a single combustion unit or multiple combustion units for which combined emissions were reported. Therefore, the number of individual combustion sources in this sector is greater than 3,000.

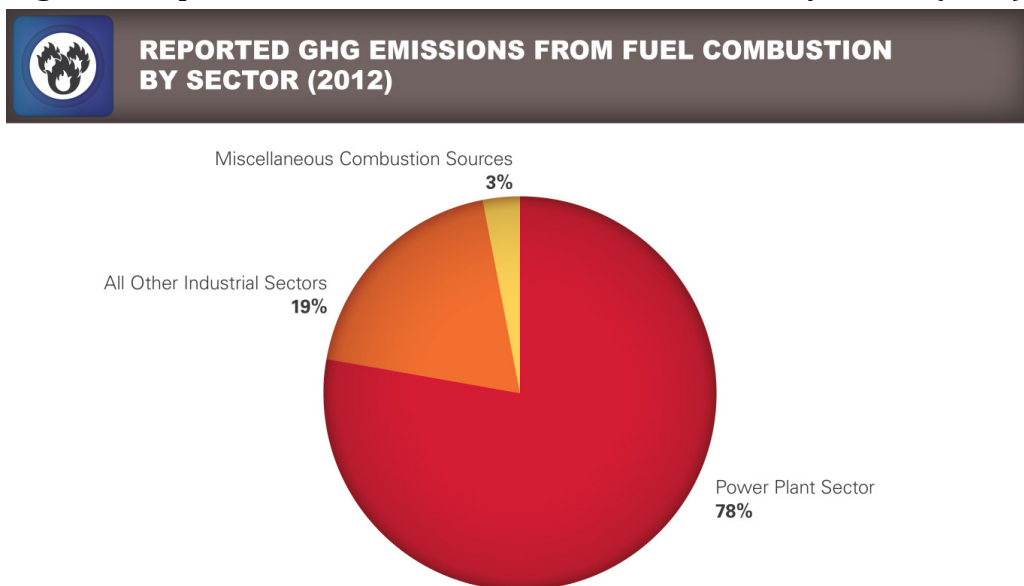
All emissions presented here are as of 9/1/2013 and exclude biogenic CO₂.

About this Sector

The Miscellaneous Combustion Sources (MCS) Sector comprises combustion-only sources that are not part of any other GHGRP industry sector.^a This profile divides the MCS Sector into several subsectors that comprise common facility types: Food Processing; Ethanol Production; Other Manufacturing; Military; Universities. There is also a grouping for “Other” facility types.

Many facilities in other sectors report emissions from combustion of fossil fuels, and those emissions are attributed to those other sectors. The GHG emissions from the MCS Sector represent only a small portion (three percent) of the total combustion emissions reported under the GHGRP (Figure 1). Power plants account for 78% of reported combustion emissions.

Figure 1: Reported GHG Emissions from Fuel Combustion by Sector^a (2012)



^a Figure 1 shows all combustion emissions reported under GHGRP Subpart C (General Stationary Fuel Combustion) and Subpart D (Electricity Generation), which is 2,601.0 MMT CO₂e (about 40% of total U.S. emissions).

^a [View the GHGRP industry sectors here.](#)

Who Reports?

In 2012, combustion operations at 1,090 facilities were included within this sector. Total reported emissions were 86.4 million metric tons of carbon dioxide equivalent (MMT CO₂e). In 2012, the Miscellaneous Combustion Sources Sector represented 14% of the facilities reporting direct emissions to the GHGRP and 1.3% of total U.S. GHG emissions.^b More than half of the reporters in this sector were Food Processing and Other Manufacturing facilities.

Table 1: MCS Sector – Reporting Schedule by Subpart

Subpart	Source Category	Applicability	First Reporting Year
C	Stationary Combustion Sources	All facilities that emit $\geq 25,000$ metric tons CO ₂ e/year from stationary fuel combustion and are not part of any other industrial sector. Click here to learn more about industrial sectors.	2010

Table 2: MCS Sector – Number of Reporters (2010–2012)

MCS Sector	Number of Reporters		
	2010	2011	2012
Total MCS Sector	1,039	1,071	1,090
Food Processing	281	309	316
Ethanol Production	161	163	166
Other Manufacturing	279	283	285
Universities	111	111	113
Military	37	43	44
Other Combustion	170	162	166

Table 3: MCS Sector – GHGRP Coverage

Source Category	Estimated Percent of Industry Facilities Covered by GHGRP	Estimated Percent of Industry Emissions Covered by GHGRP
Food Processing	Not available ^a	60% ^b
Ethanol Production	Not available ^a	100% ^b
Other Manufacturing	Not available ^a	Not available ^c
Universities	2% ^d	Not available ^e
Military	42% ^f	Not available ^g
Other Combustion	Not available ^a	Not available ^c

^a Due to the diversity of facilities and products in this category, the U.S. population of similar facilities is not available.

^b Estimate of category's annual emissions based on EIA's Manufacturing Energy Consumption Survey data publication for 2010, available at <http://www.eia.gov/consumption/manufacturing/about.cfm>.

^c Due to the diversity of facilities and products in this category, U.S. emissions from similar facilities are not available.

^d Based on comparison of 113 universities reporting to GHGRP and 6,742 postsecondary institutions listed at http://nces.ed.gov/programs/digest/d11/tables/dt11_005.asp.

^e Total emissions from all U.S. colleges and universities are not available.

^f Based on comparison of 134 military bases reporting to GHGRP and 320 military bases listed [here](#).

^g Total emissions from all U.S. military bases are not available.

^b Total U.S. GHG emissions are 6,525.6 MMT CO₂e, as reported in the Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2012. U.S. Environmental Protection Agency. April 15, 2014. EPA 430-R-14-003. Available at: <http://www.epa.gov/climatechange/ghgemissions/usinventoryreport.html>.

Reported Emissions

All GHG emissions data, displayed in units of carbon dioxide equivalent (CO₂e) reflect the global warming potential (GWP) values from the Intergovernmental Panel on Climate Change (IPCC), Climate Change 1995: The Science of Climate Change (Second Assessment Report (SAR), Cambridge, United Kingdom: Cambridge University Press). The SAR values also can be found in the version of Table A-1 to 40 CFR part 98, published in the Federal Register on October 30, 2009 (74 FR 56395).

Table 4: MCS Sector – Emissions by Subsector (2010–2012)

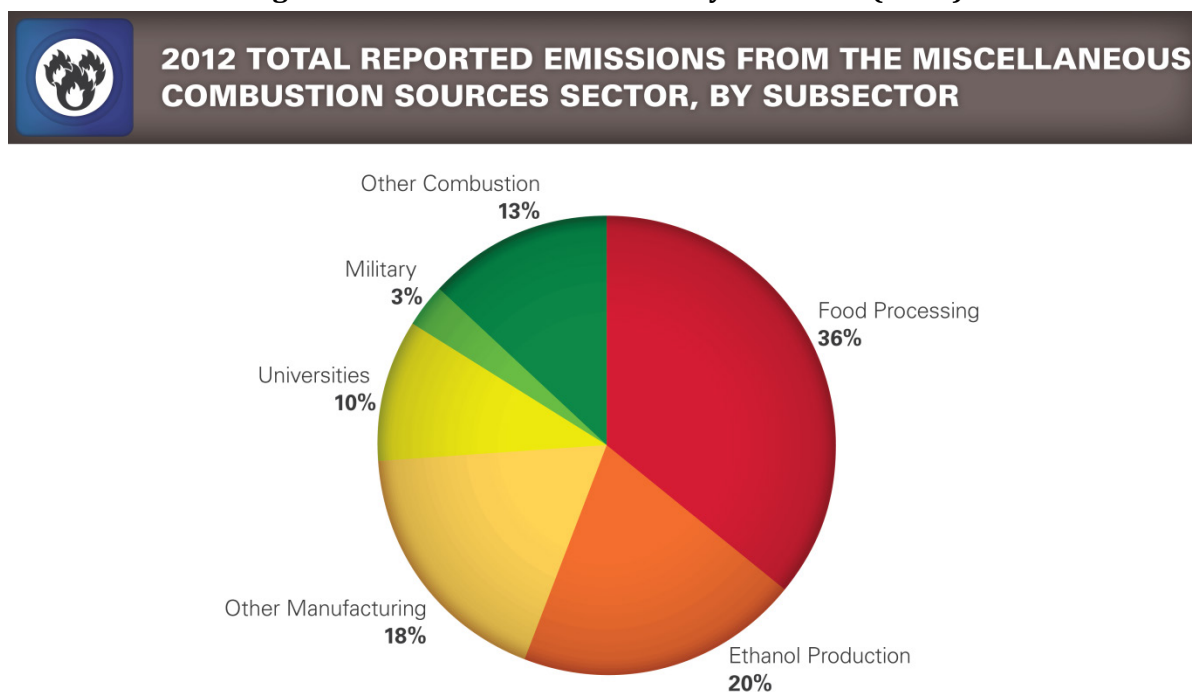
MCS Sector	Emissions (MMT CO ₂ e) ^{a,b}		
	2010	2011	2012
Total MCS Sector	89.2	88.9	86.4
Food Processing	31.6	30.8	30.6
Ethanol Production	17.7	18.1	17.4
Other Manufacturing	15.7	17.0	16.1
Universities	9.6	9.4	8.9
Military	2.3	2.7	2.6
Other Combustion	12.3	10.8	10.9

^a Totals may not sum due to independent rounding.

^b These values represent total emissions reported to the GHGRP in these industry sectors. Additional emissions occur at facilities that have not reported, for example, those below the 25,000 metric ton CO₂e reporting threshold.

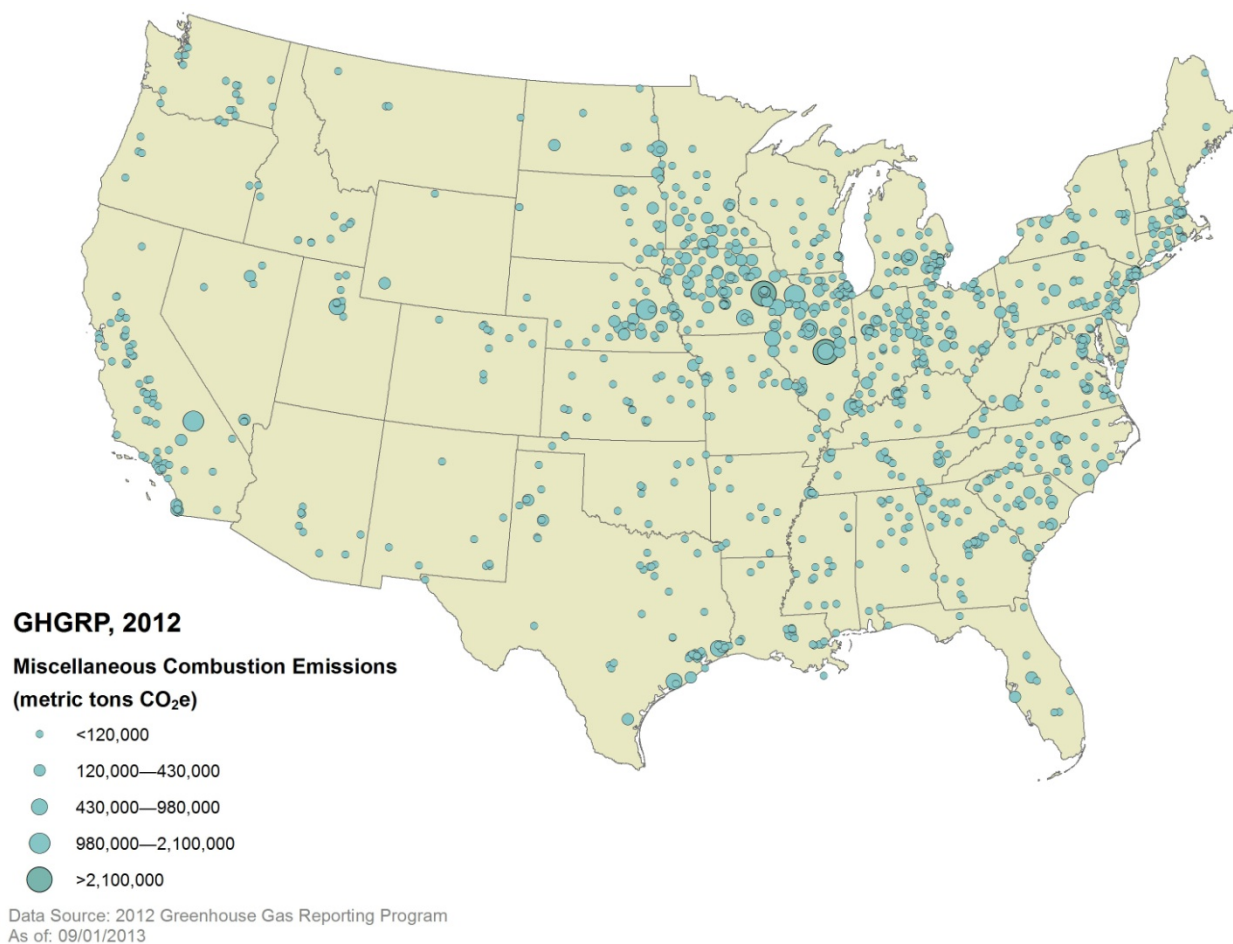
Total reported emissions from the MCS Sector in 2012 were 86.4 MMT CO₂e. The two largest emitting subsectors were Food Processing and Ethanol Production, representing more than 50% of reported emissions.

Figure 2: MCS Sector – Emissions by Subsector (2012)



[Click here to view the most current data using FLIGHT.](#)

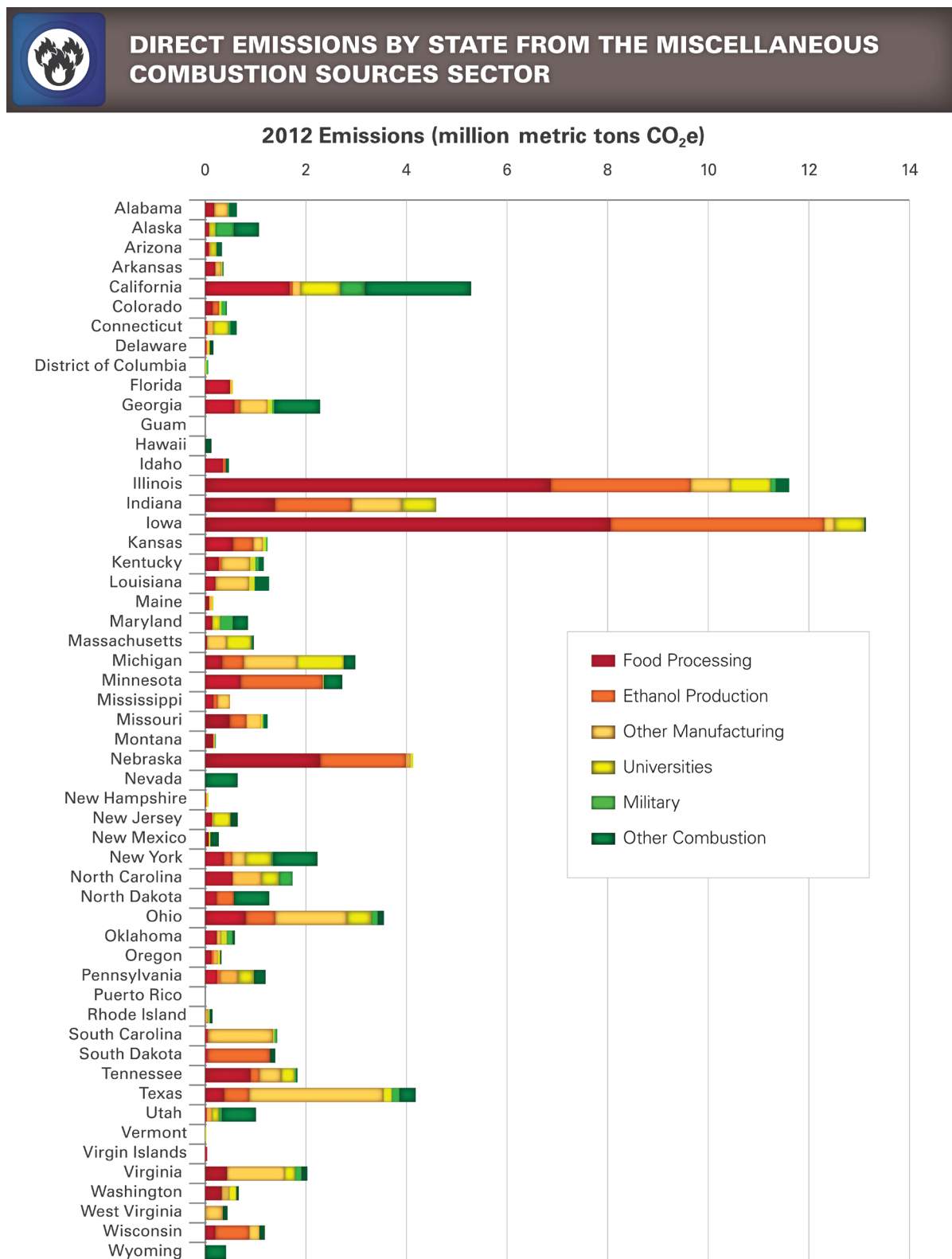
Figure 3: Location and Emissions Range for Each Reporting Facility in the Miscellaneous Combustion Sources Sector (as of 9/1/13)



This map shows the locations of direct-emitting facilities. The size of a circle corresponds to the quantity of emissions reported by that facility. There are also miscellaneous combustion facilities located in Alaska and Hawaii (<http://www.epa.gov/ghgreporting/ghgdata/reported/misccombustion.html>).

Readers can [identify the largest emitting facilities](#) by visiting the Facility Level Information on Greenhouse Gases (FLIGHT) website (<http://ghgdata.epa.gov>).

Figure 4: MCS Sector – Emissions by State (2012)



** Represents total emissions reported to the GHGRP in this sector. Additional emissions occur at facilities that have not reported; for example, those below the 25,000 metric ton reporting threshold.

[Click here to view the most current data using FLIGHT.](#)

Miscellaneous Combustion Sources Sector Emissions Trends 2010 to 2011

In 2011, emissions reported for the MCS sector decreased by 0.3 MMT CO₂e (0.3%) from 2010 levels. Emissions from all of the subsectors were similarly flat.

- 509 reporters in this sector reported lower emissions in 2011 than 2010.
- 540 reporters in this sector reported higher emissions in 2011 than 2010.
- Four reporters in this sector reported the same emissions in 2011 as in 2010.
- 95 reporters in this sector did not report in 2010 or reported zero emissions in 2010, but reported greater than zero in 2011.
- Nine reporters in this sector reported greater than zero emissions in 2010, but reported zero emissions in 2011.

Miscellaneous Combustion Sources Sector Emissions Trends 2011 to 2012

In 2012, emissions reported for the MCS sector decreased by 2.5 MMT CO₂e (2.8%) from 2011 levels.

- 691 reporters in this sector reported lower emissions in 2012 than 2011.
- 403 reporters in this sector reported higher emissions in 2012 than 2011.
- Two reporters in this sector reported the same emissions in 2012 as in 2011.
- 30 reporters in this sector did not report in 2011 or reported zero emissions in 2011, but reported greater than zero in 2012.
- 17 reporters in this sector reported greater than zero emissions in 2011, but reported zero emissions in 2012.

Comparison of Tables 5 and 6 reflects changes in fuel usage that contributed to the change in emissions from 2011 to 2012. The increase in natural gas usage and the corresponding reduction in use of coal and coke supported the slight decrease in emissions from 2011 to 2012.

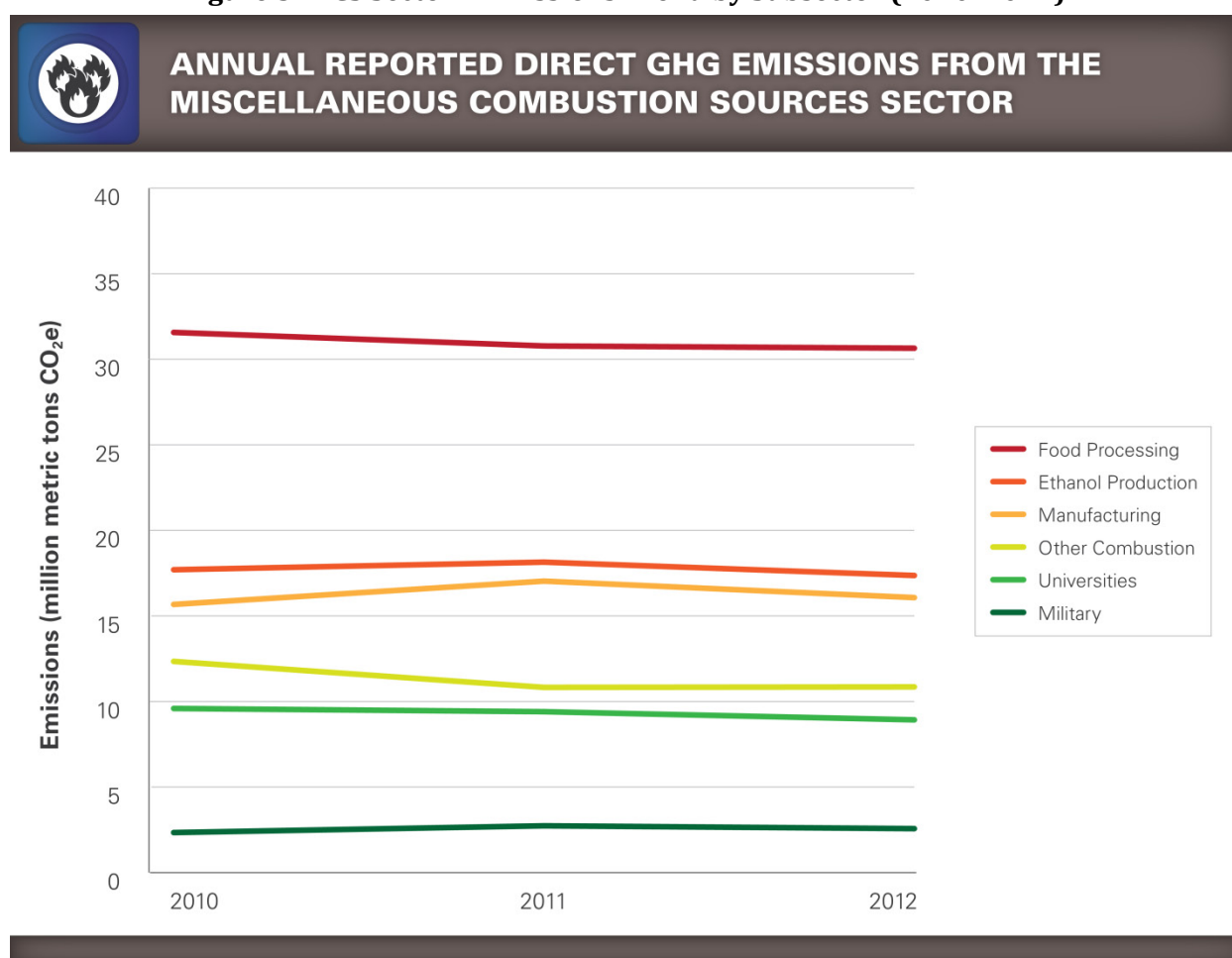
Table 5: Distribution of GHG Emissions Based on Fuel Type (2012)

Sector and Subsector	Natural Gas	Coal and Coke	Petroleum Products	Other Fuels
Total MCS Sector (CO₂e Emissions)	64.3%	30.5%	5.0%	0.01%
Total MCS Sector (Heat Input)	76.2%	20.0%	3.7%	0.01%
Food Processing (CO ₂ e Emissions)	46.8%	50.9%	2.3%	0.00%
Ethanol Production (CO ₂ e Emissions)	90.9%	8.7%	0.5%	0.00%
Other Manufacturing (CO ₂ e Emissions)	68.5%	18.3%	13.1%	0.03%
Universities (CO ₂ e Emissions)	73.7%	23.4%	2.9%	0.00%
Military (CO ₂ e Emissions)	62.9%	29.7%	7.4%	0.00%
Other (CO ₂ e Emissions)	56.7%	33.8%	8.2%	0.00%

Table 6: Distribution of GHG Emissions Based on Fuel Type (2011)

Sector and Subsector	Natural Gas	Coal and Coke	Petroleum Products	Other Fuels
Total MCS Sector (CO₂e Emissions)	63.6%	33.6%	2.4%	0.3%
Total MCS Sector (Heat Input)	75.7%	22.1%	2.1%	0.1%
Food Processing (CO ₂ e Emissions)	43.5%	55.3%	1.2%	0.0%
Ethanol Production (CO ₂ e Emissions)	89.8%	10.0%	0.2%	0.0%
Other Manufacturing (CO ₂ e Emissions)	73.7%	23.0%	2.5%	0.9%
Universities (CO ₂ e Emissions)	65.3%	31.9%	2.8%	0.0%
Military (CO ₂ e Emissions)	58.5%	28.5%	12.9%	0.0%
Other (CO ₂ e Emissions)	60.6%	31.3%	6.8%	1.3%

Figure 5: MCS Sector – Emissions Trend by Subsector (2010–2012)



[Click here to view the most current information using FLIGHT.](#)

Table 7: MCS Sector – Emissions by GHG (MMT CO₂e)

MCS Sector	Reporting Year		
	2010	2011	2012
Number of facilities	1,039	1,071	1,090
Total emissions (MMT CO₂e)	89.2	88.9	86.4
Emissions by GHG			
Carbon dioxide (CO₂)			
• Food Processing	31.3	30.6	30.5
• Ethanol Production	17.6	18.1	17.2
• Other Manufacturing	15.6	16.9	16.0
• Universities	9.6	9.4	8.9
• Military	2.3	2.7	2.6
• Other Combustion	12.3	10.8	10.8
Methane (CH₄)			
• Food Processing	0.1	0.1	0.1
• Ethanol Production	**	**	**
• Other Manufacturing	**	**	**
• Universities	**	**	**
• Military	**	**	**
• Other Combustion	**	**	**
Nitrous oxide (N₂O)			
• Food Processing	0.2	0.1	0.1
• Ethanol Production	0.1	**	0.2
• Other Manufacturing	0.1	0.1	0.1
• Universities	**	**	**
• Military	**	**	**
• Other Combustion	**	**	**

** Total reported emissions are less than 0.05 MMT CO₂e.

Carbon dioxide accounts for the vast majority of emissions from the MCS sector.

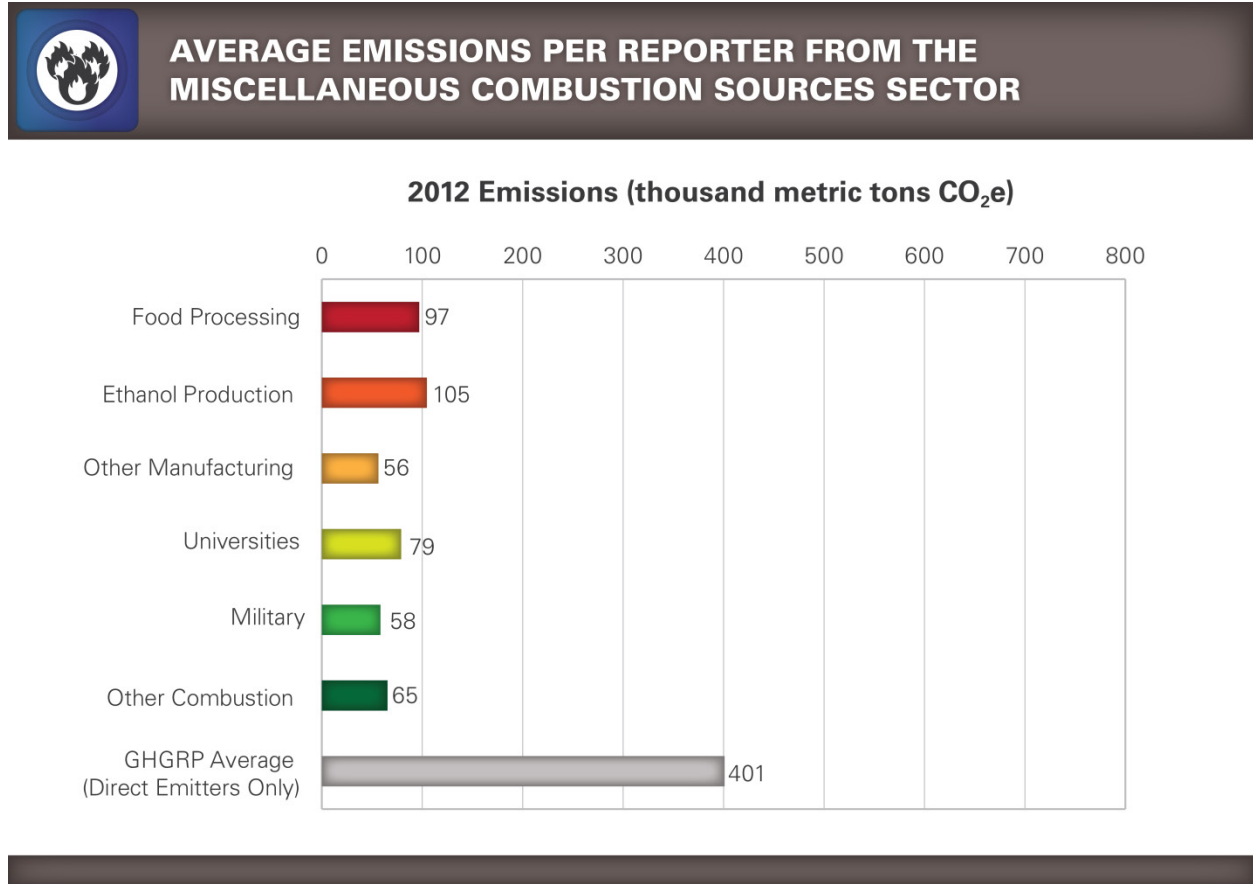
Figure 6: MCS Sector – Average Emissions per Reporter (2012)

Figure 7: MCS Sector – Percentage of Reporters by Emissions Range (2012)

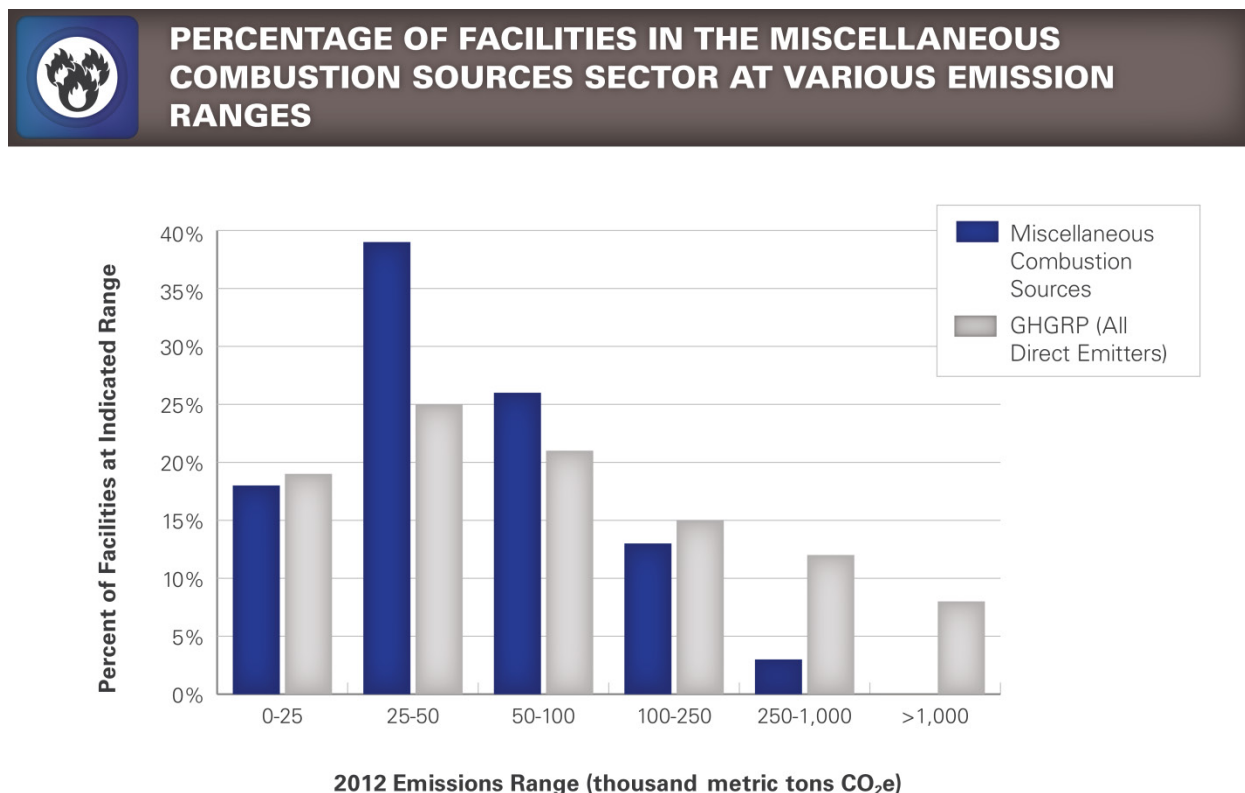


Table 8: MCS Sector – Number of Reporters by Emissions Range (2012)

Subsector	Emissions Range (MMT CO ₂ e)					
	0 - 0.025	0.025 - 0.05	0.05 - 0.1	0.1 - 0.25	0.25 - 1	> 1
Total MCS Sector	185	417	299	149	34	6
Food Processing	48	155	72	25	11	5
Ethanol Production	11	19	74	58	4	
Other Manufacturing	48	135	67	27	8	
Universities	11	42	32	24	4	
Military	12	17	8	6	1	
Other Combustion	55	49	46	9	6	1

Emissions from Combustion of Biomass Fuels

Biomass fuels are non-fossilized and biodegradable organic material originating from plants, animals or micro-organisms, including products, by-products, residues and waste from agriculture, forestry and related industries, as well as the non-fossilized and biodegradable organic fractions of industrial and municipal wastes, including gases and liquids recovered from the decomposition of non-fossilized and biodegradable organic material. As shown in Table 9, emissions of biogenic CO₂ were essentially level across all subsectors from 2010 through 2012.

Table 9: MCS Sector – Biogenic CO₂ Emissions by Subsector (2010–2012)

MCS Sector	Emissions (MMT CO ₂)		
	2010	2011	2012
Total MCS Sector	5.4	5.4	5.3
Food Processing	2.5	2.4	2.5
Ethanol Production	0.2	0.3	0.2
Other Manufacturing	2.1	2.1	2.0
Universities	0.1	0.1	0.1
Military	**	**	**
Other Combustion	0.5	0.5	0.5

** Total reported emissions are less than 0.05 MMT.

Types of Combustion Units Reported

The MCS sector includes a diverse collection of different types of combustion sources. In addition to the individual combustion source reporting requirement, there are three optional “configurations” that allow a facility to group multiple individual combustion sources together, designate them as a single configuration, and report the total emissions for the configuration rather than emissions from each unit. The three allowable optional configurations are as follows: “aggregation of units” for multiple small units each with a maximum rated heat input capacity of 250 mmBtu/hr or less, “common pipe” for multiple units that share a fuel supply line and fuel flow meter, and “common stack” for multiple units that share a common stack in which the combined emissions are measured using a CEMS. In the MCS sector in 2012, multi-unit configurations accounted for a combined 97% of reported configurations and 98% of reported GHG emissions, whereas individual unit configurations accounted for a just three percent of reported configurations and two percent of reported GHG emissions (Table 10). This is not unexpected because this sector generally consists of smaller sources that can use the optional reporting configurations.

Table 10: MCS Sector Reporting Configurations (2012)

Configuration Type	Percentage of Total MCS Sector Configurations	Percentage of Total MCS Sector GHG Emissions
Common Pipe	36%	26%
Aggregation of Units	61%	64%
Common Stack	1%	8%
Individual Unit	3%	2%

Within the reported individual unit configurations, there were eleven different types of combustion units reported in 2012 (Table 11). Multi-unit configurations may include a mixture of different unit types and so a similar table cannot be created for these configurations.

Table 11: Number of Combustion Units Reported in the MCS Sector by Type of Unit (2012)

Type of Combustion Unit	Food Processing	Ethanol Production	Manufacturing	Military	Universities	Other
Stoker Boilers	13	1	22	3	16	10
Pulverized Coal Boilers	5	2	5	0	5	12

Type of Combustion Unit	Food Processing	Ethanol Production	Manufacturing	Military	Universities	Other
Product or Intermediate Product Dryers	9	13	3	1	0	13
Circulating Fluidized Bed Boilers	13	0	2	0	6	1
Flares	8	6	0	0	0	2
Thermal Oxidizers	1	7	17	3	0	1
Natural Gas Line Heaters	0	2	8	1	0	3
Kilns	1	0	1	1	1	3
Bubbling Fluidized Bed Boilers	3	3	1	0	0	0
Incinerators, Commercial and Industrial	0	1	2	1	1	1
Other Types of Boilers	69	24	113	87	70	56

Calculation Methods Used

Combustion units report under subpart C and the reporter generally must use one of four calculation methodologies (tiers) to calculate CO₂ emissions. The primary determinants of the required tier calculation methodology are the fuel type and unit size, such that multiple tiers may be used to calculate CO₂ mass emissions from the same unit if more than one fuel is used. The calculation methods are as follows:

- **Tier 4** – The use of a Continuous Emissions Monitoring System (CEMS).
- **Alternative Part 75 methodologies** – Units that are required by states to monitor emissions according to 40 CFR part 75 can report CO₂ emissions under subpart C using Part 75 calculation methods and monitoring data that they already collect under Part 75 (e.g. heat input, fuel use).
- **Tier 3** – The use of measured fuel quantity (estimates can be used for solid fuels), carbon content, and molecular weight (gaseous fuels) of the fuel.
- **Tier 2** – The use of estimated fuel quantity, measured high heating value (HHV) and default emissions factor.
- **Tier 1** – The use of estimated fuel quantity, default HHV and default emissions factors.

Methane (CH₄) and nitrous oxide (N₂O) mass emissions are also required to be reported for fuels that are included in Table C-2 of Part 98 and are calculated using either an estimated or measured fuel quantity, default or measured HHV, and default emission factors. The calculation method depends on the tier used to calculate CO₂ emissions.

Facilities were eligible to submit an abbreviated report for reporting year 2010 if the only emissions being reported by the facility were stationary fuel combustion sources subject to Subpart C. Facilities that elected to submit abbreviated reports were required to submit only facility-level GHG emissions and were allowed to use any of the four calculation tiers. Beginning with the 2011 reporting year, all facilities were required to submit full reports.

For units with acid gas emission controls, facilities must report CO₂ emissions resulting from sorbent use if the CO₂ emissions are not measured with CEMS (Tier 4).

Tables 12 through 17 show, for each industry subsector, the percentage of reported emissions calculated using each method.

Table 12: Miscellaneous Combustion Sources - Food Processing Methodologies

Type of Emissions	Methodology	Portion of Emissions Monitored by Method		
		2010	2011	2012
Combustion Emissions	CEMS (Tier 4)	7.3%	43%	42.4%
	Measured carbon content, and, if applicable, molecular weight (Tier 3)	0.0%	0.3%	0.3%
	Measured high heating values (HHVs) and default emission factors (Tier 2)	18.2%	21.8%	21.4%
	Default HHVs and emission factors (Tier 1)	22.3%	34.9%	35.9%
	Abbreviated reporting ^a	52.2%	0.0%	0.0%
	Sorbent emissions	0.0%	0.1%	0.0%

^a Abbreviated reporting was allowed for RY2010 only.

Table 13: Miscellaneous Combustion Sources - Ethanol Production Methodologies

Type of Emissions	Methodology	Portion of Emissions Monitored by Method		
		2010	2011	2012
Combustion Emissions	CEMS (Tier 4)	1.5%	3.5%	3.6%
	Alternative Part 75 Methodology	0.0%	2.0%	1.7%
	Measured carbon content, and, if applicable, molecular weight (Tier 3)	0.8%	0.0%	0.0%
	Measured high heating values (HHVs) and default emission factors (Tier 2)	10.8%	31.7%	28.2%
	Default HHVs and emission factors (Tier 1)	45.2%	62.8%	66.5%
	Abbreviated reporting ^a	41.6%	0.0%	0.0%
	Sorbent emissions	**0%	**0%	**0%

^a Abbreviated reporting was allowed for RY2010 only.

** Value is between 0 and 0.05%.

Table 14: Miscellaneous Combustion Sources – Other Manufacturing Methodologies

Type of Emissions	Methodology	Portion of Emissions Monitored by Method		
		2010	2011	2012
Combustion Emissions	CEMS (Tier 4)	0.1%	1.6%	1.3%
	Measured carbon content, and, if applicable, molecular weight (Tier 3)	1.5%	3.2%	2.4%
	Measured high heating values (HHVs) and default emission factors (Tier 2)	42.2%	51.3%	50.6%
	Default HHVs and emission factors (Tier 1)	32.5%	44%	45.8%
	Abbreviated reporting ^a	23.7%	0.0%	0.0%
	No method specified by the reporter	**0%	0.0%	0.0%
	Sorbent emissions	**0%	**0%	0.0%

^a Abbreviated reporting was allowed for RY2010 only.

** Value is between 0 and 0.05%.

Table 15: Miscellaneous Combustion Sources – Universities Methodologies

Type of Emissions	Methodology	Portion of Emissions Monitored by Method		
		2010	2011	2012
Combustion Emissions	CEMS (Tier 4)	9.1%	9.1%	8.4%
	Alternative Part 75 Methodology	6.1%	6.0%	6.1%
	Measured carbon content, and, if applicable, molecular weight (Tier 3)	0.8%	1.3%	0.6%
	Measured high heating values (HHVs) and default emission factors (Tier 2)	29.5%	36.2%	35.6%
	Default HHVs and emission factors (Tier 1)	31.3%	47.3%	48.8%
	Abbreviated reporting ^a	22.7%	0.0%	0.0%
	Sorbent emissions	0.2%	0.3%	0.3%

^a Abbreviated reporting was allowed for RY2010 only.

Table 16: Miscellaneous Combustion Sources – Military Methodologies

Type of Emissions	Methodology	Portion of Emissions Monitored by Method		
		2010	2011	2012
Combustion Emissions	Measured high heating values (HHV) and default emission factors (Tier 2)	24.6%	44.8%	45.2%
	Default HHVs and emission factors (Tier 1)	48.6%	55.2%	54.8%
	Abbreviated reporting ^a	26.8%	0.0%	0.0%

^a Abbreviated reporting was allowed for RY2010 only.

Table 17: Miscellaneous Combustion Sources – Other Facility Methodologies

Type of Emissions	Methodology	Portion of Emissions Monitored by Method		
		2010	2011	2012
Combustion Emissions	CEMS (Tier 4)	0.0%	15.2%	16.1%
	Measured carbon content, and, if applicable, molecular weight (Tier 3)	22.7%	8.3%	8.8%
	Measured high heating values (HHVs) and default emission factors (Tier 2)	23.0%	22.5%	25.4%
	Default HHVs and emission factors (Tier 1)	34.6%	53%	49.7%
	Abbreviated reporting ^a	19.8%	0.0%	0.0%
	Sorbent emissions	**%	1.0%	0.0%

^a Abbreviated reporting was allowed for RY2010 only.

** Value is between 0 and 0.05%.

Data Verification and Analysis

As a part of the reporting and verification process, EPA evaluates annual GHG reports with electronic verification checks. EPA contacts facilities regarding potential reporting issues. Additional information on EPA's verification process is available [here](#).

GLOSSARY

CEMS means continuous emissions monitoring system.

CO₂e means carbon dioxide equivalent, which is a metric used to compare the emissions from various greenhouse gases based upon their global warming potential (GWP). The carbon dioxide equivalent for a gas is calculated by multiplying the tons of the gas by the associated GWP.

Direct emitters are facilities that combust fuels or otherwise put greenhouse gases into the atmosphere directly from their facility. Alternatively, **suppliers** are entities that supply certain fossil fuels or fluorinated gases into the economy that—when combusted, released or oxidized—emit greenhouse gases into the atmosphere.

FLIGHT refers to EPA's GHG data publication tool, named Facility Level Information on Greenhouse Gases Tool (<http://ghgdata.epa.gov>).

GHGRP means EPA's Greenhouse Gas Reporting Program (40 CFR part 98).

GHGRP vs. GHG Inventory: EPA's Greenhouse Gas Reporting Program (GHGRP) collects and disseminates annual greenhouse gas data from individual facilities and suppliers across the U.S. economy. EPA also develops the annual Inventory of U.S. Greenhouse Gas Emissions and Sinks (GHG Inventory) to track total national emissions of greenhouse gases to meet U.S. government commitments to the United Nations Framework Convention on Climate Change. The GHGRP and Inventory datasets are complementary and may inform each other over time. However, there are also important differences in the data and approach. For more information, please see <http://www.epa.gov/climatechange/ghgemissions/usinventoryreport.html>.

GWP (Global Warming Potential) is a measure of the total energy that a gas absorbs over a particular period of time (usually 100 years), compared to carbon dioxide.

MCS means miscellaneous combustion sources.

MMT means million metric tons.