

Louisiana 2021 GHG Inventory: Update and summary of preliminary findings.

Presentation before the Climate Initiatives Task Force.

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Presentation Organization

1.1	Introduction
1.2	Louisiana aggregate GHG emission trends
1.3	State inventory tool (“SIT”) estimation methods
1.4	SIT sector emission trends
1.5	Annual SIT emission estimates (module, sector)
1.6	Detailed industrial analysis
1.7	Conclusions

1.1 Introduction

Study background/purpose

- In January 2021, the **Governor's Office of Coastal Activities** ("OCA") contracted with the **LSU Center for Energy Studies** ("CES") to update prior statewide estimates on GHG emissions from all major sources.
- CES' prior work includes **publishing estimates of the state's GHG emissions in 2000 and 2010.**
- The goal of the current study was to provide the state with an updated GHG emissions inventory that **could be used as a policy making tool by the Governor's Clean Climate Initiatives Task Force** in formulating a net zero by 2050 strategy.
- While the OCA has contracted and coordinated CES' research activities, **scholarly and subject-matter input, guidance, and peer review has been provided by the Scientific Advisory Group ("SAG").**

Study approach

CES followed an approach comparable to its prior efforts at estimating the state's GHG emissions. This approach includes:

- Developing a **transparent**, high-level, **top-down inventory of emissions** by major GHG emissions type, process, and by economic sector.
- **Supplement** the “top-down” analysis with **detailed, “bottoms-up” GHG emissions** estimates for the **industrial** and **power generation** sectors.
- **Employ methods outlined by the Environmental Protection Agency (“EPA”)** for estimating state-level GHG emissions by the use of its **state inventory tool (“SIT”)**.
- **Corroborate SIT estimates** with alternative data sources that publish Louisiana-specific GHG emissions estimates.

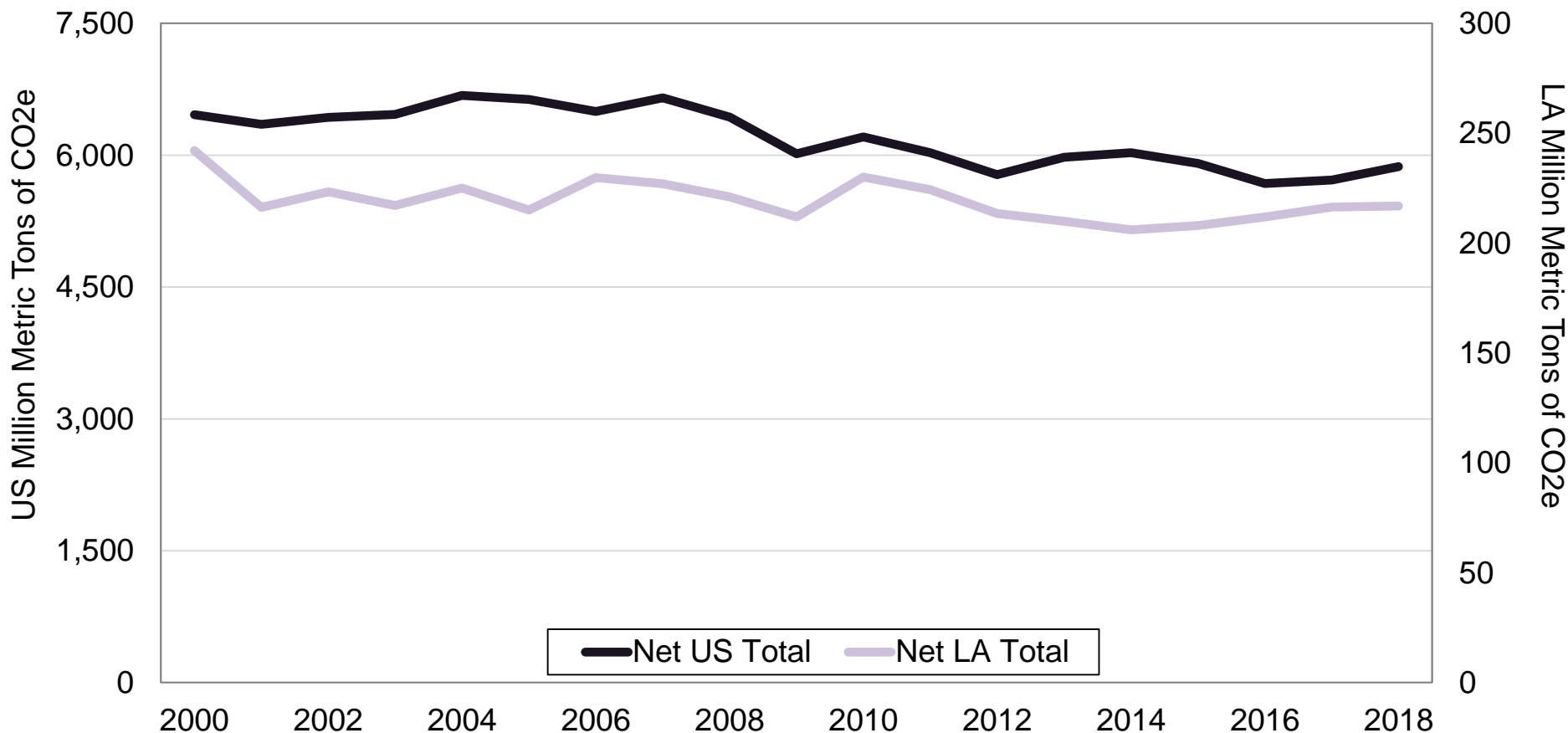
This section of the report

- This section of the report (introduction) provides **an overview of Louisiana's GHG emissions.**
- GHG emission that are the **component parts of the Louisiana GHG inventory will be labelled "SIT" or "SIT estimates"** since they are based on the underlying EPA SIT.
- **Comparison are made aggregate GHG emissions information also estimated by the Energy Information Administration ("EIA").**
- The next portion of this section of the report will provide historic trend information from the EIA.
- The last section will provide the final GHG inventory data and comparisons to the EIA estimates.

1.2 Louisiana aggregate GHG emission trends

Total US vs LA emissions

Total GHG emissions for the US and LA have trended down since 2000. LA emissions are down relative to 2000, but flat since 2001.

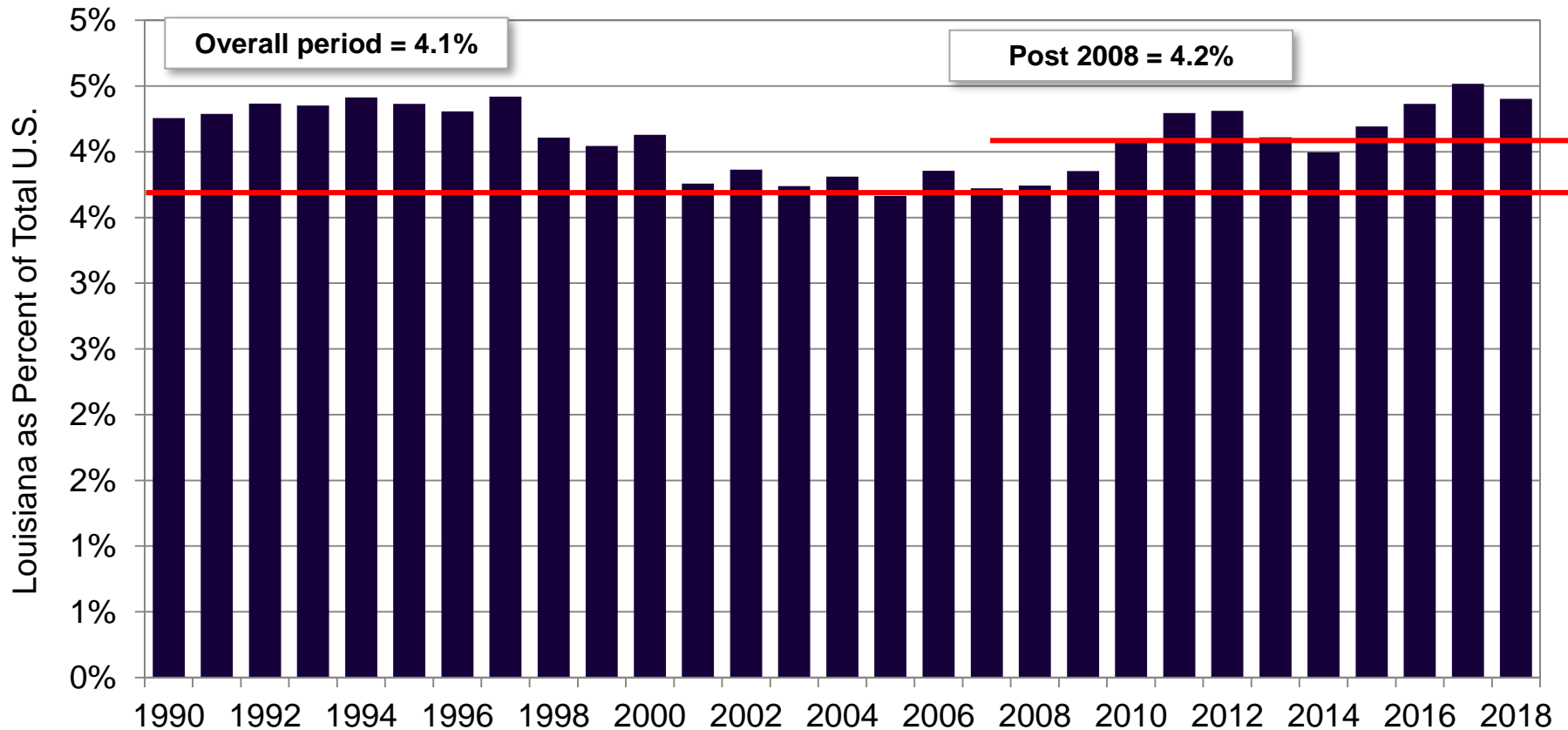


Note: CO₂ emissions are net of sinks..

Source: U.S. Environmental Protection Agency, Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2018; and State CO₂ Emissions from Fossil Fuel Combustion.

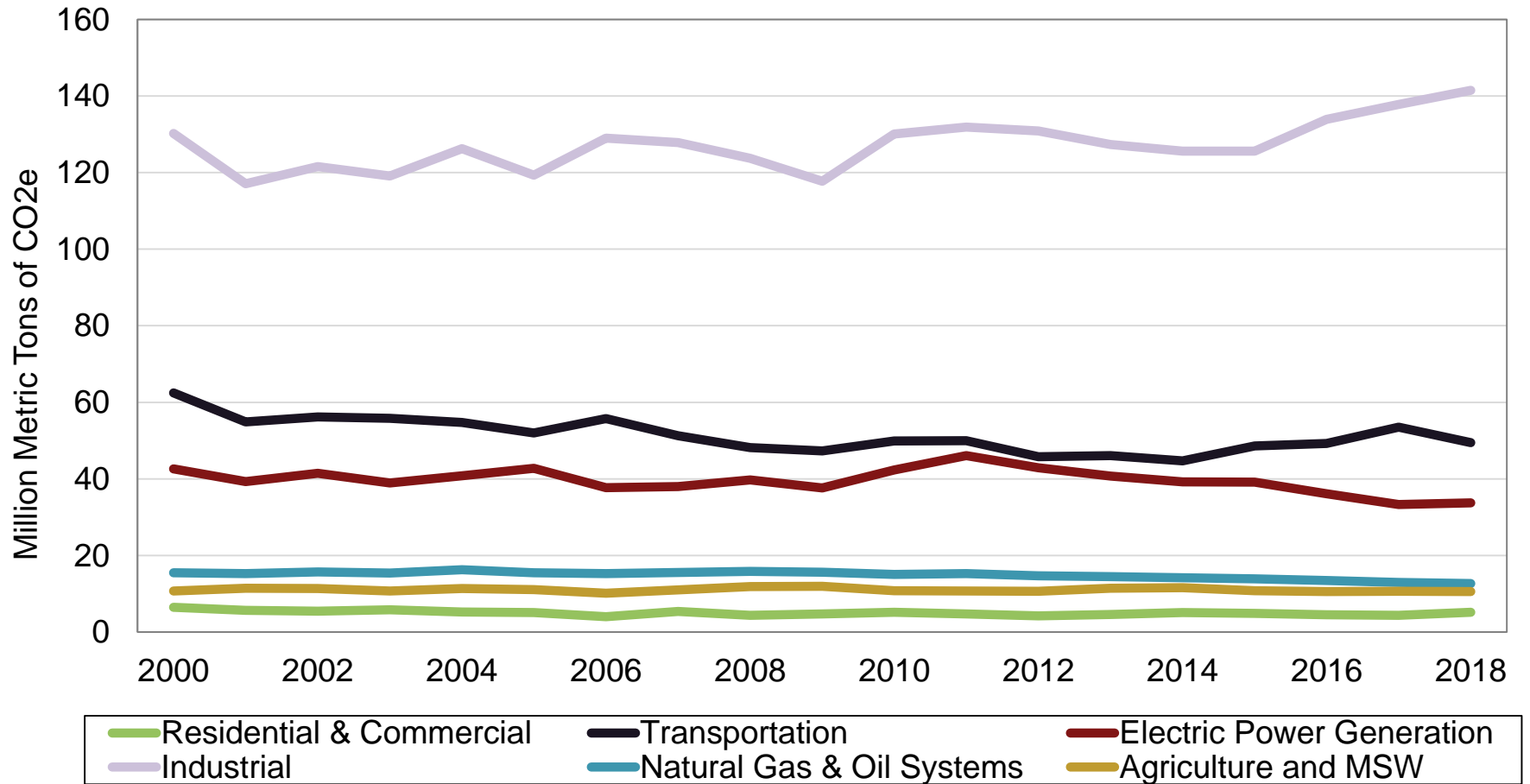
Louisiana share of total U.S. CO₂ emissions

Louisiana's share of total U.S. GHG emissions has been between three and four percent. Louisiana now accounts for **just over four percent of all U.S. carbon emissions.**



Louisiana CO₂ emissions per sector

Louisiana GHG emissions are **dominated by the industrial sector.**



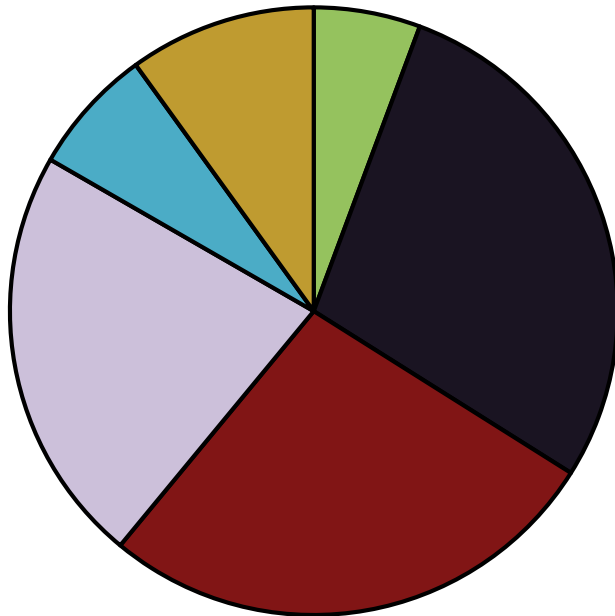
Note: CO₂ emissions are from fossil fuel combustion only.

Source: U.S. Environmental Protection Agency, Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2018; and State CO₂ Emissions from Fossil Fuel Combustion.

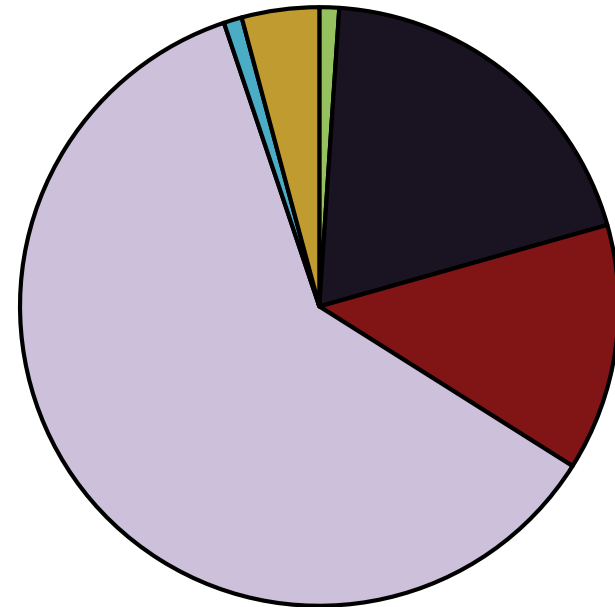
U.S. and Louisiana CO₂ emissions per sector, 2018

In the U.S., **power generation** comprises about **35 percent** of overall national emissions.

In Louisiana, **power generation** comprises about **17 percent** of overall state emissions. Louisiana's primary source of CO₂ emissions comes from **industrial sources**.



- Residential, 6%
- Transportation, 28%
- Power Generation, 27%
- Industrial, 22%
- Commercial, 7%
- Agriculture, 10%



- Residential, 1%
- Transportation, 20%
- Power Generation, 13%
- Industrial, 61%
- Commercial, 1%
- Agriculture, 4%

Note: CO₂ emissions are from fossil fuel combustion only, adjusted for feedstock use.

Source: U.S. Environmental Protection Agency, Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2018; and State CO₂ Emissions from Fossil Fuel Combustion.

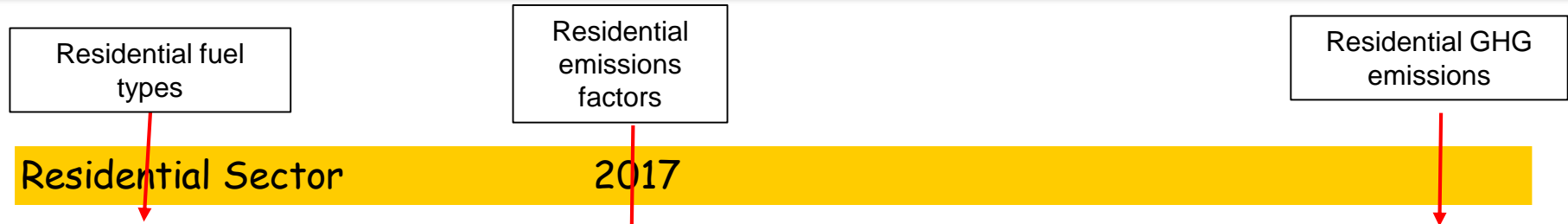
1.3 State inventory tool (SIT) estimation methods

Study methods

- The **Intergovernmental Panel on Climate Change (“IPCC”)** has **published guidelines**, starting in 1997, for GHG emissions inventory estimation that have been, and **are currently used by the EPA** in the development and maintenance of a statewide level tool for estimating GHG emissions.
- The **SIT establishes framework for estimating GHG emissions** that span various sectors, emissions types, and processes. The SIT is comprised of a **variety of “modules”** that estimate various GHG emissions that goes **beyond just CO₂ emissions and includes other GHGs such as nitrous oxides and methane.**
- GHG emissions estimates are generally derived by taking historic **“emission factors”** and multiplying those factors by an **“activity type.”** So, for the power sector, the emissions factor is typically in pounds per kWh of generation multiplied by total kWh generation by fuel type.

Example: Combustion of Fossil Fuels - Residential

As an example, residential fuel use per fuel type data is collected, multiplied by a **unique emissions factor per fuel type** to arrive at total GHG emissions.



Fuel Type	Consumption (Billion Btu)	Emission Factor (lbs C/Million Btu)	Combustion Efficiency (%)	Emissions (short tons carbon)	Emissions (MMTCE)	Emissions (MMT _{CO2E})
Coal	-	62.02	100.0%	-	0.000	0.000
Distillate Fuel	44	44.47	100.0%	978	0.001	0.003
Kerosene	2	44.01	100.0%	44	0.000	0.000
Hydrocarbon Gas Liquids	1,699	37.11	100.0%	31,525	0.029	0.105
Natural Gas	29,680	31.90	100.0%	473,396	0.429	1.575
Other	-			-	0.000	0.000

Residential Sector 2018

Fuel Type	Consumption (Billion Btu)	Emission Factor (lbs C/Million Btu)	Combustion Efficiency (%)	Emissions (short tons carbon)	Emissions (MMTCE)	Emissions (MMT _{CO2E})
Coal	-	62.02	100.0%	-	0.000	0.000
Distillate Fuel	8	44.47	100.0%	178	0.000	0.001
Kerosene	4	44.01	100.0%	88	0.000	0.000
Hydrocarbon Gas Liquids	1,748	37.11	100.0%	32,434	0.029	0.108
Natural Gas	38,629	31.90	100.0%	616,133	0.559	2.049
Other	-			-	0.000	0.000

Greenhouse gas (“GHG”) emission types

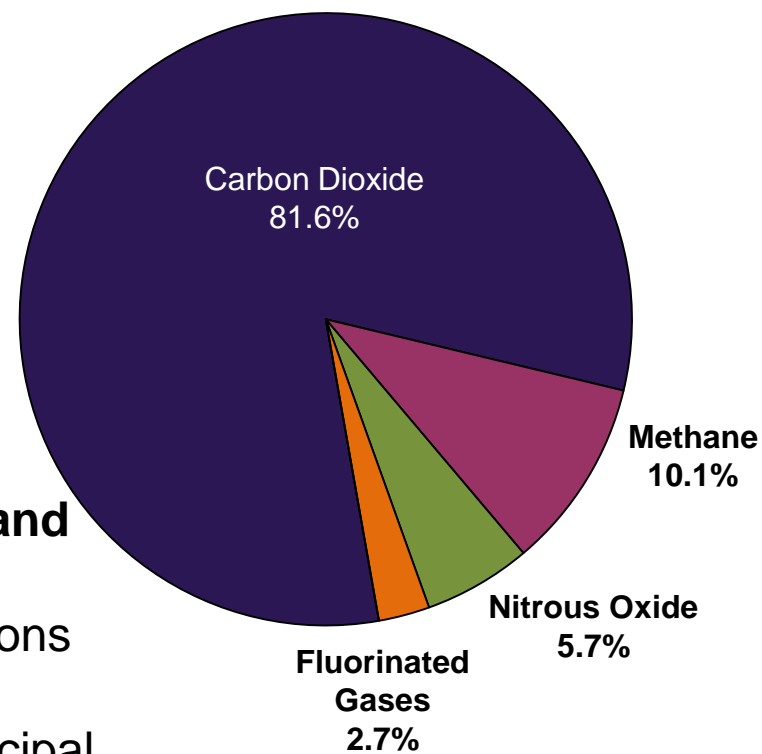
Carbon dioxide (CO₂) enters the atmosphere through the burning of fossil fuels (oil, natural gas, and coal), solid waste, trees and wood products, and also as a result of other chemical reactions (e.g., manufacture of cement).

Nitrous oxide (N₂O) is emitted during agricultural and industrial activities, as well as during combustion of fossil fuels and solid waste.

Methane (CH₄) is emitted during the production and transport of fossil fuels in the petroleum and chemical manufacturing sectors. Methane emissions can also result from livestock and other agricultural practices and by the decay of organic waste in municipal solid waste landfills.

Fluorinated greenhouse gases (F-gases) are a family of gases containing fluorine. They are powerful greenhouse gases found and released from refrigerants, heat pumps, air conditioning, blowing agents for foam/solvents, and fire extinguishers.

Total U.S. Greenhouse Gas Emissions, 2016 (CO₂ eq.)
(naturally-occurring and anthropogenic sources)



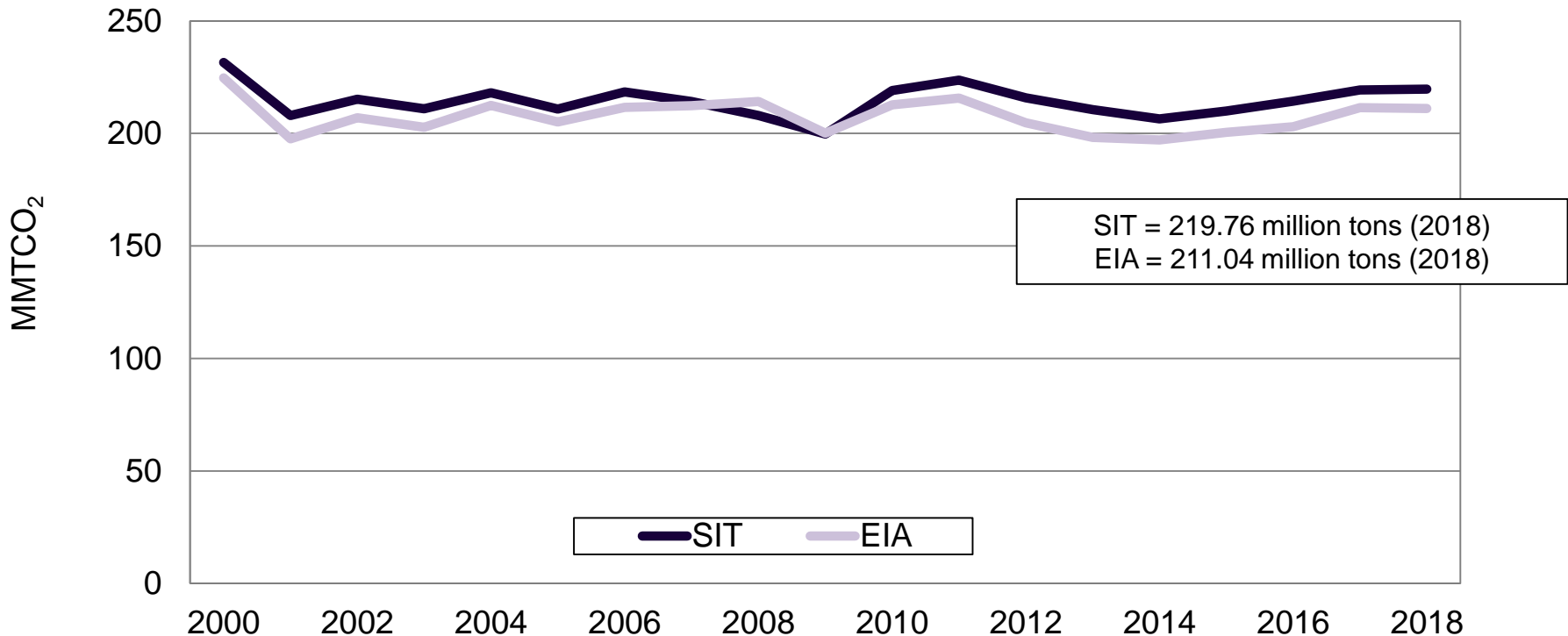
SIT modules

- Each SIT module is unique and estimates one or several types of GHG emissions. **Over 80 percent of all GHG emissions arise from the combustion of fossil fuels** so the module dedicated to estimating GHGs arising from fossil fuel burning is important.
- A variety of sectors and combustion/production types are included in each module. **Some modules focus on CO₂ emissions, while others focus on nitrous oxides and methane only.** All GHG emissions, however, are converted to a total “CO₂ equivalent” or “CO₂E.”
- **Each section of this report addresses each unique module**, the estimated emission types in each module, and the activity and activity data that is used to estimate each GHG emissions.
- **Section 16 summarizes the inputs and data** used for each module.

1.4 Louisiana GHG inventory summary estimates

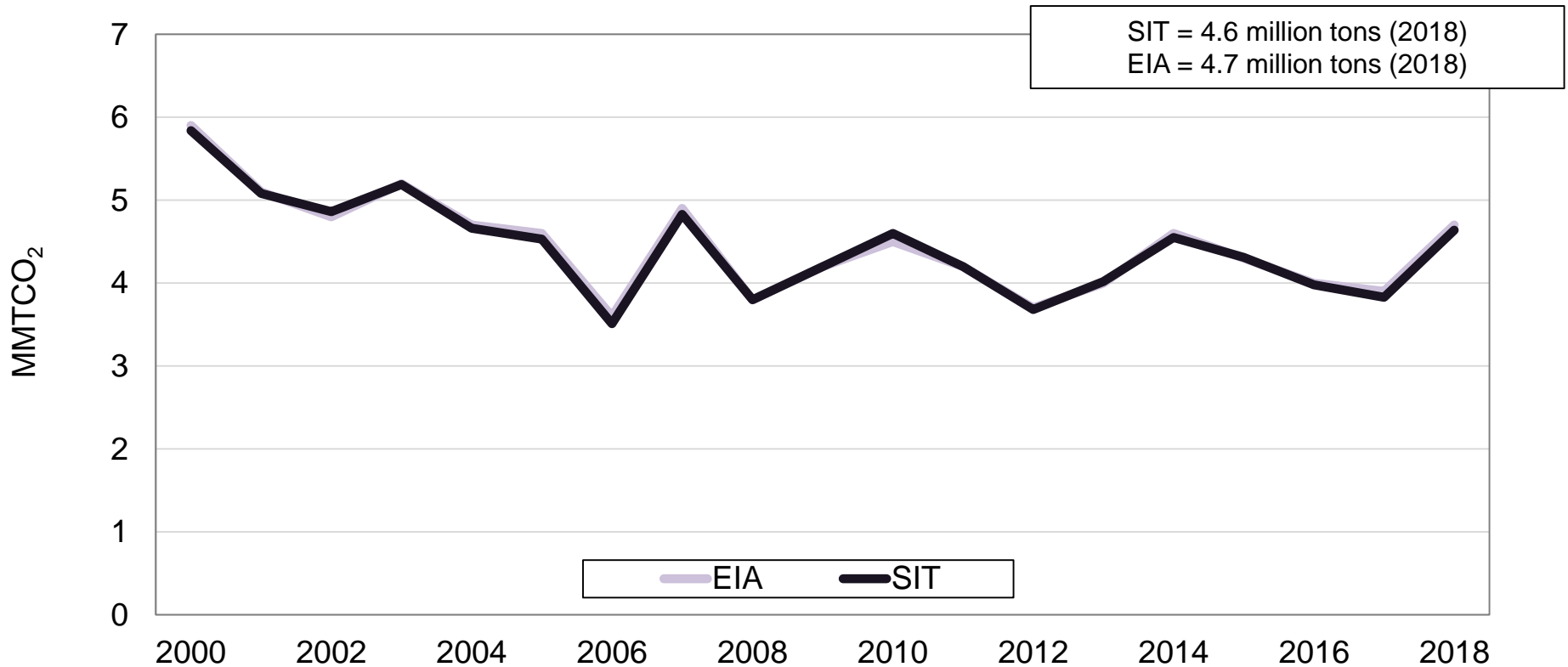
Total Louisiana GHG CO₂ emission trends (combustion only)

The Louisiana GHG inventory has good comparability with the aggregate GHG estimates produced by the EIA. The currently estimated Louisiana GHG inventory (SIT-based estimates) while consistently higher than EIA, tend to become more closely aligned starting in 2008.



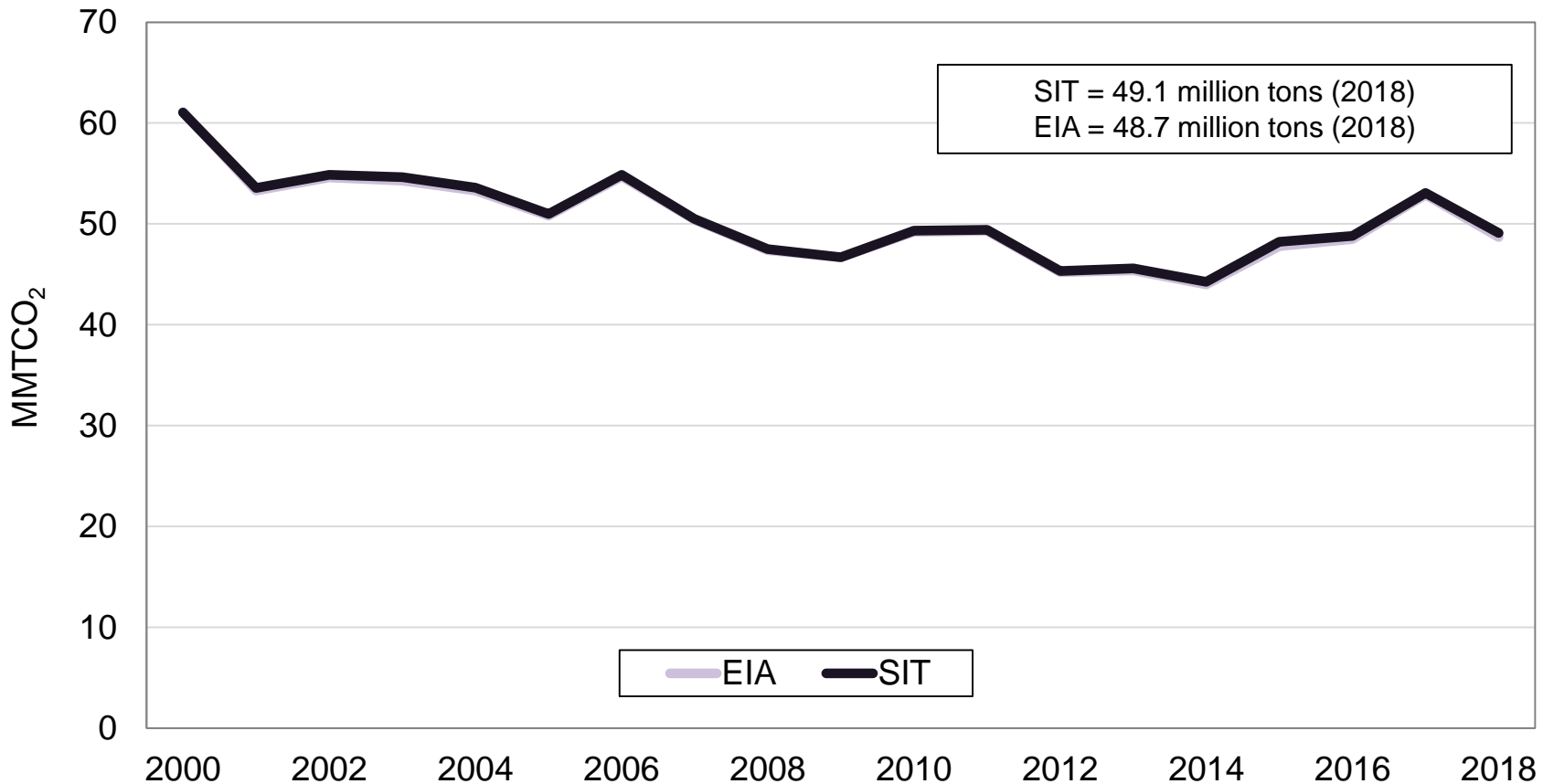
Louisiana residential and commercial GHG CO₂ emissions (combustion only)

Louisiana's **residential and commercial GHG emissions have been falling since 2000**, likely due to end-use energy efficiencies. The SIT estimates a slightly higher emissions level than the EIA.



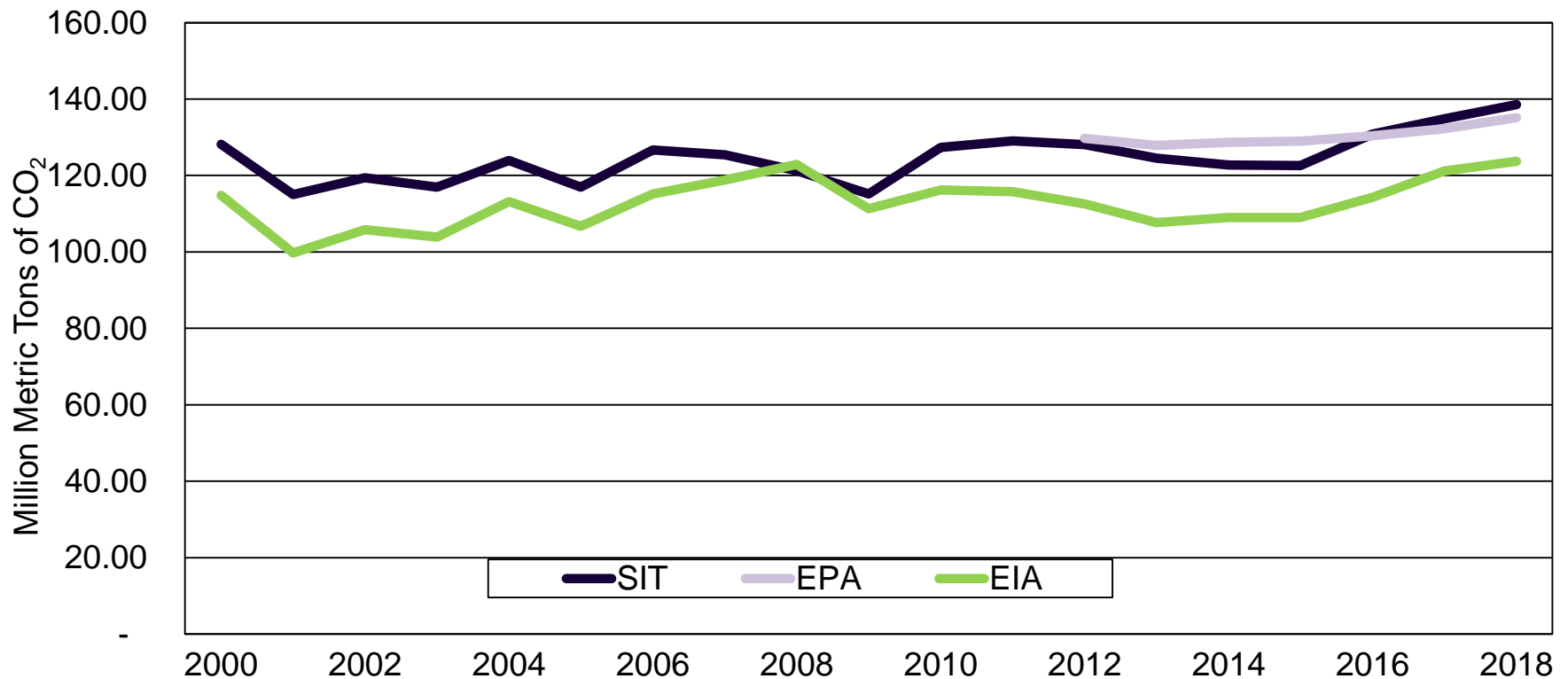
Louisiana transportation GHG CO₂ emissions (combustion only)

Louisiana’s transportation related GHGs, as estimated by the SIT, are almost exactly the same as the EIA estimates. These GHG emissions have been falling since 2000.



Louisiana industrial carbon emissions, SIT, EPA and EIA (combustion only).

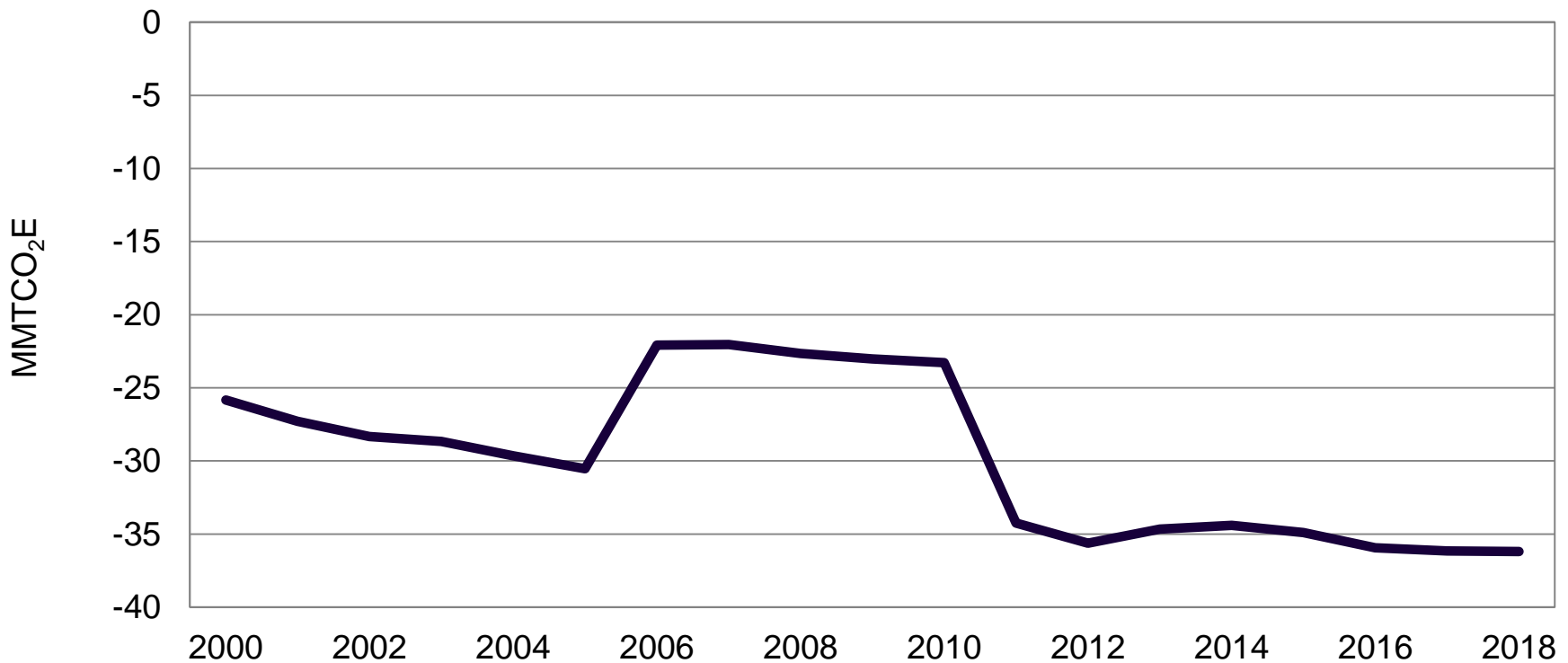
Over time all series estimate relatively comparable Louisiana industrial GHG emissions. EIA estimates the lowest GHG emissions level whereas the SIT and the EPA FLIGHT data are generally in very close agreement.



Note: EPA (FLIGHT) data not available prior to 2012. Also note that all comparisons are based on combustion alone, and do not include other process GHG emissions since they are not consistently included in other sources.

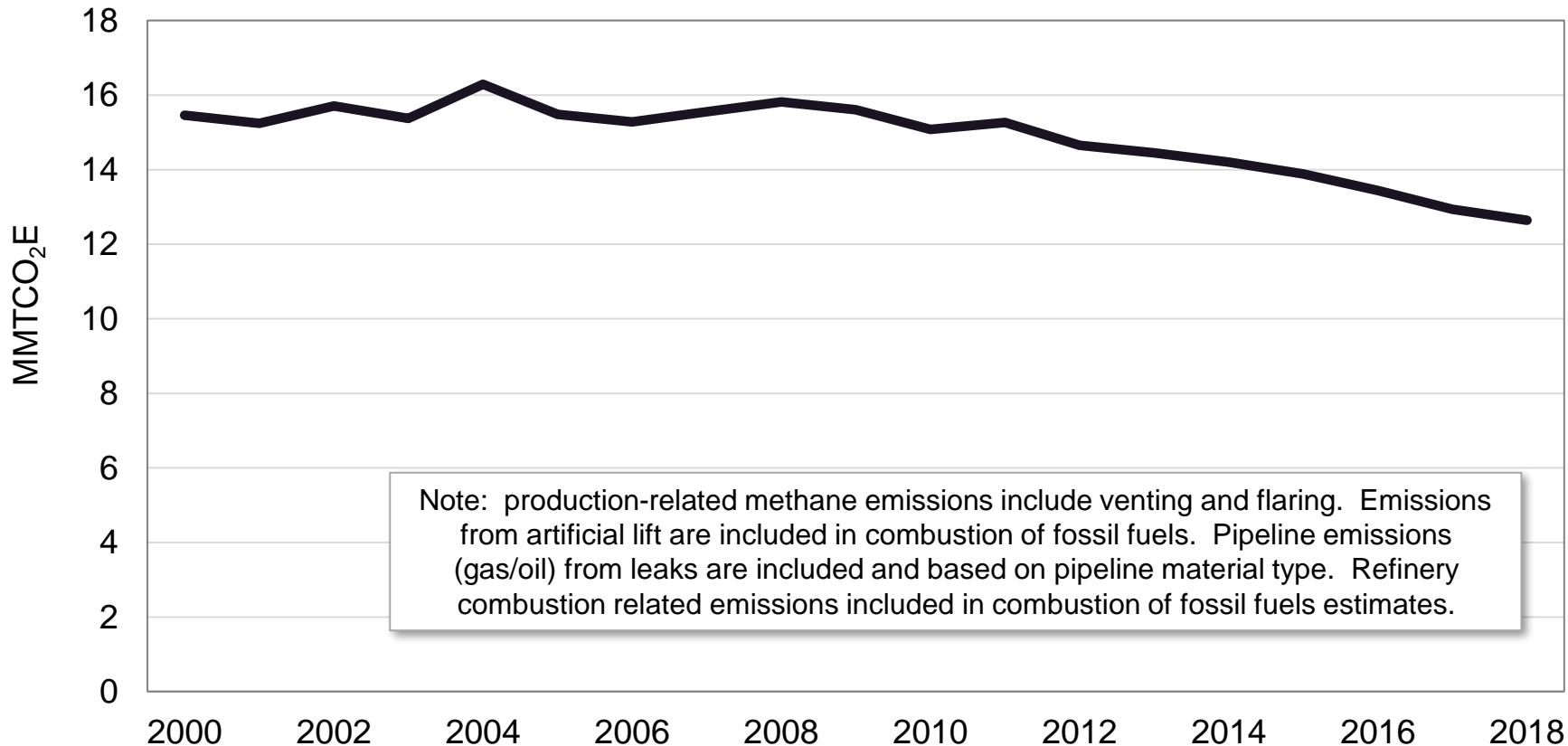
Louisiana land-use and wetlands net flux GHG emissions (SIT estimates)

The 2021 Louisiana GHG inventory includes estimates, provided directly by the EPA, on the wetlands contribution to the state’s GHG emissions. Wetlands, and all Louisiana forest lands, are a net sink that have increased from a negative 25 million tons to **negative 36 million tons**.



Louisiana natural gas and oil systems GHG emissions (SIT estimates)

Natural gas and oil systems GHG emissions (methane only) have been falling since 2008. These GHG emissions include those associated with oil and gas production, and various pipeline systems (gathering, transmission, distribution). **Total emissions are 12.65 million tons in 2018.**



1.5 Louisiana GHG inventory annual estimates (sector, module)

Louisiana GHG inventory by sector

The following table provides **Louisiana’s GHG inventory by year and by sector.**

Year	Total emissions (MMTCO ₂ E)						Total
	Residential & Commercial	Transportation	Electric Power Generation ¹	Industrial	Natural Gas Oil Systems ²	Other	
2000	6.40	62.46	42.76	130.21	15.46	-15.15	242.13
2001	5.62	54.89	39.39	117.06	15.24	-15.84	216.37
2002	5.41	56.15	41.54	121.54	15.70	-16.95	223.39
2003	5.74	55.84	39.07	119.14	15.38	-17.92	217.25
2004	5.21	54.70	40.95	126.27	16.29	-18.32	225.11
2005	5.06	51.96	42.85	119.28	15.48	-19.47	215.17
2006	4.00	55.75	37.86	129.01	15.28	-11.97	229.92
2007	5.34	51.27	38.13	127.83	15.55	-11.02	227.11
2008	4.32	48.18	39.87	123.72	15.82	-10.79	221.11
2009	4.73	47.28	37.74	117.75	15.60	-11.09	212.00
2010	5.13	49.90	42.48	130.07	15.08	-12.52	230.14
2011	4.74	49.95	46.24	131.84	15.26	-23.56	224.46
2012	4.22	45.78	42.99	130.88	14.65	-25.01	213.52
2013	4.57	46.04	40.84	127.34	14.45	-23.25	209.99
2014	5.10	44.67	39.33	125.63	14.20	-22.81	206.11
2015	4.84	48.62	39.27	125.57	13.88	-24.08	208.10
2016	4.51	49.22	36.21	133.86	13.44	-25.33	211.90
2017	4.36	53.50	33.38	137.77	12.94	-25.51	216.44
2018	5.17	49.47	33.84	141.46	12.65	-25.63	216.96

Note: ¹ includes coal

² natural gas distribution estimates 2001-2003 due to incomplete data

Source: EPA SIT

Louisiana GHG emissions inventory by SIT module

The following table provides Louisiana's GHG inventory by year and by SIT module.

Year	Total emissions (MMTCO ₂ E)										Total
	Agriculture	Coal	Combustion of Fossil Fuels	Industrial Process	Land and Land Use	Mobile Combustion	Municipal Solid Waste	Natural Gas Oil Systems	Stationary Combustion	Wastewater	
2000	7.74	0.04	231.58	7.64	-25.85	1.43	2.96	15.46	0.63	0.50	242.13
2001	8.20	0.04	207.92	6.58	-27.29	1.34	3.26	15.24	0.59	0.49	216.37
2002	8.16	0.05	215.21	7.01	-28.33	1.27	3.22	15.70	0.60	0.50	223.39
2003	7.82	0.05	211.02	6.40	-28.67	1.21	2.93	15.38	0.62	0.50	217.25
2004	8.35	0.05	218.05	6.68	-29.65	1.10	2.98	16.29	0.71	0.55	225.11
2005	8.14	0.05	210.79	6.17	-30.54	0.98	2.94	15.48	0.62	0.55	215.17
2006	7.08	0.05	218.48	6.06	-22.08	0.88	3.03	15.28	0.62	0.53	229.92
2007	7.83	0.04	214.17	6.45	-22.05	0.78	3.20	15.55	0.60	0.54	227.11
2008	8.43	0.05	208.03	6.28	-22.65	0.69	3.44	15.82	0.50	0.54	221.11
2009	8.40	0.04	199.75	6.10	-23.01	0.58	3.52	15.60	0.49	0.53	212.00
2010	7.87	0.05	219.13	6.77	-23.29	0.56	2.91	15.08	0.53	0.54	230.14
2011	7.86	0.04	223.75	7.36	-34.26	0.52	2.84	15.26	0.54	0.55	224.46
2012	7.79	0.05	215.81	6.47	-35.64	0.46	2.84	14.65	0.53	0.56	213.52
2013	8.37	0.03	210.65	6.56	-34.67	0.44	3.05	14.45	0.54	0.56	209.99
2014	8.66	0.03	206.50	6.67	-34.41	0.40	2.94	14.20	0.56	0.56	206.11
2015	7.87	0.04	210.00	6.80	-34.90	0.40	2.96	13.88	0.50	0.56	208.10
2016	7.53	0.03	214.37	7.89	-35.94	0.41	3.08	13.44	0.53	0.56	211.90
2017	7.55	0.03	219.35	8.14	-36.16	0.43	3.11	12.94	0.50	0.56	216.44
2018	7.83	0.02	219.76	8.74	-36.20	0.36	2.74	12.65	0.50	0.56	216.96

Note: ¹ includes coal

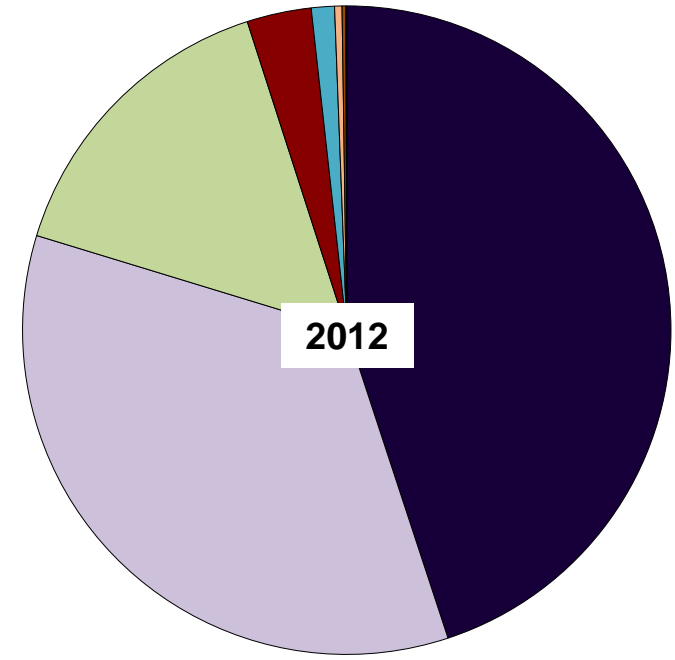
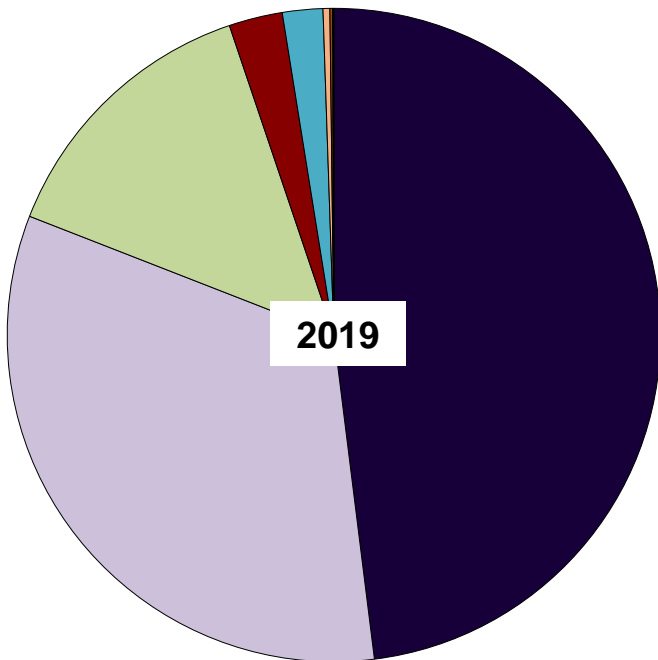
² natural gas distribution estimates 2001-2003 due to incomplete data

Source: EPA SIT

1.6 Detailed industrial analysis

Louisiana industrial carbon emissions by sector, 2012 and 2019

Industrial emission shares continue to be concentrated in the chemical (48%) and the refining (35%) sectors. Natural gas processing is third (13.9%). Chemical emissions shares have increased over the last seven years while refining and natural gas emissions have decreased.

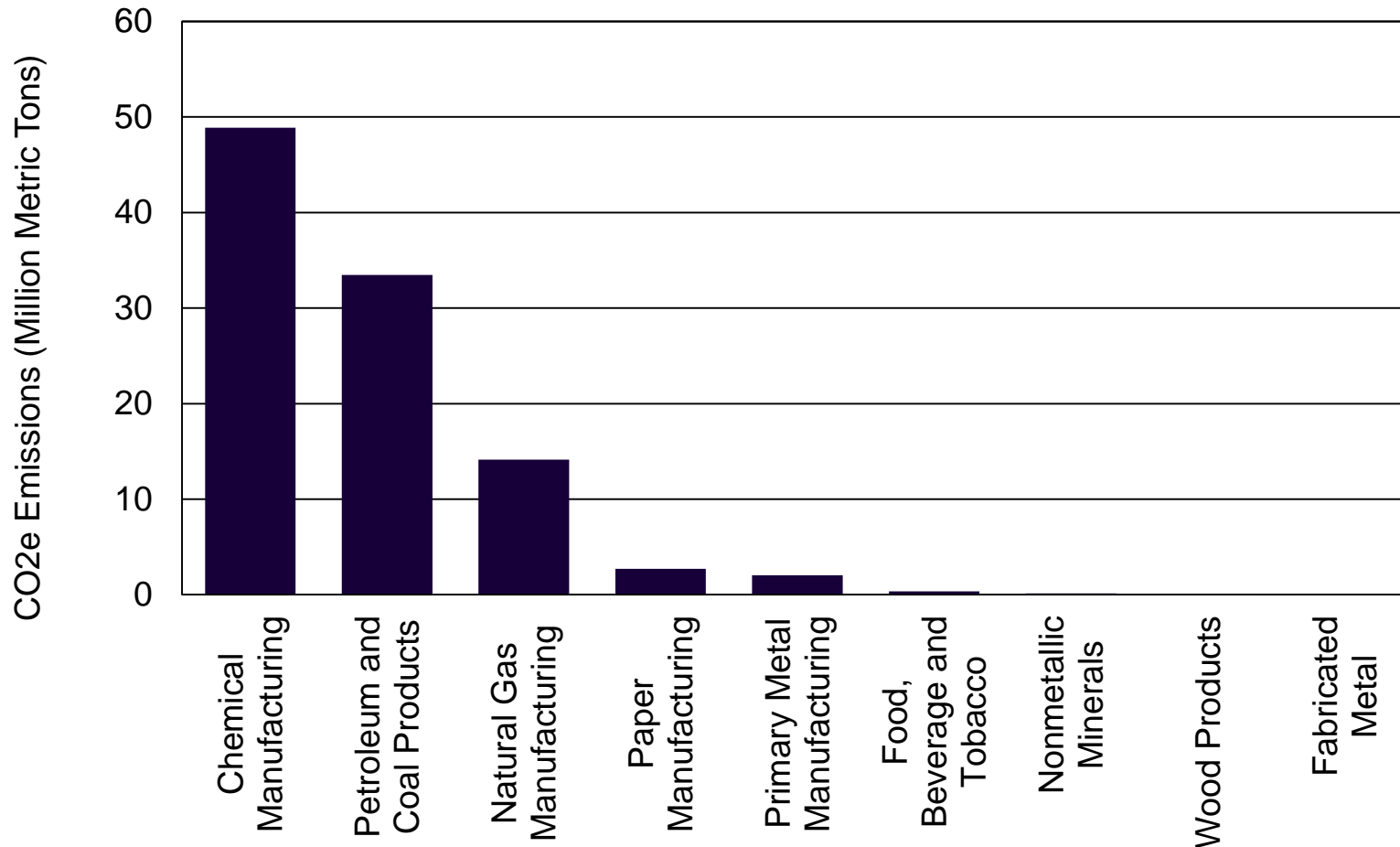


■ Chemical Manufacturing, 48.02%	■ Petroleum and Coal Products, 32.90%
■ Natural Gas Manufacturing, 13.90%	■ Paper Manufacturing, 2.65%
■ Primary Metal Manufacturing, 2.00%	■ Food, Beverage and Tobacco, 0.34%
■ Nonmetallic Minerals, 0.13%	■ Wood Products, 0.04%
■ Fabricated Metal, 0.02%	

■ Chemical Manufacturing, 44.94%	■ Petroleum and Coal Products, 34.77%
■ Natural Gas Manufacturing, 15.32%	■ Paper Manufacturing, 3.21%
■ Primary Metal Manufacturing, 1.15%	■ Food, Beverage and Tobacco, 0.37%
■ Nonmetallic Minerals, 0.19%	■ Wood Products, 0.04%
■ Fabricated Metal, 0.00%	

Louisiana industrial emissions, 2019

Chemical, refining, and gas processing industries account for over 96 million tons of GHG emissions (2019).



Louisiana industrial carbon emissions, SIT, EPA and EIA.

The three primary sources of Louisiana GHG emissions all have relatively good comparability. For 2018, the SIT estimates the highest total industrial emissions (~139 million tons) followed by the EPA FLIGHT data (~135 million tons).

Note that all comparisons are based on combustion only given inconsistent reporting on non-CO₂ GHGs in other sources. (SIT estimate for industry in prior table is total emissions from combustion, feedstock use, and process GHG emissions)

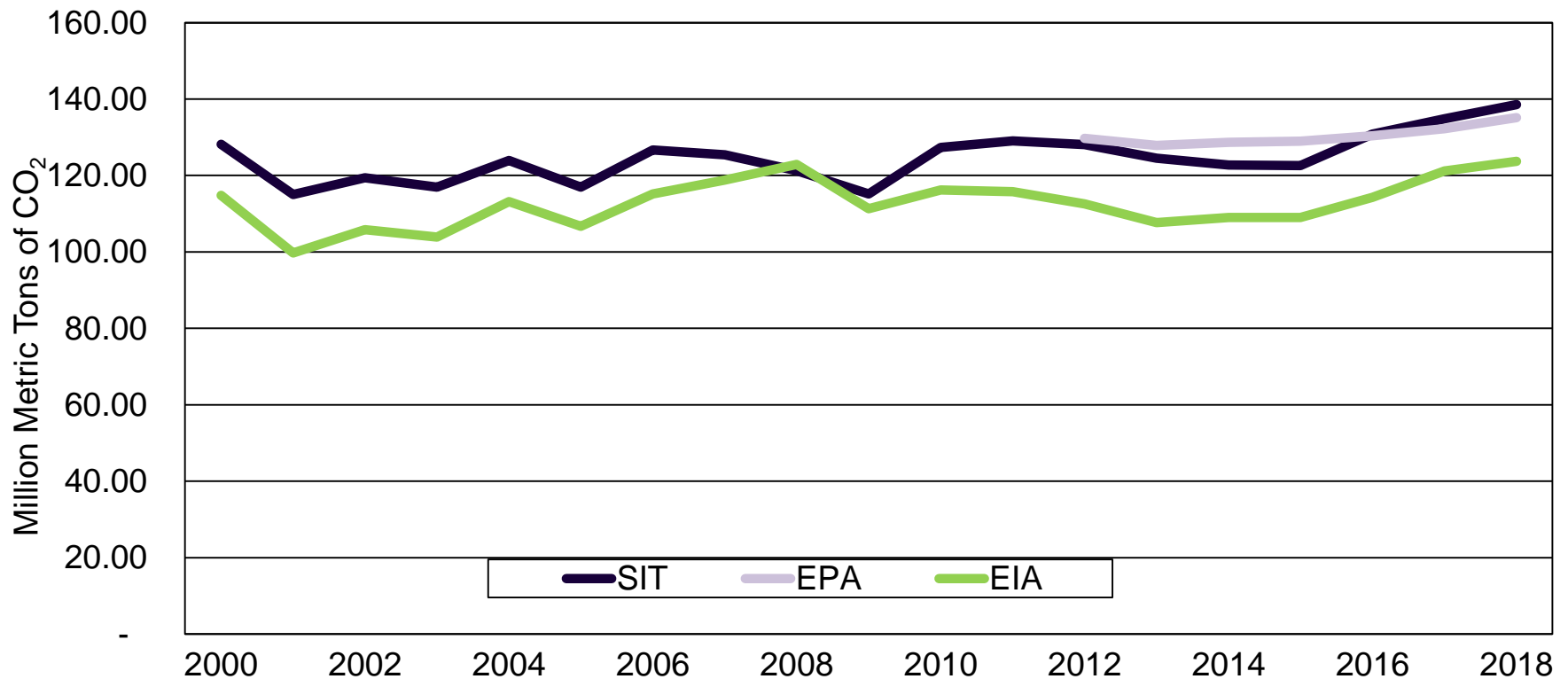
Year	CO ₂ emissions (MMTCo ₂ E) (total of CO ₂ emissions)			Total U.S. (EPA)
	SIT	EPA	EIA	
2000	128.19		114.8	
2001	115.01		99.7	
2002	119.39		105.8	
2003	116.95		103.9	
2004	123.91		113.2	
2005	116.96		106.7	
2006	126.69		115.2	
2007	125.42		118.8	
2008	121.28		122.9	
2009	115.19		111.3	
2010	127.33		116.2	3,049.3
2011	129.05		115.8	2,984.9
2012	128.07	129.70	112.6	2,847.7
2013	124.51	127.90	107.7	2,869.6
2014	122.71	128.65	109.0	2,879.3
2015	122.63	129.00	109.0	2,738.6
2016	130.85	130.37	114.3	2,614.8
2017	134.82	132.25	121.2	2,545.8
2018	138.52	135.18	123.7	2,586.4

Note: EPA (FLIGHT) data not available prior to 2012

Sources: EPA FLIGHT, EPA SIT, EIA

Louisiana industrial carbon emissions, SIT, EPA and EIA (combustion only).

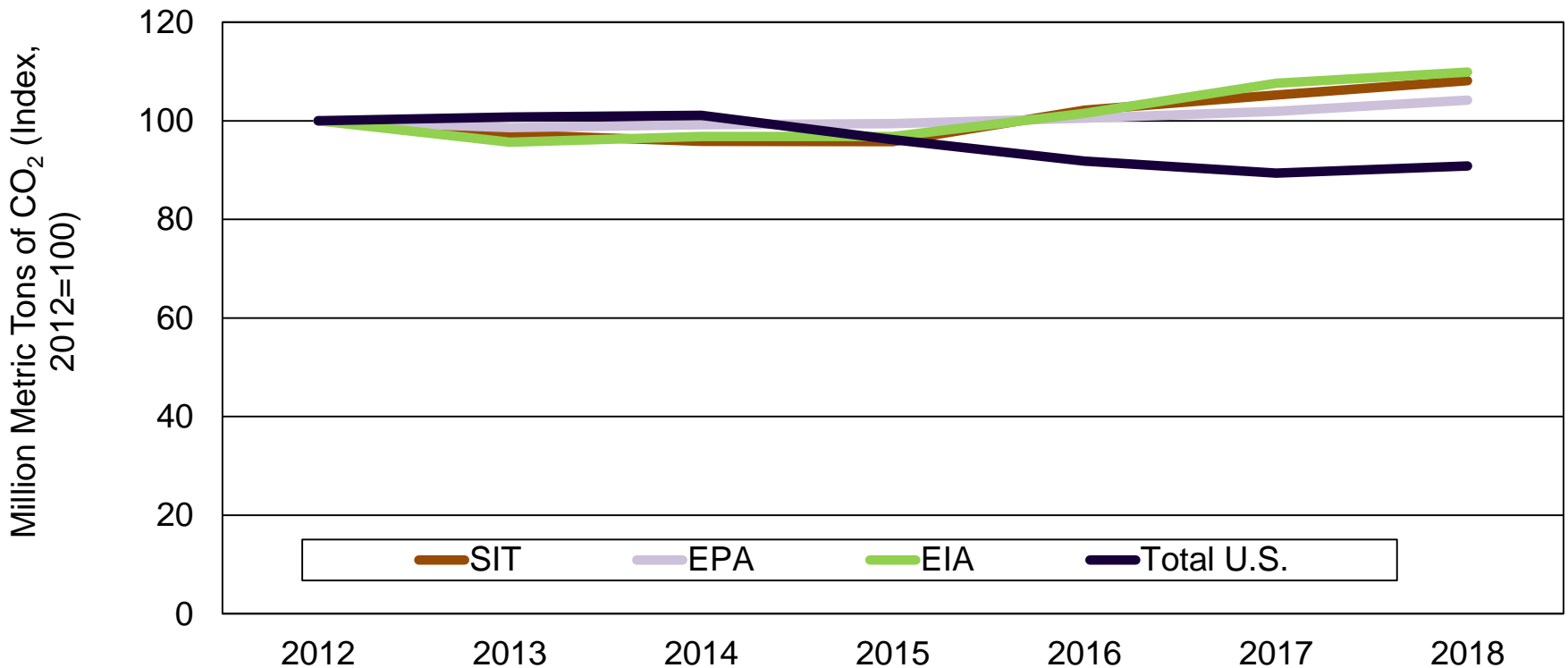
Over time all series estimate relatively comparable Louisiana industrial GHG emissions. EIA estimates the lowest GHG emissions level whereas the SIT and the EPA FLIGHT data are generally in very close agreement.



Note: EPA (FLIGHT) data not available prior to 2012. Also note that all comparisons are based on combustion alone, and do not include other process GHG emissions since they are not consistently included in other sources.

U.S. and Louisiana industrial carbon emissions (indexed)

All three series estimate Louisiana industrial GHG emissions are **up by about 8% to 10% since 2012**. Total **U.S. industrial emissions are down by about 10%** over a comparable time period.



Note: EPA (FLIGHT) data not available prior to 2012. Also note that all comparisons are based on combustion alone, and do not include other process GHG emissions since they are not consistently included in other sources.

Top 20 Louisiana industrial GHG emission sources

The top 20 industrial facilities in Louisiana account for over half of the state's industrial GHG emissions totaling between ~48 million tons and ~61 million tons per year (collectively). GHG emissions for these 20 facilities have been increasing by 3.4 percent on an annual average basis.

Facility Name	Facility Type	2012	2013	2014	2015	2016	2017	2018	2019
		(metric tons CO ₂)							
CF Industries Nitrogen - Donaldsonville	Chemical Manufacturing	6,854,462	6,921,307	6,716,321	7,985,546	7,829,243	8,730,636	8,685,862	10,005,456
ExxonMobil - Baton Rouge Refinery	Petroleum and Coal Products	6,475,810	6,355,424	6,286,678	6,000,189	6,213,242	6,131,245	6,380,368	6,360,077
Sabine Pass LNG	Petroleum and Coal Products	62,003	59,472	173,625	181,518	1,259,324	3,383,744	4,197,628	5,093,801
CITGO Petroleum Corp-Lake Charles	Petroleum and Coal Products	4,370,519	4,587,270	4,792,825	4,723,531	4,652,445	4,681,829	4,895,572	4,703,535
Marathon Petroleum Company	Petroleum and Coal Products	3,958,139	3,946,970	3,956,022	3,978,498	3,806,019	4,040,303	4,103,370	3,967,921
Norco Manufacturing Complex	Petroleum and Coal Products	4,032,242	3,586,525	3,596,965	3,522,732	3,981,844	4,071,427	3,901,231	3,961,652
Eagle US 2 LLC	Chemical Manufacturing	2,991,200	3,053,842	2,843,695	2,787,825	2,673,863	2,894,510	2,962,654	3,307,323
Union Carbide Corp- St. Charles	Chemical Manufacturing	2,089,716	2,830,069	2,905,740	2,868,338	2,881,109	2,957,077	3,053,784	2,970,876
Phillips 66 - Alliance Refinery	Petroleum and Coal Products	2,175,659	2,416,372	2,122,581	1,973,789	2,582,034	2,803,216	2,741,632	2,697,634
Valero Refining-New Orleans	Petroleum and Coal Products	2,395,982	2,764,110	2,606,177	2,529,869	2,800,860	2,535,694	2,528,290	2,312,540
Motiva Enterprises - Convent Refinery	Petroleum and Coal Products	2,044,250	1,985,611	2,089,138	2,271,203	2,371,145	2,370,044	2,165,013	2,301,471
Sasol Chemicals (USA) LLC, Lake Charles Chemical Complex	Chemical Manufacturing	724,244	743,325	808,304	781,522	771,955	780,782	818,956	1,798,680
The Dow Chemical Company -- Louisiana Operations	Chemical Manufacturing	2,736,145	2,684,825	2,728,810	2,527,725	2,418,381	2,659,951	2,152,003	1,919,713
Phillips 66 - Lake Charles Refinery	Petroleum and Coal Products	1,624,822	1,682,175	1,584,268	1,739,973	1,730,893	1,779,721	1,896,562	1,730,933
Chalmette Refining LLC	Petroleum and Coal Products	1,582,620	1,473,867	1,533,904	1,601,253	1,614,862	1,604,410	1,653,272	1,601,075
Georgia Gulf Chemicals & Vinyls LLC	Chemical Manufacturing	1,377,625	1,349,492	1,291,403	1,271,561	1,137,967	1,168,226	1,215,427	1,149,415
Air Products and Chemicals- Norco	Chemical Manufacturing	-	-	844,232	1,139,730	1,156,879	1,169,458	1,073,525	1,072,351
Shell Chemical Co.-Geismar Plant	Chemical Manufacturing	918,606	907,640	939,534	933,213	898,534	917,053	980,823	1,064,539
PCS Nitrogen Fertilizer	Chemical Manufacturing	342,861	1,439,791	1,684,388	1,452,448	1,302,763	1,244,129	1,230,111	1,428,934
Westlake Petrochemicals LP	Chemical Manufacturing	1,055,582	1,157,973	2,102,927	901,198	785,374	896,666	740,227	1,034,631
Total		47,812,487	49,946,058	51,607,536	51,171,663	52,868,737	56,820,121	57,376,309	60,482,558
Average		2,390,624	2,497,303	2,580,377	2,558,583	2,643,437	2,841,006	2,868,815	3,024,128

Top 20 Louisiana industrial GHG emission sources

There is a high degree of variability in the reported annual GHG emissions for the top 20 locations in Louisiana.

Facility Name	Facility Type	2012	2013	2014	2015	2016	2017	2018	2019
		(metric tons CO ₂)							
CF Industries Nitrogen - Donaldsonville	Chemical Manufacturing		1.0%	-3.0%	18.9%	-2.0%	11.5%	-0.5%	15.2%
ExxonMobil - Baton Rouge Refinery	Petroleum and Coal Products		-1.9%	-1.1%	-4.6%	3.6%	-1.3%	4.1%	-0.3%
Sabine Pass LNG	Petroleum and Coal Products		-4.1%	191.9%	4.5%	593.8%	168.7%	24.1%	21.3%
CITGO Petroleum Corp-Lake Charles	Petroleum and Coal Products		5.0%	4.5%	-1.4%	-1.5%	0.6%	4.6%	-3.9%
Marathon Petroleum Company	Petroleum and Coal Products		-0.3%	0.2%	0.6%	-4.3%	6.2%	1.6%	-3.3%
Norco Manufacturing Complex	Petroleum and Coal Products		-11.1%	0.3%	-2.1%	13.0%	2.2%	-4.2%	1.5%
Eagle US 2 LLC	Chemical Manufacturing		2.1%	-6.9%	-2.0%	-4.1%	8.3%	2.4%	11.6%
Union Carbide Corp- St. Charles	Chemical Manufacturing		35.4%	2.7%	-1.3%	0.4%	2.6%	3.3%	-2.7%
Phillips 66 - Alliance Refinery	Petroleum and Coal Products		11.1%	-12.2%	-7.0%	30.8%	8.6%	-2.2%	-1.6%
Valero Refining-New Orleans	Petroleum and Coal Products		15.4%	-5.7%	-2.9%	10.7%	-9.5%	-0.3%	-8.5%
Motiva Enterprises - Convent Refinery	Petroleum and Coal Products		-2.9%	5.2%	8.7%	4.4%	0.0%	-8.7%	6.3%
Sasol Chemicals (USA) LLC, Lake Charles Chemical Complex	Chemical Manufacturing		2.6%	8.7%	-3.3%	-1.2%	1.1%	4.9%	119.6%
The Dow Chemical Company -- Louisiana Operations	Chemical Manufacturing		-1.9%	1.6%	-7.4%	-4.3%	10.0%	-19.1%	-10.8%
Phillips 66 - Lake Charles Refinery	Petroleum and Coal Products		3.5%	-5.8%	9.8%	-0.5%	2.8%	6.6%	-8.7%
Chalmette Refining LLC	Petroleum and Coal Products		-6.9%	4.1%	4.4%	0.8%	-0.6%	3.0%	-3.2%
Georgia Gulf Chemicals & Vinyls LLC	Chemical Manufacturing		-2.0%	-4.3%	-1.5%	-10.5%	2.7%	4.0%	-5.4%
Air Products and Chemicals- Norco	Chemical Manufacturing		-	-	35.0%	1.5%	1.1%	-8.2%	-0.1%
Shell Chemical Co.-Geimar Plant	Chemical Manufacturing		-1.2%	3.5%	-0.7%	-3.7%	2.1%	7.0%	8.5%
PCS Nitrogen Fertilizer	Chemical Manufacturing		319.9%	17.0%	-13.8%	-10.3%	-4.5%	-1.1%	16.2%
Westlake Petrochemicals LP	Chemical Manufacturing		9.7%	81.6%	-57.1%	-12.9%	14.2%	-17.4%	39.8%
Total			4.5%	3.3%	-0.8%	3.3%	7.5%	1.0%	5.4%
Average			4.5%	3.3%	-0.8%	3.3%	7.5%	1.0%	5.4%

Note: Table ranked based on 2019 emissions level
 Source: EPA FLIGHT

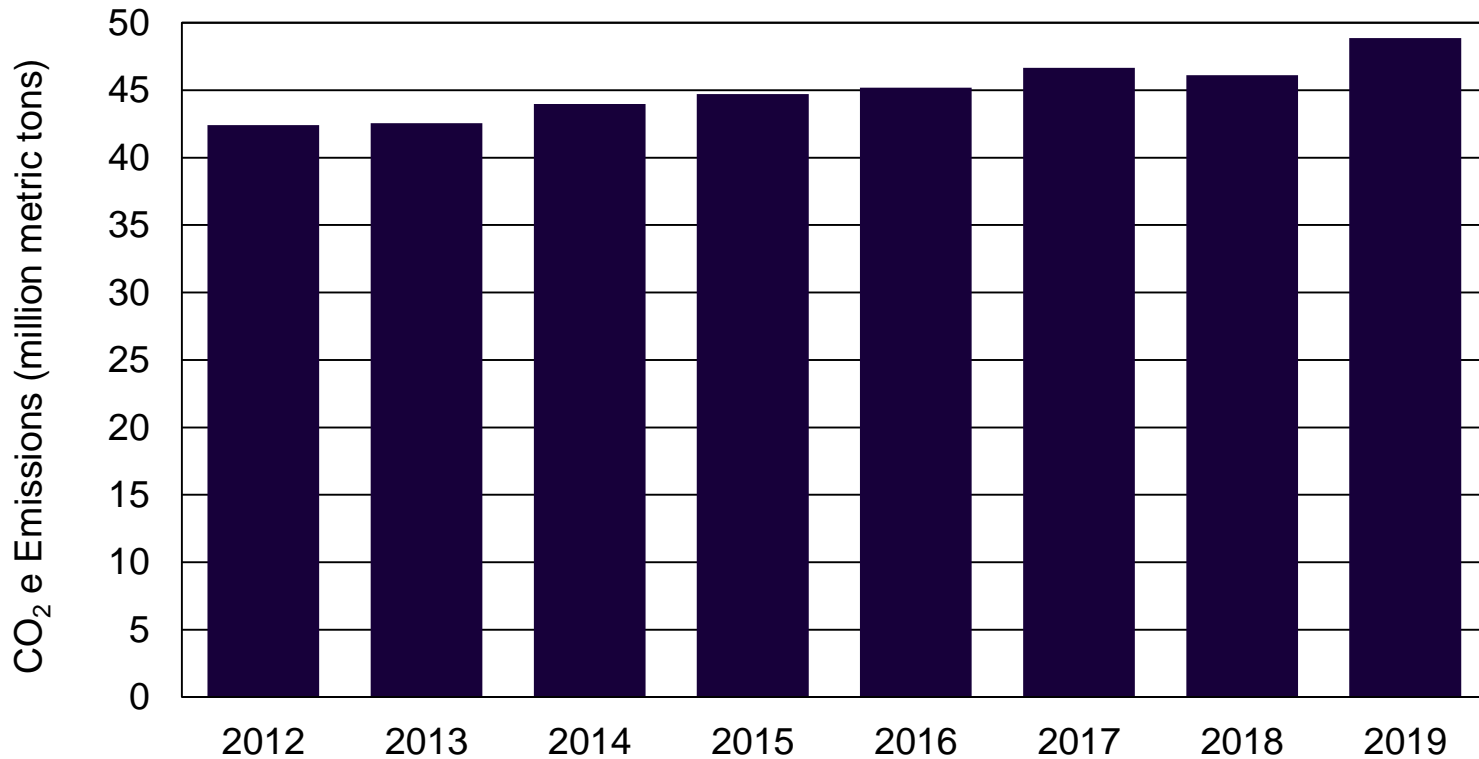
Top 20 Louisiana industrial GHG emission sources (cumulative 2012-2019, by type).

Most Louisiana industrial GHG emissions come from stationary combustion. Refining accounts for the second highest share followed by ammonia production.

Facility Name	Facility Type	Stationary Combustion	Electricity Generation	Ammonia Production	Hydrogen Production	Nitric Acid	Petrochemical Production	Refining	Other Sources	Total Emissions
(metric tons total emissions, 2012-2019)										
CF Industries Nitrogen - Donaldsonville	Chemical Manufacturing	20,137,193	-	31,052,002	-	12,539,639	-	-	-	63,728,834
ExxonMobil - Baton Rouge Refinery	Petroleum and Coal Products	36,003,391	-	-	-	-	293,329	13,906,312	-	50,203,032
Sabine Pass LNG	Petroleum and Coal Products	13,473,534	-	-	-	-	-	-	937,581	14,411,116
CITGO Petroleum Corp-Lake Charles	Petroleum and Coal Products	28,020,909	-	-	-	-	-	9,386,617	-	37,407,526
Marathon Petroleum Company	Petroleum and Coal Products	22,485,177	-	-	-	-	-	9,272,065	-	31,757,242
Norco Manufacturing Complex	Petroleum and Coal Products	20,970,293	-	-	126,668	-	575,438	8,982,219	-	30,654,617
Eagle US 2 LLC	Chemical Manufacturing	10,891,419	12,425,358	-	-	-	176,316	-	21,819	23,514,912
Union Carbide Corp- St. Charles	Chemical Manufacturing	18,649,062	-	-	-	-	3,907,646	-	-	22,556,708
Phillips 66 - Alliance Refinery	Petroleum and Coal Products	12,249,354	-	-	-	-	-	7,263,561	-	19,512,916
Valero Refining-New Orleans	Petroleum and Coal Products	7,846,141	-	-	4,803,063	-	-	7,824,317	-	20,473,522
Motiva Enterprises - Convent Refinery	Petroleum and Coal Products	10,370,904	-	-	130,006	-	-	7,096,966	-	17,597,876
Sasol Chemicals (USA) LLC, Lake Charles Chemical Complex	Chemical Manufacturing	5,356,691	-	-	-	-	1,871,076	-	-	7,227,767
The Dow Chemical Company - Louisiana Operations	Chemical Manufacturing	17,681,390	-	-	-	-	1,475,009	-	671,155	19,827,553
Phillips 66 - Lake Charles Refinery	Petroleum and Coal Products	9,527,009	-	-	-	-	-	4,242,338	-	13,769,347
Chalmette Refining LLC	Petroleum and Coal Products	8,116,049	-	-	-	-	-	4,549,216	-	12,665,265
Georgia Gulf Chemicals & Vinyls LLC	Chemical Manufacturing	9,658,863	-	-	-	-	302,253	-	-	9,961,115
Air Products and Chemicals- Norco	Chemical Manufacturing	-	-	-	6,456,175	-	-	-	-	6,456,175
Shell Chemical Co.-Geimar Plant	Chemical Manufacturing	6,346,685	-	-	-	-	1,213,257	-	-	7,559,942
PCS Nitrogen Fertilizer	Chemical Manufacturing	3,016,284	-	3,782,501	-	3,299,196	-	-	27,445	10,125,426
Westlake Petrochemicals LP	Chemical Manufacturing	6,952,045	-	-	-	-	1,722,533	-	-	8,674,578
Total (2012-2019)		267,752,393	12,425,358	34,834,502	11,515,912	15,838,835	11,536,857	72,523,611	1,658,000	428,085,469
Share of Total Emissions (%)		62.55%	2.90%	8.14%	2.69%	3.70%	2.69%	16.94%	0.39%	100.00%

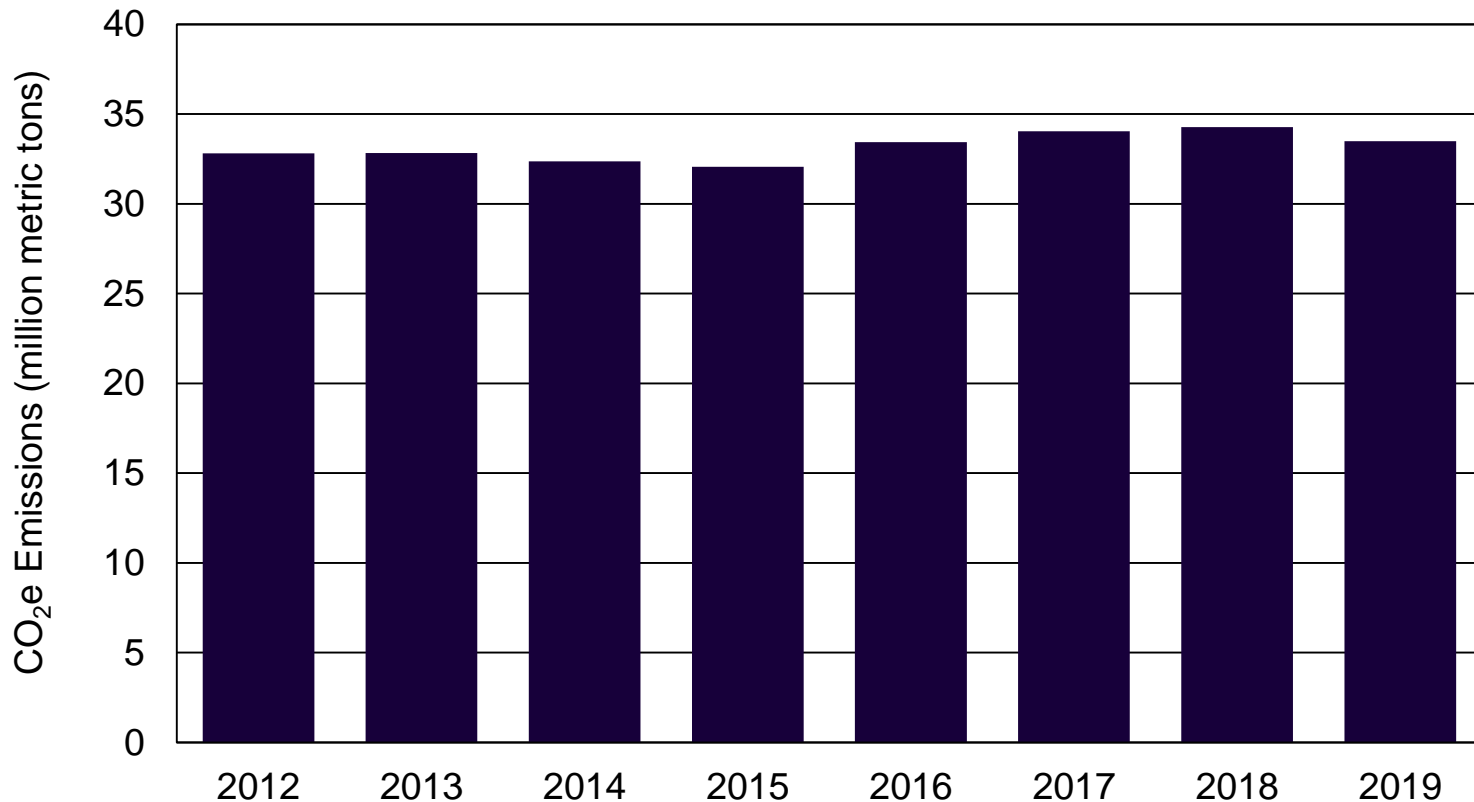
Louisiana chemical manufacturing (NAICS 325) GHG emissions

Chemical industry GHG emissions have been steadily increasing since 2012. This sector’s emissions have been increasing at an annual average rate of 2.06 percent.



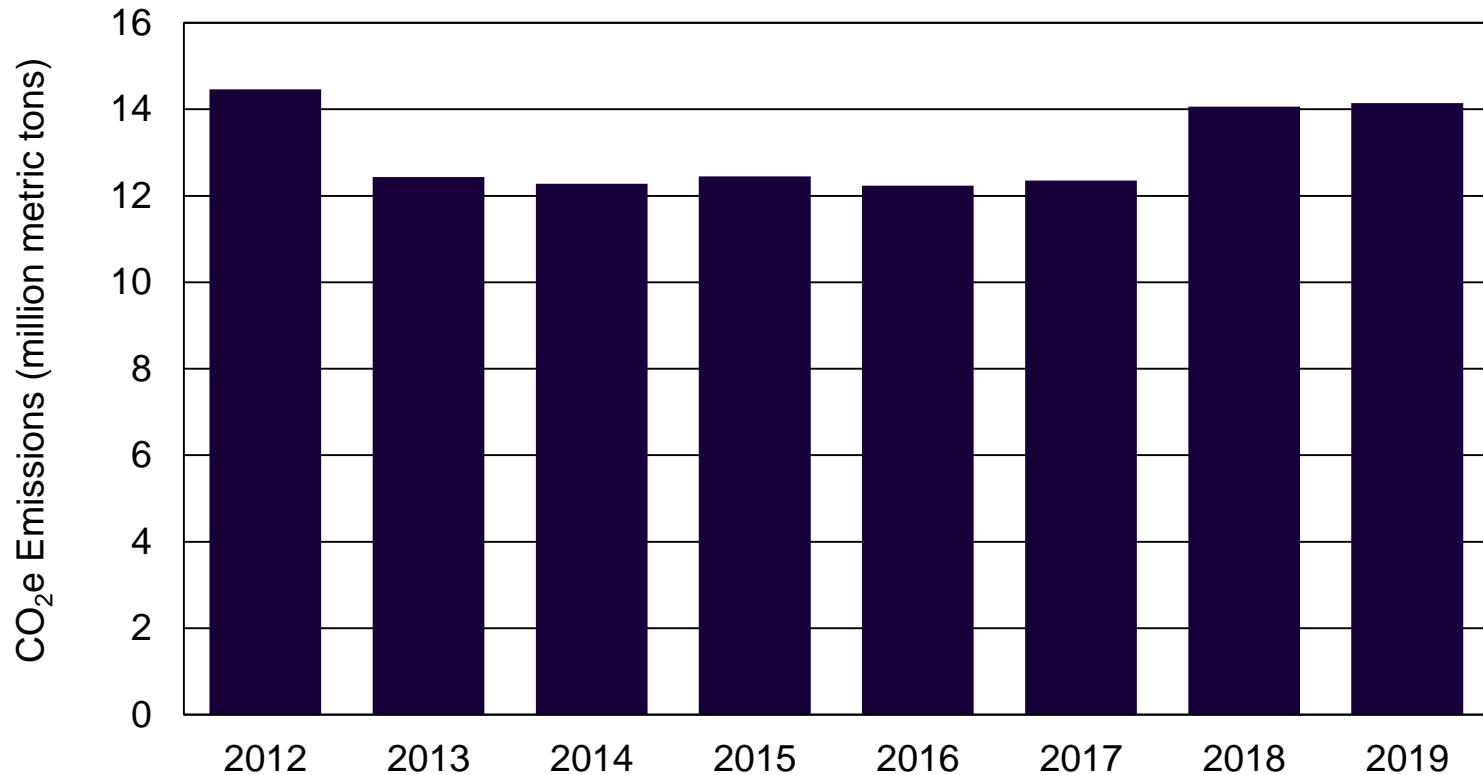
Louisiana refining (NAICS 324) GHG emissions

Louisiana refining GHG emissions have been relatively constant since 2012. Current refining GHG emissions (33.5 million tons) are comparable to 2012 levels (32.8 million tons).



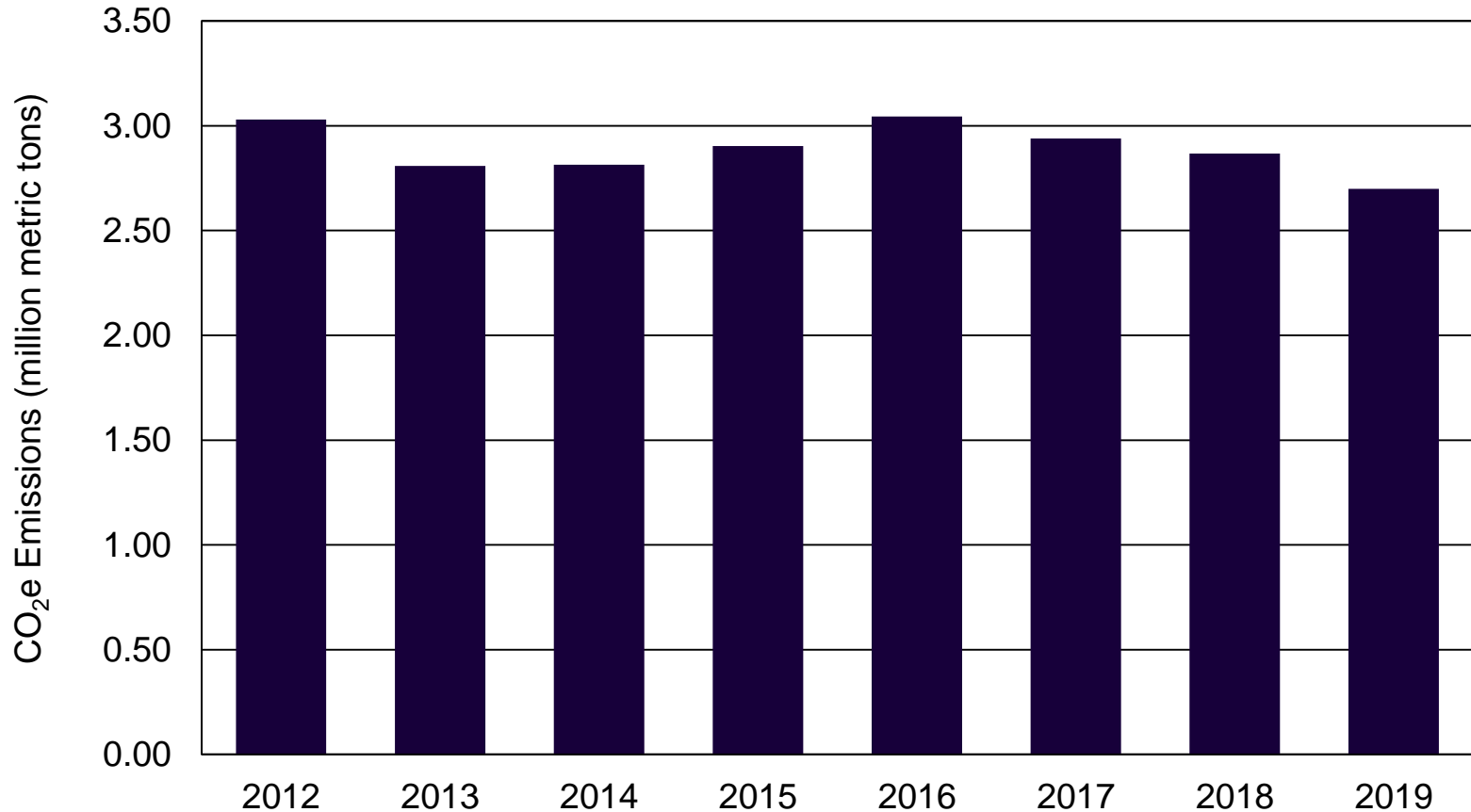
Louisiana natural gas manufacturing (NAICS 211, 213 & 486) GHG emissions

Natural gas processing GHG emissions fell and remained relatively lower up to 2017 but have increased in the last two years of reported information.



Louisiana paper manufacturing (NAICS 324) GHG emissions

Louisiana paper industry GHG emissions have been relatively constant since 2012.



1.7 Conclusions

Next steps

Two separate meetings with the SAG on the preliminary estimates. The first set of SAG comments have been incorporated, a second set of verbal feedback from the meeting has been provided and these comments are being incorporated. Awaiting final set of written SAG comments. Other follow up includes:

- Additional non-CO₂ GHG emissions in industrial sector were added. Continued work to assure all non-combustion related emissions are appropriately accounted.
- Continuing to review oil and gas related emissions particularly wells and pipelines. Comments provided by Healthy Gulf in the last meeting recommended analyzing abandon and orphan wells and to review/reconcile SIT estimates with PHMSA leak information.
- Continued work on wetlands sink incorporation.
- Mapping of specific high GHG emission locations (power and industrial).
- GHG projections based on large industrial announcements.
- Uncertainties discussion.
- Working with Energy Innovation to link results to the policy simulation tool and coordinate with GDS Associates on the energy policy analysis (DNR).



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