



pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION



Bureau of Air Quality

Overview of the Stationary Source Emission Inventory from 2012-2015

Citizen Advisory Council

January 16, 2018

Harrisburg, PA

Tom Wolf, Governor

Patrick McDonnell, Secretary

Self-Reporting Data Requirements

- Sources required to report per [25 Pa. Code § 135.2](#) (related to Applicability) must report their emission inventories to the Department by March 1 of the following year.
- [25 Pa. Code § 135.5](#) requires operators to keep records that are necessary to report the above.
- Self-reported emission inventory data is required to be updated by facilities if they develop better emission factors or identify errors.

Self-Reported Emission Inventory

- Approx. 11,000 facilities report air emissions to the Department. This has increased significantly with the growth of the shale gas industry.
- Emission inventory information is collected for the following pollutants:
 - Nitrogen Oxides - NO_x
 - Sulfur Oxides - SO_x
 - Particulate Matter – PM₁₀ and PM_{2.5}
 - Volatile Organic Compounds – VOCs
 - Greenhouse Gases – GHGs (CO₂, CH₄ and N₂O)
 - Approx. 260 Hazardous Air Pollutants - HAPs

Self-Reported Emission Inventory

- The self-reported emissions data consists of information submitted to DEP by operators.
- DEP staff continuously review the data for accuracy and consistency, and the information is subject to change.
- DEP also occasionally receives data corrections from companies.

Pollutants

5 Pollutants Compared in this Presentation

- NO_x
- SO_x
- PM_{2.5}
- VOCs
- Carbon Dioxide Equivalent (CO_{2e})

Comparison Grouping

- Electrical Generating Units
- Manufacturing
- Unconventional Natural Gas
- All Other Sectors combined

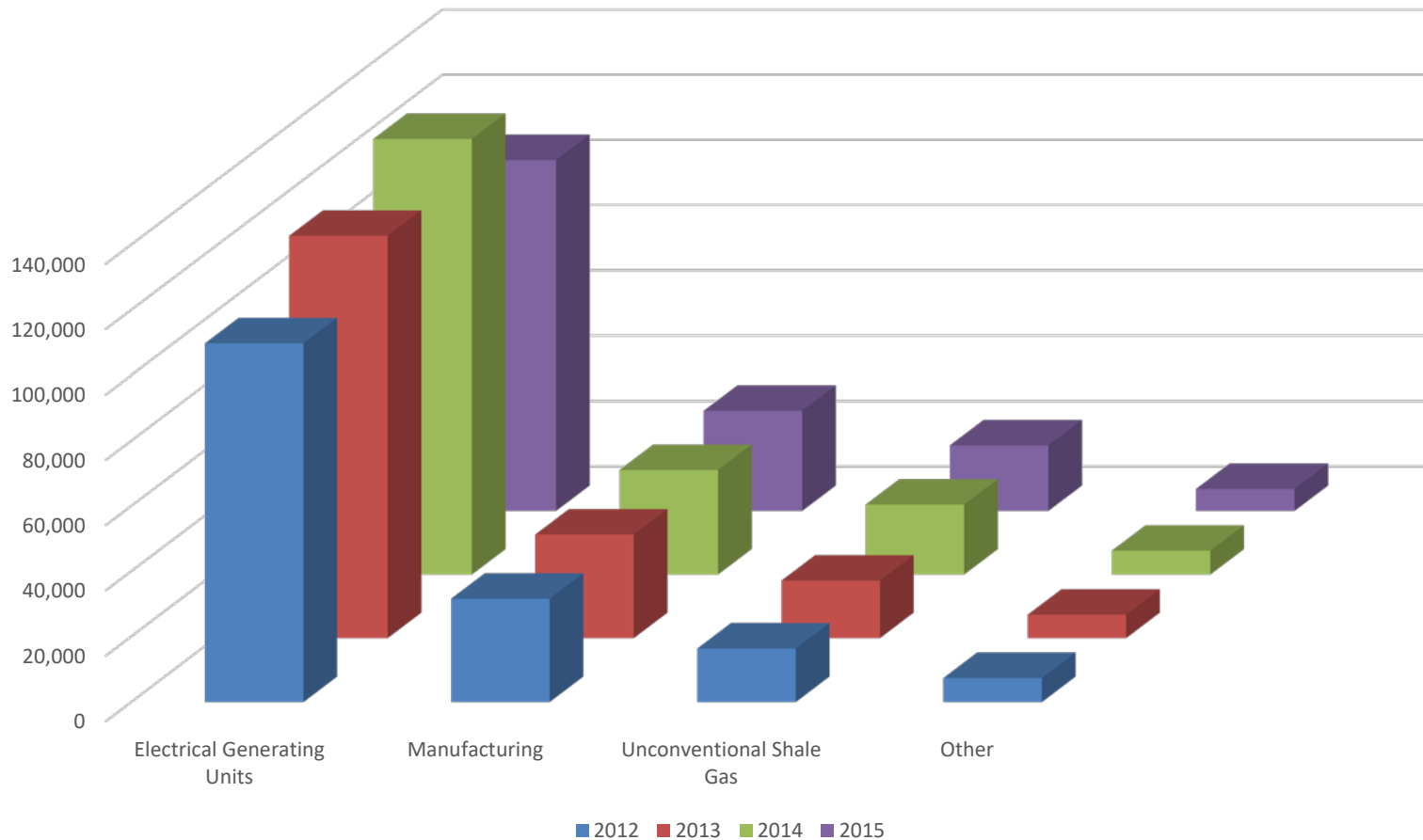
NOx Comparison

Tons Per Year

	2012	2013	2014	2015
Electrical Generating Units	109,734	123,191	133,408	107,438
Manufacturing	31,562	31,767	32,031	30,686
Unconventional Shale Gas	16,304	17,616	21,423	20,090
Other	7,317	7,130	7,260	6,724
Total	164,917	179,704	194,122	164,938

NOx Comparison

Tons Per Year



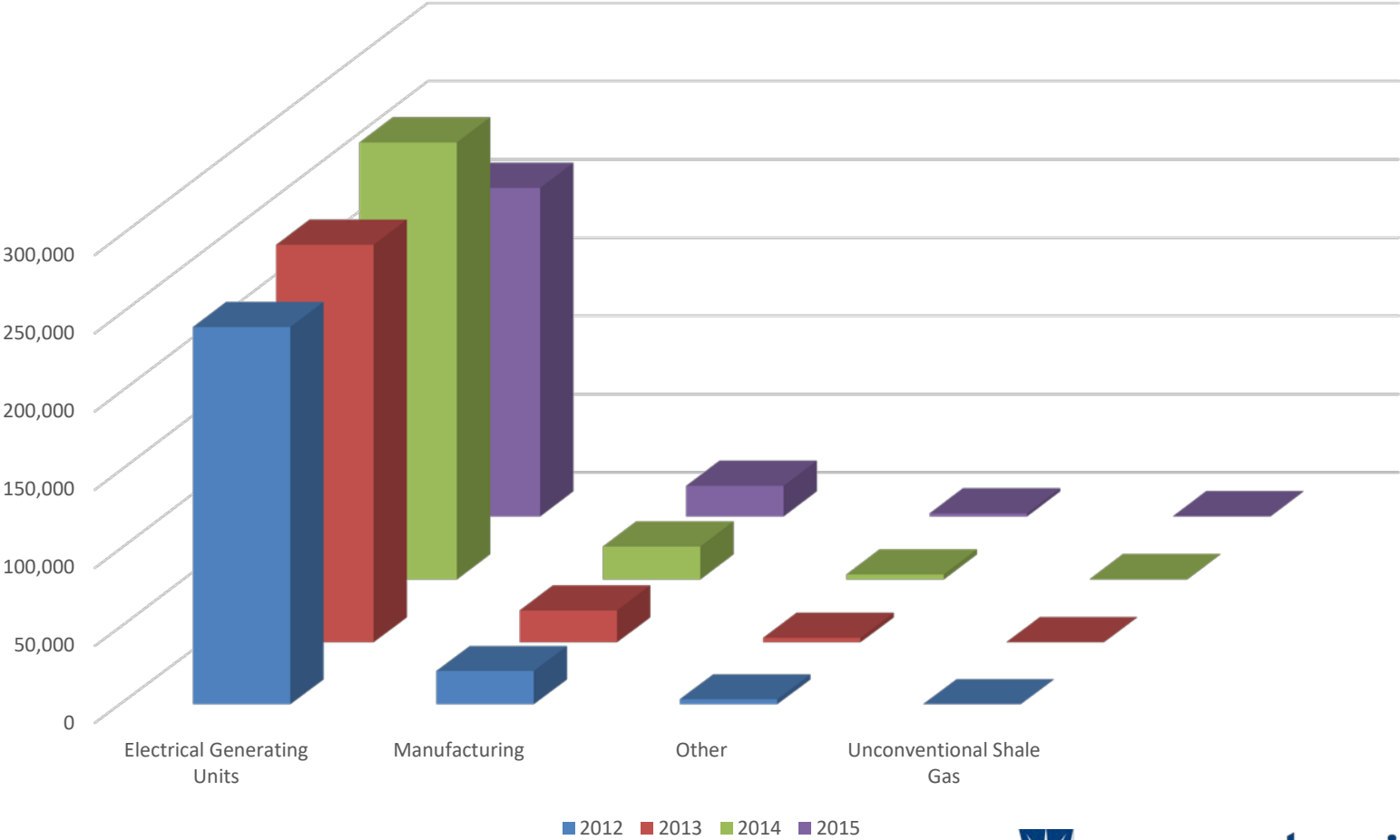
SOx Comparison

Tons Per Year

	2012	2013	2014	2015
Electrical Generating Units	241,825	254,122	279,232	209,911
Manufacturing	21,627	20,490	21,057	19,552
Other	3,232	2,886	3,213	1,953
Unconventional Shale Gas	99	157	257	176
Total	266,783	277,655	303,759	231,592

SOx Comparison

Tons Per Year



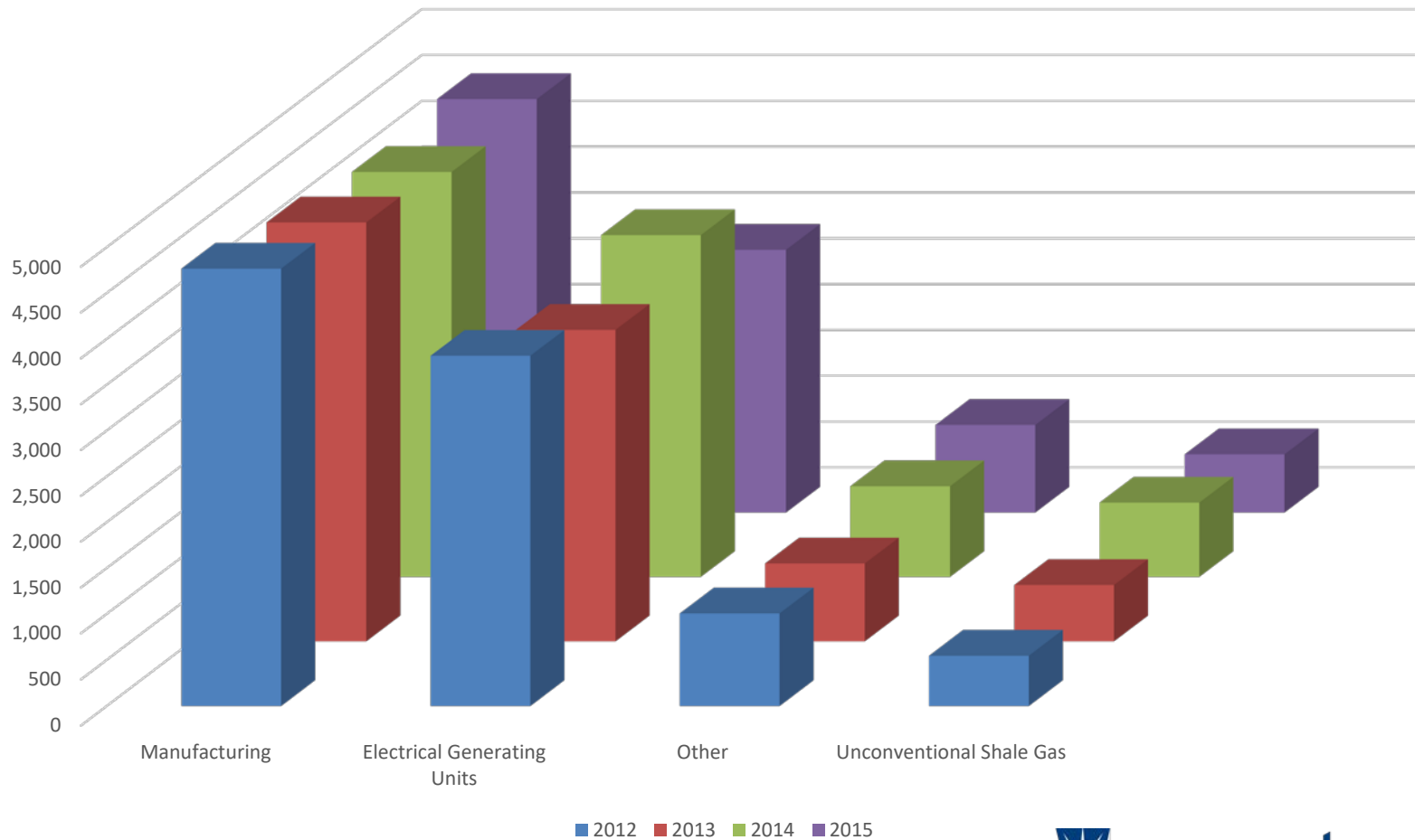
PM_{2.5} Comparison

Tons Per Year

	2012	2013	2014	2015
Manufacturing	4,767	4,569	4,417	4,510
Electrical Generating Units	3,817	3,397	3,728	2,866
Other	1,006	849	989	956
Unconventional Shale Gas	547	609	812	630
Total	10,137	9,424	9,946	8,962

PM_{2.5} Comparison

Tons Per Year



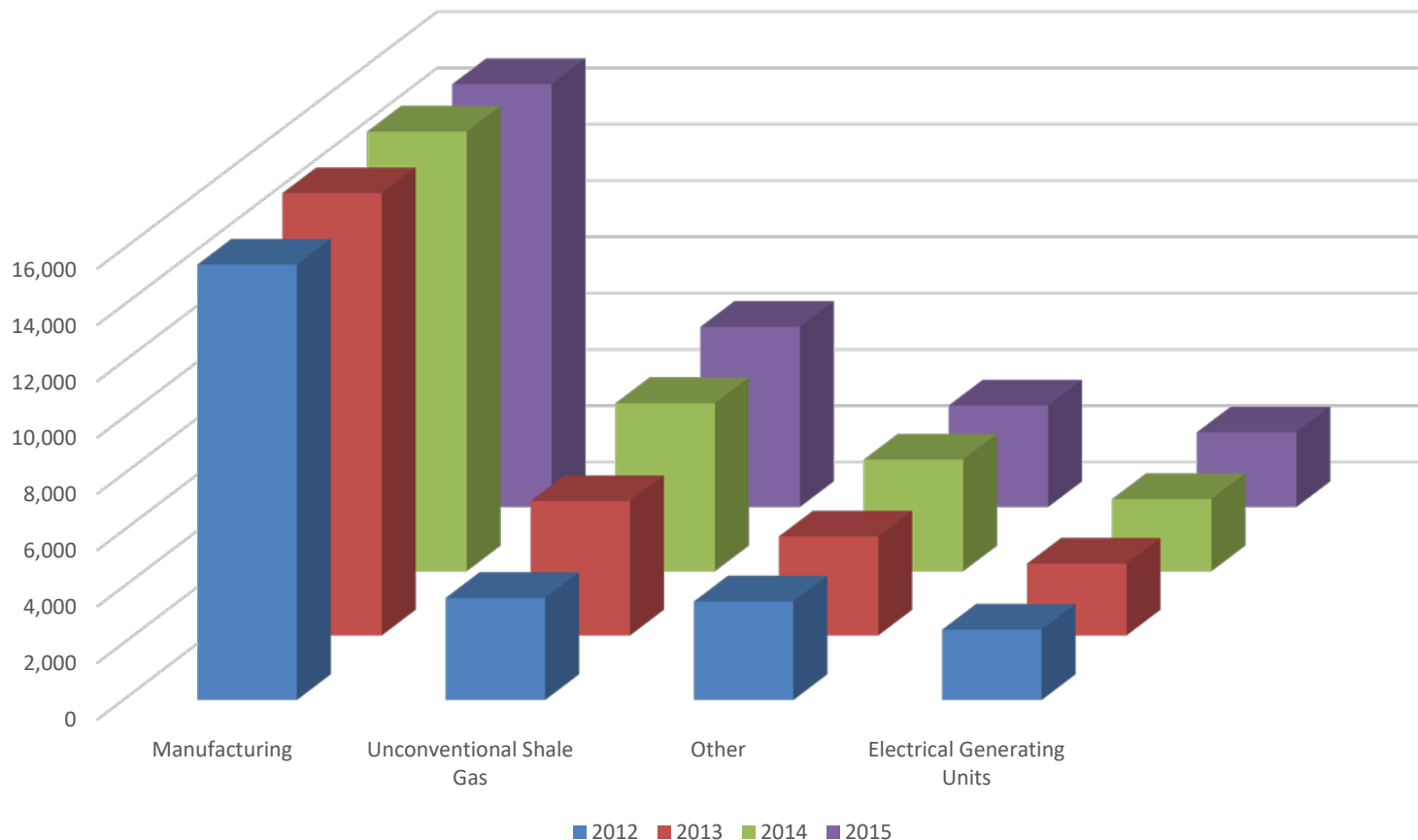
VOC Comparison

Tons Per Year

	2012	2013	2014	2015
Manufacturing	15,450	15,707	15,614	15,017
Unconventional Shale Gas	3,606	4,776	5,961	6,410
Other	3,483	3,513	3,961	3,604
Electrical Generating Units	2,484	2,549	2,558	2,655
Total	25,023	26,545	28,094	27,686

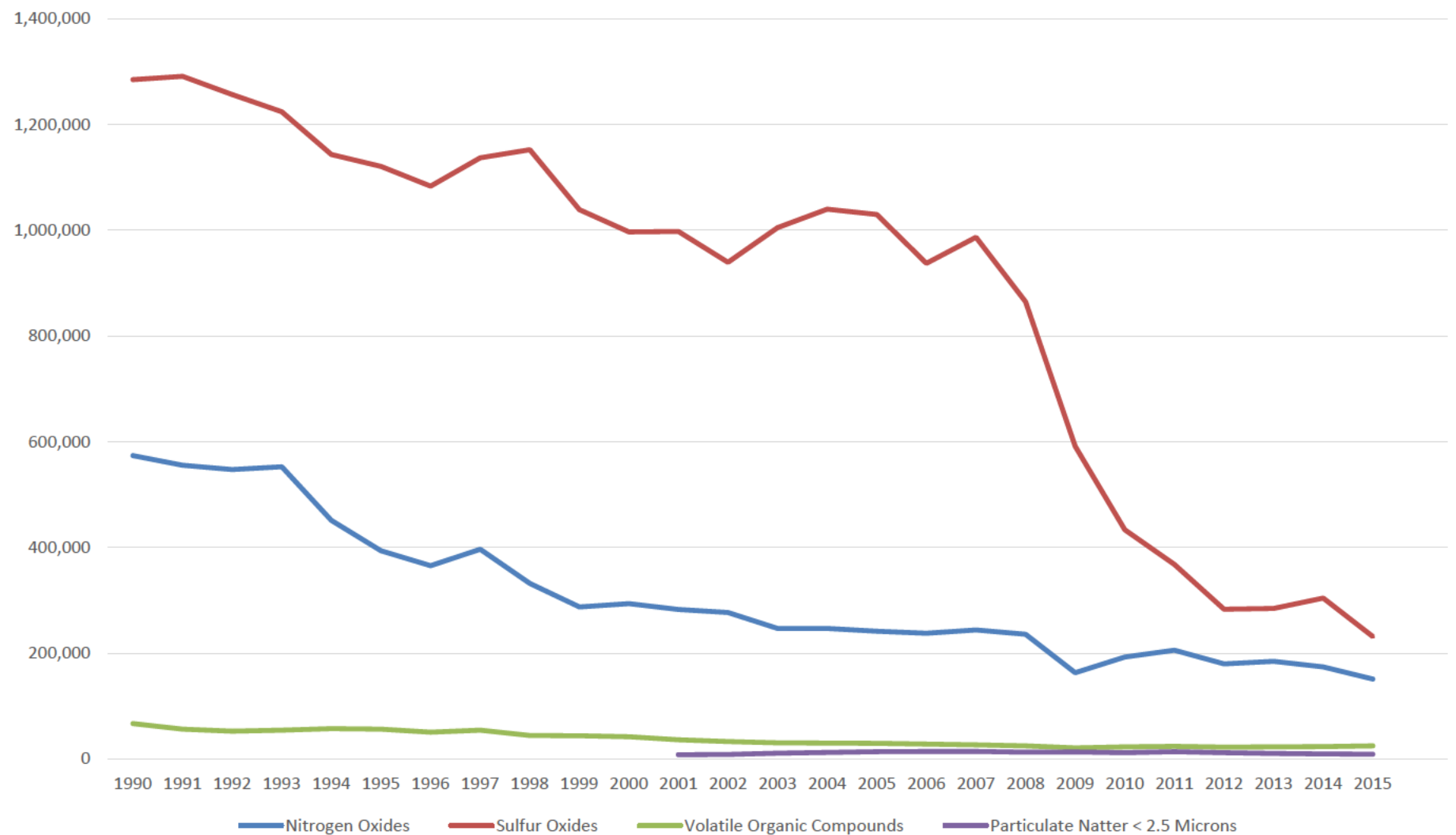
VOC Comparison

Tons Per Year



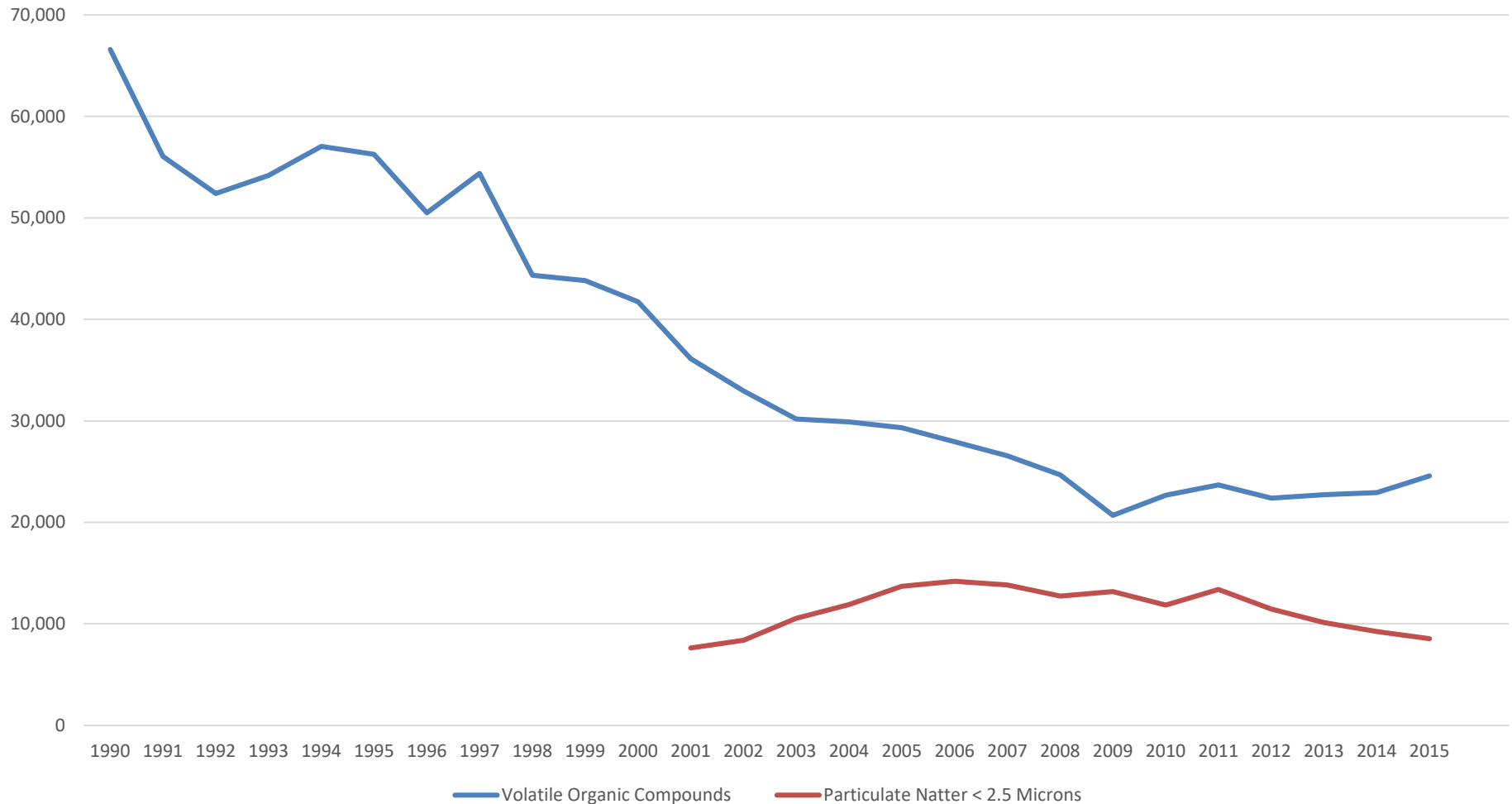
Criteria Pollutant Comparison

Criteria Pollutant Comparison from 1990-2015



Criteria Pollutant Comparison

VOC and PM_{2.5}



CO₂ Equivalent Values

CO₂e is Calculated By Adding:

- Actual CO₂
- Methane Expressed as CO₂e
- Nitrous Oxide (N₂O) Expressed as CO₂e

CO₂ Equivalent Values

CO_{2e} numbers are calculated for Methane and Nitrous Oxide emissions reported using the Intergovernmental Panel on Climate Change's 100 Year Global Warming Potential and adding them to the actual CO₂ reported.

- CO_{2e} Factor of 25 for Methane and CO_{2e} Factor of 298 for Nitrous Oxide
- These are the factors the Department currently uses for State Greenhouse Gas Inventory
- https://www.ipcc.ch/publications_and_data/ar4/wg1/en/ch2s2-10-2.html

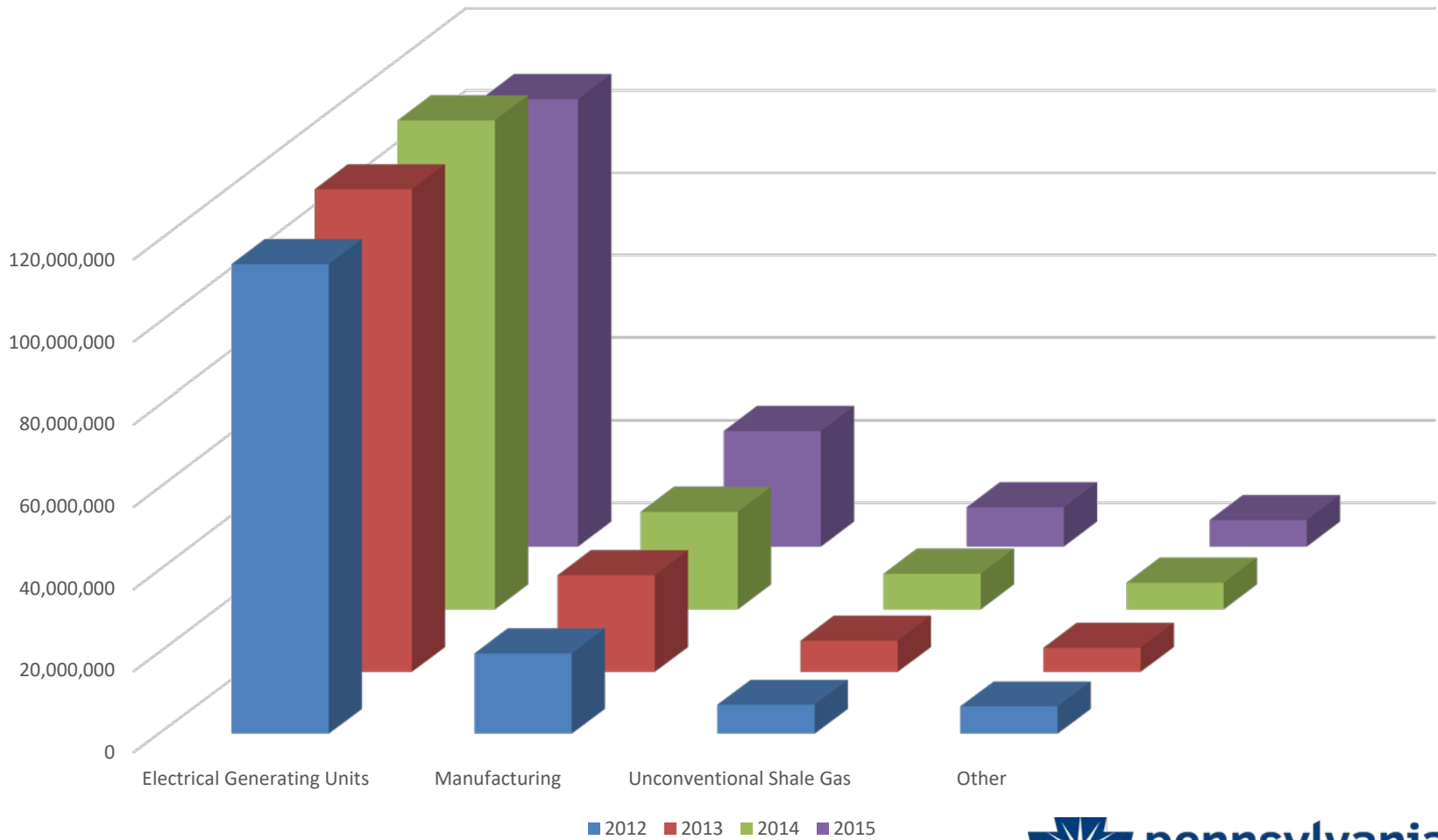
CO₂e

Tons Per Year

	2012	2013	2014	2015
Electrical Generating Units	114,227,291	117,154,548	118,652,148	108,548,386
Manufacturing	19,793,882	23,532,272	23,676,993	28,054,550
Unconventional Shale Gas	7,153,811	7,615,720	8,644,638	9,538,206
Other	6,720,003	5,898,344	6,452,333	6,422,350
Total	147,894,987	154,200,884	157,426,112	152,563,492

CO₂e

Tons Per Year



▶ Unconventional Natural Gas Industry

DEP began collecting emissions data from owners and operators of unconventional natural gas sources in 2011. In 2012, DEP expanded the data reporting requirement to include midstream compressor stations that support the conventional natural gas industry. It also required the reporting of methane and other greenhouse gases emitted by all stationary sources. DEP again expanded the reporting requirements in 2013 to include data from mid-stream compressor stations that support coal-bed methane formations. Lastly, in 2015 pigging stations were added to the reporting requirements.

▶ Unconventional Natural Gas Industry

Sources and Activities Required to Report

- Blowdown Vents
- Completions
- Dehydrators
- Drill Rigs
- Engines
- Fugitives
- Heaters
- Pigging
- Pumps
- Tanks

Unconventional Natural Gas Industry

Number of Facilities Reported

	2011	2012	2013	2014	2015
Mid-Stream Compressor Stations	150	453	447	508	534
Unconventional Well Sites	9,037	8,962	10,275	10,010	10,287

▶ Unconventional Natural Gas Industry

Tons of Methane Reported

	2012	2013	2014	2015
Mid-Stream Compressor Stations	48,424	56,923	50,212	52,049
Unconventional Well Sites	74,165	50,892	57,523	60,079
Total	122,589	107,815	107,735	112,128

▶ Unconventional Natural Gas Industry

Average Tons of Methane Reported (Tons Per Year) Per Facility

	2012	2013	2014	2015
Mid-Stream Compressor Stations	106.9	127.3	98.8	97.5
Unconventional Well Sites	8.3	5.0	5.7	5.8

▶ Unconventional Natural Gas Industry

Tons Per Year (2015)

	CO _{2e}	NO _x	PM _{2.5}	SO _x	VOC
All Other Point Sources	143,025,286	144,848	8,331	231,416	21,277
Unconventional Natural Gas	9,538,206	20,090	630	176	6,410
% Attributed To Unconventional Natural Gas	6.3	12.12	7.1	0.1	23.2

Unconventional Natural Gas Industry

Top 5 Counties in TPY of Methane (2015)

County	TPY	# Mid Stream Compressor Stations	# Unconventional Well Facilities
Susquehanna	28,422	37	1048
Lycoming	16,316	25	289
Bradford	10,269	22	872
Tioga	9,506	24	251
Greene	8,181	52	718

▶ Unconventional Natural Gas Industry

Top 5 Counties in TPY of VOCs (2015)

County	TPY	# Mid Stream Compressor Stations	# Unconventional Well Facilities
Washington	1,913	28	495
Butler	943	12	391
Greene	638	52	720
Lycoming	292	25	293
Susquehanna	265	37	1,048

Comprehensive Emissions Inventory

A comprehensive inventory of actual emissions for point, area, and mobile sources for calendar year 2017 must be submitted to the U.S. Environmental Protection Agency (EPA) by December 31, 2018.



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