# Pennsylvania's Dirty Dozen

## The Keystone State's top climate polluters

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# Executive summary

**CLIMATE CHANGE IS AFFECTING** Pennsylvania today, and without quick action to reduce emissions of the greenhouse gases (GHGs) that cause global warming, our future is at risk. Pennsylvania has gotten warmer and wetter in recent decades, and scientists predict a future of more extreme heat waves, more extreme rainfall *and* more drought — with impacts ranging from higher flood risks to threats to public health, agriculture and infrastructure.[1]

Pennsylvania is one of America's largest sources of greenhouse gases, including carbon dioxide, most of which comes from the burning of fossil fuels, and methane, a climate pollutant more than 80 times as potent as carbon dioxide over a 20-year timeframe. The largest sources of methane in Pennsylvania are oil and gas systems and coal mines.[2]

In 2020, Pennsylvania was the fourth-largest greenhouse gas-emitting state in the nation.[3] As a result, the commonwealth has a unique opportunity — and responsibility — to act on climate.

More than 40% of the commonwealth's greenhouse gas pollution comes from 287 industrial facilities, power plants, mines and other large polluters that are required to report their emissions to the U.S. EPA. Among those facilities, just 12 — **Pennsylvania's "Dirty Dozen"** — account for nearly one-fifth of the commonwealth's total climate pollution.[4]

**To meet our responsibility to act on climate, Pennsylvania must take strong, quick action to limit pollution from power plants and industrial air polluters, especially the highest polluting facilities.**

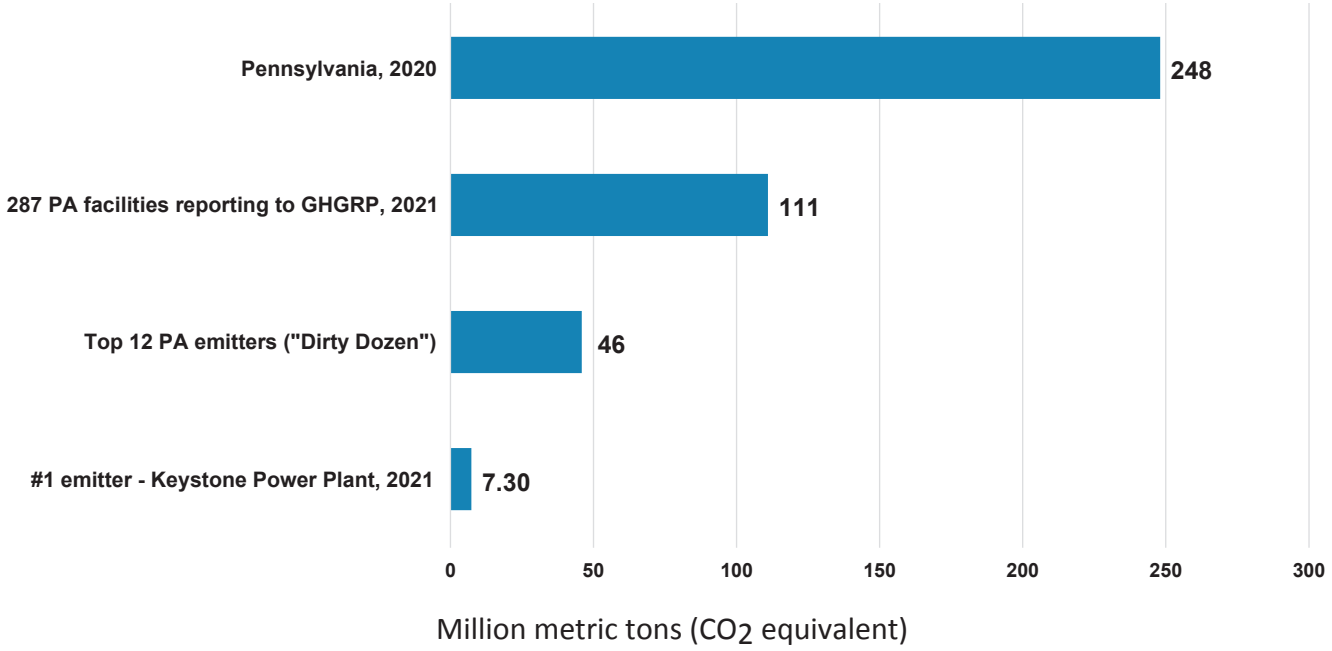



*Figure ES-1. Overview of Pennsylvania's GHG emissions*[5]

**Industrial facilities and power plants are the biggest sources of climate pollution in Pennsylvania.**

- In 2020, industrial facilities were responsible for 76.9 million metric tons of GHGs (carbon dioxide equivalent) — 31% of the commonwealth's total emissions. The industrial and electric power sectors combined added up to 60% of the state's GHG total. (See Figure ES-2)
- The 287 large Pennsylvania facilities required to report their greenhouse gas emissions to the EPA — most of them industrial facilities and power plants — released a total of 110.9 million metric tons of GHGs in 2021, equivalent to about 45% of the commonwealth's GHG emissions in 2020 (the latest year for which complete data on all of Pennsylvania's GHG emissions is available).[7]

**Just 12 large GHG emitters in Pennsylvania — the "Dirty Dozen" — produce nearly one-fifth of the commonwealth's climate pollution.**[8]

- These Dirty Dozen facilities emitted nearly 46 million metric tons of GHGs in 2021, the equivalent of 18% of the state's total GHG emissions in 2020.
- All but one of the Dirty Dozen facilities are power plants. The state's top two emitters, the **Keystone** and **Conemaugh** coal-fired power plants, released a combined 14 million metric tons of greenhouse gases in 2021. Emissions from these two facilities in 2021 would have represented 6% of the commonwealth's total GHG emissions in 2020.
- Five of the Dirty Dozen — **Lackawanna Energy Center**, **Hummel Station**, **CPV Fairview Energy Center**, **Tenaska Westmoreland Generating Station**, and **Moxie Freedom Generating Station** — are gas-powered power plants that have opened since the beginning of 2018, showing the limitations of the transition from coal- to gas-fired power generation for reducing climate pollution.[9]
- The one non-power plant facility in the Dirty Dozen is the **U.S. Steel Edgar Thomson** plant in Allegheny County, which ranks fifth for GHG emissions statewide. In 2021, this facility emitted 3.8 million metric tons of GHGs, which is the $CO_2$ emissions equivalent of burning 4 billion pounds of coal.[10]

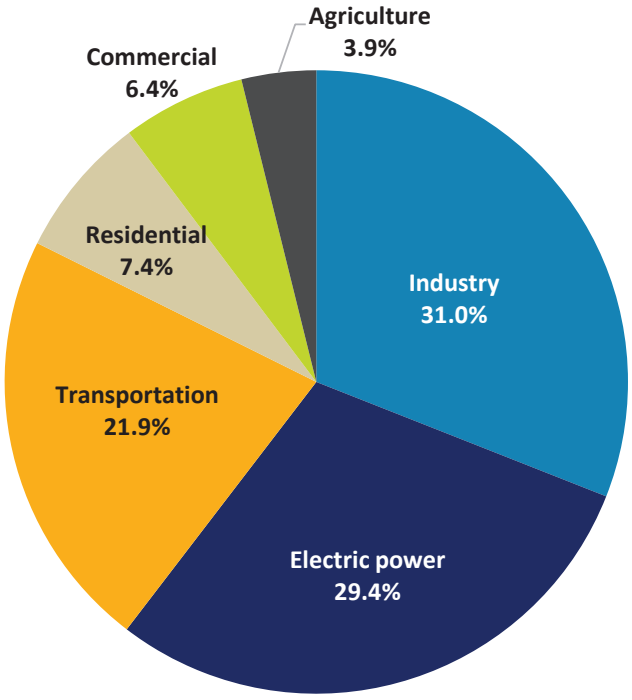



*Figure ES-2. Pennsylvania GHG emissions by economic sector, 2020*[6]

**Half of the Dirty Dozen facilities are located in southwestern Pennsylvania.**

- Southwestern Pennsylvania accounted for 44% of greenhouse gas emissions reported by large polluters reporting their GHG emissions to the EPA in 2021 — by far, the largest share of any Pennsylvania region. (See Figure ES-3)
- The Pittsburgh and Southwest region is also home to the greatest number of facilities reporting their emissions to the EPA, with 88 out of the 287 facilities reporting statewide, or about 30%.[12]
- Industrial facilities releasing greenhouse gases are often major sources of particulate soot, toxic air pollutants, and smog-forming pollutants — pollution that puts the public's health at immediate risk.[13] The Pittsburgh area, home to more than half of the "Dirty Dozen," ranks 14th-worst in the country for year-round emissions of particulate pollution according to the American Lung Association.[14]

**Industrial facilities other than power plants are also major sources of greenhouse gases. The top 12 industrial emitters in Pennsylvania accounted for nearly 17 million metric tons of greenhouse gas emissions in 2021. Metals and minerals were the top industrial sources of greenhouse gases.**[16]

- **Consol Energy, Inc.** is the parent company of three of the top 12 large industrial emitters — Bailey Mine, Enlow Fork Mine and Harvey Mine — which accounted for 5.7 million metric tons of GHG emissions in 2021. **U.S. Steel** is the parent company of two other facilities, the Edgar Thomson Steel Works and Clairton Coke Works.
- Combined, the five Pennsylvania facilities owned by Consol Energy or U.S. Steel produced more than 10 million metric tons of greenhouse gas pollution in 2021. That is equivalent to about 4% of Pennsylvania's total statewide emissions in 2020.[17]

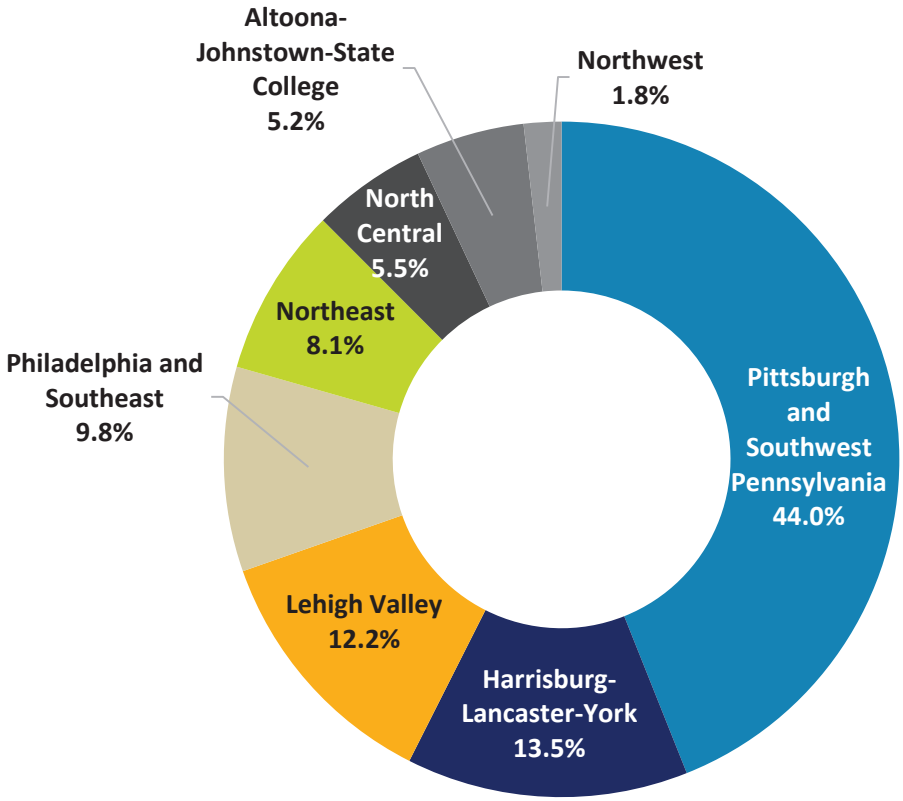



*Figure ES-3. Proportion of greenhouse gases from large emitters by Pennsylvania region*[15]

## TABLE ES-1. PENNSYLVANIA'S DIRTY DOZEN CLIMATE POLLUTERS[11]

| Rank | Facility name | County | Region | Industry sector | Total direct emissions | Parent companies |
|---|---|---|---|---|---|---|
| 1 | Keystone | Armstrong | Pittsburgh and Southwest | Power plants | 7,267,256 | Arclight Capital Holdings, LLC (67.29%); Keycon Operating, LLC (20.37%); Talen Energy Corp. (12.34%) |
| 2 | Conemaugh | Indiana | Pittsburgh and Southwest | Power plants | 6,959,749 | Arclight Capital Holdings, LLC (57.61%); Keycon Operating, LLC (20.17%); Talen Energy Corp. (22.22%) |
| 3 | Homer City | Indiana | Pittsburgh and Southwest | Power plants | 4,452,105 | Homer City Generation, LP (100%) |
| 4 | Lackawanna Energy Center | Lackawanna | Northeast | Power plants | 3,750,862 | Invenergy, LLC (100%) |
| 5 | U.S. Steel (Edgar Thomson) | Allegheny | Pittsburgh and Southwest | Metals | 3,661,557 | U.S. Steel Corp. (100%) |
| 6 | York Energy Center | York | Harrisburg-Lancaster-York | Power plants | 3,128,643 | Volt Parent, LP (100%) |
| 7 | Seward Generation, LLC | Indiana | Pittsburgh and Southwest | Power plants | 2,991,417 | Generation Holdings, LP (100%) |
| 8 | Hummel Station, LLC | Snyder | Harrisburg-Lancaster-York | Power plants | 2,830,394 | Hummel Station, LLC (100%) |
| 9 | Fairless Energy, LLC | Bucks | Philadelphia and Southeast | Power plants | 2,814,228 | Edgewater Generation Holdings, LLC (100%) |
| 10 | Competitive Power Ventures (CPV) Fairview Energy Center, LLC | Cambria | Altoona-Johnstown-State College | Power plants | 2,752,835 | Osaka Gas USA Corp. (50%); CPV Fairview, LLC (25%); CPV Power Holdings, LP (25%) |
| 11 | Tenaska Westmoreland Generating Station | Westmoreland | Pittsburgh and Southwest | Power plants | 2,669,501 | Tenaska Pennsylvania Partners, LLC (100%) |
| 12 | Moxie Freedom | Luzerne | Northeast | Power plants | 2,599,619 | Moxie Freedom, LLC (100%) |
| | **Dirty Dozen total** | | | | **45,878,166** | |

**To protect the commonwealth's future and prevent the worst impacts of global warming, Pennsylvania needs to pursue a long-term and large-scale transition away from the use of fossil fuels, and toward sources that emit low or zero GHGs.**

Fortunately, there are deliberate steps that Pennsylvania can take to reduce its contribution to global warming.

**Specifically, Pennsylvania should:**

- **Accelerate the transition to renewable energy.** Clean energy sources such as solar and wind power are here and increasingly cost-competitive with electricity from fossil fuels.[18] Pennsylvania should commit to obtaining at least 30% of its electricity from clean, renewable sources by 2030 on the way to powering the commonwealth with 100% renewable energy.

- **Transition** homes, businesses, transportation and industry **away from fossil fuels**. As Pennsylvania shifts to renewable energy, it is also important that we shift wherever possible from direct combustion of fossil fuels like oil, coal and gas to electricity.
- Continue **Pennsylvania's commitment to, and participation in, the Regional Greenhouse Gas Initiative**. The program is expected to reduce carbon emissions in Pennsylvania by up to 227 million tons by 2030, while generating hundreds of millions of dollars annually for reinvestment that can be used to accelerate the commonwealth's efforts to reduce emissions and transition away from fossil fuels.[19] However, the program has come under frequent attacks in the Pennsylvania General Assembly. Public officials should end those attacks and embrace the program, along with other efforts to reduce greenhouse gas emissions in the commonwealth.
- **Strengthen enforcement of clean air laws**. By requiring industrial facilities and power plants to control the health-threatening air pollution they produce, the commonwealth can also encourage them to adopt cleaner, less fossil fuel-intensive processes overall, curbing Pennsylvania's emissions of greenhouse gases.
- **Support environmentally responsible decarbonization of industry**. The federal Inflation Reduction Act (IRA) of 2022 includes funding to help a variety of industrial sectors reduce their emissions of greenhouse gases.[20] The commonwealth should aggressively apply for competitive federal grants and encourage and support industries in obtaining those funds where appropriate, while ensuring that industrial decarbonization efforts lead to real, significant and lasting emission reductions without negative impacts on air quality or public health and safety.

# Pennsylvania industrial facilities and power plants are fueling climate change

**PENNSYLVANIA IS ONE** of America's largest sources of the greenhouse gas (GHG) pollution that causes global warming — and large industrial facilities and power plants are the commonwealth's largest sources of those pollutants. To protect the Keystone State and the world from the threats posed by climate change, reducing emissions from Pennsylvania's biggest GHG polluters is essential.

## Global warming threatens Pennsylvania and the world, now and in the future

Global warming poses an existential threat to Pennsylvania and the planet.

Pennsylvania's climate is already changing. Temperatures today are nearly 2°F hotter in Pennsylvania on average than they were at the beginning of the 20th century.[21] In addition, the commonwealth received an average of almost five more inches of rain annually on average during the period spanning from 2001 to 2020 than it did during the period from 1971 to 2000.[22] From the scorching summer 2022 heat wave that led Philadelphia to post its second-hottest summer ever recorded, to the devastating flooding that followed 2021's Hurricane Ida, climate change is making its presence felt in Pennsylvania.[23]

Without immediate action to reduce emissions of greenhouse gases (GHGs) like carbon dioxide and methane that cause global warming, Pennsylvania faces a future of even more dramatic changes to the climate that put our health, environment and welfare at risk.

A 2021 report produced for the Pennsylvania Department of Environmental Protection found that Pennsylvania will experience serious consequences from climate change unless urgent action is taken here and around the world to curb greenhouse gas pollution.[24]

Among the specific impacts:

- **Heat waves will become more frequent.** By mid-century, Pennsylvania could experience an average of 37 days with temperatures above 90°F, compared to an average of 5 days during the late 20th century.[25] Hotter temperatures worsen air pollution and put more people at risk of heat-related illness and death.[26]
- **Flooding risks will increase.** Days with three or more inches of rain could happen more than 50% more often by the end of the 21st century than they did in the late 20th century.[27]
- **Sea level rise could severely damage infrastructure and ecosystems** in the Delaware River basin and drive the "salt front" — the line separating fresh and salt water — further up the river, threatening drinking water in Philadelphia and other municipalities.[28]

The Intergovernmental Panel on Climate Change, the world's leading scientific authority on climate change, estimates that the world will need to cut emissions of greenhouse gases to about 45% below 2010 levels by 2030, and to achieve net-zero emissions by 2050, in order to prevent global warming from exceeding

## TABLE 1: GREENHOUSE GAS EMISSIONS BY STATE (GROSS EMISSIONS), 2020[30]

| Rank | State | GHG emissions (million metric tons $CO_2$ equivalent) | % of US Total |
|---|---|---|---|
| 1 | Texas | 817.05 | 13.7% |
| 2 | California | 372.49 | 6.2% |
| 3 | Florida | 253.52 | 4.2% |
| **4** | **Pennsylvania** | **248.13** | **4.1%** |
| 5 | Ohio | 221.91 | 3.7% |
| 6 | Illinois | 210.8 | 3.5% |
| 7 | Louisiana | 209.84 | 3.5% |
| 8 | Indiana | 183.95 | 3.1% |
| 9 | New York | 173.48 | 2.9% |
| 10 | Michigan | 168.53 | 2.8% |
| | **US Total** | **5981.35** | |

1.5°C (2.7°F) — the aspiration the world's leaders set in adopting the 2015 Paris Climate Agreement.[29] Nations like the United States — and states like Pennsylvania — that have historically released a large share of the world's emissions have a responsibility to move farther, faster.

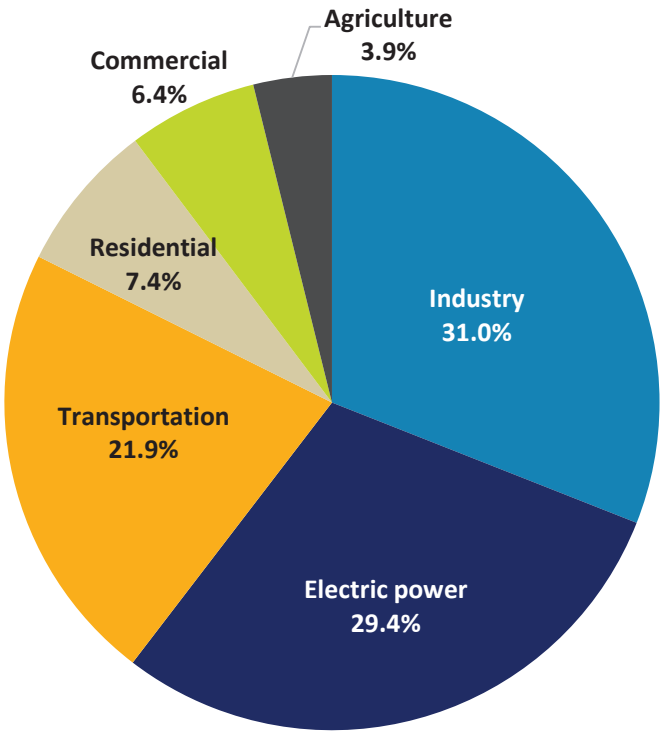



*Figure 1. Pennsylvania GHG emissions by economic sector, 2020[32]*

## Pennsylvania is a leading contributor to climate change

Pennsylvania is one of America's leading sources of greenhouse gas pollution. In 2020, the commonwealth was the fourth-largest GHG-emitting state in the nation, producing the equivalent of 248 million metric tons of carbon dioxide. (See Table 1.)

GHG emissions include carbon dioxide ($CO_2$), fluorinated gases, methane and nitrous oxide. Carbon dioxide is by far the top greenhouse gas emitted in Pennsylvania, accounting for 81% of the state's emissions of greenhouse gases in 2020 (in carbon dioxide equivalent).[31]

## Industry and power plants are Pennsylvania's top GHG polluters

Industrial facilities and power plants are the two biggest sources of climate pollution in Pennsylvania. In 2020, industrial facilities alone were responsible for 76.9 million metric tons of GHGs, or 31% of the commonwealth's total emissions. The industrial and electricity-producing sectors combined to produce 60% of the state's GHG emissions.

The remainder of Pennsylvania's 2020 GHG emissions came from transportation (22%) and the residential (7%), commercial (6%) and agriculture (4%) sectors. (See Figure 1.)

The electric power sector was the largest source of greenhouse gas pollution in the commonwealth between 1990 (when recordkeeping began) and 2017. But in 2018, industry took over as the largest emitter, and it remains so today.[33] This shift is likely due to the dramatic reduction in coal-fired power generation in Pennsylvania.[34] (Studies suggest, however, that regulatory agencies may severely undercount greenhouse gas emissions from leaks of methane gas, which has become the predominant fuel used to generate electricity in Pennsylvania.[35] A 2020 study by Environmental Defense Fund, for example, found that the oil and gas industry in Pennsylvania released more than 15 times as much methane pollution as it reported to the state of Pennsylvania.[36])

Between 2019 and 2020, Pennsylvania's gross GHG emissions decreased from 272 million tons to 248 million metric tons, or 9%.[37] This decrease was likely the result of the COVID-19 pandemic, and, therefore, temporary. Cleaning up industrial facilities and power plants is essential if Pennsylvania is to rapidly reduce greenhouse gas emissions and avoid the worst impacts of climate change.

## Facilities that emit greenhouse gases often release other dangerous pollutants

Industrial facilities and electric power plants are among the leading sources of greenhouse gases worldwide.[38] They are also leading sources of other pollutants that affect air quality and are harmful to human health.

Industrial facilities and power plants are important sources of nitrogen oxides (which contribute to the formation of ozone "smog") and particulate soot, pollutants that can cause asthma attacks, reduced mental functioning and even premature death.[39] In parts of Pennsylvania, ozone and particulate pollution often reach levels that are harmful to health. In 2022, the American Lung Association gave a grade of "F" to Allegheny, Bucks and Philadelphia counties for the level of ozone pollution in the air and gave an "F" to Allegheny and Lancaster counties for levels of particulate pollution.[40]

Industrial facilities are also major sources of toxic air pollutants such as mercury and benzene, which have serious impacts on public health.[41] In Allegheny County in 2021, for example, just 10 industrial facilities released a total of more than 1.4 million pounds of toxic substances to the county's air.[42]

Reducing the combustion of dirty fossil fuels like coal and cleaning up dirty industrial processes can often result in a win-win — curbing both greenhouse gas emissions and emissions of pollutants that put the health of Pennsylvanians at immediate risk.

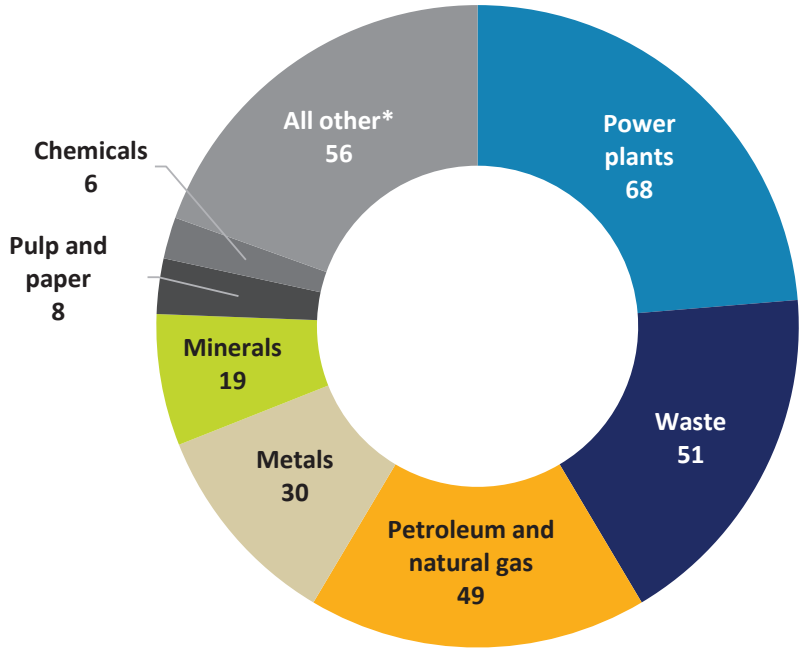
# Pennsylvania's "Dirty Dozen" climate polluters

**INDUSTRIAL FACILITIES** and power plants produce roughly three-fifths of the commonwealth's emissions of greenhouse gases. A significant share of those industrial and power plant emissions come from a small number of facilities — Pennsylvania's **"Dirty Dozen."**

## Major greenhouse gas polluters are required to report their emissions to the EPA

The EPA requires that polluters releasing more than 25,000 metric tons $CO_2$ equivalent of greenhouse gases in 2021 report those emissions to the EPA's Greenhouse Gas Reporting Program (GHGRP).[43] In Pennsylvania in 2021, there were 287 facilities that met that threshold and also reported a specific location. The following analysis describes emissions from those facilities.

In addition to these specific facilities, there are other greenhouse gas emissions required to be reported to the GHGRP that are not included in this analysis. This includes emissions from oil and gas production, pipelines and associated equipment, and from local gas distribution networks. These emissions are significant contributors to global warming but cannot be tied to a specific location and are therefore excluded from this analysis. (For more information on these emissions, see text box page 13.)




* "All other" includes facilities with multiple sector categories and those categorized as "other" by the EPA.

*Figure 2. Pennsylvania facilities reporting to GHGRP by sector, 2021*[44]

# The oil and gas industry is a significant source of emissions

**PRODUCTION, TRANSPORTATION** and distribution of oil and gas generate significant emissions of greenhouse gases. This is particularly true in Pennsylvania, which is a major gas-producing state.

Unlike the emissions from power plants, industrial facilities and mines analyzed in the rest of this report, many emissions from oil and gas producers are not reported at specific locations, but rather over a larger geographic area — either the statewide level or at the level of geologic basins.

Two categories of oil and gas emissions are reported to the GHGRP at the level of geologic basins: emissions from onshore oil and gas production, and emissions from gathering and boosting (the process of collecting oil or gas from production wells and preparing it for processing or injection into a pipeline).[45]

Pennsylvania's oil and gas producing regions are located in the Appalachian Basin, a 185,500-square mile area that reaches from New York across most of Pennsylvania and down through northeastern Alabama.[46] According to a report from the U.S. Energy Information Administration in September 2021, the Appalachian Basin set a new methane gas production record in the first half of 2021.[47]

In 2021, oil and gas companies reported more than 20 million metric tons (MMT) of greenhouse gas emissions from production, gathering and boosting in the Appalachian Basin. There is no accurate way (based on EPA reporting) to determine Pennsylvania's share of those emissions, but the Keystone State is far and away the largest producer of methane gas in the Appalachian Basin, suggesting that Pennsylvania is responsible for a significant share of those emissions.[48]

Pipeline transmission and local gas delivery company GHG emissions totaled over 1 MMT of GHG in the commonwealth in 2021. That is the GHG equivalent of driving nearly 2.7 billion miles in a gasoline-powered passenger vehicle.[49] Among Pennsylvania gas distribution utilities, Philadelphia Gas Works led the state with emissions of more than 260,000 metric tons of greenhouse gases. (See Table 2.)

These estimates of emissions from the oil and gas industry should be taken with a grain of salt. Research has found that emissions reported to the EPA by the oil and gas industry are likely significantly lower than actual emissions, as the methods used by EPA to estimate emissions fail to account for malfunctions and other unusual circumstances that can lead to large-scale releases of methane to the atmosphere.[50] The GHGRP also omits emissions from facilities that do not meet the program's reporting threshold and emissions from abandoned oil and gas infrastructure.[51] The EPA is currently considering changes to the GHGRP that could improve the accuracy of reporting under the program.[52]

### TABLE 2. REPORTED GREENHOUSE GAS EMISSIONS FROM PENNSYLVANIA GAS DISTRIBUTION UTILITIES

| Local distribution company | GHG emissions (MMT $CO_2$ eq.) |
|---|---|
| Philadelphia Gas Works – Corporate | 261,042 |
| PECO Gas Division | 110,209 |
| Peoples Natural Gas Company, LLC | 213,317 |
| UGI Utilities, Inc. | 136,750 |
| Columbia Gas of Pennsylvania | 123,861 |
| National Fuel Gas Distribution Corp – Pennsylvania | 84,019 |
| Peoples Gas Company Pennsylvania | 47,488 |
| **Total** | **976,685** |

## The Dirty Dozen are responsible for a large share of Pennsylvania's emissions

In 2021, Pennsylvania's largest-emitting facilities reported releasing 110.9 million metric tons of greenhouse gases to the GHGRP — a 6%, or 6.4 million metric ton, increase over 2020, which was affected by the COVID-19 pandemic.[53]

Pennsylvania's top 12 large direct GHG-emitting facilities, or "Dirty Dozen," emitted nearly 46 million metric tons of GHGs in 2021 — or 41% of all emissions reported by large Pennsylvania facilities to the GHGRP. Comprehensive statewide data on greenhouse gas emissions for 2021 was not available from the EPA as of the time of publication of this

### TABLE 3. PENNSYLVANIA'S "DIRTY DOZEN" CLIMATE POLLUTERS[55]

| Rank | Facility name | County | Region | Industry sector | Total direct emissions | Parent companies |
|---|---|---|---|---|---|---|
| 1 | Keystone | Armstrong | Pittsburgh and Southwest | Power plants | 7,267,256 | Arclight Capital Holdings, LLC (67.29%); Keycon Operating, LLC (20.37%); Talen Energy Corp. (12.34%) |
| 2 | Conemaugh | Indiana | Pittsburgh and Southwest | Power plants | 6,959,749 | Arclight Capital Holdings, LLC (57.61%); Keycon Operating, LLC (20.17%); Talen Energy Corp. (22.22%) |
| 3 | Homer City | Indiana | Pittsburgh and Southwest | Power plants | 4,452,105 | Homer City Generation, LP (100%) |
| 4 | Lackawanna Energy Center | Lackawanna | Northeast | Power plants | 3,750,862 | Invenergy, LLC (100%) |
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| | **Dirty Dozen total** | | | | **45,878,166** | |

report. But emissions from the Dirty Dozen facilities would have represented 18% of the state's total GHG emissions in 2020.[54] **In short, the Dirty Dozen facilities are responsible for nearly one-fifth of Pennsylvania's greenhouse gas emissions.**

All but one of the state's Dirty Dozen facilities are power plants. The state's top two facilities, the **Keystone** and **Conemaugh** coal-fired power plants, together emitted 14 million metric tons of greenhouse gases (carbon dioxide equivalent) in 2021, which is the emissions equivalent of driving 35 billion miles in an average gasoline-powered passenger vehicle, enough to circle the earth 1.4 million times.[56] Emissions from these two facilities in 2021 are equivalent to 6% of the commonwealth's total GHG emissions from all sources in 2020. Keystone and Conemaugh are owned by the same parent companies, with Arclight Capital Holdings being the majority owner of both. (See Table 3, page 14.)

Both the Keystone and Conemaugh plants have announced plans to close by (or before) the end of 2028, citing an EPA rule revised in 2020 that prohibits coal power plants from dumping toxic elements such as mercury, arsenic and selenium into streams and rivers.[57] The plant owners decided to forgo making investments to comply with the rule and will instead retire. The retirement or repowering of coal-fired power plants is a leading reason why Pennsylvania's greenhouse gas emissions from power plants fell by more than 40% between 2010 and 2020.[58]

**Homer City**, the third-highest emitting facility in the state in 2021, is also a coal-fired power plant. In April 2023, the facility announced that it intended to decommission its coal units over the ensuing several months.[59]

The decrease in emissions from coal-fired power plants in Pennsylvania, however, corresponded with a large increase in emissions from systems for producing, processing and distributing methane gas, and from gas-fired power plants, which have emerged as Pennsylvania's leading source of electricity generation.[60]

Five of the Dirty Dozen facilities — **Lackawanna Energy Center**, **Hummel Station**, **CPV Fairview Energy Center**, **Tenaska Westmoreland Generating Station**, and **Moxie Freedom Generating Station** — are gas-powered power plants that have opened since the beginning of 2018. These plants, which have decades of useful life ahead of them, show the limitations of the transition from coal- to gas-fired power generation for reducing climate pollution and the need to transition to zero-emission renewable energy.[61]

## Steel, mining, cement facilities are top industrial emitters

While greenhouse gas emissions from power plants have fallen over the last decade, emissions from industrial facilities have been on the rise and are now Pennsylvania's top source of greenhouse gas emissions.[65]

Unlike power plants, for which the vast majority of greenhouse gas emissions are reported to the GHGRP, many industrial facilities are not required to report to the GHGRP. The facility-by-facility data presented in this report capture a smaller share of emissions from industrial facilities and processes — likely because many industrial facilities do not meet the reporting threshold and not all sectors are included in the facility-by-facility data. For example, natural gas and petroleum systems are the second-largest source of industrial emissions in Pennsylvania, but many of those emissions cannot be attributed to a specific location.[66] For more on these emissions, see text box on page 13.

Still, the top 12 non-power plant emitters in Pennsylvania reported nearly 17 million metric tons of greenhouse gas emissions in 2021. Metals and minerals were the top industrial sources of greenhouse gases. (See Figure 3, page 17.)

## Several high-emitting facilities operate without key air permits

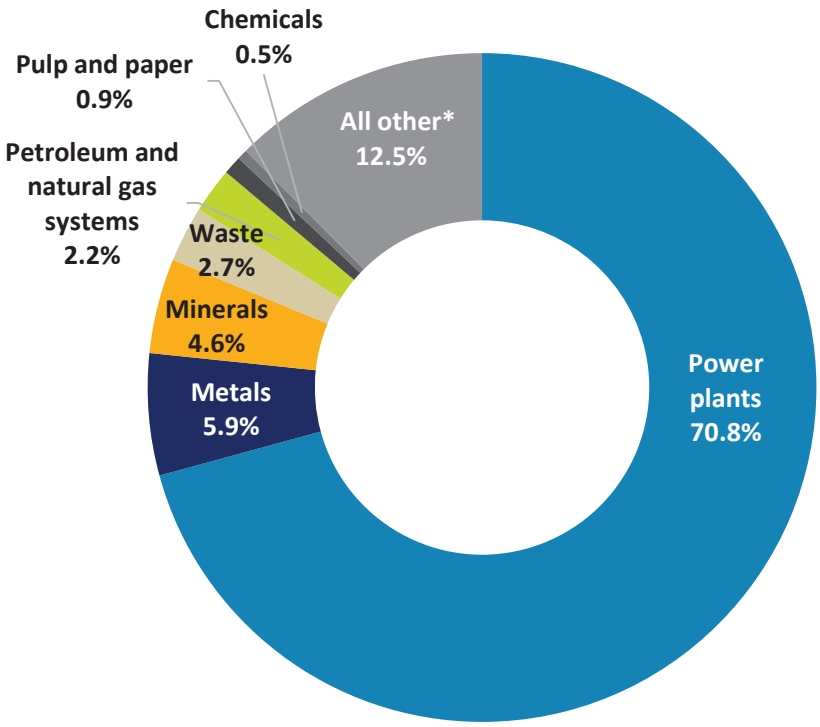
**UNDER THE CLEAN AIR ACT**, major sources of air pollution (and some other non-major sources) are required to obtain operating permits that include all the clean air requirements in force at that facility. These "Title V" permits are key tools for transparency and public accountability, and to improve enforcement and compliance with clean air rules. They are scheduled to be updated every five years.[62]

In some cases, there have been long delays in the issuance or renewal of Title V permits, and some polluters in Pennsylvania have never been issued a Title V permit since the requirement was implemented nationally in 1992.[63] More than half of the "Dirty Dozen" did not have current Title V permits as of January 2023, with several newer gas-fired power plants having not yet been issued a Title V permit and two facilities – Edgar Thomson Works and the retiring Homer City power plant – operating under expired permits. (See Table 4.).

**TABLE 4. TITLE V PERMIT STATUS OF "DIRTY DOZEN" CLIMATE POLLUTERS AS OF JANUARY 2023[64]**

(Shaded facilities have no Title V permit or an expired permit)

| Rank | Permit No. | Title V permit? | Facility Name | County | Title V Permit Expiration | Permit status |
|---|---|---|---|---|---|---|
| 1 | 03-00027 | Y | Keystone Generating Station | Armstrong | 3/31/25 | Up-to-date |
| 2 | 32-00059 | Y | Conemaugh Generating Station | Indiana | 3/31/26 | Up-to-date |
| 3 | 32-00055 | Y | Homer City | Indiana | 11/16/17 | EXPIRED |
| 4 | Plan approval 35-00069C | N | Lackawanna Energy Center | Lackawanna | N/A | NONE Application pending |
| 5 | 0051 | Y | U.S. Steel (Edgar Thomson) | Allegheny | 4/13/16 | EXPIRED Renewal application pending |
| 6 | 67-05083 | Y | York Energy Center | York | 10/31/24 | Up-to-date |
| 7 | 32-00040 | Y | Seward Generation, LLC | Indiana | 6/30/26 | Up-to-date |
| 8 | GP-11 | N | Hummel Station, LLC | Snyder | N/A | NONE Application pending |
| 9 | 09-00124 | Y | Fairless Energy, LLC | Bucks | 5/20/25 | Up-to-date |
| 10 | Plan approval 11-00536B | N | CPV Fairview Energy Center, LLC | Cambria | N/A | NONE Application pending |
| 11 | Plan approval 65-00990C | N | Tenaska Westmoreland Generating Station | Westmoreland | N/A | NONE |
| 12 | 40-00129 | y | Moxie Freedom | Luzerne | 5/4/25 | Up-to-date |




## BREAKOUT OF EMISSIONS FROM "ALL OTHER" CATEGORY ABOVE

| Industry/industries | Total (MMT $CO_2e$) |
|---|---|
| Petroleum product suppliers, refineries | 1,523,168 |
| Pulp and paper, waste | 921,018 |
| Chemicals, refineries | 640,586 |
| Chemicals, industrial gas suppliers | 611,845 |
| Natural gas and natural gas liquids suppliers, petroleum and natural gas systems | 321,133 |
| Other, waste | 262,970 |
| Metals, waste | 250,613 |
| Import and export of equipment containing fluorinated GHGs, other | 29,687 |
| Import and export of equipment containing fluorinated GHGs, industrial gas suppliers, other | 26,010 |
| Other | 9,270,195 |
| **All other total (MMT $CO_2e$)** | **13,857,226** |

* "All other" includes releases by the facilities reporting emissions under more than one industry type or whose industry type is listed as "other" by the EPA.

*Figure 3. Greenhouse gas emissions reported to the GHGRP by industry type, 2021*[67]

## TABLE 5. PENNSYLVANIA'S TOP 12 GHG-EMITTING INDUSTRIAL FACILITIES (EXCLUDING POWER PLANTS)[70]

| Rank | Facility name | County | Region | Industry sector | Total direct emissions (MMT $CO_2e$) | Parent company |
|---|---|---|---|---|---|---|
| 1 | U.S. Steel (Edgar Thomson) | Allegheny | Pittsburgh and Southwest | Metals | 3,661,557 | U.S. Steel Corp. |
| 2 | Bailey Mine-Crabapple Portal | Greene | Pittsburgh and Southwest | Other | 2,302,524 | Consol Energy, Inc. |
| 3 | Enlow Fork Mine | Washington | Pittsburgh and Southwest | Other | 2,082,189 | Consol Energy, Inc. |
| 4 | Iron Cumberland, LLC | Greene | Philadelphia and Southeast | Other | 1,666,338 | Iron Senergy Holding, LLC |
| 5 | Monroe Energy, LLC, Trainer Refinery | Delaware | Philadelphia and Southeast | Petroleum product suppliers, refineries | 1,341,408 | Delta Air Lines, Inc. |
| 6 | Harvey Mine | Greene | Pittsburgh and Southwest | Other | 1,313,729 | Consol Energy, Inc. |
| 7 | Graymont (PA), Inc./ Pleasant Gap Plant | Centre | Altoona-Johnstown-State College | Minerals | 834,879 | Graymont, Inc. |
| 8 | U.S. Steel (Clairton Coke) | Allegheny | Pittsburgh and Southwest | Metals | 796,231 | U.S. Steel Corp. |
| 9 | Procter & Gamble Paper Products | Wyoming | Northeast | Pulp and paper, waste | 700,177 | Procter & Gamble Co. |
| 10 | Keystone Cement Co. | Northampton | Lehigh Valley | Minerals | 697,880 | Giant Cement Holding, Inc. |
| 11 | Lehigh Cement Co., LLC, Nazareth | Northampton | Lehigh Valley | Minerals | 679,570 | Hanson Lehigh, Inc. |
| 12 | United Refining Company | Warren | Northwest | Chemicals, refineries | 640,586 | Red Apple Group, Inc. |
| | **Top 12 industrial polluters total** | | | | **16,717,068** | |

The one industrial (non-power plant) facility in the statewide Dirty Dozen is the **U.S. Steel Edgar Thomson Steel Works**, which ranks fifth among all large emitters statewide. In 2021, this facility emitted 3.7 million metric tons of GHGs, which is the $CO_2$ emissions equivalent of burning 4 billion pounds of coal. In 2019, U.S. Steel announced plans for a $1 billion upgrade that it said would "keep steelmaking in Pittsburgh with fewer emissions." However, in April 2021 the company said it was scrapping the plan.[68]

Two U.S. Steel facilities in the Monongahela Valley – the **Edgar Thomson** and **Clairton** plants – rank among the top 12 industrial emitters of GHGs in Pennsylvania, accounting for 4.5 million metric tons of the state's GHG emissions in 2021. (See Table 5 below.)

**Consol Energy, Inc.**, is the parent company of three of the top 12 large non-power plant industrial emitters, accounting for 5.7 million metric tons of $CO_2$ equivalent emissions. (See Table 5.) The three facilities are underground coal mines located in southwestern

Pennsylvania. The majority of the emissions from the mines (as measured in carbon dioxide equivalent) came in the form of methane, which has more than 80 times the global warming potential of carbon dioxide, pound for pound, over a 20-year timeframe.[69]

Combined, Consol Energy and U.S. Steel facilities produced more than 10 million metric tons of greenhouse gas pollution in 2021. That is equivalent to about 4% of Pennsylvania's total statewide emissions in 2020.

## Large greenhouse gas emitters exist in every part of the commonwealth

Every region of Pennsylvania has large industrial facilities and/or power plants that are significant producers of climate-warming pollution. However, one region of Pennsylvania — the southwest — has a particularly high concentration of polluting facilities.

## Regional definitions

For the purposes of this report, Pennsylvania was divided into eight regions, as shown in the map below. (See Figure 4.) For more on the regional definitions used in this report, see Table 6 page 20.

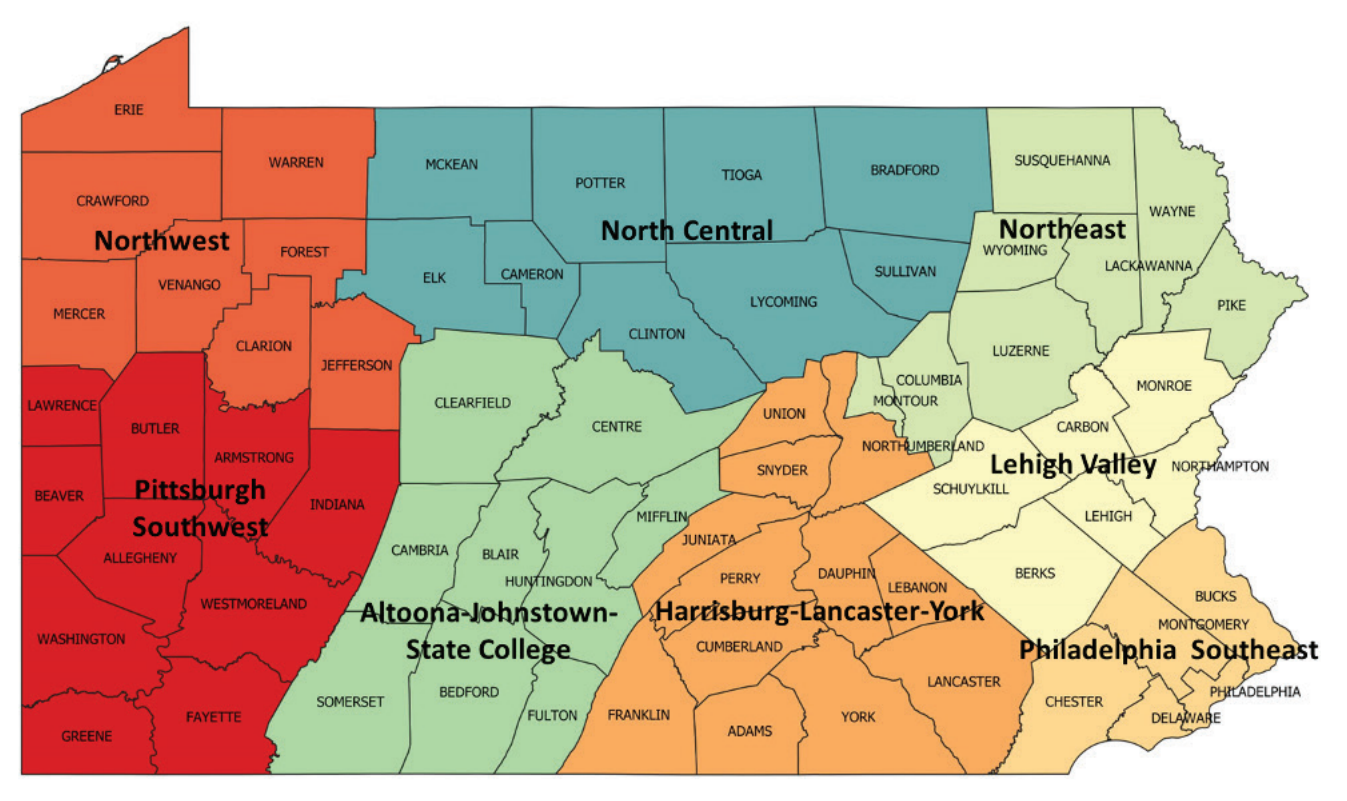



*Figure 4. Regional definitions used in this report*

## TABLE 6. REGIONAL DEFINITIONS USED IN THIS REPORT

| Region | Counties |
|---|---|
| Pittsburgh and Southwest Pennsylvania | Allegheny, Armstrong, Beaver, Butler, Fayette, Greene, Indiana, Lawrence, Washington and Westmoreland |
| Northwest | Clarion, Crawford, Erie, Forest, Jefferson, Mercer, Venango and Warren |
| Harrisburg-Lancaster-York | Adams, Cumberland, Dauphin, Franklin, Juniata, Lancaster, Lebanon, Northumberland, Perry, Snyder, Union and York |
| Philadelphia and Southeast | Bucks, Chester, Delaware, Montgomery and Philadelphia |
| Lehigh Valley | Berks, Carbon, Lehigh, Monroe, Northampton and Schuylkill |
| Northeast | Columbia, Lackawanna, Luzerne, Montour, Pike, Susquehanna, Wayne and Wyoming |
| Altoona-Johnstown-State College | Bedford, Blair, Cambria, Centre, Clearfield, Fulton, Huntingdon, Mifflin, and Somerset |
| North Central | Bradford, Cameron, Clinton, Elk, Lycoming, McKean, Potter, Sullivan and Tioga |

Half of the Dirty Dozen facilities are located in Pittsburgh and Southwestern Pennsylvania, with three of them operating in Indiana County. Southwestern Pennsylvania accounted for 44% of greenhouse gas emissions reported by large facilities through the GHGRP in 2021 — by far the most of any region. (See Figure 5.)

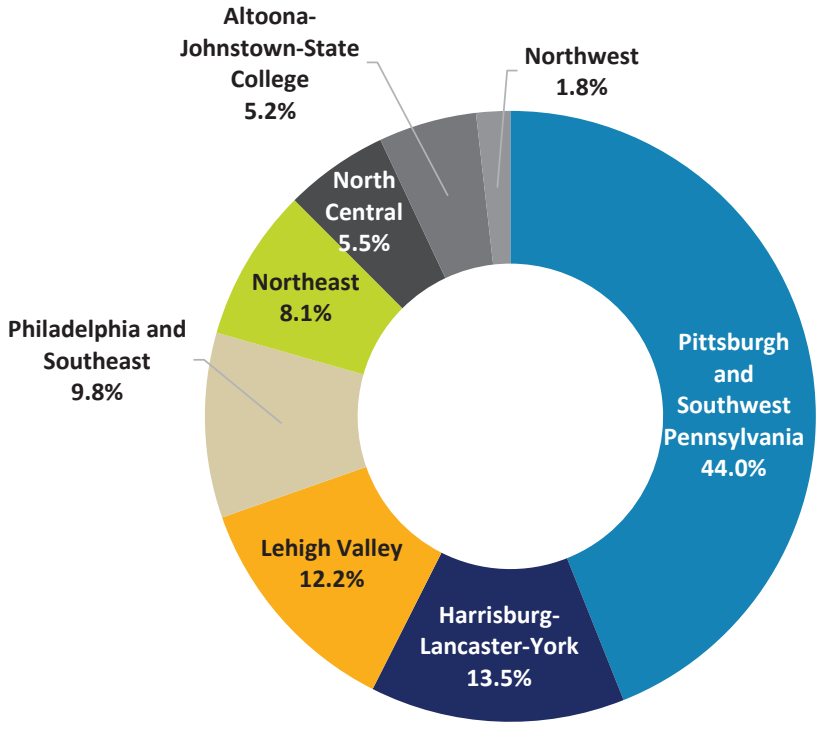



*Figure 5. 2021 PA large facility GHG emissions by region (GHGRP)*[71]

## TABLE 7. GHG EMISSIONS BY REGION AS REPORTED TO GHGRP IN 2021[75]

| Ranking | Region name | 2021 regional total (MMT $CO_2e$) | % of 2021 GHGRP state total |
|---|---|---|---|
| 1 | Pittsburgh and Southwest | 48,733,640 | 44% |
| 2 | Harrisburg-Lancaster-York | 14,972,940 | 14% |
| 3 | Lehigh Valley | 13,510,333 | 12% |
| 4 | Philadelphia and Southeast | 10,895,950 | 10% |
| 5 | Northeast | 8,931,182 | 8% |
| 6 | North Central | 6,055,531 | 5% |
| 7 | Altoona-Johnstown-State College | 5,810,550 | 5% |
| 8 | Northwest | 1,954,593 | 2% |
| | **2021 GHGRP totals** | **110,864,720** | |

*NOTE: Large emitting facilities (>25,000 MTCO$_2$e/Year) reporting to the GHGRP in 2021.*

The Harrisburg-Lancaster-York region, with 14% of emissions, and the Lehigh Valley region, with 12%, ranked second and third, respectively. (See Table 7.)

Southwestern Pennsylvania industrial facilities and power plants are responsible for a significant share of Pennsylvania's overall greenhouse gas emissions. The 49 million metric tons of greenhouse gas emissions reported to the GHGRP by facilities in the Pittsburgh and Southwest region were equivalent to 20% of the state's total greenhouse gas emissions in 2020.[72]

The Pittsburgh and Southwest region was also home to the greatest number of large GHG emitters required to report to the GHGRP, with 88 out of the 287 Pennsylvania facilities, or roughly 31%. (See Figure 6.) The Northeast region had the fewest facilities, 19, but released the 5th highest amount of GHG among the eight regions, 8.9 MMT, the $CO_2$ equivalent of GHG emissions from 22 billion miles driven by an average gas-powered car.[73] That would be the same distance as nearly 8 million cross country trips between Los Angeles and New York City.[74] The Northwest region released the lowest amount of greenhouse gases, 2.0 million metric tons.

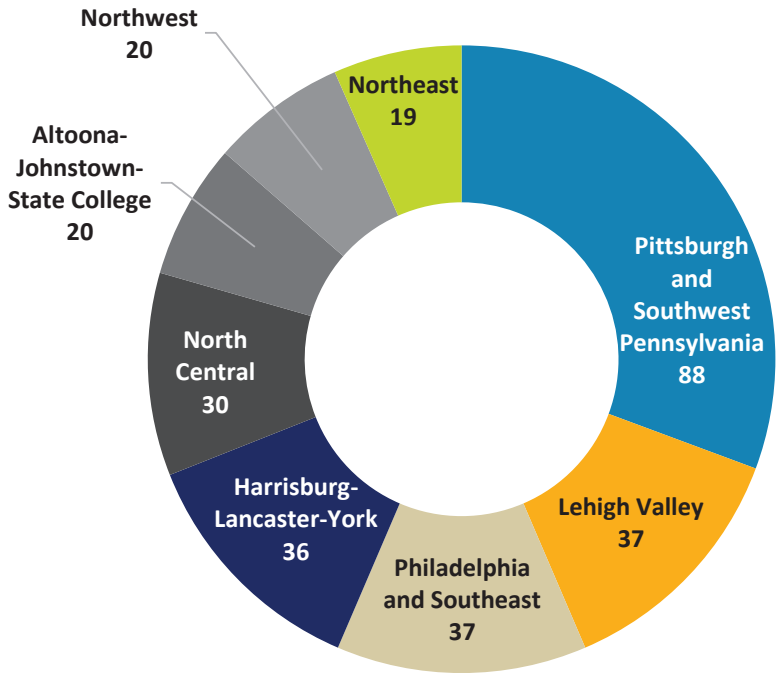



*Figure 6. 2021 Pennsylvania large emitters by region (GHGRP)*

## Top emitters by region

Looking at the number one GHG-producing facility in each region, power plants again dominate the list. All regions but the Northwest have a power plant as their top producer of GHG emissions. (See Table 8.)

The following were the top-emitting facilities by region: [77]

### Pittsburgh and Southwest

The top GHG-emitting facility in the Pittsburgh and Southwest region was the **Keystone Generating Station**, a coal-fired power plant, which was also the top polluter in the state. This facility alone was responsible for over 7 million metric tons (MMT) of greenhouse gas emissions released in 2021. That's the equivalent of GHG emissions from over 18 billion miles driven by an average gasoline-powered passenger vehicle.[78] That is well over 724,000 trips around the globe.[79]

The Keystone plant is due to close on or before December 31, 2028, as a result of a new wastewater rule that prohibits coal power plants from dumping mercury, arsenic and selenium into streams and rivers.[80] The Conemaugh Generating Station, another coal-fired power plant in the Pittsburgh and Southwest region, ranked as the second-largest GHG polluter in the state and emitted just under 7 MMT. The Conemaugh facility has also announced its intention to close in 2028.[81]

### TABLE 8. TOP EMITTING FACILITY BY REGION[76]

| Region | Facility | County | Industrial sector | Parent company |
|---|---|---|---|---|
| Pittsburgh and Southwest | Keystone | Armstrong | Power plants | Arclight Capital Holdings, LLC (67.29%); Keycon Operating, LLC (20.37%); Talen Energy Corp. (12.34%) |
| Northeast | Lackawanna Energy Center | Lackawanna | Power plants | Invenergy, LLC (100%) |
| Harrisburg-Lancaster-York | York Energy Center | York | Power plants | Volt Parent, LP (100%) |
| Philadelphia and Southeast | Fairless Energy, LLC | Bucks | Power plants | Edgewater Generation Holdings, LLC (100%) |
| Altoona-Johnstown-State College | CPV Fairview Energy Center, LLC | Cambria | Power plants | Osaka Gas USA Corp (50%); CPV Fairview LLC CPV Fairview (25%); CPV Power Holdings LP (25%) |
| North Central | Hamilton Liberty, LLC | Bradford | Power plants | Carlyle Group Management, LLC (100%) |
| Lehigh Valley | Ontelaunee Energy Center | Berks | Power plants | Vistra Corp. (100%) |
| Northwest | United Refining Co. | Warren | Chemicals, refineries | Red Apple Group, Inc. (100%) |

## Northwest

In the Northwest region of the state, **United Refining Co.** in Warren County was the top GHG-producing facility in 2021. The facility refines an average of 70,000 barrels of oil a day into gasoline, diesel fuel and other petroleum products.[82] Though United Refining's emissions numbers are not near the top of the state's 2021 rankings, the facility emitted 641,000 metric tons of $CO_2$ equivalent into the atmosphere, according to GHGRP reporting. That is the equivalent of the emissions produced by nearly 140,000 average gasoline-powered passenger vehicles driven for a year.[83]

## Harrisburg-Lancaster-York

**York Energy Center,** located in York County, is a 1,449-megawatt (MW) methane gas and fuel oil power plant and was the number one producer of GHG emissions in this region.[84] At just over 3 MMT of GHG emissions, it was the sixth-highest GHG emitter in the state in 2021. This facility emitted the equivalent amount of GHG pollution as more than 670,000 typical cars driven for a year.[85]

## Philadelphia and Southeast

**Fairless Energy** in Fairless Hills, Bucks County, is a 1,338-MW gas-fired power plant.[86] In operation since 2004, the Fairless facility was the ninth-highest GHG emitter in the commonwealth as reported to the GHGRP in 2021. Ranked number one in the Philadelphia and Southeast region, it produced nearly 3 million metric tons of GHGs, which is the $CO_2$ equivalent of more than 600,000 typical passenger vehicles driven for a year.

## Lehigh Valley

As was true in all of the state's eight regions (with the exception of the Northwest region), a power plant was the top GHG-producing facility in the Lehigh Valley. **Ontelaunee Energy Center** is a 728-MW gas-fired power plant that reported producing 1.7 MMT of $CO_2$-equivalent GHG emissions in 2021.[87] While this facility didn't make the state's Dirty Dozen list, it was still responsible for producing GHG emissions equivalent to 4 billion miles of driving by the average gasoline-powered passenger vehicle.[88]

## Northeast

In the Northeast region of the state, **Lackawanna Energy Center** in Jessup, Lackawanna County, emitted 3.8 MMT of $CO_2$-equivalent GHG pollution in 2021.[89] Lackawanna was the fourth-largest emitter in the state's Dirty Dozen, according to 2021 GHGRP reporting. The facility began commercial operations in January 2019.[90]

## Altoona-Johnstown-State College

Located near Johnstown, **Competitive Power Ventures (CPV) Fairview Energy Center** is a 1,050-MW natural gas-fueled electric power plant.[91] CPV Fairview released 2.8 MMT of $CO_2$-equivalent GHGs into the atmosphere in 2021. That's the equivalent of $CO_2$ emissions from burning 3 billion pounds of coal.[92]

## North Central

The two biggest polluters in the North Central region share the same parent company. Carlyle Group Management, owners of Cogentrix Energy, acquired the facilities in 2020.[93] The **Hamilton Liberty** power plant in Towanda, Bradford County, and the **Hamilton Patriot** power plant near Williamsport in Lycoming County each has an 829-MW capacity and produced roughly similar GHG emissions in 2021 (2.2 million metric tons for Hamilton Liberty versus 2.1 million metric tons for Hamilton Patriot). Together, the facilities accounted for nearly three-quarters of the region's 2021 total reported to the GHGRP from large facilities, or the equivalent GHG emissions of more than 900,000 typical passenger vehicles driven for a year.[94]

# Recommendations

**PENNSYLVANIA**, along with the rest of the country and the world, will need to dramatically reduce emissions of greenhouse gases to prevent the worst impacts of global warming. In Pennsylvania, that means cutting pollution from power plants and industrial facilities that are responsible for about three-fifths of the state's greenhouse gas emissions.

Fortunately, there are steps that Pennsylvania can take to reduce its contribution to global warming. These include:

- **Accelerate the transition to clean, renewable energy.** Clean energy sources such as solar and wind power are here and increasingly cost-competitive with electricity from fossil fuels.[95] Pennsylvania's technical potential for solar energy is more than four times as great as our annual electricity use and Pennsylvania also has access to abundant wind energy resources.[96] Pennsylvania should commit to obtaining at least 30% of its electricity from clean, renewable sources by 2030 on the way to powering the commonwealth with 100% renewable energy. Committing to a transition to clean energy would not only reduce emissions from power plants, but also reduce methane emissions from coal mining and the production, transportation and processing of fracked gas — all of which are significant sources of greenhouse gases in the commonwealth.

- **Transition homes, businesses, and the transportation and industrial sectors away from fossil fuels.** As Pennsylvania shifts to renewable energy, it is also important that the commonwealth shift from direct combustion of fossil fuels like oil, coal and gas to electricity wherever possible. The Inflation Reduction Act (IRA) of 2022 includes significant incentives for electric vehicles, heat pumps, induction electric stoves, energy-efficiency improvements and more.[97] The law also includes incentives for the production of renewable energy and for decarbonization of various industrial sectors. Pennsylvania should work to ensure that the Keystone State's residents, businesses and industry can take full advantage of the IRA's clean energy provisions.

- **Continue Pennsylvania's commitment to, and participation in the Regional Greenhouse Gas Initiative (RGGI).** In April 2022, Pennsylvania finalized a rule that formally allows the state to link with RGGI, a bipartisan market-based effort that includes 11 neighboring Northeast and Mid-Atlantic states that has dramatically cut carbon pollution from power plants since 2009.[98] The program is expected to reduce carbon emissions in Pennsylvania by up to 227 million tons by 2030, while generating hundreds of millions of dollars annually that can be reinvested to accelerate the commonwealth's efforts to reduce emissions and transition away from fossil fuels.[99]

  Despite the program's benefits and history of success, Pennsylvania's participation in the program has been repeatedly attacked in the state's General Assembly. Pennsylvania elected officials should stop their multi-year efforts to keep Pennsylvania from sharing in RGGI's benefits and instead embrace the program and other critical initiatives to reduce greenhouse gas emissions in the commonwealth.

- **Strengthen enforcement of clean air laws.** Many of the state's leading greenhouse gas polluters are also among its biggest emitters of health-threatening air pollution. By requiring industrial facilities and power plants to control the health-threatening air pollution they produce, the commonwealth can also encourage them to adopt cleaner, less fossil fuel-intensive processes overall, curbing Pennsylvania's emissions of greenhouse gases.

- **Encourage environmentally responsible decarbonization of industry.** The commonwealth should encourage efforts to reduce greenhouse gas emissions from industry that deliver real, meaningful and lasting emission reductions while protecting air quality and the commonwealth's environment. The Inflation Reduction Act includes numerous sources of funding to support projects that reduce greenhouse gas pollution from high-emitting facilities and cut methane pollution from oil and gas facilities.[100] The commonwealth should aggressively apply for competitive federal grants and encourage facilities to apply for this funding as well, while also ensuring that emerging, nascent technologies such as hydrogen and carbon capture are employed in ways that deliver net reductions in greenhouse gas emissions, reduce air pollution in Pennsylvania, and do not compromise public health or safety.

# Methodology

**THE PURPOSE OF THIS REPORT** is to determine which industrial facilities are emitting the most greenhouse gases in Pennsylvania.

The EPA has two key programs that provide data on greenhouse gas emissions in the United States: the Inventory of U.S. Greenhouse Gas Emissions and Sinks (GHG Inventory) and the Greenhouse Gas Reporting Program (GHGRP).[101] These two data sources complement each other by providing both a higher-level perspective on Pennsylvania's total emissions and detailed information about the sources and types of emissions from individual facilities. The GHG Inventory goes back to 1990 and tracks U.S. emission trends by source, economic sector and type of GHG. This data comes from various national sources to provide a comprehensive accounting of total GHG for all human-made sources.

The EPA's GHGRP began collecting annual emissions data in 2010 from industrial sources that directly emit large amounts of GHGs (>25,000 $MTCO_2e$/year). This program helps EPA and the public understand where greenhouse gas emissions are coming from, improving our ability to make informed policy, business and regulatory decisions.

At the time the analysis was conducted, the GHGRP's latest data was for 2021. However, the GHG Inventory was only updated through 2020. Therefore, we pulled the facility-specific GHG emission data for 2021 from the GHGRP data and compared that to the commonwealth's total emissions in 2020 from the GHG Inventory. We then took the specific 2021 GHGRP data — for example, the Dirty Dozen total — and calculated its percentage or proportion of the state's total 2020 GHG Inventory amount.

In order to identify the top 10 states' emissions from the 2020 EPA Inventory data, we used the U.S. Energy Information Administration's 2020 summary report on carbon dioxide emissions by state.[102] We used the top 10 states from that report to verify the top 10 according to the EPA.

We also used the 2020 EPA Greenhouse Gas Inventory to report on the change in the nearly two-decades-long trend of electric power being the largest polluter in the state, and the 2018 change in that trend with the industrial sector taking over as the largest GHG emitter. This data set was also used to show emissions by economic sector for the entire state. We then downloaded the 2021 Pennsylvania reporting data from the GHGRP website (accessed October 11, 2022) and saved it to an Excel document which provided the facility name, address, county, parent company, and GHG emissions in MMT for each facility.[103] We deleted all of the facilities that did not report GHG emissions that year.

To this 2021 GHGRP data set we assigned regions by county (see Table 6, page 20), eight in total, so we could look at the top 12 polluters by different areas of the commonwealth. By looking at this from a regional perspective, we can see where the greatest amount of gases are emitted and where the highest-polluting facilities are located. (See Appendix.) Once that was done, we created a map outlining the eight regions and added a column to the GHGRP data report to assign the regions.

Then we downloaded the 2021 GHGRP Data Summary Spreadsheets Zip file from the EPA for comparison and to find and assign the Industry Type (sector) to each facility.[104] Once we completed

these steps, we ended up with 287 facilities for the analysis.

The data was then sorted by the facility with the largest amount of GHG emissions to the smallest and the total of all 287 facilities was summed to arrive at the 110.9 MMT of GHG for large facilities reporting in 2021. To arrive at the state's Dirty Dozen list, we took a closer look at the top 12 emitting facilities in the state.

Since power plants emit the largest amount of GHG in Pennsylvania by sector, we also pulled a list of top 12 polluters excluding that sector.

Because the GHGRP's latest available data was from 2021, and the most recent EPA inventory was from 2020, we calculated what the proportion of certain 2021 GHGRP data groupings would have been of the 2020 EPA state total. For the regional 2021 GHG polluter lists, we sorted facilities from highest to lowest emissions by each region and also compared these groupings to the 2020 EPA state total.

In some cases, the source reports did not include a particular piece of information like a county or parent company. In these instances, we searched the internet for the information, which is indicated by an asterisk.

Emissions data are shown in metric tons (carbon dioxide equivalent), and always refer to greenhouse gases unless otherwise mentioned.

In order to determine if the facilities in the Dirty Dozen list were current on their Title V Operating Permits, we used the Pennsylvania Department of Environmental Protection Lookup Tool sent by Mark Houser, Chief, Air Information Management, Department of Environmental Protection, Bureau of Air Quality.[105] Houser instructed us to look up the facility name from the pulldown list to view its latest permitting information. An example is this search on the Keystone Conemaugh Station facility. When information could not be found there, Mr. Houser looked up the information and sent PDF files to us via email.

To assess the GHG emissions from the oil and gas industry, we again used the 2021 GHGRP Data Summary Spreadsheets Zip file from the EPA.[106] From there we gathered Pennsylvania's $CO_2$ emissions numbers from the Onshore Oil & Gas Production spreadsheet, as well as those for Gathering & Boosting, Transmission Pipelines, and Local Distribution Companies (LDC) direct emissions.

For the onshore oil and gas production, and gathering and boosting activities, we searched the lists by basin, and selected basins 160 and 160A, which contain oil and gas-producing areas of Pennsylvania. We selected the total reported emissions from those categories, which include non-biogenic emissions of $CO_2$, as well as those from methane and nitrous oxide.

For the pipeline transmission and LDC direct emissions, we searched the GHGRP lists by "the state where those emissions occur" and reported those totals as well. LDC emissions includes the three gases mentioned above, and the pipeline emissions include $CO_2$ and methane only.

At various points throughout this report, we have provided emissions equivalency information which was found using the EPA's Greenhouse Gas Equivalencies Calculator.[116]

# Appendix: Top 12 emitting facilities by region

## TABLE A-1. TOP 12 POLLUTING FACILITIES — PITTSBURGH AND SOUTHWEST REGION[107]

| Facility | Total GHG (MMT $CO_2$ eq.) | City | County | Industrial sector | Parent company |
|---|---|---|---|---|---|
| Keystone | 7,267,256 | Shelocta | Armstrong | Power plants | Arclight Capital Holdings, LLC (67.29%); Keycon Operating, LLC (20.37%); Talen Energy Corp. (12.34%) |
| Conemaugh | 6,959,749 | New Florence | Indiana | Power plants | Arclight Capital Holdings, LLC (57.61%); Keycon Operating, LLC (20.17%); Talen Energy Corp. (22.22%) |
| Homer City | 4,452,105 | Homer City | Indiana | Power plants | EFS-N, LLC (100%) |
| U.S. Steel (Edgar Thomson) | 3,661,557 | Braddock | Allegheny | Metals | U.S. Steel Corp. (100%) |
| Seward Generation, LLC | 2,991,417 | New Florence | Indiana | Power plants | Generation Holdings, LP (100%) |
| Tenaska Westmoreland Generating Station | 2,669,501 | Smithton | Westmoreland | Power plants | Tenaska Pennsylvania Partners, LLC (100%) |
| Hickory Run Energy Station | 2,334,994 | New Castle | Lawrence | Power plants | Hickory Run Energy, LLC (100%) |
| Bailey Mine-Crabapple Portal | 2,302,524 | Wind Ridge | Greene | Other | Consol Energy, Inc. (100%) |
| Enlow Fork Mine | 2,082,189 | Claysville | Washington | Other | Consol Energy, Inc. (100%) |
| Fayette Energy Facility | 1,908,599 | Masontown | Fayette | Power plants | Vistra Corp. (100%)* |
| Iron Cumberland, LLC | 1,666,338 | Waynesburg | Greene | Other | Iron Senergy* |
| Cheswick^ | 1,427,048 | Springdale | Allegheny | Power plants | GenOn Energy, Inc. (100%) |
| **Top 12 Total** | **39,723,278** | | | | |
| **Region Total** | **48,733,640** | | | | **88 total facilities in Pittsburgh and Southwest** |

*Data missing from original source. Information included through an internet search.
^Closed March 31, 2022[108]

## TABLE A-2. TOP 12 POLLUTING FACILITIES — NORTHWEST REGION[109]

| Facility | Total GHG (MMT $CO_2$ eq.) | City | County | Industrial sector | Parent company |
|---|---|---|---|---|---|
| United Refining Co. | 640,586 | Warren | Warren | Chemicals, refineries | Red Apple Group, Inc. (100%) |
| Scrubgrass Generating Plant | 453,333 | Kennerdell | Venango | Power plants | Q Power, LLC (100%) |
| NLMK Pennsylvania, LLC | 169,710 | Farrell | Mercer | Metals | Top Gun Investment Corp. II (100%) |
| Owens Brockway Glass Container, Inc., Plant 19 | 81,062 | Brockport | Jefferson | Minerals | O-I Glass, Inc. (100%) |
| Vitro Meadville Flat Glass, LLC | 76,435 | Cochranton | Crawford | Minerals | Vitro Assets Corp. (100%) |
| Tennesse Gas Pipeline Station 219 Mercer | 64,241 | Mercer | Mercer | Petroleum and natural gas systems | Kinder Morgan, Inc. (100%) |
| Clarion Boards/Clarion Plt | 60,969 | Shippenville | Clarion | Other | Clarion Industries, Inc. (100%) |
| Tennessee Gas Pipeline Station 303, Seneca, PA | 54,006 | Seneca | Venango | Petroleum and natural gas systems | Kinder Morgan, Inc. (100%) |
| Lake View Landfill | 49,432 | Erie | Erie | Waste | Waste Management, Inc. (100%) |
| Tennessee Gas Pipeline Station 307 Marienville | 44,356 | Marienville | Forest | Petroleum and natural gas systems | Kinder Morgan, Inc. (100%) |
| GE Transportation - Erie Plant | 42,423 | Erie | Erie | Other | Wabtec U.S. Rail, Inc. (100%) |
| Handsome Lake Energy | 42,019 | Kennerdell | Venango | Power plants | Exelon Corp. (100%) |
| **Top 12 Total** | **1,778,571** | | | | |
| **Region Total** | **1,954,593** | | | | **20 total facilities in Northwest Region** |

## TABLE A-3. TOP 12 POLLUTING FACILITIES — HARRISBURG-LANCASTER-YORK REGION[110]

| Facility | Total GHG (MMT $CO_2$ eq.) | City | County | Industrial sector | Parent company |
|---|---|---|---|---|---|
| York Energy Center | 3,128,643 | Delta | York | Power plants | Volt Parent, LP (100%) |
| Hummel Station, LLC | 2,830,394 | Selinsgrove | Snyder | Power plants | Hummel Station, LLC (100%) |
| Brunner Island, LLC | 2,280,197 | Mt. Wolf | York | Power plants | Talen Energy Corp. (100%) |
| Hunterstown Combined Cycle | 2,183,973 | Gettysburg | Adams | Power plants | Platinum Equity, LLC (100%) |
| Helix Ironwood, LLC | 1,755,457 | Lebanon | Lebanon | Power plants | LS Power Equity Partners, LP (100%) |
| Pixelle Specialty Solutions | 439,049 | Spring Grove | York | Pulp and paper | Lindsay Goldberg, LLC (100%) |
| Magnesita Refractories/ York | 364,507 | York | York | Minerals | LWB Holding Co. (100%) |
| Vitro Flat Glass, LLC | 206,194 | Carlisle | Cumberland | Minerals | Vitro Flat Glass, LLC (100%) |
| Lancaster Waste to Energy Facility | 163,588 | Bainbridge | Lancaster | Waste | Lancaster County Soild Waste Management Authority (100%) |
| York County Resource Recovery | 154,605 | York | York | Waste | York County Solid Waste and Refuse Authority (100%) |
| Susquehanna Resource Mgmt Complex | 111,205 | Harrisburg | Dauphin | Waste | Lancaster County Soild Waste Management Authority (100%) |
| Arconic Lancaster Corp. | 109,531 | Lancaster | Lancaster | Metals | Arconic Corp. (100%) |
| **Top 12 Total** | **13,727,342** | | | | |
| **Region Total** | **14,972,940** | | | | **36 total facilities in Harrisburg-Lancaster-York** |

## TABLE A-4. TOP 12 POLLUTING FACILITIES — PHILADELPHIA AND SOUTHEAST REGION[111]

| Facility | Total GHG (MMT $CO_2$ eq.) | City | County | Industrial sector | Parent company |
|---|---|---|---|---|---|
| Fairless Energy, LLC | 2,814,228 | Fairless Hills | Bucks | Power plants | Edgewater Generation Holdings, LLC (100%) |
| Marcus Hook Energy Center - MH750 | 2,013,106 | Marcus Hook | Delaware | Power plants | Jera Energy America, LLC (50%); Starwood Capital Group, LLC (50%) |
| Liberty Electric Power Plant | 1,644,160 | Eddystone | Delaware | Power plants | Vistra Corp. (100%) |
| Monroe Energy, LLC, Trainer Refinery | 1,341,408 | Trainer | Delaware | Petroleum product suppliers, refineries | Delta Air Lines, Inc. (100%) |
| Grays Ferry Cogen Partnership | 609,303 | Philadelphia | Philadelphia | Power plants | Vicinity Energy, Inc. (100%) |
| Delaware Valley Resource Recovery Facility | 383,033 | Chester | Delaware | Waste | Covanta Holding Corp. (100%) |
| Merck & Co. - West Point | 245,526 | West Point | Montgomery | Chemicals | Merck & Co., Inc. (100%) |
| Wheelabrator Falls | 192,597 | Morrisville | Bucks | Waste | Wheelabrator Technologies Holdings, Inc. (100%) |
| Sunoco Partners Marketing & Terminals, LP - Marcus Hook Industrial Complex | 183,129 | Marcus Hook | Delaware | Other | Energy Transfer, LP (100%) |
| GROWS Landfill Waste Mgmt | 182,004 | Morrisville | Bucks | Waste | Waste Management, Inc. (100%) |
| Covanta Plymouth Renewable Energy, LLC | 168,004 | Conshohocken | Montgomery | Waste | Covanta Holding Corp. (100%) |
| AdvanSix Resins & Chemicals, LLC | 164,946 | Philadelphia | Philadelphia | Chemicals | AdvanSix, Inc. (100%) |
| **Top 12 Total** | **9,941,445** | | | | |
| **Region Total** | **10,895,950** | | | | **37 total facilities in Philadelphia Southeast** |

## TABLE A-5. TOP 12 POLLUTING FACILITIES — LEHIGH VALLEY REGION[112]

| Facility | Total GHG (MMT $CO_2$ eq.) | City | County | Industrial sector | Parent company |
|---|---|---|---|---|---|
| Ontelaunee Energy Center | 1,671,349 | Reading | Berks | Power plants | Vistra Corp. (100%) |
| Lower Mount Bethel Energy | 1,644,980 | Bangor | Northampton | Power plants | Talen Energy Corp. (100%) |
| Bethlehem Power Plant | 1,518,360 | Bethlehem | Northampton | Power plants | Volt Parent, LP (100%) |
| Birdsboro Power Project | 1,251,358 | Birdsboro | Berks | Power plants | AEIF Birdsboro, LLC (33.33%); Sojitz Birdsboro, LLC (33.33%); Tokyo Gas America, Ltd. (33.33%) |
| St. Nicholas Cogeneration Project | 1,139,345 | Shenandoah | Schuylkill | Power plants | Schuylkill Energy Resources, Inc. (100%) |
| John B. Rich Memorial Power Station, Gilberton Power Co. | 823,537 | Frackville | Schuylkill | Power plants | RI-Corp Development, Inc., dba Gilberton Power Co. (100%) |
| Keystone Cement Co. | 697,880 | Bath | Northampton | Minerals | Giant Cement Holding, Inc. (100%) |
| Lehigh Cement Co., LLC, Nazareth | 679,570 | Nazareth | Northampton | Minerals | Hanson Lehigh, Inc. (100%) |
| Versum Materials U.S., LLC | 608,051 | Tamaqua | Schuylkill | Chemicals, industrial gas suppliers | Versum Materials, Inc. (100%) |
| Hercules Cement Stockertown Plant Quarry | 582,535 | Stockertown | Northampton | Minerals | RC Lonestar, Inc. (100%) |
| Lehigh Cement/Evansville Cement Plant & Quarry | 523,191 | Fleetwood | Berks | Minerals | Hanson Lehigh, Inc. (100%) |
| Lafarge, NA, Whitehall Plant | 376,170 | Whitehall | Lehigh | Minerals | Holcim Participations (U.S.), Inc. (100%) |
| **Top 12 Total** | **11,516,327** | | | | |
| **Region Total** | **13,510,333** | | | | **37 total facilities in Lehigh Valley** |

## TABLE A-6. TOP 12 POLLUTING FACILITIES — NORTHEAST REGION[113]

| Facility | Total GHG (MMT $CO_2$ eq.) | City | County | Industrial sector | Parent company |
|---|---|---|---|---|---|
| Lackawanna Energy Center | 3,750,862 | Jessup | Lackawanna | Power plants | Invenergy, LLC (100%) |
| Moxie Freedom | 2,599,619 | Berwick | Luzerne | Power plants | Moxie Freedom, LLC (100%) |
| Montour, LLC | 1,111,586 | Danville | Montour | Power plants | Talen Energy Corp. (100%) |
| Procter & Gamble Paper Products | 700,177 | Mehoopany | Wyoming | Pulp and paper, waste | Procter & Gamble Co. (100%) |
| Hunlock Creek Energy Center | 137,469 | Hunlock Creek | Luzerne | Power plants | UGI Corp. (100%) |
| Transco Station 515 | 121,211 | Bear Creek | Luzerne | Petroleum and natural gas systems | Williams Cos., Inc. (100%) |
| Transco Station 517 | 92,846 | Benton | Columbia | Petroleum and natural gas systems | Williams Cos., Inc. (100%) |
| Tennesse Gas Pipeline Station 321 Clifford | 55,187 | Uniondale | Susquehanna | Petroleum and natural gas systems | Kinder Morgan, Inc. (100%) |
| Keystone Sanitary Landfill | 52,506 | Dunmore | Lackawanna | Waste | Keystone Sanitary Landfill, Inc. (100%) |
| Alliance Sanitary Landfill | 48,527 | Taylor | Lackawanna | Waste | Waste Management, Inc. (100%) |
| U.S. Gypsum – Washingtonville Plant | 45,939 | Danville | Montour | Minerals | USG Corp. (100%) |
| Geisinger Medical Center | 35,384 | Danville | Montour | Other | Geisinger Health (100%) |
| **Top 12 Total** | **8,751,311** | | | | |
| **Region Total** | **8,931,182** | | | | **19 total facilities in Northeast** |

## TABLE A-7. TOP 12 POLLUTING FACILITIES — ALTOONA-JOHNSTOWN-STATE COLLEGE REGION[114]

| Facility | Total GHG (MMT $CO_2$ eq.) | City | County | Industrial sector | Parent company |
|---|---|---|---|---|---|
| Competitive Power Ventures (CPV) Fairview Energy Center, LLC | 2,752,835 | Johnstown | Cambria | Power plants | Osaka Gas USA Corp. (50%); CPV Fairview LLC (25%); CPV Power Holdings, LP (25%) |
| Graymont PA Inc./Pleasant Gap Plt | 834,879 | Pleasant Gap | Centre | Minerals | Graymont, Inc. (100%) |
| Colver Green Energy | 817,672 | Colver | Cambria | Power plants | Generation Holdings, LP (100%) |
| Shawville Station | 410,028 | Shawville | Clearfield | Power plants | GenOn Energy, Inc. (100%) |
| Ebensburg Power Co. | 349,292 | Ebensburg | Cambria | Power plants | Ebensburg Power Co. (99.5%) |
| Pennsylvania Grain Processing, LLC | 162,552 | Clearfield | Clearfield | Other, waste | Pennsylania Grain Processing, LLC (100%) |
| Pennsylvania State Univ.–University Park | 107,885 | University Park | Centre | Other | Pennsylvania State University (100%) |
| Lilly | 80,896 | Lilly | Cambria | Petroleum and natural gas systems | Enbridge (U.S.), Inc. (100%) |
| Standard Steel Burnham Plant | 61,222 | Burnham | Mifflin | Metals | Nippon Steel North America, Inc. (100%) |
| Entriken Compressor Station | 38,297 | James Creek | Huntingdon | Petroleum and natural gas systems | Enbridge (U.S.), Inc. (100%) |
| North American Hoganas | 29,441 | Hollsopple | Somerset | Metals | North American Hoganas (100%) |
| Eastern Gas Transmission and Storage – Centre Station (Tran) | 29,425 | Pleasant Gap | Centre | Petroleum and natural gas systems | Berkshire Hathaway, Inc. (100%) |
| **Top 12 Total** | **5,674,424** | | | | |
| **Region Total** | **5,810,550** | | | | **20 total facilities in Altoona-Johnstown-State College** |

## TABLE A-8. TOP 12 POLLUTING FACILITIES — NORTH CENTRAL REGION[115]

| Facility | Total GHG (MMT $CO_2$ eq.) | City | County | Industrial sector | Parent company |
|---|---|---|---|---|---|
| Hamilton Liberty, LLC | 2,214,491 | Towanda | Bradford | Power plants | Carlyle Group Management, LLC (100%) |
| Hamilton Patriot | 2,096,221 | Montgomery | Lycoming* | Power plants | Carlyle Group Management, LLC (100%) |
| First Quality Tissue/Lock Haven | 220,841 | Lock Haven | Clinton | Pulp and paper, waste | First Quality Enterprises, Inc. (100%) |
| Domtar Paper Co., LLC | 198,585 | Johnsonburg | Elk | Pulp and Paper | Domtar Corp. (100%) |
| Eastern Gas Transmission and Storage – Leidy and Finnefrock Stations (Stor and Tran) | 140,139 | Renovo | Clinton | Petroleum and natural gas systems | Berkshire Hathaway, Inc. (100%) |
| American Refining Group, Inc. | 125,098 | Bradford | McKean | Petroleum product suppliers, refineries | American Refining Group, Inc. (100%) |
| Clinton County Solid Waste Authority - Wayne TWP Landfill | 91,871 | McElhattan | Clinton | Waste | Clinton County Solid Waste Authority (100%) |
| International Waxes Inc. | 91,792 | Smethport | McKean | Petroleum and natural gas systems | The International Group, Inc. (100%) |
| Tennessee Gas Pipeline Station 315 Wellsboro | 88,313 | Wellsboro | Tioga | Petroleum and natural gas systems | Kinder Morgan, Inc. (100%) |
| NFGSC Ellisburg Station | 85,551 | Genessee | Potter | Petroleum and natural gas systems | National Fuel Gas Co. (100%)* |
| Lycoming County Resource Management Services | 82,087 | Montgomery | Lycoming | Waste | County of Lycoming (100%) |
| Ardagh Glass, Inc. (Port Allegany) | 65,442 | Port Allegany | McKean | Minerals | Ardagh Glass, Inc. (100%) |
| **Top 12 Total** | **5,500,431** | | | | |
| **Region Total** | **6,055,531** | | | | **30 total facilities in North Central** |

*Data missing from original source. Information included through an internet search.

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