

**OUR
AIR**

HEALTH AND EQUITY IMPACTS OF OHIO'S POWER PLANTS



01. INTRODUCTION

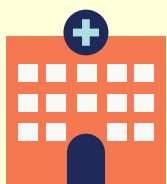
Ohio's coal and natural gas power plants create health risks and harms across the state and beyond. The distribution of these impacts falls unevenly among Ohioans, and the state's most vulnerable residents bear a disproportionate burden from these large polluting facilities.

The Clean Power Plan, which sets carbon emission reduction goals for Ohio's power sector, also provides the Buckeye state with an opportunity to achieve public health and environmental justice benefits. But the scale and distribution of these benefits will depend on policy choices the state makes when implementing the plan.

This report is based on a comprehensive public health and environmental hazard analysis authored by the energy, science, and policy institute, PSE Healthy Energy.¹ The study examines demographic,

social, and economic characteristics of communities located near fossil fuel plants, as well as the environmental health burdens and environmental hazards these neighborhoods face. The study models the national, regional, and local public health impacts of particulate matter associated with combustion at Ohio's power plants in 2015. This information can inform community-centered planning that will incorporate health, environmental, and equity dimensions to help ensure a more effective and fair Ohio State Plan for Clean Power Plan compliance.

**FIG 01. DIRTY POWER PLANTS HURT
ALL OHIOANS — ESPECIALLY OUR MOST
VULNERABLE RESIDENTS**

FIG 01.²

2,130
PREMATURE DEATHS &
\$18 BILLION
IN HEALTH BURDENS

Caused by particle pollution from burning coal and gas in Ohio power plants in 2015 alone.



88% OF OHIO'S
POWER PLANTS

In neighborhoods with more low income and/or minority families than the state median.



42% HIGHER
CONCENTRATION OF
LOW INCOME FAMILIES

Near coal and gas power plants in Ohio than the state median.

IN THIS REPORT:

- 02** The Clean Power Plan Is an Opportunity to Improve Health and Environmental Equity in Ohio
- 03** The Deadly Cost of Burning Coal and Natural Gas for Electricity in Ohio
- 04** Findings & Recommendations
- 05** Endnotes

02. THE CLEAN POWER PLAN IS AN OPPORTUNITY TO IMPROVE HEALTH AND ENVIRONMENTAL EQUITY IN OHIO

The Clean Power Plan sets a target for Ohio to reduce carbon pollution from the state's power plants. Cutting carbon pollution from coal and natural gas power plants will help Ohio do its part to fight global climate change. However, carbon pollution is just one of the many types of harmful pollution produced when fossil fuels are burned to generate electricity.

The environmental and health burdens of electricity generation in Ohio weigh disproportionately on vulnerable and disadvantaged communities. 88% of currently active fossil fuel power plants in Ohio are located in areas with higher concentrations of low-income populations than the statewide median. Additionally, 76% of these plants are located in communities with a higher prevalence of disabilities and higher proportions of elderly individuals than the state median.³ Many of these communities are also burdened by numerous other environmental, health-related, and socioeconomic stressors.⁴

When Ohio prepares its plans for carbon reduction, it has the opportunity to also address the serious health and equity harms of non-climate pollutants produced from burning dirty fossil fuels. Ohio has tremendous flexibility to implement its state plan in a way that will work best for Ohioans.

All plans must limit carbon pollution, but not all plans will result in the same level of health benefits or address environmental injustices that currently exist. Some plants have roughly equivalent carbon pollution levels, but dramatically different levels of other harmful pollution, such as fine

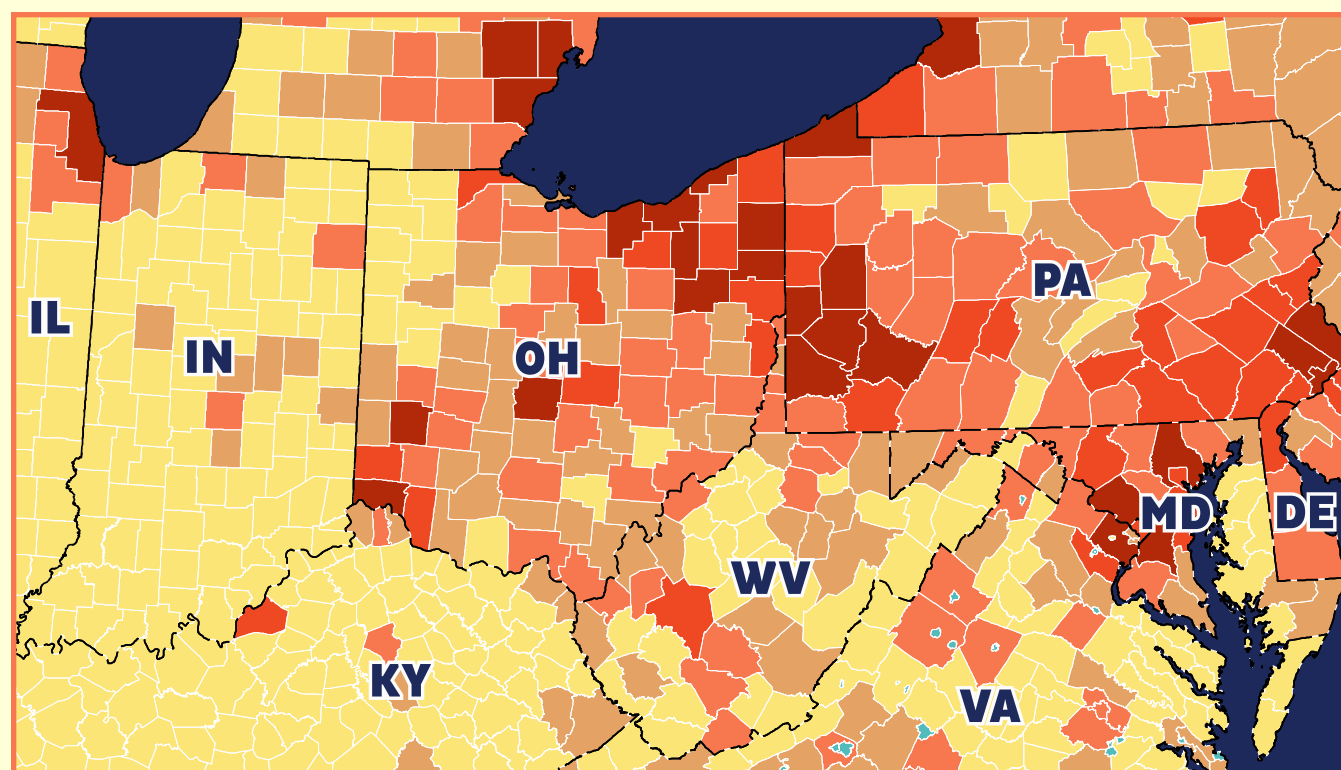
particles, sulfur dioxide, and nitrogen oxides. Prioritizing pollution cuts at the dirtiest plants will help to prevent more asthma attacks, heart attacks, and premature deaths than a plan that only addresses carbon pollution.

Ohio should implement a comprehensive plan that considers other health-damaging pollutants, in addition to carbon dioxide. Moreover, regulators should engage the communities living near power plants as central partners in the planning process. Community engagement can help ensure the most effective, fair, and healthy Ohio state plan.

KEY FINDINGS:

- 1 Pollution from Ohio coal and natural gas power plants is responsible for thousands of premature deaths a year – as many as 2,130 premature deaths from fine particulate pollution alone.⁵ This pollution also causes tens of thousands of asthma attacks and other dangerous health effects. These harms are most pronounced near and downwind of coal-burning power plants, and in major population centers such as Cleveland, Columbus, and Cincinnati.⁶
- 2 Ohio power plants are located disproportionately in low-income communities, and communities with higher proportions of residents who are elderly and residents with disabilities than the state as a whole. These trends are even more exaggerated near natural gas combined cycle plants. Populations living near many of these plants are burdened by multiple socioeconomic, health and environmental stressors.
- 3 In addition to the air pollution impacts, Ohio power plants are associated with numerous other environmental health hazards, including groundwater contamination and dangerous coal ash disposal facilities. These environmental hazards magnify the burdens placed on communities located near dirty power plants.

FIG 02. 2015 ESTIMATED REGIONAL PM_{2.5} MORTALITY FROM OHIO POWER PLANTS⁷



03. THE DEADLY COST OF BURNING COAL AND NATURAL GAS FOR ELECTRICITY IN OHIO

In addition to the health impacts of climate change, the burning of fossil fuels for electric power directly causes a wide range of negative public health impacts. In 2015 alone, particle pollution attributable to Ohio's power plants (particularly its aging coal power plants) was responsible for up to 2,130 deaths nationwide, and caused an estimated \$18 billion in health impacts.⁸ Ohio's ten highest-impact power plants alone were responsible for 90% of these estimated mortalities.⁹

FIG 03.
Health burdens from Ohio
power plants' fine particle
pollution in 2015.

2015 EMISSIONS IMPACT	
COST OF HEALTH BURDEN (\$ MILLION)	18,232
ADULT MORTALITY (US)	2,133
ADULT MORTALITY (OH ONLY)	420
NON-FATAL HEART ATTACKS	1,085
RESPIRATORY SYMPTOMS	39,289
ASTHMA ATTACKS	24,534

The effects of this pollution can be felt for hundreds of miles. In 2015, pollution from Ohio power plants was responsible for hundreds of deaths in Pennsylvania, New York, Virginia, New Jersey, Michigan, and other areas of the United States.¹⁰ But the health effects of these plants are felt most acutely in areas that are near the power plants and with the highest populations.¹¹ Cleveland, for example, is heavily impacted by nearby coal power plants including the state's

deadliest plant, Avon Lake. But the city also suffered tens of millions of dollars worth of health impacts in 2015, caused by coal-burning power plants located on the opposite side of the state.¹²

In 2015, in addition to premature mortality, dirty power plants caused thousands of heart attacks, respiratory disease (such as acute bronchitis severe enough to warrant emergency room visits), and sometimes life-

threatening asthma attacks.¹⁵ These plants also created a major drain on our economy and added potentially significant financial burdens for families by causing 112,000 lost work days nationwide.

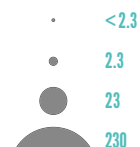
These health burdens are caused in part by fine particulate matter associated with operating these power plants. In addition to direct emissions of particulate matter, fossil fuel combustion also releases

FIG 04. ADULT MORTALITY FROM PM_{2.5} ATTRIBUTABLE TO OHIO POWER PLANTS¹⁴

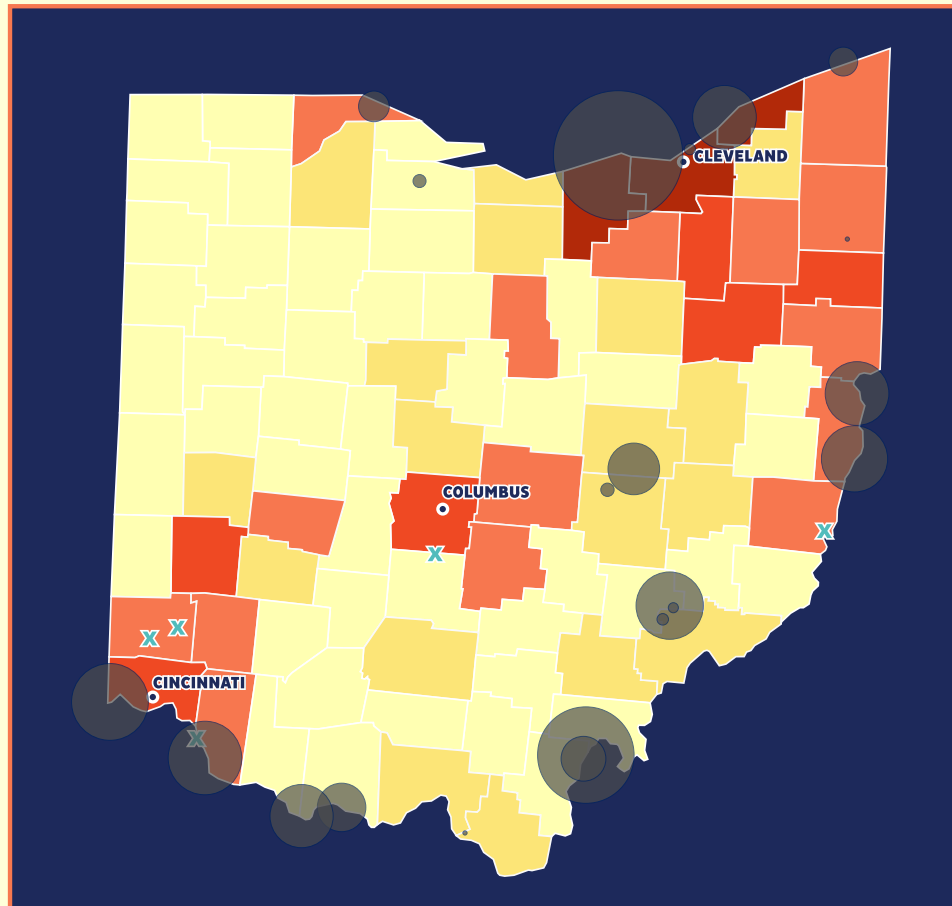
LEGEND (2015 Adult Mortality Estimate By County)



2015 ESTIMATED NATIONAL ADULT MORTALITY BY POWER PLANT



X Retired, not operational in 2015, or no data



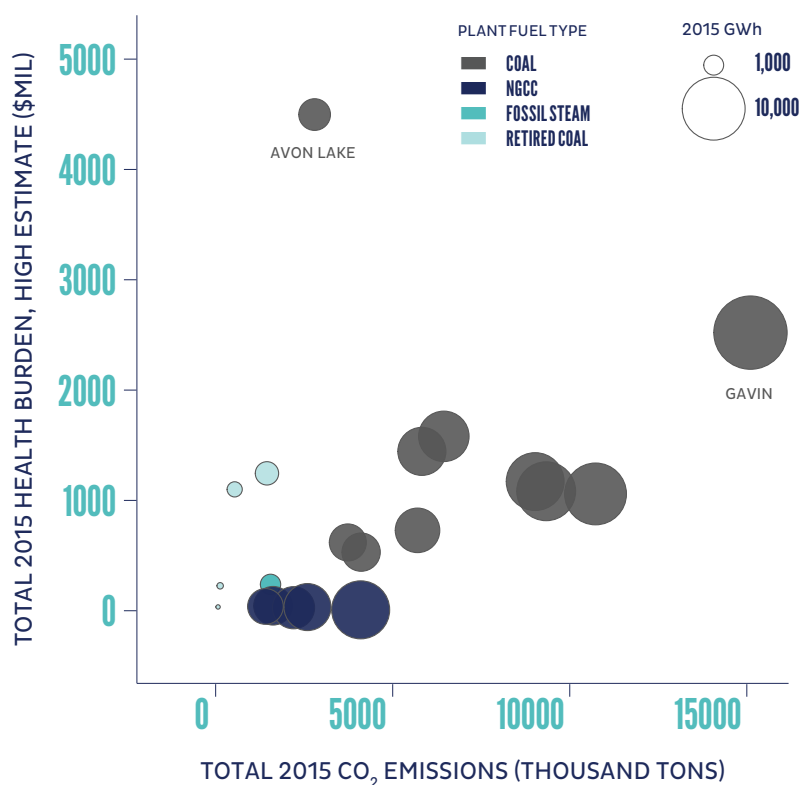
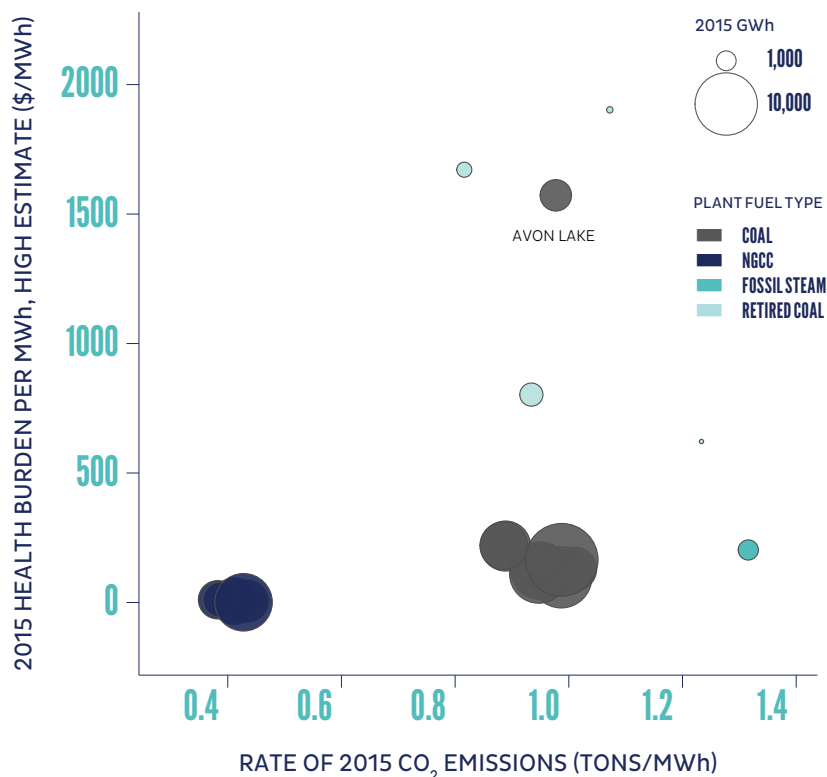
other pollutants, such as nitrogen oxides and sulfur dioxide, that can form the same types of hazardous fine particles through chemical reactions in the atmosphere. Nitrogen oxides can also react in the atmosphere to cause tropospheric ozone, a strong respiratory irritant which can contribute to a wide range of cardiovascular and respiratory health problems, particularly among members of already-vulnerable populations (e.g. low-income, minority, the elderly, and those with pre-existing diseases).¹⁶

Not only does fossil fuel combustion degrade air quality, but it also creates toxic waste products that pose environmental hazards in communities that host facilities to dispose of this waste.¹⁷

Both operating and retired power plants, particularly coal plants, are often associated with other human and environmental health hazards. Coal combustion leaves a residual known as coal ash, which is one of the largest contributors by volume to industrial waste in the United States.¹⁸

FIG 05 & 06.²¹

The health benefit of eliminating one ton of carbon pollution can vary significantly even among plants of the same type (Fig 5), but overall, the most-polluting plants are also the most dangerous to our health (Fig 6).



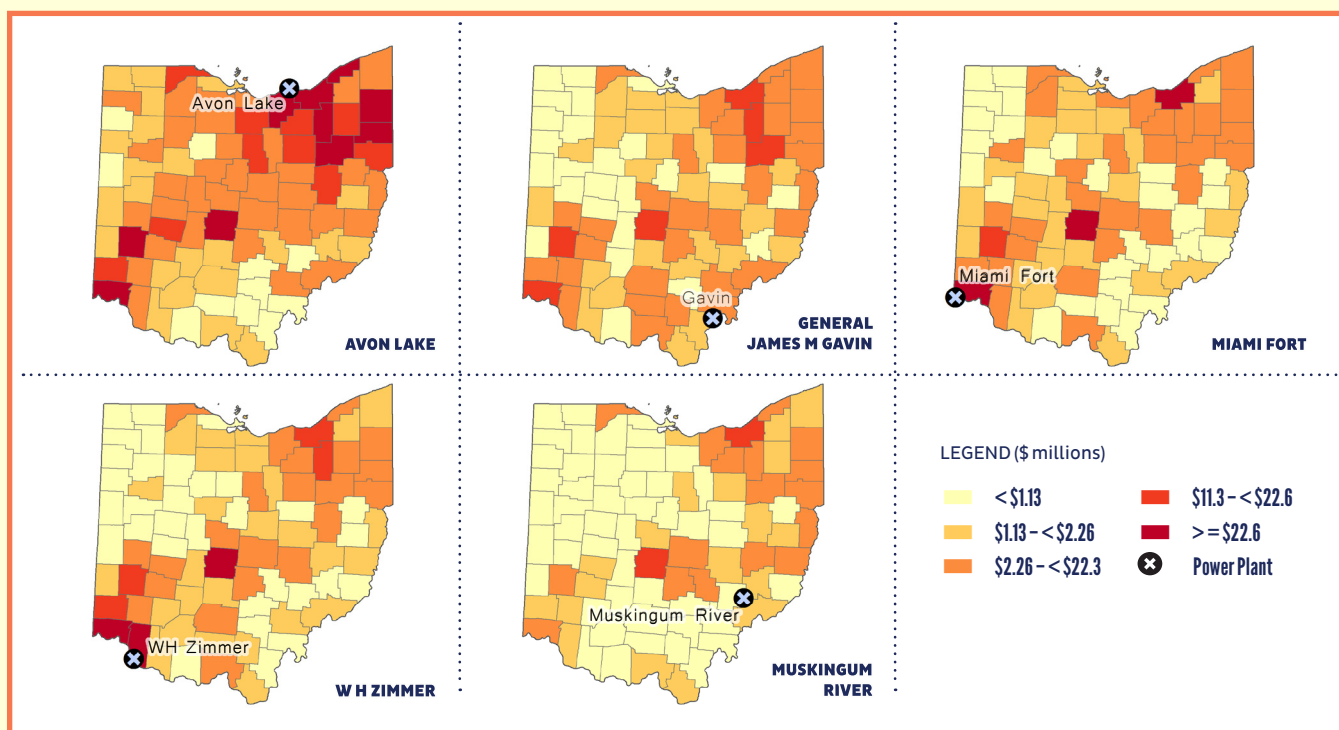
OHIO'S DEADLIEST POWER PLANT: AVON LAKE

Located just outside of Cleveland, Avon Lake Power Plant is one of the dirtiest, deadliest power plants in America.¹⁸

- 1 Avon Lake caused an estimated 512 premature deaths across the country in 2015 from fine particulate pollution alone.
- 2 Avon Lake has the second-highest total emissions of sulfur dioxide in the country.
- 3 Avon Lake is located in Lorain County, which suffers the second-largest cumulative impacts of Ohio power plant pollution (despite ranking only 9th in population). Lorain County faces the highest per-capita health impacts, and one of the highest asthma prevalence rates in the state.
- 4 Both Lorain County, which is where Avon Lake is located, and Cuyahoga County, which is right next door and home to Cleveland, suffer from dangerously poor air quality due to levels of both ozone and fine particulate matter that exceed federal standards.
- 5 Avon Lake has been out of compliance with Clean Air Act requirements for at least the last three years.



FIG 07. 2015 COST ESTIMATE OF HEALTH IMPACTS BY COUNTY FROM OHIO'S 5 DIRTIEST PLANTS



Because of these patterns of contamination, the fact that groundwater wells are the source of fresh drinking water for nearly half of Ohio residents and businesses is cause for special concern.¹⁹ According to the data available, wells near coal ash ponds show levels of lead, arsenic, and other contaminants at concentrations many times higher than the EPA's maximum allowable levels.²⁰ Although all exceedances cannot necessarily be attributed to coal ash ponds, both the exceedance and the physical proximity of coal ash ponds to drinking water sources represent environmental and health risks in these communities. There is also a risk that these coal ash ponds can leak or spill, causing widespread water contamination and health and environmental impacts. This hazard continues to persist long after coal plants retire.

A key characteristic of fossil fuel combustion is the connection between carbon emissions and the release of other harmful pollutants. The relationship may vary depending on whether we consider total emissions or rate of emission per MWh, but it is undeniable that reducing Ohio's reliance on the types of energy that emit carbon pollution will also mean reducing the amount of environmental pollutants associated with burning these fuels.

PATTERNS OF INEQUITY

Power plants are often located near marginalized communities that have higher proportions of low-income, disabled, minority, less-educated, and elderly residents.²³ As mentioned above, 88% of currently active fossil fuel power plants in Ohio are located in areas with higher concentrations of low-income populations than the statewide median.²⁴

All Ohio power plants covered by the Clean Power Plan, except five, are surrounded by communities where the population is more likely than the state median to have not completed a high school degree. Also, all power plants except five are located in communities with higher percentage of residents above 64 years old than the median.²⁵

There are also notable patterns across the different types of fossil fuel plants. When weighted by population density, communities near current and proposed natural gas plants, for example, have higher percentages of low-income households, minority households, and individuals without a high school education than communities near coal plants.²⁶

If Ohio cuts power plant carbon pollution by relying more on existing natural gas plants and less on existing coal plants, pollution reductions will result in fewer negative health effects and improvements in air quality overall. But these health and

environmental benefits will accrue unevenly across the state. Increased reliance on natural gas may mean more generation at plants located near disproportionately low-income communities.²⁷ Constructing new natural gas plants may further exacerbate environmental inequities. For example, two of Ohio's planned natural gas plants (Middletown Energy and Carroll County) and one of its existing natural gas plants (Hanging Rock) are to be located in areas facing cumulative health, environmental, and demographic burdens that make them among the five most vulnerable communities near active or planned power plants in Ohio. (See Fig. 11)

Often, communities near power plants also start from a place of poorer health quality, experiencing lower rates of health insurance and a higher prevalence of disability than the state as a whole.²⁸ This trend is amplified near natural gas plants, which have an even higher prevalence of low-income families, adult disability, and lack of health insurance than communities living near coal plants.²⁹ The steeper socioeconomic and health obstacles these communities face mean they are less equipped to deal with the negative health impacts of power plant pollution. These socioeconomic factors are often compounded by other environmental stressors like poor air quality, proximity to traffic congestion, and toxic exposures from industrial activities.

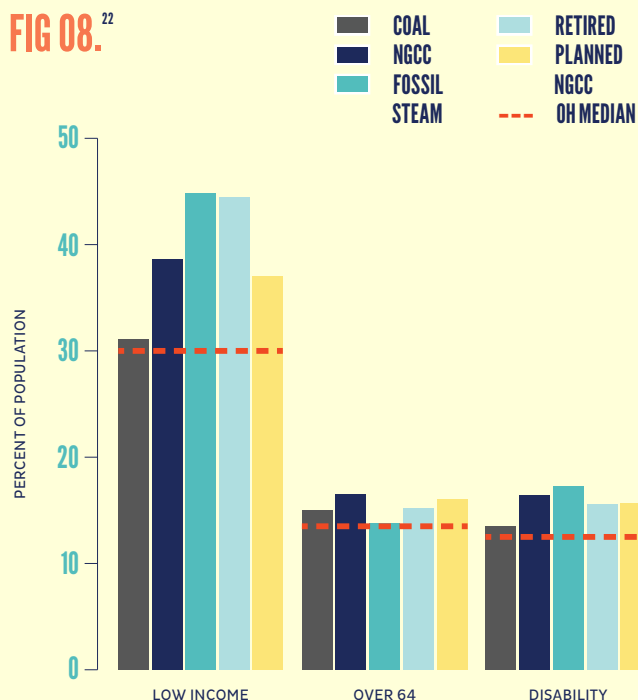
FIG 08.²²

FIG 09.

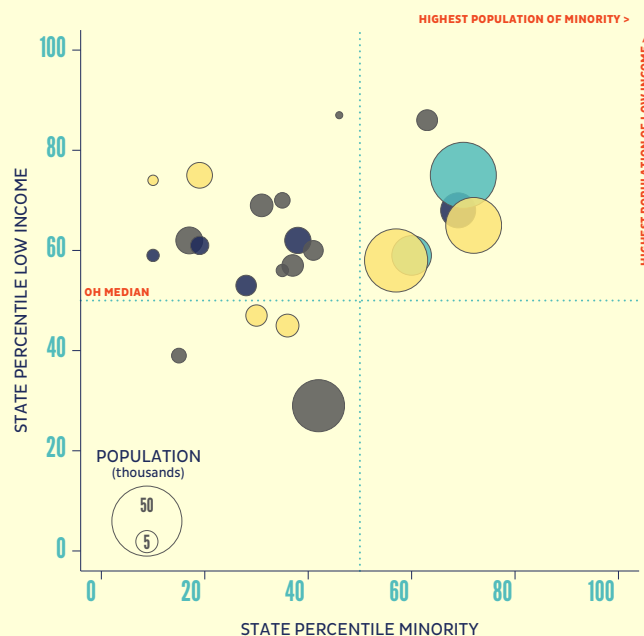


FIG 10. TOTAL AND AVERAGE NUMBER OF INSPECTIONS AND VIOLATIONS BY POWER PLANT CLASS (2011–2015)

	TOTAL 2011-2015	AVERAGE PER PLANT	AVERAGE PER TWh	AVERAGE PENALTY PER VIOLATION	AVERAGE NUMBER NEAR HIGH-DI AREA PLANT	AVERAGE NUMBER NEAR LOW-DI AREA PLANT
VIOLATIONS						
COAL	29	3.22	0.0737	\$834,310	6	1.83
NGCC	2	.33	0.0185	\$0	0	0.5
INSPECTIONS						
COAL	31	3.44	0.0788	—	4.33	3.0
NGCC	20	3.33	0.185	—	2.5	3.75

FOSSIL PLANTS ARE HEAVILY CONCENTRATED IN LOW-INCOME AREAS. PLANNED NATURAL GAS PLANTS MAY DISPROPORTIONATELY IMPACT AREAS WITH HIGH CONCENTRATIONS OF MINORITY RESIDENTS (FIGS 08 & 09). PLANTS IN VULNERABLE AREAS SEE FAR MORE VIOLATIONS OF STATE AND FEDERAL LAWS (FIG 10).

Not only are people near plants routinely exposed to pollution, but they are also on the front lines for exposure when plants violate state and federal statutes. The average number of violations that coal plants received between 2011-2015 was almost 3 times higher in low income and/or minority areas, defined as above the 60th percentile on the EPA's Demographic Index.³⁰ Across all fuel types, the 18 power plants located in higher-income, low-minority Demographic Index communities had 23 violations over the past five years, whereas the remaining 9 power plants in lower-income, higher-minority

communities had 24 violations—more than twice the number of violations per plant. Conversely, inspection rates at plants near those same low income, higher-minority areas are nearly 1.5 times higher for coal than natural gas combined cycle.³¹ This suggests that plants in vulnerable communities receive more violations, which may mean that additional environmental health hazards are occurring in the surrounding communities. (See Fig 10)

The environmental hazards associated with these violations could potentially be reduced or eliminated through reduced energy generation at these

facilities under the Clean Power Plan. But these data also underscore the need for careful, consistent, and more frequent inspections of power generation sites, especially in disproportionately vulnerable communities.

These patterns matter because they indicate how shifts in energy production could affect different communities in different ways. For example, we found that four of the five most vulnerable communities living near power plants are near retired coal plants, so repowering these retired coal plants as natural

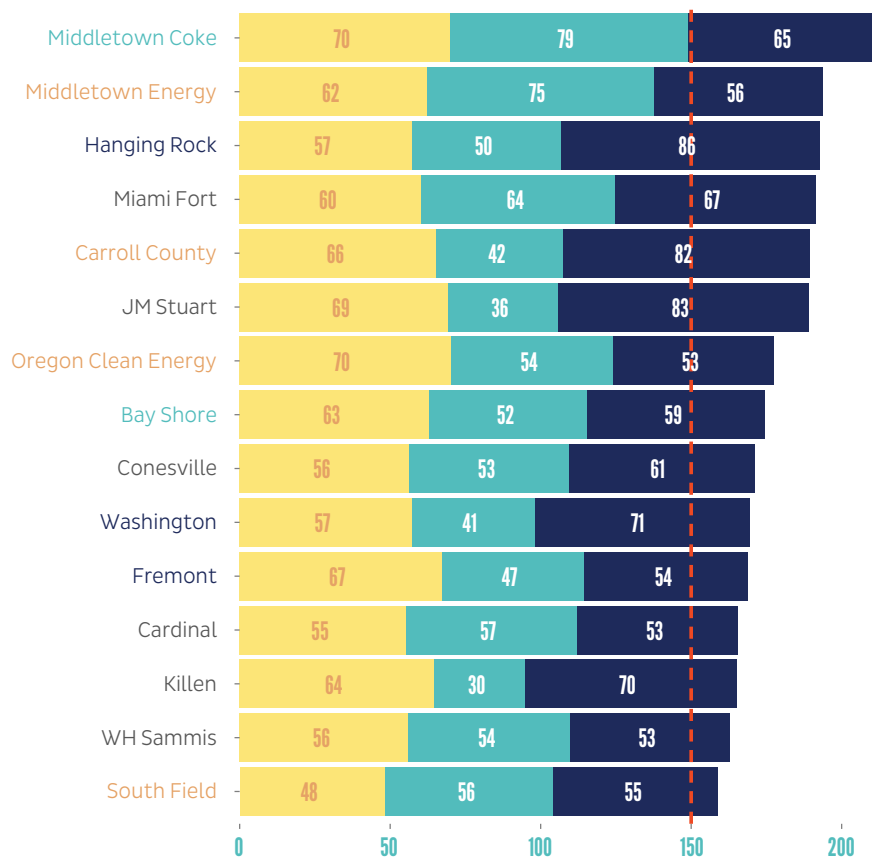


FIG 11.
CUMULATIVE VULNERABILITY INDEX²⁷

Cumulative index of demographic, environmental and health indicators for populations living near OH power plants.

PLANT FUEL TYPE

- Coal
- NGCC
- Fossilsteam
- Planned NGCC
- OH Median
- Demographic
- Environmental
- Health

gas plants would mean at least partially re-introducing burdens on the most vulnerable communities. Five of six planned natural gas plants will be located in Ohio communities that are more vulnerable than the median when considering cumulative environmental, health and demographic characteristics. Two of these planned plants are in areas that are among the top five most burdened areas near active or planned power plants in the state. Relying on new fossil generation at these or other new natural gas plants is likely to further increase health and environmental burdens on these communities.³² On the other hand, moving to renewable generation or decreasing total energy production through efficiency measures would avoid this increase in disproportionate impacts, although legacy toxic hazards associated with retired plants will remain.

The Environmental Protection Agency has instructed states that State Plans must not disproportionately impact vulnerable and overburdened communities.³³ Policymakers must take past and present environmental and health inequities into consideration as in order to implement the Clean Power Plan in a way that maximizes benefits and improves fairness going forward.

PATHWAYS TO MAXIMUM BENEFITS

The Clean Power Plan requires states to reduce carbon emissions from coal and natural gas power plants. States have flexibility to map their own unique pathways to accomplish this goal. When evaluating different policy options to meet its state target, Ohio has the opportunity to design a program that prioritizes health and equity outcomes for all of its communities.

There are many potential strategies for Clean Power Plan compliance. These approaches could include shifting the electrical generation from coal to existing natural gas combined cycle plants, increasing energy efficiency and ramping up generation from renewables like wind and solar, or a combination of these strategies. Ohio has seen significant shifts in the character of its fossil fuel fleet over the past three years, including the closure of ten coal power plants. Plans also exist to more than double the number of natural gas plants in the state. While these changes will result in lower levels of carbon pollution from existing sources, there is a risk that this pollution abatement could be significantly eroded by a rush to build new fossil fuel generation at natural gas plants, rather than focusing on clean energy resources. The key to ensuring effective limits on power plant pollution will be Ohio's adoption

of the "New Source Complement" to the state's Clean Power Plan emissions target so that all Ohio sources are accounted for in its plans.

Given the presence of vulnerable communities near existing natural gas combined cycle generation, an emphasis on renewables and efficiency, rather than increased natural gas generation, is the best way to realize the benefits of the Clean Power Plan without placing a disproportionate impact on vulnerable communities. Deployment of renewables and increasing efficiency at faster rates than required to meet Clean Power Plan targets is another way to achieve significant improvements in air and water quality without increasing reliance on gas.

Given the wide distribution of burdens on communities living near all types of power plants, extensive community input and careful modeling of possible changes in generation are needed. Changes in the electricity generation levels at power plants throughout the state will affect the associated health burdens in vulnerable communities. The concerns of these communities should be front and center; the best people to represent these concerns are the members of these communities themselves.

04. FINDINGS AND RECOMMENDATIONS

- Targeting carbon reductions at plants with high emission rates for multiple pollutants has the potential to achieve both carbon goals and health improvements.
- Shifting generation to natural gas plants or converting retired coal plants to run on natural gas may increase generation near already disadvantaged and vulnerable communities, while deployment of efficiency and renewable energy to meet the Clean Power Plan targets could lessen some of these burdens.
- Adopting the “New Source Complement” will ensure that emissions, and associated health burdens, are not just shifted from old plants to new but are effectively reduced.
- Engaging communities can provide further insight into environmental and health concerns at a local level as communities assess how reduced fossil fuel reliance will impact them.

CONCLUSION

Ohio's state strategy to meet the federal Clean Power Plan provides the Buckeye state with an opportunity to achieve public health and environmental justice co-benefits. Fossil fuel combustion for energy produces air and water pollutants and toxic releases. The combustion of fossil fuels for electricity in Ohio causes thousands of premature deaths every year, non-fatal heart attacks, respiratory symptoms, asthma attacks, and other health issues. Our study found that communities already disproportionately burdened with a lower socioeconomic status and environmental hazards are the most likely to be affected, positively

or negatively, by shifts in Ohio's energy generation sector. Ohio should approach its State Plan by maintaining a focus both on greenhouse gas reductions and protecting public health, especially among the most currently overburdened communities. The state should adopt a community-centered approach that prioritizes cutting both carbon dioxide and health damaging air pollutants, especially from the worst offenders, and we all should aim to reduce pollution to the greatest extent possible, rather than merely meeting the minimum requirements of the Clean Power Plan.

APPROACHES TO IMPLEMENTING THE CLEAN POWER PLAN THAT INTEGRATE HEALTH, ENVIRONMENTAL JUSTICE AND EQUITY GOALS SIMULTANEOUSLY HOLD POTENTIAL TO MITIGATE CLIMATE CHANGE, REDUCE PUBLIC HEALTH RISKS, AND HELP TO ALLEVIATE ENVIRONMENTAL BURDENS ON THE MOST VULNERABLE POPULATIONS.

ENDNOTES

- 1** Krieger, E, et al., "The Clean Power Plan in Ohio: Analyzing power generation for health and equity," July 2016. <https://nextgenamerica.org/news-reports/our-air-ohio-technical/>. PSE modeled health impacts from each plant using the EPA-developed Co-Benefits Risk Assessment (COBRA) model and an externally developed Air Pollution Emission Experiments and Policy (AP2) model. COBRA provides a low and a high estimate based on two different underlying epidemiological studies. Unless otherwise noted, all numbers in this report refer to the COBRA high estimate.
- 2** Id. p. 55; p. 16 (Figure 3.3); p. 14 (Figure 3.2).
- 3** Id. p. 15 (Figure 3.3).
- 4** Id. p. 13 (Figure 3.1); p. 20 (Figure 3.7).
- 5** Id. p. 64. <https://nextgenamerica.org/news-reports/our-air-ohio-technical/>.
- 6** Id. p. 57 (Figure 5.8).
- 7** Id. p. 58 (Figure 5.9).
- 8** Id. p. 54 (Table 5.2).
- 9** Id. p. 55.
- 10** Id. p. 56 and p. 58 (Figure 5.9).
- 11** Id. p. 57.
- 12** Id. p. 60 (Figure 5.12).
- 13** Id. p. 47 et seq.
- 14** Id. p. 57 (Figure 5.8).
- 15** Id. p. 54 (Table 5.2).
- 16** The health impacts of ozone pollution from power plants are substantial, but were not modeled in this study. The impacts modeled in this study are therefore likely an underestimate of the total health and environmental burden associated with air pollution from Ohio's power plants.
- 17** Krieger, E, et al., "The Clean Power Plan in Ohio: Analyzing power generation for health and equity," July 2016, p. 23. <https://nextgenamerica.org/news-reports/our-air-ohio-technical/>.
- 18** US EPA, "Coal Ash (Coal Combustion Residuals, or CCR)," 4/11/16. <https://www.epa.gov/coalash>
- 19** Id. p. 25.
- 20** Krieger, E, et al., "The Clean Power Plan in Ohio: Analyzing power generation for health and equity," July 2016, p. 31. <https://nextgenamerica.org/news-reports/our-air-ohio-technical/>.
- 21** Id. p. 61 (Figures 5.14a and 5.14b).
- 22** Id. p. 14 (Figure 3.2).
- 23** Id. p. 14 (Figure 3.2).
- 24** Id. p. 15 (Figure 3.3).
- 25** Id. p. 14.
- 26** Id. p. 14 (Figure 3.2).
- 27** Id. p. 64.
- 28** Id. p. 21 (Figure 3.8).
- 29** Id. p. 14 (Figure 3.2) and p. 21 (Figure 3.8)
- 30** Id. p. 39 (Table 4.3).
- 31** Id. p. 38.
- 32** Id. p. 22 (Figure 3.9).
- 33** Id. p. 1 (Box 1.0.1)