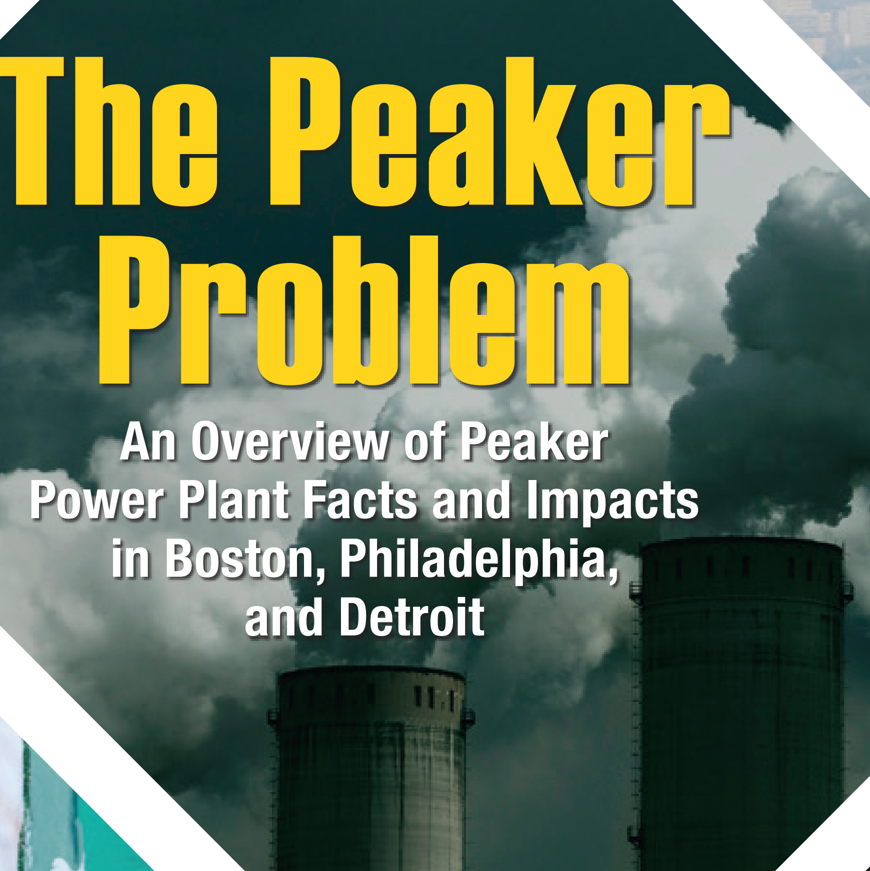
Prepared by
Clean Energy Group
with STRATEGEN

JULY 2022



The Peaker Problem

An Overview of Peaker Power Plant Facts and Impacts in Boston, Philadelphia, and Detroit

ABOUT THIS REPORT

This report, prepared by Clean Energy Group (CEG) with Strategen, examines the peaker power plant landscape in Boston, Philadelphia, and Detroit. The report describes specific peaker plants and their emissions, their context within the surrounding community, and the disparity in the impacts on low-income communities and communities of color in those cities. The report also presents the differing policies in each city that affect these plants as well as a look at the latest health impact research related to small particulate matter ($PM_{2.5}$) and nitrogen oxides (NO_x) and their impact on the human body.

ACKNOWLEDGEMENTS

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Contents

Glossary

Ancillary services: functions that help maintain the proper flow and direction of electricity on the grid, address imbalances between supply and demand, and help the grid recover after an outage (including frequency regulation, voltage control, and black start).

Baseload plant: a power plant that runs continuously over extended periods of time to meet the "base" power demand on the grid.

Battery storage: devices that enable energy to be stored and then released when needed. Also called battery energy storage systems (BESS). The most common battery technology today is lithium-ion, but the technology options are constantly evolving.

Black start: the capability of a generator to start from total shut-down without pulling energy from the grid. Black start as a service means putting energy into the grid after a power outage to restore power in a part of the system or to start generation turbines.

Btu: a British thermal unit (BTU or Btu) is a unit of heat; it is defined as the amount of heat required to raise the temperature of one pound of water by one degree Fahrenheit.

Capacity factor: a measure of plant utilization based on the energy produced in a year as a percentage of the maximum energy that it could have produced assuming it operated all 8,760 hours in the year.

Capacity market: in wholesale electricity markets, capacity markets are used to pay resources for being able to meet electricity demand. Capacity markets often compensate generators for the ability to produce electricity in the future.

Carbon dioxide (CO_2): a colorless gas formed during the combustion of any material containing carbon; a significant greenhouse gas.

Combined cycle (CC): a type of natural gas power plant that combines a simple cycle gas turbine with a second steam engine. The plant uses a heat recovery system to capture the hot exhaust gases from the combustion turbine to heat water to create steam which can be used to turn another turbine, increasing the plant's overall efficiency.

Combustion turbine (CT): a turbine that uses pressurized gas to spin it to generate electricity. The pressurized gas is created by burning a fuel, such as natural gas, kerosene, propane or jet fuel.

Community-based organization (CBO): a public or private nonprofit organization of demonstrated effectiveness that is representative of a community and provides educational or related services to individuals in the community.

Demand response: programs that allow consumers to be compensated to reduce or shift their consumption of electricity, reducing the need for peaker power plants. Tools used to incentivize these customers include special electricity rates that are highest during anticipated peak demand periods on the grid as well as utility notifications for customers to lower consumption or discharge batteries and direct load control programs for appliances such as air conditioners and water heaters.

Energy efficiency: the use of less energy to perform the same task or produce the same result. Common energy efficiency practices include improving building insulation, sealing ducts and air leaks, switching to LED lighting, switching to heat pump HVACs and water heaters, and weatherizing buildings.

Energy equity: energy equity recognizes that disadvantaged communities have been historically marginalized and overburdened by pollution, underinvestment in clean energy infrastructure, and lack of access to clean energy technologies.

Federal Energy Regulatory Commission (FERC): an independent agency that regulates the interstate transmission of electricity, natural gas, and oil.

Gas turbine (GT): see combustion turbine.

Generation: as used in this report, this term refers to electric power generation.

Generators: as used in this report, this term typically refers to utility-scale power plants.

Gigawatt (GW): a gigawatt (GW) is 1,000 megawatts and one billion watts.

Heat rate: a measure of the efficiency by which a power generator converts fuel into heat and electricity. It is the amount of energy used to generate one kilowatt-hour (kWh) of electricity. A high heat rate indicates an inefficient plant that, 1) requires more fuel to generate the same kilowatt-hour, and 2) often has higher emissions as a result.

Investor-owned utility (IOU): a private (owned by investors/stockholders) monopoly utility that provides electricity to a defined service territory. IOU's are regulated by a state entity such as a utility commission or a public service commission.

Independent System Operator (ISO): the term is often used synonymously with Regional Transmission Organization (RTO). An ISO or RTO is an independent non-profit corporation that operates the region's electricity grid, administers the region's wholesale electricity markets, and provides reliability planning for the region's bulk electricity system. There are seven ISOs/RTOs in the U.S. The Southeast and many western states do not have an ISO/RTO.

Kilowatt: a kilowatt (kW) is one thousand watts.

Kilowatt-hour (kWh): a measure of electrical energy equivalent to a power consumption of 1,000 watts for one hour.

Load: the amount of electricity on the grid at any given time. Load can vary by location and it fluctuates to meet demand.

Megawatt: a megawatt (MW) is one million watts. It is a commonly used in the power business when describing generation or load consumption.

Megawatt-hour (MWh): a measure of electricity equal to 1,000 kilowatt hours (kWh). It is equal to 1,000 kilowatts of electricity used continuously for one hour.

Merchant plant: a merchant-owned power plant is owned by private investors who raise the capital to build the plant and then sell power to off-takers such as cities and towns, investor-owned utilities, and grid operators. The private investors assume the financial risks associated with the plant.

Municipal plant/muni: power plants that are owned and operated by a local government entity such as a city or a county.

Nitrogen oxides (NO_x): a family of poisonous, highly reactive gases that are formed when fuel is burned. Exposure to nitrogen dioxide (NO_2) and other nitrogen oxides can cause severe long-term damage to the respiratory system, including the development of asthma and respiratory infections. NO_x serves as a precursor to the formation of particulate matter and ozone.

Ozone/Ground-level ozone: a colorless gas formed through chemical reactions between nitrogen oxides (NO_x) and volatile organic compounds (VOCs) in the presence of sunlight. Ground-level ozone forms just above the earth's surface and is an irritant and can negatively affect human health.

Particulate matter ($PM_{2.5}$): $PM_{2.5}$ is tiny particles that measures 2.5 micrometers in diameter or smaller. It can be a direct by-product of fossil fuel combustion, or it can be formed when other emissions such as nitrogen oxides (NO_x) and sulfur dioxide (SO_2) clump together. A human hair is 50-70 micrometers in diameter. The tiny air sacs in our lungs, called alveoli, are 200 micrometers in diameter.

Peaker plant: a power plant that can turn on and off very quickly to meet temporary peaks in electricity demand. Peaker power plants are usually located close to load (people and businesses) and are typically fueled by oil or natural gas (methane).

Ramping or ramp rate: the speed at which a generator can increase (ramp up) or decrease (ramp down) generation.

Renewable Portfolio Standard (RPS): a regulatory mandate to increase production of energy from renewable sources such as wind and solar.

Sulfur dioxide (SO_2): a gaseous pollutant composed of sulfur and oxygen that forms when sulfur-containing fuel such as coal, oil, or diesel is burned. Sulfur dioxide converts to sulfates in the atmosphere, a major part of fine particulate matter ($PM_{2.5}$) pollution.

Transmission: the bulk movement of electrical energy from a generating site such as a power plant to an electrical substation. This is distinct from the local wiring between high-voltage substations and customers, which is called the *distribution* network.

Watt: the amount of energy (in Joules) that an electrical device (such as a light) is burning per second that it's running.

Virtual Power Plant (VPP): a network of distributed energy resources, such as homes with solar and battery systems, all coordinated by an aggregator and working together in a way that mimics the operation of a large power plant.

PHOTO: ISTOCKPHOTO/CAHKT

Introduction

ON THE VERY HOTTEST SUMMER AFTERNOONS, as the heat of the day builds up to its maximum, a specific type of electric power plant fires up to handle the surge in demand for electricity. This kind of power plant is called a "peaker power plant," or a "peaker" for short. The role of peakers is to quickly add enough power to the grid to make sure that the electricity needed for air conditioners and refrigerators is readily available to keep both people and products at a safe temperature. Peakers supply temporary power to the grid in addition to the power that baseload power plants provide. Baseload plants typically generate electricity at a fairly steady level throughout the day all year long, while peakers fire up and then power down over a short duration of time, sometimes for only a couple of hours on a few days per year.

Many peakers emit pollutants at a higher rate than baseload plants, spewing harmful emissions from fossil fuel combustion into communities that surround them. These communities are often already overburdened by pollution. **Nationwide, the majority of peaker plants are located in communities that have a higher-than-average percentage of low-income households, and the dirtiest peakers disproportionately impact communities of color**.[1,2] **Table 1** and **Table 2** below summarize these findings.

TABLE 1

Peaker Distribution and Emissions: Low-Income Percentiles

Percentile	Number of peakers	Population within a 3-mile radius	Low-income percentage of population	Average nitrogen oxide (NOx) emission rate
0–25th	86	2.3 million	0–16%	9.9 lb/MWh
25th –50th	307	13.1 million	16–29%	12.0 lb/MWh
50th –75th	538	28.6 million	29–46%	19.5 lb/MWh
75th–100th	217	12.3 million	46–100%	16.2 lb/MWh

Two-thirds of peaker power plants in the U.S. are located near communities with a higher percentage of low-income households than the national average, represented by populations where at least 29 percent of household incomes are less than or equal to twice the federal poverty level. On average, nitrogen oxide emissions rates are higher for peakers located near these lower-income populations. These findings are based on Clean Energy Group analysis of data from the U.S. EPA's Power Plants and Neighboring Communities mapping tool.

SOURCE: CLEAN ENERGY GROUP

1 Seth Mullendore, "Mapping the Inequities of Fossil Peaker Power Plants," *Clean Energy Group*, April 21, 2022, https://www.cleanegroup.org/mapping-the-inequities-of-fossil-peaker-power-plants (accessed June 6, 2022).

2 Low-income for the purposes of this report is defined as those with a household income lss than or equal to twice the federal poverty level. People of color is defined as individuals not identifying as Non-Hispanic White.

TABLE 2

Peaker Distribution and Emissions : People of Color Percentiles

Percentile	Number of peakers	Population within a 3-mile radius	People of color percentage of population	Average nitrogen oxide (NOx) emission rate
0–25th	346	2.9 million	0–13%	14.6 lb/MWh
25th –50th	304	8.0 million	13–31%	16.4 lb/MWh
50th –75th	348	28.3 million	31–65%	14.2 lb/MWh
75th–100th	150	17.1 million	65–100%	23.8 lb/MWh

The majority of Americans impacted by peakers live in communities with higher percentages of people of color. Some of the country's most racially diverse communities, where at least 65 percent of the population identifies as a race other than non-Hispanic White, are disproportionately subject to higher levels of toxic peaker emissions than other communities, with nitrogen oxide emissions rates that average more than 60 percent higher than populations with low percentages of people of color. These findings are based on Clean Energy Group analysis of data from the U.S. EPA's Power Plants and Neighboring Communities mapping tool.

SOURCE: CLEAN ENERGY GROUP

Clean Energy Group (CEG), a national nonprofit organization working to accelerate an equitable and inclusive transition to a resilient, clean energy future, focuses on peakers through its Phase Out Peakers project for two reasons. First, it is increasingly possible to replace dirty fossil fuel peakers with non-combustion alternatives such as battery storage, renewable energy, transmission improvements, virtual power plants, and aggressive energy efficiency and demand-side management. Second, and more importantly, are the disproportionate health impacts that peakers impose on the communities that surround them, as Tables 1 and 2 demonstrate. Closing fossil-fueled peakers and replacing their function on the grid with non-combustion alternatives removes one source of systemic pollution from communities that are shouldering a disproportionate burden.

Boston, Philadelphia and Detroit were chosen because they have a high number of peakers that disproportionately impact low-income communities and communities of color, according to the U.S. Environmental Protection Agency's (EPA) Power Plants and Neighboring Communities mapping tool.

Clean Energy Group has extensive experience analyzing peakers and providing support for their replacement with batteries in New York City through its work with the PEAK Coalition (see **Appendix A**). After the PEAK Coalition's success in halting the repowering of polluting peakers in New York City, CEG sees the need and opportunity to provide similar support in other urban areas. This report is an overview of the peaker landscape in three urban areas: Boston, Philadelphia, and Detroit.

Boston, Philadelphia and Detroit were chosen because they have a high number of peakers that disproportionately impact low-income communities and communities of color, according to the U.S. Environmental Protection Agency's (EPA) Power Plants and Neighboring Communities mapping tool.[3] These cities also represent different transmission organizations that run the grid as well as different new and emerging state policy options that may be

PHOTO: IJUBAPHOTO

3 "Power Plants and Neighboring Communities Mapping Tool," *United States Environmental Protection Agency*, https://experience.arcgis.com/experience/2e3610d731cb4cfcbcec9e2dcb83fc94?views=view_12 (accessed June 6, 2022).

helpful tools to facilitate peaker replacement. The most important considerations in these cities are the frontline communities and community-based organizations (CBOs) who face the impacts of pollution burden every day. New Orleans is highlighted in **Appendix A** to illustrate the lessons learned after a new $210 million gas peaker—that was built on the premise of providing resilience during severe weather—failed during Hurricane Ida, leaving thousands without power for days.[4] The report spotlights some of the community-based organizations in each city and the important work they are already doing to create healthy, vibrant, thriving communities.

The report also details several specific, high-impact peakers in each city in order to provide a robust explanation of how peakers differ from neighborhood to neighborhood, and how they impact the communities around them. **The intention is to raise general awareness rather than to advocate for the replacement of *specific* facilities with non-combustion alternatives. Community-based organizations have a much better understanding of which pollution emitters are of the highest priority for replacement.**

New Orleans is highlighted to illustrate the lessons learned after a new $210 million gas peaker—that was built on the premise of providing resilience during severe weather—failed during Hurricane Ida, leaving thousands without power for days.

Communities across the country deserve a clean energy supply, and peaker plants are some of the best targets for rapid replacement to accelerate the transition toward a cleaner, more equitable energy system.

4 Sophie Kanaskove and Nicholas Bogel-Burroughs, "New Orleans Built a Power Plant to Prepare for Storms. It Say Dark for Two Days, *The New York Times*, Sept. 10, 2021, Updated September 18, 2021, https://www.nytimes.com/2021/09/10/us/ida-new-orleans-power.html (accessed July 7, 2022).

PHOTO: GOOGLE EARTH

PART ONE
A Peaker Primer

What is a peaker plant?

MOST OF THE ELECTRICITY that is used every day is supplied by "baseload" power plants. These plants run at some basic level of power production, most of the time. They can be nuclear or fossil-fuel plants (coal, oil, or natural gas, also known as methane), and they are difficult to turn on and off quickly as demand for power changes. To supplement the baseload plants during times of extreme heat and cold when demand for power for heating or cooling ramps up, the electric power industry builds "peaker" plants that can turn on and off quickly (called "ramping"). Utilities and grid operators are also increasingly relying on gas peaker plants to provide ramping to balance intermittent energy resources.

Helpful Definitions

Ramping or ramp rate: The speed at which a generator can increase (ramp up) or decrease (ramp down) generation.

Capacity factor: A metric of plant utilization based on the energy produced in a year as a percentage of the maximum energy that it could have produced assuming it operated during all 8,760 hours in the year.

Heat rate: A measure of the efficiency by which a power generator converts fuel into heat and electricity. It is the amount of energy used to generate one kilowatt-hour (kWh) of electricity. A high heat rate indicates an inefficient power plant that 1) requires more fuel to generate the same kilowatt-hour and 2) often has higher emissions as a result.

Peakers are used during the hours of highest energy demand, when an unexpected event occurs such as a generator going offline, and to balance intermittent resources that are connected to the grid, such as wind and solar. Sometimes the need to use a peaker plant is only a few hours a year. The percentage of time a power plant is running at maximum power is called its capacity factor. A **baseload** plant might have a capacity factor of 95 percent, meaning it runs 95 percent of the time during the year. A **peaker** might have a capacity factor of only 5 percent, meaning it only runs 5 percent of the time (or only 438 total hours out of the 8,760 hours in a year). For this report, **peaker plants are defined as all operating power plants running on oil or gas turbines with a minimum generating capacity of 10 megawatts and a maximum capacity factor of 15 percent**.[5] Peakers have a variety of sizes and forms, and several examples are featured throughout this report. The photo on page 12 is of a gas turbine with a low profile. Peaker plants can also look more like a traditional power plant with taller emissions stacks.

For most peakers, the capability to rapidly turn on and off is a crucial feature, allowing the plant to meet real-time demand for

5 This definition allows for the screening of the most important peaker plants in the grid, leaving out the non-emitting resources and the ones that are not capable of providing the peak energy services, as well as smaller backup generators and the fossil-fueled power plants providing baseload and intermediate load to the system.

Street-level view of Delaware CT peaker plant in Philadelphia
PHOTO: GOOGLE EARTH

Merchant, Municipal, or Investor-Owned Utility?

One factor that is important to understand is the ownership of any particular peaker plant. Ownership typically falls into one of three categories: merchant, municipal, and investor-owned utility. A merchant-owned peaker plant is owned by private investors who raise the capital to build the plant and then sell power to off-takers such as cities and towns, investor-owned utilities, and grid operators; the private investors assume the financial risks associated with the plant. Municipalities or local government agencies can also build and own a municipal peaker plant to serve local communities. Most generation in regulated markets is built by the electric utilities themselves, the investor-owned utilities (IOUs). The operation and maintenance for these plants, as well as the return on investment to shareholders by these plants, are essentially paid for by the utilities' ratepayers. The need assessment and profit incentive driving peaker plant construction (as well as removal from service and/or replacement) will be different depending upon the ownership of the plant.

electricity. For natural gas (methane) and oil-fueled turbines, this rapid response often comes as a trade-off for high fuel consumption and disproportionate emissions of air pollutants such as **nitrogen oxides (NO_x)** into local neighborhoods. The high fuel consumption indicates *inefficiency*, and this is indicated in this analysis as heat rate. **A higher heat rate indicates a less efficient power plant**. The national average heat rate for peaker plants is 13,300 Btu/kWh, with the most efficient peakers having heat rates between 6,000 and 9,000 Btu/kWh.

Why are peakers so harmful to local communities?

Quite simply, peaker plants are dirty. They typically emit far more localized pollution such as small particulates ($PM_{2.5}$), NO_x, and sulfur dioxide (SO_2) per megawatt-hour than baseload plants because 1) their fuels are often dirtier, 2) the quick ramping up and down does not allow pollution controls to effectively capture air pollutants, and 3) combustion turbine peakers are inherently less efficient than baseload combined cycle power plants. Because peakers are needed most in places with the highest electricity demand, the majority are sited within urban areas. Nationwide, the majority of peakers are located in communities that have a higher-than-average percentage of low-income residents, and the dirtiest plants tend to be concentrated near communities of color.[6] For each metropolitan area, the size of its peaker fleet is related to the size of its population and the constraints of its energy system.

Peakers in the U.S. emit an average of 60 million tons of carbon dioxide (CO_2) each year, making them a significant contributor to climate change. More important for the surrounding communities, the U.S. peaker fleet emits more than 46,000 U.S. tons of NO_x and 7,700 U.S. tons of SO_2 every year. These pollutants contribute to the formation of ground-level ozone and small particles called $PM_{2.5}$,[7] and this causes multiple respiratory and pulmonary diseases and contributes to premature mortality.

Many peakers are so old that they are not equipped with modern pollution control devices. For those that are equipped, the pollution controls may never kick in because they rely on attaining a high heat level, something a peaker plant might not do if the peak is very short in duration (called a "narrow peak"). As a result, peaker emissions spew out of the emission stack and into the surrounding community on hot summer afternoons. These hot, summer days are also when high levels of ground-level ozone and small particulates typically form in the air. **NO_x and SO_2 contribute to the formation of both ground-level ozone and $PM_{2.5}$**.

These pollutants contribute to the formation of ground-level ozone and small particles called $PM_{2.5}$, and this causes multiple respiratory and pulmonary diseases and contributes to premature mortality.

The American Lung Association's (ALA) new report *Zeroing in on Healthy Air*, released in April of 2022, details the negative impacts of fossil fuel vehicle and power plant emissions on adults and children.[8] The report builds on previous research and utilizes the EPA's CO-Benefits Risk Assessment (COBRA) Health Impacts Screening and Mapping tool to model the impacts of improvements in air quality due to decreased emissions.

The ***ALA notes that transportation and the electricity sector are the leading sources of unhealthy air in the United States***:

> "Research demonstrates that the burdens of unhealthy air include increased asthma attacks, heart attacks and strokes, lung cancer and premature death. These poor health outcomes are not shared equitably, with many communities of color and lower income communities at greater risk...."[9] The report further adds, "The adverse impacts of pollution from the transportation and electricity generation sectors are clear, and must be recognized as a threat to local community health, health equity and a driver of major climate change-related health risks. ***Even with certification to meet existing standards, it is clear that combustion technologies often generate far greater levels of pollution in the real world than on paper.***"[10]
> *[emphasis added]*

Short-term exposure to $PM_{2.5}$, NO_x, and SO_2 can cause wheezing and coughing, shortness of breath, and asthma attacks. Long-term exposure to these pollutants can affect the entire body[11] (see **Figure 1**, page 15). Research from the ALA and Johns Hopkins University shows the following impacts:

6 Seth Mullendore, "Mapping the Inequities of Fossil Peaker Power Plants," *Clean Energy Group*, April 21, 2022, https://www.cleanegroup.org/mapping-the-inequities-of-fossil-peaker-power-plants (accessed June 6, 2022).

7 William M. Hodan and William R. Barnard, "Evaluating the Contribution of PM2.5 Precursor Gases and Re-entrained Road Emissions to Mobile Source PM2.5 Particulate Matter Emissions," *Prepared by MACTEC Under Contract to the Federal Highway Administration*, p. 16, https://www3.epa.gov/ttnchie1/conference/ei13/mobile/hodan.pdf (accessed June 6, 2022).

8 "Zeroing in on Healthy Air: A National Assessment of Health and Climate Benefits of Zero-Emission Transportation and Electricity," *American Lung Association*, https://www.lung.org/getmedia/13248145-06f0-4e35-b79b-6dfacfd29a71/zeroingin-on-healthy-air-report-2022.pdf (accessed June 6, 2022).

9 Ibid.

10 Ibid.

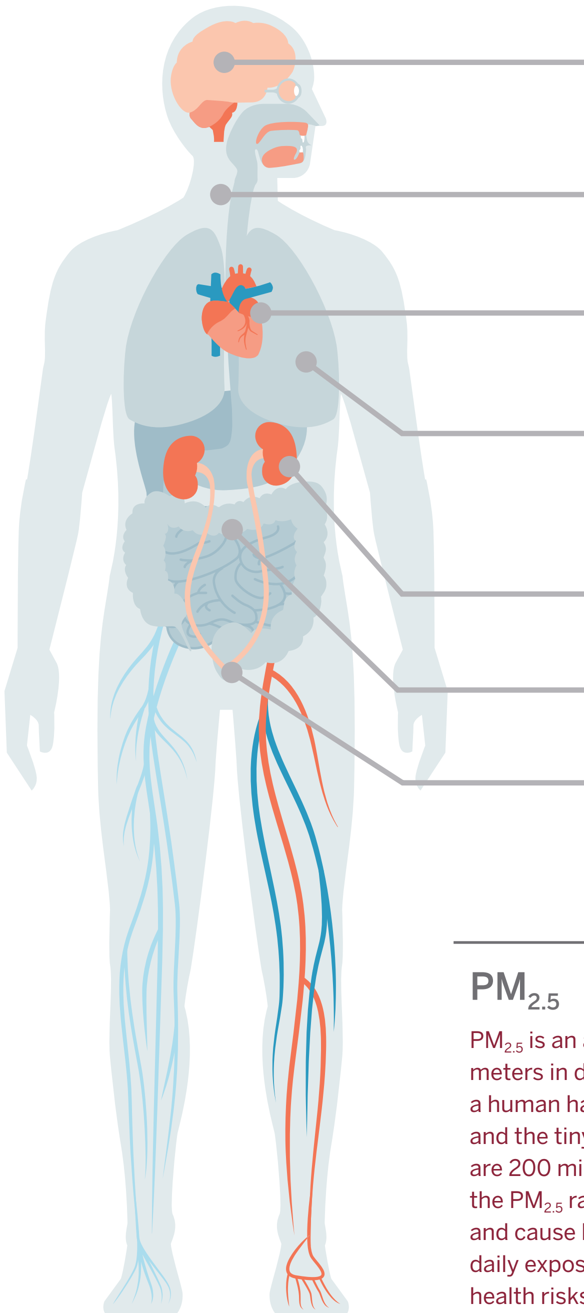
11 Jason Treat and Kelsey Nowakowski, "Pollution's Toll on the Body," *National Geographic*, March 16, 2021, https://www.nationalgeographic.com/magazine/graphics/see-how-polluted-air-attacks-our-bodies-feature (accessed June 6, 2022).

Pollution from peaker plants affects the health of everyone in the surrounding community.
PHOTO: ISTOCKPHOTO/BONNONTAWAT

- **In the brain**, long-term exposure to $PM_{2.5}$, SO_2, and NO_x can lead to cognitive declines, changes in brain structure, and an increased risk of Alzheimer's disease.
- **In the nervous system**, these pollutants are linked to neurodevelopment disorders and deaths from Parkinson's disease. Particles can travel to the central nervous system.
- **In the cardiovascular system**, exposure is linked to a higher mortality from coronary artery disease, heart attacks, strokes, and blood clots.
- **In the respiratory system**, it can cause shortness of breath, coughing and wheezing, asthma, lung cancer, and chronic obstructive pulmonary disease (COPD).
- **In the renal system**, long-term exposure to these pollutants is associated with a greater likelihood of chronic kidney disease. Renal disease rates are highest in urban areas.
- **In the endocrine system**, $PM_{2.5}$ is an endocrine disruptor, contributing to increased development of metabolic diseases such as obesity and diabetes, which in turn are risk factors for cardiovascular disease.
- **In the reproductive system**, small particle pollution exposure is linked to diminished fertility, miscarriages, premature birth, low birth rate, and respiratory diseases.

FIGURE 1

How Peaker Plants Affect the Body



BRAIN
Changes in brain structure, cognitive decline, increased risk of Alzheimer's

NERVOUS SYSTEM
Neurodevelopment disorders, Parkinson's disease

CARDIOVASCULAR SYSTEM
Heart attacks, strokes, coronary artery disease, blood clots

RESPIRATORY SYSTEM
Asthma attacks, wheezing and coughing, shortness of breath, chronic obstructive pulmonary disease (COPD), lung cancer

RENAL SYSTEM
Chronic kidney disease

ENDOCRINE SYSTEM
Metabolic diseases, diabetes, obesity

REPRODUCTIVE SYSTEM
Premature birth, low birth weight, miscarriage, diminished fertility

$PM_{2.5}$

$PM_{2.5}$ is an air pollutant that measures 2.5 micrometers in diameter or smaller. In comparison, a human hair is 50–70 micrometers in diameter, and the tiny air sacs in our lungs, called alveoli, are 200 micrometers in diameter.[12] Pollution in the $PM_{2.5}$ range can easily travel into the body and cause harm. Scientific studies have linked daily exposure to $PM_{2.5}$ pollutants to increased health risks, disease, and death.

Pollution from peaker plants such as $PM_{2.5}$ enters the body through the lungs, but long-term exposure can have adverse effects throughout the entire body.

SOURCE: CLEAN ENERGY GROUP

12 Jason Treat and Kelsey Nowakowski, "Pollution's Toll on the Body," *National Geographic*, March 16, 2021, https://www.nationalgeographic.com/magazine/graphics/see-how-polluted-air-attacks-our-bodies-feature (accessed June 6, 2022).

The importance of energy equity and inclusive processes for peaker siting and licensing

Within the power sector, peaker plants often inflict more harm on the surrounding communities than baseload plants because their fuels are dirtier, combustion is less efficient, and emissions controls are often ineffective.

In order for the grid to remain stable for everyone, communities located near peakers pay the cost. These neighborhoods experience increased asthma rates, increased mortality, increased heart attacks, and increased missed days from work and school. It is therefore critical that the voices of frontline communities and community-based organizations (CBOs) be amplified as they work to close down these plants and replace them with non-combustion alternatives. These communities have borne the brunt of the harm. They should be at the table and their objectives and concerns about peakers should be prioritized, especially when non-combustion alternatives are available. Non-combustion alternatives to a peaker plant can become an opportunity to build wealth, job opportunities, and stability when they include distributed options such as aggressive energy efficiency, community solar, and behind-the-meter battery storage programs.

GreenRoots' ECO Youth protesting the proposed Chelsea power plant.
PHOTO: GREENROOTS

PHOTO: GOOGLE EARTH

PART TWO

The National Peaker Landscape

BASED ON THE DEFINITION OF PEAKERS used for this report, there are over 217 gigawatts of oil- and gas-fueled peaker capacity in the United States. This peaker fleet is 28 percent of the total fossil-fueled power plant capacity in the country. The fleet is composed of generators of all sizes and ages, with an average capacity factor of 5 percent (meaning they run for 5 percent of the total hours in a year), with many of them running less 1 percent of the year.[13]

Figure 2 on page 18 shows the distribution of peakers across the country, with relative capacity, average utilization, and Independent System Operator (ISO) territories indicated.

Approximately 154 gigawatts of the peaker capacity in the U.S. is located within or close to an urban area,[14] where the peakers were built to provide local capacity and ancillary services, such as load balancing and frequency regulation. These urban peakers affect the air quality of these cities and, most directly, the environment of people living close to them. **Over 4.4 million people in urban areas are currently living within one mile of a peaker, and almost 32 million people are living within three miles of one.**[15] Of the people living within one mile of an urban peaker, **1.7 million are low-income** and **over 2 million are people of color**. In a three-mile radius, about **11.9 million are low-income** and **16.4 million are people of color**, with larger disparities in some of the most populated metropolitan areas.

Over 4.4 million people in urban areas are currently living within one mile of a peaker, and almost 32 million people are living within three miles of one.

Peakers have traditionally played an important role in supplying timely energy to keep the lights on and the grid functioning during periods of highest demand and when unexpected events disrupt the electricity system. Besides capacity, peakers often provide grid services such as fast-response generation to follow

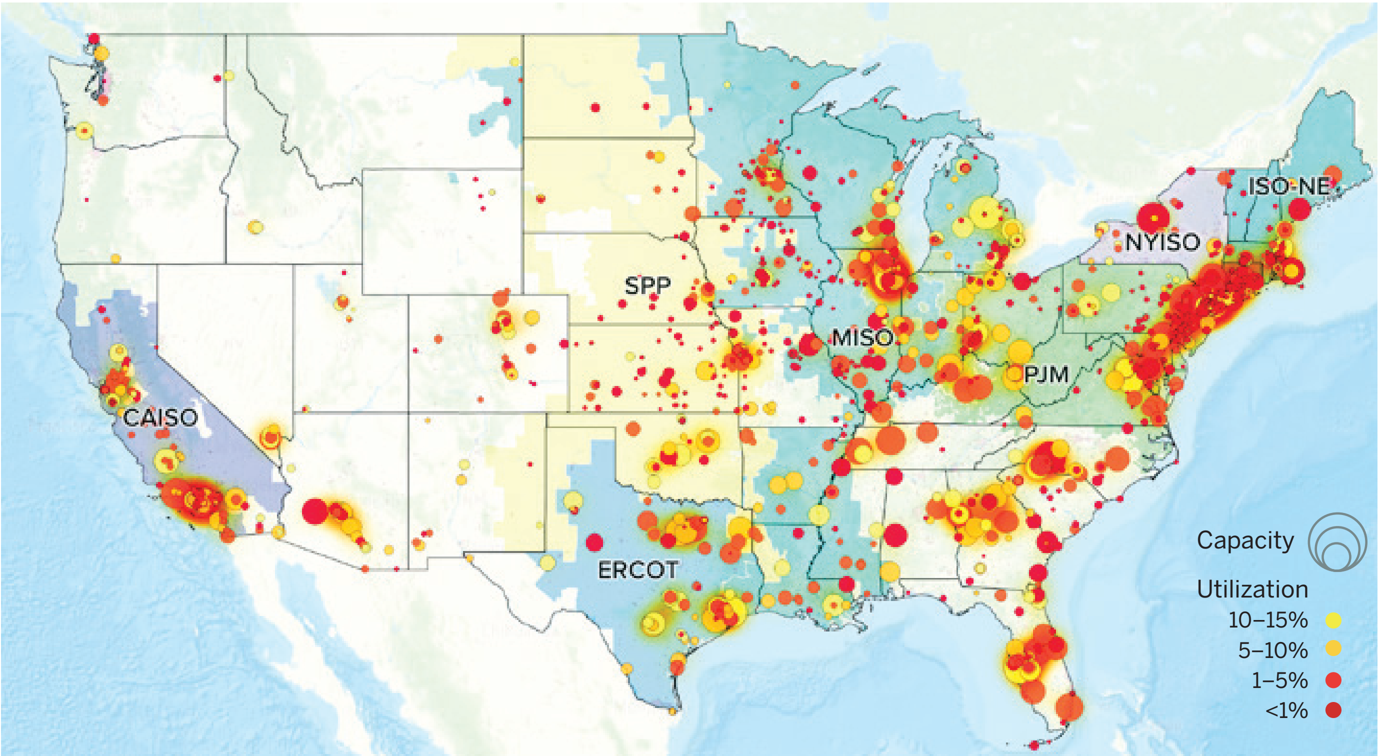
13 The capacity factor is a metric of utilization for power generators based on the energy produced in a year as a share of the maximum energy that it could have produced assuming operations during every hour of the year. This can be computed as "total generation in period/operating capacity x hours in period." Strategen has found that a 15 percent capacity factor is a suitable benchmark to identify peakers under the configuration of the current energy system.

14 The U.S. Census Bureau defines an urbanized area as a continuously built-up area with a population of 50,000 or more. It comprises one or more central places and the adjacent densely settled surrounding area, defined as urban fringe. Outside of urban areas, an urban place is any incorporated place or census-designated place (CDP) with at least 2,500 inhabitants. A CDP is a densely settled population center that has a name and community identity and is not part of any incorporated place.

15 The one-mile and three-mile radius from peakers are used to illustrate the impact of peakers on nearby populations, but it is worth noting that emission impacts are not limited to the areas near power plants.

FIGURE 2

Fossil Peakers in the United States by ISO



This map shows all of the peaker plants across the U.S., with ISO territories shown on the base map. Size indicates the capacity of the plant (larger circles mean higher generating capacity). The colors indicate the capacity factor, or utilization. The closer to red a circle is, the lower its utilization. This is one factor that can be used to identify peakers that can technically be replaced by non-combustion alternatives. SOURCE: STRATEGEN

ramps on demand, voltage regulation, backup and black start capabilities to restore power after system disruptions, and local generation with relatively small land footprints to alleviate congestion in the transmission system. Peaker plants do not create many jobs (they are largely automated), but they do often contribute taxes to the municipalities that host them.

In many—if not all—cases, however, these services can be provided by non-combustion technologies. **A mix of energy storage and renewable energy resources is already an economical alternative to fossil fuel peakers in many parts of the country.** Non-combustion technologies such as batteries do not emit local pollutants, respond faster to demand and voltage fluctuations, can provide emergency power even when the grid is down, can provide black start to restart the grid after an outage, and can be sited in distributed locations to better suit demand and land availability. These resources increase the resiliency of a community to outages and, because they do not pollute the surrounding community, lead to significant health savings as outlined by the recent American Lung Association report *Zeroing in on Healthy Air*. In this technological context, the replacement of fossil fuel peakers with clean technologies is a no-regrets solution for local pollution abatement and renewable energy integration.

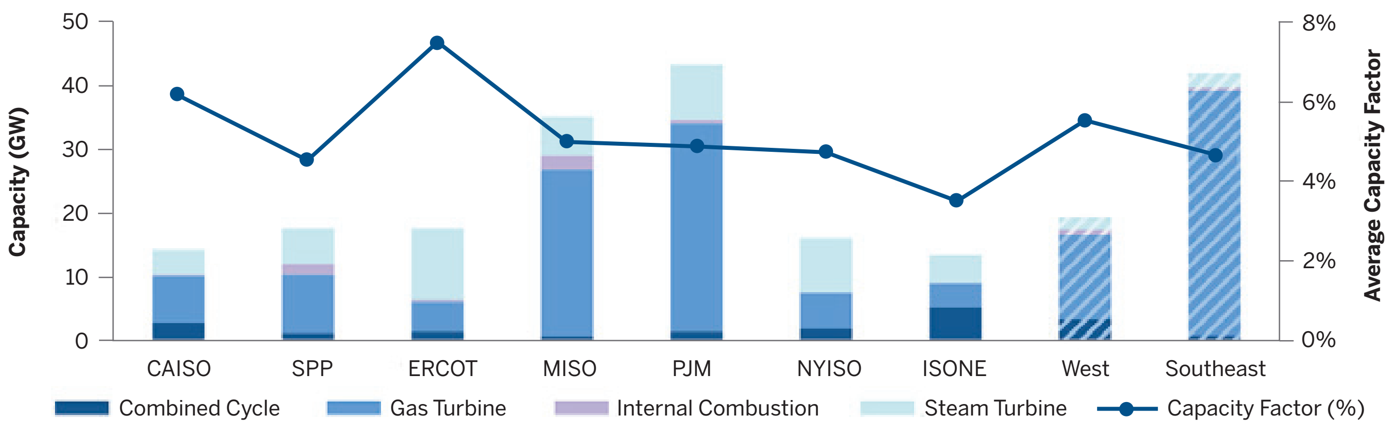
Peakers in different regions and ISOs

Across the country, the peaker capacity is distributed in territories of different grid system operators, including the seven Independent System Operators (ISOs) and Regional Transmission Organizations (RTOs) in the country, and many balancing authorities in the West and the Southeast regions that are not covered by an ISO/RTO.[16]

16 Bentham Paulos, "How Wholesale Power Markets Work," *Clean Energy States Alliance*, August 19, 2021 https://www.cesa.org/resource-library/resource/how-wholesale-power-markets-work (accessed June 6, 2022).

FIGURE 3

Peaker Capacity in the United States by ISO Territory and Generating Technology



This figure shows peaker capacity by ISO and geographic area (if there is no ISO). The total peaker capacity by ISO/region is shown as well as the average utilization rate (average capacity factor). Peaker technologies are also shown. Some technologies, such as internal combustion engines, can run on a variety of fuels. PJM, the Southeast, and MISO have the most peaker capacity and ISO-New England has the lowest average peaker utilization.

SOURCE: STRATEGEN

What is an ISO?

ISO stands for Independent System Operator. The term is often used synonymously with RTO, or Regional Transmission Organization. An ISO or RTO is an independent nonprofit corporation that operates the region's electricity grid, administers the region's wholesale electricity markets, and provides reliability planning for the region's bulk electricity system. There are seven ISOs/RTOs in the U.S. The Southeast and many western states do not have an ISO/RTO.

Each ISO territory has specific market rules that set conditions for participation and prices that allow for the competition of diverse energy resources. These market rules combined with the policy set by each state define the opportunities for peaker replacement by non-combustion alternatives in each location.[17]

At the most granular level, every peaker replacement opportunity can be assessed separately using publicly available information about the peaker's historical operations to inform the needs of the system and to guide the design of replacement portfolios (technologies that could be used instead). Utilization as a benchmark to identify peakers can provide a broad picture of the fleet; however, the the specific location, capabilities, and limitations of each power plant need to be considered in its replacement. The graph in **Figure 3** shows the distribution of the peaker capacity among the ISO territories and the two areas without ISO oversight (ISO geographic locations are shown in **Figure 2** on page 18). It also shows the capacity by generation technology and the average utilization of the fleet in each territory.

17 Utilization shown as the average capacity factor of the peakers in each ISO weighted by capacity of the fleet.

PHOTO: ISTOCKPHOTO/DRAZEN ZIGIC

PART THREE
A Look at Peakers in Boston, Philadelphia, and Detroit

IN THIS SECTION, an overview of the peaker landscape is presented for three urban areas: Boston, Philadelphia, and Detroit.

Boston, **Philadelphia** and **Detroit** were chosen because they have a high number of peakers that disproportionately impact low-income communities and communities of color, according to the U.S. Environmental Protection Agency's (EPA) Power Plants and Neighboring Communities mapping tool.[18] These cities also represent different transmission organizations (ISOs) that run the grid as well as different new and emerging state policy options that may be helpful tools to facilitate peaker replacement.

The most important considerations in these three cities are the frontline communities and the community-based organizations (CBOs) who face the impacts of pollution burden every day. Several of these organizations will be introduced to spotlight the important work they are already doing to create healthy, vibrant, thriving communities.

Several specific, high-impact peakers are highlighted in Boston, Philadelphia, and Detroit in order to provide a robust explanation of how peakers differ from neighborhood to neighborhood and how they impact the communities around them. **The intention is to raise general awareness rather than to advocate for the replacement of specific facilities with non-combustion alternatives.** Community-based organizations have a much better understanding of which pollution emitters are of the highest priority for replacement. A complete list of the peaker plants identified in each metropolitan area is included as Appendix C.

Community-based organizations have a much better understanding of which pollution emitters are of the highest priority for replacement.

18 "Power Plants and Neighboring Communities Mapping Tool," *United States Environmental Protection Agency*, https://experience.arcgis.com/experience/2e3610d731cb4cfcbcec9e2dcb83fc94?views=view_12 (accessed June 6, 2022).

BOSTON

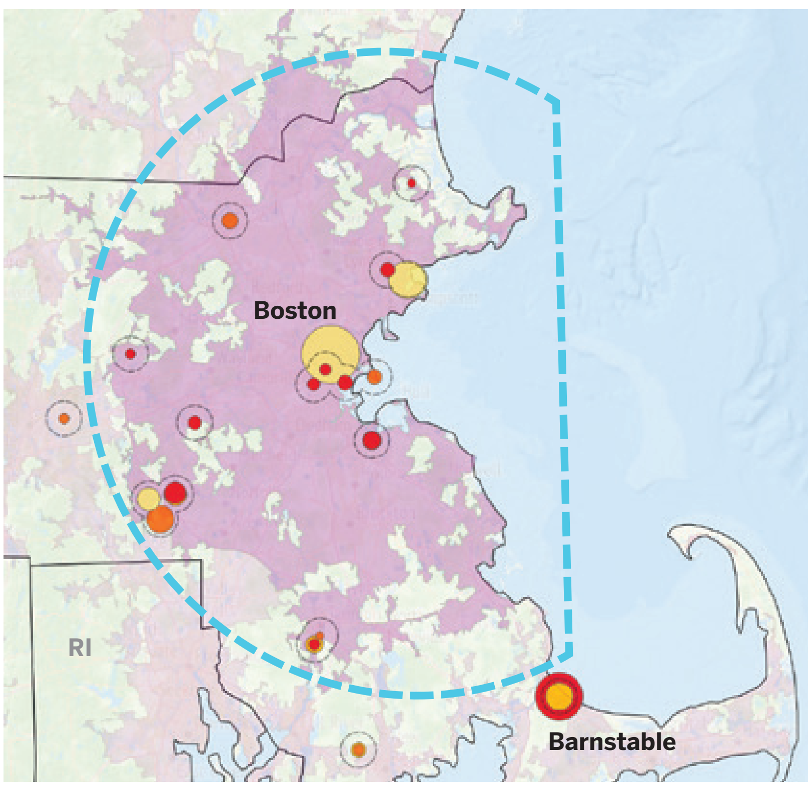
Home to over 675,000 people, the City of Boston is the most populous city in New England. It is the cultural anchor of the Greater Boston Metropolitan Area, which is home to an estimated 4.8 million people. The Greater Boston Area includes most of the eastern third of Massachusetts, excluding the South Coast and Cape Cod.

There are 20 peakers in Boston's Metropolitan Area (see **Figure 4** and **Appendix C**). They have a combined capacity of 4,120 megawatts, and 14 percent of this capacity is fueled with oil. Boston's peaker fleet has a utilization rate of 8.5 percent, higher than the country's 5 percent average, which means **they run more often than the national average**. These peakers contribute an annual average of 544,500 pounds of NO_x and 63,000 pounds of SO_2 to the city's local pollutants.

About 256,000 people live within one mile of these power plants, and 1.45 million people live within three miles of a peaker. Of the people living within the three-mile radius, 36 percent are people of color and 28 percent are low-income.[19] In the report *Zeroing in on Healthy Air*, the American Lung Association estimates that the Boston-Worcester-Providence metro area could see **cumulative health benefits totaling $22.7 billion between 2020 and 2050 if the emissions from both transportation and power generation are eliminated. These benefits include 2,070 avoided premature deaths.**[20]

FIGURE 4

Boston Metro Area Peaker Fleet



About 256,000 people live within one mile of these power plants, and 1.45 million people live within three miles of a peaker. Of the people living within the three-mile radius, 36 percent are people of color and 28 percent are low-income.

All 20 peakers within the Greater Boston metropolitan area. Size indicates capacity, yellow to red indicates highest to lowest capacity factor.

SOURCE: STRATEGEN

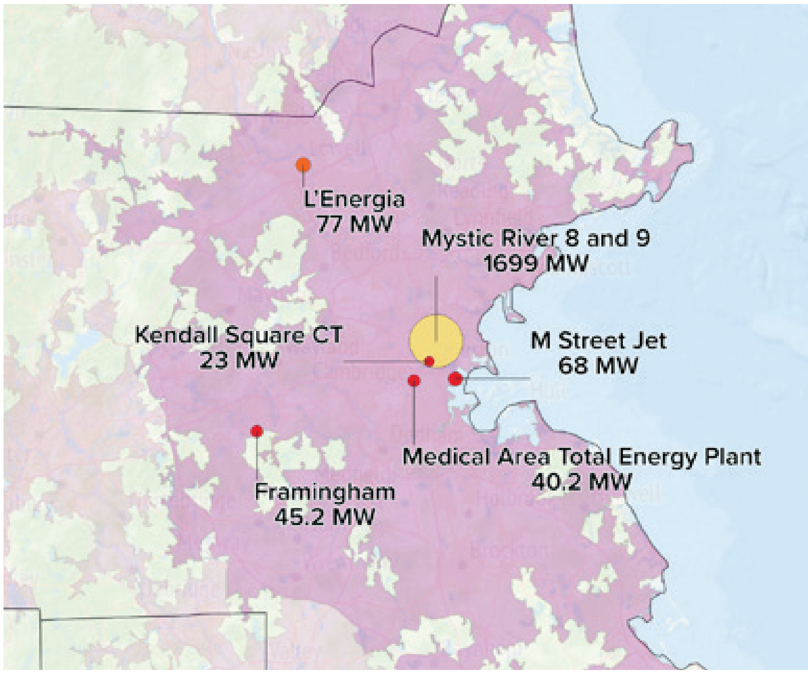
19 Under the current Environmental Justice Policy of Massachusetts, updated in 2021, the definition of an "Environmental Justice Population" is wider than the one used in this nation-wide study. Hence, the share of environmental justice or "potentially disadvantaged" communities could be larger than the composition presented here. https://www.mass.gov/doc/environmental-justice-policy6242021-update/download (accessed June 29, 2022).

20 "Zeroing in on Healthy Air: A National Assessment of Health and Climate Benefits of Zero-Emission Transportation and Electricity," p.12, *American Lung Association*, https://www.lung.org/getmedia/13248145-06f0-4e35-b79b-6dfacfd29a71/zeroingin-on-healthy-air-report-2022.pdf (accessed June 6, 2022).

In the Boston Metropolitan Area, six plants stand out due to their proximity to low-income communities and communities of color (see **Figure 5**). These are Framingham, Kendall Square CT, L'Energia/UAE Lowell, M Street Jets, Medical Area Total Energy Plant (MATEP), and Mystic River Units 8 and 9. Framingham and L'Energia are outside of the city center.

FIGURE 5

Boston High-Impact Peakers



Six high-impact peakers in the Boston metropolitan area.
SOURCE: STRATEGEN

The Boston-Worcester-Providence metro area could see cumulative health benefits totaling $22.7 billion between 2020 and 2050 if the emissions from both transportation and power generation are eliminated. These benefits include 2,070 avoided premature deaths.

BOSTON METRO AREA HIGH-IMPACT PEAKERS

FRAMINGHAM

FUEL: **OIL**
OPERATING CAPACITY: **45 MW**
CAPACITY FACTOR: **0.14 PERCENT**
HEAT RATE: **17,646 BTU/KWH**
NO_x EMISSIONS RATE: **9.61 LBS/MWH**

Framingham is a 52-year-old plant owned by Exelon Corporation. Like L'Energia/UAE Lowell, it is outside the central Boston area in a more rural setting. It is close to a neighborhood and is 1,273 feet from Harmony Grove Elementary School. The community within a three-mile radius is 37 percent persons of color and 23 percent low-income. It has the second highest NO_x emissions rate in this group, and its heat rate suggests it is very inefficient and consumes a lot of oil when operating. It runs 123 hours per year, most likely on hot summer afternoons. Framingham is one of the locations chosen by Eversource to pilot a "geogrid" concept. This new concept for geothermal energy and ground-sourced heat pumps has the potential to reduce the need for peakers if it is able to scale.[21]

21 "Eversource and the City of Framingham Set to Launch Environmentally Friendly Geothermal Project, *Eversource*, January 26, 2022, https://www.eversource.com/content/ema-c/residential/about/our-company/news-room/massachusetts/newspost (accessed June 6, 2022).

KENDALL SQUARE CT

FUEL: **OIL**
OPERATING CAPACITY: **23 MW**
CAPACITY FACTOR: **0.18 PERCENT**
HEAT RATE: **20,167 BTU/KWH**
NO_x EMISSIONS RATE: **22.31 LBS/MWH**

The Kendall Square Combustion Turbine (CT), also called Kendall Green Energy, is a 50-year-old, privately-owned peaker located in Cambridge in the midst of Harvard and MIT facilities. It has a low capacity factor, a high heat rate (inefficient), and an extremely high NO_x emissions rate—the highest of the Boston metro peakers by a wide margin. The surrounding community in the three-mile radius is 43 percent persons of color and 33 percent low-income. This plant is located 3,777 feet from Newtowne Court, a Cambridge public housing complex with 294 low-income units.

L'ENERGIA/UAE LOWELL

FUEL: **NATURAL GAS (METHANE)**
OPERATING CAPACITY: **77 MW**
CAPACITY FACTOR: **3.46 PERCENT**
HEAT RATE: **8,869 BTU/KWH**
NO_x EMISSIONS RATE: **0.28 LBS/MWH**

L'Energia/UAE Lowell is also called Tanner Street Generation. It is a merchant plant that is privately owned by EDF Trading North America, Inc. The most recent turbines at the power plant were installed in 2008. The community in the surrounding three miles is 45 percent persons of color and 36 percent low-income. The facility is 500 feet from the surrounding neighborhood and has the highest capacity factor of the six high-impact peakers in Boston. It runs an average of 303 hours per year when called on by the grid operator ISO New England. Its NO_x emission rate is lower than other Boston metro peakers because it is a newer plant, but it also runs more often than the others.

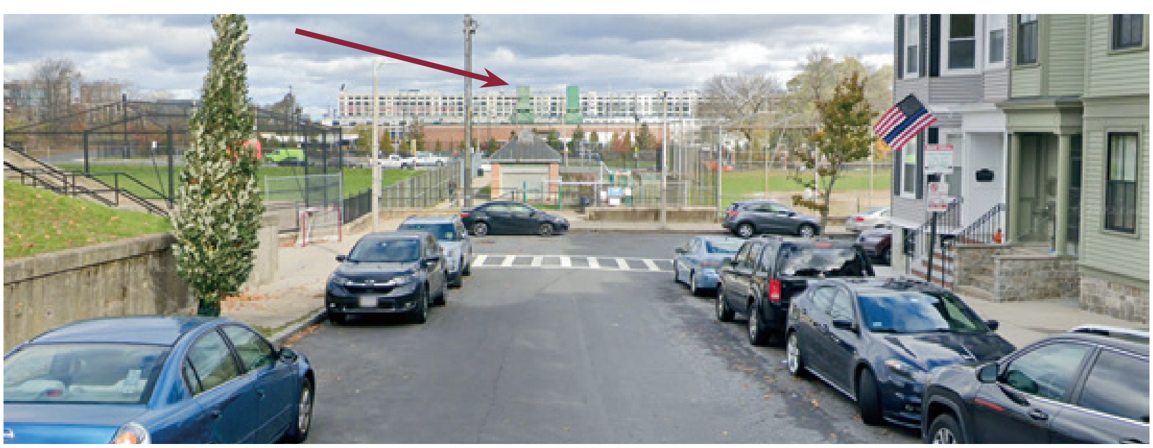
M STREET JETS

FUEL: **OIL**
OPERATING CAPACITY: **68 MW**
CAPACITY FACTOR: **0.07 PERCENT**
HEAT RATE: **21,146 BTU/KWH**
NO_x EMISSIONS RATE: **2.9 LBS/MWH**

The **M Street Jets** are also called the MBTA South Boston Power Facility. They are two Pratt and Whitney jet engines installed in 1979 that are owned by the Massachusetts Bay Transportation Authority. They are used to back up the power supply for the transit system in Boston. Within a three-mile radius, 49 percent of the population are people of color and 35 percent are low-income. These peakers have the lowest capacity factor and the highest heat rate of Boston's peaker fleet (high heat rate indicates a high level of inefficiency—they require a lot of fuel to produce power). The jets run only 61 hours per year, but they are sited in South Boston, across the street from ball fields, a park, and a dense urban neighborhood (see **Figure 6**).

FIGURE 6

M Street Jets and Nearby Ball Fields and Homes



The Massachusetts Bay Transit Authority's M Street Jets peaker plants sit near ball fields, a park, and a dense urban neighborhood. The red arrow points to the jets' emissions stacks. PHOTO: GOOGLE EARTH

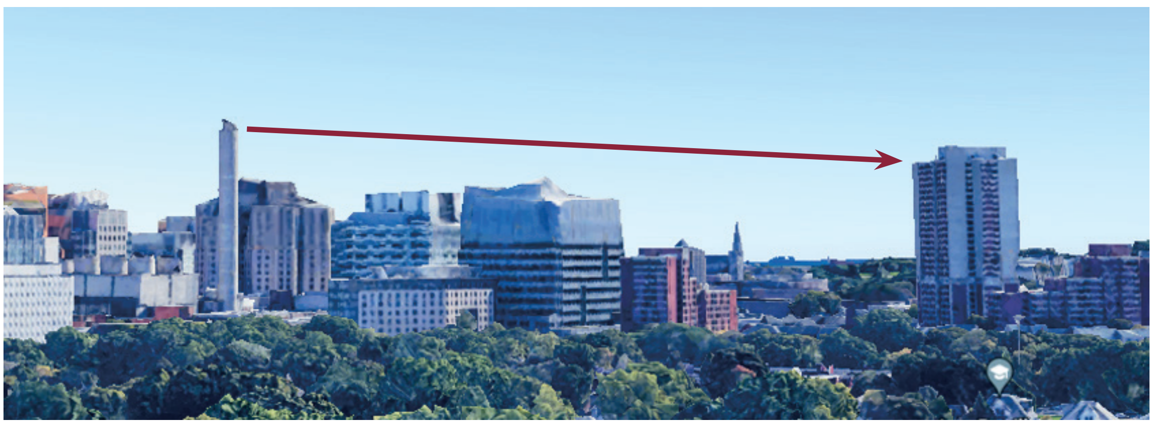
MEDICAL AREA TOTAL ENERGY PLANT (MATEP)

FUEL: OIL
OPERATING CAPACITY: 40 MW
CAPACITY FACTOR: 0.82 PERCENT
HEAT RATE: 9,031 BTU/KWH
NO_x EMISSIONS RATE: 3.09 LBS/MWH

MATEP is a 36-year-old merchant plant in Boston. It is privately owned by ENGIE and Axium Infrastructure, and it serves the Longwood Medical and Academic Area with electricity, steam, and chilled water. Customers include five hospitals affiliated with the Harvard Institutes of Medicine, but the community within a three-mile radius of the plant is 48 percent persons of color and 36 percent low-income. MATEP is 975 feet from Boston's Mission Park affordable housing high-rise tower (see **Figure 7**). The MATEP emissions stack is only slightly higher than the upper floors of the apartment tower, which is concerning given MATEP's NO_x emissions rate of 3.09 pounds per megawatt-hour.

FIGURE 7

Proximity of MATEP Power Plant Stack to Mission Park Affordable Housing Tower—Medical Area Total Energy Plant



The Medical Area Total Energy Plant has an emissions stack that is only slightly higher than the upper floors of the Mission Park highrise affordable housing development.

PHOTO: GOOGLE EARTH

MYSTIC RIVER 8 AND 9

FUEL: NATURAL GAS (METHANE)
OPERATING CAPACITY: 1,699 MW
CAPACITY FACTOR: 11.6 PERCENT
HEAT RATE: 7.608 BTU/KWH
NO_x EMISSIONS RATE: 0.07 LBS/MWH

Mystic River 8 & 9 is almost a success story. The 19-year-old units are part of the much larger Mystic River power plant that has closed. These remaining units are being kept online to satisfy ISO New England capacity requirements until 2024, when they will be shuttered for good and **replaced by transmission line improvements** rather than more fossil fuel infrastructure. This will reduce the pollution burden in the surrounding community, which is 45 percent persons of color and 30 percent low-income.

Policies that are affecting these peaker plants

Electricity in the Boston metropolitan area is provided by investor-owned utilities (IOUs) and municipal utilities, also known as Municipal Light Plants (MLPs).[22] The major IOUs serving this area are Eversource (formerly NSTAR Electric) and Massachusetts Electric Company; both also serve broader regions across the state.

The Massachusetts Department of Public Utilities regulates the IOUs, but its role in regulating MLPs is limited. MLP electricity rates are set by municipal officials. The ISO New England (ISO-NE) manages the wholesale markets for energy, ancillary services, and capacity. The Boston Metro Area is part of Southeast New England (SENE), an import-constrained capacity zone.[23]

Across New England, recent changes in market participation rules have accelerated the growth of alternatives to fossil peaker plants. This can be noted in the results of the latest forward capacity auction.[24] The most recent auction in New England (FCA-16) concluded with 700 megawatts of battery storage (up from 17 megawatts in 2020) and 3,300 megawatts of demand-side resources, including energy efficiency, load management, and distributed generation resources.[25] In addition to this, The Commonwealth of Massachusetts invests heavily in energy efficiency and has the goal of procuring 1,000 megawatts of energy storage by 2025.[25] In 2019, Massachusetts also added a behind-the-meter energy storage program to its energy efficiency plan called ConnectedSolutions, which targets peak demand (see **Appendix B**). These grid-connected, customer-sited resources could help the grid operator manage the system peak and reduce the need for peakers and the overall cost of capacity.

Massachusetts is also a pioneer in incenting the use of clean energy technologies to supply peak power. In 2018, the state created the Clean Peak Standard (CPS) with the goal of creating a price signal to shift clean power to the hours it's most valuable for the grid. The CPS requires retail electricity providers to meet a baseline minimum percentage of sales with qualified clean peak resources that dispatch electricity to the electric distribution system during seasonal peak periods, or alternatively, reduce load on the system. The CPS baseline is increased every year; however, MLPs are not required to participate in the program.

While these market trends and programs create new opportunities for clean resources to provide peak power, Massachusetts' Environmental Justice Policy sets barriers for the development of new fossil fuel peakers in proximity to communities. The updated rules require enhanced analysis of impacts and mitigation, as well as public participation for every pollution-emitting project located up to one mile from an environmental justice community or up to five miles, if the project is expected to exceed certain air emission thresholds.[27]

22 Massachusetts has 41 MLPs, generally run by municipal light boards that provide both distribution and supply service to their customers. MLPs serving Boston's Metropolitan Area include Marblehead, Peabody, Reading, Wakefield and Danvers in the north. Braintree, Taunton, and Norwood in the south. Wellesley, Hudson, Littleton, Concord, and Belmont in the west; and Hull and Hingham in the central area.

23 ISO-NE is responsible for operation of the bulk transmission system and wholesale electricity markets across the six New England states—Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont—a region with a population of 14.8 million people.

24 ISO-NE also holds annual Forward Capacity Auctions (FCAs) through its Forward Capacity Market (FCM). The FCM is a long-term market that ensures resource adequacy, both zonally and for the ISO-NE system as a whole. The market is designed to promote economic investment in capacity resources when and where they are needed. The FCM allows for the participation of generating resources, energy storage, imports, demand response resources, aggregated DER, and energy efficiency resources.

25 "New England's Forward Capacity Auction closes with adequate power system resources for 2025-2026," *ISO Newswire*, March 9, 2022, https://isonewswire.com/2022/03/09/new-englands-forward-capacity-auction-closes-with-adequate-power-system-resources-for-2025-2026 (accessed June 6, 2022).

26 Massachusetts ranked second in the 2020 State Energy Efficiency Scorecard by the American Council for an Energy-Efficient Economy (ACEEE). The scorecard analyzes the energy efficiency efforts of all 50 U.S. states and Washington, DC. It tracks their policies and programs to reduce energy use, such as adopting or advancing energy-saving targets, vehicle rules, or appliance standards.

27 "Environmental Justice Policy of The Executive Office of Energy and Environmental Affairs," *Massachusetts Executive Office of Energy and Environmental Affairs*, June 24, 2021, https://www.mass.gov/doc/environmental-justice-policy6242021-update/download (accessed June 6, 2022).

PEAKER OPPOSITION
A Case Study of Community Action in Boston

Below is a brief overview of several community-based efforts in the Metro Boston Region and other surrounding regions that are focused on efforts to 1) reduce the harmful impacts of fossil-fueled infrastructure and, 2) develop opportunities for resilient and renewable energy alternatives.

GreenRoots Chelsea is a nonprofit community-based organization working to improve the urban environment and public health in Chelsea, an environmental justice community in Massachusetts.[28] In 2007, GreenRoots was part of a coalition that successfully advocated against the development of a 250-megawatt diesel-powered peaker power plant.[29,30] The community was credited with the withdrawal of the peaker permit, focusing their opposition campaign on the impact peaker emissions would have on air pollution and health in a community already suffering with high asthma rates—Chelsea has the fourth highest asthma rate in the state.[31]

Since then, GreenRoots has continued advocating for environmental justice. In 2021, GreenRoots published a Health Equity Report with policy recommendations to address health disparities in the community and fundraised over $1 million for local microgrid development.[32]

Breathe Clean North Shore (BCNS) is a grassroots group created by concerned citizens who oppose the development of a 55-megawatt fossil-fuel-powered peaker plant (the Peabody Peaker) in their community

BCNS supporters and activists outside of the Peabody Municipal Light Plant (PMLP) headquarters before the start of PMLPs monthly meeting.

PHOTO: ©2022, JERRY HALBERSTADT, CLEANPOWERCOALITION.ORG

28 To learn more about GreenRoots Chelsea, visit http://www.greenrootschelsea.org/history.

29 At the time of this effort, GreenRoots Chelsea was the Chelsea Collaborative's Chelsea Green Space and Recreation Committee.

30 Conti, Katheleen, "No power plant, and Chelsea cheer," *Boston.com*, November 18, 2007, http://archive.boston.com/news/local/articles/2007/11/18/no_power_plant_and_chelsea_cheers (accessed July 19, 2022).

31 Massachusetts Department of Public Health, "Prevalence of Asthma Among Adults and Children in Massachusetts," *Mass.gov*, 2017, https://www.mass.gov/doc/prevalence-of-asthma-among-adults-and-children-in-massachusetts/download (accessed July 19, 2002).

32 Read more about GreenRoots Chelsea's 2021 accomplishments at https://static1.squarespace.com/static/57ac44ebb3db2b4ff1e21ced/t/61d5dc006aaf15678a4e7e8c/1641405445247/2021+Accomplishments+2-Pager.pdf (accessed July 19, 2022).

of Peabody, Massachusetts.[33] The proposed gas and oil-fired peaker would be sited near two existing fossil-fuel peakers located in an environmental justice community within Peabody and across the river from Danvers, another environmental justice community.

"I've been going door-to-door and pointing to the smokestack next to where the currrent peakers are. Until this winter, when the site was clear cut, the generators were hidden from view. People seemed oblivious to what's there, what they're building, and how it will impact them."

— Susan Smoller, Breathe Clean North Shore member

BCNS has argued that there haven't been adequate environmental reviews or health impact assessments, and that the cost of construction ($85 million —of which 30 percent would be the responsibility of Peabody ratepayers) is too high; the investment should, instead, be in clean energy infrastructure. Throughout, BCNS has advocated for transparency in a process that has been anything but.

A 2022 analysis prepared by Strategen for Clean Energy Group assessed the economics of energy storage as an alternative to the Peabody Peaker. The study found that "energy storage is not only a viable replacement option for the needed capacity but is also preferable from an environmental perspective and results in significant benefits for consumers, including cost savings and environmental justice issues."[34]

BCNS's efforts have resulted in progress. Massachusetts' Municipal Wholesale Electric Company—which facilitates the purchase of energy supply for 20 municipalities and is the entity responsible for building the Peabody Peaker—has agreed to shut down one of the existing 50-year-old peaker power plants on the site and has also removed a 200,000-gallon oil tank from the current Peabody Peaker construction proposal. Additionally, in partnership with the City of Peabody, BCNS was recently awarded air sensors through the Massachusetts Department of Environmental Protection. The sensors, which will be primarily installed on local businesses and libraries, will measure levels of fine particulate matter in the outdoor air, allowing the City of Peabody to understand the quality of their air.

Slingshot, a regional nonprofit that works side-by-side with frontline communities to tackle environmental threats and build the grassroots movement, is supporting BCNS in developing a campaign strategy, outlining tactics, and expanding their reach through rallies, petition drives, and webinars. Slingshot also connects BCNS to the broader efforts to overhaul the regional energy grid through the Fix the Grid campaign.[35]

Massachusetts Climate Action Network (MCAN), a statewide nonprofit that consists of local chapters and nonprofits working to fight the climate crisis by supporting local environmental groups in their efforts, has supported and amplified BCNS efforts by also demanding the Peabody Peaker undergo environmental and health impact reports. MCAN has opposed the Peabody Peaker in statewide forums and published articles on the harmful impacts of Peabody, as well as other proposed peakers in the state.[36]

"Given the climate law that codified protections for environmental justice communities, it's infuriating to see the state move forward with yet another dirty fossil fuel project in an overburdened neighborhood. It's past time for us to stop dumping more pollution on residents who are clearly saying they don't want it, especially when we have cleaner alternatives."

— Mireille Bejjani, Co-Executive Director of Slingshot and Campaign Facilitator for Fix the Grid

33 To learn more about Breathe Clean North Shore, visit their Facebook page at https://www.facebook.com/BreatheCleanNS or their website at https://breathecleannorthshore.org.

34 To read the full report, visit https://www.cleanegroup.org/wp-content/uploads/Strategen-Addendum.pdf.

35 To learn more about Slingshot's Fix the Grid Campaign, visit https://fixtheisogrid.wordpress.com.

36 To learn more about MCAN, visit https://www.massclimateaction.org.

PHILADELPHIA

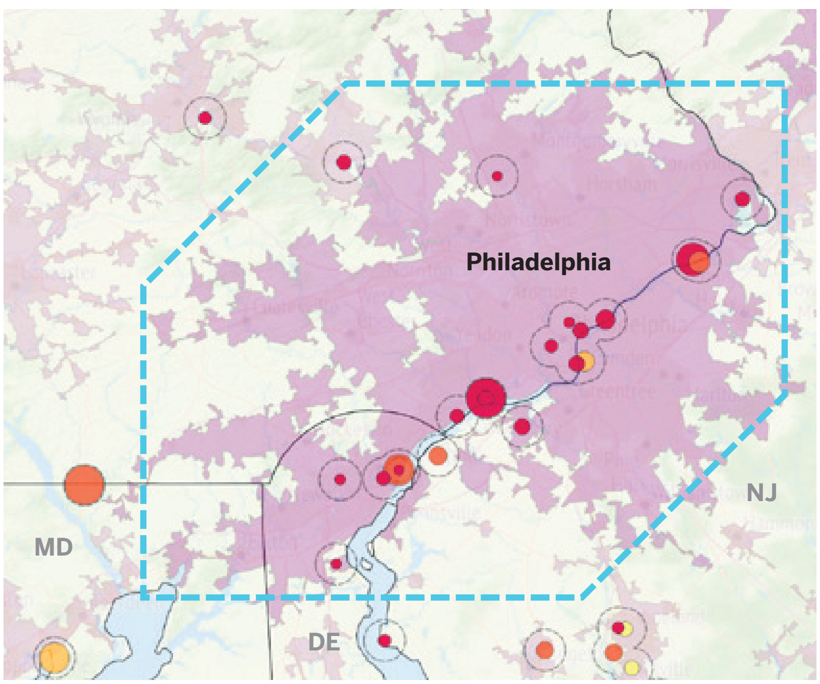
Philadelphia is the largest city in the Commonwealth of Pennsylvania and center of the 7th largest metropolitan area in the country. The Greater Philadelphia Metropolitan Area has 6.25 million residents and encompasses two other states, New Jersey and Delaware. It is served by different electricity providers in each state: PECO in Pennsylvania; PSE&G and Atlantic City Electric in New Jersey; and Delmarva in Delaware. Each utility is part of a different zone of the PJM interconnection[37] and is regulated by its corresponding Public Utility Commission.

There are 22 peaker plants in the Greater Philadelphia Metropolitan Area (which includes New Jersey and Delaware border areas; see **Figure 8**), contributing 3,184 megawatts of total capacity (see **Appendix C**). Every year, they emit over 646,000 pounds of NO_X and over 216,000 pounds of SO_2 to their surroundings. The Philadelphia peakers affect over 220,000 people living within one mile and over 1.5 million people living within three miles of a peaker. Moreover, almost 70 percent of the people living close to a peaker, in the most densely populated areas of the city, are part of a low-income community and/or in a community of color.

The American Lung Association estimates the Philadelphia-Reading-Camden metro area could see **cumulative public health benefits of $41.1 billion between 2020 and 2050 by eliminating transportation and power plant emissions**. This includes 3,760 avoided premature deaths. In fact, the Philadelphia-Reading-Camden area is the fifth-highest ranking metro area nationally in the ALA's *Zeroing in on Healthy Air* report, meaning it is **one of the metro areas nationally with the most to gain by eliminating these emissions.**

FIGURE 8

Philadelphia Metro Area Peaker Fleet



All 22 peakers within the Greater Philadelphia metropolitan area. Size indicates capacity, yellow to red indicates highest to lowest capacity factor.

SOURCE: STRATEGEN

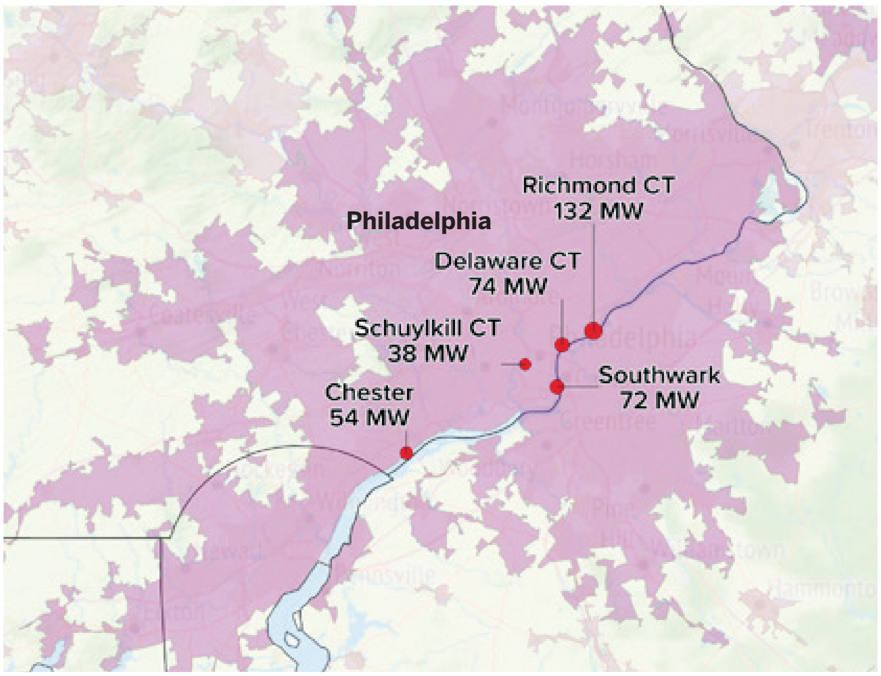
The Philadelphia-Reading-Camden metro area could see cumulative public health benefits of $41.1 billion between 2020 and 2050 by eliminating transportation and power plant emissions. This includes 3,760 avoided premature deaths.

37 PJM is the largest ISO in the United States, with jurisdiction over 13 states and the District of Columbia. PJM has a membership of over 1,000 companies, serves 65 million customers, and has 180 gigawatts of generating capacity.

Of the 22 peakers impacting Philadelphia across the tri-state area, twelve are located in Pennsylvania and were analyzed for this report. Ten of these twelve peakers still rely on oil, and eleven of the twelve have heat rates above the national average of 13,300 Btu/kWh, indicating the Philadelphia fleet as a whole is inefficient. **The five plants highlighted below (Chester, Delaware Combustion Turbine, Richmond Combustion Turbine, Schuylkill Combustion Turbine, and Southwark) are all oil peakers with extremely high NO_x emissions.** The fleet's average utilization is 0.27 percent, making them potential targets for replacement using battery storage technologies (see **Figure 9**).

FIGURE 9

Philadelphia High-Impact Peakers



The Philadelphia peakers affect over 220,000 people living within one mile and over 1.5 million people living within three miles of a peaker. Moreover, almost 70 percent of the people living close to a peaker, in the most densely populated areas of the city, are part of a low-income community and/or in a community of color.

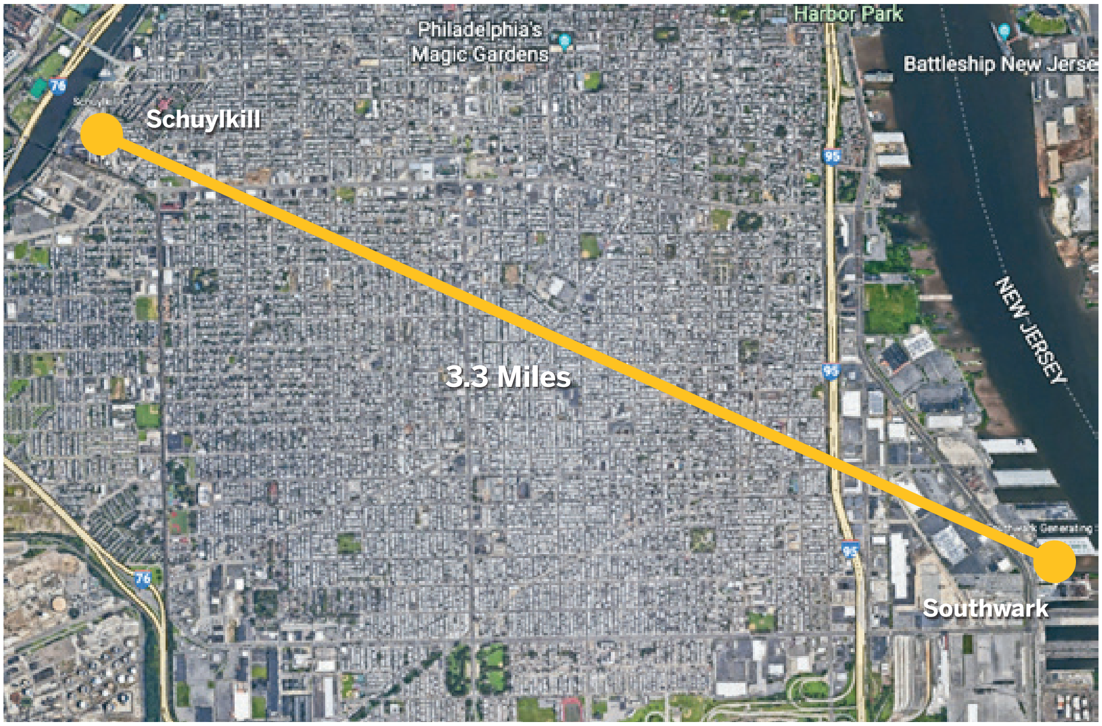
Five high-impact peakers in the Philadelphia metropolitan area.

SOURCE: STRATEGEN

One area of special concern is South Philadelphia ("South Philly"), the neighborhood bounded by South Street to the north, the Delaware River to the east and south, and the Schuylkill River to the west. This dense and diverse neighborhood is sandwiched between the Southwark CT and the Schuylkill CT, with only 3.3 miles separating these peakers. (See **Figure 10**.)

FIGURE 10

Neighborhoods Bookended by Peaker Plants in Philadelphia



Schuylkill Connecticut
- People of Color (60%)
- Low Income (44%)
- Plant Age (51 Years)
- Capacity Factor (0.24%) (219 hrs/yr)
- NO_x Emissions Rate (14.93 lbs/MWh)

Southwark Generating
- People of Color (49%)
- Low Income (40%)
- Plant Age (53 Years)
- Capacity Factor (0.09%) (79 hrs/yr)
- NO_x Emissions Rate (15.59 lbs/MWh)

The neighborhoods of South Philadelphia are sandwiched between the Schuylkill CT plant and the Southwark Generating Station. There are only 3.3 miles between these plants.

SOURCE: CLEAN ENERGY GROUP

PHILADELPHIA METRO AREA HIGH-IMPACT PEAKER PLANTS

CHESTER

FUEL: **OIL**
OPERATING CAPACITY: **54 MW**
CAPACITY FACTOR: **0.13 PERCENT**
HEAT RATE: **18,536 BTU/KWH**
NO_X EMISSIONS RATE: **17.42 LBS/MWH**

Chester is a 53-year old regulated plant owned by Exelon Corporation. It is the most southern of the plants analyzed in this section, located in the Chester Township along the Delaware River. The surrounding community is 58 percent people of color and 47 percent low-income. It is adjacent to a sports complex and the stadium that is home to the major league soccer team the Philadelphia Union. Another neighbor along the river is the Covanta Delaware Valley incinerator. The neighborhoods of Chester Township begin about 1,000 feet from this plant.

DELAWARE CT

FUEL: **OIL**
OPERATING CAPACITY: **74 MW**
CAPACITY FACTOR: **0.07 PERCENT**
HEAT RATE: **21,527 BTU/KWH**
NO_X EMISSIONS RATE: **20.23 LBS/MWH**

Delaware CT is an unregulated merchant plant owned by Exelon Corporation. It is a 52-year-old plant running on oil close to Philadelphia's city center. At 21,500 Btu/kWh, it is **one of the most inefficient peakers in the fleet** and one with most people living in proximity. Of the 370,000 people living in a three-mile radius from the peaker, 63 percent are people of color and 51 percent are low-income.

RICHMOND CT

FUEL: OIL
OPERATING CAPACITY: 132 MW
CAPACITY FACTOR: 0.42 PERCENT
HEAT RATE: 15,416 BTU/KWH
NO_x EMISSIONS RATE: 9.1 LBS/MWH

Richmond CT is a 49-year-old unregulated merchant plant owned by Exelon Corporation. The neighbors within a three-mile radius of the plant are 67 percent persons of color and 53 percent low-income. The two combustion turbines (of 19 originally commissioned in the 1960s) sit adjacent to a 1925 coal plant that was decommissioned in 1984.[38] It is less than one mile from Franklin Towne Charter Elementary School.

SCHUYLKILL CT

FUEL: OIL
OPERATING CAPACITY: 38 MW
CAPACITY FACTOR: 0.24 PERCENT
HEAT RATE: 15,889 BTU/KWH
NO_x EMISSIONS RATE: 14.93 LBS/MWH

Schuylkill CT is a 52-year-old regulated plant owned by Exelon Corporation and is one of the two peakers (with Southwark) that bookend the South Philadelphia area. This peaker is located along the Schuylkill River in the Devil's Pocket neighborhood. The peaker sits immediately adjacent to row houses (see **Figure 11**). The surrounding community is 60 percent persons of color and 44 percent low-income.

FIGURE 11

Schuykill Combustion Turbine (CT)

Schuylkill CT is located adjacent to row houses in the Devil's Pocket neighborhood of South Philadelphia.
PHOTO: GOOGLE EARTH.

38 "Workshop of the World—Philadelphia—Richmond-Bridesburg—Richmond Generating Station, 1925," Workshop of the World, 1990, https://www.workshopoftheworld.com/richmond_bridesburg/generating.html (accessed June 6, 2022).

SOUTHWARK

FUEL: OIL
OPERATING CAPACITY: 72 MW
CAPACITY FACTOR: 0.09 PERCENT
HEAT RATE: 16,694 BTU/KWH
NO_X EMISSIONS RATE: 15.69 LBS/MWH

Southwark is an unregulated 54-year-old merchant plant owned by Exelon Corporation. It is located in a highly industrialized area at the bend in the Delaware River, but the dense neighborhoods of South Philadelphia are less than 4,000 feet away. The community is 49 percent persons of color and 40 percent low-income. Within a one-mile radius is the George W. Sharswood School, a K-8th grade school in the Whitman neighborhood (see **Figure 12**). Southwark is one of the two peakers, along with Schuylkill, that bookend the South Philadelphia neighborhoods.

FIGURE 12

Whitman neighborhood in South Philadelphia

Philadelphia is known for its dense neighborhoods of row houses. This street is in the Whitman neighborhood of South Philadelphia.

PHOTO: GOOGLE EARTH.

Policies that are affecting these plants

One significant factor affecting the health of residents in Philadelphia is that the city is bordered by the urbanized areas of New Jersey and Delaware. Peakers located across the river in those states impact the city as well, though this report only focuses on the Pennsylvania side of the lower Delaware River.

The energy and environmental policies of the Philadelphia metropolitan area are influenced by the goals of each adjacent state and the city's own goals. In 2021, the City of Philadelphia adopted an economy-wide commitment to carbon neutrality by 2050 and announced an Environmental Justice Commission to prioritize support for the communities most impacted by infrastructure and climate stressors.[39] At the state level, Pennsylvania does not have a renewable portfolio standard (RPS) or an energy storage deployment target, but its Department of Environmental Protection (PA DEP) is in the process of creating the state's Environmental Justice Public Participation Policy.[40] New Jersey has established the goals of procuring 2 gigawatts (2,000 megawatts) of energy storage by 2030 and generating 7.5 gigawatts of electricity from offshore wind by 2035 as part of the state's Energy Master Plan to transition to 100 percent clean energy by 2050.[41] In Delaware, the RPS is set at 40 percent renewable energy by 2035.

In the larger PJM region, interconnection requests from renewables and storage have reached historically high levels as these technologies become viable and more economical under new market participation rules. As of March 2022, PJM had approximately 347 gigawatts of potential projects with active interconnection requests. This amounts to over 140 gigawatts of summer capacity, where about 46 percent of the capacity comes from solar, 25 percent from energy storage, 6 percent from wind, and 15 percent from paired resources.[42] While most of the projects in the interconnection queue might never be built, it is a good indication of the size and proportion of new generation that will come online in the short term. In fact, PJM has proposed updates to its interconnection process and the expansion of the transmission system to keep up with renewables interconnecting to the system.[43] Similarly, the PA DEP has recognized the key role of storage to enable the integration of intermittent renewables.[44]

In February 2022, PJM filed its compliance proposal for FERC Order 2222.[45] One element of the proposal is the adoption of a new valuation mechanism for capacity to better recognize the reliability of renewables and storage, easing their participation in the capacity market. PJM's Effective Load Carrying Capability (ELCC) values are set annually based on the performance, availability and reliability of each resource in the peak hours of the year.

For example, in the Base Residual Auction for the 2024–2025 delivery year to be carried out this year,[46] the ELCC value of 4-hour storage was set at 82 percent meaning that a 10-megawatt energy storage system can bid as an 8.2-megawatt capacity resource in the market.[47] This is more than twice the value that storage had under the previous 10-hour duration requirement for storage participation in PJM's capacity market.[48]

39 "City Commits to Carbon Neutrality by 2050, Releases Climate Action Playbook and Hires First Chief Resilience Officer," *City of Philadelphia*, January 15, 2021, https://www.phila.gov/2021-01-15-city-commits-to-carbon-neutrality-by-2050-releases-climate-action-playbook-and-hires-first-chief-resilience-officer (accessed June 6, 2022).

40 The Environmental Justice Public Participation Policy is being created to increase engagement in EJ Areas and ensure those communities have the opportunity to participate and be involved in a meaningful manner throughout the permitting process when regulated activities are proposed in their neighborhood or when existing facilities expand their operations. https://www.dep.pa.gov/PublicParticipation/OfficeofEnvironmentalJustice/Pages/Summaries-and-Documents.aspx (accessed June 29, 2022).

41 "Energy Master Plan," *State of New Jersey*, https://nj.gov/emp (accessed June 6, 2022).

42 "PJM News Services Queue," PJM, https://www.pjm.com/planning/services-requests/interconnection-queues.aspx (accessed March 2022).

43 In March 2022, PJM released its Transmission Expansion Plan where it lays out the strategy to accommodate new renewable generation projects and DER as it prepares the grid to deliver the nation's goals on energy decarbonization. https://insidelines.pjm.com/pjm-releases-2021-annual-planning-report (accessed June 29, 2022).

44 "Energy Programs Office: Clean Energy Program Plan," *Pennsylvania Department of Environmental Protection*, 2020, https://www.dep.pa.gov/Business/Energy/OfficeofPollutionPrevention/Pages/default.aspx (accessed June 6, 2022). The plan summarizes DEP's energy-related plans, supporting policies, and programs; recommends new clean energy actions to be taken over the next one to three years; and explores approaches that may be taken to anticipate future events and mitigate disruptions to ensure energy resilience and security.

45 "Order No. 2222 Compliance Filing of PJM Interconnection, L.L.C. Motion for Extended Comment Period," *United States of America Before The Federal Energy Regulatory Commission*, February 1, 2022, https://pjm.com/directory/etariff/FercDockets/6522/20220201-er22-962-000.pdf (accessed June 6, 2022).

46 Similar to ISO-NE, PJM conducts capacity auctions three years in advance of the delivery year through its capacity market, called the Reliability Pricing Model. The RPM ensures long-term grid reliability by securing the appropriate amount of power supply resources needed to meet predicted energy demand in the future.

47 "December 2021 Effective Load Carrying Capability (ELCC) Report," *PJM*, December 31, 2021, 2021 Effective Load Carrying Capability (ELCC) Report. ELCC accounts for the reliability value of resource diversity. This means that the ELCC value of a resource category (e.g., solar, wind, storage) decreases as its share of capacity increases, so the ELCC of intermittent renewables and storage is forecasted to go dawn in the 2021 report. https://www.pjm.com/-/media/planning/res-adeq/elcc/elcc-report-december-2021.ashx (accessed June 29, 2022).

48 Up to last year, PJM employed a "10-hour rule" for duration-limited resources in the capacity market. Under this rule, a resource's "capability" for the purposes of the capacity market is calculated by the power output it can provide for 10 continuous hours. A 4-hour battery, for example, needed to be derated to 40 percent of its capacity during each hour of the 10-hr period.

Peak Shaving and Battery Storage

Peak shaving using large-scale battery storage and renewables is already taking place in Philadelphia, and a prominent example is the **Philadelphia Navy Yards**. This former military property is now a commercial center with its own microgrid. In late 2021, a 6.4 megawatt lithium-ion battery system was added to the development's existing 400-kilowatt community solar installation. **The battery is intended to kick in when the facility's load peaks, replacing the fossil fuel generators that would otherwise run.**[49] It is essentially a battery replacement for fossil fuel peaking generators for the Navy Yards.

These changes to the wholesale market's design are a step forward in removing barriers for clean energy in the region as they improve the economics of renewables and storage from previous valuation frameworks. The new market participation rules and the expected boom in renewable generation could bolster the adoption of storage closer to levels seen in other ISO territories, integrating intermittent generation and reducing the need for fossil fuel peakers in load centers like Philadelphia.

In 2020, Strategen assessed the barriers and opportunities for energy storage in Pennsylvania and identified the potential for solar-plus-storage projects to provide significant economic and environmental benefits.[50] The study found that $65 million of public investment could be used to leverage private investment and yield $545 million annually in grid and environmental benefits. Recommendations included a storage deployment target that could facilitate the target proposed in Pennsylvania's Solar Future Plan to get 10 percent of the state's electricity from solar energy by 2030.[51]

49 Tom MacDonald, "A big power pack with a goal of sustainability in Philadelphia," *WHYY.org*, August 13, 2021, https://whyy.org/articles/a-big-power-pack-with-a-goal-of-sustainability-in-philadelphia (accessed July 7, 2022)

50 "Pennsylvania Energy Storage Assessment: Status, Barriers, and Opportunities," *Strategen*, prepared for the Pennsylvania DEP, April 2021, https://files.dep.state.pa.us/Energy/Office%20of%20Energy%20and%20Technology/OETDPortalFiles/EnergyAssurance/Strategen_PA_Energy_Storage_Assessment_April_2021.pdf (accessed June 6, 2022).

51 "Pennsylvania's Solar Future Plan," *Pennsylvania Department of Environmental Protection*, November 2018, https://www.dep.pa.gov/Business/Energy/OfficeofPollutionPrevention/SolarFuture/Pages/Pennsylvania%27s-Solar-Future-Plan.aspx (accessed June 6, 2022).

PEAKER OPPOSITION
A Case Study of Community Action in Philadelphia

The Clean Air Council in Philadelphia is highlighted below to summarize several of its efforts to 1) reduce the harmful impacts of fossil-fueled infrastructure and, 2) develop opportunities for resilient and renewable energy alternatives.

The Clean Air Council (CAC), founded in 1967, is the oldest environmental health advocacy nonprofit in Pennsylvania. The CAC works at the municipal, statewide, and federal level to protect residents from the harmful impacts of air pollution.[52] To achieve this mission, CAC is focused on quickly phasing out existing fossil-fuel power plants and halting future ones. CAC works towards achieving this goal through education, community organizing, advocacy, coalition-building, and legal actions. The Council also submits technical comments on air quality permits for peaker plants in the region and is exploring ways to get involved with reducing harmful emissions from these sources or displacing them altogether.

CAC's current power plant opposition efforts include:

- Opposing the proposal to build a new 1,026-megawatt gas-fired power plant in Renovo, an environmental justice community in central Pennsylvania. The Pennsylvania Department of Environmental Protection

Clean Air Council staff, partners, and members hold a press conference to call for stronger rules to reduce air pollution from the oil and gas industry.
PHOTO: CLEAN AIR COUNCIL

52 To learn more about the Clean Air Coalition, visit https://cleanair.org.

(DEP) issued an air quality permit for the plant, despite Renovo residents demanding an opportunity to learn more about the permit and potential health impacts. CAC helped a group of concerned residents to organize, to submit letters to DEP to comment on the air permit, and to request a public meeting; CAC also provided them with educational materials and information about the impacts of the facility, and supported them in publicly raising their concerns.[53] The Council also is the lead group appealing the air quality permit for the Renovo Energy Center.

- Opposing Invenergy's proposal to build the Allegheny Energy Center, a 639-megawatt gas-fired power plant in Elizabeth Township in southwest Pennsylvania. With partner groups, CAC appealed the air quality permit for the power plant. The Council is also coordinating with partner groups to support a local group in opposing the power plant through letter-writing campaigns and getting information about the impacts of the plant out to the public.[54]

"Fossil fuel power plants emit huge quantities of health-harming and climate-warming pollution. To protect the health of our communities and avoid the worst impacts of the climate crisis, we must rapidly transition away from using fossil fuels for generating power and on to renewable energy supported by things like battery storage, energy efficiency, and smart programs that balance energy supply and demand."

— Matt Walker, Advocacy Director, Clean Air Council

In addition to these efforts, CAC has been advocating for a new health risk assessment requirement for major sources of air pollution in Philadelphia. This assessment would be required for new industrial sources of air pollution and when existing facilities reapply for permits. The Council and its partners are urging the Philadelphia Health Department to review the *cumulative* risks of pollution from these facilities on air quality and public health. There is an active public comment period at the time of publication and a public hearing is scheduled for August 10, 2022.

53 To learn more about the Renovo plant opposition visit Healthy Renovo at https://www.healthyrenovo.org and Clean Air Council's website https://cleanair.org/take-action.

54 To learn more about Alleghany Energy Center opposition efforts, visit Yough Communities CARE at https://www.youghcommunitiescare.org.

DETROIT

Detroit is the largest city in the state of Michigan and the center of the second-largest metropolitan area in the Midwest. With over 4 million people, the Detroit Metropolitan Area is known as a major industrial center with deep historical ties to the automotive industry. The Michigan Public Service Commission (PSC) regulates the utilities in the state and the Midwest Independent System Operator (MISO) operates the wholesale energy markets in the region. Most of the electricity in the metropolitan area is provided by Detroit Edison Company (DTE), an investor-owned utility serving over two million customers, and by municipal and cooperative utilities serving the remaining parts of the metropolitan area.

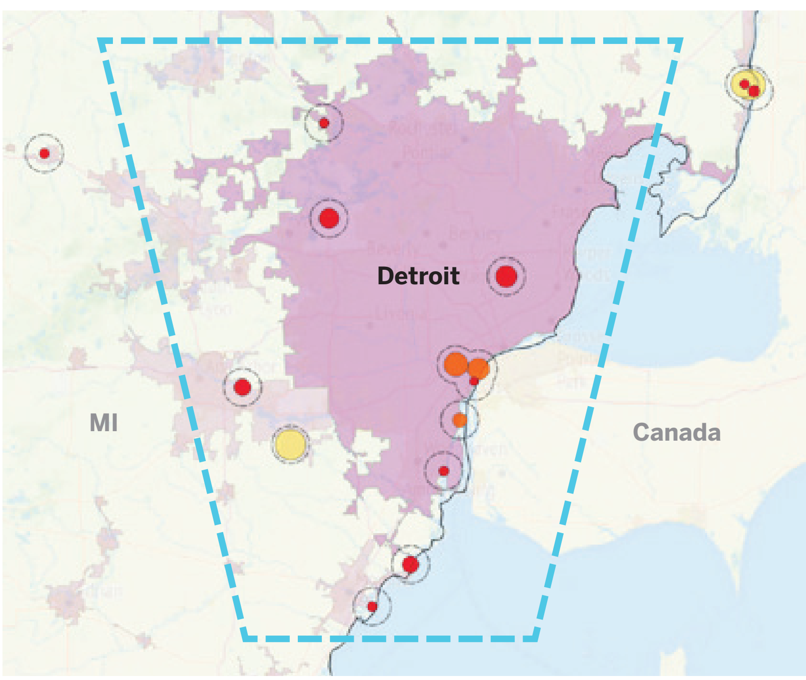
Detroit has 13 peakers in its metropolitan area with a total capacity of 1,273 megawatts (see **Figure 13** and **Appendix C**). The fleet's utilization is below the national average, with a 3.9 percent average capacity factor over the last three years. It is the oldest fleet considered in this study, with 40 percent of its capacity being older than 50 years. The fleet emits an annual average of over 375,000 lbs. of NO_x and 27,000 lbs. of SO_2.

In Detroit's Metropolitan Area, about 46,300 people live within one mile of a peaker, and 553,400 people reside within three miles of a peaker. In the City of Detroit, the most densely populated locality of the metro area, peakers are more likely to impact historically marginalized communities. Within a three-mile radius of these central peakers, up to 73 percent of the population are people of color and 70 percent live in a low-income household.

In the *ALA Zeroing in on Healthy Air* report, the Detroit-Warren-Ann Arbor metro area could see **cumulative public health benefits of $29.2 billion between 2020 and 2050 if transportation and power plant emissions are eliminated. This includes 2,690 avoided deaths during that time period**.[55]

FIGURE 13

Detroit Metro Area Peaker Fleet



All 13 peakers within the Greater Detroit metropolitan area. Size indicates capacity, yellow to red indicates highest to lowest capacity factor.

SOURCE: STRATEGEN

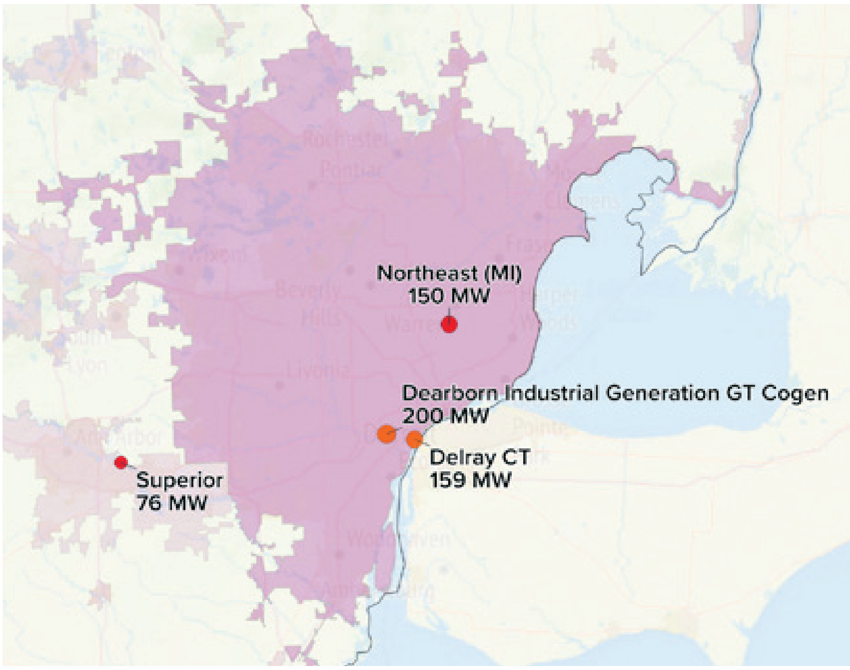
Detroit has the oldest fleet considered in this study, with 40 percent of its capacity being older than 50 years. The fleet emits an annual average of over 375,000 lbs. of NO_x and 27,000 lbs. of SO_2.

55 "Zeroing in on Healthy Air: A National Assessment of Health and Climate Benefits of Zero-Emission Transportation and Electricity," *American Lung Association*, p.12, https://www.lung.org/getmedia/13248145-06f0-4e35-b79b-6dfacfd29a71/zeroingin-on-healthy-air-report-2022.pdf (accessed June 6, 2022).

Considering factors such as utilization, efficiency, and proximity to potentially disadvantaged communities, there are four peakers that could be considered as priority candidates for replacement. This list includes Dearborn Industrial Generation GT, Delray CT, Northeast, and Superior (see **Figure 14**). Two-thirds of this capacity is owned by DTE Energy.

FIGURE 14

Detroit High-Impact Peakers



Four high-impact peakers in the Detroit metropolitan area.

SOURCE: STRATEGEN

In Detroit's Metropolitan Area, about 46,300 people live within one mile of a peaker, and 553,400 people reside within three miles of a peaker. Within a three-mile radius of these central peakers, up to 73 percent of the population are people of color and 70 percent live in a low-income household.

DETROIT METRO AREA HIGH-IMPACT PEAKERS

DEARBORN INDUSTRIAL GENERATION GAS TURBINE

FUEL: NATURAL GAS (METHANE)
OPERATING CAPACITY: 200 MW
CAPACITY FACTOR: 2.7 PERCENT
HEAT RATE: 13,512 BTU/KWH
NO_X EMISSIONS RATE: 0.37 LBS/MWH

Dearborn Industrial Generation GT is a 23-year-old, unregulated merchant plant owned by Hydra-Co Enterprises, Inc., a subsidiary of CMS Energy Corporation. It is one of the two plants that bookend the Springwells neighborhood. While it has the lowest NO_x emissions rate of the Detroit peakers, it also has the highest utilization rate or capacity factor of the highlighted Detroit peakers, so it runs more often. As a merchant plant, it sells its capacity into the Midcontinent ISO (MISO) market. The surrounding community is 51 percent persons of color and 68 percent low-income. This peaker is located right beside Salina Elementary School (see **Figure 15**). The surrounding community also consists of 15 percent persons considered linguistically-isolated, the highest of all of the peakers covered in this report.

FIGURE 15

Dearborn Industrial Generation Gas Turbine

The Dearborn Industrial Generation GT site is located next to Salina Elementary School.

PHOTO: GOOGLE EARTH

DELRAY COMBUSTION TURBINE (CT)

FUEL: **NATURAL GAS (METHANE)**
OPERATING CAPACITY: **159 MW**
CAPACITY FACTOR: **1.47 PERCENT**
HEAT RATE: **13,156 BTU/KWH**
NO_X EMISSIONS RATE: **0.56 LBS/MWH**

Delray CT is a 22-year-old regulated peaker plant owned by DTE Energy. While its NO_x emissions are on the lower end, it runs more often than many others, and it is surrounded by the highest percentage of persons of color (73 percent of the community) and low-income citizens (70 percent) of any peaker described in this report. It has the second-highest percentage (14 percent) of residents who are considered linguistically isolated of all the peakers covered in this report. Delray CT is located along the Detroit River in an area that is highly industrialized, south of I-75. The Springwells neighborhood begins north of I-75, less than one mile from the plant. Springwells (much like South Philadelphia) is sandwiched between two peaker plants (Delray and Dearborn). The Springwells community is 60 percent Latinx.[56]

NORTHEAST

FUEL: **NATURAL GAS (METHANE) AND OIL**
OPERATING CAPACITY: **150 MW**
CAPACITY FACTOR: **0.26 PERCENT**
HEAT RATE: **18,000 BTU/KWH**
NO_X EMISSIONS RATE: **8.95 LBS/MWH**

Northeast is a 51-year-old regulated peaker plant owned by DTE. It is the northernmost of the Detroit peakers and is sited in a small industrial strip that is completely surrounded by dense urban neighborhoods, including Grant, Krainz Woods, and Mt. Olivet. It sits 3,200 feet from Mound Park Elementary School. The surrounding community is 67 percent persons of color and 58 percent low-income.

56 "Springwells neighborhood in Detroit, Michigan (MI), 48209 detailed profile," *City-Data.com*, http://www.city-data.com/neighborhood/Springwells-Detroit-MI.html (accessed June 6, 2022).

SUPERIOR

FUEL: OIL
OPERATING CAPACITY: 76 MW
CAPACITY FACTOR: 0.02 PERCENT
HEAT RATE: 31,709 BTU/KWH
NO_X EMISSIONS RATE: 29.79 LBS/MWH

Superior is a 56-year-old regulated peaker plant owned by DTE Energy. It is located outside the Detroit urban area, on the outskirts of Ann Arbor. It is within a mile of the Ann Arbor St. Joseph Mercy Medical Center, as well as Eastern Michigan University and the Ypsilanti Community High School and its surrounding neighborhood. Superior is an extremely inefficient plant with a very low capacity factor but exceptionally high NO_x emission rate—***the highest NO_x emission rate of all of the peakers profiled in this report***. The surrounding community is 45 percent persons of color and 39 percent low-income.

Policies that affect these plants

In 2019, DTE set the goal to reach net-zero emissions by 2050.[57] The utility's plan for net-zero relies on fossil-fueled resources coupled with carbon offsets and renewable gas in the near term, and technologies like carbon capture and hydrogen in the longer term. While the plan is focused on the sector's reach of net-zero carbon emissions, it does not propose a plan to reduce burdens of localized pollution from fossil fuel combustion such as NO_x and $PM_{2.5}$ on local communities. Similarly, Michigan Gov. Whitmer signed an executive directive in 2020 committing the state to go carbon-neutral by 2050, with an interim goal of reducing greenhouse gas emissions by 52 percent by 2030. While the order does not include a specific renewable energy or energy storage target, it calls for the Michigan Public Service Commission to have additional oversight over the utilities' integrated resource plans.[58]

The Michigan Department of Environment, Great Lakes, and Energy (EGLE) coordinates the state's efforts to achieve carbon neutrality by 2050 through the development and implementation of the Michigan Healthy Climate Plan.[59] The plan's draft states that "meeting the 2050 goal will require a switch to 100 percent clean, renewable electricity paired with robust energy storage" and lists environmental justice among its key focus areas.[60] Considering the potential implementation of these energy goals, the state could expand its current decarbonization plans and regulatory tools to accelerate the reduction of local pollutants and environmental burdens on communities. **A plan to retire the urban peakers could be a "no-regrets" step forward toward a just energy transition.**

Considering the emissions, size, and location of Detroit's peaker fleet, a plan to retire the most inefficient and impactful peakers first could help the state to realize the environmental justice focus of its proposed policy.

Considering the emissions, size, and location of Detroit's peaker fleet, a plan to retire the most inefficient and impactful peakers first could help the state to realize the environmental justice focus of its proposed policy.

57 "Our Bold Goal for Michigan's Clean Energy Future: Net zero carbon emissions by 2050," *DTE Energy*, https://dtecleanenergy.com (accessed June 6, 2022).

58 Executive Directive No. 2020-10: Building a Carbon-Neutral Michigan, *State of Michigan Office of the Governor*, September 23, 2020, https://content.govdelivery.com/attachments/MIEOG/2020/09/23/file_attachments/1553296/ED%202020-10%20Carbon_Neutral_Goal.pdf (accessed June 6, 2022).

59 "Michigan Healthy Climate Plan," *Michigan Department of Environment, Great Lakes, and Energy*, April 2022, https://www.michigan.gov/egle/-/media/Project/Websites/egle/Documents/Offices/OCE/MI-Healthy-Climate-Plan.pdf?rev=d13f4adc2b1d45909bd708cafccbfffa (accessed June 6, 2022).

60 At the local level, Detroit is a signatory of the Chicago Climate Charter and thus committed to the goal of reducing GHG emissions 30 percent below 2012 levels by 2025, among other goals comparable to the Paris Climate Accord. "Mayor Emanuel and Global Mayors Sign the Chicago Climate Charter at the North American Climate Summit," *Chicago, Office of the Mayor*, Press release, December 5, 2017, https://www.chicago.gov/city/en/depts/mayor/press_room/press_releases/2017/december/ChicagoClimateSummitCharter.html (accessed June 6, 2022).

PEAKER OPPOSITION
A Case Study of Community Action in Detroit

Highlighted below are several organizations in Michigan that are leading community-based efforts in Detroit and the surrounding areas to 1) reduce the harmful impacts of fossil-fueled infrastructure and, 2) develop opportunities for resilient and renewable energy alternatives.

Michigan Environmental Justice Coalition (MEJC) is a statewide coalition that works to achieve a clean, healthy, and safe environment for environmental justice communities.[61] MEJC's work includes advocacy, community education, and awareness building. In addition to partnering with community organizations and residents to combat existing and planned fossil-fuel infrastructure, MEJC works to expose the cumulative impacts of emissions on environmental justice communities. Their efforts include an upcoming analysis of the impacts of air pollution; the analysis will include the impacts that peaker emissions have on local air quality.

In 2018, MEJC helped launch the Work for Me, DTE! campaign with more than a dozen Detroit-area environmental justice organizations and activists. The campaign mobilized community members in opposition to DTE's 15-year Integrated Resource Plan, leading with a vision of a healthy, affordable, and community-based energy system. Work for Me, DTE! campaign members continue to partner on regulatory interventions and energy democracy organizing.[62]

Detroit area high school students address the crowd at a protest at DTE Energy Headquarters, December 2019.
PHOTO: SARA FARAJ

61 To learn more about the Michigan Environmental Justice Coalition visit https://www.michiganej.org.

62 To learn more about Work for me, DTE! Visit https://ourpowermi.org/local-campaigns/work-for-me-dte.

In addition to advocacy work, MEJC builds awareness through research and reporting. In a report co-authored by Union of Concerned Scientists, MEJC, GreenRoots (Massachusetts), and COPAL (Minnesota), it was estimated that a transition to a "100% RES" (renewable electric standard) scenario could equate to 9,000 fewer cases of asthma exacerbation in Michigan.[63] The report states that over half of Michigan's in-state electricity comes from coal and gas plants. Many of these plants are in urban centers, such as Detroit.

> "We need state policies that slash toxic emissions by accelerating plant closures in EJ communities, prohibiting the construction of new gas-fired power plants, and supporting community-owned renewables."
>
> **— Bridget Vial, Energy Democracy Organizer, MEJC**

Soulardarity is a nonprofit organization that serves Highland Park, an environmental justice community in the center of Detroit, in their efforts to transition to a just and equitable energy system for all.[64] In addition to building community awareness about energy-related health concerns (such as extreme heat) impacting the community, Soulardarity implements clean energy strategies, oftentimes as part of a broader coalition of nonprofit organizations, citizen-led groups, and city agencies. A recent example includes Souladarity's contributions to Highland Park's successful application to join the U.S. Department of Energy's Communities Local Energy Action Program (LEAP) pilot. The city is now eligible to receive up to $500,000 in technical assistance funding to develop a clean energy strategy for Highland Park.

Soulardarity is also member of the **Highland Park Crisis Coalition (HPC3)**. HPC3 works to uplift and empower Highland Park residents through social, economic, and ecological justice.[65] HPC3 is advocating for a just transition to 100 percent clean energy as part of its efforts towards a just recovery from COVID-19. HPC3, which also contributed to the LEAP application, has published a list of Highland Park energy-related concerns—including blackouts and high energy burdens—and builds community momentum to address these concerns.

63 To read the entire "On the Road to 100 Percent Renewables" report, visit https://www.ucsusa.org/sites/default/files/2022-04/on-the-road-100-renewable-report.pdf or read the blog https://blog.ucsusa.org/guest-commentary/michigan-can-transition-to-100-percent-renewable-energy-by-2035-save-lives-and-create-jobs.

64 To learn more about Soulardarity, visit https://www.soulardarity.com/about.

65 To learn more about the Highland Park Crisis Coalition, visit https://www.hpcrisiscoalition.org.

Conclusion

URBAN PEAKERS IN THE U.S. IMPACT 32 MILLION PEOPLE EVERY YEAR. They disproportionately harm low-income communities and communities of color. Peaker emissions cause asthma, heart disease, kidney disease, neurological disorders, premature birth and miscarriages. They cut lives short. It is abundantly clear that peaker plants are harming the communities that surround them. Peakers may not always be the sole source of harmful localized emissions, but they are a source of harmful emissions that can be replaced with non-combustion alternatives today without losing the services needed by the grid. From an emissions standpoint, replacing peaker plants is the lowest hanging fruit in the effort to improve local health.

It is also clear that the policies that govern local and regional power markets play an outsized role in keeping peaker plants in operation despite the availability of cleaner technologies. The entities that set and enforce these policies (ISOs/RTOs, federal agencies, and state agencies and legislatures) can be slow to innovate and hesitant to challenge existing rules and regulations, impeding the replacement of peakers with non-combustion alternatives. "Barriers to exit" for the owners of peaker plants is a significant problem, but owners themselves can be part of the effort to modernize the regulatory structure.

Coalitions of community-based organizations are successfully pushing back on these outdated and polluting technologies. Case studies highlighting several effective campaigns by community organizations and their successes were provided in this report. By halting the development of more than a gigawatt of gas peaker plants over the past year, community campaigns like those supported by the PEAK Coalition in New York City have proven that local efforts can be successful on a very large scale (see **Appendix A**).

The science directly connecting fossil fuel combustion to significant health impacts and related costs is robust and cannot be ignored. The peaker problem has zero-emission, non-combustion solutions. These solutions—battery storage, renewable generation, transmission improvements, virtual power plants, energy efficiency, demand-side management—are reliable, cost-effective, and significantly improve people's lives, while improving the reliability of the grid. It is time to end the unnecessary harm that is being inflicted on 32 million Americans.

The science directly connecting fossil fuel combustion to significant health impacts and related costs is robust and cannot be ignored. The peaker problem has zero-emission, non-combustion solutions.

Above: The Berkshire Environmental Action Team volunteers at a weekly protest held to raise public awareness of the air impacts of a peaker plant in Pittsfield Massachusetts.

PHOTO: JANE WINN, BERKSHIRE ENVIRONMENTAL ACTION TEAM

APPENDIX A

Lessons Learned: New York City and New Orleans

PEAKER OPPOSITON

Lessons Learned from Community Action in New York City

The PEAK Coalition—UPROSE, THE POINT CDC, New York City Environmental Justice Alliance (NYC-EJA), New York Lawyers for the Public Interest (NYLPI), and Clean Energy Group (CEG)—was formed in 2020 to end the long-standing pollution burden from power plants on New York City's most climate-vulnerable people. PEAK represents the first comprehensive effort in the U.S. to reduce the negative and racially disproportionate health impacts of a city's peaker plants by replacing them with renewable energy and energy storage solutions. The collaboration brings technical, legal, public health, and planning expertise to support organizing and advocacy led by communities harmed by peaker plant emissions. Together with communities, the PEAK Coalition is advocating for a system of localized renewable energy generation and battery storage to replace peaker plants, reduce greenhouse gas (GHG) and local emissions, lower energy bills, improve equity and public health, and make the electricity system more resilient in the face of increased storms and climate impacts.

In May of 2020, the PEAK Coalition released the groundbreaking report *Dirty Energy, Big Money* that, for the first time in the country, detailed the true social and economic costs of these dirty power plants.[1]

94-megawatt Joseph Seymour Peaker Plant (NYPA)

PHOTO: SUMMER SANDOVAL, UPROSE

1 The Peak Coalition, "Dirty Energy, Big Money: How Private Companies Make Billions from Polluting Fossil Fuel Peaker Power Plants in New York City's Environmental Justice Communities—and How to Create a Cleaner, Most Just Alternative," C*lean Energy Group,* May 2020, https://www.cleanegroup.org/ceg-resources/resource/dirty-energy-big-money (accessed July 7, 2022).

Top findings from the report include that an estimated $4.5 billion in ratepayers' funds over 10 years went toward the continued operation of the city's peaker plants—most of which operate no more than a few hundred hours each year. The research found that New York City's peakers generate some of the most expensive energy in the country, costing as much as 1,300 percent more than the average cost of electricity in New York.

352-megawatt Narrows Peaker Plant in Sunset Park (ArcLight Capital Holdings LLC/AGC)
PHOTO: UPROSE

This was followed by a second report in 2021, *The Fossil Fuel End Game: A Frontline Vision to Retire New York City's Peaker Plants by 2030*, detailing a strategic and policy road map to retire and replace all of New York City's fossil-fuel peaker plants.[2] The report lays out a community-led strategy to replace about half of the city's existing peaker plants, representing more than 3 gigawatts of peaker generation, with a combination of offshore wind, distributed solar, energy efficiency, and battery storage by 2025. The remaining peaker plants could be reliably and cost-effectively replaced with the same mix of resources by 2030. The proposed retirement and replacement would save ratepayers $1 billion in energy market costs by 2035 and displace emissions amounting to an additional $1 billion in reduced environmental and health impacts. PEAK also researched and published *Big Pollution, Big Influence* that found that the biggest polluters in New York are spending more money than ever on lobbyists to try to stall or derail the urgent push for climate legislation in the state.[3]

These reports were coupled with legislative and legal interventions along with on-the-ground advocacy, resulting in multiple successes:

- In September 2021, PEAK joined Earthjustice, Sierra Club, and Chhaya CDC in submitting joint comments to New York State Department of Environmental Conservation (DEC) detailing the many ways that NRG's proposed 437-megawatt Astoria Replacement Project is inconsistent with New York's Climate Leadership and Community Protection Act's (CLCPA) emissions mandates and highlighted the disproportionate harm the project would have on disadvantaged and overburdened communities.[4] DEC agreed on all counts. In October 2021, DEC ruled that NRG's proposed gas plant was not compliant with CLCPA's zero-emission requirement and denied the project's Title V Air Permit. While NRG has appealed the decision, the denial effectively halts the Astoria Replacement Project and removes the threat of subjecting environmental justice communities in Astoria, Queens and nearby neighborhoods to decades of additional pollution. Along with stopping NRG's proposed gas plant, the ruling established a precedent for every polluting peaker plant that will be impacted by new NO_x emissions limits set to take effect in 2023, making it clear that new gas is not an acceptable solution.

2 The PEAK Coalition, "The Fossil Fuel End Game: A Frontline Vision to Retire New York City's Peaker Plants by 2030," *Clean Energy Group*, March 2021, https://www.cleanegroup.org/ceg-resources/resource/fossil-fuel-end-game (accessed July 7, 2022).

3 The PEAK Coaliton and NY Renews, "Big Pollution, Big Influence: Power Companies Ramp Up Spending in Albany, Targeting Climate Laws, *NYLPI.org*, December 2020, https://nylpi.org/wp-content/uploads/2020/12/Big-Pollution-Big-Influence_Final.pdf (accessed July 7, 2022).

4 PEAK Coalition, et al., "Comments on Astoria Gas Plant Replacement," *Clean Energy Group*, September 2021, https://www.cleanegroup.org/ceg-resources/resource/peak-coalition-et-al-comments-on-new-york-city-astoria-gas-plant-replacement (accessed July 7, 2022).

- Less than two months later, on December 16, 2021, UPROSE and PEAK won another major victory when Eastern Generation, an affiliate of the private equity firm ArcLight, announced that it would be withdrawing its Article 10 application to repower the 640-megawatt Gowanus peaker plant with new gas turbines.[5] Instead, the company is pivoting to pursue the development of energy storage at the site of the half-century-old peaker in Sunset Park, Brooklyn. Eastern Generation plans to shut down the Gowanus plant and nearby 352-megawatt Narrows peaker as soon as November 2022. Along with energy storage, Eastern Generation is in the process of engaging clean energy developers to repurpose its fossil fuel assets in New York City to facilitate the transmission of gigawatts of planned offshore wind energy.

- In 2020, the New York Power Authority (NYPA) and PEAK executed an unprecedented agreement committing to a joint study of the feasibility of retiring the NYPA's six gas-fired peaker plants in NYC. NYPA also agreed to fund technical consultant Strategen to work directly for the PEAK coalition during the 18-month technical analysis and drafting process. In April 2022, NYPA and PEAK released the results of this joint study finding that each of the authority's peakers could be effectively retired and replaced by four-hour battery storage by 2030. As an immediate result of the study and collaborative process with PEAK, NYPA also released a parallel request for proposals for development of bulk battery storage projects at its peaker facilities, which could completely replace gas combustion at these sites.

These environmental justice victories would effectively replace all three fossil-fuel peakers impacting the Sunset Park community in Brooklyn and incentivize the development of renewable energy and energy storage alternatives. This is a significant start in achieving the PEAK Coalition's goal of retiring all peakers in New York City. The coalition represents a model for success that other communities can learn from and look to replicate.

PEAKER OPPOSITON

Lessons Learned from Community Action in New Orleans

The harmful health impacts and socioeconomic disparities from peaker power plants affecting nearby environmental justice communities, low-income communities, and communities of color are increasingly well documented; yet peakers continue to be a go-to resource for utilities when addressing grid reliability concerns.[6]

The following case study provides an overview of community-led efforts in New Orleans to stop the construction of the New Orleans Power Station, a 126-megawatt gas-fired peaker power plant, and instead replace it with resilient power technologies—solar PV paired with battery storage (solar+storage). Though the community did not succeed in stopping the construction of this plant, the obstacles, processes, and lessons-learned are invaluable experiences for other community organizations working to combat fossil-fuel investments in own their community.

This case study describes how the brand-new plant failed to provide power during Hurricane Ida, and it concludes with a description of community-led resilient power efforts currently underway in New Orleans.

Background

According to the U.S. Energy Information Administration, Louisiana ranked first in the nation for the most time with interrupted power in 2020 (totaling 60 hours of power outages for the year), and second for

5 Eastern Generation LLC, "Major New York City Power Producer Shifts Focus to Energy Storage," *EasternGeneration.com*, December 16, 2021, https://www.easterngeneration.com/2021/12/16/major-new-york-city-power-producer-shifts-focus-to-energy-storage (accessed July 7, 2022).

6 Clean Energy Group's Peaker Power Plan Mapping Tool provides basic operating and emissions information for the U.S. fleet of fossil-fuel peaker power plants, along with demographic information about populations living near each power plants. https://www.cleanegroup.org/ceg-projects/phase-out-peakers/maps/#tab-id-2 (accessed July 18, 2022).

frequency of power outages.[7] An increase in natural disasters is directly linked to the increase in power outages—Louisiana had a record five hurricanes to make landfall in 2020. However, community advocates argue that the increasing duration of power outages can also be attributed to reliability issues plaguing the grid.

In New Orleans, community leaders and nonprofit organizations have been working to hold Entergy (the state's largest utility and primary electricity and gas provider to New Orleans) and the New Orleans City Council (the entity responsible for regulating the utility) responsible for grid reliability concerns.[8,9] These organizations have advocated for renewable and resilient energy investments as an opportunity to build grid stability, improve resilience in the event of an outage, andreduce harmful emissions.

Despite these efforts, Entergy's response to major grid reliability issues has been to prioritize investment in gas-fueled energy infrastructure. The most recent of these investments was the New Orleans Power Station. Entergy's justification for the peaker plant was three-fold: 1) it was necessary to meet demand during peak hours, 2) it would improve reliability, and 3) it would have the ability to jump-start the grid in the event the city's power supply was jeopardized.

A flyer encouraging the public to attend a New Orleans City Council meeting regarding the (at the time) proposed New Orleans Power Station

SOURCE: ENERGY FUTURE NEW ORLEANS/#NOGASPLANT CAMPAIGN

A coalition led by the Alliance for Affordable Energy, Louisiana's only dedicated watchdog organization working to protect consumer rights at the Louisiana Public Service Commission and New Orleans City Council, and other local advocates, including the Deep South Center for Environmental Justice, the Greater New Orleans Housing Alliance, 350 New Orleans, VAYLA, and the local Sierra Club chapter, formed an opposition campaign when the plant was proposed in 2016.[10] Clean Energy Group worked with the coalition to commission an independent assessment to install battery storage systems as an alternative to the proposed gas plant. The results of that analysis clearly indicated that battery storage could deliver the needed

7 US Energy Information Administration, "U.S. electricity customers experienced eight hours of power interruptions in 2020," *EIA.gov*, November 10, 2021, https://www.eia.gov/todayinenergy/detail.php?id=50316#:~:text=Customers%20in%20Alabama%2C%20Iowa%2C%20Connecticut,to%2060%20hours%20in%20Louisiana (accessed July 18, 2022).

8 Entergy New Orleans is a subsidiary of Entergy Corporation and serves approximately 210,000 customers.

9 New Orleans is the only city in the nation to regulate an investor-owned utility when there is a state-level agency in place, the Louisiana Public Service Commission (LPSC). The remaining investor-owned energy utilities are regulated by the LPSC.

10 To learn more about the community organizations fighting fossil-fuel infrastructure, visit:

Alliance for Affordable Energy at https://www.all4energy.org.

Deep South Center for Environmental Justice: https://www.dscej.org.

The Greater New Orleans Housing Alliance: https://www.gnoha.org/main/home.

350 New Orleans: https://350neworleans.org.

FIGURE 16

New Orleans Metro Area Peaker Fleet

SOURCE: STRATEGEN

services to the grid and would cost significantly less than the gas plant over time.[11] Furthermore, battery storage would produce no emissions.

Despite efforts to advance clean energy solutions, the New Orleans City Council ultimately approved Entergy's proposal, and the peaker plant was built. The now two-year-old peaker is in the city's outskirts, though over 22,000 people live within three miles of the plant (see **Figure 16**). These people also live in potentially disadvantaged communities: 98 percent of them are part of minority groups, and 47 percent live in a low-income household.

There are two other peakers in the area—both part of the Waterford site (**Figure 16**). To learn more about Waterford peakers, information is provided in the footnotes for this section.[12]

The New Orleans Power Station's Failure to Produce Power

Entergy's claim that the New Orleans Power Station would be able to jump-start the grid in the event of a grid outage was an essential selling point for the City Council, as New Orleanians' are repeatedly left in the dark, sometimes for weeks, after a natural disaster and subsequent power outages.

11 Strategen Consulting, "Assessment of Potential Alternatives for Local Peaking Capacity in the Entergy New Orleans Service Area," *Clean Energy Group*, March 4, 2019, https://www.cleanegroup.org/ceg-resources/resource/assessment-of-potential-alternatives-for-local-peaking-capacity-in-the-entergy-new-orleans-service-area (accessed July 18, 2022).

12 The other two peakers are part of the Waterford site, located in a less populated area (see Figure 16). Approximately 3,000 people live within a three-mile radius of the peaker, and almost half of them live in a potentially disadvantaged community where over 90 percent of the residents are part of low-income and minority groups. The Waterford power plants are one of the largest single emitters of NO_X identified in this study, emitting over 1.5 million pounds of NO_x to the air each year.

However, when Hurricane Ida landed in New Orleans on August 29, 2021—the first major storm to hit after the completion of the New Orleans Power Station—the peaker plant failed to come online.[13] The entire City of New Orleans was without power. Three weeks after Ida, almost 40,000 people still didn't have power. At least 10 people died as temperatures reached over 100 degrees. Without power, the medically vulnerable and elderly had no access to air conditioning. Many more were hospitalized. Entergy had failed to deliver, and the consequences were devastating.

Community Leadership

Louisianans know what it means to live with extreme weather and the costs of not having access to clean power. The 2021 and 2022 hurricane seasons put a spotlight on how vital resilient energy solutions are, as the leading cause of death for both years was loss of grid power, both directly due to extreme heat impacts and from carbon monoxide poisoning when families turned to fossil fueled generators. It is time to follow community leaders who know what they need to stay safe.

— Logan Burke, Executive Director, Alliance for Affordable Energy[14]

Community-Led Resiliency Efforts

Community organizations continue to push back against polluting energy infrastructure. In addition to protesting new investment in fossil fuels, New Orleans has a robust grassroots effort to build new resilient and renewable energy technologies—solar PV paired with battery storage (solar+storage).

Highlighted below are several community-led resilience efforts currently underway in New Orleans.

Together New Orleans, a coalition of congregations and community-based organizations in New Orleans, has launched the Community Lighthouse initiative. The initiative will equip 85–100 resiliency "hubs" with solar+storage systems, primarily at congregations and nonprofit institutions located throughout New Orleans and Southeast Louisiana.[15] The hubs will offer residents necessities such as a safe location with lighting, electric outlets for charging devices, and supportive services. Together New Orleans has already broken ground on the first Community Lighthouse, a health clinic in New Orleans, and it has funding to start development at more sites.

Feed the Second Line, a nonprofit organization dedicated to supporting the culture bearers of New Orleans, launched the GET LIT STAY LIT program as an opportunity for New Orleans restaurants to access solar+storage technologies.[16] Restaurants are forced to throw away spoiled food during a power outage due to lack of refrigeration. Solar+storage systems would ensure food remains refrigerated and available to the community while also allowing restaurants to remain open and operational. With sufficiently sized solar+storage systems, restaurants could also become cooling centers, cell phone charging sites, and food distribution sites for their neighborhoods. GET LIT STAY LIT has a goal of 300 restaurants to cover every neighborhood in New Orleans and create a never-ending, self-funded stream of future microgrids.

Policy efforts are also underway. **The Gulf South for a Green New Deal**, which is led by Taproot Earth (formerly Gulf South Center for Law and Policy) and encompasses Texas, Louisiana, Mississippi, Alabama, Florida, and Puerto Rico, supports renewable and resilient energy development through their environmental policy platform.[17,18] This platform highlights many key environmental and equity issues that will need to be addressed to ensure equitable access to clean energy technologies.

The efforts to fight the New Orleans Power Station, as well as the PEAK Coalition's work in New York City to replace peaker plants with clean energy alternatives, demonstrate that peaker opposition campaigns are seldom a short-term commitment, and they do not exist in a vacuum. Community-led efforts to improve air quality, community health, resilience, and energy equity are all intertwined and must

13 Logan Atkinson Burke and Marriele Mango, "Build Louisiana Back Resilient," *Clean Energy Group*, November 16, 2021, https://www.cleanegroup.org/build-louisiana-back-resilient (accessed July 18, 2022).

14 To learn more about the Alliance for Affordable Energy, visit https://www.all4energy.org.

15 To learn more about the Community Lighthouse Initiative, visit https://www.togethernola.org/home.

16 To learn more about GET LIT STAY LIT, visit https://www.feedthesecondline.org/programs/getlitstaylit.

17 To learn more about the Gulf South for a Green New Deal, visit https://www.gulfsouth4gnd.org.

18 To learn more about Taproot Earth (formerly Gulf South Center for Law and Policy) visit, https://taproot.earth.

GET LIT STAY LIT installation at the Queen Trini Lisa restaurant in New Orleans
PHOTO: KATIE SIKORA

become an integral part of the fossil fuel/non-combustion alternative decision-making process. The concept of the public good is larger than the issue of reliability alone. Local community organizations require a seat at the table when decisions are made regarding energy security and infrastructure. This ensures that all ratepayers' health and energy burden issues are represented in the process.

A Success Story

Facilities with solar+storage have already proven successful at supporting vulnerable New Orleanians in the event of an outage. Residents at St. Peters Apartments, a mixed-income apartment building in New Orleans equipped with solar+storage, were able to remain in their apartments with access to lights, refrigeration, and a cooktop during the Hurricane Ida outage. Residents, all of whom are seniors and/or mobility impaired, could run air conditioners certain times of the day, which helped to avoid heat-related health emergencies.[19]

19 Emily Lane, "Solar could power homes after storms, policy and law changes make it hard to afford," *WDSU News*, October, 18, 2021. https://www.wdsu.com/article/solar-could-power-homes-after-storms-policy-and-law-changes-make-it-hard-to-afford/37977398# (accessed July 18, 2022).

APPENDIX B

Non-Combustion Alternatives

AS MORE RENEWABLE ENERGY RESOURCES such as solar and wind come online, the length of time that peak power is needed on the grid has narrowed. In many cases, a peaker power plant is only needed for two-to-four hours or even less. Power plants only called upon for short-duration peak events are prime candidates to be replaced by non-combustion alternatives. In some instances, utilization of only one type of non-combustion resource may suffice, such as a large-scale battery storage installation. Often, a more effective, holistic, resilient, and equitable option is to combine multiple energy resources in such a way that the surrounding community benefits both from a reduction in emissions as well as from economic and resilience benefits. As noted in **Appendix A**, members of the PEAK Coalition in New York City have advocated for localized non-combustion alternatives, including projects such as the community owned and operated Sunset Park Solar. **A comprehensive approach to peaker replacement should prioritize the needs and desires of the community immediately surrounding the plant, and it ideally should contribute to more long-term, positive outcomes, including better health but also lower power bills, increased comfort, ownership and wealth creation, resilience in the event of outages, and improved community stability.** Following is a brief explanation of several non-combustion alternatives and examples of their use to reduce fossil fuels.

Battery storage (lithium-ion batteries, long-duration storage)

The simplest non-combustion alternative to a fossil-fuel peaker with a very narrow peak and a low capacity-factor is a large lithium-ion battery installation, which can typically provide an equal level of power within the same footprint and fence line of the peaker being replaced. A prominent example of this is the Moss Landing project in Monterey County, California. That project features 300 megawatts of lithium-ion batteries (1,200 megawatt-hours) housed within the turbine building of a retired power plant.[1] Utilizing the same footprint allows the battery energy storage system (BESS) to take advantage of the facility's existing

Battery energy storage systems can be stand-alone installations. PHOTO:
PHOTO: ISTOCKPHOTO/PETMAL

1 NS Energy, "Moss Landing Battery Storage Project," *NSenergybusiness.com*, https://www.nsenergybusiness.com/projects/moss-landing (accessed July 13, 2022).

transmission infrastructure and grid interconnection. In New York City, Eastern Generation has received approval to begin installing a 135-megawatt BESS at its Astoria Generating Station in Queens, and it has plans to install an additional 350 megawatts of storage to replace its peakers at its Gowanus and Narrows plants in Brooklyn.[2] See **Appendix A** for more information about local peaker replacement advocacy in New York City.

Large battery energy storage system installations can be charged during peak solar production hours from the grid and discharged during times of peak demand that would ordinarily be met by fossil peaker plants. Large batteries can also be paired with solar PV installations where space is available. Batteries are increasingly being added to existing solar and wind farms, especially in places where renewable energy resources produce more electricity than can be used on the grid at a given time. Adding batteries to solar, both at the utility scale as well as at the residential scale, is happening rapidly in solar-rich regions such as Hawaii, which has a goal of transitioning to 100 percent clean energy by 2045.[3,4]

Longer-duration batteries, capable of delivering power for at least ten hours and, in some cases, multi-day peak events, are also in development. These technologies include but are not limited to flow batteries and iron air batteries. Flow batteries are rechargeable batteries with a liquid electrolyte that flows through one or more electrochemical cells. The energy storage capacity of a flow battery is increased by increasing the quantity of the electrolyte.[5] Iron-air battery technology essentially utilizes the principles associated with the rusting process to charge and discharge energy.[6] Form Energy has announced a potential iron-air pilot project with Georgia Power, a subsidiary of Southern Company, consisting of a 15-megawatt/1,500 megawatt-hour installation in Georgia.[7]

A 1-megawatt/4-megawatt-hour vanadium flow battery owned by Avista Utilities in Pullman, Washington.
PHOTO: WIKIMEDIA COMMONS ROSEGILL13

2 Andy Colthorpe, "Eastern Generation gets permit for 135MW battery storage at New York fossil fuel plant site," *Energy Storage News*, June 23, 2022, https://www.energy-storage.news/eastern-generation-gets-permit-for-135mw-battery-storage-at-new-york-fossil-fuel-plant-site (accessed July 14, 2022).

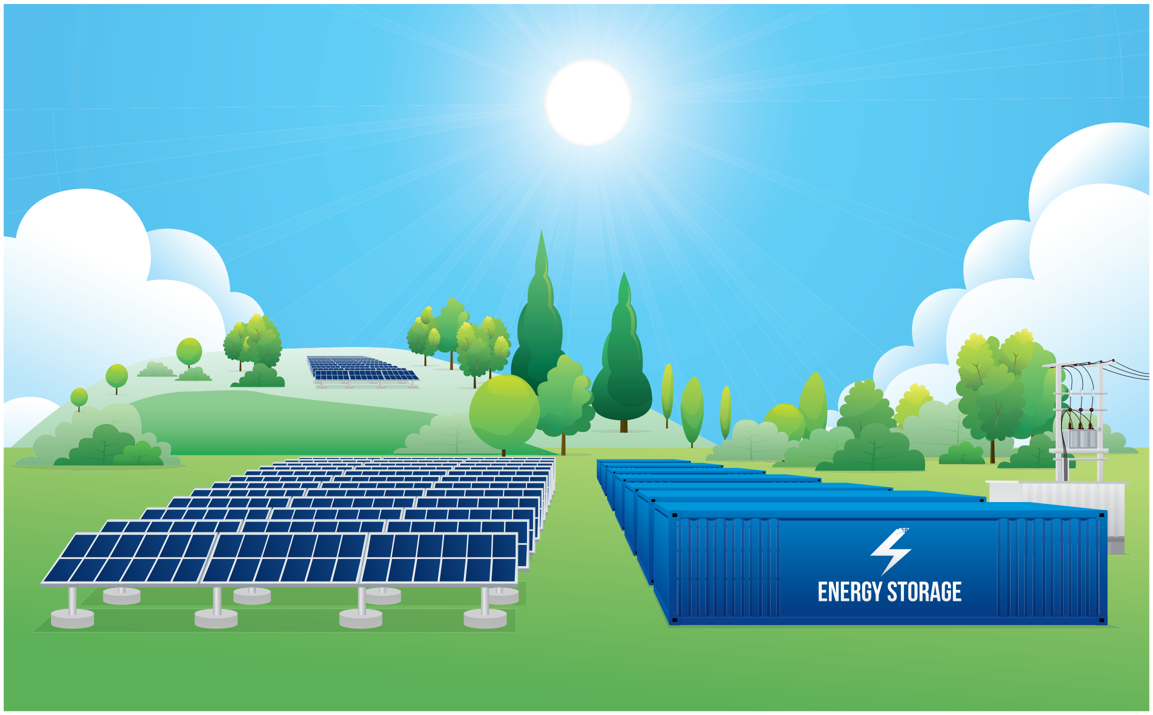
3 Andy Colthorpe, "Peak time to take action," *Energy Storage News*, March 12, 2019, https://www.energy-storage.news/peak-time-to-take-action (accessed July 14, 2022).

4 "Climate Change Action – A vision for 2030 and 2045," *Hawaiian Electric*, https://www.hawaiianelectric.com/about-us/our-vision-and-commitment/climate-change-action (accessed July 14, 2022).

5 Dan Gearino, "Inside Clean Energy: Flow Batteries Could Be a Big Part of Our Energy Storage Future. So What's a Flow Battery?" *Inside Climate News*, Many 19, 2022, https://insideclimatenews.org/news/19052022/inside-clean-energy-flow-battery (accessed July 13, 2022).

6 "Enabling a 100% Renewable Grid," *Formenergy.com*, https://formenergy.com/technology/battery-technology (accessed July 13, 2022).

7 Andy Colthorpe, "Form Energy in talks with Georgia Power for 100-hour iron-air battery storage project," *Energy Storage News*, February 10, 2022, https://www.energy-storage.news/form-energy-in-talks-with-georgia-power-for-100-hour-iron-air-battery-storage-project (accessed July 13, 2022).



Battery energy storage systems can be paired with solar panels.
IMAGE: ISTOCKPHOTO/DOGGIEMONKEY

Distributed Renewable Energy Resources (rooftop solar, community solar)

Distributed renewable energy resources, such as rooftop solar and community solar, can be part of a holistic alternative to peaker plants. Incorporating a plan to increase access to distributed clean energy in the neighborhoods immediately surrounding a peaker plant is a way to incorporate equity into peaker replacement, especially if these resources result in local benefits, such as bill savings, community ownership, and energy resilience. UPROSE's Sunset Solar Park project is an example of how a community-based organization is building New York City's first community solar project that is operated by a cooperative for the benefit of local residents and businesses. The 685-kilowatt installation on the Brooklyn Army Terminal rooftop will provide financial benefits from utility bill savings and serve as a non-combustion alternative for the proposed closure of a peaker plant.[8]

Another holistic approach, utilizing both large-scale batteries as well as a local virtual power plant, has been used to replace a 165-megawatt peaker in Oakland, California. Called the Oakland Clean Energy Initiative, this multi-faceted plan to replace an old and dirty peaker calls for a combination of substation upgrades, large batteries, and a contract with the solar and storage company Sunrun to develop 500 kilowatts of grid reliability capacity, serving over 500 low-income housing units in the adjacent community. This project was assembled by East Bay Community Energy, a community choice aggregator in Oakland.[9,10,11] The project has been approved by the California Public Utilities Commission and is awaiting interconnection.

8 "Sunset Park Solar," *Uprose.org*, https://www.uprose.org/sunset-park-solar (accessed July 14, 2022).

9 East Bay Community Energy, "Our Community Transitioning to Renewable Energy," *ebce.org*, https://ebce.org/transition-to-renewable-energy (accessed July 14, 2022).

10 Sunrun, "Sunrun Solar and Battery Systems To Help Replace Retiring Oakland Power Plant," *globenewswire.com*, July 18, 2019, https://www.globenewswire.com/news-release/2019/07/18/1884659/0/en/Sunrun-Solar-and-Battery-Systems-To-Help-Replace-Retiring-Oakland-Power-Plant.html (accessed July 14, 2022).

11 Pacific Gas and Electric Company, "Oakland Clean Energy Initiative," *cpuc.ca.gov*, February 15, 2018, https://www.cpuc.ca.gov/-/media/cpuc-website/files/legacyfiles/p/6442456241-pge-oakland.pdf (accessed July 14, 2022).

Transmission upgrades

In some instances, a peaker plant can be retired when improvements are made to the transmission system. Transmission lines are large power lines that carry electricity from its point of generation to a substation where it is converted to a lower voltage. Transmission is different than distribution lines, which are the lines that carry electricity directly to homes and businesses at a lower voltage. A peaker plant may exist in an area that is "transmission constrained," meaning there is not enough transmission capacity available to bring in the power that it needs during peak demand from outside sources of generation. This may happen when a community or area grows much faster than expected and the infrastructure has not kept pace. A peaker plant may have seemed like a workable solution for that load pocket at the time. But today, we know that the emissions impact on the surrounding communities can be significant, and cost-effective non-combustion alternatives are more readily available.

Both New York City and Boston have utilized transmission upgrades to bring cleaner energy generated away from the city to constrained load pockets. The New York Public Service Commission has authorized a transmission project called Clean Path NY to bring Upstate hydropower as well as offshore wind into New York City's constrained Zone J, which covers most of New York City.[12] This transmission project is one factor that is enabling the New York Power Authority to plan for the retirement of its fleet of peakers in New York City.[13] ISO New England has approved a transmission project called Ready Path Solution that is enabling the retirement of the fossil-fueled Mystic Generating Station in Everett, Massachusetts, part of the Boston metropolitan area.[14]

Virtual Power Plants

A virtual power plant (VPP) is a network of distributed energy resources, such solar and battery systems on homes and businesses, all coordinated by an aggregator and working together in a way that mimics the operation of a large power plant. Sunrun's solar and battery storage VPP contribution to the Oakland Clean Energy Initiative, referenced above, is one example. Puerto Rico is also assembling a fleet of VPP's with the dual goal of improving the island's resilience as well as ending its reliance on fossil fuel.[15]

Virtual power plants can stack and orchestrate a portfolio of assets, including behind-the-meter batteries, electric heat pumps and heat pump hot water heaters, smart thermostats, and electric vehicle charging and discharging. They require an aggregator and complex management systems and software, but they are becoming increasingly common, delivering local resilience and revenue generation and accelerating the democratization of energy.

Energy Efficiency

Energy efficiency is defined as the use of less energy to perform the same task or produce the same result. Common energy efficiency practices include improving building insulation, sealing ducts and air leaks, switching to LED lighting, switching to electric heat pumps for home heating and cooling and water heaters, and weatherizing buildings. Energy efficiency has long been called the "low hanging fruit" in efforts to reduce fossil fuel consumption and related impacts. This is because, as the saying goes, the cheapest kilowatt hour is the one that is never used. The Philadelphia Energy Authority's web page summarizes the benefits and value proposition of energy efficiency well where it describes energy efficiency as a

12 Robert Walton, "New York approves transmission contracts to advance Clean Path NY, Champlain Hudson projects," *Utility Dive*, April 20, 2022, https://www.utilitydive.com/news/new-york-approves-transmission-contracts-to-advance-clean-path-ny-champlai/622353 (accessed July 13, 2022).

13 Kevin Clark, "New York Power Authority seeks to replace gas peaker plants with battery storage," *Renewable Energy World*, April 25, 2022, https://www.renewableenergyworld.com/storage/new-york-power-authority-seeks-to-replace-gas-peaker-plants-with-battery-storage/#gref (accessed July 14, 2022).

14 Greater Boston Ready Path Solution, "About the Ready Path," *greaterbostonreadypath.com*, https://www.greaterbostonreadypath.com/about-the-ready-path (accessed July 14, 2022).

15 Lisa Cohn, "Puerto Rico's utility needs to act on solar, storage and microgrids, says industry group," *Microgrid Knowledge*, January 17, 2022, https://microgridknowledge.com/prepa-storage-and-microgrids-puerto-rico (accessed July 14, 2022).

Energy efficiency programs create local jobs, lower energy bills, and improve quality of life
PHOTO: ISTOCKPHOTO/AVAILABLELIGHT

tool for impact by its ability to stimulate economic development, create jobs, alleviate poverty, and improve public health.[16] Aggressive investment in energy efficiency reduces peak demand by reducing total demand. It also results in lower power bills as well as homes that are safer and more comfortable, especially when energy efficiency programs are coordinated with programs that address health and safety issues such as leaking roofs and unsafe floors.

Demand Response

Demand response programs allow utility customers to play an active role in reducing peak demand by reducing their consumption of energy during peak hours. At the residential level, certain types of energy-consuming activities can be shifted to a different time of day. Laundry can be washed and dried earlier or later in the day. A house can be pre-cooled or pre-heated ahead of the peak demand hours. Water heaters with smart controls can be programmed to heat water during "off peak" hours. In exchange for this active participation, the customer is compensated, either by direct payments for performance or through a rate structure with time-of-use rates that result in a lower energy bill if electricity use is successfully shifted. Demand response can include direct load control programs which provide the ability for power companies to cycle air conditioners and water heaters on and off during periods of peak demand. These types of demand response programs are generally voluntary and participants often have the option to opt out of specific events.

Most utilities have some variation of demand response program as described above. Increasingly, demand response programs are incorporating behind-the-meter batteries. One example of this kind of program is ConnectedSolutions. In the Mass Save ConnectedSolutions program, using customer-owned batteries for demand response provides performance payments for participating Massachusetts utility customers when they allow the utility to access the power in the batteries during system peak conditions.[17] The Connected-Solutions program is available to residential, commercial, and industrial customers of Massachusetts electric distributors. Enrolled customers are compensated on a pay-for-performance basis for their average kilowatt curtailment during utility-defined peak demand events each season.[18]

16 The Philadelphia Energy Authority is an independent municipal authority focused on energy affordability and sustainability, see https://philaenergy.org (accessed July 14, 2022).

17 Mass Save, "Use your Battery Storage Device to Make the Grid More Sustainable," *massave.com*, https://www.masssave.com/saving/residential-rebates/connectedsolutions-batteries (accessed July 14, 2022)

18 Clean Energy Group has produced several reports on the ConnectedSolutions model, learn more at https://www.cleanegroup.org/ceg-projects/energy-storage-policy/connectedsolutions.

APPENDIX C

Peaker Power Plant Operating and Demographic Data for Boston, Philadelphia, and Detroit Metro Areas

Street-level view of Superior GT in the Detroit Metro Area
PHOTO: GOOGLE EARTH

Aerial view of Richmond CT in Philadelphia
PHOTO: GOOGLE EARTH

TABLE APPENDIX C1

Boston Metro Area Peaker Data

Power Plant	City	Owner	Operating Capacity (MW)	Most recent capacity addition	Fuel Type	Tech Type	Capacity Factor (%)	Heat Rate (Btu/kWh)	3-year Avg. CO_2 Emissions (US Ton)	3-year Avg. NO_x Emissions (lbs)	NO_x Rate (lbs/MWh)	3-year Avg. SO_2 Emissions (lbs)	Raw data for People of Color Population w/in 3-mile radius	Raw data for Low-Income Population w/in 3-mile radius
M Street Jet	Boston	Massachusetts Bay Transportation Authority	68	1979	Oil	Gas Turbine	0.07	21,146	688	1,163	2.90	2,497	49%	35%
Medical Area Total Energy Plant (MATEP)	Boston	ENGIE & Axium Infrastructure	40	1986	Oil	Internal Combustion	0.82	9,031	1,409	8,915	3.09	915	48%	36%
L'Energia	Lowell	EDF Trading North America, Inc.	77	2008	Gas	Combined Cycle	3.46	8,869	12,510	6,611	0.28	124	45%	36%
Kendall Square CT	Cambridge	Antin Infrastructure Partners SAS	23	1972	Oil	Gas Turbine	0.18	20,167	598	8,286	22.31	2,201	43%	33%
Framingham	Framingham	Exelon Corporation	45	1970	Oil	Gas Turbine	0.14	17,646	780	5,317	9.61	2,868	37%	23%
Cleary Flood Steam	Taunton	City of Taunton	27	1966	Oil	Steam Turbine	0.36	15,458	1,035	3,358	4.06	6,559	25%	33%
Cleary Flood	Taunton	City of Taunton	108	1976	Oil	Combined Cycle	5.55	11,217	35,201	93,675	1.79	1,114	25%	33%
West Water Street Project	Taunton	City of Taunton	10	2018	Oil	Internal Combustion	1.43	9,409	618	636	0.51	63	23%	33%
Potter Station 2	Braintree	Multi-Owned, Merchant	96	1977	Gas	Combined Cycle	0.46	13,888	3,217	16,279	4.18	1,092	26%	22%
Thomas A. Watson Generating Station	Braintree	Multi-Owned, Merchant	115	2009	Gas	Gas Turbine	2.34	9,868	14,584	2,910	0.12	140	26%	22%
Waters River	Peabody	City of Peabody	66	1990	Gas	Gas Turbine	0.58	12,360	1,699	17,393	5.10	1,928	20%	26%
Salem Harbor Station NGCC	Salem	Multi-Owned, Regulated	710	2018	Gas	Combined Cycle	11.48	7,717	342,655	64,193	0.09	3,459	20%	26%
Deer Island Treatment CT Plant	Winthrop	Massachusetts Water Resources Authority	54	1995	Oil	Gas Turbine	1.11	12,695	5,424	25,729	4.89	3,253	16%	24%
Cherry Street	Hudson	Town of Hudson	15	1972	Oil	Internal Combustion	0.27	9,242	181	2,129	6.26	666	20%	16%
Milford Power CC	Milford	Multi-Owned, Regulated	225	1993	Gas	Combined Cycle	12.49	8,742	114,882	59,475	0.27	1,160	18%	17%
High St Station	Ipswich	Town of Ipswich	11	1986	Gas	Internal Combustion	0.10	15,239	111	547	5.43	50	6%	15%
Bellingham Cogeneration	Bellingham	NextEra Energy, Inc.	336	1991	Gas	Combined Cycle	2.66	8,859	42,250	61,729	0.79	6,874	9%	10%
Medway CT	Medway	Exelon Corporation	186	1971	Oil	Gas Turbine	0.14	28,168	5,120	32,529	14.50	18,571	10%	8%
West Medway II	Medway	Exelon Corporation	207	2019	Gas	Gas Turbine	8.54	10,736	100,892	16,903	0.11	999	10%	8%
Mystic River 8 and 9	Boston	Exelon Corporation	1,699	2003	Gas	Combined Cycle	11.60	7,608	837,378	116,702	0.07	8,445	45%	30%

Note: The values presented above on power plant operations and emissions are averages for the 2018–2020 period. The data was sourced from EIA and EPA public reports by Strategen Consulting where available. For power plants not reporting to the public entities, Strategen approximated their performance characteristics based on plant size, age, technology and fuels used. Null values indicate no activity in those years.

Street-level view of L'Energia peaker in Lowell, MA
PHOTO: GOOGLE EARTH

Street-level view of Delaware CT in Philadelphia
PHOTO: GOOGLE EARTH

TABLE APPENDIX C2

Philadelphia Metro Area Peaker Data

Power Plant	City	State	Owner	Operating Capacity (MW)	Most recent capacity addition	Fuel Type	Tech Type	Capacity Factor (%)	Heat Rate (Btu/kWh)	3-year Avg. CO_2 Emissions (US Ton)	3-year Avg. NO_x Emissions (lbs)	NO_x Rate (lbs/MWh)	3-year Avg. SO_2 Emissions (lbs)	Raw data for People of Color Population w/in 3-mile radius	Raw data for Low-Income Population w/in 3-mile radius
Eddystone 3-4	Eddystone	PA	Exelon	760	1976	Gas	Steam Turbine	0.32	18,280	25,357	30,016	1.40	3,876	33%	31%
Croydon	Bristol Township	PA	Exelon	512	1974	Oil	Gas Turbine	0.43	14,222	21,977	162,320	8.39	55,574	45%	29%
Richmond CT	Philadelphia	PA	Exelon	132	1973	Oil	Gas Turbine	0.42	15,416	5,962	44,036	9.10	15,077	67%	53%
Eddystone CT	Eddystone	PA	Exelon	76	1970	Oil	Gas Turbine	0.30	14,660	2,370	27,874	13.77	8,720	33%	31%
Delaware CT	Philadelphia	PA	Exelon	74	1970	Oil	Gas Turbine	0.07	21,527	781	9,183	20.23	2,873	63%	51%
Southwark	Philadelphia	PA	Exelon	72	1968	Oil	Gas Turbine	0.09	16,694	774	9,103	15.69	2,848	49%	40%
Falls	Morrisville	PA	Exelon	60	1970	Oil	Gas Turbine	0.18	19,713	1,463	17,207	18.52	5,383	33%	27%
Moser	Pottstown	PA	Exelon	60	1970	Oil	Gas Turbine	0.19	21,581	1,753	20,621	20.28	6,451	25%	28%
Chester	Chester	PA	Exelon	54	1969	Oil	Gas Turbine	0.13	18,536	922	10,844	17.42	3,393	58%	47%
Schuylkill CT	Philadelphia	PA	Exelon	38	1971	Oil	Gas Turbine	0.24	15,889	1,004	11,813	14.93	3,696	60%	44%
Temple SEGF Plant	Philadelphia	PA	Temple University	16	1993	Gas	Internal Combustion	0.81	12,531	847	1,479	1.30	35	64%	51%
West Point Facility IC	Upper Gwynedd	PA	Merck & Co., Inc.	12	2020	Gas	Internal Combustion	0.04	14,877	55	96	1.54	2	25%	14%
Burlington GT	Burlington	NJ	Public Service Enterprise Group Incorporated	168	2000	Gas	Gas Turbine	1.72	10,615	16,684	27,941	1.10	206	48%	28%
Camden Cogeneration	Camden	NJ	Riverstone Holdings LLC	145	1993	Gas	Combined Cycle	5.71	9,565	41,279	29,219	0.40	417	50%	42%
Pedricktown Cogeneration Plant	Pedricktown	NJ	Riverstone Holdings LLC	115	1992	Gas	Combined Cycle	3.55	10,013	21,490	18,471	0.51	215	36%	31%
Mickleton	Mickleton	NJ	CPN Management, LP	78	1974	Gas	Gas Turbine	0.25	22,803	2,294	42,852	25.31	23	20%	19%
Edge Moor 5	Wilmington	DE	Multi-Owned, Merchant	450	1973	Gas	Steam Turbine	3.10	12,743	96,742	121,422	0.99	101,903	70%	44%
Edge Moor 3-4	Wilmington	DE	Multi-Owned, Merchant	260	1966	Gas	Steam Turbine	3.80	11,498	58,939	53,624	0.62	597	70%	44%
Christiana	Wilmington	DE	Multi-Owned, Merchant	50	1973	Oil	Gas Turbine	0.08	32,318	931	7,423	20.87	3,379	68%	43%
West Energy Center	Wilmington	DE	Multi-Owned, Merchant	19	1964	Oil	Gas Turbine	0.15	16,509	322	954	3.91	1,184	35%	28%
Delaware City 10	Delaware City	DE	Multi-Owned, Merchant	18	1968	Oil	Gas Turbine	0.03	20,792	91	317	5.76	336	58%	17%
Edge Moor CT	Wilmington	DE	Multi-Owned, Merchant	15	1963	Oil	Gas Turbine	0.02	19,956	36	107	4.71	133	70%	44%

Note: The values presented above on power plant operations and emissions are averages for the 2018–2020 period. The data was sourced from EIA and EPA public reports by Strategen Consulting where available. For power plants not reporting to the public entities, Strategen approximated their performance characteristics based on plant size, age, technology and fuels used. Null values indicate no activity in those years.

TABLE APPENDIX C3

Detroit Metro Area Peaker Data

Power Plant	City	Owner	Operating Capacity (MW)	Most recent capacity addition	Fuel Type	Tech Type	Capacity Factor (%)	Heat Rate (Btu/kWh)	3-year Avg. CO_2 Emissions (US Ton)	3-year Avg. NO_x Emissions (lbs)	NO_x Rate (lbs/MWh)	3-year Avg. SO_2 Emissions (lbs)	Raw data for People of Color Population w/in 3-mile radius	Raw data for Low-Income Population w/in 3-mile radius
Delray CT	Detroit	DTE Energy Company	159	2000	Gas	Gas Turbine	1.47	13,156	16,055	11,491	0.56	162	73%	70%
Northeast (MI)	Warren	DTE Energy Company	150	1971	Gas	Gas Turbine	0.26	18,000	3,775	30,073	8.95	2,765	67%	58%
Dearborn Industrial Generation GT Cogen	Dearborn	CMS Energy Corporation	200	1999	Gas	Gas Turbine	2.70	13,512	42,322	19,442	0.37	427	51%	68%
Superior	Superior Charter Township	DTE Energy Company	76	1966	Oil	Gas Turbine	0.02	31,709	373	4,389	29.79	1,373	45%	39%
Monroe IC	Monroe	DTE Energy Company	14	1969	Oil	Internal Combustion	—	12,656	—	—	—	—	17%	42%
Wyandotte	Wyandotte	Wyandotte Municipal Service Commission	47	1986	Gas	Steam Turbine	1.57	18,226	11,619	21,637	2.01	59	18%	35%
Sumpter	Belleville	Wolverine Power Supply Cooperative, Inc.	375	2002	Gas	Gas Turbine	10.27	12,979	260,583	150,105	0.44	2,631	25%	22%
Hancock	Commerce Township	DTE Energy Company	124	1970	Gas	Gas Turbine	0.53	14,844	6,398	75,896	10.39	65	23%	17%
Slocum	Trenton	DTE Energy Company	14	1968	Oil	Internal Combustion	—	19,438	—	—	—	—	10%	20%
Fermi CT	Newport	DTE Energy Company	75	1966	Oil	Gas Turbine	0.43	23,602	5,300	62,335	22.18	19,502	9%	20%
Placid 12	Village of Clarkston	DTE Energy Company	14	1970	Oil	Internal Combustion	—	12,656	—	—	—	—	11%	17%
Putnam IC	Mayville	DTE Energy Company	14	1971	Oil	Internal Combustion	0.01	12,656	4	46	7.22	14	11%	17%

Note: The values presented above on power plant operations and emissions are averages for the 2018–2020 period. The data was sourced from EIA and EPA public reports by Strategen Consulting where available. For power plants not reporting to the public entities, Strategen approximated their performance characteristics based on plant size, age, technology and fuels used. Null values indicate no activity in those years.

APPENDIX D

Additional Resources

THERE IS AN ABUNDANCE OF EDUCATIONAL RESOURCES, web-based tools, webinars, and publications available to help local communities learn more about the power system, air emissions, and peaker power plants in their community. Many of the mapping and calculation tools have associated trainings and webinars on their respective websites. Below is a list of resources to serve as a sampling of materials that are available.

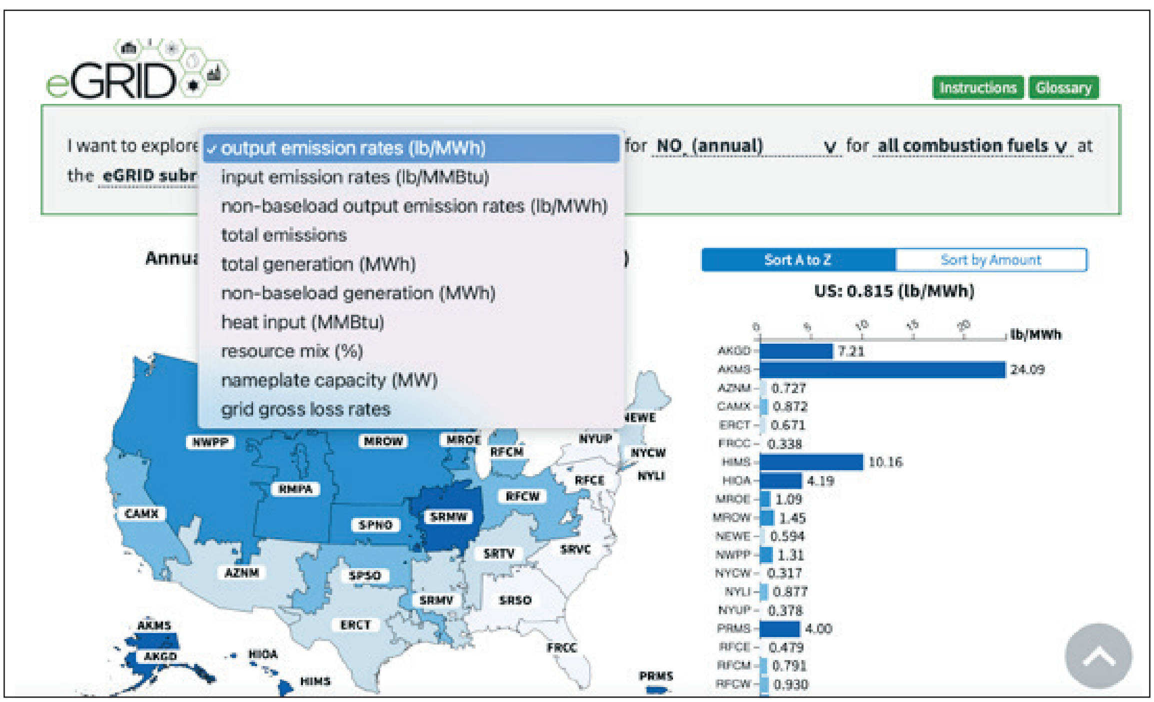
We have also provided some information about hydrogen and the dangers of hydrogen combustion. Fossil fuel generation facilities are increasingly being proposed or kept online by promising that they will be able to burn "clean" with hydrogen in the future. This is false. There are many problematic issues with burning hydrogen (explained within the listed resource), but most important to note for the purposes of this report is that **burning hydrogen emits more NO_x into the air than burning natural gas (methane)**.

Mapping Tools

eGrid

www.epa.gov/egrid

The Emissions & Generation Resource Integrated Database (eGRID) is a searchable data tool that includes emissions, emission rates, generation, and many other attributes, and it can be used to estimate avoided



Sample from the eGRID Explore the Data Tool

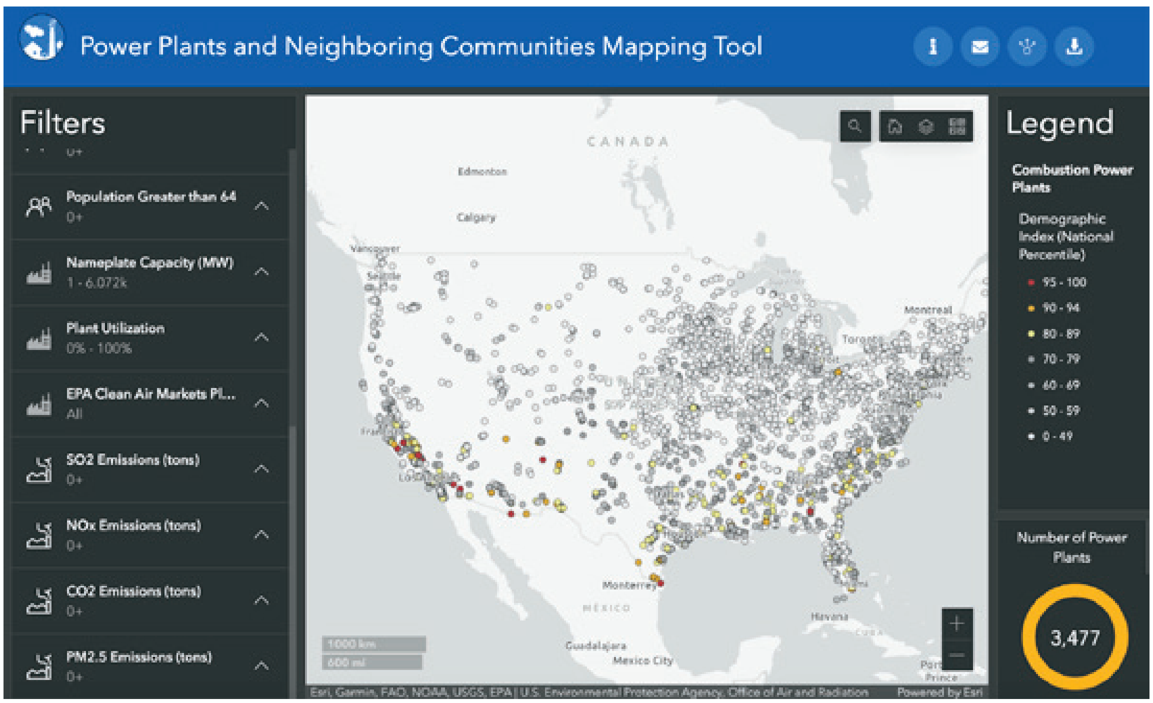
SOURCE: US EPA

emissions. Features include “Explore the data with visuals,” “Find your electricity emissions,” and within the “Neighboring Communities” tab, there are links to the Power Plants and Neighboring Communities Tool (see below), the Graphing Power Plants and Neighboring Communities Tool, and the Mapping Power Plant Retirements Tool. Within the Explore the Data tab, data can be explored by subregion. Many data sets and GIS layers are downloadable.

EPA Power Plants and Neighboring Communities Mapping Tool

https://experience.arcgis.com/experience/2e3610d731cb4cfcbcec9e2dcb83fc94?views=view_12

This mapping tool allows the exploration of combustion power plants on a map with filters on the left side that can be toggled on and off. Filters include State, Demographic Index, Low-Income, People of Color, Linguistically Isolated, Population Less than 5, Population Greater than 64, and plant-specific filters such as Nameplate Capacity, Plant Utilization, NO_x Emissions, $PM_{2.5}$ emissions, and others. The Demographic Index is the average of low-income and people of color populations. Demographic data is shown for populations within three miles of each facility.



Screenshot of the Power Plants and Neighboring Communities Mapping Tool
SOURCE: ARCGIS.COM

AVERT: AVoided Emissions and geneRation Tool

www.epa.gov/avert

AVERT is a free tool with a simple user interface designed to meet the needs of state air quality planners and other interested stakeholders. Non-experts can use AVERT to evaluate county, state and regional emissions displaced at fossil-fueled power plants by energy efficiency and renewable energy policies and programs. Created by EPA’s State and Local Climate and Energy Program, AVERT is designed to use public data that are accessible and auditable. It has a web version as well as a desktop version based on Excel that has more functionality. AVERT scenarios can be easily exported to COBRA for evaluation of health impacts (see COBRA, p. 63). The tool has a quick-start guide, a new webinar, and tutorials. Clean Energy Group hosted a webinar about AVERT and COBRA (see Webinars, p. 65).

AVERT Tool
SOURCE: US EPA

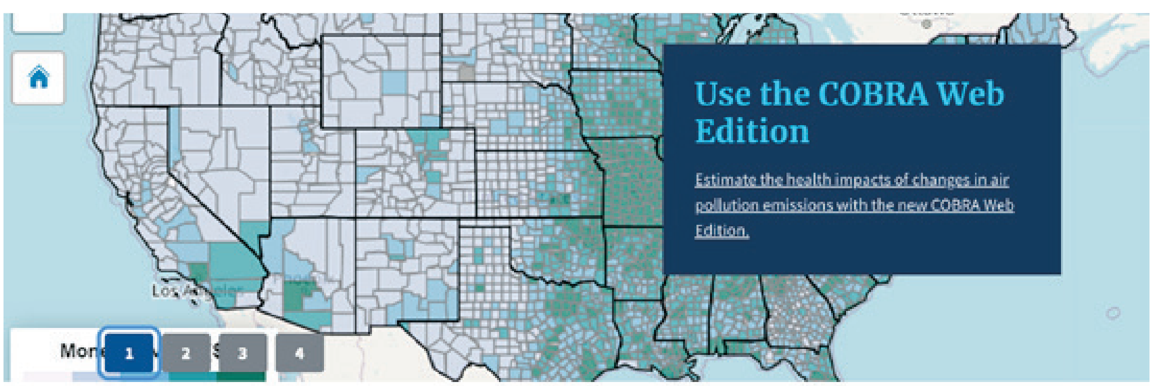
COBRA: CO-Benefits Risk Assessment Health Impacts Screening and Mapping Tool

www.epa.gov/cobra

EPA's CO–Benefits Risk Assessment (COBRA) screening model is a free tool that helps state and local governments:

- Explore how changes in air pollution from clean energy policies and programs, including energy efficiency and renewable energy, can affect human health at the county, state, regional, or national levels.
- Estimate the economic value of the health benefits associated with clean energy policies and programs to compare against program costs.
- Map and visually represent the air quality, human health, and health-related economic benefits from reductions in emissions of particulate matter ($PM_{2.5}$), sulfur dioxide (SO_2), nitrogen oxides (NO_x), ammonia (NH3), and volatile organic compounds (VOCs) that result from clean energy policies and programs.

The tool has both a web version as well as a downloadable desktop version that offers more functionality and detail. AVERT scenarios (see AVERT above) can be easily exported to COBRA for evaluation of health impacts. The tool has a user manual. Clean Energy Group hosted a webinar about AVERT and COBRA (see Webinars, p. 65).



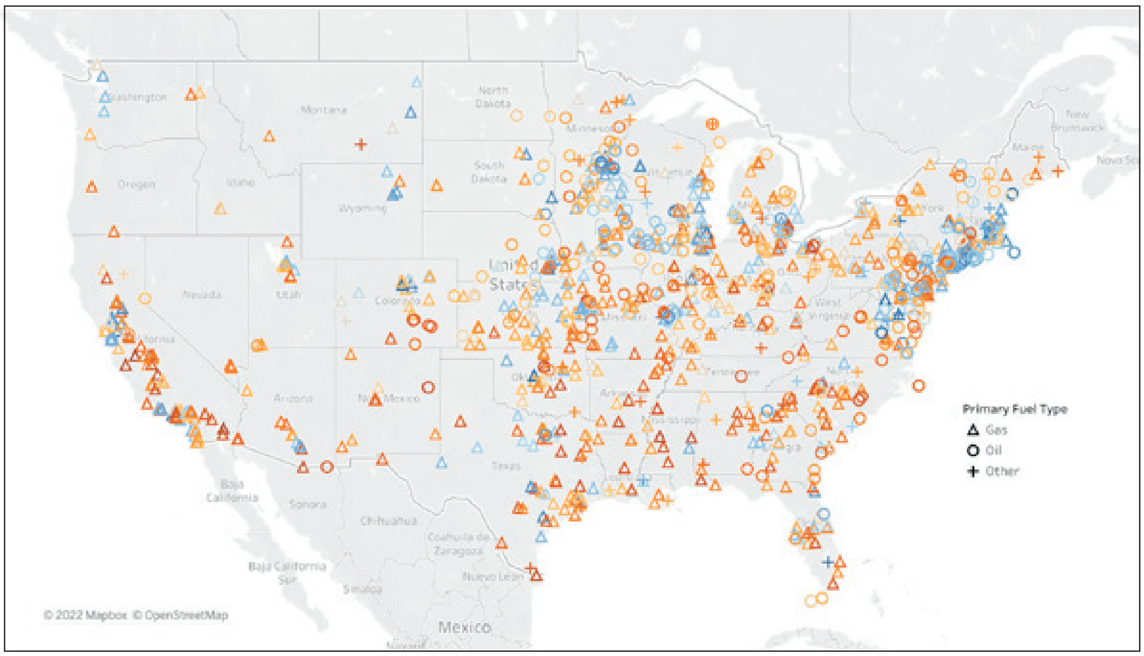
COBRA Tool
SOURCE: US EPA

Clean Energy Group Peaker Power Plant Mapping Tool

www.cleanegroup.org/ceg-projects/phase-out-peakers/maps

Clean Energy Group's Peaker Power Plant Mapping Tool allows users to access basic operating and emissions information for the U.S. fleet of fossil-fuel peaker power plants, along with demographic information about populations living near each power plant. Peaker plant demographic information can be viewed in three ways: Low-Income Percentile, People of Color Percentile, and Demographic Index Percentile (average of Low-Income and People of Color). The data indicates significant racial and economic disparities in the communities that are most burdened by peaker plant emissions.

All information included in the tool is based on data made available by the U.S. Environmental Protection Agency through the agency's Power Plants and Neighboring Communities Mapping Tool (see tool, p. 62). Clean Energy Group hosted a webinar about this tool (see Webinars, p. 65).



CEG Peaker Plant Mapping Tool

SOURCE: CLEAN ENERGY GROUP

Air Data: Air Quality Data Collected at Outdoor Monitors Across the US

www.epa.gov/outdoor-air-quality-data

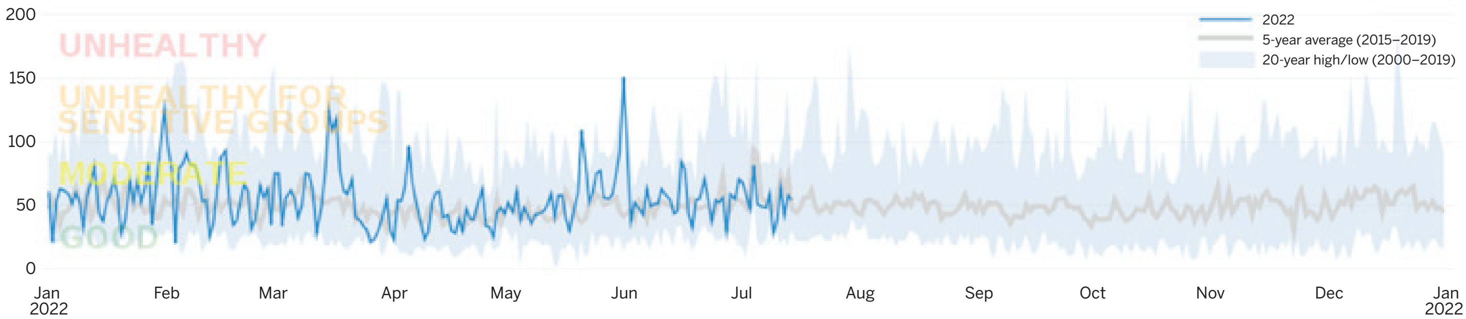
The AirData website gives you access to air quality data collected at outdoor monitors across the United States, Puerto Rico, and the U. S. Virgin Islands. The data comes primarily from the AQS (Air Quality System) database. Data can be downloaded or displayed in a visualization tool.

The tool includes an interactive map of air quality monitors across the United States. AirData assists a wide range of people, from the concerned citizen who wants to know how many unhealthy air quality days there were in their county last year to air quality analysts in the regulatory, academic, and health research communities who need raw data.

AirData lets you display and download monitored hourly, daily, and annual concentration data, AQS data, and speciated particle pollution data.

PM2.5 Daily AQI Values

Detroit-Warren-Dearborn, MI



Sample of data available for visualization in the AirData Tool

SOURCE: US EPA

Webinars on Peaker Power Plants

Clean Energy Group

Quantifying the Health Benefits of Clean Energy Policies with EPA's AVERT and COBRA Tools
www.cleanegroup.org/webinar/epa-avert-cobra

Colby Tucker from EPA's State and Local Energy and Environment Office and David Cooley from Abt Associates provide an introduction to AVERT and COBRA, overview their functionality, and walk through a demonstration of how the tools can be used in practice.

Exploring Peaker Power Plant Inequities with Clean Energy Group's New Mapping Tool
www.cleanegroup.org/webinar/peaker-mapping-tool

Introduction to the Clean Energy Group's Peaker Power Plant Mapping Tool and an overview of how it can be used to explore the economic and racial disparities of peaker plants. UPROSE, a community-based organization fighting peaker plants impacting the Sunset Park neighborhood of New York City, and the Berkshire Environmental Action Team, which has been leading opposition efforts against multiple peakers in Western Massachusetts, also present on the impact of peakers on their communities and the work they are doing to retire and replace fossil peakers with renewables and energy storage.

Replacing New York City's Dirty Peaker Power Plants with Renewables and Battery Storage
www.cleanegroup.org/webinar/replacing-new-york-citys-dirty-peaker-power-plants-with-renewables-and-battery-storage

Members of the PEAK Coalition detail the findings of their report, *Dirty Energy, Big Money,* which exposes the environmental and economic harms these power plants are inflicting on communities in New York City, and they introduce measures the organizations are taking to replace peakers with renewables and battery storage. (See Studies and Publications, p. 66, for more about the report.)

Replacing Peaker Plants with Battery Storage
www.cleanegroup.org/webinar/replacing-peaker-plants-with-battery-storage

This webinar presents the case for battery storage, both standalone and paired with renewables, as an increasingly viable alternative to traditional fossil-fuel peaker plants. Topics covered include: the economics of batteries versus peakers, a look at solar and storage peaker projects in development, an overview of the emissions and social equity impact of existing peaker plants, and the story of how one proposed peaker plant was successfully challenged by advocates in California.

Clean Energy Group and the PEAK Coalition

Replacing Peaker Power Plants with Clean Energy: A Frontline Vision for New York City
www.cleanegroup.org/webinar/replacing-nyc-peaker-power-plants-with-clean-energy

Speakers from New York City Environmental Justice Alliance and Strategen introduce the PEAK Coalition's work to end fossil-fuel peakers in New York City and present the findings of PEAK's Coalition's report The *Fossil Fuel End Game: A Frontline Vision to Retire New York City's Peaker Plants by 2030,* high-lighting the economic, environmental, and social costs of existing peaker plants and the pathway toward replacement.

Studies and Publications

Zeroing in on Healthy Air: A National Assessment of Health and Climate Benefits of Zero-Emission Transportation and Electricity

The American Lung Association
https://www.lung.org/getmedia/13248145-06f0-4e35-b79b-6dfacfd29a71/zeroing-in-on-healthy-air-report-2022.pdf

Zeroing in on Healthy Air finds that a widespread transition to zero-emission cars, trucks, buses and other vehicles, coupled with non-combustion, renewable energy resources would yield tremendous air quality, public health, and climate benefits across the United States. To illustrate the potential benefits, a transition to 100 percent sales of light duty passenger vehicles and medium-and heavy-duty vehicles were assumed over the coming decades, along with a transition to non-combustion electricity generation.

Nationwide and Regional $PM_{2.5}$-Related Air Quality Health Benefits from the Removal of Energy-Related Emissions in the United States

Nicholas A. Mailloux, David W. Abel, Tracey Holloway, and Jonathan A. Patz
https://agupubs.onlinelibrary.wiley.com/doi/10.1029/2022GH000603

Clean energy policy can provide substantial health benefits through improved air quality. As ambitious clean energy proposals are increasingly considered and adopted across the United States (US), quantifying the benefits of removal of such large air pollution emissions sources is crucial to understanding potential societal impacts of such policy. This study estimates health benefits resulting from the elimination of emissions of fine particulate matter ($PM_{2.5}$), sulfur dioxide, and nitrogen oxides from the electric power, transportation, building, and industrial sectors in the contiguous US. The study uses EPA's CO-Benefits Risk Assessment screening tool to estimate health benefits resulting from the removal of $PM_{2.5}$-related emissions from these energy-related sectors, finding that nationwide efforts to eliminate energy-related emissions could prevent 53,200 premature deaths each year and provide $608 billion in benefits from avoided $PM_{2.5}$-related illness and death with an average of 69 percent of the health benefits from emissions removal remaining in the emitting region. The study provides an indication of the potential scale and distribution of public health benefits that could result from ambitious regional and nationwide clean energy and climate mitigation policy.

Dirty Energy, Big Money: How Private Companies Make Billions from Polluting Fossil Fuel Peaker Power Plants in New York City's Environmental Justice Communities—and How to Create a Cleaner, More Just Alternative

PEAK Coalition and Strategen
https://www.cleanegroup.org/ceg-resources/resource/dirty-energy-big-money

This report details the disproportionate impact that New York City's peaker power plants have on the city's most vulnerable people and details how replacing peaker plants with a system of localized renewable energy generation and battery storage can reduce greenhouse gas emissions, reduce energy bills, improve public health and equity, and make the system more resilient in the face of increased storms and climate impacts.

The Fossil Fuel End Game

PEAK Coalition and Strategen

https://www.cleanegroup.org/ceg-resources/resource/fossil-fuel-end-game

This report is the first detailed strategy and policy road map to retire and replace an entire city's fossil-fuel peaker power plants. It lays out a community-led strategy to replace about half of New York City's existing fleet of polluting peaker plants with a combination of offshore wind, distributed solar, energy efficiency, and battery storage by 2025. The remaining peaker plants could be reliably and cost-effectively replaced with the same mix of resources by 2030. This decentralized approach creates a more resilient power system than the current grid, which depends on centralized fossil-fuel power plants. The report also highlights the alarming economic, environmental, and social costs of New York City's existing peaker plants, expanding on the findings of the PEAK Coalition's previous report, *Dirty Energy, Big Money.*

Assessment of Potential Energy Storage Alternatives for Project 2015A in Peabody, Massachusetts

Strategen for Clean Energy Group and the Massachusetts Climate Action Network

www.cleanegroup.org/wp-content/uploads/Energy-Storage-Alternatives-Peabody-MA.pdf

This briefing paper assesses the viability of battery storage as a replacement for a proposed gas and oil peaker power plant in Peabody, Massachusetts. It examines the cost-effectiveness and public health implications of developing battery storage as an alternative solution to the proposed fossil-fuel power plant, known as Project 2015A.

Clean Energy Group—Hydrogen Information and Public Education Project

Clean Energy Group

www.cleanegroup.org/ceg-projects/hydrogen

Hydrogen has generated a lot of interest as a zero- or low-carbon fuel. However, much of the hydrogen hype relies on false claims—for example, incorrectly stating that hydrogen is an emissions-free source of energy when burned, when in fact, hydrogen combustion releases high amounts of harmful NO_x. To combat this sort of misinformation and to equip advocates, regulators, and policymakers with non-biased facts to counter irresponsible industry proposals, Clean Energy Group has developed a repository of research and information on the viability and issues related to the production and use of hydrogen. In addition to in-depth research and reporting, CEG is working in partnership with environmental justice advocates and community-based organizations to push back against hydrogen projects and proposals impacting frontline communities.

The Peaker Problem

An Overview of Peaker Power Plant Facts and Impacts in Boston, Philadelphia, and Detroit

Clean Energy Group

Clean Energy Group (CEG), a national nonprofit organization, works at the forefront of clean energy innovation to enable a just energy transition to address the urgency of the climate crisis. Its mission is to accelerate an equitable and inclusive transition to a resilient, sustainable, clean energy future.

CEG fills a critical resource gap by advancing new energy initiatives and serving as a trusted source of technical expertise and independent analysis in support of communities, nonprofit advocates, and government leaders working on the frontlines of climate change and the clean energy transition. CEG collaborates with partners across the private, public, and nonprofit sectors to accelerate the equitable deployment of clean energy technologies and the development of inclusive clean energy programs, policies, and finance tools.

Founded in 1998, CEG has been a thought leader on effective climate and clean energy strategies for more than two decades. CEG specializes in providing resources and assistance related to emerging technology trends and transformative policy, regulatory, and market approaches.

www.cleanegroup.org

STRATEGEN

Strategen advises and empowers leading organizations—utilities, government agencies, NGOs, and industry clients—to design innovative, practical solutions that capture the promise of a clean energy future, strengthen resilience and adaptability, and are equitable, collaborative, and impactful.

Headquartered in Northern California, and with offices across the western U.S. and in Australia, Strategen's mission-driven experts leverage a global perspective and market-leading capabilities to deliver novel, high-impact, stakeholder-aligned approaches across the policy, regulatory, and market design spheres that sustainably accelerate the deployment of low-carbon energy systems.

Strategen's expertise spans corporate strategy, energy system planning, policy and regulatory innovation, and multi-stakeholder engagement. We take an integrated, multidisciplinary approach, informed by our core values of intellectual honesty, humility, sustainability, diversity, and inclusion.

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