Understanding Peaking Generation Assets:

The majority of the electricity supplied to the electrical grid is generated by baseload powerplants. A baseload plant operates almost constantly at some pre-defined level of generation. To meet spikes in demand that cannot be supplied by baseload generation assets, utility companies utilize what are known as peaking power plants. Also known as peaker plants or peakers, these generation assets are designed to go online in a matter of minutes in order to provide electricity during periods of high demand. Found primarily in the United States, peaking power plants are dated generation assets that have been ruled inefficient for meeting baseload use and are downgraded to peaker status before being entirely retired. For the intentions of this report, peakers are defined as plants operating under a 20% capacity factor, meaning they generate 20% or less then their maximum nameplate capacity in a given period. For example, a plant with a nameplate capacity of 100MW, that generated <20MW of power in a given year would be considered a peaking generation asset.

Due to their old age and usage logistics, peakers are typically among the biggest culprits of emissions. As these assets are designed to be brought online quickly, they utilize less efficient fuels such as oil and coal, leading to higher emissions of air pollutants and greenhouse gases. Additionally, because they are powered on and off frequently, peakers cause greater emissions, similarly to how accelerating and decelerating a car uses more fuel then driving at a constant speed. Finally, because peaking power plants are only used for a few hours a day, they are rarely able to recoup the costs of their operation, leading to higher costs for electricity consumers.

Peakers, while a primary target of replacement, still exist widely across the United States. Areas that remain disproportionally impacted by the health and economic damages imposed by these sorts of facilities are known as Environmental Justice Communities and see increased sightings of these types of assets. Due to social, political, and economic factors, many of these communities consist of low-income

and minority populations, who historically lack the resources and information that could help them advocate for policies and regulation that can protect them from the negative effects of these power plants. For these reasons, it is imperative that such communities are identified as stakeholders and considered as policy makers work to advance a green-energy transition.

Peakers in the United States:

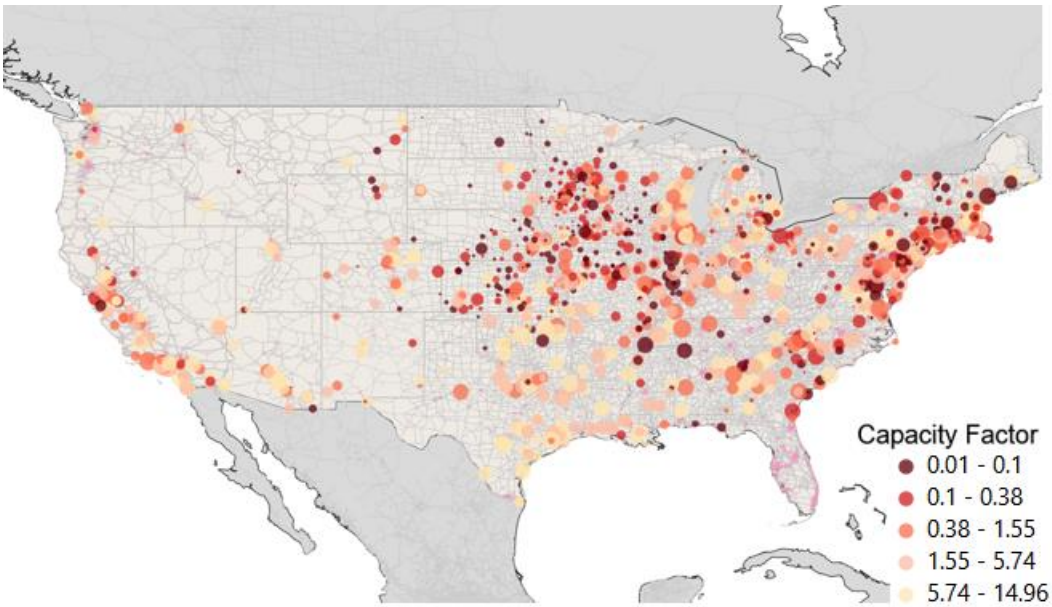

Figure 1: Peakers in the United States, sized by capacity

The United States utilizes a peaker fleet across the entire country but especially in population centers. This is because areas of higher populations are more prone to experiencing sharper spikes in demand correlated with human behavior and needs, such as people coming home from work and turning the lights on in their home or using air conditioners on hot days, etc. While different regulation is enacted in different municipalities, typically, utility companies are required to operate a fleet with a nameplate capacity, also known as maximum technical capacity, a defined amount larger than the maximum demand that is expected in extreme

scenarios due to the possibility of combined spikes and outages. This figure increases with population.

In the United States, power plants can be owned by a variety of different entities. In some cases, power plants may be owned and operated by government-owned utilities or by state-owned enterprises. In other cases, they may be owned and operated by private companies, either as stand-alone entities or as part of a larger energy company. The ownership structure of a power plant can have significant implications for the way it is operated and regulated, as well as for the prices and availability of the electricity it generates due to varying incentives. Due to the varying ownership and their respective incentives, regulations and policies, different regions experience different assortments of generating assets. For example, southern states like Texas, New Orleans, and Arkansas, see fewer generation assets that are larger in capacity and operate more extensively. Midwestern states, on the other hand, use of far more plants but they operate at smaller capacities. The Northeast, and the Delaware Valley in particular, is of interest due to its operating large numbers of significantly sized plants, theoretically in contrast to their intended

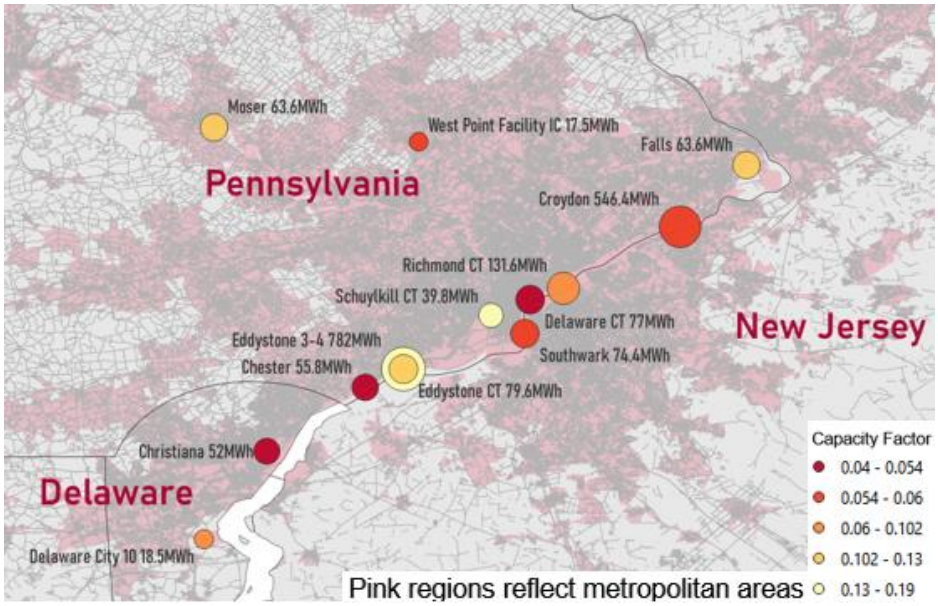

Figure 2: Peakers in the Delaware Valley, Sized by Capacity

use. Operating a significant amount of large capacity peaking plants can be seen as comparable to operating one baseload plant regularly, without yielding the associated emissions reductions.

The Delaware Valley is home to numerous major cities such as Philadelphia, Camden, Wilmington, and has a total population of over 6 million people. Even with numerous different population centers in the valley, the area sees some of the worst pollution in the United States. All of the peakers within the valley are cited in areas defined as metropolitan population centers, as defined by the US Office of Management and Budget (OMB). Generation facilities in the Delaware Valley are under the authority and regulation of PJM Interconnection, an independent system operator (ISO), comprised of over 1,000 partners serving 60 million customers. Recently, PJM has voiced generation reliability concerns amid a renewable transmission. Such concerns indicate that the chances of even more peaking generation facilities being retired or moth-balled (temporarily retired but left as back-up generation, if needed), are very low. Specifically, the president of PJM noted, "The trend lines in PJM are pointing to power demand increases with the move to electrified vehicles and greater use of heat pumps replacing gas, which will make the demands on the electricity system go up"[1] as the logic behind the lack of peaking generation retirement, ironically. PJM's failure to bring green generation assets such as solar, wind, and battery storage

[1] https://www.spglobal.com/commodityinsights/en/market-insights/latest-news/natural-gas/080122-us-power-system-pjm-reliability-storm-clouds-loom-amid-transition-exec

online fast enough to replace inefficient peaking generation is damaging many communities within its territory, most notably neighborhoods in South Philadelphia.

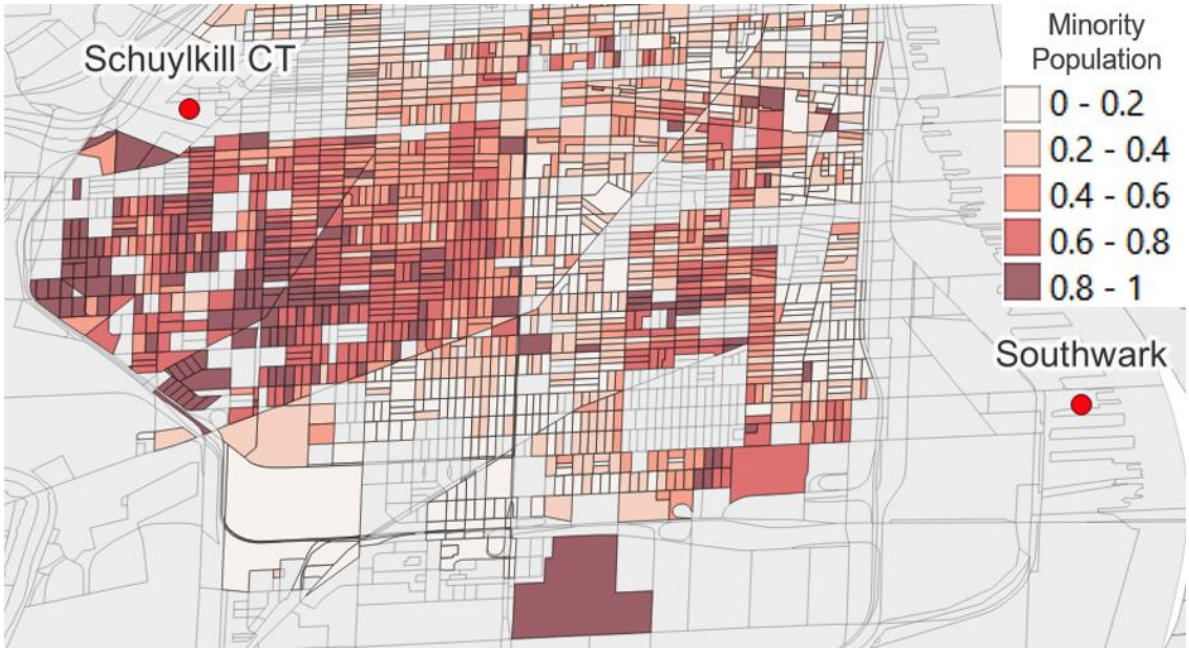

Figure 3: Minority Populations in South Philadelphia

As defined in the Clean Power Plan in the Community and Environmental Justice Considerations section (IX), a "proximity analysis" considered any inhabitants within a three mile radius to be at increased risk of health effects due to emissions. The neighborhood of South Philadelphia, as shown in figure 3, is bookended by the Schuylkill Combustion Turbine (CT) and Southwark generation centers, separated by 3.3 miles. Much of the population between these two facilities consists of minorities, especially surrounding the Schuylkill facility.

Environmental justice communities should be considered in policy for several reasons. First, these communities have a right to live in a healthy and safe environment, just like everyone else. Ensuring that environmental justice communities are protected from environmental hazards is a matter of social justice and equality. Additionally, considering the needs of environmental

justice communities in policy can help to prevent and mitigate the negative health effects of pollution and other environmental hazards, which can save lives and reduce healthcare costs universally. Finally, addressing the issues faced by environmental justice communities can also help to build trust and improve relationships between these communities and policymakers, which can foster greater cooperation and collaboration on environmental issues.

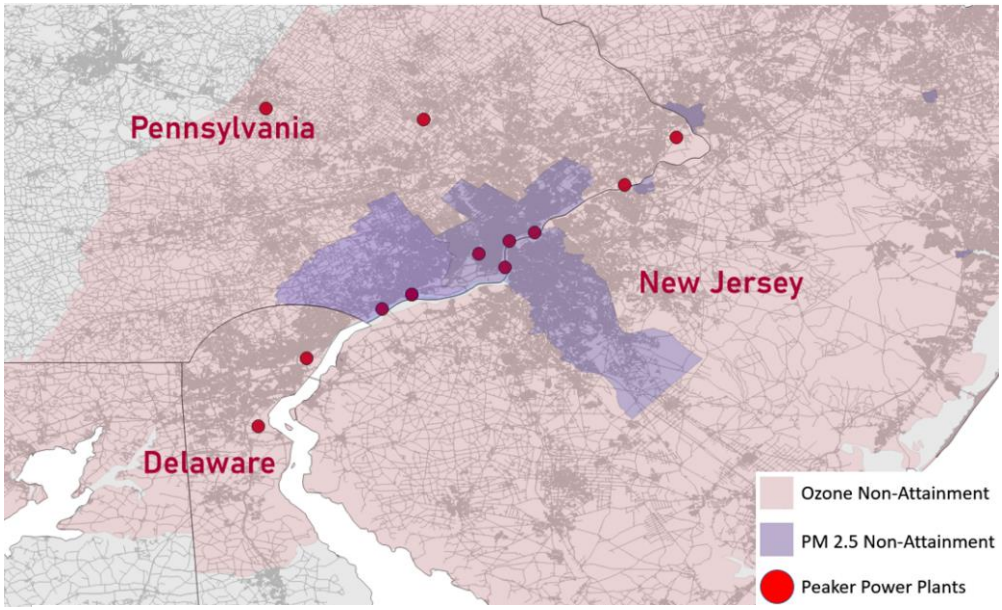

Figure 4: Emissions Non-Attainment Zones In the Delaware Valley

However, it is not just the areas surrounding these plants that are impacted. Down winds are responsible for carrying pollutants from areas of generation into neighboring states. Delaware, despite operating only two peaking facilities, ranks among the worst in air quality as a state. Over 90% of the pollution that contributes to the poor air quality in Delaware is transported from out-of-state sources.[2] In 2018 the Governor's Office sought relief from the downwind

[2] https://governor.delaware.gov/clean-air/

pollution by petitioning the EPA to require more stringent use of pollution control equipment in other states. The EPA has denied all petitions.

As seen in the figure 4, the pollution impacts of generation assets extend far beyond three miles. A non-attainment area is an area considered to have a quality of air that is worse than the National Ambient Air Quality Standards, as defined in the Clean Air Act Amendments. There are various different standards for evaluating non-attainment areas, based on various emission types. Ozone emissions are commonly misunderstood, due to the differentiation between high level ozone and ground level ozone. Ground level ozone forms when nitrogen oxides and organic compounds react in hot temperatures in processes such as energy generation and produce smog. This is different from high level ozone, known as the ozone layer, which reflects ultraviolet radiation. Nearly all of New Jersey, and large segments of Pennsylvania, Delaware, and Maryland are impacted by the ground level ozone emissions from the plants in the Valley.

Particulate matter 2.5 ($PM_{2.5}$), are fine particles or droplets in the air that are 2.5 microns or less in width. These emissions tend to exist closer in proximity to generation assets, but still travel beyond the three miles defined by the CPP. These emissions are of particular concern, as their small size allows them to travel deeply into the respiratory track and directly impact the lungs. There are short term health risks, such as eye, nose, and throat irritation, and studies have linked exposure to increased respiratory and cardiovascular deaths.[3] Other emissions from power plants can include nitrogen oxides (NOx), sulfur dioxide (Sox), and other volatile organic compounds (VOCs).

[3] https://www.health.ny.gov/environmental/indoors/air/

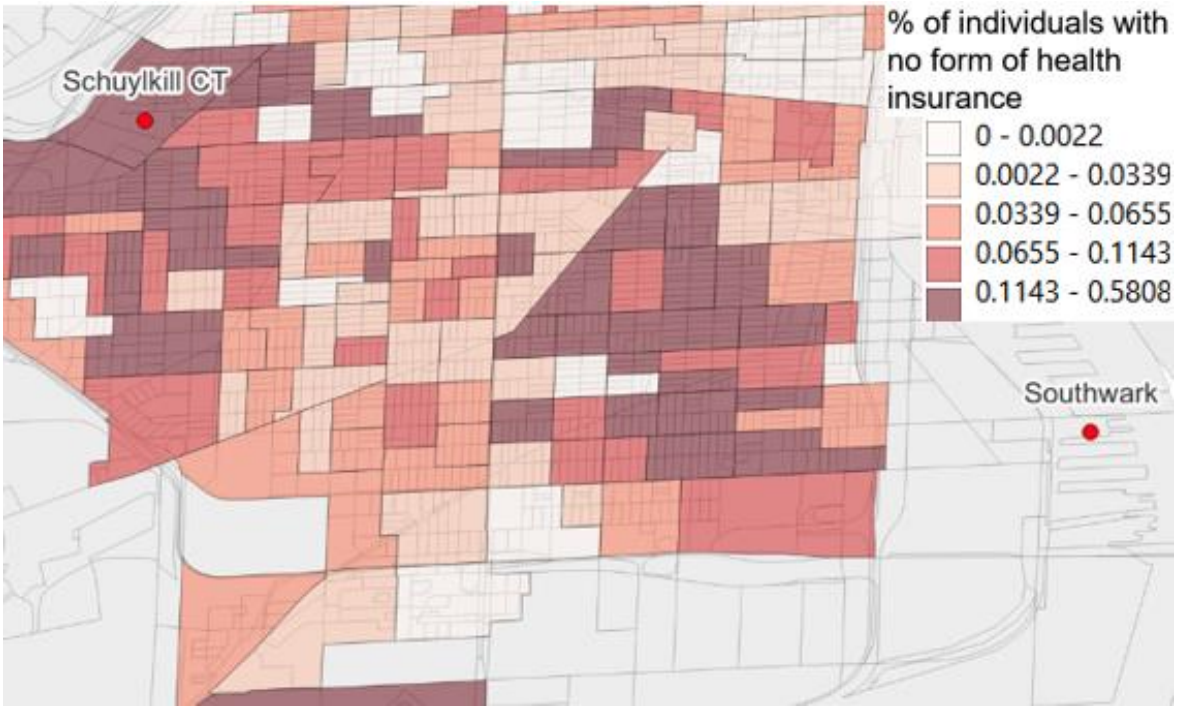

Figure 5a: Individuals without healthcare in South Philadelphia

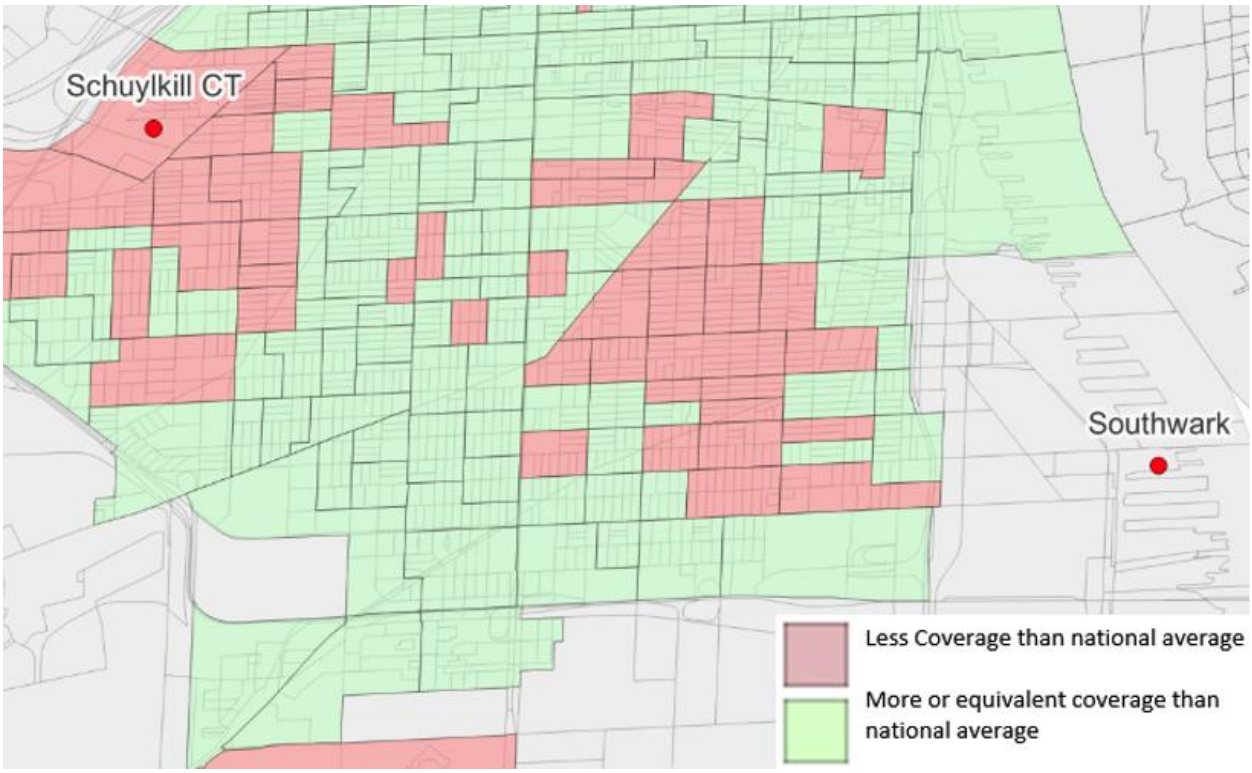

Figure 5b: Individuals without healthcare, compared to the national average

As seen in figure 5a and 5b, South Philadelphia has a large population in which has no access to any form of health care. Figure 5a displays the percentage of the population of a block group without health insurance, and 5b displays the same information binarily compared to the national average of 8.7%. While all block groups displayed are within the three mile guidelines defined as "close proximity", those residing adjacently to the Schuylkill CT facility see the highest percentage of individuals without coverage. While access to affordable healthcare is imperative regardless of where one resides, the increased risks of health defects due to the increased emissions exacerbates its importance.

Without access to healthcare, individuals in the Southern Philadelphia community, and many others like it, may not receive the care they need, which can lead to worsening of their health and potentially serious or even life-threatening consequences related to prolonged exposure to emissions.

Access to healthcare is also important from a social and economic perspective. When individuals have access to healthcare, they are more likely to be able to work and contribute to their communities, which can have a positive impact on the overall economy.[4]

[4] https://health.gov/healthypeople/priority-areas/social-determinants-health

Power Plants and Home Values

In addition to the health risks that residing near a peaking generation unit pose, there are also indirect economic consequences. Values for homes near power plants are significantly lower than comparable homes cited elsewhere. This is due to a variety of reasons. Audially, power plants can be a nuisance, as power generation can be very noisy. In addition to this, these facilities are typically viewed as being aesthetically displeasing, which subtracts value from surrounding homes. These issues act as reminders of the presence of facilities and accentuate the health risks that may otherwise go unnoticed.

Figure 6: Schuylkill CT as seen from a South Philadelphia Neighborhood

According to EarthJustice, a nonprofit public interest law organization comprised of over 200 lawyers, those residing between and around generation facilities possess less wealth than those living at a greater distance from them.[5] This is exacerbated by Philadelphia's preexisting wealth inequality. According to data from the U.S. Census Bureau, Philadelphia has one of the highest levels of income inequality among large cities in the United States. In 2019, the top 5% of

[5] https://earthjustice.org/news/press/2011/communities-of-color-poverty-bear-burden-of-air-pollution

households in the city had an average income just shy of $250,000, nearly twenty times that of the average among the bottom 20%. Philadelphia's households of color make up roughly 73% of households that earn less than $10,000 a year. [6] There are a number of factors that contribute to wealth inequality in Philadelphia, including the historical and ongoing systemic barriers faced by communities of color, a lack of affordable housing, and a lack of access to high-paying jobs.

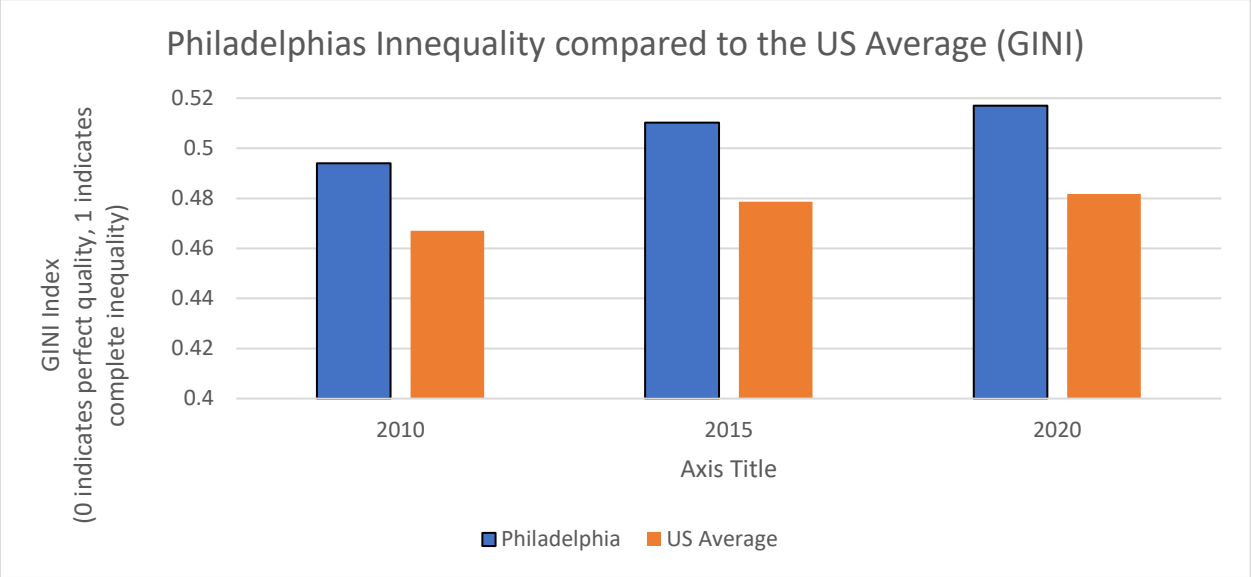

Figure 7: Wealth inequality in Philadelphia

To address this issue, city and community leaders have implemented a number of programs, such as affordable housing initiatives, job training programs, and education initiatives, in an effort to reduce wealth inequality and promote economic opportunity for all residents of the city. However, peaker plants in historically poor and majority-minority neighborhoods remains an existing barrier to defeating these intersecting inequalities.

Across the United States, cities are reliant on an aging, inefficient fleet of peaking generation assets, that often are cited in areas historically disadvantaged. In the Delaware valley,

[6] https://economyleague.org/providing-insight/leadingindicators/2022/04/05/gini2020

and Southern Philadelphia specifically, peaker plants result in numerous emissions nonattainment zones, that even by standards set a half century ago in the National Ambient Air Quality Standards, are not of safe quality.

With the electrification of additional sectors, such as consumer vehicles, the energy grid is falling under increasing stress. With this, it is imperative that utility corporations and independent system operators alike take initiative to incorporate renewable generation assets into their respective portfolios, while paying special attention to communities that are impacted the worst. Communities such as South Philadelphia, which see extreme wealth disparity and restricted access to health care, are due extreme consideration in an increasingly renewable society.