GRAHAM SUSTAINABILITY INSTITUTE
UNIVERSITY OF MICHIGAN

Catalyst Grant Final Project Report
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Project title: The cumulative economic burden of air pollution health impacts and fuel poverty under different energy mix and utility rate scenarios

Project team: Carina Gronlund, Tony Reames, Amy Schulz, Michelle Martinez (Michigan Environmental Justice Council, MEJC)

Project Summary:

The Michigan Public Service Commission (MPSC) is a three-member governor-appointed body responsible for approving Integrated Resource Plans (IRPs) from each of Michigan's utilities, including DTE Energy. The MEJC, and others, including the Natural Resources Defense Council, proposed during the review of the most recent IRP that health impact assessments should be considered by the MPSC in deciding on IRP approvals. This recommendation was adopted by the administrative law judge but ultimately rejected by the MPSC. In this project, partially funded by the Graham Sustainability Institute, we performed a health impact assessment to demonstrate its utility in identifying monetized health impacts from DTE emissions as well as their spatial distributions, disparities in exposures, and spatial co-occurrence with energy poverty, or the financial hardship resulting from low incomes and energy inefficient housing, and the monetized deleterious health impacts of lack of household air conditioning during extreme heat events. Our findings have implications for energy justice, or the unequal distribution of costs and benefits across the energy spectrum from generation to use. Specifically, we found greater residential energy inefficiency in Detroit and certain neighboring suburbs in the tri-county area. We found greater heatwave-associated health costs (which vary according to residential air conditioning availability) in Detroit compared to the surrounding suburbs. We found an overall health burden of $302 million (with an uncertainty range of $66-$570 million) annually from air pollution from DTE in the tri-county area, with per-person burdens as high as $218 dollars annually among individuals with high exposure (closer to coal power plants) and older adults (who are more vulnerable to air pollution-related mortality). Areas with energy poverty, i.e., the City of Detroit, were more likely to be in areas with high health burdens from air pollution as well as areas most impacted by extreme heat.

Project background and approach

The Michigan Public Service Commission (MPSC) is responsible for approving Integrated Resource Plans (IRPs) from each of Michigan's utilities, including DTE Energy. For example, DTE's recent IRP proposes energy mix scenarios that will reduce reliance on coal in order to reduce greenhouse-gas emissions while improving air quality. However, both the overall and the unequal distributions of *air pollution health burdens* in this region may justify a more aggressive schedule for phasing out coal power plants, and more innovative scenarios, including faster replacement with natural gas plants or more solar or wind energy sources, deserve consideration. Besides decommissioning coal power plants, a range of stakeholders have discussed increases to *weatherization and energy efficiency assistance* funds to further reduce carbon emissions from power generation as well as alleviate the high financial burden of energy bills on low-income households. The proposed DTE rate structure change, which would have potentially *raised* rates on households using the least amount of energy, may counter these

stakeholder goals and adversely impact the budgets of many Detroit households facing fuel poverty, or the inability to adequately cool or heat homes or address other basic household energy demands. Both air pollution exposure and fuel poverty are correlated with low socioeconomic status and race/ethnicity in Detroit, and these correlations have implications for *energy justice*, or the equitable distribution of energy benefits and burdens across the continuum from energy production to use. The cumulative effects of fuel poverty and air pollution from electricity generation may elucidate greater inequities in household financial burden across the energy continuum than the effects of each individually. To enhance real-world application of sustainability research (RFP objective 2) we performed a health impact assessment of DTE emissions which can be used to inform the MPSC's decisions on DTE Energy's IRPs and proposed rates within an energy justice framework by quantifying the separate and combined economic burdens of air pollution health effects and fuel poverty.

With funding from the Graham Institute, the Michigan Center on Lifestage Environmental Exposures and Disease (M-LEEaD), and an NIEHS career development award on climate change and health (R00ES026198/PI Gronlund), we characterized residential electricity use and inefficiency in electricity use by census tract, the monetized health impacts of extreme heat (which varies by residential air conditioning availability), and the monetized health impacts of air pollution exposure from DTE power plants. We mapped these outcomes and visually examined overlap in costs and benefits of energy use and production.

To characterize residential electricity use and inefficiency, we followed the methods used in Bednar et al. 2017, restricting the results to electricity rather than total energy use. The health impacts of extreme heat were monetized by using estimates of heat-associated mortality and hospitalizations and how these vary by air conditioning prevalence in conjunction with a model of air conditioning availability by census tract. DTE air pollution exposure estimates were based on CalPUFF air pollution dispersion modeling results and DTE Energy annual emissions estimates. EPA's BenMAP software was used to estimate the health impacts, across multiple health endpoints, of PM2.5 and to monetize these health impacts as well as estimate uncertainty ranges around the estimates due to uncertainty in the epidemiologic associations and the costs of individual health events.

Findings (note that these are preliminary until they have been peer-reviewed)

- Residential electricity consumption by census tract in the tri-county region of Wayne, Oakland, and Macomb Counties: We found higher electricity consumption in the suburbs, lower electricity consumption in Detroit, Pontiac, and other cities closer to Detroit, with homes in the suburbs consuming up to two times more electricity than homes in Detroit and Pontiac.
- Residential energy inefficiency (Kwh/sqft) is generally lower in the suburbs and higher in areas such as Detroit and Pontiac.
- Residential electrical cost burden (electric utility bill percent of annual income) is generally lower in the suburbs and higher in Detroit.
- Cumulative socioeconomic vulnerability (based on % below poverty, % without GED, median household income (reverse), % renters, linguistic isolation, %≤5 years, %≥65 years) is generally inversely related to residential electricity consumption and positively related to energy inefficiency and electrical cost burden.
- Annual health costs per person associated with extreme heat are higher in areas with less residential air conditioning availability. On average, annual heat-related costs per person (based on heat-associated mortality and hospitalizations) vary from less than a dollar to around $40. These costs are greater in Wayne County and in the City of Detroit, with high

vulnerability in the older homes on the Lower East Side and in Northwest Detroit. This can also be regarded as an estimate of where suffering in summer heat is greater.

- Using emissions estimates for 2018-2019 provided by DTE Energy, we were able to model where those emissions travel to and their chemical transformations. The areas with greater exposure to DTE air pollution are Eastern Wayne County, and Southern Oakland and Macomb counties.
- We can also estimate, based on decades of epidemiologic research, how smaller doses of air pollution can increase the risk of variety of health outcomes, including asthma exacerbations, emergency department visits and hospitalizations, heart attacks, chronic bronchitis, and death due to cardiovascular, respiratory, and lung cancer causes. We calculated these estimates using standard EPA methods, assigned dollar values to those health care costs and deaths, and added them all together. If we put a dollar value on the health care costs and mortality, the health costs from DTE power plant air pollution sum to $302 million annually across the tri-county area.
- If we look at individual health endpoints and focus in on asthma symptom days among children that are attributable to DTE power plants, we see that the greater health burden is in the Northeast and Southwest sections of the City of Detroit. The burden is greater here because these are areas that are both more exposed to DTE air pollution and are also areas with a higher percentage of children.
- If we focus in on mortality, the areas with greater vulnerability to DTE air pollution are those that are either highly exposed to DTE air pollution or are areas with a high percentage of older adults. Annual mortality rates attributable to DTE air pollution range from 0 to 2 per 100,000 people.
- Annual health costs per person attributable to air pollution from DTE power plants range from less than $1 per person to over $200 per person depending on both DTE air pollution exposure in the census tract and its age structure. The burden is highest in certain areas of Detroit but also in suburban tracts with a high percentage of older adults. There is uncertainty in these estimates and their spatial distribution. Based on a Monte Carlo analysis accounting for variability in effect estimates from epidemiologic studies of identical health endpoints and uncertainties in costs assigned to health events, in the census tracts with the highest estimates, annual attributable health costs could range from $20 to $400 per person, and it's difficult to assign a value to life lost. Nevertheless, these are substantial health costs and a substantial burden--health costs between $66 million and $570 million dollars annually across the tri-county region that are attributable to DTE air pollution.
- Together this suggests that areas of the tri county area who consume the least energy and accrue the least in benefits from electricity, such as air conditioning, also are more likely to be areas where individuals are particularly vulnerable to the adverse health effects of the pollutants that are generated by production of that energy and are exposed to more air pollution from electricity production.
- Areas of the tri-county area with the greatest percentage of people of color tend to be areas that have the lowest energy consumption and the greatest vulnerability to the adverse health effects of air pollutants that are generated by that energy production.
- In summary, the costs of energy production, including the health impacts of pollution generated, fall disproportionately in low to moderate income neighborhoods. Those neighborhoods are disproportionately African American and Latinx. The health burden - and associated costs - also fall more heavily on the youngest and the oldest members of DMA communities.
- We recommend that: Health Impact Assessments should be required components of IRPs, which would allow us to see the health costs associated with current energy production and incorporate them into decision making process. Affordability assessments should include

health costs of pollution generated by energy production. Safety assessments should include consideration of health impacts. When uncertain about health impacts, cleaner, safer forms of energy production (e.g., solar) should be prioritized. Impacts of energy production on climate change should also be considered as part of assessment of "affordability" and "safety". HIAs are an opportunity to rectify energy injustice, or the unequal distribution of the benefits and burdens of energy without respect to race or income.

Outputs

A webinar on our HIA was hosted by the MEJC on 5/27/2020 and is available to re-watch at: https://www.facebook.com/makeDTEworkforus/videos/3461029840575376/

Outcomes

The administrative law judge reviewing the most recent case challenging DTE's IRP adopted the recommendation that HIAs become part of the IRP review process. However, the MPSC did not adopt this recommendation.

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