YOUR ENERGY, YOUR POWER!
A Case Study on Renewable Energy and Public Health Equity in Michigan

National Association for the Advancement of Colored People
Michigan State Conference
October 2012
ABOUT THE NAACP

The National Association for the Advancement of Colored People (NAACP), as the nation’s oldest and largest grassroots civil rights organization, supports the Clean Air Act and has passed eight resolutions since 1996 supporting environmental and climate justice. Furthermore, the Michigan State Conference has enacted policy to further reduce our reliance on coal-based energy by advocating for Michigan’s increased usage of renewable energy to 25% by 2025.

ACKNOWLEDGEMENTS

This report was made possible with the generous support of the William and Flora Hewitt Foundation.

The Michigan State Conference NAACP would like to acknowledge the following individuals for their contributions to this report: Pamela Smith, Project Manager, NAACP Campaign to Increase Clean Energy who has been the leader and steward of the report development process from inception through finalization; Pamela J. Maxson, Ph.D., Children’s Environmental Health Initiative, University of Michigan; Sandra Turner Handy, Community Outreach Director, Michigan Environmental Council; Sheryl Weir, Michigan Resident; Donele Wilkins, President, Green Door Initiative; Jessica Yorko, Environmental Justice Coordinator, Ingham County Health Department; and also NAACP’s partners on the Coal Blooded Report—the Indigenous Environmental Network, and the Little Village Environmental Justice Organization.

ABOUT THE AUTHOR

The primary data collection, analysis and results presented in this report were provided by Environmental Health & Engineering (EH&E), a professional services firm established in 1987 to provide businesses and institutions with a reliable resource for environmental consulting and engineering services. Edits were performed by MWM Consulting Group, LLC. Research findings referenced in the introduction of this report were previously reported in greater detail in a NAACP report entitled, Coal Blooded: Putting Profits Before People by Adrian Wilson, University of Massachusetts at Amherst; Jacqueline Patterson, NAACP; Kimberly Wasserman, LVEJO; Amanda Starbuck and Annie Sartor, Rainforest Action Network; and Judy Hatcher. The Coal Blooded report is available online at www.naacp.org/pages/coal-blooded1.

Your Energy, Your Power! A Case Study on Renewable Energy and Public Health Equity in Michigan, can be viewed or downloaded from the NAACP website at www.michigannaacp.org.

As Health Officer for the Ingham County Health Department, I oversee a department that provides primary care services, community-based home visitation services, and a variety programs designed to prevent chronic disease and advance health equity. A growing body of literature identifies adverse childhood experiences that lead to life-long negative health effects. Children remain especially vulnerable to environmental and other exposures. A life-course perspective drives us to find ways to position children for healthy childhoods as a strategy to ultimately promote healthy adults. Promoting healthy individuals and communities requires adequate access to healthcare services, but equally as important, it requires attention to social and environmental benefits and protections.

Good health is not attained exclusively through robust healthcare systems. Nor is it attained solely through a focus on improving health—related behaviors. While access to healthcare and attention to healthy behaviors are important, these things do not occur in isolation from the other factors in peoples’ lives. For example, access to education and employment, safe and healthy homes and communities, transportation, food and recreation are all factors that impact public health outcomes. In our Building Healthy Communities and Environmental Justice work, our goal is to make healthy lifestyle choices available to everyone and to make healthy behaviors a clear and easy option.

We work diligently to create more equitable access to environmental benefits and protections throughout our county, because we know that inequitable access contributes to the disparities in morbidity and mortality that we observe both locally and nationally.

I thank the Michigan State Conference of the National Association for the Advancement of Colored People for releasing this analysis of air quality and public health benefits through a non—clinical intervention. The study is warranted and appropriate given the continuous disproportionate health outcomes among people of color in Michigan and the United States. The report will serve as a source of information and point of important dialogue as we consider new ways to meet the public’s health needs.

Dr. Renee Canady
Health Officer Ingham County Health Department
MESSAGE FROM THE NAACP

The National Association for the Advancement of Colored People (NAACP) has been working on policy and practice to advance clean energy from renewable sources, higher standards of livability for communities and to fight against pollution that damages health, well-being and livelihoods.

When folks think about climate change, the first thing some people think of are melting ice caps and suffering polar bears. However, many fail to make the connection in terms of the direct impact on our own lives, families and communities.

The NAACP Environmental Justice initiative was created to educate and mobilize communities to address this social justice issue. The program stands for people’s rights and calls for shutting down or cleaning up polluting facilities that threaten communities. The NAACP stands in favor of energy efficiency and rallying our communities behind a clean energy economy that will strengthen our investment in jobs and our children’s future.

Creative approaches are crucial to accelerating the nation’s shift away from energy sources that contaminate the air we breathe, the water we drink and the food we eat. We are on our way to debunking a powerful myth that clean energy comes with higher energy costs. It’s an idea that prevents many families from insisting on clean power.

Curbing power plant emissions and advancing use of clean energy and energy efficiency are clear public health priorities. By bringing our rich history of moral leadership to bear on clean energy, the NAACP seeks to broaden support for small grassroots efforts that can bring about enormous social change.

Social justice is the sustained commitment to create a society based on equality and fairness for all people. It calls for fair and equal treatment of the “haves” and the “have not.” The social justice movement is centered on fighting all forms of oppression, discrimination, and disenfranchisement. It calls for systemic change of governments, policies, and practices that empower all people to live healthy and productive lives. While social justice can be explored from an economic, educational, and political perspective, it also has a historic and health foundation that compels us to work for the equitable treatment of all people.

“Social justice is a matter of life and death. It affects the way people live, their consequent chance of illness, and their risk of premature death.”

- World Health Organization’s Commission on Social Determinants of Health Final Report, 2008

Coal pollution harms us all, and we hope that this case study report will help facilitate partnerships and collaboration among the NAACP, environmentalists, non-profit organizations and other environmental and climate justice advocates to address its disproportionate impact and harm to communities of color.

We are on the right track and hope you will join us on this important journey to true environmental and climate justice. It’s “Your Energy, Your Power!”

Yvonne M. White
President
Michigan State Conference NAACP

Pamela Smith
Chair
Health Committee
“The Your Energy, Your Power! Report is a critical advancement in giving a Michigan specific snapshot which quantifies the health, financial, and quality of life costs of this nation’s continued reliance on coal based energy production processes that disproportionately pollute communities of color. The report also demonstrates that we have a clear pathway in pursuing alternatives that preserve community health and wellbeing while ensuring that Michigan gets its energy from local sources with local labor. Through this transition, Michigan can be a light for the nation.”

- Jacqueline Patterson, Director, NAACP Environmental and Climate Justice Program

“Clearly, with this influential study of adverse health effects that stem from the burning of coal, a growing mountain of evidence is being uncovered around issues of environmental sustainability and environmental justice that simply can’t be ignored. The sooner we face these incontrovertible facts, the sooner we can move on to solutions that work for everyone.”

- Keith W. Cooley, CEO, Principia, LLC

“If we make the right choices now, Michigan will be a healthier and more productive place to live for everyone in the future. How can we afford not to?”

- Tina Reynolds, Health Policy Director Michigan Environmental Council

“Public health effects of coal-fired power plants is one of the most important reasons to shift toward more modern sources of electricity. This report demonstrates the very large objective benefits of that transition.”

- Douglas Jester, 5 Lakes Energy
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LIST OF ABBREVIATIONS AND ACRONYMS

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>BTU</td>
<td>British Thermal Unit</td>
</tr>
<tr>
<td>CMS</td>
<td>Consumer’s Energy</td>
</tr>
<tr>
<td>DTE</td>
<td>Detroit Edison</td>
</tr>
<tr>
<td>EH&amp;E</td>
<td>Environmental Health &amp; Engineering, Inc.</td>
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<tr>
<td>EPA</td>
<td>U.S. Environmental Protection Agency</td>
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<tr>
<td>HIA</td>
<td>Health Impact Assessment</td>
</tr>
<tr>
<td>KWK</td>
<td>Kilowatt Hour</td>
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<td>MATS</td>
<td>Mercury and Air Toxics Standards</td>
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<td>NAACP</td>
<td>National Association for the Advancement of Colored People</td>
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<td>NOx</td>
<td>Oxides of Nitrogen</td>
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<tr>
<td>PM2.5</td>
<td>Particulate Matter that is 2.5 Micrometers or smaller in size</td>
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<tr>
<td>RPS</td>
<td>Renewable Portfolio Standards</td>
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<td>SO2</td>
<td>Sulfur Dioxide</td>
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Introduction

In Michigan, 783,560 people live within three miles of a coal-fired power plant. Among those living within three miles of a coal power plant, 24 percent are people of color — a figure that is 1.7 times greater than (nearly double) the proportion (18%) of people of color living in Michigan overall. Coal power plants tend to be disproportionately located in low-income communities and communities of color, and they are overwhelmingly responsible for a large proportion of toxic emissions that produce negative health outcomes for these and other communities in the United States.

In Coal Blooded: Putting Profits Before People, researchers presented the findings of the systematic study of 378 coal-fired power plants in the United States. In that study, each plant was assigned an environmental justice performance (EJP) ‘score,’ a relative ‘rank,’ and a ‘grade’ based on how it affects low-income communities and communities of color. The score assigned to each plant, and each company, is based on five factors: emissions of sulfur dioxide (SO2) and nitrogen oxides (NOX); the total population living within three miles of the plant(s); and the median income and percentage of people of color among the total population living within three miles of the plant(s).

In the Coal Blooded report, 75 plants earned an environmental justice performance grade of “F.” These 75 ‘failing plants’ produced only 8 percent of U.S. electricity in 2005 (375,552 GWh), but they were responsible for 14% of SO2 emissions and 13% of all NOX emissions from all U.S. power plants. These 75 failing plants were found to have a considerable and disproportionate impact on people of color and low-income people. A total of four million people live within three miles of these 75 failing plants, and the average per capita income of these four million people is just $17,500 (or 25% lower than state average). Out of these four million people, nearly 53% are people of color. NOX emissions from all U.S. power plants. These 75 failing plants were found to have a considerable and disproportionate impact on people of color and low-income people. A total of four million people live within three miles of these 75 failing plants, and the average per capita income of these four million people is just $17,500 (or 25% lower than state average). Out of these four million people, nearly 53% are people of color.

There are several driving forces for changes in the development of a portfolio of electricity sources in Michigan and elsewhere in the United States, which could potentially improve this situation. Implementation of new emission limits for existing coal plants will reduce the amount of air pollutants released from these facilities. Likewise, increased reliance on wind, solar, and hydropower as sources of electricity will lower the nation’s use of coal and decrease overall pollutant emissions from electricity generation compared with the current portfolio of electricity generation in the United States. Lower emissions are expected to result in decreased levels of exposure to air pollution, which would logically yield fewer air pollution-related health effects, particularly in the communities that are disproportionately affected.
Introduction

To characterize this chain of events more fully, the Michigan State Conference of the National Association for the Advancement of Colored People (NAACP) commissioned Environmental Health & Engineering, Inc. (EH&E) to conduct an analysis of the public health benefits associated with an increase in the proportion of electricity generated from renewable energy sources in Michigan, with a focus on communities of color.4

This report provides an empirical discussion of the effects of burning coal in power plants. The purpose is to provide residents of Michigan with information on the costs of the current reliance on electricity production from coal and the benefits of pending emission limits and an increase in use of renewable sources of electricity production. With informed responses to energy policies aimed to affect public health and the environment, we can ensure that we have the power we need, the jobs to sustain our livelihoods, and moreover, preservation of health and wellbeing—in all communities.

<table>
<thead>
<tr>
<th>City</th>
<th>Plant Name</th>
<th>3-mile Average Income</th>
<th>State Income Percentage</th>
<th>3-mile P.O.C. population</th>
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<tr>
<td>River Rouge</td>
<td>River Rouge</td>
<td>$13,037</td>
<td>58.8%</td>
<td>65.3%</td>
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<td>Lansing</td>
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<td>Muskegon</td>
<td>B C Cobb</td>
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<tr>
<td>Monroe</td>
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<tr>
<td>Trenton</td>
<td>Trenton Channel</td>
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<td>34.0%</td>
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<td>Essexville</td>
<td>Karn/Weadock</td>
<td>$20,962</td>
<td>94.6%</td>
<td>6.7%</td>
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Figure: Michigan’s failing coal fired plants
According to the National Research Council, there are enough renewable energy resources in the U.S. to meet a significant portion of the nation’s electricity needs. The transition from fossil fuels to wind, solar, and hydropower for generation of electricity is driven by several forces: new rules authorized under the Clean Air Act; renewable portfolio standards (RPS) adopted by states; advances in technology; and financial incentives for renewable sources of energy.

New Clean Air Act rules such as the Mercury and Air Toxics Standards (MATS) published in 2012 require reduction of air pollutants — primary particulate matter, acid gases, mercury, etc. — released from existing coal-fired power plants throughout the U.S. At the same time, states are generating more electricity from renewable sources of power. For instance, thirty (30) states and the District of Columbia had enforceable renewable portfolio standards as of January 2012.

As the nation increases its usage of wind, solar, and hydropower as sources of electricity, it will decrease emissions of air pollutants compared with fossil fuel electricity. Lower emissions would then result in decreased levels of exposure to air pollution, which in turn would yield fewer air pollution-related health effects. To characterize this chain of events more fully, the Michigan State Conference of the National Association for the Advancement of Colored People (NAACP) commissioned Environmental Health & Engineering, Inc. (EH&E) to prepare a report on the public health benefits associated with an increase in the proportion of electricity generated from renewable energy sources in Michigan, with a focus on communities of color.

This report describes EH&E’s analysis of public health benefits expected to result from substitution of coal as a fuel to generate electricity with renewable sources of electric power. EH&E researchers applied a standard methodology to compare public health impacts of air pollutant emissions from coal-fired power plants in Michigan for a baseline case (2011) and future case (2025) emissions scenario, referred to as Business as Usual and Cleaner Energy Future respectively. The Business as Usual case was developed from coal consumption and emissions data reported by the U.S. Energy Information Administration and Environmental Protection Agency (EPA). Emissions for the Cleaner Energy Future case reflect compliance with the Clean Air Act Mercury and Air Toxics Standards (MATS) for existing plants and a renewable portfolio standard that would require wind, solar, biomass and hydropower to account for 25% of electricity sales in Michigan by the year 2025. The scope of the analysis includes fine
EXECUTIVE SUMMARY

particle (PM2.5) concentrations attributable to the coal-fired power plants in Michigan owned by Detroit Edison (DTE) and Consumers Energy (CMS). These two utilities produce 73% of the energy in the state.

This case study of power generation in Michigan finds that implementing the impending Clean Air Act rules and advances in renewable portfolio standards would provide substantial public health benefits for communities of color, low income communities, and the general population. The major conclusions of the analysis are as follows:

Reduced air pollutant emissions from coal-fired power plants and increased reliance on renewable sources of energy forecasted for 2025 are expected to result in substantial reduction of health effects associated with Business as Usual for coal-fired power plants in Michigan.

The health benefits include the avoidance of over 800 premature deaths and 322,000 asthma attacks in the U.S. annually. These benefits are distributed across Michigan, Ohio, Pennsylvania, New York and other states of the Midwest and Mid-Atlantic regions.

Communities of color are disproportionately over-represented among those with negative health outcomes associated with the Business as Usual case and therefore stand to benefit more as air pollutants emissions from electricity sources are reduced.

For example, communities of color in Michigan represent only 18% of people with asthma in the state, but were found to account for 75% of the Business as Usual case emergency room visits for asthma. Communities of color were also estimated to receive the majority (76%) of the public health benefits for emergency room visits for asthma in the Cleaner Energy Future scenario.

The emission rates and portfolio of energy sources for the Cleaner Energy Future case would reduce the value of the annual health-related damages associated with Michigan power plants by 83%.

The value of public health damages for the Business as Usual case was estimated to be $1.3 billion annually. In comparison, remaining damages associated with the Cleaner Energy Future scenario were estimated to be $220 million per year.

“The purpose of this report is to describe the public health benefits of improved air quality associated with a reduction in combustion of coal to generate electricity in Michigan, focusing on communities of color.”
APPENDIX

ENVIRONMENTAL HEALTH
& ENGINEERING, INC.

Public Health Benefits
of Replacing Coal with Renewable
Sources of Energy: A Case Study in Michigan

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800-825-5343

October 3, 2012
EH&E Project 18336
The United States has produced energy by burning coal since the 1800s. The burning of this carbon-rich mineral accounts for 42% of all electricity produced in the United States and 66% of the electricity generated in Michigan. In 2009, Michigan's total use of this fossil fuel to produce electricity amounted to 35 million tons, all of which was imported from out of state.

Coal is formed from fossilized plant life that is subjected to high pressure and heat over millions of years. As coal forms, it incorporates impurities from the surrounding soil and sediment. These impurities include sulfur and hazardous elements such as mercury, arsenic, lead, and nickel. When coal is burned, the metal, sulfur dioxide (SO2), and nitrogen oxide (NOx) are released to the atmosphere where they combine with emissions from other sources to form tiny particles (see Figure 1). Coal combustion is also the source of 35% of carbon dioxide (CO2) emissions in the United States.

The microscopic particles produced by emissions from coal-fired power plants are part of a class of air pollutants known as fine particulate matter (abbreviated as PM2.5). Fine particulate matter is defined as aerosols that are about 20 times smaller than the width of a human hair. Particles of this size can penetrate deep into the lung and initiate a series of negative effects on the human body. Fine particles also contribute to acid rain and limit visibility, most notably in national parks and other pristine areas throughout the United States.

Figure 1. Emissions from coal-fired power plants form microscopic particles composed of heavy metals, sulfur and other impurities in coal.
These particles have been named as a leading contributor to the burden of air pollution on health by the World Health Organization, the National Academy of Sciences, the American Lung Association, the American Heart Association, American Thoracic Society, as well as other U.S. health agencies, and leading scientists. When people inhale these pollutants, some of these particles deposit along the respiratory tract, while others penetrate deeply into the lung where they can enter the bloodstream. Along the way, the particles irritate tissue, cause inflammation, and worsen existing breathing illnesses and damage circulatory systems. Inhalation of these tiny particles over both short and long periods of time is recognized to cause cardiovascular harm, including heart attacks, and in some cases, premature death. Community-based and laboratory studies demonstrate strong links between PM2.5 and hospital admissions for breathing problems, worsening of existing respiratory illness such as asthma, elevated risks of reproductive, developmental, and cancer-causing outcomes, as well as other effects such as irregular heartbeat and pulmonary and systemic inflammation (Figure 2).

“Leading scientific organizations, independent researchers, and medical professionals agree that exposure to fine particles increases the risk of early death, heart attack, stroke, asthma attack and other less severe outcomes.”

Figure 2. Fine particle air pollution is a cause of inflammation and oxidative stress that is associated with a spectrum of respiratory and cardiovascular illness. Adapted from EPA.
To estimate the public health benefits of 1) reducing air pollution from coal-fired power plants and 2) increasing reliance on renewable sources of energy, EH&E researchers implemented a standard Health Impact Assessment (HIA). As Figure 3 illustrates, this assessment evaluates the extent to which increased reliance on wind, solar, and hydropower as sources of electricity—as compared with fossil fuel electricity—will lower emissions of air pollutants. Lowering these emissions will result in decreased levels of exposure to air pollution, which in turn is anticipated to reduce the negative health effects that are linked to air pollution.

The HIA methodology estimates the number of negative health outcomes that are avoided as a result of the energy sector’s compliance with the Clean Air Act and its implementation of a renewable portfolio standard. The term “health impact assessment” refers to a widely accepted tool used to estimate public health impacts of air pollutants.13 An HIA considers the baseline health status of the population, as well as pollutant concentrations in ambient air, concentration-response functions for air pollutant-related health outcomes, and the size of the exposed population. Details of the HIA methodology used for this analysis are described in a technical report from EH&E that was issued in 2011.14 A more general description of HIA as a tool for evaluation of proposed air pollution regulations is available from the National Research Council.15

For this study of the emission impacts from Michigan’s coal-fired electric generating units, EH&E researchers began by determining which pollutants would be incorporated into the analysis. Based on reviews of past air pollution benefit-cost analyses conducted by the EPA, researchers concluded that PM2.5 would contribute to a significant portion of the total health impacts associated with emissions from the facilities considered in this analysis. Therefore, estimates focused on pollutants that would influence ambient concentrations of PM2.5. As noted previously, there is strong and consistent evidence supporting health effects at current levels of PM2.5 exposure throughout the nation.

**Emissions: A Comparison Between Business As Usual and a Cleaner Energy Future**

EH&E researchers conducted an HIA analysis to compare the public health impacts of air pollutant emissions from coal-fired power plants in Michigan for a baseline case (2011) and future case (2025) emissions scenario, referred to as Business as Usual and Cleaner Energy Future, respectively. The Business as Usual case was developed from coal consumption and emissions data reported by the U.S. Energy Information Administration and the Environmental Protection Agency (EPA). Emissions for the future case reflect compliance with the

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**Total Air Pollutant Emissions**

<table>
<thead>
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<th>Scenario</th>
<th>Amount</th>
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<tbody>
<tr>
<td>Business As Usual</td>
<td>300,000 tons</td>
</tr>
<tr>
<td>Cleaner Air Future</td>
<td>70,000 tons</td>
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</tbody>
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Clean Air Act and a renewable portfolio standard that would require renewable sources of energy to account for 25% of electricity sales in Michigan.

The Business As Usual case for our analysis is reflective of the PM2.5-related air pollutant emissions generated in 2011 from eleven coal-fired power plants in Michigan owned by Detroit Edison (DTE) or Consumers Energy (CMS). These two utilities alone produced 73% of the energy in Michigan for 2011. Power plant utilization for the Business as Usual case was derived from information reported by DTE and CMS to the U.S. Energy Information Administration. Air pollutant emission rates were calculated from emission factors for primary PM2.5 reported by EPA and emissions of SO2 and NOx reported in the EPA Clean Air Markets Database.

The Cleaner Energy Future case for our analysis is a scenario in which power generation meets projected future demand and complies with the Clean Air Act and a renewable portfolio standard. This scenario also minimizes the number of the plants that would require capital upgrades to meet new Clean Air Act regulations. The standard for the Cleaner Energy Future scenario would require 25% of electricity sales in Michigan to be generated from wind, solar, biomass, or hydropower by the year 2025. The future case emission rate for sulfur dioxide was set to 0.2 pounds per million BTU to comply with the MATS requirements. In this scenario, the effect is to close plants that would not be needed due to the increase in sources of renewable energy, to maximize utilization of the remaining plants, and to meet emission rates of sulfur dioxide and other acid gases required by MATS. It is understood that the future scenario selected for our analysis represents one of many by which Michigan could accomplish all goals stated above. Though the methods for each scenario vary, this case study is representative of the overall public health and economic benefits that would be observed with the changes in energy reliance in each scenario.

Under the rules set by the MATS and a renewable portfolio standard in Michigan, it is projected that the state will realize a 77% reduction in total emissions from coal-fired power plants. Figure 4 shows the 11 DTE and CMS coal-fired power plants in Michigan and their combined emissions of primary PM2.5, sulfur dioxide and oxides of nitrogen for the Business as Usual and Cleaner Air Future scenarios. The output of electricity from seven of the coal-fired power plants is projected to be replaced by renewable sources of electricity generation, resulting in an overall reduction of 211,000 total tons of primary PM2.5, sulfur dioxide (SO2), and oxides of nitrogen (NOx). Other plants are projected to have modest decreases or increases in utilization compared to the Business as Usual case and a decrease of 170,000 tons of SO2 to comply with the MATS requirements. Overall, a 90% decrease in carbon dioxide emissions is also anticipated with these changes.

EH&E researchers used EPA’s county-resolution Source-Receptor Matrix to estimate annual average fine particle concentrations resulting from the PM2.5, SO2, and NOx emissions for the Business as Usual (2011) and Cleaner Air Future (2025) scenarios. The county-level changes in PM2.5 exposure between the two cases constitute the air quality impacts of emissions from the 11 coal-fired plants considered for this analysis.

As expected, the greatest air quality impacts occur in Michigan and in counties of surrounding states to the east. The Source-Receptor Matrix results for the
Business as Usual case PM2.5 concentrations are shown for counties of Michigan and surrounding states in Figure 5, Panel A. The Cleaner Energy Future emissions scenario is projected to result in reductions of Michigan power plant-related PM2.5 by as much as 60%, with the largest benefits expected for eastern Michigan and Great Lakes states to the east (Figure 5, Panel B).

Within Michigan, the greatest air quality impacts for the Business as Usual case occur for counties that contain the coal-fired power plants and for counties throughout the eastern parts of the state (Figure 6, Panel A). The largest air quality benefits from the Cleaner Energy Future case are expected to occur in the eastern parts of Michigan as well (Figure 6, Panel B).

Figure 5. Business as Usual case fine particle impacts of Michigan coal-fired power plant emissions (Panel A) and percentage reduction in those impacts (Panel B) anticipated to result from a reduced reliance on coal for generation of electricity in Michigan by 2025.

Figure 6. Business as Usual case fine particle impacts of Michigan coal-fired power plant emissions in counties of Michigan (Panel A) and the corresponding percentage reduction in those impacts (Panel B) anticipated to result from a reduced reliance on coal for generation of electricity in Michigan by 2025.
Public Health
Health impact assessments of the type EH&E researchers conducted for the 11 selected electricity facilities in Michigan combine information on changes in air pollutant concentrations, the relationship between air pollutant concentrations and the risk of a negative health outcome, the Business as Usual incidence of each health outcome, and the size of the population exposed to the air pollutants.

EH&E’s analysis considered the following PM2.5-related health outcomes: premature mortality, hospital admissions for cardiovascular and respiratory disease, emergency room visits for asthma, asthma exacerbation, chronic bronchitis, and minor restricted activity days (MRADs). The annual number of cases of each health outcome associated with air pollutant emissions from Michigan’s coal-fired power plants was estimated for each county in the continental United States. By conducting the analysis at the resolution of counties rather than a larger geographic area (e.g., state), EH&E researchers maintained spatial relationships among population sizes, baseline incidence of disease, and air quality important for determining a reasonable estimate of public health impacts associated with pollutant emissions from the 11 modeled facilities.

Poor Communities and Communities of Color
Environmental health research has indicated that the burden of air quality impacts resulting from emissions by local sources may be carried disproportionately by poor communities and communities of color. In one study, nearly 50% of the risks for premature death caused by power plant-related exposures were borne by the 25% of the population with less than high school education. This result reflected both higher background rates of mortality and higher relative risks for air pollution related to mortality for individuals with lower education. In addition, lower-income people and people of color have been found to be disproportionately exposed to air pollution because of their proximity to point and mobile sources of emissions. Low-income populations are also more likely to lack access to health care and to live in conditions associated with asthma exacerbations.

Susceptibility to the negative effects of air pollution may also be the result of different baseline rates of air pollution or different responses to various levels of exposure.

For these reasons, EH&E researchers conducted a refined HIA to explore the distribution of Michigan coal-fired power plant air pollution impacts on public health for communities of color in the state. Baseline rates for each public health outcome were developed for the total population and for communities of color within each county in Michigan. The differences in baseline rates used in this analysis for each population allowed the public health benefits between the Business As Usual (2011) and Cleaner Energy Future (2025) cases to be determined. The inputs to this analysis on baseline prevalence of health outcomes associated with PM2.5 exposure for the general population and communities of color are provided in the endnotes.

Economic Valuation
EH&E researchers also estimated the economic impact of public health conditions associated with the Business as Usual scenario in Michigan. For each health outcome, an economic value per case was assigned and used to calculate the annual estimated economic value for the Business as Usual and Cleaner Energy Future scenarios. The values that were selected for this analysis were used most recently in the EPA Regulatory Impact Analysis for the Proposed Federal Transport Rule and described in the EPA BenMAP Environmental Mapping and Regulatory Analysis Program. Details of the valuation methodology are provided in EH&E’s prior technical report on assessment of public health damages associated with air pollutant emissions from coal-fired power plants in Michigan.

“Public health benefits of the reduced coal combustion were estimated from the projected reduction of air pollutant emissions from coal fired power plants, the corresponding decrease in PM2.5 exposure, baseline rates of PM2.5 related health effects for the general population and communities of color and the number of people exposed.”
**General Population**

This public health impact analysis indicates significant health benefits would be observed in both Michigan and the United States in association with reduced air pollutant emissions from the coal-fired power plants and increased renewable energy sources in Michigan. The estimates of the annual health-related impacts in the U.S. are summarized in Figure 7. In the Cleaner Energy Future scenario, 820 premature deaths would be avoided in the U.S., including 130 in Michigan, as compared with the Business As Usual case. Additionally, the analysis found that as a result of reduced emissions from coal combustion in 2025, there would be 50,000 fewer asthma exacerbations in Michigan and 320,000 for the U.S.

![Figure 7](image)

*Figure 7. Business As Usual case and Cleaner Energy Future case annual mortality and morbidity impacts associated with fine particulate air pollutant emissions from coal-fired electricity generating units in Michigan. Orange line and value represent the number of cases that would be avoided in the Cleaner Energy Future scenario.*

The projected public health benefits of reducing coal combustion in 2025 would extend from Michigan into Ohio, Pennsylvania, New York and other states of the Midwest and Northeast regions (Figure 8). Similarly, the estimated public health benefits in Michigan are distributed across the state; as illustrated by the predicted distribution of countywide asthma attacks shown in Figure 9. The greatest benefits in Michigan are estimated for counties that host power plants, in which the reduction of coal combustion would be greatest in the Cleaner Energy Future scenario. Comparatively large public health benefits are also expected for counties that contain the largest metropolitan areas in the state: Detroit, Grand Rapids, Lansing, Flint and Ann Arbor.

![Figure 8](image)

*Figure 8. Annual number of asthma attacks estimated to be avoided by state as a result of reduced emissions from coal burning to generate electricity in Michigan by 2025.*

![Figure 9](image)

*Figure 9. Annual number of asthma attacks estimated to be avoided in Michigan counties as a result of reduced emissions from coal burned to generate electricity in Michigan by 2025.*
**Communities of Color**

This analysis found that in 2011, communities of color in the state disproportionately carry the public health burden of the pollutants from coal-fired power plants in the Business As Usual scenario. As shown in Figure 10, communities of color account for 25% of the premature mortality cases in the Business As Usual case, but represent only 15% of the age group (30 years and older or less than one year) considered at highest risk of premature mortality from pollutants. The differential is even greater for emergency room visits for asthma: communities of color account for 75% of the baseline cases and 18% of the asthmatic population in the state. Similar findings for the other PM2.5-related health outcomes considered in our analysis are shown in the figure as well.28

![Figure 10](image.png)

**Figure 10.** As shown in this figure, the public health burden of the Business As Usual case emissions was found to be disproportionately borne by communities of color in Michigan. The blue bars indicate the fraction of the Michigan population represented by communities of color, and the grey bars show the proportion of the Business as Usual case public health impacts borne by those communities. Consider emergency room visits for asthma as an example: people of color represent 18% of the asthmatic population in Michigan, but account for 75% of the Business as Usual case emergency room visits for asthma.
Figure 11. Communities of color in MI were found to be burdened with a disproportionate share of PM2.5-related health impacts, and therefore stand to benefit more as electricity sources are cleaned up. The blue images show the proportion of the Business As Usual case public health impacts borne by those communities. The proportion of the public health benefits of reduced emissions received by communities of color is shown in green. Consider emergency room visits for asthma as an example: people of color represent 18% of the asthmatic population in Michigan, but account for 75% of the Business As Usual case emergency room visits for asthma, and are estimated to receive 76% of the public health benefits of the emission reductions.
This study found that the Cleaner Energy Future scenario will yield public health benefits for communities of color that are proportional to their share of the public health impacts produced by the Business as Usual scenario (see Figure 11). In other words, people of color will benefit from this initiative at a rate proportional to their share of negative health impacts currently caused by coal-burning pollutants. For example, while communities of color are estimated to bear 75% of the Business As Usual case emergency room visits for asthma, this study also shows that 76% of the public health benefits of the emission reductions will be in communities of color. Similar results were found for the other PM2.5-related health outcomes considered in this analysis.

**Economic Impact**

The results of an economic analysis for both the United States and for Michigan indicate that the effective cost of electricity in Michigan would decrease significantly with reduced emissions from coal-fired power plants. As shown in Table 1, this study estimates Michigan’s total annual health-related damages in 2011 associated with air pollutant emissions from coal-fired power plants to be $1.3 billion. The value of the damages in Michigan is equivalent to $0.03 per kilowatt hour (kwh) ($1.3 billion of damages divided by 53 billion kwh of electricity generated by the 11 power plants in 2011 equals 3 cents per kwh). The value of the Business as Usual public health damages are substantial in comparison to the current cost of electricity in Michigan, $0.10 per kwh.

The emission rates and portfolio of renewable energy sources for the Cleaner Energy Future case represent an 83% reduction in the value of the annual health-related damages associated with Michigan power plants: $220 million for the Cleaner Energy Future in comparison to $1.3 billion for the Business as Usual case.

When Michigan-derived air pollutants that are transported out of state are considered, the annual value of the public health damages is estimated to decrease from $8.2 billion (Business as Usual) to $1.5 billion (Cleaner Energy Future), an 82% reduction in the value of public health impacts associated with these electricity-generating facilities in Michigan.

| TABLE 1 Valuation of Annual Public-Health Damages Associated with Contributions of Coal-fired Power Plants in Michigan to Fine Particle Levels in Air |
|-------------------------------------------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| Estimate             | 2011 | 2025 | Percent | 2011 | 2025 | Percent |
| Total value of health-related damages ($ billion) | $1.3 | $0.22 | 83% | $8.2 | $1.5 | 82% |
| Per kwh value of health-related damages ($/kwh) | $0.03 | $0.01 | 80% | $0.15 | $0.04 | 75% |
Over the next two decades, the United States has the opportunity to shift from its current energy portfolio that is heavily dependent on coal and other fossil fuels, toward a more diverse portfolio that includes a greater share of wind, solar, hydropower and biomass sources of energy. The driving forces for this shift include new and pending rules on air pollutant emissions authorized by the Clean Air Act, enforceable standards on the use of renewable energy sources being adopted by states, and advances in technology and policy that increase the cost competitiveness of renewables.

Increased reliance on wind, solar, and hydropower as sources of electricity will lower emissions of air pollutants and consequently, the levels to which humans are exposed to pollutants from electricity produced from fossil fuels. This analysis of a Business As Usual (2011) case and a Cleaner Energy Future (2025) case provides reasonable central estimates of the public health benefits expected to result from a decrease in air pollutant emissions from coal-fired power plants in Michigan. The results of this analysis indicate that a reduced reliance on coal-produced energy will provide substantial public health benefits. The major conclusions of the analysis are as follows:

Reduced air pollutant emissions from coal-fired power plants and increased reliance on renewable sources of energy forecasted for 2025 are expected to result in substantial reduction of health effects associated with Business as Usual for coal-fired power plants in Michigan.

The health benefits include an avoidance of over 800 premature deaths and 322,000 asthma attacks in the U.S. annually. These benefits are distributed across Michigan, Ohio, Pennsylvania, New York and other states of the Midwest and Mid-Atlantic regions.

Communities of color are disproportionately over-represented among those with negative health outcomes associated with the Business as Usual case and therefore stand to benefit more as air pollutants emissions from electricity sources are reduced.

For example, communities of color in Michigan represent only 18% of asthmatics in the state, but were found to account for 75% of the Business as Usual case emergency room visits for asthma. Communities of color were also estimated to receive the majority (76%) of the public health benefits for emergency room visits for asthma of the Cleaner Energy Future scenario.

The emission rates and portfolio of energy sources for the Cleaner Energy Future case would reduce the value of the annual health-related damages associated with Michigan power plants by 83%.

The value of public health damages for the Business as Usual case was estimated to be $1.3 billion annually. In comparison, remaining damages associated with the Cleaner Energy Future scenario were estimated to be $220 million per year.
**RECOMMENDATIONS**

Using informed advocacy, the NAACP’s focus is to advance and expand the usage of efficient and “clean” energy sources while ensuring a reduced community exposure to pollutants. Toward the goal of reaching a clean energy future, the NAACP and its partners have developed a series of recommendations to advance solutions that safeguard communities against coal-fired power plant pollution:

I. Communities should educate themselves, engage in organizing and advocacy efforts to enforce accountability and social responsibility in energy production.

II. Philanthropic organizations should support grassroots community organizing to reduce pollution and increase clean alternatives.

III. Research entities must increase research on the impact of energy choices on communities.

IV. Policymakers must advance just energy policies and other specific legislative interventions to reduce the harm produced by coal-fired power plants.

V. Corporations and plant owners must act responsibly to safeguard communities against pollution from coal.

**GLOSSARY OF TERMS/PHRASES**

**Acid rain** – a mixture of wet and dry material that deposits from the atmosphere and contains higher than normal amounts of nitric acid and sulfuric acid

**Ambient air** – outdoor air that is accessible to the general public; for instance, outdoor air at ground level

**Clean Air Act** – a United States law that defines the federal government’s responsibilities for protecting and improving the nation’s air quality

**Biomass** – combustible vegetation (e.g., wood) that can be a fuel for production of electricity

**Fine particulate matter** – liquid and solid aerosols in air that have an aerodynamic diameter less than 2.5 micrometers

**Hydropower** – the process of generating electricity by harnessing the power of moving water

**Point and mobile sources of emissions** – release of pollutants to air from a process at a fixed location such as an exhaust stack (point sources) or from a process that is mobile (e.g., a moving vehicle)

**Renewable portfolio standards** – a mechanism for states to create a legally enforceable requirement for renewable energy generation using a cost-effective, market-based approach that is administratively efficient.

**Renewable sources of energy** - resources that rely on fuel sources that restore themselves over short periods of time and do not diminish. Such fuel sources include the sun, wind, moving water, organic plant and waste material (biomass), and the earth’s heat (geothermal).
Note: Demographic data in this report are based on the 2000 Census.


In this analysis, communities of color are defined as the total population of African American (Non-Hispanic) and Latino/Hispanic (any race). This definition was developed using the data available from the 2010 Census. Information on baseline rates of health outcomes associated with air pollution were generally available for African-American populations but not always for other ethnic groups that comprise communities of color. Consequently, our analysis of impacts and benefits for communities of color is limited to African-American populations for three of the eight health outcomes. Details of ethnic groups represented for each health outcome are as follows:

<table>
<thead>
<tr>
<th>Health Outcome</th>
<th>At-Risk Population</th>
<th>African American</th>
<th>Latino/Hispanic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Premature mortality</td>
<td>&gt; 29 years</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Infant mortality</td>
<td>&lt; 1 year</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Asthma emergency room visits</td>
<td>All ages</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Cardiovascular hospital admissions</td>
<td>&gt; 64 years</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Respiratory hospital admissions</td>
<td>All ages</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Asthma exacerbation</td>
<td>Asthmatics, all ages</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Chronic bronchitis</td>
<td>&gt; 26 years</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Minor restricted activity days</td>
<td>18 – 65 years</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>


Some impurities produced by combustion of coal are captured by air pollution control equipment. The coal-fired power plants in Michigan operate systems that capture a portion of the fly ash generated by burning coal, but in general do not have systems that remove sulfur dioxide and nitrogen oxides which are converted to fine particulate matter once in the atmosphere.


Projections for future utilization of DTE and CMS coal-fired power plants were prepared by 5 Lakes Environmental.
Future demand for electric power is based on an annual growth rate of 0.5% per year for DTE and 1.2% annual growth for CMS. Emissions of primary PM2.5 and oxides of nitrogen per unit of electricity generated were assumed to be equal in the baseline and future cases.


<table>
<thead>
<tr>
<th>Health Outcome</th>
<th>At-Risk Population</th>
<th>Resolution</th>
<th>Baseline Rate per 1,000 Population</th>
<th>Percent Increase per μg/m3 PM2.5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Total</td>
<td>Color</td>
</tr>
<tr>
<td>Premature mortality</td>
<td>&gt; 29 years</td>
<td>County*</td>
<td>3.30 – 56.3</td>
<td>1.4 – 923.1</td>
</tr>
<tr>
<td>Infant mortality</td>
<td>&lt; 1 year</td>
<td>County*</td>
<td>2.60 – 31.4</td>
<td>4.20 – 33.2</td>
</tr>
<tr>
<td>Asthma emergency room visits</td>
<td>All ages</td>
<td>Region 1</td>
<td>8.14</td>
<td>19.44</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Region 2</td>
<td>7.75</td>
<td>24.64</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Region 3</td>
<td>5.58</td>
<td>7.33</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Region 4</td>
<td>3.46</td>
<td>4.60</td>
</tr>
<tr>
<td>Cardiovascular hospital admissions</td>
<td>&gt; 64 years</td>
<td>Region 1</td>
<td>31.44</td>
<td>41.79</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Region 2</td>
<td>28.27</td>
<td>20.01</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Region 3</td>
<td>24.67</td>
<td>33.62</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Region 4</td>
<td>18.66</td>
<td>39.24</td>
</tr>
<tr>
<td>Respiratory hospital admissions</td>
<td>All ages</td>
<td>Region 1</td>
<td>4.65</td>
<td>5.23</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Region 2</td>
<td>4.40</td>
<td>3.36</td>
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<td></td>
<td>Region 3</td>
<td>4.89</td>
<td>4.90</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Region 4</td>
<td>3.49</td>
<td>5.41</td>
</tr>
<tr>
<td>Asthma exacerbation**</td>
<td>Asthmatics, all ages</td>
<td>National</td>
<td>63.0 – 109.3</td>
<td>71.0 – 179.1</td>
</tr>
<tr>
<td>Chronic bronchitis</td>
<td>&gt; 26 years</td>
<td>National</td>
<td>3.78</td>
<td></td>
</tr>
<tr>
<td>Minor restricted activity days</td>
<td>18 – 65 years</td>
<td>National</td>
<td>7805.39</td>
<td></td>
</tr>
</tbody>
</table>

** Values represent range of baseline rates for each county

** Asthma prevalence and asthma attack per asthmatic based on national resolution for age and race groups

Region 1 Northeast (ME, NH, VT, MA, CT, RI, NY, NJ, PA)
Region 2 Midwest (MI, OH, IL, IN, WI, MN, IA, MO, ND, SD, NE, KS)
Region 3 South (DE, MD, DC, VA, WV, NC, SC, GA, FL, KY, TN, AL, MS, AR, LA, OK, TX)
Region 4 West (MT, ID, WY, CO, NM, AZ, UT, NV, WA, OR, CA, HI, AK)


### Business as Usual Case and Cleaner Air Future Case Annual Mortality and Morbidity Impacts for Communities of Color Associated with Fine Particulate Air Pollutant Emissions from Coal-fired Electricity Generating Units in Michigan

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Michigan</th>
<th>Continental United States</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2011 Cases</td>
<td>2025 Cases</td>
<td>Cases Avoided</td>
<td>Percent Reduction</td>
<td>2011 Cases</td>
<td>2025 Cases</td>
<td>Cases Avoided</td>
<td>Percent Reduction</td>
</tr>
<tr>
<td>Premature mortality</td>
<td>44</td>
<td>7</td>
<td>37</td>
<td>85%</td>
<td>200</td>
<td>35</td>
<td>165</td>
<td>83%</td>
</tr>
<tr>
<td>Cardiovascular hospital admissions*</td>
<td>1</td>
<td>&lt;1</td>
<td>1</td>
<td>85%</td>
<td>12</td>
<td>2</td>
<td>10</td>
<td>84%</td>
</tr>
<tr>
<td>Respiratory hospital admissions*</td>
<td>3</td>
<td>&lt;1</td>
<td>3</td>
<td>85%</td>
<td>14</td>
<td>3</td>
<td>11</td>
<td>82%</td>
</tr>
<tr>
<td>Chronic bronchitis</td>
<td>14</td>
<td>2</td>
<td>12</td>
<td>85%</td>
<td>70</td>
<td>10</td>
<td>60</td>
<td>82%</td>
</tr>
<tr>
<td>Asthma emergency room visit</td>
<td>18</td>
<td>3</td>
<td>15</td>
<td>84%</td>
<td>280</td>
<td>60</td>
<td>220</td>
<td>80%</td>
</tr>
<tr>
<td>Asthma exacerbation*</td>
<td>24,000</td>
<td>3,700</td>
<td>20,300</td>
<td>85%</td>
<td>101,000</td>
<td>18,000</td>
<td>83,000</td>
<td>82%</td>
</tr>
<tr>
<td>Minor restricted activity days</td>
<td>16,000</td>
<td>2,500</td>
<td>13,500</td>
<td>84%</td>
<td>86,000</td>
<td>15,000</td>
<td>71,000</td>
<td>82%</td>
</tr>
</tbody>
</table>

* Community of color includes African American population only

Communities of color represent both African American and Latino/Hispanic populations unless otherwise noted. The percentage of the cases avoided for the overall community of colored represented by the African American population is as follows:

- Premature mortality: 89%
- Chronic bronchitis: 86%
- Asthma emergency room visits: 84%
- Minor restricted activity days: 81%

---

28. Business as Usual Case and Cleaner Air Future Case Annual Mortality and Morbidity Impacts for Communities of Color Associated with Fine Particulate Air Pollutant Emissions from Coal-fired Electricity Generating Units in Michigan


30. U.S. Energy Information Administration, data obtained from State Electricity Price Rankings spreadsheet, Available online at 
   [http://www.eia.gov/energyexplained/index.cfm?page=electricity_home#tab2](http://www.eia.gov/energyexplained/index.cfm?page=electricity_home#tab2)