Climate and Energy 101: Energy Generation, Health Impacts, and Policy Solutions

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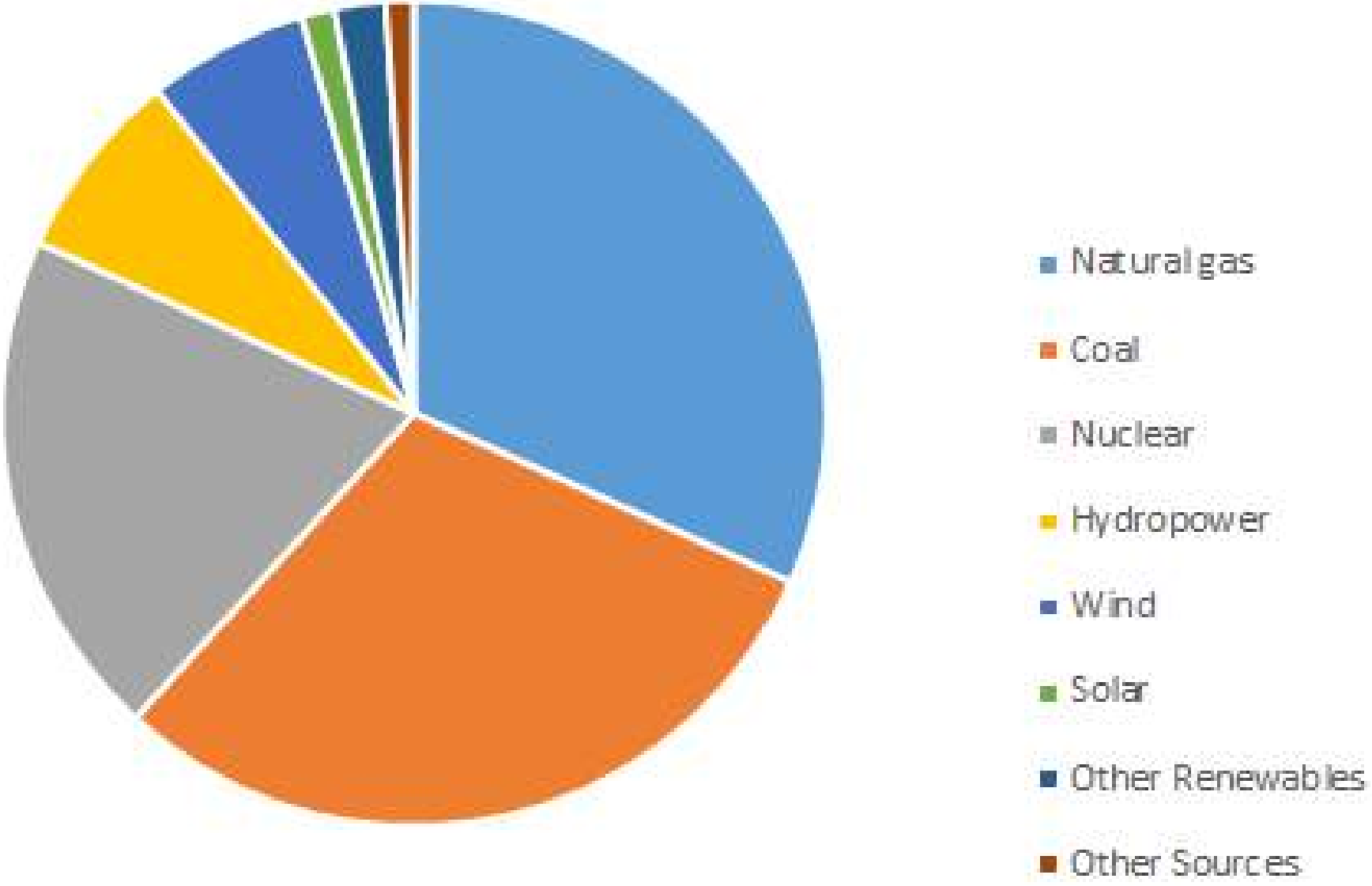
Learning Objectives

- Name 2 chemicals that contribute to adverse health effects when they are released through the burning of fossil fuels.
- List 3 health problems linked to poor outdoor air quality.
- Identify 2 strategies to reduce fossil fuel reliance.

US Electricity Generation by Energy Source

Natural gas: 35.1%
Coal: 27.4%
Nuclear: 19.3%
Hydropower: 7.0%
Wind: 6.6%
Solar: 1.6%
Other renewables: 1.9%
Other Sources: 0.3%

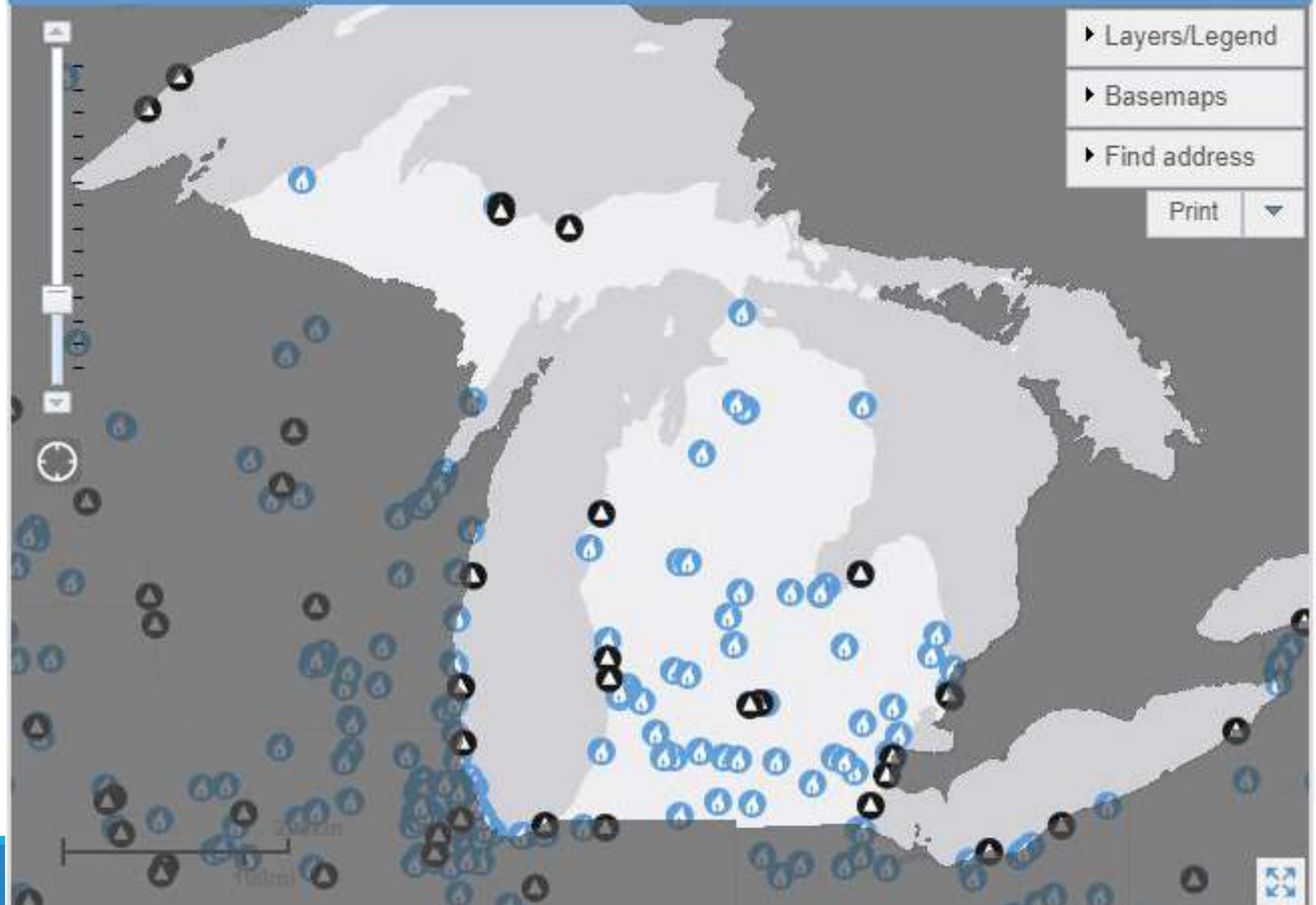


Energy source	Billion kWh	Share of total
Total - all sources	4,009	
Fossil fuels (total)	2,419	60.3%
Natural Gas	1,617	40.3%
Coal	774	19.3%
Petroleum (total)	17	0.4%
Petroleum liquids	10	0.2%
Petroleum coke	8	0.2%
Other gases	11	0.3%
Nuclear	790	19.7%
Renewables (total)	792	19.8%
Wind	338	8.4%
Hydropower	291	7.3%
Solar (total)	91	2.3%
Photovoltaic	88	2.2%
Solar thermal	3	0.1%
Biomass (total)	56	1.4%
Wood	37	0.9%
Landfill gas	10	0.3%
Municipal solid waste (biogenic)	6	0.2%
Other biomass waste	2	0.1%
Geothermal	17	0.4%
Pumped storage hydropower[3]	-5	-0.1%
Other sources[4]	13	0.3%

Fossil fuel use in Michigan

- In 2019, Michigan used coal for 32% of its net electricity generation.
  - Was more than 50% in 2014
- Natural gas-fired power plant electricity generation nearly doubled during that same period.
  - Natural gas provided more than 30% of the state's electricity generation in 2019.
  - Nulclear accounts for 28%

Renewables only at 10%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Fossil Fuel Life Cycle

Harmful air pollutants

Hazardous pollutants	Health associations
Pollutants include: • acid gases • benzene • dioxins • formaldehyde • lead • arsenic • mercury • radioactive materials, like radium and uranium.	These pollutants are associated with: • Asthma exacerbations • Chronic obstructive pulmonary disease • Bronchitis and other lung diseases • Heart attacks and strokes • Lung cancer and other cancers • Birth defects and premature death

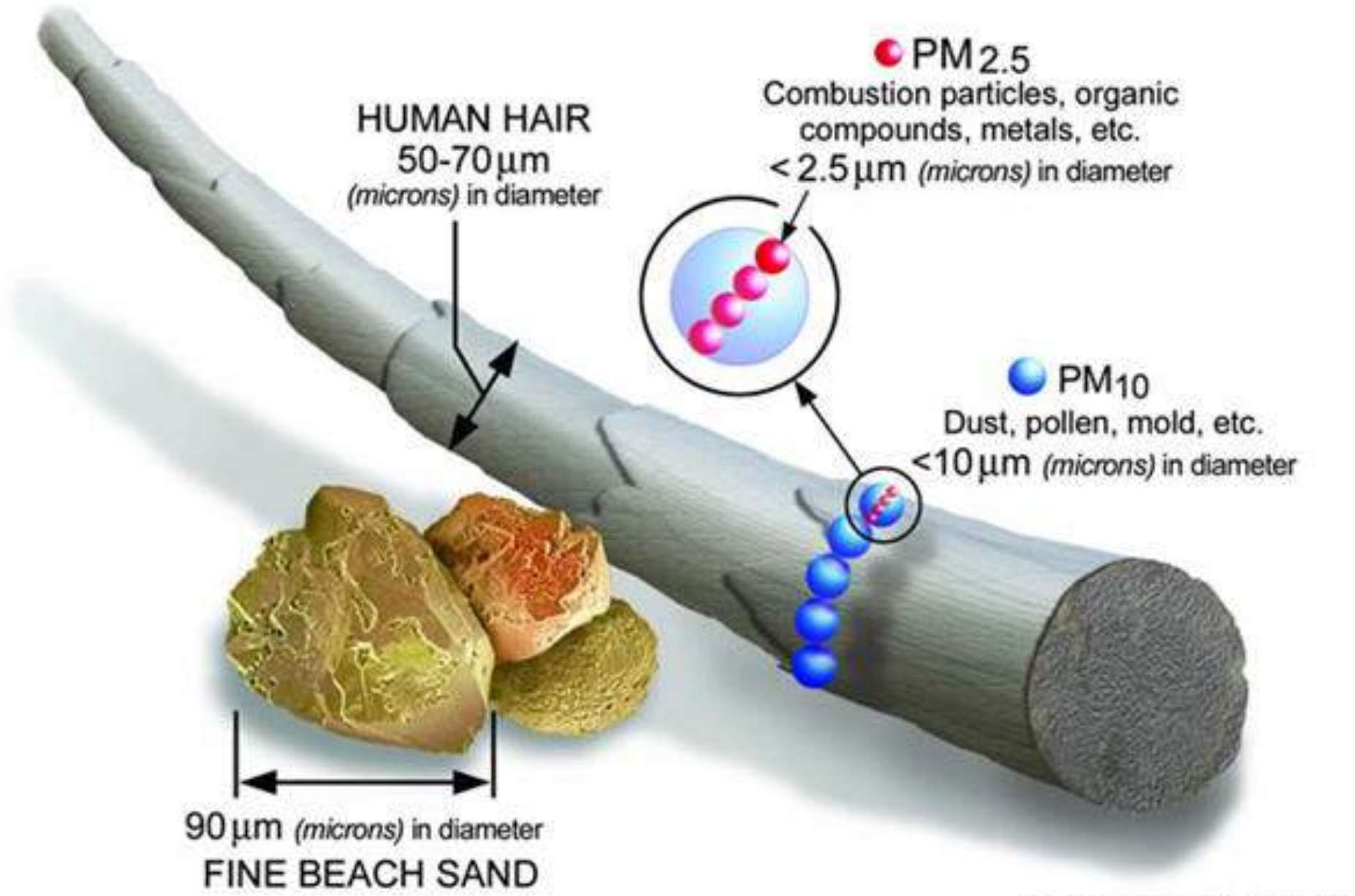
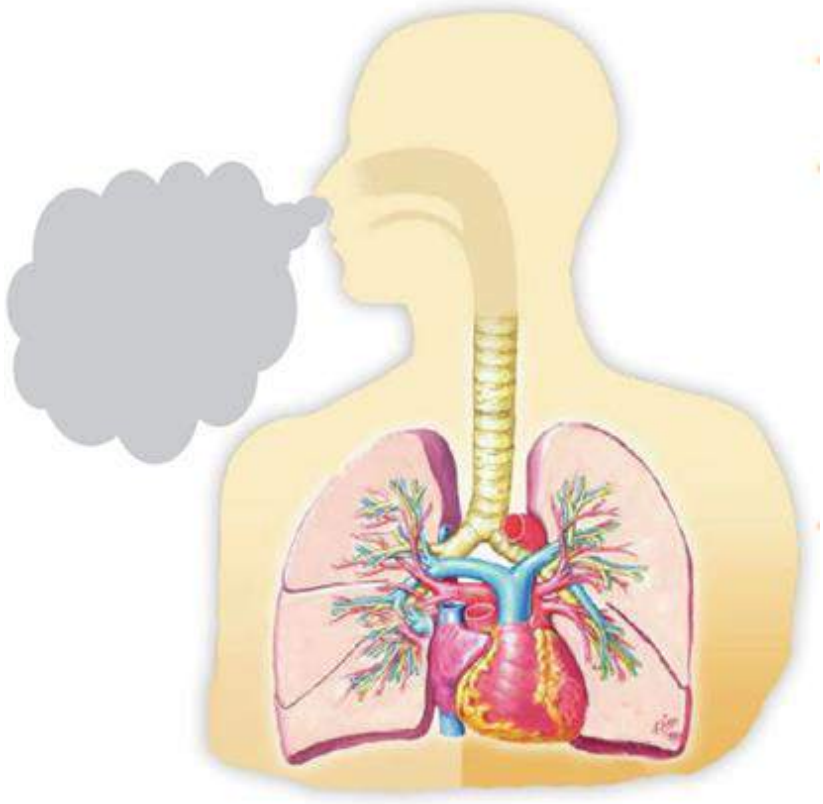


Image courtesy of the U.S. EPA

Particulate Matter (PM2.5)



- Particles get very deep into airways
- Inhalation can lead to:
  - Inflammation
  - Oxidative stress
  - Autonomic changes
  - Impacts throughout the body
- Susceptible individuals include:
  - Children
  - Elderly populations
  - Pre-existing conditions


Ground Level Ozone Formation
Sunlight + NOx + VOCs = O3
Sunlight
Nitrogen Oxides (NOx)
Volatile Organic Compounds (VOCs)
Ozone
Mobile and Combustion Sources
Vegetation, Mobile, and Industry Sources

Ozone

- Created from VOC+NOx+Sun
- Causes “sunburn” in the lungs
- Breathing ozone can trigger a variety of health problems
  - Lower birth weight babies, asthma exacerbations, lung size reduction

VITAL STATISTICS

Ozone lev… time and… …for lost …year

By Julie Mack
jmack1@mlive.com

An estimated 275 people in Michiga… each year and another 640 experience… ous illness as a result of air pollution t… exceeds standards recommended by t… American Thoracic Society, according… report by the scientific group that focu… on respiratory and critical care medic…

In addition, Michigan has 565,414 "i… days" per year, or the cumulative total… individuals' lost time for work, school… other activities.

Michigan ranks seventh in the natio… estimated deaths related to air pollutio… analysis shows.

The state regions most affected are… Detroit metro area and West Michigan… downwind from Chicago, Milwaukee a… Gary, Ind.

Allegan, Berrien and Muskegon had… highest scores among counties for air… tion, mainly in the form of high ozone… the analysis shows.

Poor air quality can contribute to he… attacks, chronic bronchitis, hospital ad… sions or emergency room visits for pe… with cardiovascular or respiratory con… tions, the study said.

The point of the study is to publicize… the health consequences of air pollutio… according to Kevin Cromar, lead autho… and director of air quality studies at N… York University's Marron Institute of … Management. The study appears in th… Annals of the American Thoracic Stud…

The study comes with an online data… which Cromar said he and his colleagu… hope to update each year. (See the data on… MLive at bit.ly/AirMich.)

"We hope to create a tool that's acces-

BY THE NUMBERS

Here are the ozone scores for the 23 Michigan counties with federal-level air monitoring, with the estimated number of deaths and serious illnesses each year as well as days when residents missed work or school or limit their activities because of poor air quality.

	Ozone	Death	Illness	Days lost
Wayne	77	64	173	143,554
Oakland	76	41	106	97,185
Macomb	77	32	88	68,520
Kent	74	17	40	46,969
Genesee	74	16	37	30,027
Berrien	82	9	15	16,013
Muskegon	81	9	16	17,442
Ottawa	77	9	19	25,238
Washtenaw	75	9	25	28,848
Kalamazoo	75	8	18	19,899
St. Clair	75	6	17	11,212
Ingham	72	6	16	16,498
Allegan	86	5	9	10,259
Lenawee	75	4	8	8,027
Cass	78	3	4	4,859
Clinton	71	2	4	5,092
Mason	75	1	3	1,943
Benzie	74	1	1	1,105
Manistee	74	1	2	1,448
Huron	72	1	4	1,801
Schoolcraft	72	1	1	425
Missaukee	70	0	1	765
Chippewa	64	0	1	726

Source: American Thoracic Society

…drunken-driving accidents.

Dr. Samya Nasr, a pediatric pulmonologist at University of Michigan, said she sees the

…er patients include children with …ma, cystic fibrosis and other lung condi… …s, she said.

"They can have a hard time breathing," …said. "Sometimes, it's so bad, we have to …them on a ventilator. Some kids actually …

…e study looked at levels of two major air …utants — ambient ozone and fine par… …ate matter (soot) — in the 650 counties … "federally valid air monitoring." That …udes 23 counties in Michigan.

…romar and his colleagues estimated …hs and serious illnesses for each county …d on levels of outdoor air pollution from … to 2013, factoring in city-specific demo… …hics and baseline health conditions.

…e study found the most severe issues in …ornia, with an estimated 3,632 deaths a … That's followed by Pennsylvania (728 …hs), Texas (604), Ohio (578), Arizona …), New York (317) and Michigan.

…zone is created when plumes of fossil …emissions from vehicles and factories …with sunlight, which means the areas …t impacted are often downwind from …ources of the emissions.

…r instance, Cromar said, the city of Los …eles has lower ozone levels than its east… …suburbs; New York City has lower levels … southwest Connecticut, and Chicago …ower levels than southwest Michigan.

"…here needs to be some regional coop… …on" in addressing air-quality issues, he … "But there are also things every city …do to lower its ozone levels."

…arting this year, the federal Environ… …tal Protection Agency lowered its ozone …standard from 75 parts per billion to 70 ppb. The ATS would like to see the standard set at 60 ppb, Cromar said.

Mercury


arsenic
soot
mercury
chromium
nickel
lead
soot
acid
nickel
mercury
mercury
mercury
mercury
mercury
mercury

Coal Plants and Water

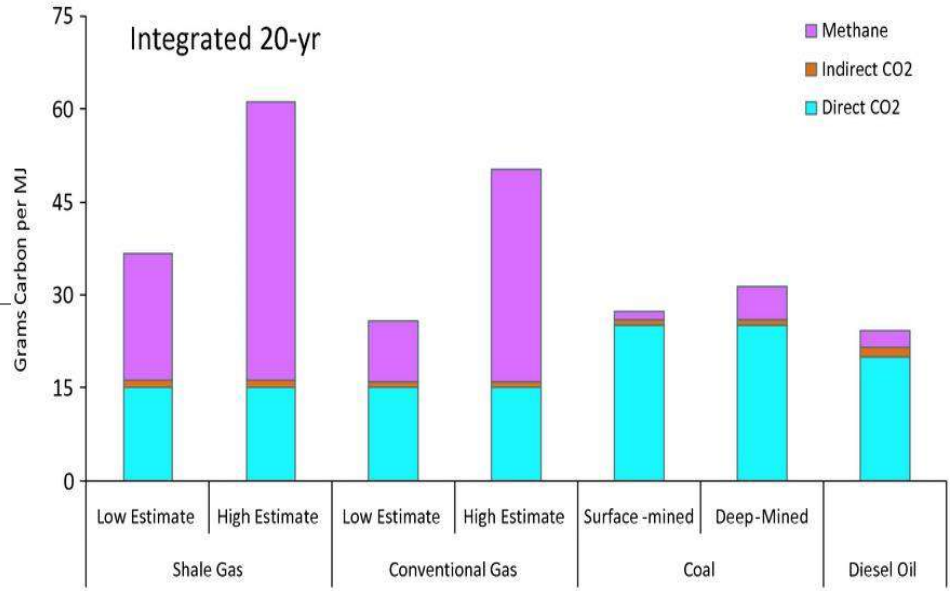
- In 2016, coal plants in Michigan discharged 48,697 pounds of toxic pollutants
- Coals plants also generate a toxic waste called coal ash
  - Contains mercury, arsenic, lead and other toxic heavy metals
- Michigan's 13 largest coal plants generated more than 1.4 million tons of coal ash waste in 2016

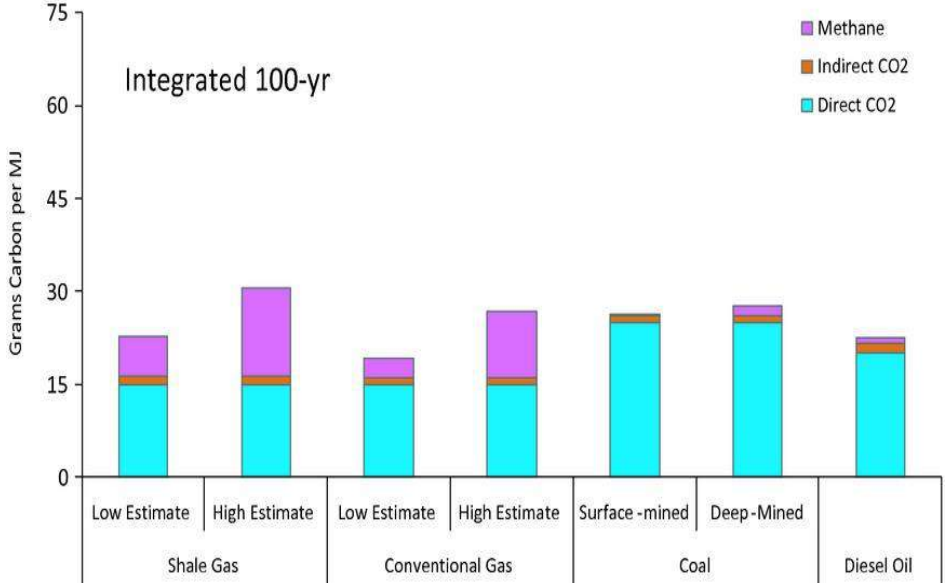
Coal Plants and Water

- 29 coal ash waste sites in Michigan
  - Includes 35 unlined coal ash ponds
  - A review of the 22 sites with available data showed 17 contained groundwater with toxic chemicals above drinking water standards
- In the US, 2.7 million Americans live within 3 miles of a coal plant that discharges pollutants into a public waterway

Natural Gas and Methane

- In June 2019 Natural Gas Accounted for 30% of the United States' primary energy consumption
  - Natural Gas produces less CO2 than Coal plants but exudes many times more methane gas emissions
  - In the lifetime of a natural gas well 1.7%-6% of its total emissions are methane



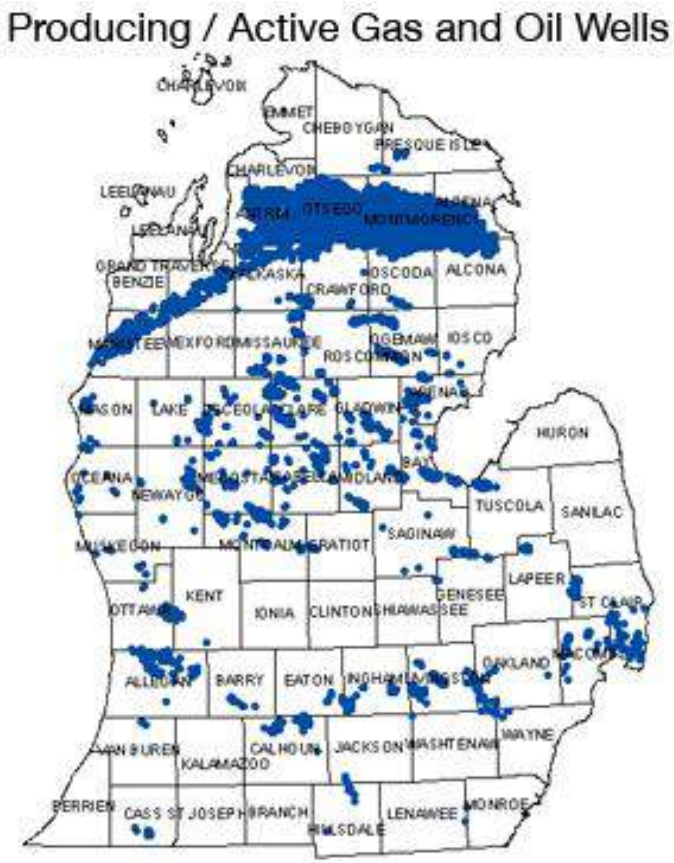


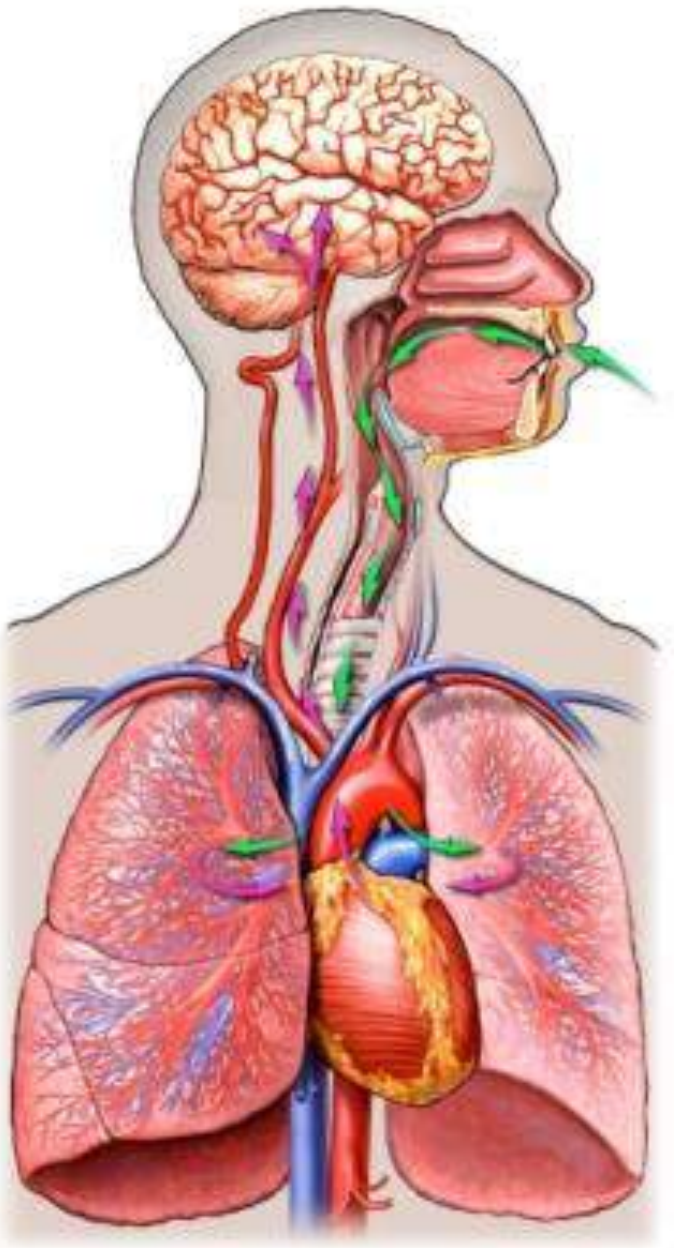
Methane vs CO2

- Lifespan of Methane is 12 years compared to CO2 being over a century
  - Methane is 30 times more potent than CO2 at trapping heat
  - CO2 Global Warming Potential (GWP) over a 100 year cycle is 1 and Methane GWP is 21
    - Worldwatch Institute said Methane GWP should be 72 as the next 20 years are integral to global warming
- Methane contributes 1.0 watts m^-2 out of the total 2.29 watts m^-2 of radiative forcing in 2014

Natural Gas and Michigan

- Michigan has natural gas storage capacity in the nation at 1.1 trillion cubic feet.
- Michigan used 9 times more natural gas than it produced in 2017
- Michigan is top 5 in the nation for residential natural gas use, top 10 in total natural gas use





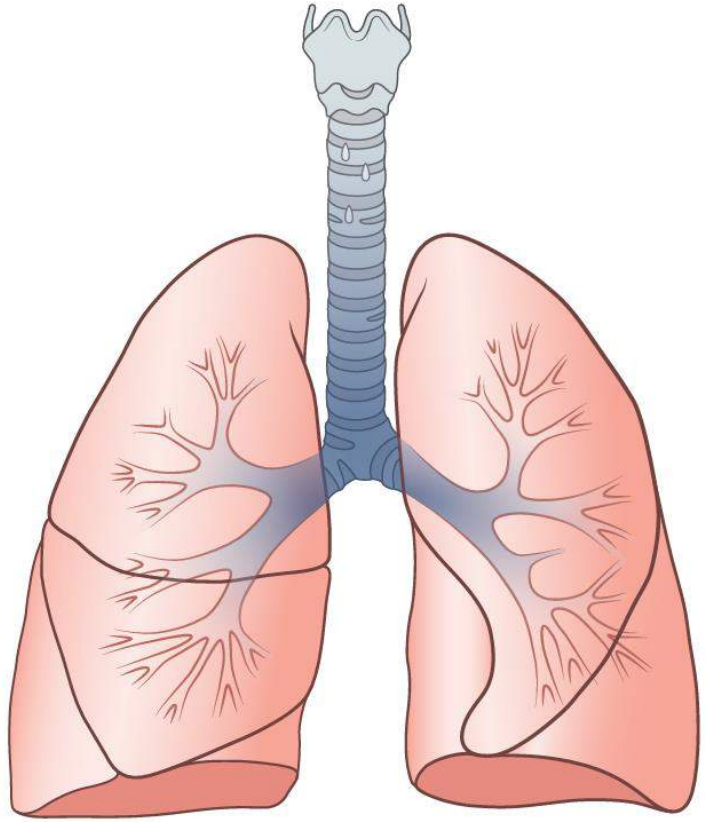
Air Pollution and Health

Air Pollution and the Brain

- Stroke
- Loss of intellectual capacity
- Alzheimer's and dementia

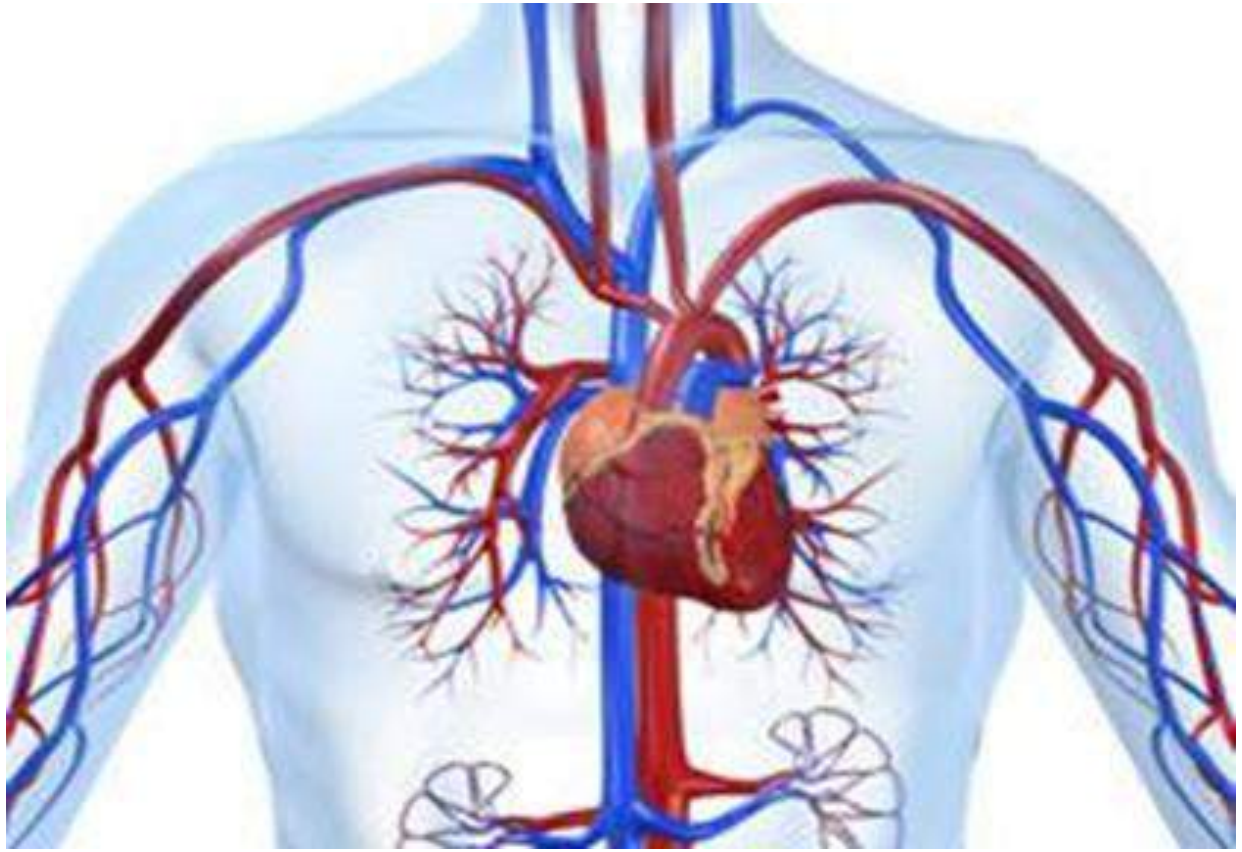
Air Pollution and Respiratory Health

- Asthma
- COPD
- Lung cancer
- Reduced lung function and size



Air Pollution and Cardiovascular Health

- Coronary heart disease
- Myocardial infarction
- Arrhythmias
- Congestive heart failure



Global Air Pollution

- 4.2 million deaths/ year linked to outdoor air pollution
- Outdoor + indoor air pollution= 7 million premature deaths
- 1 in 9 total global deaths from exposure to indoor and outdoor air pollution

Who is most at risk?

- Pollutants from burning fossil fuels can travel distances when carried by the wind, affecting people who don't even live near a plant.
- The most at risk include:
- Pregnant woman
- Children
- Individuals with asthma, lung disease, and cardiovascular disease
- Diabetics
- Individuals with existing health conditions
- Frontline communities

Air Pollution in Michigan

- 1.8 million Michiganders still live in areas that have unacceptable levels of PM2.5 pollution.
  - 275 people die and 640 experience serious illness each year
- Michigan ranks 5th in the nation in premature deaths, hospital admissions, and heart attacks attributed to coal-fired power plant pollution.
  - Costs Michiganders more than $15 billion per year.

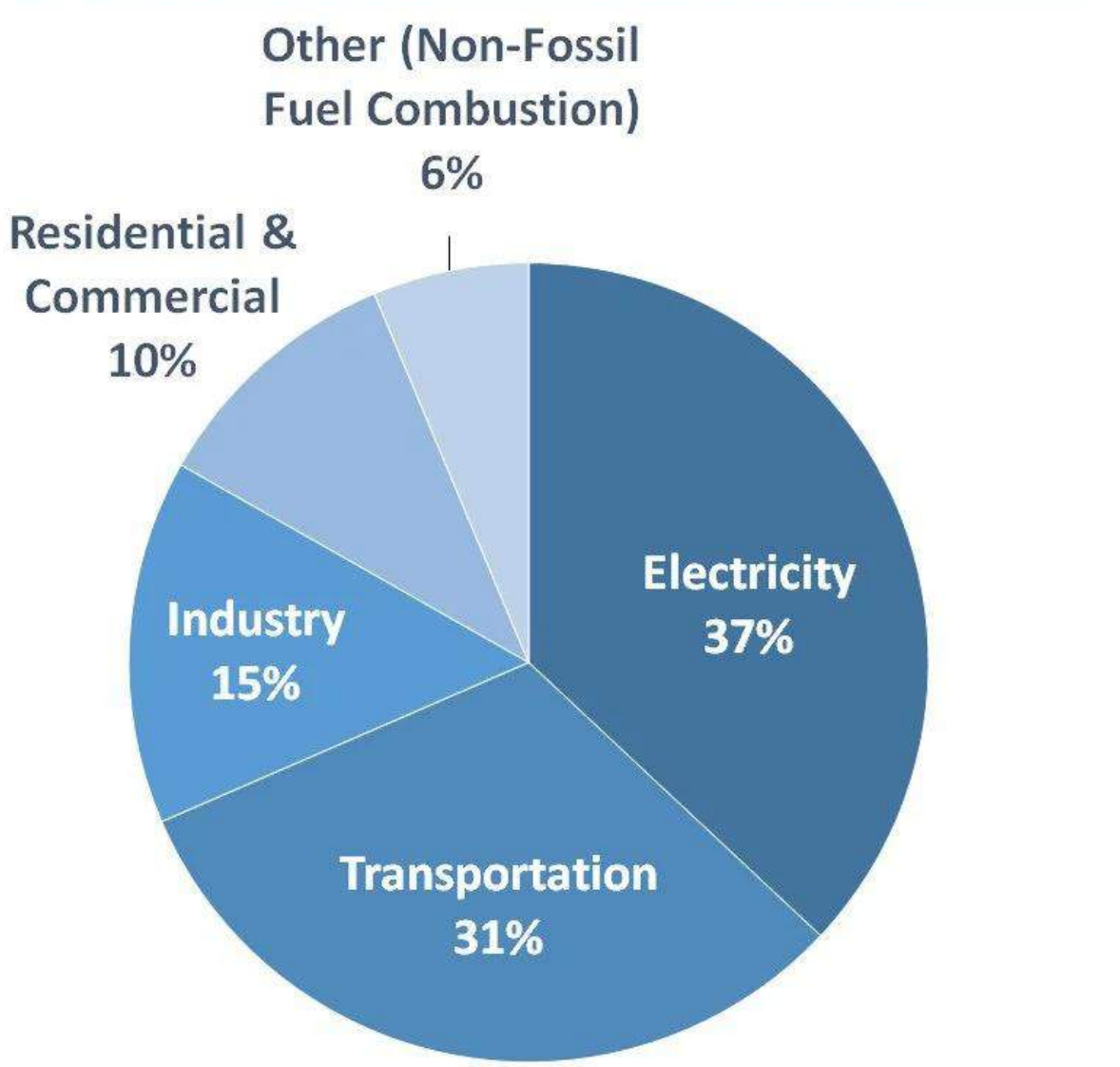
Table 1.2 Annual Mortality and Morbidity Impacts in Michigan Associated with Air Pollutant Emissions from Older Coal-fired Electricity Generating Units in Michigan

Outcome	Cases
Premature mortality	180
Cardiovascular hospital admissions	38
Respiratory hospital admissions	55
Chronic bronchitis	76
Asthma emergency room visits	140
Asthma exacerbations	68,000
Minor restricted activity days	72,000

Fossil fuels and climate change

- Fossil fuel combustion is a leading contributor to climate change.
- Coal has the highest carbon content of all fossil fuels.
- Leaking methane from natural gas supply chain another contributor.

U.S. Carbon Dioxide Emissions, By Source



What is climate change?

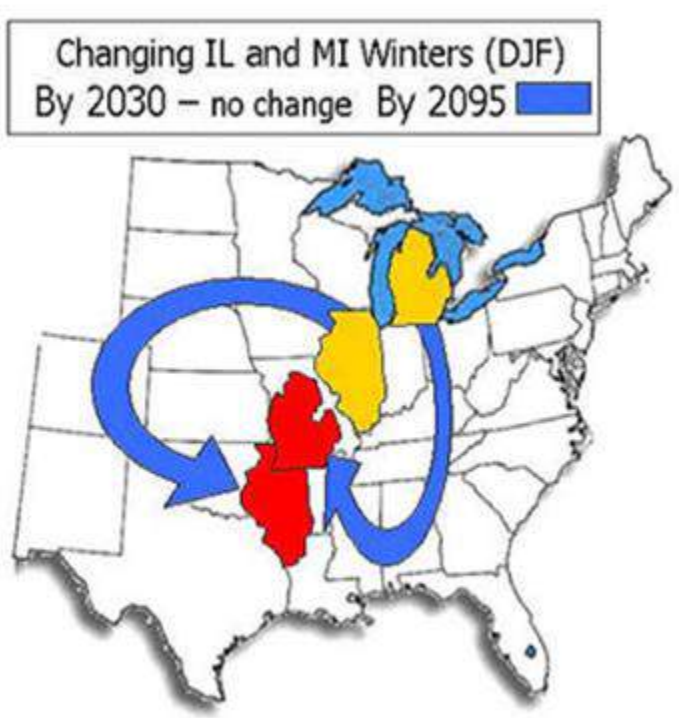
- Warming temperatures due to burning of fossil fuels increases the blanket of greenhouse gases that keeps our surface temperatures warm.
- It has resulted in:
  - Acidification of the oceans
  - Increase in extreme weather events
  - Rising sea levels
  - Loss of biodiversity due to ecosystem disruption

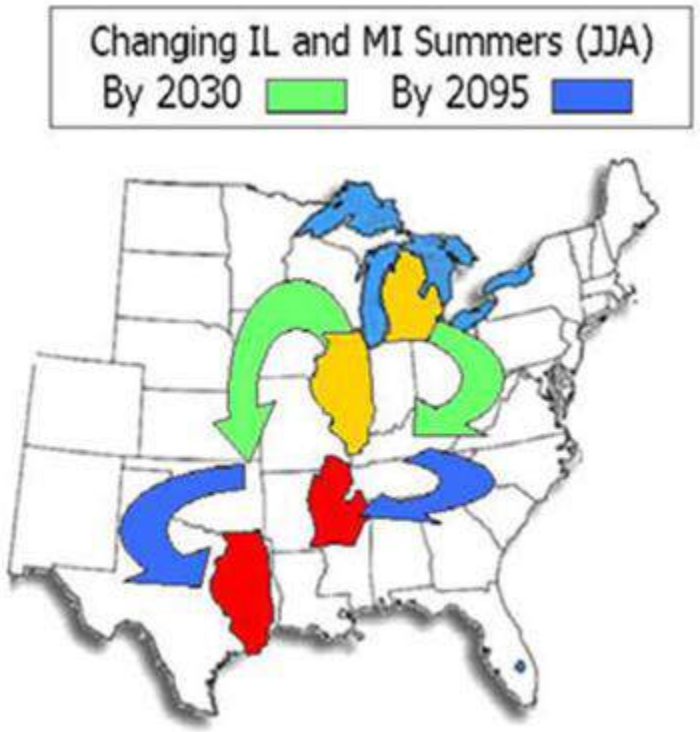
Climate Change Impacts

- Extreme heat
- Poor air quality
- Increased precipitation, flooding
- Superstorms, changing weather patterns
- Insect borne diseases
- Psychological damage

Climate Change Impacts in Michigan

- Higher temperatures
  - Extreme heat
- Extended allergy season
- Lower lake levels
- Agricultural difficulties and decline
- Sudden large amounts of rain





Solutions

Renewable Energy (RE)

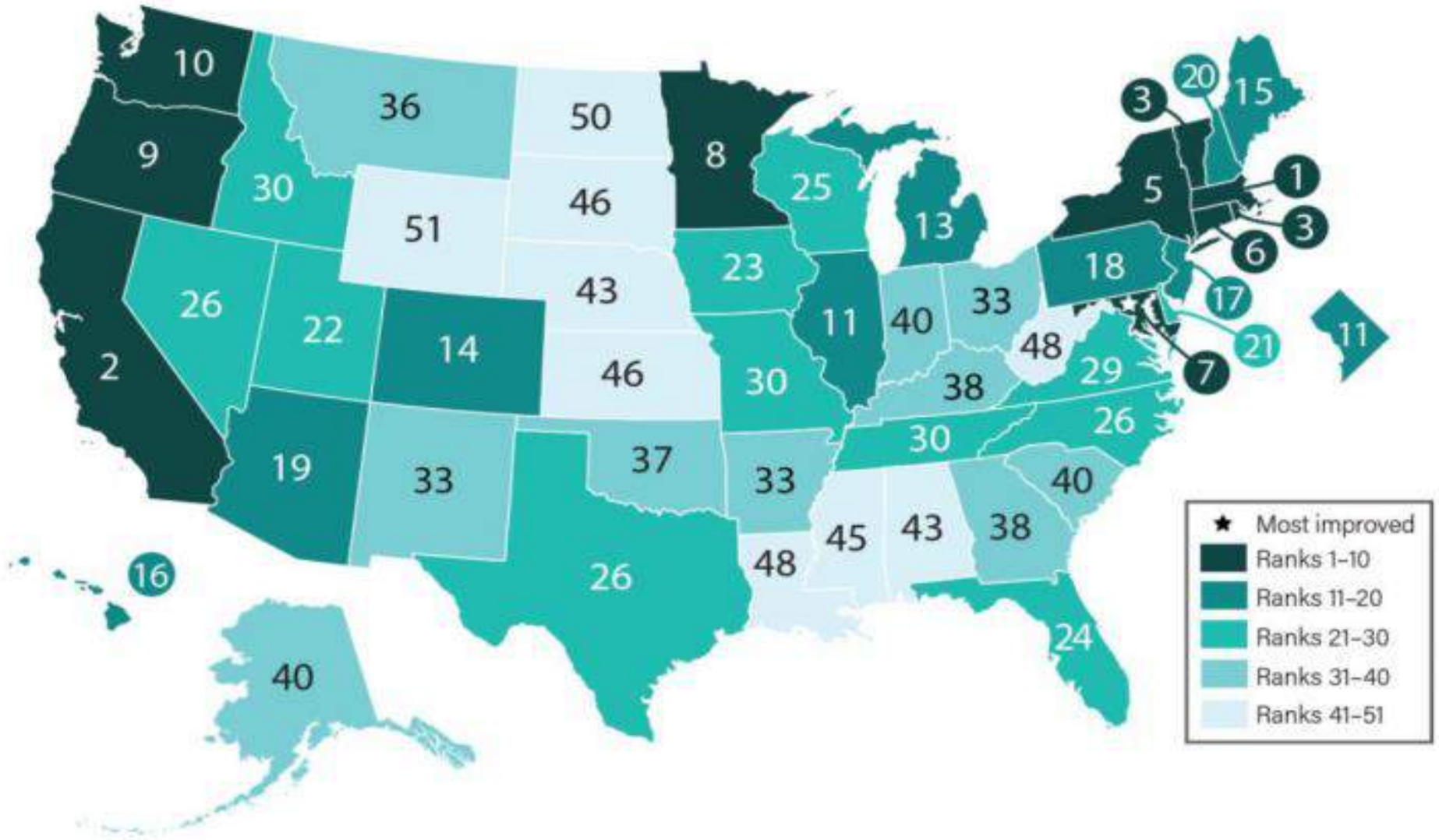
- Replacing coal fired power plants with alternatives like wind, solar, and geothermal
- According to the Michigan Public Service Commission, renewable energy is already cheaper than building a new coal plant
- If MI produced just 25% of our energy from renewable sources by 2030 we could reduce annual health damages by more than $1 billion per year
- Utilizing these sources allows us to source our power from our own state and with our own workers, instead of sending money out of state to pay for resources like coal that we don’t have here


Top 7 Renewable Energy Sources in 2020
SOLAR ENERGY
Wind ENERGY
HYDROGEN ENERGY
OCEAN ENERGY
HYDRO POWER
GEOTHERMAL POWER
BIO ENERGY
Image source: Civic Concepts

Energy Efficiency (EE)/ Energy Waste Reduction (EWR)

- By reducing our energy use, we reduce the demand for electricity from fossil fuel burning power plants
- Cheapest energy is energy we don't use
- More efficient homes and buildings - Examples
  - Sealing windows in your home, updating your furnace
  - Hospital installing a new lighting system
  - Adding more insulation to your business
- For every $1 invested in energy efficiency, customers avoid $4.35 in energy costs

State Energy Efficiency Scorecard



Energy Efficiency Policies Can Help

Healthy Homes	Healthy Communities	Healthy Economics
Improves quality of life by making homes better insulated- warmer in the winter and cooler in the summer Many energy efficiency programs target low income housing, which are often the unhealthiest homes to live in	• Reduces need to extract and burn new fossil fuels → reduces harmful emissions • Will protect the Great Lakes and our drinking water • With renewable energy, we can replace coal plants that emit dangerous toxins	• Reduces stress and mental ilness for those financially burdened by utility costs • Will reduce $1.5 billion annually in health care expenses related to coal

Energy Efficiency Measure	Primary Housing Effect	Secondary Housing Effect	Expected Health Outcomes
Insulation & Air Sealing	Heating/cooling retained within dwelling	· Comfortable indoor temperatures · Lower indoor relative humidity Reduced allergens	· Reduced deaths due to temperature extremes · Reduced symptoms of respiratory disease
Improved Heating Systems	Heating provided to whole dwelling Cleaner burning heating systems Combustion by-products properly vented to outdoors	· Comfortable indoor temperatures · Reduced gases and particulates · Increased usable living space	· Reduced deaths due to cold · Reduced symptoms of respiratory disease · Reduced street and infectious disease
Improved Cooking Systems	Cleaner-burning cooking systems	· Reduced gases and particulates	· Reduced symptoms of respiratory disease · Reduced risk of cancer
Improved Ventilation	Combustion by-products properly vented to outdoors Increased air flow within dwelling	· Reduced gases and particulates · Reduced dampness · Reduced mold	· Reduced symptoms of respiratory disease · Reduced risk of cancer · Reduced symptoms of cardiovascular disease · Reduced arthritis · Reduced depression

Federal Mitigation Efforts

Biden's Climate & Infrastructure Plan: A Snapshot

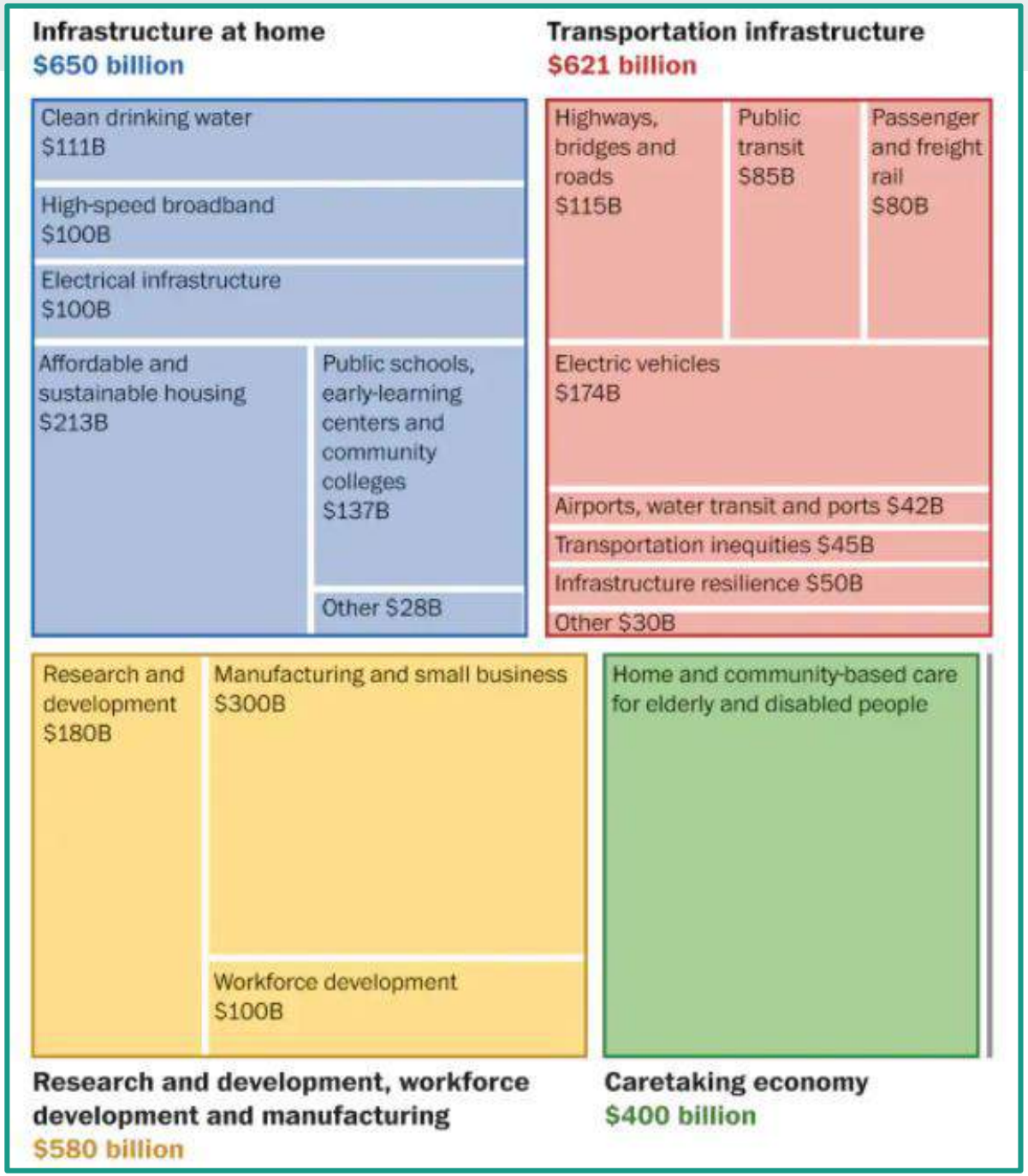


Image source: Washington Post

Biden's Climate & Infrastructure Plan

Equity Considerations?

- Executive Order 14008: The Biden administration released a broad climate and EJ exec order that creates a special council to study environmental injustice and figure out how to address disparities. Council will develop recommendations within 120 days to meet a "***goal that 40% of overall benefits flow to disadvantaged communities***" (benefits include federal investments in clean energy and energy efficiency, public transit, training and workforce development, and affordable and sustainable housing, etc.)

- Climate and Infrastructure Plan Factsheet: "[. . .] *Unlike past major investments, the plan prioritizes addressing long-standing and persistent racial injustice. The plan targets* ***40 percent of the benefits of climate and clean infrastructure investments to disadvantaged communities****.* And, the plan invests in ***rural communities and communities impacted by the market-based transition to clean energy***."

A map of the former Black Bottom neighborhood in Detroit. *Martha Thierry, DFP*

State Energy Policies

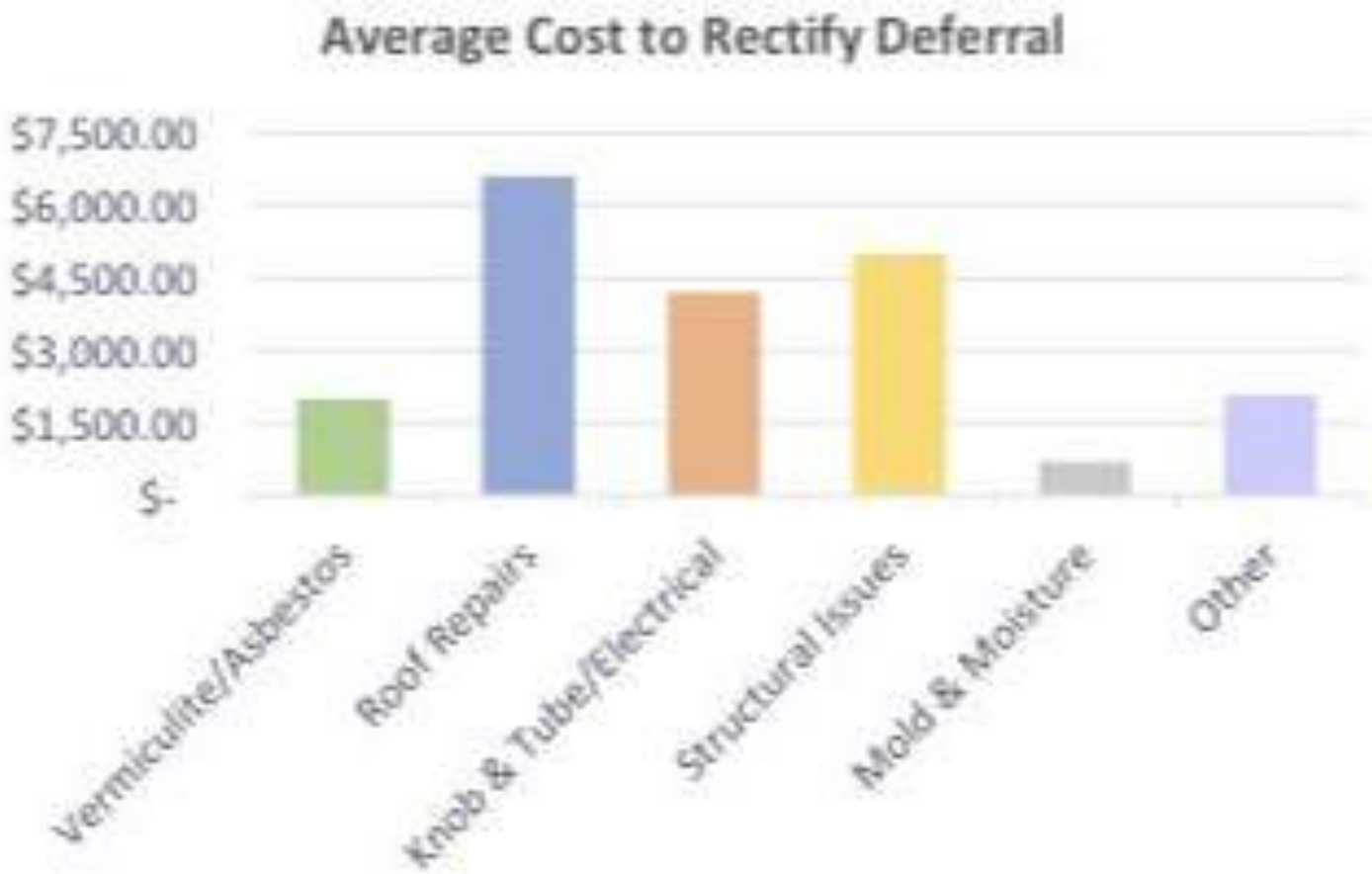
Public Acts 341 and 342 of 2016

- Comprehensive Energy Policy –
- Requires Michigan electric providers to achieve a retail supply portfolio that includes at least 15% renewable energy by 2021
- Required all electric utilities to provide energy waste reduction (EWR) programs and energy savings of 1% per year (Percentages are savings relative to the prior year's total retail electricity sales)
- Provides incentives for electric utilities who achieve energy savings beyond 1.5% per year (In last DTE IRP, Commission required 2%)
- Requires regulated utilities to engage in a comprehensive Integrated Resource Planning (IRP) process to determine all aspects of electric generation, energy optimization and rate setting.

Stand Alone Energy Policies that can make a difference

- Solar Access – package of bills that make it easier for customers to utilize solar for individual power generation (Distributed Generation (DG)
- Tax policies (solar)
- Energy Financing policies
- Health Safety Fund
- Expansion of Shut-off protections
- Coordination of Weatherization (wx) and Energy Efficiency programs – coordination of other home interventions (lead/asbestos remediation)
- Transportation policies that advance electrification and expansion of public transportation
- Expansion of % of LIHEAP funds going to weatherization

Health and Safety Interventions



State Budget Developments: Health and Safety Fund

Governor's FY22 Executive Budget Recommendation: $5 million in the MDHHS Budget for Health and Safety

Boilerplate:

ONE-TIME APPROPRIATIONS 10 Sec. 8-1933. From the funds appropriated in part 1 for Home Health and Safety, the department shall create a pilot health and safety fund grant program. The creation of the pilot program shall be supported by a work group which may include representatives from the department, Michigan energy utility companies, residential energy efficiency and weatherization experts and companies, community-action agencies, low-income and affordable housing organizations, affordable housing owners and renters, and environmental and public health organizations. Funds from the pilot shall be used for the purpose of making grants for construction, reconstruction, improvement, or repair of single-family and multi-family residential buildings to correct health and safety conditions as identified by the department's weatherization assistance program's energy audit, directed by the weatherization assistance manager that would require a deferral from participation in energy efficiency and weatherization programs targeted at low-income residential buildings.

House MDHHS Subcommittee FY22 Budget

- Included a $100 placeholder for health and safety fund

Senate MDHHS Subcommittee FY22 Budget

- Did not include funding

State Budget Developments: Additional LIHEAP to Wx

Governor's FY22 Executive Budget Recommendation:

- Increased LIHEAP funding for Wx from $6 million to $15 million in the MDHHS Budget

House MDHHS Subcommittee Budget FY22:

- Increased LIHEAP funding for Wx to $15,505

Senate MDHHS Subcommittee Budget FY22:

- ?????

Michigan Public Service Commission (MPSC)

Integrated Resource Plans (IRP)

- The energy law requires rate-regulated electric utilities to submit IRPs to the Michigan Public Service Commission (MPSC) for review and approval every 5 years.

- IRPs must include: Planning Process and Modeling, Forecasts and Supply Resources, Demand Reduction Resources, Scenarios and Risk Analysis, and Proposed Course of Action

- Consumers next IRP will be filed in June
- DTE IRP will be filed in late 2022/early 2023
  - In March 2020, Commission rejected DTE plan as is and required changes – increase energy efficiency to 2%
  - First time Commission has applied MEPA (MI Env Protection Act) to utility case

Energy Waste Reduction (EWR) Plans

- Every two years, utilities must submit EWR plans to the MPSC
- Consumers & DTE will file their plans this summer
- Program design for each class of customers including $ investments
  - Opportunity to Influence
  - Intervention
  - Focus on Low Income Budgets, Programs and Pilots

Low Income Energy Waste Reduction Workgroup (LIEWR)

- Created in 2018 to address barriers to achieving EWR in low income communities
- Collaboration of MPSC staff, Utilities, Environmental Advocates, Community Action Agencies, Energy Contractors, Social Service Orgs
- Analyzing program design and regulations to address issues
- Compiling one-stop clearing house for all programs
- Working to address Health/Safety/Walk-away issues in homes
  - Considering adopting and funding certain healthy homes improvements as part of weatherization and energy-efficiency programs in their jurisdictions. These strategies can be combined through normal weatherization and energy-efficiency improvements.

Thank You