Breathing Easier for All:
How EVs Help Air Quality and Public Health Across Communities

October 10, 2020
Transportation-Related Air Pollution:

- Particulate matter (10, 2.5 and < 0.1)
- Sulfur dioxide (SO2)
- Carbon monoxide (CO)
- Nitrogen oxides (NOx)
- Volatile organic compounds (VOCs)
- Ozone (O3)

Source: EPA, 2018
Air pollution remains a major danger to the health of children and adults.

Health risks from:
- Ozone Pollution
- Particle Pollution

- PREMATURE DEATH
  - May cause developmental harm
  - May cause reproductive harm

Health risks from:
- Asthma attack
- Lung cancer
- Wheezing and coughing
- Shortness of breath
- Cardiovascular harm
- Susceptibility to infections
- Lung tissue redness, swelling

Source: American Lung Association: The Road to Clean Air (2020)
PARTICULATE MATTER (PM) OR “SOOT”

HUMAN HAIR
50-70 μm (microns) in diameter

PM$_{2.5}$
Combustion particles, organic compounds, metals, etc.
< 2.5 μm (microns) in diameter

PM$_{10}$
Dust, pollen, mold, etc.
< 10 μm (microns) in diameter

90 μm (microns) in diameter
FINE BEACH SAND

Image courtesy of the U.S. EPA
WHAT DOES SOOT DO TO OUR BODIES?

- Particles get very deep into airways
- Inhalation can lead to:
  - Inflammation
  - Oxidative stress
  - Autonomic changes
  - Impacts throughout the body
- Susceptible individuals include:
  - Children
  - Seniors
  - Existing disease
Air Action! Days

- Typically “high heat” days
- SE MI experiences approximately 10-12 of these per year
- Timelapse maps correlate with rush hour traffic
AIR POLLUTION AND RESPIRATORY HEALTH

- Asthma
- COPD
- Lung cancer
- Chronic laryngitis, acute and chronic bronchitis
“Outdoor air pollution is not only a major environmental risk to health in general, it is the most important environmental cancer killer due to the large number of people exposed.”

- Kurt Straif, PhD, head of the IARC Monographs Section
AIR POLLUTION AND CARDIOVASCULAR HEALTH

- Myocardial infarction (heart attacks)
- Arrhythmias
- Congestive heart failure (CHF)
AIR POLLUTION AND HEALTH DISPARITIES

State of the Air 2020
Americans Living in Counties with 3 Failing Grades:
Ozone Days, Particle Days, Annual Particle Levels

- White: 14,329,923
- People of Color: 6,894,881

Source: American Lung Association: The Road to Clean Air (2020)
Conclusions: A small increase in long-term exposure to PM$_{2.5}$ leads to a large increase in COVID-19 death rate. An increase of only 1 $\mu$g/m$^3$ in PM$_{2.5}$ is associated with an 8% increase in the COVID-19 death rate. The study results underscore the importance of continuing to enforce existing air pollution regulations to protect human health both during and after the COVID-19 crisis.

Source: https://projects.iq.harvard.edu/covid-pm
Screening tool utilized to identify populations that are most vulnerable and hardest hit by pollution

- EJ Score factors

NAAQS nonattainment counties

- 8 hour ozone - 5 million residents
- SO2- 300,000 residents
HOW EVS WILL IMPROVE PUBLIC HEALTH

<table>
<thead>
<tr>
<th>Health Benefits in 2050</th>
<th>Value of Benefits in 2050</th>
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<tbody>
<tr>
<td>Premature Deaths Avoided</td>
<td>Health Benefits</td>
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<td>Asthma Attacks Avoided</td>
<td>Climate Benefits</td>
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<td>Lost Work Days Avoided</td>
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“Business as usual” vs. transition to zero-emission transportation technologies
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<tr>
<th>State</th>
<th>Avoided Health Impact Cost in 2050</th>
<th>Premature Deaths Avoided in 2050</th>
<th>Asthma Attacks Avoided in 2050</th>
<th>Work Loss Days Avoided in 2050</th>
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