

# Environmental and Equity Implications of Electric, Shared Autonomous Vehicles (SAVs) in Urban Transportation: A Case Study of San Francisco



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**Automated Transportation  
Technology**

## A Case Study of San Francisco

High levels of air and noise pollution are a fact of life for many people living and commuting in urban areas, but these problems are more than just an inconvenience for city dwellers—they're a major social justice issue. Lower income populations and communities of color are disproportionately burdened by the air and noise pollution caused by society's overreliance of single-occupancy personal vehicles.

SAFE's case study unpacks how the broader adoption of electric, Shared Autonomous Vehicles (SAVs) can improve air quality and reduce noise pollution for neighborhoods across a city, and especially in disadvantaged communities.

The implications of this research extend far beyond San Francisco—SAVs have the potential to improve the quality of life for tens of millions of urban residents by reducing unhealthy and harmful air pollutants and noise. City officials and policymakers should consider the full scope of benefits and enable further deployment and study of electrified SAVs to help realize the potential of this technology.

## The Research

SAFE evaluated the air and noise quality impacts that would result from widespread SAV deployment in San Francisco. The research involved the development of a data model utilizing state and federal datasets on noise pollution, air pollution, and equity metrics. To project the potential environmental improvements a decade from now in San Francisco, the model incorporated a series of assumptions regarding the expansion of SAV fleets and shifts in vehicle ownership trends. This approach allowed for the exploration of the potential outcomes associated with scaled AV deployment in the city, offering insights into future transportation and environmental scenarios.

## KEY FINDINGS

If just 6.6 percent of vehicles on the road in 2033 were SAVs, San Francisco would see massive reductions in air and noise pollution. In 10 years:

- ✓ 40% decrease in fine particulate matter (PM<sub>2.5</sub>) concentrations
- ✓ 61% decrease in noise-polluting vehicle trips
- ✓ The greatest reductions in air and noise pollution will occur in low-income neighborhoods and communities of color.

## CITY SNAPSHOT

San Francisco, CA is experiencing a deployment wave of electric SAVs. This technology has sparked a new era of thinking because of its potential for:

- Fewer Crashes
- Greater Accessibility
- Less Congestion
- Freedom from the Parking Hassle
- Efficiency and Productivity Gains
- Emissions Reductions



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Scan or visit [secureenergy.org/savs-sf-case-study](https://secureenergy.org/savs-sf-case-study)

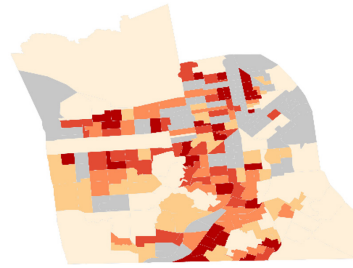
## Dive Deeper

### AIR POLLUTION REDUCTION

- Particulate matter can lead to serious health issues and particles under 2.5 micrometers in diameter, or  $PM_{2.5}$ , pose the highest health risk.
- Air pollution causes approximately 107,000 premature deaths each year.
- Exposure to air pollution results in an average annual increase of about \$2,500 in medical expenses per person in the U.S., collectively resulting in an astounding \$820 billion additional medical costs every year.

**The model suggests a 40% decrease in  $PM_{2.5}$  concentration levels associated with increased SAV deployment over a 10-year period.**

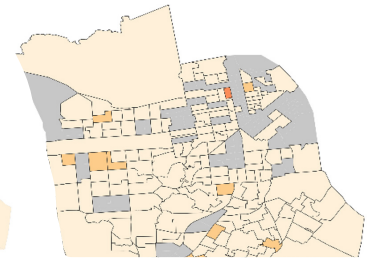
**Before:**  $PM_{2.5}$  @ Year 0



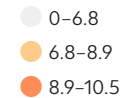
$PM_{2.5}$  ( $\mu\text{g}/\text{m}^3$ )



**After:**  $PM_{2.5}$  @ Year 10



$PM_{2.5}$  ( $\mu\text{g}/\text{m}^3$ )

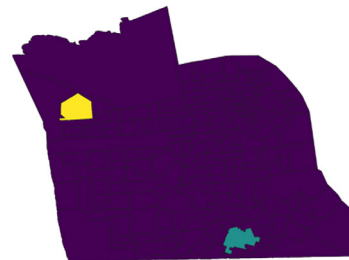


### NOISE POLLUTION REDUCTION

- Studies have found direct links between noise and medical conditions like high blood pressure, hearing loss, sleep disruption, and lost productivity.
- Noise pollution is particularly acute in urban areas, where vehicle traffic is a major source.

**By replacing trips taken by traditional internal combustion engine—or ICE—vehicles SAVs result in an estimated 61% decrease in noise-polluting vehicle trips over 10 years.**

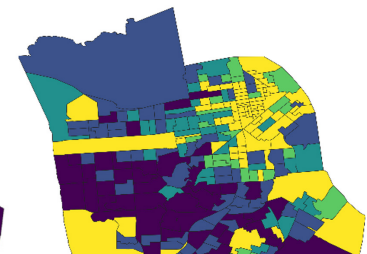
**Before:** Noise-polluting trips, 200 SAEVs



Percent Noise Polluting Trips



**After:** Noise-polluting trips, 10,000 SAEVs



Percent Noise Polluting Trips



### EQUITY AND ENVIRONMENTAL JUSTICE

- Low-income households and communities of color in the city of San Francisco experience  $PM_{2.5}$  levels of  $7.77 \mu\text{g}/\text{m}^3$  on higher levels of pollution, than the city.
- Even modest deployment of electric SAVs can result in marked improvements in air and noise pollution factors in low-income communities.

**$PM_{2.5}$  concentration levels in low-income areas are projected to decrease by an average of 50%, indicating a potential positive impact on the health and well-being of people living in vulnerable communities.**

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