Sacramento County Public Health Advisory Board

Feb 2, 2022

SACRAMENTO METROPOLITAN AIR QUALITY MANAGEMENT DISTRICT

Air Quality, Climate Change, and Public Health: *the Sacramento region's path towards a zero-carbon future*

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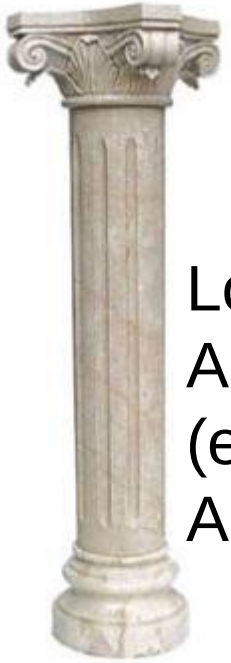
Adjunct Professor, Mechanical and Aerospace Engineering, West Virginia U.
(Former) Deputy Executive Officer, California ARB

Regulatory Pillars of Air Quality Management in US

Federal
(US EPA)



Local/Regional
Air Agencies
(e.g., Sac Metro
AQMD)

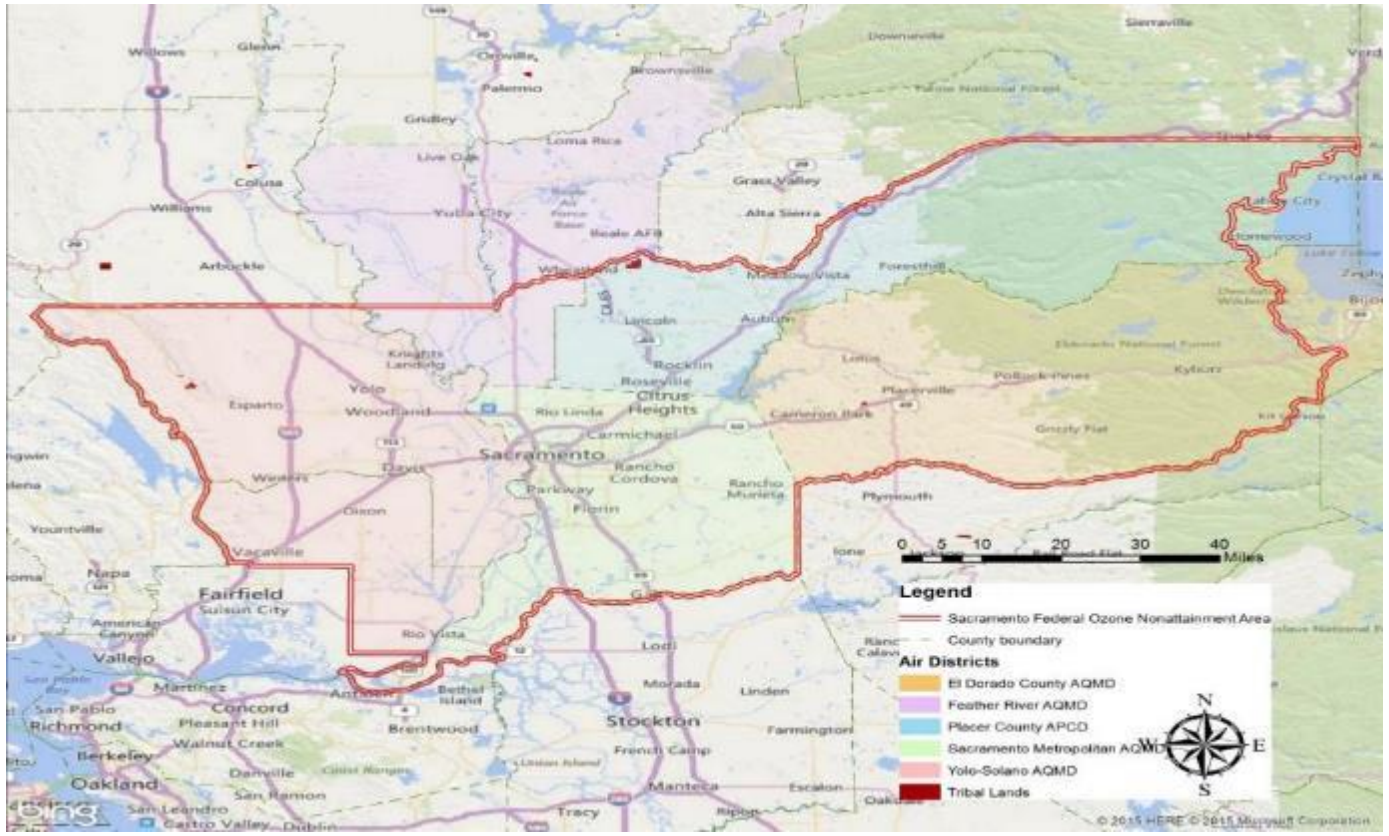
State
agencies
(e.g., ARB)

Sac Metro AQMD Priorities

- #1 Protecting public health from adverse effects of air and climate pollution
- Attainment of National Ambient Air Quality Standards (NAAQS)
- Implementing state/national clean air and climate agendas
- Stationary source permitting, compliance, and enforcement
- Land use and CEQA
- Zero-emission and cleaner transportation policies
- Education and research
- Regional leadership and collaboration
- Community engagement
- Local, state, national, and international engagement

Air quality planning area

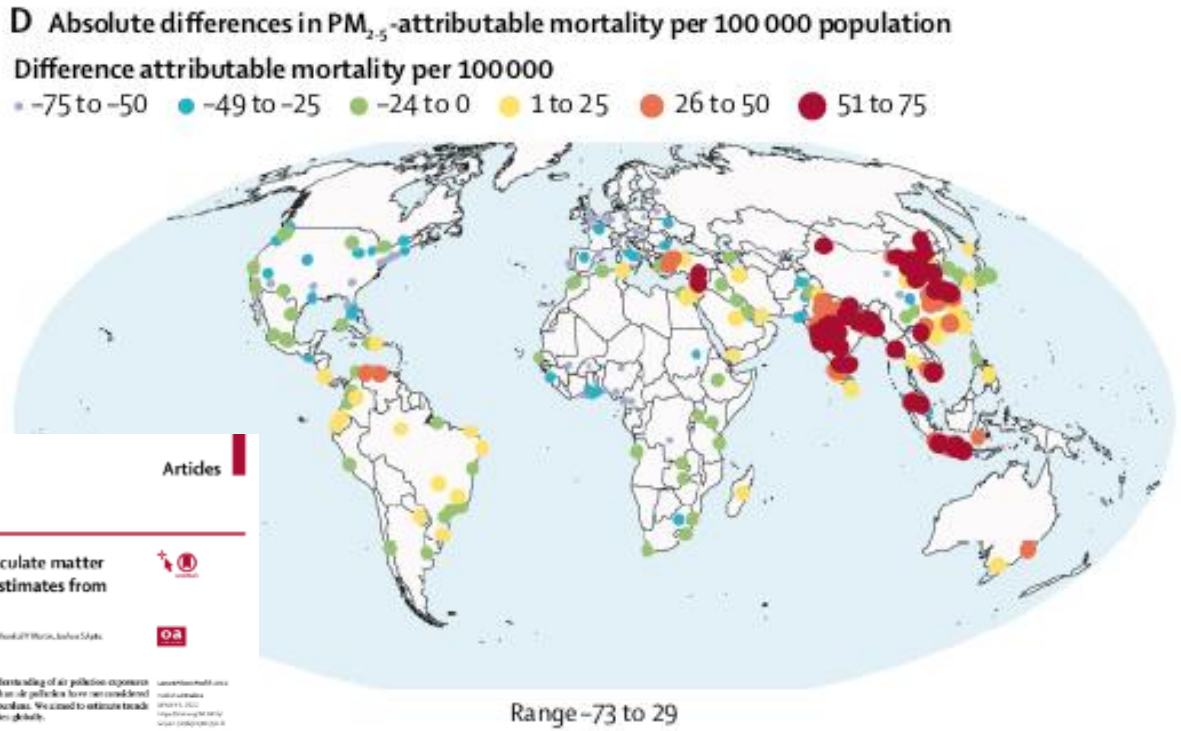
Sacramento Federal Nonattainment Area (SFNA)



Sacramento Federal Nonattainment Area (SFNA)

- All of Sacramento and Yolo Counties
- Portions of Placer, El Dorado, Solano, and Sutter Counties

Annual global premature mortality burden from PM pollution ~4 - 8 million




Articles

Global urban temporal trends in fine particulate matter ($PM_{2.5}$) and attributable health burdens: estimates from global datasets

Summary


Burning fossil fuels kills an estimated 350000 Americans a year including 7600 in Massachusetts study finds

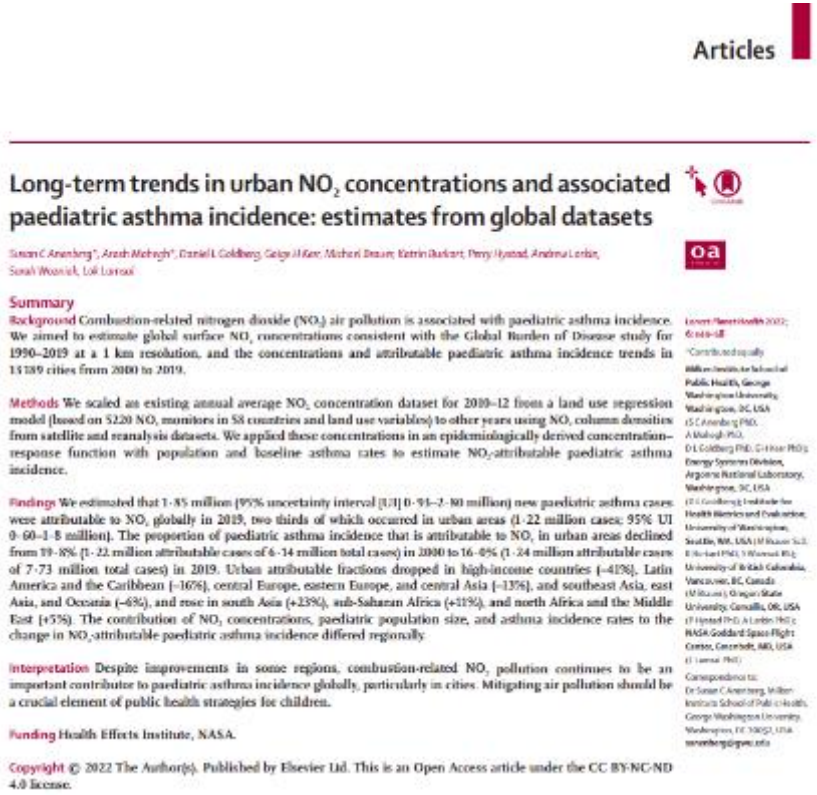
By David Abel Globe Staff, Updated February 8, 2021, 2:01 p.m. 6

In May 2019, smog blanketed the Mexico City skyline. Schools and universities were closed for days because of the pollution, brought on by brush fires and a lack of rain.MARCO UGARTE/ASSOCIATED PRESS

- 2.5 billion urban inhabitants breathe air above WHO annual PM2.5 value of 10 $\mu g/m^3$
- 1.8 million excess urbanite deaths

Source:Vohra et al., *Env. Res.* April 2021. Harvard group

Combustion-generated NO_2 pollution and incidence of pediatric asthma



Articles

Long-term trends in urban NO_2 concentrations and associated paediatric asthma incidence: estimates from global datasets

Susan C Anenberg*, Arash Mohegh*, Daniel L Goldberg, Gaige H Kerr, Michael Brauer, Katrin Burkart, Perry Hystad, Andrew Larkin, Sarah Wozniak, Lok Lamsal

Summary

Background Combustion-related nitrogen dioxide (NO_2) air pollution is associated with paediatric asthma incidence. We aimed to estimate global surface NO_2 concentrations consistent with the Global Burden of Disease study for 1990–2019 at a 1 km resolution, and the concentrations and attributable paediatric asthma incidence trends in 13 189 cities from 2000 to 2019.

Methods We scaled an existing annual average NO_2 concentration dataset for 2010–12 from a land use regression model (based on 5220 NO_2 monitors in 58 countries and land use variables) to other years using NO_2 column densities from satellite and reanalysis datasets. We applied these concentrations in an epidemiologically derived concentration–response function with population and baseline asthma rates to estimate NO_2-attributable paediatric asthma incidence.

Findings We estimated that 1·85 million (95% uncertainty interval [UI] 0·91–2·80 million) new paediatric asthma cases were attributable to NO_2 globally in 2019, two thirds of which occurred in urban areas (1·22 million cases; 95% UI 0·60–1·8 million). The proportion of paediatric asthma incidence that is attributable to NO_2 in urban areas declined from 19·8% (1·22 million attributable cases of 6·14 million total cases) in 2000 to 16·0% (1·24 million attributable cases of 7·73 million total cases) in 2019. Urban attributable fractions dropped in high-income countries (–41%), Latin America and the Caribbean (–16%), central Europe, eastern Europe, and central Asia (–13%), and southeast Asia, east Asia, and Oceania (–6%), and rose in south Asia (+23%), sub-Saharan Africa (+11%), and north Africa and the Middle East (+5%). The contribution of NO_2 concentrations, paediatric population size, and asthma incidence rates to the change in NO_2-attributable paediatric asthma incidence differed regionally.

Interpretation Despite improvements in some regions, combustion-related NO_2 pollution continues to be an important contributor to paediatric asthma incidence globally, particularly in cities. Mitigating air pollution should be a crucial element of public health strategies for children.

Funding Health Effects Institute, NASA.

Ultrafine particles and neurological effects

International Journal of *Environmental Research and Public Health*

MDPI

Review

Particulate Air Pollution and Risk of Neuropsychiatric Outcomes. What We Breathe, Swallow, and Put on Our Skin Matters

Lilian Calderón-Garcidueñas [1,2], Elijah W. Stommel [3], Ravi Philip Rajkumar [4], Partha S. Mukherjee [5] and Alberto Ayala [6,7,*]

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check for updates

Citation: Calderón-Garcidueñas, L.; Stommel, E.W.; Rajkumar, R.P.; Mukherjee, P.S.; Ayala, A. Particulate Air Pollution and Risk of Neuropsychiatric Outcomes. What We Breathe, Swallow, and Put on Our Skin Matters. *Int. J. Environ. Res. Public Health* **2021**, *18*, 11568. https://doi.org/10.3390/ijerph182111568

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Abstract: We appraise newly accumulated evidence of the impact of particle pollution on the brain, the portals of entry, the neural damage mechanisms, and ultimately the neurological and psychiatric outcomes statistically associated with exposures. PM pollution comes from natural and anthropogenic sources such as fossil fuel combustion, engineered nanoparticles (NP ≤ 100 nm), wildfires, and wood burning. We are all constantly exposed during normal daily activities to some level of particle pollution of various sizes—$PM_{2.5}$ (≤2.5 µm), ultrafine PM (UFP ≤ 100 nm), or NPs. Inhalation, ingestion, and dermal absorption are key portals of entry. Selected literature provides context for the US Environmental Protection Agency (US EPA) ambient air quality standards, the conclusions of an Independent Particulate Matter Review Panel, the importance of internal combustion emissions, and evidence suggesting UFPs/NPs cross biological barriers and reach the brain. NPs produce oxidative stress and neuroinflammation, neurovascular unit, mitochondrial, endoplasmic reticulum and DNA damage, protein aggregation and misfolding, and other effects. Exposure to ambient $PM_{2.5}$ concentrations at or below current US standards can increase the risk for TIAs, ischemic and hemorrhagic stroke, cognitive deficits, dementia, and Alzheimer's and Parkinson's diseases. Residing in a highly polluted megacity is associated with Alzheimer neuropathology hallmarks in 99.5% of residents between 11 months and <40 y. PD risk and aggravation are linked to air pollution and

National Ambient Air Quality Standards

Pollutant [links to historical tables of NAAQS reviews]		Primary/ Secondary	Averaging Time	Level	Form
Carbon Monoxide (CO)		primary	8 hours	9 ppm	Not to be exceeded more than once per year
			1 hour	35 ppm	
Lead (Pb)		primary and secondary	Rolling 3 month average	0.15 µg/m^3 (1)	Not to be exceeded
Nitrogen Dioxide (NO_2)		primary	1 hour	100 ppb	98th percentile of 1-hour daily maximum concentrations, averaged over 3 years
		primary and secondary	1 year	53 ppb (2)	Annual Mean
Ozone (O_3)		primary and secondary	8 hours	0.070 ppm (3)	Annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years
Particle Pollution (PM)	$PM_{2.5}$	primary	1 year	12.0 µg/m^3	annual mean, averaged over 3 years
		secondary	1 year	15.0 µg/m^3	annual mean, averaged over 3 years
		primary and secondary	24 hours	35 µg/m^3	98th percentile, averaged over 3 years
	PM_{10}	primary and secondary	24 hours	150 µg/m^3	Not to be exceeded more than once per year on average over 3 years
Sulfur Dioxide (SO_2)		primary	1 hour	75 ppb (4)	99th percentile of 1-hour daily maximum concentrations, averaged over 3 years
		secondary	3 hours	0.5 ppm	Not to be exceeded more than once per year

New global benchmark…..most stringent "suggested values"

World Health Organization Guideline Values

Particle Pollution (PM)	**PM2.5**	annual	5	µg/m3		
		daily	15	µg/m3		
	PM10	annual	15	µg/m3		
		daily	45	µg/m3		
Ozone		8-hr daily	100	µg/m3	50	ppb
		8-hr peak season	60	µg/m3	30	ppb
NO2		annual	10	µg/m3	5.3	ppb
		daily	25	µg/m3	13.3	ppb

5 versus 12
15 versus 35
45 versus 150

50 versus 70

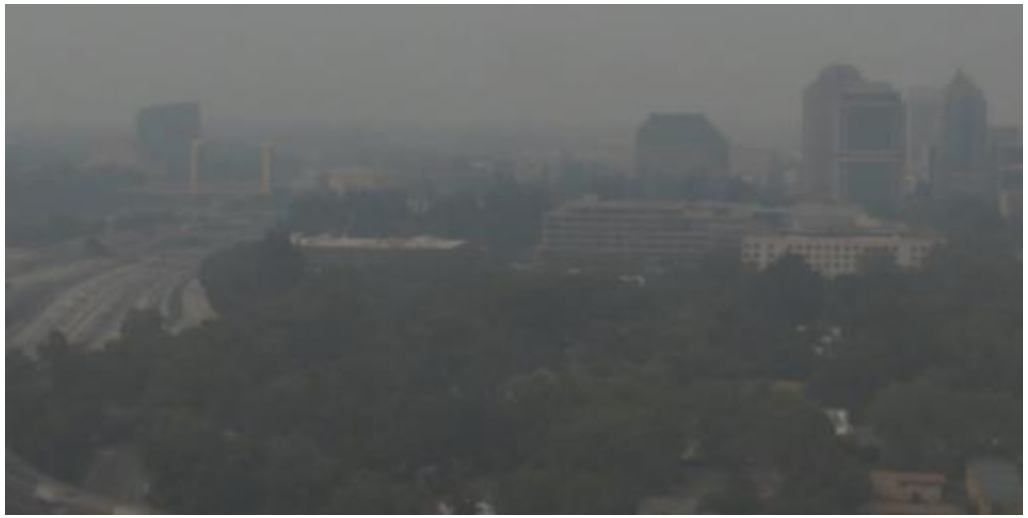
5.3 versus 53

We still suffer from too much regional air pollution

SACRAMENTO METROPOLITAN AIR QUALITY MANAGEMENT DISTRICT

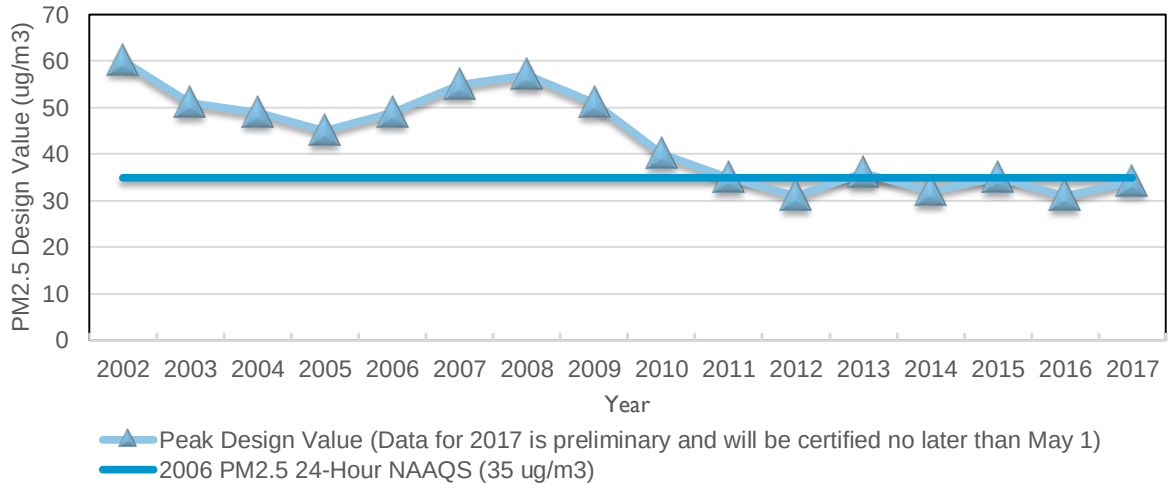
ALA State of the Air Report:

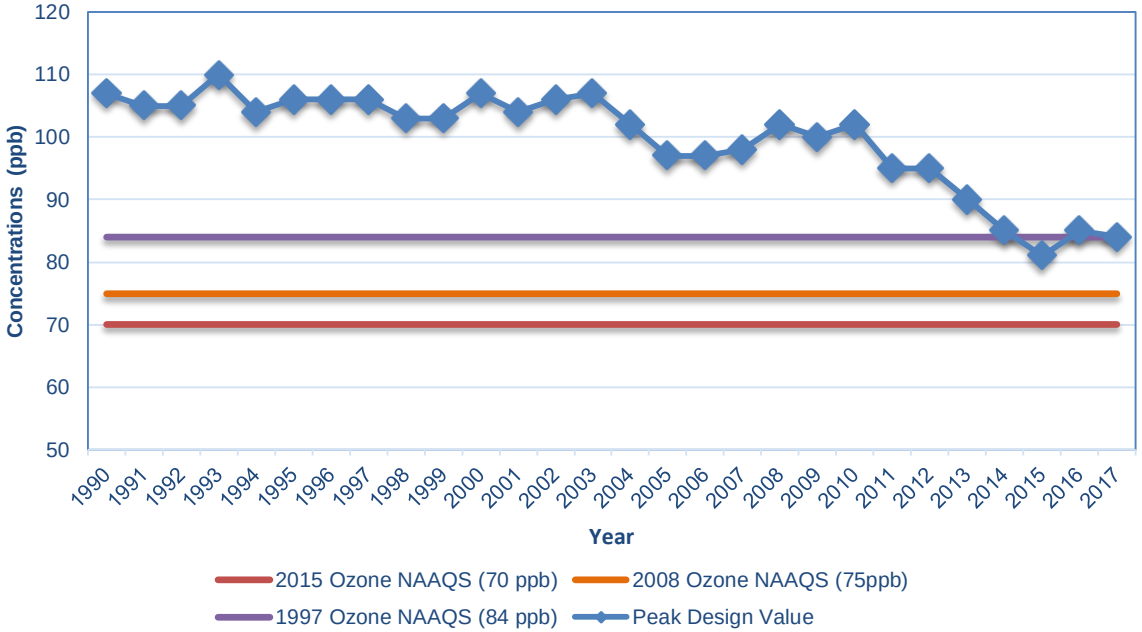
- #6 worst ozone pollution in U.S.
- #10 worst short-term particle pollution
- #24 worst year-round particle pollution

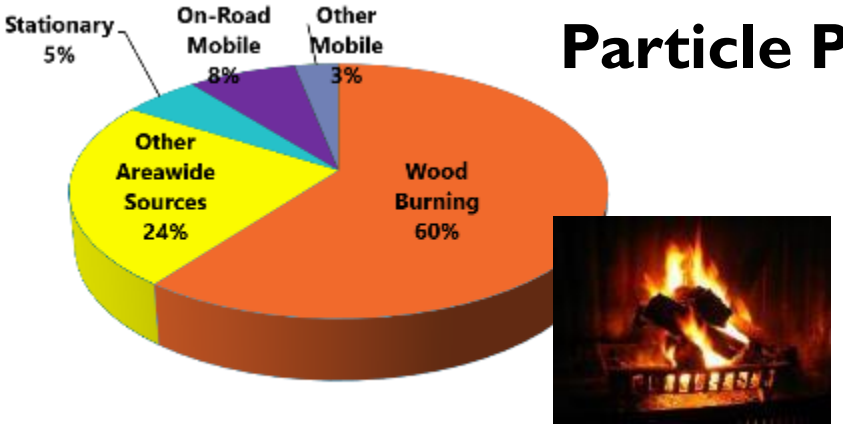


American Lung Association.

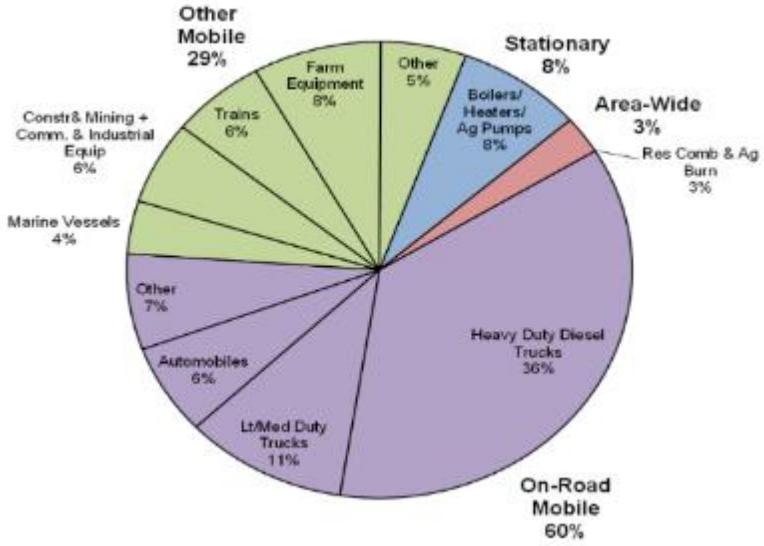
Clean air progress in the capital region







Particle Pollution

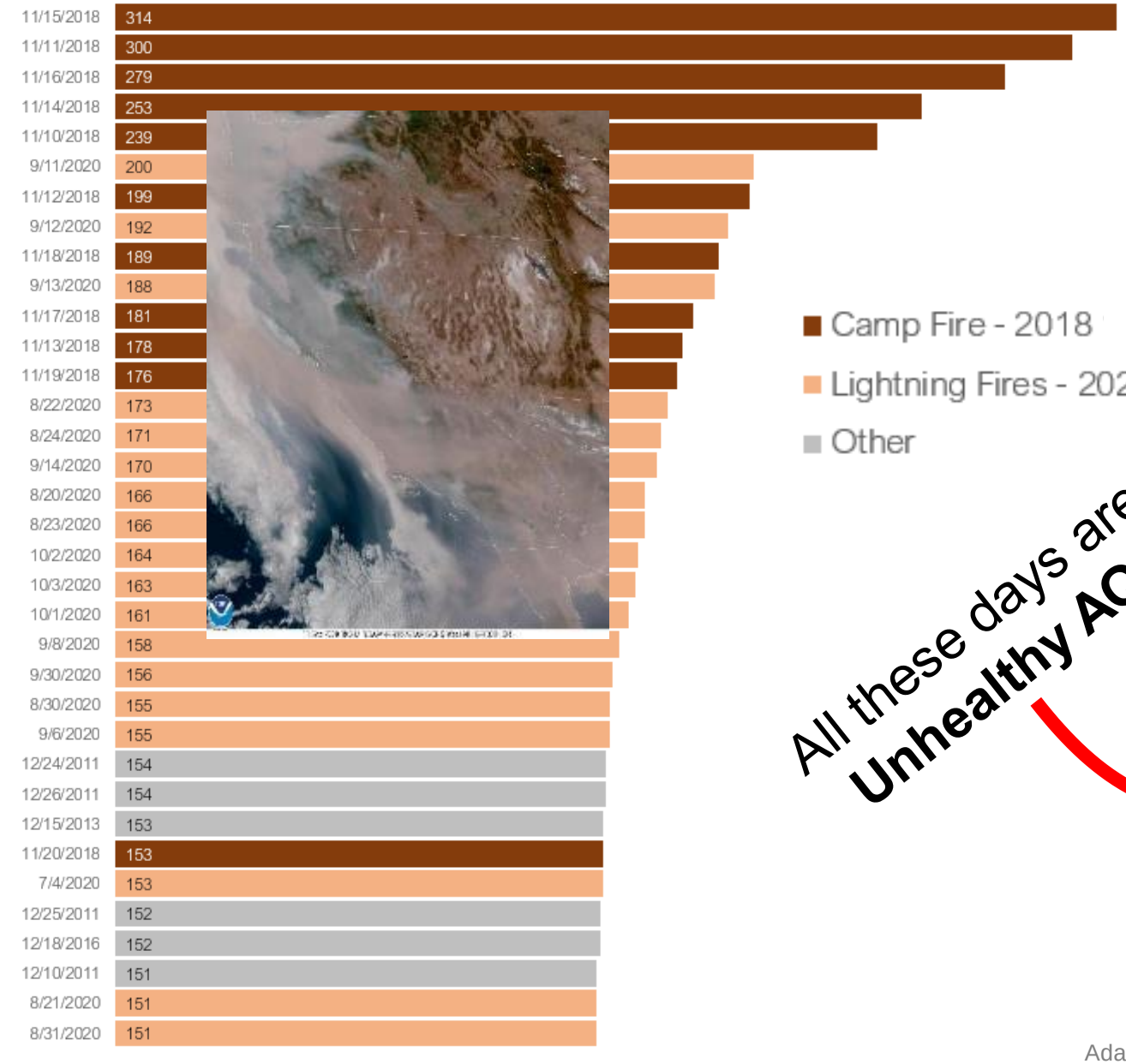


Ozone Pollution

Wildfire Smoke Impacts in the Sac Valley

Sacramento's Smokiest Days

Highest air quality index (AQI) $PM_{2.5}$ daily readings days in Sacramento County for the previous 10 years*

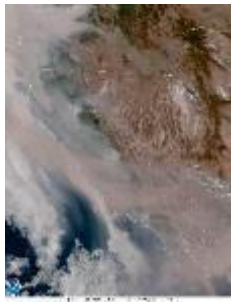


All these days are **Unhealthy AQI!**

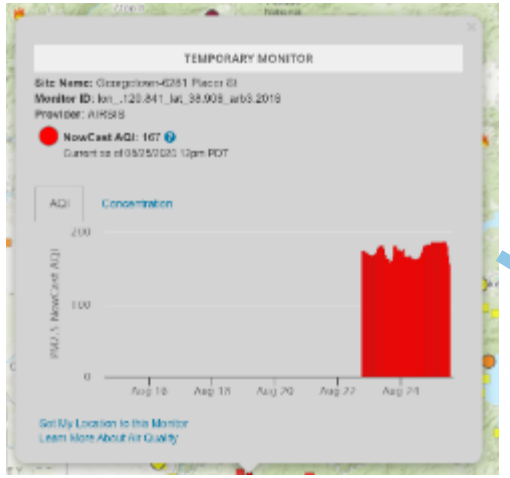
Air Quality Index (AQI) Values	Levels of Health Concern	Colors
When the AQI is in this range:	*...air quality conditions are:*	*...as symbolized by this color:*
0 to 50	Good	Green
51 to 100	Moderate	Yellow
101 to 150	Unhealthy for Sensitive Groups	Orange
151 to 200	Unhealthy	Red
201 to 300	Very Unhealthy	Purple
301 to 500	Hazardous	Maroon

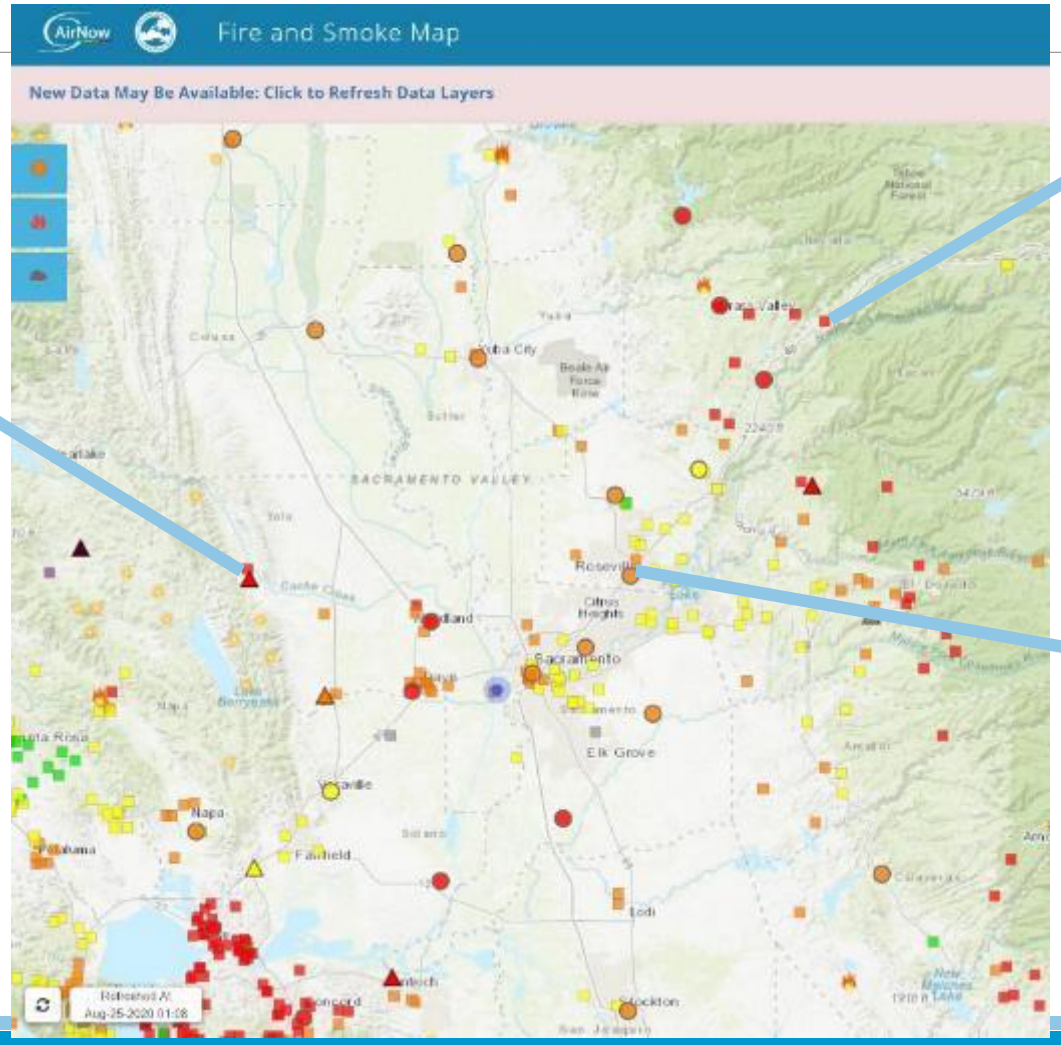
https://www3.epa.gov/airnow/aqi_brochure_02_14.pdf

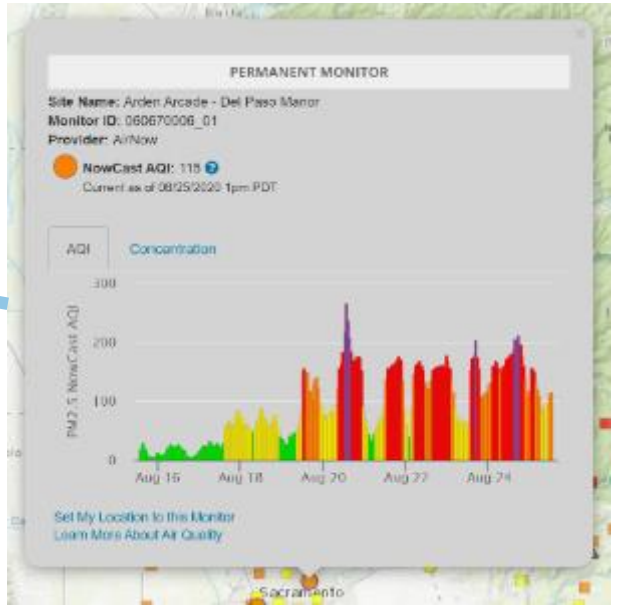
Adapted from original article here: https://www.mercedsunstar.com/news/california/article245180510.html



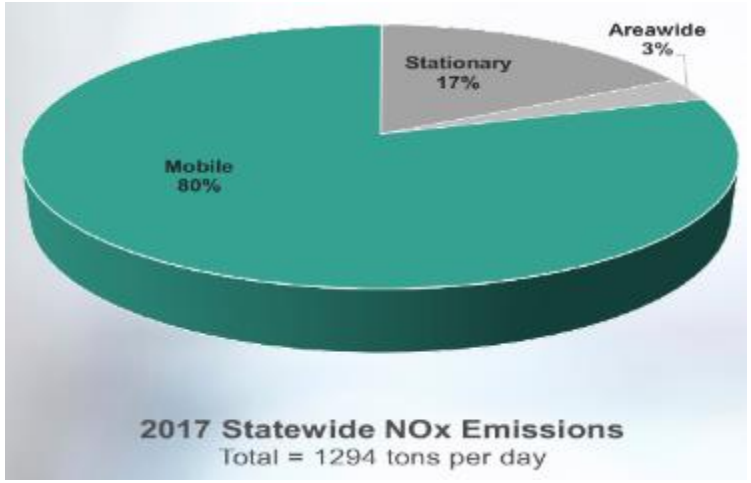
Resources (www.fire.airnow.gov)

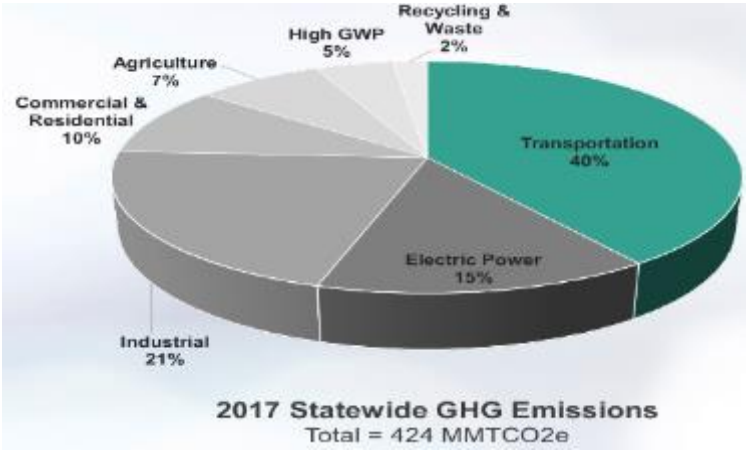






Transportation sector is largest source of air and climate pollution





What do we do about air pollution?

- **Electrify everything and transition to 100% renewable energy**
- **Improve mobility, not just transportation**
- **Strategically leveraging public investments**
- **First step – "cut the chord from fossil combustion," complete electrification of transportation**
- **Guiding the "disruptions" towards net environmental and other benefit**

Core programs for protecting public health

Clean Air Act 1970

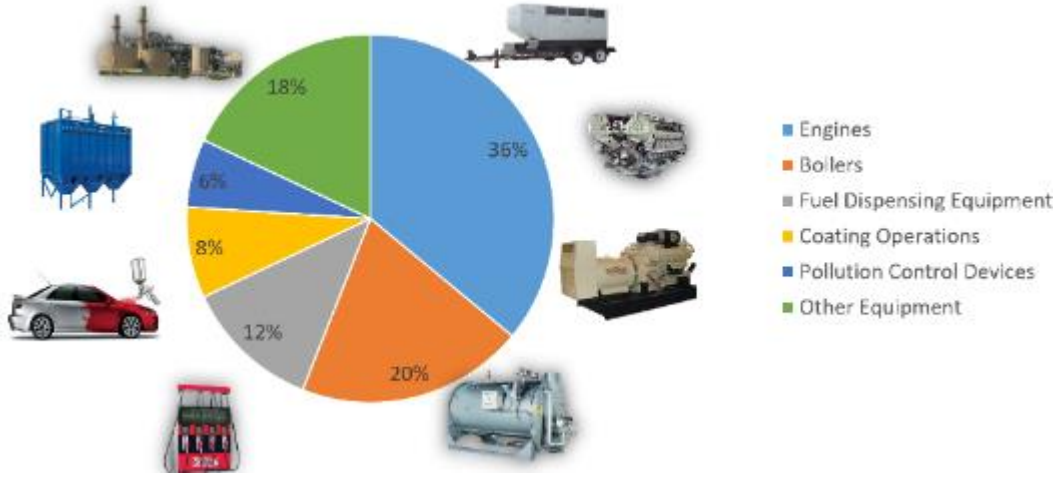
PERMITTING

+

COMPLIANCE

+

ENFORCEMENT



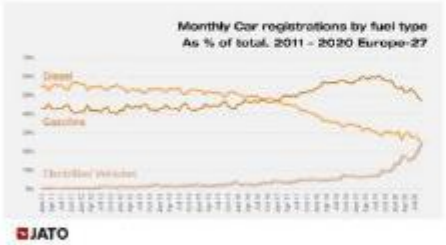
Electrons and molecules, the no compromise, cheat-free alternative to internal combustion

– CALMATTERS

Calif. will make Uber and Lyft nearly all-EV by 2030

100% renewable energy in CA by 2045 and carbon neutrality

Newsom orders ban of new gas-powered cars by 2035



JATO

October 29, 2020

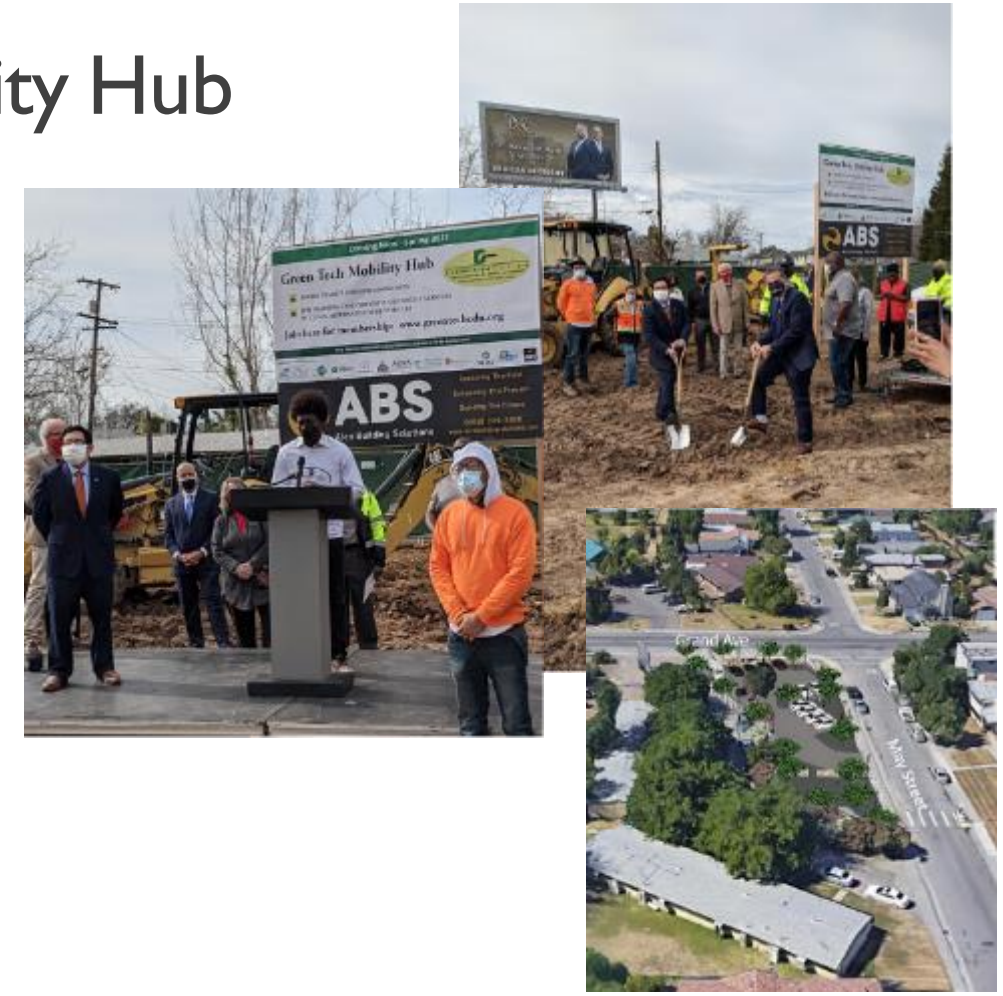
In September 2020, for the first time in European history, registrations for electrified vehicles overtook diesel

Clean Air Investments and Equity

The next Chapter in Future Mobility and Environmental Justice in Sacramento

SACRAMENTO METROPOLITAN AIR QUALITY MANAGEMENT DISTRICT

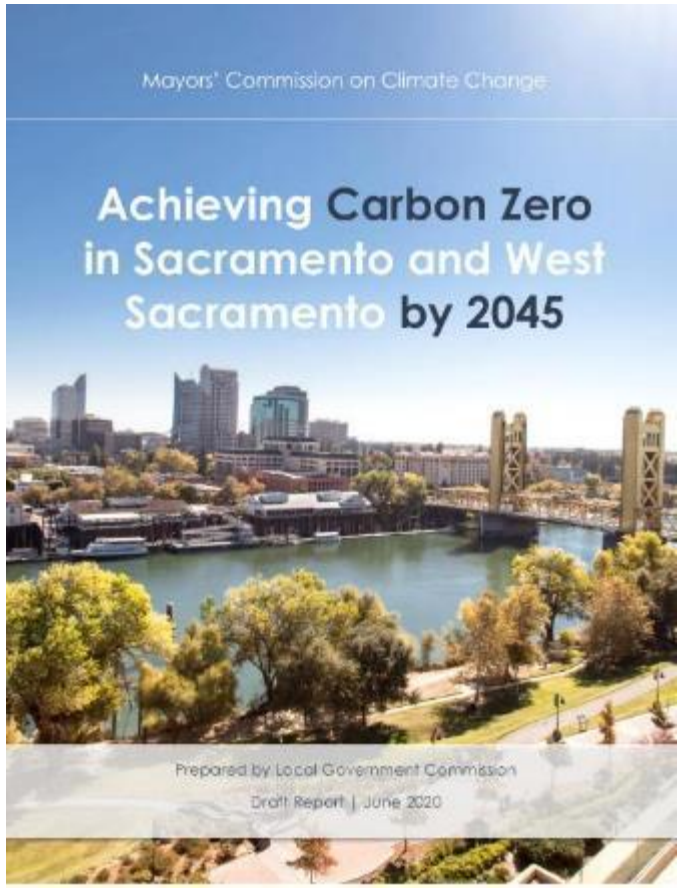
Del Paso Heights Mobility Hub



- 10 Fuel Cell and Battery EVs
- Shuttle Bus
- Chargers
- Our Community Car Share
- Shuttle Bus Transport and Microtransit
- Community Beautification

Mobility Hub Partners:

AIR QUALITY OUR COMMUNITY CARSHARE · CALIFORNIA AIR RESOURCES BOARD · zipcar · TOYOTA · AROZ CONSULTANTS · AURA planning · BREATHE CALIFORNIA Sacramento Region · beneficial state bank · BA INC · Clean Cities



Mayors' Climate Change Commission

Working toward carbon neutrality in 2045

Built Environment

- Electrification of New Construction
- Sustainable Land Use
- Electrification of Existing Buildings

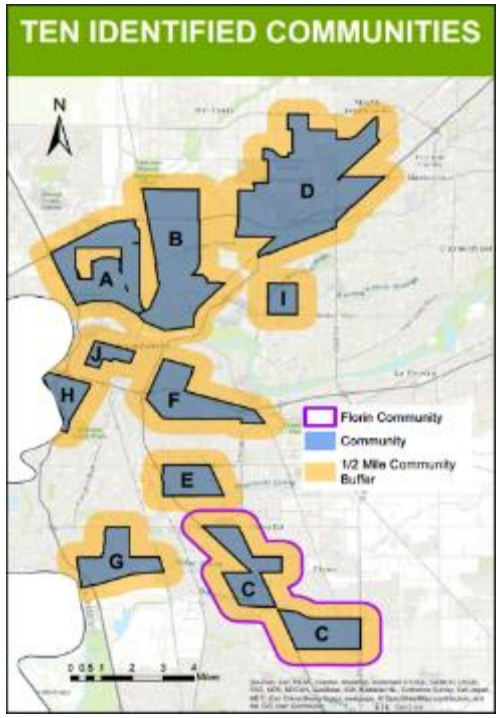
Mobility

- ACTIVE TRANSPORTATION
- TRANSIT & SHARED MOBILITY
- ZEVs

Community Health and Resiliency

- Urban Greening and Forestry
- Sustainable Food Systems
- Community Climate Resilience

AB 617 (2017) Community Air Protection for Environmental Justice Neighborhoods w/n Sac Metro AQMD



Community-scale Air Monitoring

Community Emission Reduction Programs (CERP)

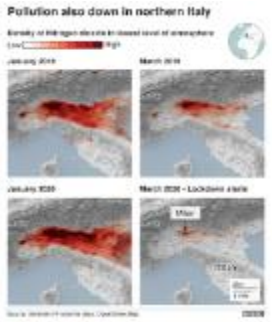
State Grans for Community-based Organizations

Enhanced Emission Reporting for Local Businesses

Clearinghouse for Cleanest Technology (BACT & BARCT)

Incentive Funding (State Cap and Trade Subsidies)

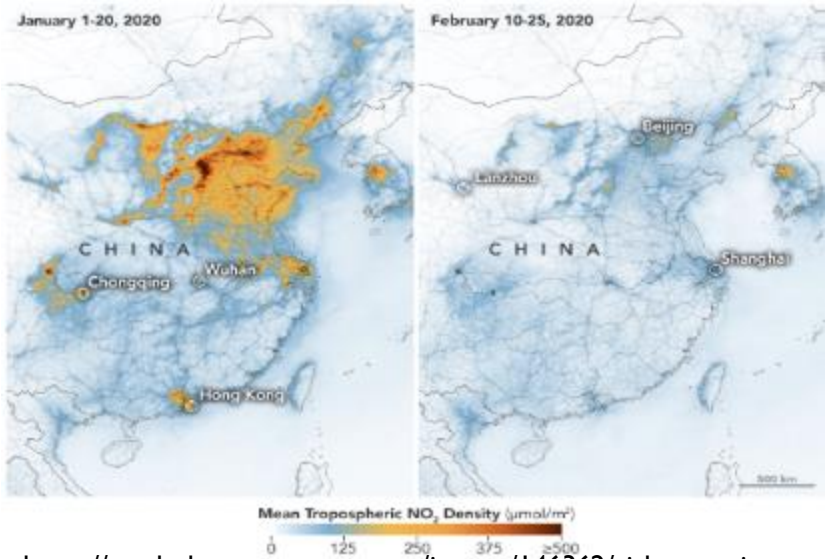
Increased Penalty Provisions



Untangling air quality benefits of shelter-in-place

Informing a regional conversation about teleworking in the COVID era

Reduction in traffic related emissions (NO_2, $PM_{2.5}$, Ozone precursors, CO_2e) across the globe being investigated



https://earthobservatory.nasa.gov/images/146362/airborne-nitrogen-dioxide-plummets-over-china?

Sacramento County, April 2020

	2012, 2015, 2019 average	2020	Conc. Difference	% Improvement
$PM_{2.5}$ (ug/m3*)	7.5	4.7	-2.8	37%
NO_2 (ppbC**)	20.1	14.0	-6.1	30%
Ozone (ppbC**)	49.3	44.0	-5.3	11%

*micrograms per cubic meter
**parts per billion concentration

- Compared to meteorologically similar years, monthly average concentrations for all three pollutants were lower in April 2020.
- Reductions were observed in all three pollutants

Thank you


Not secure
www.airquality.org
SACRAMENTO METROPOLITAN
AIR QUALITY
MANAGEMENT DISTRICT
Payments
Employment
Forms
FAQ
Air Quality Complaints
Contact Us
Search...
AIR QUALITY & HEALTH
RESIDENTS
BUSINESSES
HOW DO I?
MEETINGS
ABOUT US
Sacramento Air Quality
Tue
Wed
County
50
29
Region
50
29
Burn
N/A
Legal to Burn
Mission: Achieve state and federal clean air and climate goals
AirNow
Air Quality Near You
WILDFIRE
SMOKE
INFORMATION
CHECK
BEFORE YOU
BURN
Learn More
SPARE
THE
AIR
Visit Spare
The Air!
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Air Protection
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