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U.S. Cities Had Clean Air Before COVID-19: Reducing Emissions Will Barely Move the Needle

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Key Points

- The decline in vehicle travel during March and April 2020 of over 40% nationwide provided an unintended experiment on the effects of vehicle emissions on U.S. air quality.
- News headlines identifying the drop in vehicle travel as the primary cause of better air quality in U.S. cities during March and April 2020 are not supported by the data.
- What the data show is that U.S. cities have some of the cleanest air in the world. Weather and natural pollution sources have at least as large of an effect on U.S. pollution levels as human emissions.
- The lack of significant improvement in air quality during this major reduction in activity is evidence that tighter air quality standards and greater use of electric vehicles will likely yield negligible air quality improvements.

Executive Summary

Declines in vehicle travel and economic activity across the world due to the COVID-19 pandemic have led to an unprecedented worldwide experiment in air quality. What happens when we take a large portion of light-duty vehicles off the road or switch them to electric vehicles? With passenger vehicle travel down more than 40% in late March and early April 2020 as compared to the end of February, and remaining down over 30% through the end of April (Schuman, 2020), a normal expectation would be that the difference in air quality should be significant. Without delay, articles citing drops in air pollution levels have sprouted up (Neil, 2020; Carlton, 2020), along with an abundance of before-and-after photos of cities around the world (Regan, 2020).

But is the difference as large in the U.S. as the headlines claim? The latest air quality data from the Environmental Protection Agency (EPA, 2020a) covering the months of March and April show a mixed picture. There are some noticeable declines in pollution levels in 2020 compared to the 2015-2019 average, and there is no doubt that both vehicle travel and industrial activity have slowed significantly during the pandemic. However, the pollution declines vary dramatically from day to day and from city to city, with weather and natural factors appearing to play a much larger role than human activity.

What these news articles universally fail to mention is how much safer and cleaner the air is in U.S. cities compared to the vast majority of the world. Looking deeper into the study referenced by the CNN article (IQAir, 2020), particulate matter levels in Los Angeles and New York were a mere tenth of New Delhi's levels. The declines from 2019 to 2020 in New York and Los Angeles are barely noticeable within the context of those cities' normal year-to-year variation. The reports also fail to note how much air quality in the U.S. has improved over the past several decades, even as our economy, population, energy consumption, and vehicle miles traveled have increased dramatically (EPA, 2020b).

The unintended air quality experiments provided by the sudden decline in vehicle travel across the U.S. show how little would be gained from tighter environmental regulations and more electric vehicles. Reducing pollution levels to zero is an impossibility due to dust, naturally occurring compounds, and imported pollution from other countries, not to mention the economic impoverishment it could cause for Americans. Policymakers should hold firm against calls for higher fuel efficiency standards, tighter National Ambient Air Quality Standards (NAAQS), and more electric vehicle subsidies, during the COVID-19 crisis or

continued

otherwise, and instead eliminate costly regulations that are not leading to significant air quality improvements.

Introduction

Probably the most noticeable effect of the shutdowns by state and local governments due to the COVID-19 pandemic is the sudden decline in Americans commuting to work. With a large share of Americans either out of work or working from home, passenger vehicle travel across the country dropped 40% in late March and April compared to early March and remained down more than 30% through the end of April (Schuman, 2020). The decline in some major cities was more than 50%.

This scenario has been repeated around the world, and with it has come a flurry of news articles showing before-and-after pictures of major cities and talking up how much air pollution has supposedly decreased over this time (Regan, 2020). Some observers say this shows the need for tighter air quality regulations (Bloomberg & McCarthy, 2020), while others want to push harder for electric vehicles (EVs) or for policies that pressure people to drive less (Joselow & Storrow, 2020). A headline in the *Wall Street Journal* proclaimed that "Coronavirus Got Rid of Smog" and asked, "Can Electric Cars Do So Permanently?" (Neil, 2020).

But are the improvements in U.S. air quality as large as the newspapers are claiming? And will switching to electric vehicles make a big difference in the air we breathe? The truth is the difference will likely be barely measurable. Air quality in America has improved dramatically in the past 50 years, with aggregate emissions of the six criteria pollutants listed in the Clean Air Act down 77% since 1970 (EPA, 2020b). Tailpipe emissions from passenger vehicles are 98-99% lower than they were in the 1960s (EPA, 2020c), which means that most of the remaining pollution does not come from the cars we drive.

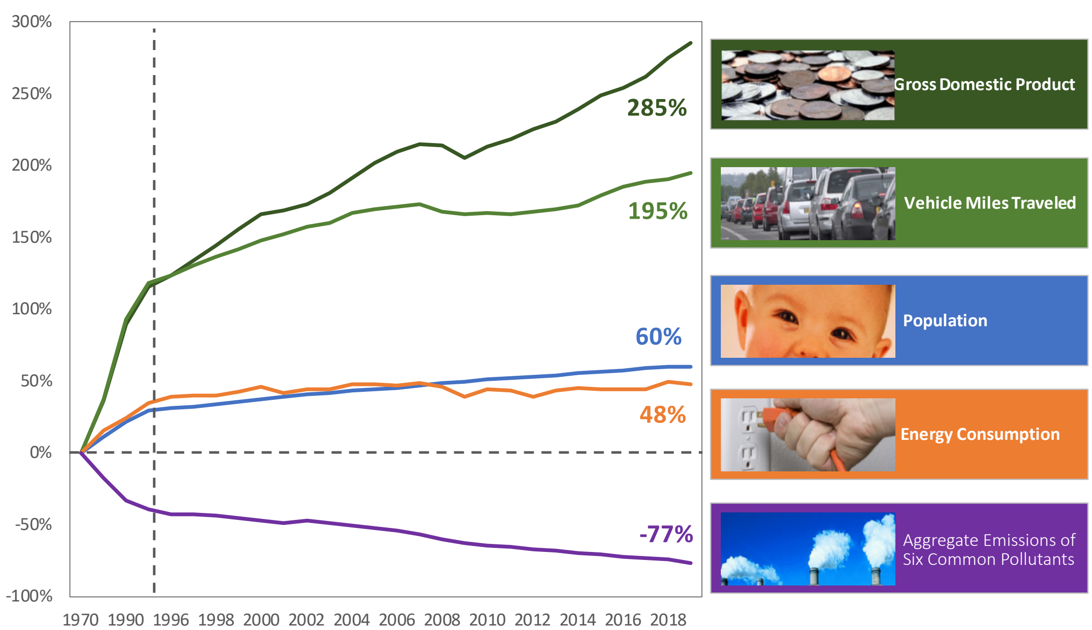
In fact, the data from the past couple of months indicate pollution levels in U.S. cities are so low that it is difficult to distinguish between the effect of the recent decline in emissions and normal day-to-day as well as year-over-year variations. This paper will outline some specific examples of how these declines in pollution are being misinterpreted, followed by some brief sketches on what these accidental air quality experiments tell us about how little will be gained from tightening regulations and getting more EVs on the road.

U.S. Air Quality During March and April 2020

The main problem with most of the news coverage of this issue is that articles report declines in pollution levels in percentages, which obscures how small the declines in U.S. cities are in absolute terms. A 30% decline in Los Angeles might sound significant, but that amount could be 10 times smaller than a 30% decline in Beijing, where lung-choking smog is the norm, because Beijing's everyday pollution levels are 10 times higher. The decline in Los Angeles is also more difficult to distinguish from naturally derived pollution and the effects of weather. The key is to look at declines

Figure 1

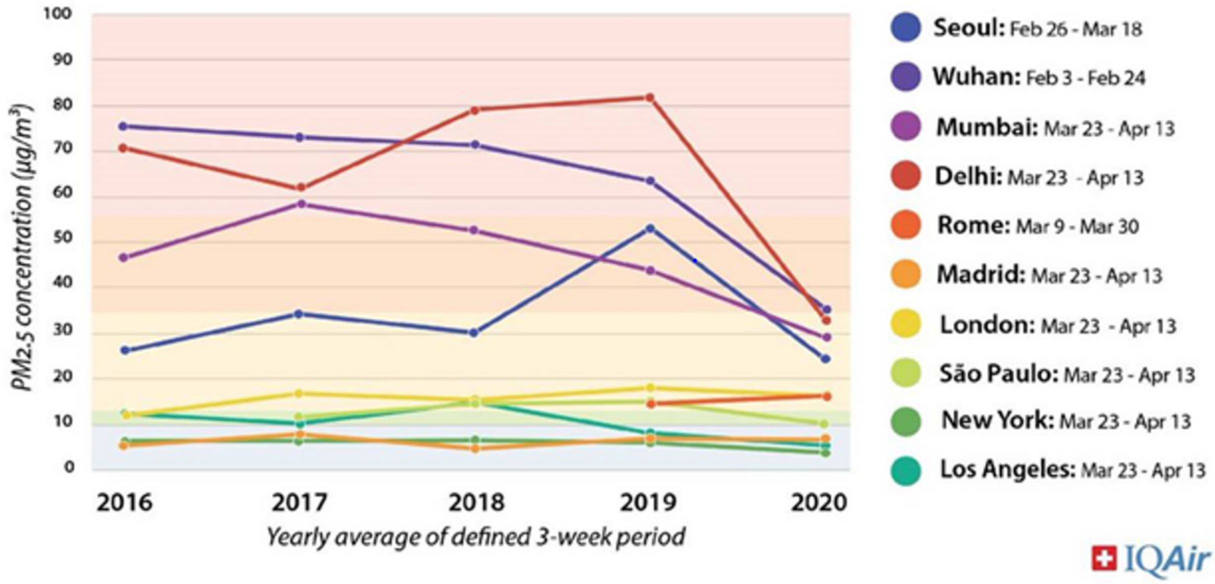
Economic Growth and Declining Emissions From 1970 to 2018



Note. From Our Nation's Air 2020, by Environmental Protection Agency, 2020b, Section "Economic Growth with Cleaner Air" (https://gispub.epa.gov/air/trendsreport/2020/#growth).

Figure 2

Three-Week Average PM2.5 Concentrations in Major World Cities, 2016 to 2020



Note. From *COVID-19 Air Quality Report*, by IQAir, 2020, p. 6 (https://www2.iqair.com/sites/default/files/documents/REPORT-COVID-19-Impact-on-Air-Quality-in-10-Major-Cities_V6.pdf).

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in absolute terms and to put them in context of both daily and annual variations in air quality.

The aforementioned CNN article comparing cities around the world (Regan, 2020) was based on a study from IQAir (2020). That study has a number of notable findings, but most of all, it affirms again that U.S. cities have some of the best air quality in the world. While cities such as New Delhi and Wuhan saw dramatic drops in fine particulate matter (PM2.5) levels from 2019 to 2020, the changes in New York and Los Angeles are less than 5% as large as most Asian cities on an absolute scale and are well within normal year-to-year variation.

These facts are obscured when the only numbers reported from the study are percentage declines, such as 31% in Los Angeles compared to 44% and 60% in Wuhan and New Delhi, respectively (Regan, 2020). Comparing percentages might imply to those unfamiliar with air quality data that air in Los Angeles is as dirty as in those other cities, which is not true, either before or after the COVID-19 pandemic.

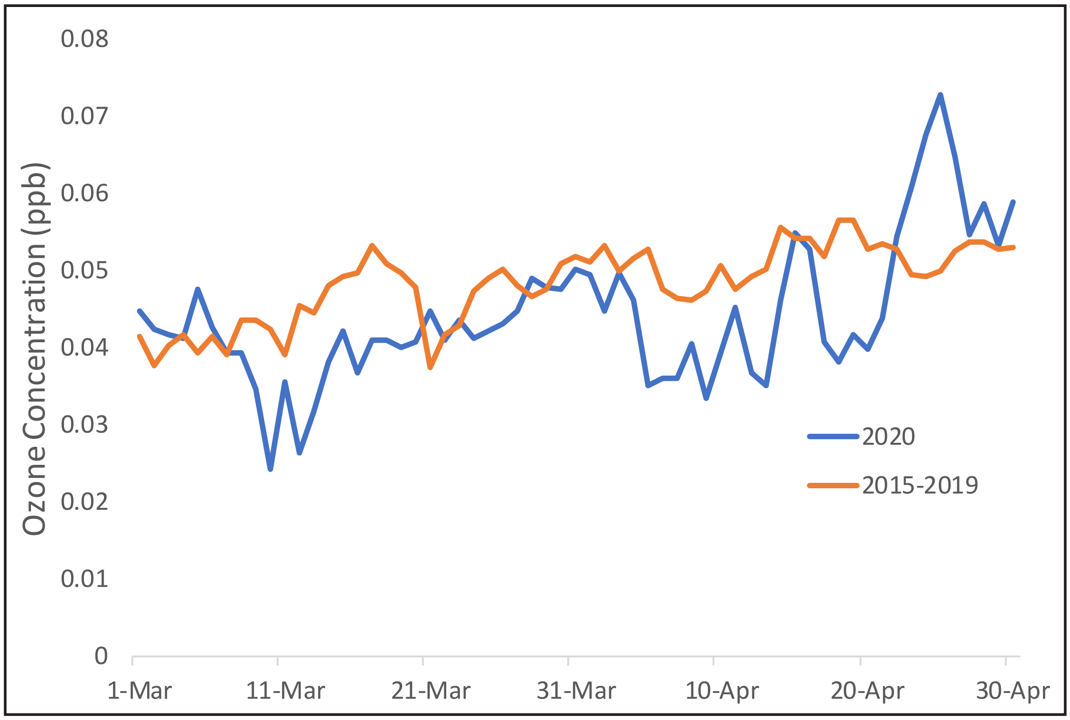
Another little-advertised fact is that pollution levels in the U.S. are already so low that it is difficult to distinguish how much of the declines are due to lower emissions and how much are due to weather and to changes in naturally derived pollution, such as dust (a source of PM2.5) and naturally occurring ozone. Some pollution is also imported from other regions of the world, especially from East Asia (Meiyun et al., 2017).

To show how difficult it is to determine the effects of reduced emissions in U.S. cities, let us compare ozone concentrations in Los Angeles in March 2020 to the 5-year average from 2015 to 2019. While ozone levels were 10% lower in March 2020 and the city recorded its longest stretch of meeting air quality standards on record (Barboza, 2020), by the end of the month, with the slowdown in full effect, the numbers from this year were barely distinguishable from the 5-year average.

Ozone levels were 18% lower from April 1 to April 20 but still with a high degree of variability. Then a sudden spike occurred at the end of the month, and the average decline for the entire month was only 7%. Given the large amount of day-to-day variation, local air quality officials admitted that it will take some time to figure out the exact effects of the decline in vehicle travel and that weather likely played a substantial role in the declines (Barboza, 2020).

Figure 3

Ozone Concentrations in Los Angeles, March and April 2020 vs. 2015-2019 Average



Note. From *Outdoor Air Quality Data – Download Daily Data*, by Environmental Protection Agency, 2020a (https://www.epa.gov/outdoor-air-quality-data/download-daily-data).

Covering the other side of the U.S., the National Aeronautics and Space Administration (NASA, 2020a) published an article with the headline *NASA Satellite Data Show 30 Percent Drop In Air Pollution Over Northeast U.S.* and a graphic to prove the point. The data from NASA's Aura satellite show that nitrogen dioxide (NO_2) levels, a key indicator of pollution from vehicles, were down 30% in March 2020 compared to the 5-year average from 2015 to 2019, from Washington, D.C., to Boston.

But the relationship between this improvement and the drop in vehicle travel is not as strong as the monthly averages indicate. For example, NO_2 concentrations in New York City took a steep drop in early February 2020—well before the declines in vehicle travel and even before the state of New York's first confirmed COVID-19 case (Goldstein & McKinley, 2020)—and remained at about that level through the end of April (NASA, 2020b). The data for Boston (NASA, 2020c) and Washington, D.C. (NASA, 2020d) are also decidedly mixed, with the year-over-year air quality improvements in April being much smaller than in March.

As the NASA article notes, "further analysis will be required to rigorously quantify the amount of the change in nitrogen dioxide levels associated with changes in emissions versus natural variations in weather" (NASA, 2020a, para. 3). Dan Goldberg (2020), an atmospheric researcher at Argonne National Laboratory, was more upfront, saying that "there has been no discernible trend in our regional NO_2 air pollution in most US cities" and that clouds have had a large influence on the data.

The reality is that highway vehicles in the U.S. only contribute about a third of carbon monoxide (CO) and nitrogen oxide (NO_x) emissions and less than 10% of particulate matter emissions (EPA, 2020b). Emissions of CO and NO_x have declined 69% and 65%, respectively in the past 30 years, and the entire U.S. is well below the national safety standards for those pollutants (EPA, 2020b).

The economic downturn caused by COVID-19 has reduced vehicle travel and related emissions over the past couple of months. However, our air is so clean that the effect of the emissions reductions on pollution levels in March and April 2020 is difficult to distinguish from the effect of other anthropogenic emissions or natural causes, especially weather effects. More time will be needed to pinpoint the magnitude of each of these different factors.

This analysis has highlighted two major metro areas, Los Angeles and New York City, specifically to rebut articles claiming that the recent declines in pollution in these cities are unprecedented and a direct result of reduced emissions. Data from Seattle, Houston, and other metro areas also consistently show less than 15% reductions, and even some increases, in March and April 2020 ozone and PM2.5 levels compared to the 5-year averages (EPA, 2020a). Most importantly, the data show large day-to-day variations with no apparent correlation to vehicle travel, indicating that many more factors are at play.

As time goes on, especially as vehicle travel and economic activity return to pre-pandemic levels, it will be necessary to gather more data from a large number of U.S. cities to determine the effects more precisely. In the meantime, policymakers and the public should be skeptical of claims that reduced emissions are having a significant impact on air quality and are evidence in favor of tighter air quality regulations and more EV subsidies and mandates. The rest of this paper will explore some of these policies in light of the recent events and provide some recommendations for policymakers.

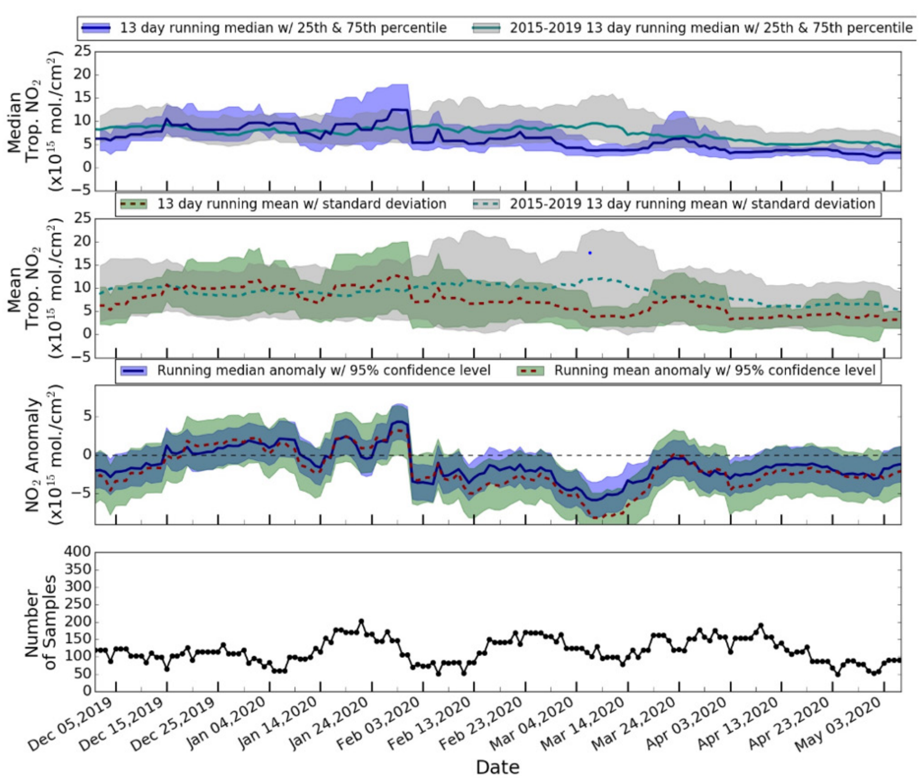
The Safer Affordable Fuel-Efficient Vehicles Rule

The recent declines in vehicle travel also provide a window into the potential air quality effects (or lack thereof) of more strict fuel economy standards and the adoption of more hybrid and electric vehicles. Initially, Congress created the fuel economy standards in the mid-1970s under the premise that the U.S. needed to preserve its dwindling oil supplies (Energy Policy and Conservation Act, 1975). In recent years, as the shale revolution and the domestic energy boom laid those concerns to rest, more strict standards have been implemented in order to reduce air pollution and carbon dioxide (CO_2) emissions.

Coincidentally, the Safer Affordable Fuel-Efficient (SAFE) Vehicles rule (The Safer Affordable Fuel-Efficient, 2020), which modifies the 2012 Corporate Average Fuel Economy (CAFE) standards (2017 and Later Model Year, 2012), was just finalized at the end of March. The rule requires a fuel economy increase of 1.5% per year over the next 6 years, less than the 5% annual increase required by the 2012 rule, and reduces the projected industry average required fuel economy for model year 2021 to 2026 vehicles from 46.6 miles per gallon (mpg) to 40.5 mpg (The Safer Affordable Fuel-Efficient, 2020, p. 24186). These changes were made due to widespread concerns about the cost to both manufacturers and consumers of meeting increasingly stringent standards in exchange for limited long-term benefits.

Figure 4

Aura/OMI Satellite NO_2 Levels for New York City, 1° Latitude by 1° Longitude Box Around City Center



Note. From *New_York OMI data*, by National Aeronautics and Space Administration, 2020b (https://so2.gsfc.nasa.gov/no2/pix/htmls/New_York_data.html).

The environmental impact statement (EIS) for the SAFE rule estimates that the rule change will increase vehicle emissions up to 4% compared to the projections under the 2012 rule, while still decreasing emissions from current levels (National Highway Traffic Safety Administration [NHTSA], 2020, pp. 4-37). Unfortunately, the EIS makes the claim that these minute changes will lead to hundreds of additional premature deaths (NHTSA, 2020, pp. 4-49), primarily from PM2.5, which critics have seized on to say the rule is endangering public health (Joselow, 2020).

These claims ignore the fact that there is a robust debate going on in the EPA about whether current pollution levels are exacerbating health conditions like lung cancer and leading to premature deaths (Cox et al., 2019). The science on PM2.5 in particular is far from settled, yet the EPA has relied on models that claim the ability to precisely determine the years of lost life expectancy from changes in PM2.5 levels (Lepeule et al., 2012). Those life-years are then added up into "statistical lives" and ascribed a monetary value that is used in the EPA's regulatory and environmental impact analyses (White & Bennett, 2019).

The data above show how difficult it is to observe the effects on pollution levels of the recent 40% reductions in vehicle travel, yet the EPA claims it can precisely determine the effect of emissions reductions that are more than 90% smaller and ascribe billions of dollars in health benefits to that tiny change. In contrast to the "statistical lives" that the EPA's models predict will be lost due to increased emissions, the rule is projected to reduce traffic fatalities by 3,300 and related hospitalizations by 46,000 over the lifetimes of vehicles built through 2029 (EPA, 2020d). Those lives saved through the increased use of newer, safer vehicles will far outweigh the minute gains in air quality under the 2012 rule.

The myopic focus on reducing air emissions as much as possible needs to give way to a more balanced discussion of public health and economic effects based on real data and sound science.

Again, the recent experiments in reducing vehicle travel should be a wake-up call to policymakers that the U.S. has already reached the point of diminishing returns of what it can achieve through tighter air quality regulations. Further reductions in emissions will enact an enormous economic cost for very small changes in pollution levels. The myopic focus on reducing air emissions as much as possible needs to give way to a more balanced discussion of public health and economic effects based on real data and sound science.

National Ambient Air Quality Standards

Much has been said in the media about the Trump administration "rolling back" air quality standards (Bloomberg and McCarthy, 2020), but for the two most important standards, the National Ambient Air Quality Standards (NAAQS) for particulate matter and ozone, the EPA is planning to *retain*, not roll back, the levels set by the Obama administration. The EPA also retained the 2010 standard for NO_2 in 2018 (Review of the Primary National, 2018), which is one of the primary emissions from passenger vehicles and one of the precursors to ozone.

What the media rarely reports is that both emissions and ambient levels of these three pollutants in the U.S. have declined dramatically over the past few decades. Emissions of PM2.5, NO_x, and volatile organic compounds (composed of many ozone precursors) have declined 36%, 65%, and 47%, respectively, since 1990 (EPA, 2020e). Ambient levels of PM2.5, NO_2, and ozone are down 43%, 51%, and 21%, respectively, since 2000 (EPA, 2020e). All in all, the story of U.S. air quality over the past several decades is one of unparalleled successes.

The recent declines in vehicle travel and economic activity are beginning to show that pollution levels in the U.S. are getting quite close to natural background levels. We are also seeing that source apportionment—determining where pollution in a certain geographic area comes from—while very difficult, is also becoming very important to determining the net benefits of reducing emissions. There is a growing body of evidence that many major cities, especially in the western U.S., suffer from imported pollution and that local emissions have had a diminishing role in determining local pollution levels in recent years.

For example, a 2017 study found that rising emissions from Asia from 1988 to 2014 approximately offset the 50% reduction in domestic emissions over the western U.S., leading to weak or insignificant declines in ozone levels (Meiyun et al., 2017). The Texas Commission on Environmental Quality (TCEQ, 2019, pp. 5-14) source apportionment models find that local emissions account for less than half of the summer ozone in the Houston area, with the rest coming from natural sources and transport from other regions.

Given the evidence from the past 2 months that ambient air pollution is approaching naturally derived levels even in our major cities, it is clear that tightening air quality regulations will provide little environmental benefit while imposing billions of dollars in costs on American consumers and businesses. To the extent that tighter regulations cause more industrial activity to shift to Asian countries with weak environmental standards, such regulations could even be a net detriment to air quality on the West Coast. Policymakers should consider these data and the real costs and benefits of air quality regulations and avoid the assumption that we must reduce pollution levels to zero at any cost.

Electric Vehicles Will Do Little to Make Our Air Cleaner

It should be evident by now that the question about whether EVs can get rid of smog is blind to the fact that naturally derived pollutants, imported pollution, and weather variations have more effects on pollution levels than emissions from vehicles in most U.S. cites. As Americans continue upgrading to more fuel-efficient and cleaner vehicles, including electric and hybrid vehicles for those who desire them, the effect of vehicles on pollution levels will keep declining, even if vehicle miles travelled keep increasing.

Of course, the main justification for EVs is their potential to reduce carbon dioxide emissions. But even if the U.S. could switch all light-duty vehicles to electric by 2030, with no corresponding increase in CO_2 emissions from the electricity sector, the effect on global CO_2 concentrations and future temperatures would be barely noticeable. Climate models suggest such a switch would lead to roughly a 1% decline in CO_2 concentrations and a 0.03°C decline in global temperatures by 2100 (see **Appendix A**).

While a large-scale shift to EVs in the U.S. will have a barely noticeable impact on our air quality, it will lead to more environmental impacts on the land. Mining for cobalt and lithium, two of the main components in EV batteries, are very environmentally intensive activities, requiring a large amount of land and often occurring in countries with poor labor and environmental standards. The data on the environmental effects and tradeoffs of adopting EVs suggest they are not fundamentally "greener" than gasoline vehicles.

Despite the lack of measurable environmental gains, EVs and charging stations have benefited from federal tax credits to the tune of $5.5 billion over the past 2 decades (Office of Management and Budget, n.d.), as well as numerous state and local subsidies and mandates. Yet EVs and plug-in electric hybrids still comprised only 2.7% of total U.S. light-duty vehicle sales in 2019 (Energy Information Administration [EIA], 2020, Table 38). EV subsidies have achieved very little at a very high cost, and it is time to reduce or eliminate them and let Americans decide when they are ready to buy more EVs.

Conclusion

The decline in vehicle travel and economic activity in March and April of 2020 due to the COVID-19 pandemic has provided another opportunity for some journalists, environmental groups, and activist scientists to claim that air quality in the U.S. is unhealthy, even deadly, and that the U.S. government needs to tighten air quality regulations and mandate more electric vehicles. This conclusion comes from a false assumption that U.S. air quality is not improving under current regulations and our continued use of fossil fuels, and it promotes a myopic focus on air emissions to the exclusion of important economic and environmental concerns.

The air quality data during the pandemic clearly show that the air in U.S. cities is already so clean, and emissions so low, that it is hard to discern the effect of reducing vehicle travel in U.S. cities by nearly half. The only significant effects have been in developing countries, where vehicle emissions are much higher and the declines in pollution levels far larger. In the U.S., it will take more time for scientists to determine the effects of emissions declines, imported pollution, weather, and natural sources of pollution.

Until that time, policymakers and the public should ignore the rush to make a story out of the declines in vehicle travel and associated emissions during the COVID-19 crisis. The small declines in U.S. cities do not support policies, such as lowering the NAAQS or increasing EV subsidies, that expand the size and scope of government in our lives. On the other hand, the SAFE rule, while far from ideal, incorporates a more holistic consideration of public health, environmental, and economic factors, instead of the myopic focus on reducing emissions regardless of cost that has dominated federal air quality regulations for decades. That type of holistic policymaking will be needed to ensure America's leadership in air quality and prosperity throughout the 21st century.

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Appendix A: Methodology for Calculating Future Global Temperature Change

The Model for the Assessment of Greenhouse Gas Induced Climate Change (MAGICC, n.d.) is used by a variety of organizations, including the U.N. and the EPA, to assess the effects of emissions reduction efforts on future CO_2 concentrations and global temperatures. To assess the effect of converting the U.S. fleet of light-duty vehicles to zero emission vehicles by 2030, we followed this procedure.

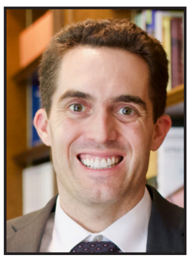
1. Create a "baseline" projection of U.S. light-duty vehicle emissions to 2100.
    a. The Energy Information Administration (EIA) provides forecasts of U.S. CO_2 emissions by sector out to 2050 in their *Annual Energy Report* (EIA, 2020, Table 18). Use the transportation CO_2 emissions provided in Table 18 of the report.
    b. Assume light-duty vehicles will constitute 58% of transportation CO_2 emissions throughout that time, as they did in 2017 (EPA, 2019).
    c. Assume U.S. light-duty vehicle CO_2 emissions stay constant after 2050. The gradual adoption of electric vehicles will be increasingly likely in ensuing decades, but the goal of this exercise is to compare a rapid adoption to a scenario with almost no adoption. The EIA reference scenario is primarily the latter and provides a good baseline.
2. Beginning in 2030, subtract those emissions from RCP6.0, which is the global emissions scenario that most closely tracks the EIA projections to 2050. In effect, the new emissions scenario "zeros-out" U.S. light-duty vehicle emissions after 2030.

CO2 Emissions (GtC)	2020	2030	2040	2050
RCP6.0	8.9504	9.9952	11.5544	13.0438
U.S. Light-Duty Vehicle Emissions	0.2951	0.2674	0.26031	0.27328
Difference	**8.9504**	**9.7277**	**11.2940**	**12.7705**

Run MAGICC with both RCP6.0 and the new emissions scenario. Compare CO_2 concentration and global temperature in 2100.

No emissions starting in 2030	CO_2 Concentration	Difference	Temperature	Difference
RCP6.0	673.8 ppm		3.203°C	
No U.S. Light-Duty Vehicles	667.7 ppm	**0.91%**	3.176°C	**0.027°C**

ABOUT THE AUTHOR



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