The Real Cost of Gasoline … Is To Our Health

Time for a Cleaner, More Efficient Fuel

CFDC CLEAN FUELS DEVELOPMENT COALITION

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Improvements to gasoline formulation are immediately available that would save money, reduce carbon emissions, and improve health, especially in urban communities. EPA's recent vehicle greenhouse gas regulations completely ignored the opportunity to double the projected benefits through the use of improved gasoline. Contemporary science and data prove that increased use of ethanol in gasoline offers great benefits for health, climate, and pocketbooks.

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Fifty years ago, doctors and environmentalists joined together to get rid of lead in gasoline. Airborne lead was harming all of us—most notably by reducing our kids' IQ—and its elimination is widely seen as a public health triumph.

What replaced lead in gasoline, however, was a similarly toxic blend of chemicals called aromatic hydrocarbons. These too are harming all of us—again reducing our kids' IQ—yet EPA has done virtually nothing to restrict them, even though a clean-burning substitute is readily available.

Fifty years from now, when the U.S. has moved away from fossil fuels for good, we will look back on this era and marvel at how much healthier we have become—and how foolish we were to allow 200 million cars and light trucks to poison the air we breathe. Human beings were not made to ingest hydrocarbons, and it will take generations to overcome the damage they have done.

The future of cars is electric—the deadly urgency of climate change demands it. But in the transition to that necessary future, let's remember that we are suffering today from the pollution produced from gasoline and will continue to do so for decades—unless we act. We can take immediate steps to make our air, particularly in our cities, cleaner and healthier to breathe.

Thanks to technology advances, our cars are cleaner now than they used to be—except in one area, where the problem is not the engine, but the fuel it burns and the particulate matter it produces. Fine-particle pollution is both the deadliest form of air pollution and one where recent trends have us moving backward, not forward.

Inhalation of fine particles from fossil fuel combustion is the leading cause of premature death in the world, killing more than 8 million people annually.

As EPA puts it, "The strong body of scientific evidence shows that long- and short-term exposures to fine particles ($PM_{2.5}$) can harm people's health, leading to heart attacks, asthma attacks, and premature death. Large segments of the U.S. population, including children, people with heart or lung conditions, and people of color, are at risk of health effects from $PM_{2.5}$."

EPA plans to propose a new rule this year to address fine particulates—a much-needed step, but one that cannot succeed without addressing mobile sources.

The Problem is Getting Worse, Not Better

Almost all of the fine particles from cars and light trucks—nearly 96%—come from a blend of toxic chemicals called aromatic hydrocarbons, used by oil refiners to increase gasoline octane and enhance engine efficiency and vehicle performance. They amount to 20% of every gallon of gasoline and have a disproportionate effect on public health—not just on our hearts and lungs, but also on child development.

EPA lists these aromatics (benzene, toluene, ethylbenzene, and xylene) as toxic air pollutants "known or suspected to cause cancer or other serious health or environmental effects."

By displacing aromatics in gasoline, EPA could save thousands of lives annually through reduced fine particle emissions and eliminate the harm now being done to newborn children by the air they breathe.

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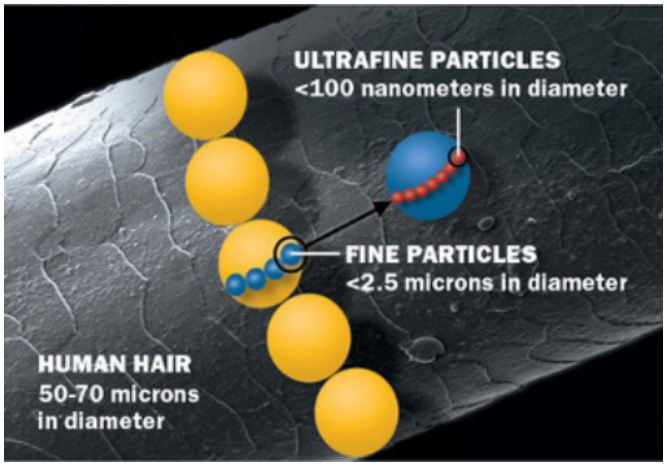


Ultrafine particles from aromatics, which also contribute importantly to ozone smog, are the smallest of the small—just 4% of the size of the fine particles that have been the focus of EPA regulation. They reach the deepest part of the lungs and enter the bloodstream, where they can cross biological membranes, even the placental barrier, and reach the brain. In most urban areas, vehicles are the primary source of these emissions.

Most of today's new cars have switched to an engine technology called gasoline direct injection—for the laudable reason of increased fuel economy. These more efficient engines have the unintended consequence, however, of increasing the volume of ultrafine particles coming out of the exhaust pipe.

"Recognition of this source of UFPs (vehicular exhaust) is essential to assessing their impacts and developing mitigation policies. Our results imply that reduction of primary particles or removal of existing particles without simultaneously limiting organics from automobile emissions is ineffective and can even exacerbate this problem." "Remarkable nucleation and growth of ultrafine particles from vehicular exhaust," Proceedings of the National Academy of Sciences (2020)

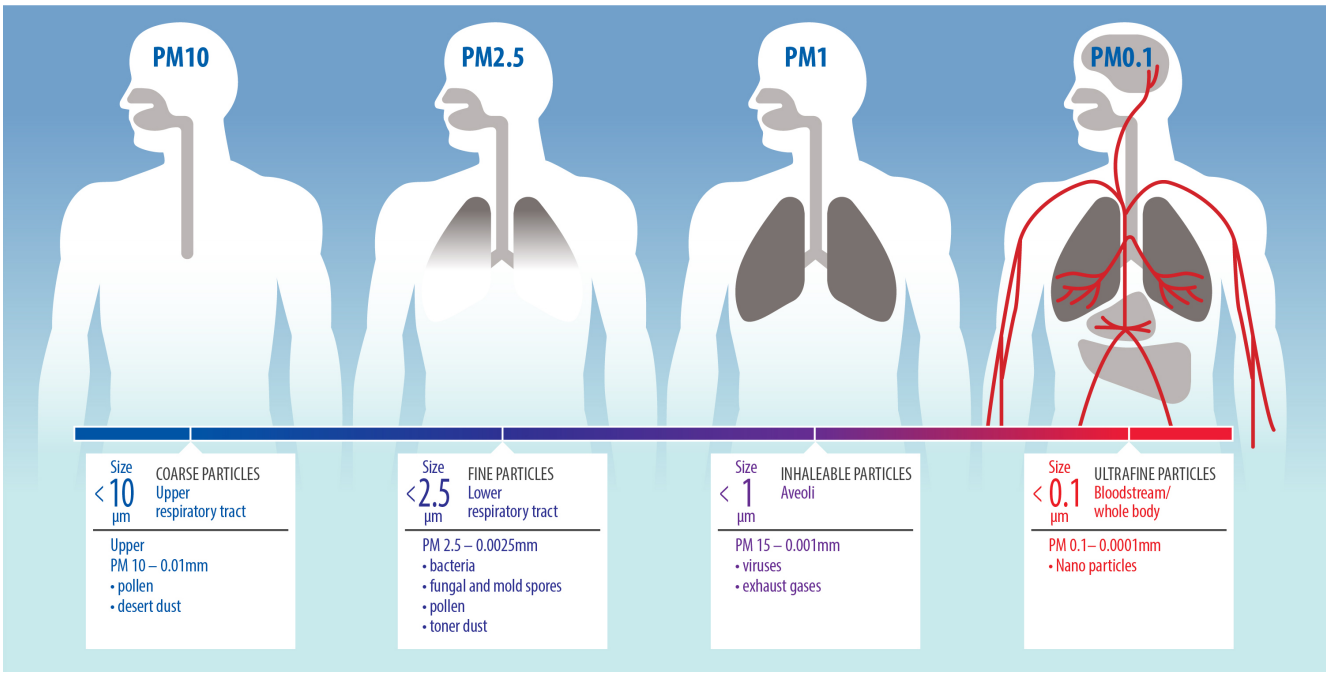
Ultrafine particles combine with each other in the air to form dangerous pollutants (known collectively as secondary organic aerosols) that can last longer and travel farther than previously thought by EPA—an effect not captured in EPA air quality models. These secondary aerosols are a much bigger health threat than the primary emissions themselves. According to EPA's 2011 National Air Toxics Assessment, secondary formation is the largest single contributor to cancer risks in the U.S., accounting for 47% of the total risk nationwide.

Among the worst of the ultrafine particles are carcinogenic PAHs (polycyclic aromatic hydrocarbons), whose harm to young children includes reduced IQ—just like the tetraethyl lead that was added to gasoline for octane until it was phased out decades ago. Aromatics are the **only** source of PAHs from cars and light trucks.

Fetal exposure to extremely low levels of PAHs—levels found in high-traffic urban areas—has been associated with developmental delay at age 3 years and reduced IQ at age 5 years.

PENETRATION OF PARTICLES INTO THE BODY

(THE SMALLER THE PARTICLE, THE MORE DANGEROUS THEY ARE)



Exposure to airborne PAHs during the last six weeks of pregnancy is also associated with early preterm birth—a predictor of infant mortality and later-life morbidity.

These toxic air pollutants can affect health and functioning over the course of life by launching a sequence of adverse effects related to the initial impairment, and/or by "seeding" latent disease that becomes evident only in later life.

To the human body, in other words, the switch from lead to aromatics may not have been much of an improvement.

Cleaner Fuels for Climate and Health

To embrace the challenge, EPA has to go beyond its past practice of regulating vehicles alone and address the composition of gasoline as well. Enabling the use of low-carbon, high-octane fuels in existing vehicles would achieve immediate reductions in emissions from mobile sources that are impossible to realize in any other way.

Even better, the greenhouse gas reductions would ramp up immediately and deliver real benefits by the end of the decade. In contrast, EPA greatly overstated the GHG reductions of electric vehicles in its recent rulemaking for new vehicles, using "tailpipe-only values to determine vehicle GHG emissions, without accounting for upstream emissions" (i.e., emissions from power plants fueled by coal and natural gas). EVs recharging from today's grid are obviously not zero-carbon vehicles.

US automakers have endorsed the need for cleaner fuels as complementary to the push for EVs. The Alliance for Automotive Innovation, a group of automakers that produce nearly 99% of the new light-duty vehicles sold in the U.S., said:

"[A]s automakers invest significantly in the transition to expanded vehicle electrification, the auto industry is also continuing to invest in vehicle improvements that increase fuel economy and reduce greenhouse gases in internal combustion engine vehicles. Many of the technologies being used to make these improvements can be enhanced or complemented with the use of high octane, low carbon liquid fuels. These fuels would simultaneously support vehicle performance, including fuel economy, and further reduce greenhouse gas emissions during vehicle use. **Such benefits would be realized by new and existing internal combustion engines and therefore should be encouraged as additional solutions as soon as possible** to maximize environmental benefits across the fleet." *(emphasis added)*

The steps needed to encourage greater use of low-carbon, high-octane fuels in existing vehicles are clearly within EPA's authority and in fact are relatively minor procedural actions. In the process, the agency could completely and permanently end the everlasting disputation about the Renewable Fuel Standard.

Ethanol is a clean-burning, readily available, and proven substitute for aromatics that provides an even greater octane punch and is in widespread use today. Already, almost all gasoline contains 10% ethanol.

But 10% ethanol is not the optimal fuel for cars, nor is E15. Higher blends, such as gasoline with 30% ethanol (E30), would enable refiners to reduce the level of aromatics by at least 40%, and the effects on emissions would be dramatic. Today's cars perform well on E30 blends—as shown in a year-long study by the State of Nebraska—and new cars will perform even better once the availability of higher-octane fuels allows automakers to calibrate their engines for higher efficiency.

That is critically important because higher efficiency means lower carbon dioxide emissions, the primary cause of climate change. EPA has issued new greenhouse gas emissions standards for model years 2023 to 2026—as indeed it should—but a switch from 10% ethanol to higher-level blends would reduce emissions even more and much faster than what the agency has required.

A 2017 assessment by the consulting firm ICF concluded that life-cycle greenhouse gas emissions associated with producing corn-based ethanol in the United States, using today's practices in a typical facility, are almost 43% lower than those of gasoline on an energy-equivalent basis. Similarly, a "state-of-the-science review" by the consulting firm Environmental Health & Engineering yielded a "central best estimate of carbon intensity for corn ethanol" that was 46% lower than that of gasoline. Those numbers get better every year as farmers improve their practices to reduce their carbon emissions.

Some recent studies and refinery modeling suggest that the net improvement may be even greater—as high as 56%—after factoring in the replacement of carbon-intensive aromatics at oil refineries.

This combination of benefits—the lower carbon impact of ethanol, plus the increased efficiency of cars that use it—means that widespread use of E30 would reduce greenhouse gas emissions by just as much as EPA's recent rulemaking. In other words, the EPA has missed an opportunity to DOUBLE its reductions of greenhouse gases by not including improved fuels in the new regulations.

The Conventional Wisdom is Wrong

Now, some people don't like ethanol because it's mostly made from corn. Corn production in the U.S. undoubtedly has had some negative effects on our waterways, due to uncontrolled nitrogen runoff from excess fertilizer. This is an important concern, and it should be addressed—through incentives for

farmers to move away from annual plowing and plant cover crops to protect their soil (increasing organic carbon and building soil health).

Other arguments against corn have turned out to be exaggerated or just plain wrong. Would greater demand for corn affect food prices? Very little. The price of corn correlates with the price of oil, not demand for ethanol; the price of oil is a much bigger factor in the price of food than the cost of the commodities themselves; and increased ethanol use would reduce the price of oil.

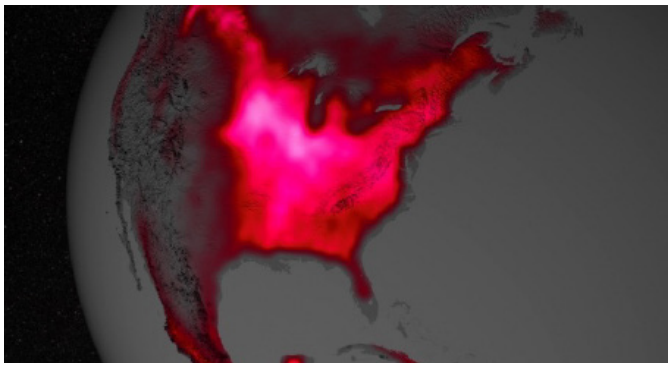
Would greater demand for corn lead to farmers breaking up virgin prairie? Hardly. U.S. farmers continually produce too much corn for their own good on existing cropland – increasing the yield of corn per acre every year. Some additional acres are planted when prices are high—but those come from previously cultivated land, not unbroken prairie, which is protected by "sodbuster" provisions in the Farm Bill.

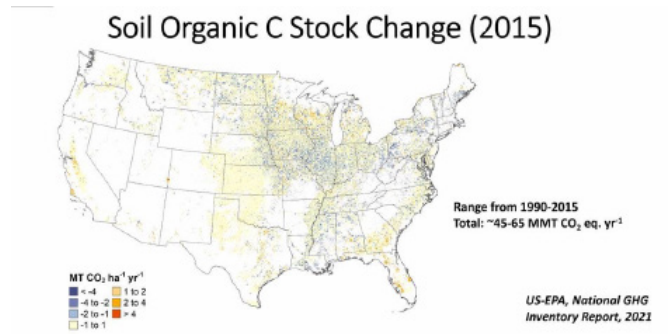
In reality, farmers could meet the demand for more corn and more ethanol on cropland that is already in use. Careful analyses, based on actual observations of land use changes, have shown that intensifying crop production through yield improvement and the cultivation of idled cropland, together with the use of biofuels by-products for animal feed, have eliminated the need for conversion of natural land to cropland for biofuel production.

Would higher blends of ethanol worsen emissions or damage automobile engines? Another myth. Tests by U.S. national laboratories, along with a grassroots rebellion in Watertown, SD, and a year-long test by the State of Nebraska, have shown no harm from E30 – and those drivers have been saving 60 cents a gallon compared to the rest of us.

In Brazil, the standard gasoline blend contains 27% ethanol, and one third of the fleet is capable of operating on ethanol alone. As a result, the city of São Paulo, which had a longstanding problem with smog and toxic emissions from automobiles, has seen significant improvements in air quality due to ethanol use. It is the sixth most populous urban area in the world, but over the past five years it had better air quality than 1,778 other cities in terms of particulate pollution

Would increased corn production worsen climate change? Just the opposite. Corn is uncommonly efficient in its use of carbon dioxide in the air—converting it to four-carbon compounds instead of the usual three. Only about 3% of flowering plant species (including sugar cane) do the same, but this relative handful accounts for 23% of all terrestrial carbon fixation. NASA satellite images and the EPA chart illustrate the astonishing carbon uptake by the Corn Belt in the summer.





As we all seek solutions to cut our carbon emissions in half by 2030 and achieve a net zero economy by 2050, encouraging the use of cleaner and more energy-efficient fuel is a complementary step that will also save thousands of lives each year and protect young children in our cities. Blending more ethanol into gasoline will improve public health, combat climate change, reduce gas prices, and increase our energy security at no extra cost. And new legislation is not required—EPA has all the authority it needs to advance these climate, public health, and environmental justice goals. It's time for EPA to seize the moment and act.

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This ***"The Real Cost of Gasoline ... Is To Our Health"*** **White Paper** was produced and distributed as part of a continuing series produced and distributed by the Clean Fuels Development Coalition. The White Paper series provides an opportunity for public officials, industry, academia, and others to express their views on issues relating to the development of ethanol and other alternative fuels. Interested parties are encouraged to submit papers and ideas to **cfdcinc@aol.com**. For more information on the coalition contact Executive Director Douglas A. Durante and visit **www.cleanfuelsdc.org**.