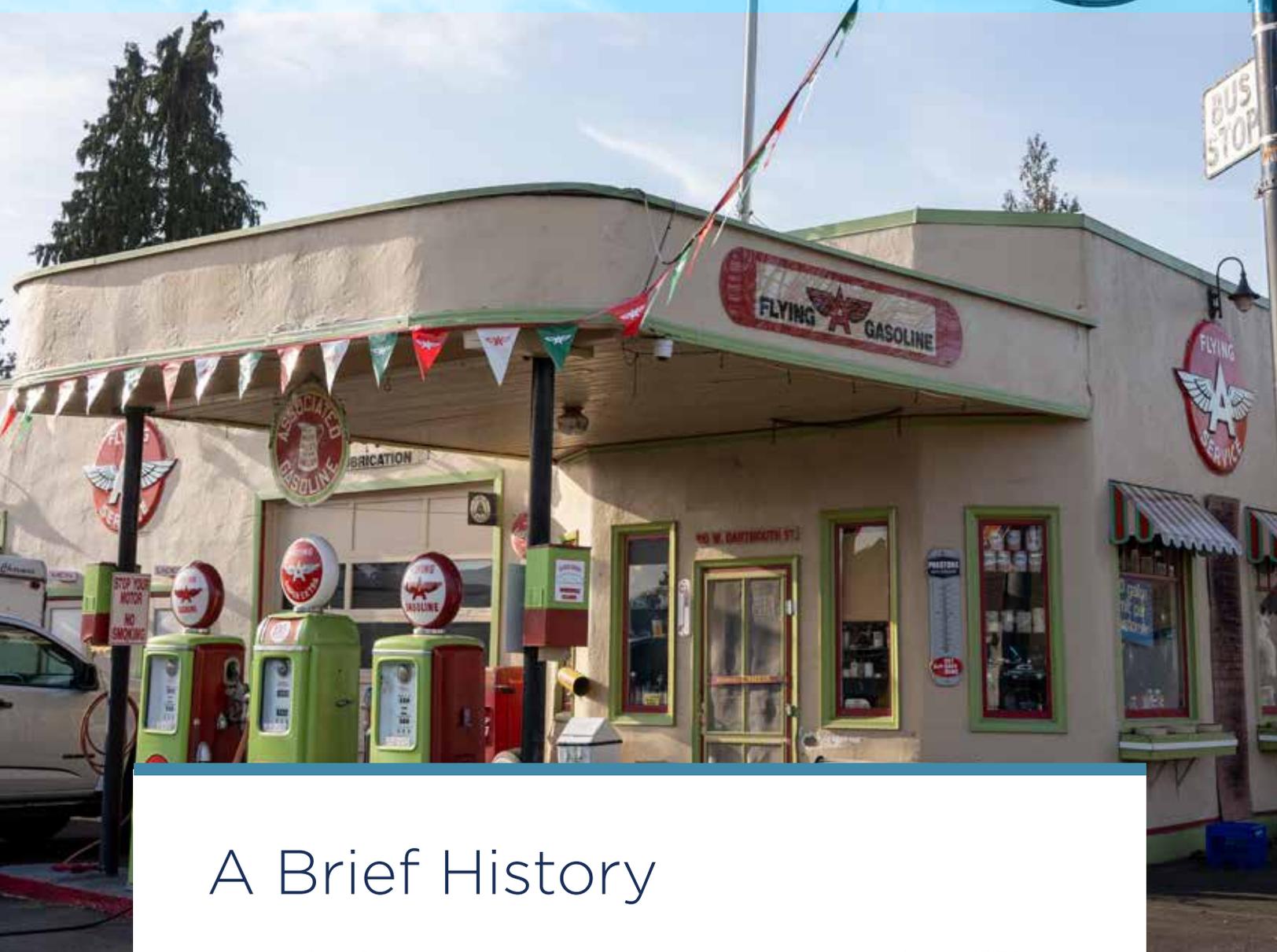


Driving Change: Leaded is Out, EVs are In

The transition from leaded to unleaded took over 20 years—how long will the transition from unleaded to EVs take?

In July, the only remaining country still using leaded gasoline for automotive transportation—Algeria—used the last of its leaded gasoline supply. Importantly, this change gives industries and consumers alike a sense of what to anticipate as the next big automotive industry shift takes place in the years ahead.



A Brief History

In the United States, leaded gasoline began to be phased out in the 1970s. The U.S. Environmental Protection Agency (EPA) began the process in 1973. This makes sense given what is widely known about the impacts of lead on public health. However, in the 1920s, despite knowledge that lead poisoning was a serious concern, lead was still introduced as a fuel additive.

Researchers, including Thomas Midgley Jr. at General Motors, were in search of chemical additives to reduce engine knock and increase compression ratios; allowing cars to be more powerful. Ethyl alcohol was found to have this effect, but tetraethyl lead was used instead. The complete reason why remains a mystery, but may be because ethyl alcohol could not be patented, while tetraethyl, could.

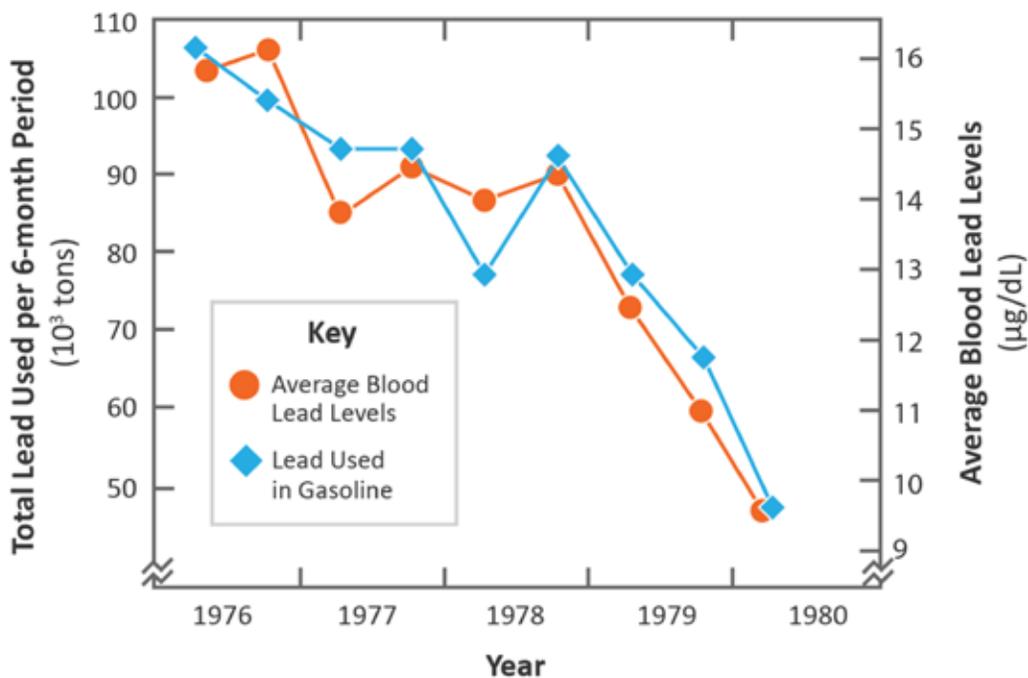


Over the years there were many stories of lead poisoning, including one factory where 35 employees were hospitalized and five died—out of the total of 49 who worked there. According to the EPA, “Once in the body, lead distributes through the body and is accumulated in the bones. Depending on level of exposure, lead can adversely affect the nervous system, kidney function, immune system, reproductive and developmental systems, and the cardiovascular system.”

Given these impacts, it’s not surprising that momentum finally grew for a change.

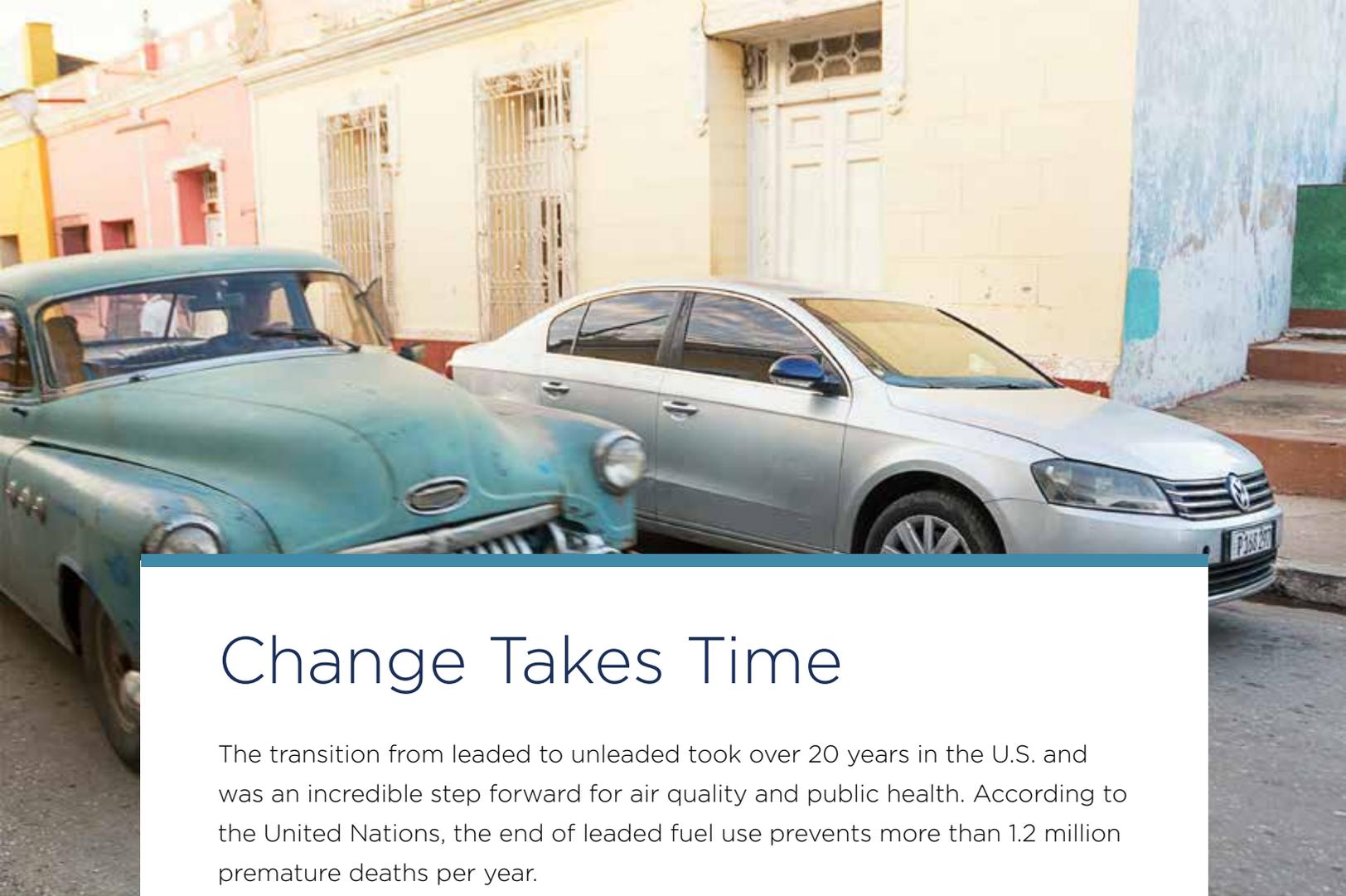
Every \$1 spent to reduce emissions results in Americans receiving \$9 of benefits to public health and the environment.

Lead Content in Gasoline and Average Blood Lead Levels



EPA standards led to parallel decreases in lead content of gasoline and blood lead level of the average American.





Change Takes Time

The transition from leaded to unleaded took over 20 years in the U.S. and was an incredible step forward for air quality and public health. According to the United Nations, the end of leaded fuel use prevents more than 1.2 million premature deaths per year.

Despite the fact that unleaded fuel was more expensive at first, as newer vehicles were designed to run without lead—and in fact would be damaged by it—the transition began to accelerate. Most gasoline was unleaded by the 1980s. Essentially, the regulations that required catalytic converters ended the use of leaded gasoline. But, it wasn't until the Clean Air Act of 1996 that it was officially banned. (It's still legal to use in piston aircraft, farm equipment and marine engines). As a result, between 1980 and 1999, the levels of lead in the [air decreased by 94%](#).

The transition from internal combustion engines (ICE) to electric vehicles (EVs) is the next important automotive transition—and it's happening now.

The air is much cleaner than it was in the 1970s, but there are still a number of air quality concerns with ICE vehicles. While most of the emissions are no longer visible due to complex emissions reduction systems on modern



vehicles, there are still a significant number of gases and particles emitted, including carbon dioxide, methane and nitrous oxide. However, fully electric vehicles, known as battery electric vehicles (BEVs) produce zero tail pipe emissions.

The Now Generation of Automotive Change

As of 2020, approximately 1.8 million EVs were registered in the U.S.; more than three times as many as in 2016. Just as with the switch from leaded to unleaded gasoline, costs for EVs are currently higher. A new EV is still more expensive compared to a gasoline vehicle, but battery prices continue to fall and manufacturers continue to scale production of EVs, which will lower the cost. In fact, **Bloomberg estimates** that most EVs will reach price parity in 2025. New EVs are quickly being released, especially in the key U.S. segments of SUV's and pickup trucks. In fact, the first Rivian pickup, backed by Amazon and Ford, rolled off the assembly line on Sept. 14, 2021; beating the Tesla Cybertruck and the Ford F-150 Lightning to market.

In addition to new models, today's EV drivers are able to take advantage of the significant decrease in total cost of ownership. Typically electricity is less expensive than buying gas and maintenance costs are greatly reduced.



After price, the most common question typically is, **“what are the emissions from creating the electricity, which powers the car?”** The answer to that depends on each driver’s location. But, even in parts of the country with the “dirtiest” electric grids, EVs are still cleaner. Better still, they actually get cleaner over time as we continue to phase out coal production and move to other forms of energy generation, including renewables.



How Long Will EV Adoption Take?

It’s difficult to say how long it will take for EVs to dominate the market. Adoption rates will likely depend on the location. For example, Norway is leading the world and California is leading the U.S., but, many projections expect 30% to 40% of total new car sales in the U.S. will be electric by 2030. Importantly, it must be noted that the change from internal combustion engine vehicles to EVs is a much larger shift than from leaded to unleaded gasoline. It requires changes in consumer behavior that were not necessary when simply pumping a slightly different fuel.





With 80% of EV charging occurring at home,

it's imperative that society adapts so that drivers have access to charging at home, whether that be at single family residences, condominiums or apartments. EV drivers typically don't make a special stop to "fill up." They simply "plug in" where their cars sit unused for extended periods of time, such as at home and work, so charging access at work is also critical. There are of course exceptions, like fleet vehicles, extended commutes and long trips. Solutions exist for those circumstances too, but will require more changes in habits and behaviors. Even though fast charging stations can add 200 miles of range in just 15 minutes, consumers have to think differently about charging than they do fueling, whether it be for long trips or shorter commutes.

It will take a few years for society to broadly embrace this change. But, as with all things in the 21st century, life and events happen much faster than they did in decades past. Change is not off in the distant future—it has arrived.



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