Union of Concerned Scientists

FACT SHEET

Clean Fuels for the Midwest

Expanding the Use of Clean Fuels Will Deliver Economic and Climate Benefits

HIGHLIGHTS

Increasing the use of cleaner transportation fuels, including low-carbon biofuels and electricity, is a smart way to help address climate change and reduce air pollution while also spending less on oil and providing more support to local economies. Midwestern states produce most of the country's ethanol and biodiesel, both of which can get cleaner through improved processes at production facilities and more sustainable practices on farms producing biofuel crops. At the same time, the Midwest leads the country in wind power generation, and electricity will play an important role in the future of clean transportation, and electric vehicles are getting cleaner as more renewable power replaces coal on the grid. Clean fuels standards would promote the increasing use of biofuels and electric vehicles and encourage all fuel producers to reduce the global warming pollution that comes from making transportation fuels.

The Midwest leads the United States in producing biofuels and wind energy, yet petroleum-based fuels brought in from other states and countries meet more than 90 percent of the region's transportation energy needs. Gasoline and diesel are also the region's largest sources of global warming pollution, threatening its economic well-being and quality of life, now and in the future. Repowering the transportation sector with electricity and cleaner biofuels is a smart way to help address climate change and reduce air pollution while spending less money on oil and supporting local economies.

Transportation powered with biofuels and electricity is cleaner than gasoline and diesel, and both have the potential to be much cleaner than they are today (see the figure, p. 2). For example, Midwestern ethanol producers have made important progress in reducing global warming pollution from their operations. The region's electric grid has also been getting cleaner, as coal-fired power plants shut down and wind power expands. Farmers who produce crops for food, feed, and fuel can reduce emissions and build the healthier soils that are critical for improving yields, producing cleaner fuels, and promoting resilience in the face of a changing climate.

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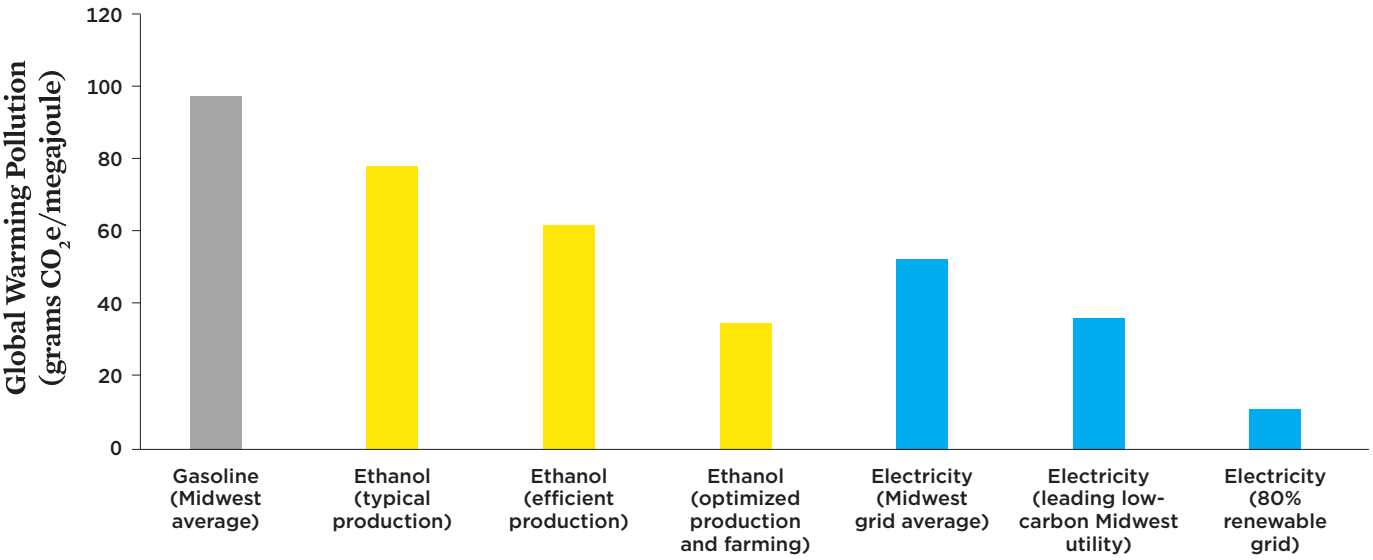
The Midwest is a leader in biofuels production and wind energy. Using renewable fuels and power to cut oil use and emissions in the transportation sector can help address global warming and air pollution and save consumers money.

Biofuels and Electricity Are Cleaner than Gasoline Today, and Have the Potential to Get Considerably Cleaner over Time



Notes: Gasoline value is for the Midwest region (PADD 2). Grid average electricity emissions are based on grid region MROW. The leading low-emissions Midwest utility is Xcel Energy Upper Midwest, based on the 2018 utility mix. All electricity scores include fuel production emissions from Argonne National Laboratory's GREET 2017.

SOURCES: COONEY ET AL. 2017 (GASOLINE); MARTIN 2017 (ETHANOL, ALL SCENARIOS); ANL 2017 (ELECTRICITY, ALL SCENARIOS); EPA 2018 (ELECTRICITY, GRID AVERAGE); XCEL 2019A, 2019B (ELECTRICITY, LEADING UTILITY); MARTIN 2017 (ELECTRICITY, 80% RENEWABLE).

Biofuels for Cars, Trucks, Buses, and Airplanes

Six Midwestern states produce 70 percent of domestic ethanol: Iowa, Nebraska, Illinois, Minnesota, Indiana, and South Dakota, in order of production. Since the ethanol industry expanded dramatically in the 2000s, ethanol producers have been optimizing their operations and implementing new technology, drawing on advances in biochemistry, industrial engineering, and other fields to produce more fuel from the same amount of corn, while using less water and fossil energy. Today, the full life cycle global warming emissions of ethanol from a typical production facility are about 20 percent lower than those for gasoline; fuel from the most advanced facilities is significantly cleaner than that (Martin 2017). Also, significant opportunities for further progress are emerging as ethanol producers implement new strategies, including capturing and sequestering or reusing carbon dioxide.

While ethanol accounts for the largest share of biofuels produced and used in the Midwest, the shares of biodiesel, renewable diesel, and biomethane are growing rapidly. Passenger cars use ethanol blended with gasoline; trucks use biodiesel and renewable diesel blended with diesel. Another important clean fuel is biomethane, captured from landfills, manure, and wastewater treatment. Biomethane can be used directly in vehicles that run on natural gas and can generate electricity to charge EVs, or it can replace fossil natural gas to reduce emissions from producing ethanol or other transportation fuels.

Farmers and Clean Fuels

The life cycle of a biofuel begins on the farm. For corn ethanol, producing and using the fertilizer associated with growing the crop account for about one-fourth of the total life cycle emissions (Martin 2017). Farmers can reduce nitrous oxide emissions to the atmosphere and nitrate pollution to watersheds as well as increase soil carbon through more sustainable agricultural practices, including improved nutrient management, cover cropping, and conservation crop rotations (Stillerman and DeLonge 2019). While it is a complex process to quantify the life cycle carbon and nitrogen changes associated with changes in farming practices, understanding is growing on the importance of healthy soils, improved water systems, and other natural climate solutions for mitigating and adapting to climate change. In addition to climate benefits, practices that build healthy soil and improve water provide other environmental benefits, from reducing erosion to increasing the habitats for pollinators and birds.

Improving soil health through agriculture is important not just for the corn grain and soybean oil used for biofuel production but for all crops regardless of their final use. Still, it makes sense to focus on biofuels because their environmental performance is a key reason to use them. Moreover, biofuels represent one of the largest markets for two key agricultural commodities: almost 40 percent of the US corn crop and almost 30 percent of soybean oil production go into biofuel production (ERS 2019a; ERS 2019b). This means that the future of biofuels has important implications for the Midwestern farmers who produce most of the corn and soybeans grown in the United States (NASS 2019). Corn and soybeans are planted on 90 percent of Illinois cropland, 87 percent in Iowa, 70 percent in Minnesota and Nebraska, and 57 percent in South Dakota (NASS 2019; Bigelow and Borchers 2017).

Large increases or decreases in biofuels production will affect agricultural commodity markets, with implications for food prices, farm income, and the land footprint of agriculture, both in the United States and around the world. Biofuel policies not only influence the demand for biofuels, but, if appropriately designed, they also can support the expansion of agricultural practices that improve soil health and reduce the global warming and watershed pollution associated with crop production for biofuels.

Clean Electricity to Power Cars, Trucks, and Buses

Petroleum has been the dominant transportation fuel for so long that most people think "fueling up" is limited to gas stations, but electricity powers a growing number of cars on today's roads, and moving from pump to plug plays an important role in clean transportation. When running on electricity, EVs produce no tailpipe pollution. Generating electricity for charging EVs' batteries is their main source of emissions, and any complete picture of an EV's fuel life cycle accounts for these.

Metro Transit

Electric buses (such as this one in Minneapolis/St. Paul) generate half the carbon dioxide emissions over their life cycle compared with diesel buses, and generate much less tailpipe pollution. This offers significant benefits to communities as a whole—not just to residents who drive electric vehicles.

> ***An EV charging on grid power in the Midwest has emissions about half those of a typical gasoline-powered vehicle.***

The Midwest's electrical grid is a mixed bag. Because about half the Midwest's power comes from coal-fired power plants, carbon dioxide emissions per unit of power generation in the largest Midwestern grid region are about 24 percent higher than the national average (EPA 2018). However, the coal-fired share is falling, and the region leads the nation in wind power, a renewable power source that is rapidly growing in importance. Considering the full grid mix, an EV charging on grid power in the Midwest has emissions about half those of a typical gasoline-powered vehicle. Moreover, the share of coal-fired power in the largest Midwestern grid region fell from 74 percent in 2005 to 52 percent in 2016, while wind energy's share rose from 2 percent to 21 percent (EPA 2018; EPA 2008). This trend is expected to continue, making the region's EVs steadily cleaner to drive.

Electric passenger cars get more public attention, yet electric buses and trucks are also critical for cutting transportation's oil use and emissions. Replacing a diesel transit bus with an electric bus cuts carbon dioxide emissions in half, while also reducing air pollution that is especially damaging because transit buses operate in densely populated areas (Chandler, Espina, and O'Dea 2017). Thus, replacing diesel buses and delivery vehicles with electric models benefits communities even for residents who do not drive electric vehicles. And transit buses and delivery vehicles are especially well suited to near-term electrification because their routes are predictable, and they can be charged at central locations.

Clean Fuels Standards: Reducing Emissions and Promoting Local Fuels

Clean fuels standards, a performance-based approach to fuel policy, create a growing market for clean fuels and encourage all fuel producers to cut emissions. Moreover, they are

Ethanol Blends beyond E10

Gasoline demand is expected to fall steadily as gasoline-powered cars get more efficient and more EVs are sold, and without changes in ethanol blending, ethanol use will fall in lockstep with gasoline (EIA 2019a). However, a gradual migration toward higher ethanol blends can offset declining gasoline demand and ensure that ethanol can continue to reduce petroleum use and cut transportation emissions. A clean fuels standard would help support the use of higher ethanol blends.

Ethanol is the most cost effective and widely used biofuel in the United States, and more than 95 percent of it is sold as a 10 percent ethanol-gasoline blend known as E10. Other blends are available as well, including E85 (an 85 percent blend of ethanol in gasoline), which can be used in specially developed "flex-fuel" vehicles, and E15, which can be used in any gasoline-powered car sold since 2001. Minnesota and Iowa lead the nation in E85 fueling stations, many of which can also sell E15 and other blends (AFDC 2019).

Interest is growing in high-octane, mid-level ethanol blends such as E25, which can improve efficiency when used in cars optimized for the fuel (Theiss et al. 2016; Leone et al. 2015). However, marketing E85 for flex-fuel vehicles and E15 for conventional vehicles has made little headway because of a limited fuel distribution infrastructure, the lack of marketing and competitive pricing for E85, and regulatory barriers for E15. The noteworthy exceptions are Minnesota, where ethanol accounted for 12.5 percent of total gasoline consumption in 2017 and Iowa, where it accounted for 11.5 percent (EIA 2019b).

Clean fuels standards can help promote the production and use of higher ethanol blends. However, experience in other jurisdictions, from the federal Renewable Fuel Standard to California's Low Carbon Fuel Standard, shows that a clean fuels standard alone will not address all the barriers to this transition. Policies regulating vehicles and an improved retail fuel infrastructure are also important. For maximum benefit, they must be designed to complement fuel standards.

technology-neutral: rather than require a specific volume of ethanol or number of EVs, for example, different clean fuels solutions can compete based on their costs and emissions reductions.

A clean fuels standard requires the transportation fuel used in a state or region to become on average steadily less polluting. Each fuel's pollution is evaluated based on its full life cycle carbon intensity (global warming pollution per unit of fuel energy). Using a science-based life cycle metric facilitates the comparison of fuels as dissimilar as gasoline, ethanol, and electricity. Each fuel's life cycle captures not only tailpipe emissions but also emissions at the oil refinery, farm, and power plant. Therefore, ethanol produced at more efficient facilities with lower fossil fuel emissions would get more credit than ethanol produced at inefficient, coal-fired facilities. Similarly, an EV charged on wind power would get more credit than one charging on a grid with a lot of coal-fired generation.

Sellers of fuels that are more polluting—for example, oil refineries selling gasoline and diesel—get flexible options about complying with the standard in a cost-effective way. They can directly reduce the carbon intensity of the fuels they sell by blending low-carbon ethanol into gasoline or low-carbon biodiesel into diesel (see box for more information on ethanol blends). Alternatively, they can purchase credits from other parties that use clean fuels. For example, a transit agency that replaces a diesel bus with an electric bus would earn credits in direct proportion to the resulting emissions reductions. That agency could sell its credits to an oil refiner and use the revenue to offset some of the cost of switching to electricity. The switch also would yield important air-quality benefits to communities in which the electric bus operates.

Clean fuels standards steadily expand the market for increasingly cleaner biofuels, including ethanol, biodiesel, renewable diesel, and biomethane. They support the electrification of cars, buses, and trucks. And they encourage all fuel producers to reduce emissions from producing transportation fuels.

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