

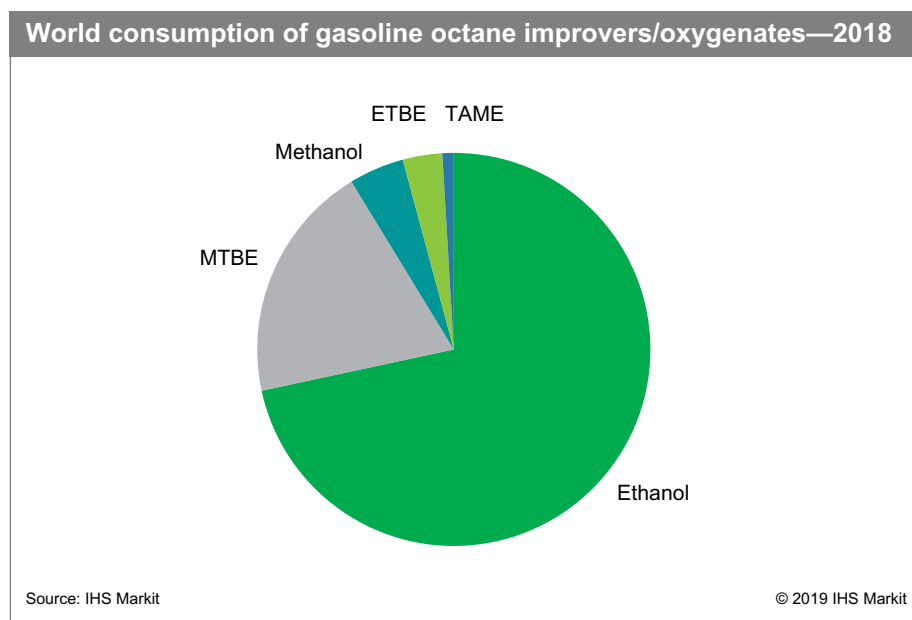
Gasoline Octane Improvers-Oxygenates

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Abstract

Worldwide, the leading gasoline octane improvers are fuel ethanol, MTBE, methanol (primarily in China), and ETBE. TAME is the smallest of the major octane improvers. Most of the growth of fuel ethanol consumption is mandated by government regulations designed to reduce vehicle emissions. The United States is the largest consumer of gasoline and gasoline octane improvers, nearly all of which is fuel ethanol. In the United States, reformulated gasoline (RFG)—gasoline blended to burn more cleanly than conventional gasoline and to reduce some smog-forming and toxic pollutants in the air—was mandated by the US Congress in the 1990 Clean Air Act amendment; RFG is currently used in 17 states and the District of Columbia. About one-third of the gasoline sold in the United States was reformulated in 2018, all with ethanol.

The following pie chart shows world consumption of gasoline octane improvers/oxygenates by type:



The largest-volume gasoline octane improver/oxygenate used in the world is ethanol, the only octane improver/oxygenate consumed in all countries/regions of the world. In recent years, ethanol use has grown significantly in the United States and Brazil, and to a lesser extent in other countries. Global capacity and consumption growth of biofuel ethanol has been largely the result of government mandates. Growth forecasts are currently at about 6% per year, but consumption could potentially double should all countries that have mandated fuel ethanol levels standards actually meet their targets. One of the main obstacles to reaching this target is that many of the developed countries are projected to have a reduced gasoline consumption in 2023 because of improved motor vehicle gas mileage, the introduction of electric (EV) and hybrid-electric (HEV) vehicles, and other new technologies. Most regions of the world will have blend rates between 5% and 10% in 2023, but some could be as high as 15–20%, and the blend rate in Brazil could approach 70%. The Chinese

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government has mandated that China consume 10% ethanol-containing gasoline (E-10) by 2020. If the Chinese government can accomplish this, Chinese ethanol consumption will grow significantly, while MTBE and methanol consumption will decline. However, China is unlikely to accomplish this transition by 2020, but could come closer to meeting this target by 2023.

The next-leading gasoline octane improver/oxygenate is MTBE. Starting in the late 1970s, MTBE was the predominant choice of gasoline oxygenate used worldwide because of its low cost, high octane value, and easy incorporation into gasoline stock. However, in the late 1990s, MTBE was alleged to cause detrimental environmental impact by contaminating water supplies. As a result, the use of MTBE as an oxygenate in gasoline ceased in Japan in 2001 and in the United States and Canada in 2006. MTBE is still widely used as an octane booster in motor gasoline in Europe, the Middle East, Africa, and Asia.

The United States still produces MTBE, but mainly for the export market or for blending into gasoline for export. There are several large Latin American consumers of MTBE (such as Mexico and Venezuela) that import considerable quantities from the United States. Both have made some plans to use more ethanol or ETBE to reduce GHGs, but general inertia and fear of higher corn prices have limited the switch. In 2018, Northeast Asia accounted for about half of total world MTBE consumption, of which China accounted for the major percentage. China will remain the largest market for MTBE, but consumption is expected to decline through the forecast period, as the country shifts to ethanol.

The third-largest-volume gasoline octane improver/oxygenate used in the world is methanol. Consumption is primarily in China (greater than 95%), with smaller quantities being consumed in Western Europe, the Middle East, Africa, and Southeast Asia. In addition to direct blending, methanol is also consumed in the production of MTBE and TAME. New Chinese plants have been built to produce methanol from coal, which is in ample supply in the country. Direct gasoline blending of methanol is expected to continue in China; however, new Chinese government mandates to increase use of E-10 ethanol blends will reduce overall consumption of methanol in China.

ETBE is consumed primarily in Western Europe and Japan, where the mandated use of biofuels is driving consumption for bioethanol-based ETBE. In 2017, Japan increased blending rates for ETBE from 7% to 22% by volume, which is expected to drive future consumption. The shift to ETBE has been in response to the commitment under the Kyoto Protocol to cut greenhouse gases. Overall consumption is expected to be stable through the forecast period.

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