# IEA-Advanced Motor Fuels
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## KOREA

## Republic of Korea

### *Introduction*

South Korea has sought to increase the use of biodiesel (BD), specifically in public vehicles, since 2002. A pilot adoption project was implemented that lasted approximately 4 years, and which expanded the use of BD in all light oil automobiles in the country. The National Government and oil wholesalers reached a voluntary agreement in March 2006, under which BD producers were required to enter into annual supply contracts with oil wholesalers to blend automotive light oils with 0.5% BD content throughout the country, starting in July 2006. The blend percentage increased by 0.5% every year, so that starting in 2010, automotive diesel blended 2.0% BD. As a result, consumption of BD in South Korea in 2014 has reached approximately 400,000 kiloliters (kL).

South Korea has studied adoption proposals and detailed implementation plans through policy research, for the introduction of a Renewable Fuel Standard (RFS) program for renewable fuels (http://www.energy.or.kr/renew_eng/new/rfs.aspx). The Government issued a notice on quality standards for the RFS act on fuel oil and fuel oil alternative fuel businesses, which stipulates that automotive diesel fuels are to be blended with 2%–5% BD content. On the basis of its policy research, South Korea incorporated the RFS program into its implementing ordinances to promote the development, use, and spread of new renewable energy, which were passed into law and took effect in July 2015, and has begun the supply of BD2.5.

Korea has eight biomethane production plants for transport fuel in operation (Figure 1) by such companies as KOGAS and Potlatch. GS Caltex developed a lignocellulosic base biobutanol process and is constructing a biobutanol pilot plant (10 kilograms [kg]/day) (Figure 2); this pilot plant will be in operation in early 2017.

Almost all city buses in Korea (more than 38,000) use natural gas, and all taxis use liquefied petroleum gas (LPG). However, it is mandatory that all diesel fuel contain 2.5% BD fuel (i.e., BD2) by July 31, 2015, and this percentage will be reviewed and increased up to 3.0% by 2018. There is no policy on bioethanol (BE) use.

Fig. 1 Biomethane Charging Station

Fig. 2 Biobutanol Pilot Plant

The Korean Government discussed future scenarios on how to introduce BD and create a long-term road map. This discussion was finalized, and the conclusions were incorporated in the new Korean RFS in June 2013.

During the 21st Session of the Conference of the Parties to the United Nations Framework on Climate Change Conference (COP21) in 2015, Korea suggested a 37% carbon dioxide ($CO_2$) reduction by 2030. Discussions are now under way as to how to achieve this goal.

## *Policies and Legislation*

The new RFS was enacted in South Korea's National Assembly in July 2013. This law requires that a renewable energy fuel be blended with any transportation fuel (Table 1). It also indicates that joint indemnity and fraternal insurance should be provided to business operators who work with manufactures and supply these renewable fuels.

Table 1 Blending of Biodiesel in Automotive Diesel Fuel in South Korea[a,b]

| | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|
| Percentage (%) of new renewable energy fuel blended in transportation fuel | 2.5 | 2.5 | 2.5 | 3.0 | 3.0 | 3.0 |

[a] Type of transportation fuel: automotive diesel.

[b] Type of new renewable energy fuel: BD.

*Source: Ministry of Trade, Industry and Energy, South Korea, announced June 15, 2015*

According to the revised RFS, oil refining agents and petroleum import and export agents are obligated to blend transportation fuel with a certain percentage or more of a renewable energy fuel. A system was established to impose a penalty on any violator. Also, an RFS task force of professionals was formed to manage the work related to carrying out this RFS.

However, the Korean Government, by allowing a 2-year grace period to implement the RFS system, enabled oil refinery companies and bioenergy-related enterprises to prepare the fuels. The Government believed that the RFS policy would be more acceptable if there was enough time to implement it.

According to legislation, it is expected that the mixing or blending of BD and BE will reach 3% in 2018, as a result of incremental increases in the mixing ratios associated with the new renewable energy sources each year. Also, the Ministry of Trade, Industry and Energy announced that quality standards exist to ensure that the renewable energy sources are of proper quality, and it is mandated that related companies register to obtain indemnity or fraternal insurance to cover a third party for any damage caused by defects in the renewable energy processes.

### *Implementation: Use of Advanced Motor Fuels*

More than 38,000 natural gas vehicles (NGVs) and 164 compressed natural gas (CNG) or liquefied natural gas (LNG) stations are currently being operated in Korea. Since 2000, the Ministry of Environment has promoted NGVs — mainly city buses — by offering subsidies and low-priced natural gas to reduce air pollution in urban areas and cut greenhouse gas emissions. About 80% of NGVs are original equipment manufacturer (OEM) transit buses, and the other 20% are OEM trucks and dual-fuel retrofit passenger cars. Dedicated CNG buses and trucks are supplied by Korean automakers, such as Hyundai, Daewoo Bus, and Tata Daewoo. NGVs run mainly on CNG. However, dedicated buses recently developed by Hyundai (which also developed a CNG hybrid bus in 2010) and some LNG-diesel dual-fuel trucks with retrofit technology are in use. Hydrogen-CNG (HCNG) engine technology is currently being developed as part of a Government project.

Biodiesel has been used as an automotive fuel in Korea since 2002. After a few years of demonstration, the Ministry of Trade, Industry and Energy decided to introduce BD0.5 nationwide. After that, the blending ratio of BD in diesel oil has been increased gradually, and the blending ratio of BD2 has been fixed since 2010. Major feedstocks for BD are waste cooking oil and imported soybean oil and palm oil. Currently, there are 16 BD production companies, and production capacity is more than 1 million tons.

In 2014, consumption of BD was approximately 400,000 kL, of which 172,000 kL (approximately 43%) were from consumption of transportation BD through the collection of waste edible oil as a waste resource. South Korea is severely limited in its energy resources and is dependent on imports for 96% (in 2014) of its overall primary energy needs. This makes it highly desirable for South Korea to have projects that recycle domestic waste resources and convert them into energy resources. Also highly favorable for South Korea are proposals that use biogas (BG) for transportation fuels, a resource that can be obtained from organic waste without being solely dependent on imports. Some local governments in South Korea are at the center of projects to produce BG from raw garbage, livestock manure, and sewer sludge, thus improving their quality for use in regional taxis and buses. The goal is to further stimulate these projects. The City Gas Business Act has been revised to enable BG to be blended into city gas, and it is hoped that NGV buses will also be used in the country.

South Korea's RFS policy sets mandates for transportation fuel businesses. But in terms of vehicles, the policy only affects approximately 38% of vehicles out of the approximately 20 million vehicles in the country. It is hoped that in the near future, BE will be used for gasoline vehicles, which account for approximately 48% of all vehicles in South Korea, and that biojet fuels will also be mirroring global trends. Currently, there is no stimulus for using biofuels in LPG vehicles, which account for approximately 14% of all vehicles in the country. However, biofuels, such as biopropane and biodimethyl ether (bioDME), which are currently in research and development, will need to be commercialized and adopted into the market.

Other alternative fuels, such as BE, DME, and synthetic liquid transportation fuels (collectively known as XTL), have been developed or demonstrated by Government institutes and some companies. However, it is not clear when these fuels will be introduced.

## *Outlook*

According to the new Korean RFS, which takes into account the supply of and demand for raw materials, in the three-step, long-term plan for 2015 to 2023, BE3 and BD3 would be introduced in 2018. During the first step from 2015 to 2018, the introduction of BE and an increase in the BD percentage up to 2.5% would be reviewed. In the second step from 2018 to 2020, BE3 and BD3 would be introduced. The final step from 2020 to 2023 would be the introduction of BD5~7 and BE5~7. The introduction of BG beginning in 2017 is also being considered.

### *Reference*


- www.kpetro.or.kr/