

IEA-Advanced Motor Fuels ANNUAL REPORT 2016

An aerial photograph of a cityscape, likely Seoul, South Korea, showing a dense urban area with many buildings, a river, and a large green forested area in the foreground. A highway with several billboards is visible in the lower part of the image.

Korea

Republic of Korea

Drivers and Policies

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 (CO₂) reduction by 2030. Discussions are now underway as to how to achieve this goal.

Under this plan, the transport sector has to reduce greenhouse gas (GHG) emissions by 24.6% (25.9 million tons) to meet the 2030 GHG target (business as usual [BAU] 105.2 million tons). This target will be met by reducing GHG emissions by 15.7 million tons with the expansion and dissemination of green passenger cars: 640,000 electric vehicles (EVs), 1 million hydrogen vehicles, and 4 million hybrid vehicles. In turn, average fuel economy will increase: 19.9 kilometer per liter (km/L) in 2017, 21.3 km/L in 2018, 22.8 km/L in 2019, and 24.3 km/L in 2020. The introduction of an average fuel economy scheme for medium- and heavy-duty vehicles will reduce GHG emissions by 6.3 million tons with the dissemination of EV buses.

Finally, by improving green transportation systems, such as an advanced public transportation system and modal shift system, GHG emissions will be reduced by 3.9 million tons.

The new Renewable Fuel Standard (RFS) program was enacted in South Korea's National Assembly in July 2015. This new RFS requires that new diesel fuel be blended with biodiesel (BD) 2.5. It also indicates that joint indemnity and fraternal insurance should be provided to business operators who work with manufacturers and supply these renewable fuels.

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 implementing this RFS. According to legislation, it is expected that the mixing or blending of BD and bioethanol (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.

Advanced Motor Fuels Statistics

South Korea's RFS policy sets mandates for transportation fuel businesses. In terms of vehicles, however, the policy only affects approximately 42.1% (8.8 million) of diesel vehicles out of the approximately 21 million vehicles in the country (Table 1). Biodiesel oil consumption per year is about 400,000 kiloliters (kL); of that, 172,000 kL comes from domestic waste edible oil and 238,000 kL is imported. The expectation is that in the near future, BE will be used for gasoline vehicles, which account for approximately 47.1% (9.9 million) of all vehicles in South Korea, that liquefied petroleum (LPG) vehicles will account for 10.6% (2.23 million), and natural gas vehicles (NGVs) will account for 0.2% (39,800 city buses).

Table 1 Number of Vehicles, by Fuel, in South Korea in 2016

Gasoline	Diesel (BD2.5)	LPG	NGV	Total
9,902,836	8,838,993	2,229,256	39,800	21,010,885

Research and Demonstration Focus

The Korea Institute of Machinery and Materials (KIMM) and Doosan Infracore developed the first hydrogen (H₂) enriched compressed natural gas (HCNG) engine. This engine emits fewer gas emissions (one-third of the EURO-6 standard), emits less CO₂ (18% reduction), and gives an 8% energy gain compared with the base CNG engine. Two HCNG buses are under demonstration in the South Korean cities of Ulsan and Incheon. The company KOGAS constructed an H₂/HCNG station that is using CNG; H₂ is produced by reforming CNG. This H₂/HCNG station can service three HCNG buses and five FCVs a day (Figures 1 and 2).



Fig. 1 HCNG Bus



Fig. 2 KOGAS H₂/HCNG Station

Korea has eight biomethane production plants for transport fuel in operation (Figure 3) 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 4); this pilot plant will be in operation in early 2017.



Fig. 3 Biomethane Charging Station



Fig. 4 Biobutanol Pilot Plant

For the next generation of fuels that will give high biomass productivity, non-food resources, a high CO₂ reduction, and the use of various water, two projects are being conducted to develop microalgae BD — one at KAIST's Advanced Biomass R&D Center and one at Inhae University's Marine Bioenergy Research Center.

Outlook

According to the new Korean RFS, which takes into account the supply 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 biogas (BG) beginning in 2017 is also being considered.

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 South Korean companies. However, it is not clear when these fuels will be introduced.

Additional Information Sources

- KPetro, www.kpetro.or.kr/ (in Korean)
- “Commercialization of HCNG Bus Opened,” <http://www.todayenergy.com/news/articleView.html?idxno=112499> (in Korean)