



e-Fuel Production & Emission Impact on the Automotive Industry

**APS1028 – Operations and Production Management
Team 6 – Executive Summary
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Executive Summary

There is no denying that mankind has neglected the environmental impacts of its progression towards globalisation, particularly in the last two centuries. The ever-increasing greenhouse gas (GHG) emissions and record pollution levels have become a global cause for concern. This report prepared by Team 6 of the APS1028 course at the University of Toronto discusses a very promising solution to tackle both of those issues in the transportation sector.

The proposal is a type of fuel that not only reduces the emissions from internal combustion engines (ICEs) on the road by up to 85%, but also prevents high-concentration CO₂ emitted by various power plants from being released into the atmosphere. It is thereby delivering a 90-108% reduction in well-to-wheel GHG emissions compared to conventional fossil fuels, which is quite an accomplishment. This synthetic fuel, known as “e-Fuel”, is being heavily pursued by global conglomerates such as Porsche AG and Siemens. Production of e-Fuel can best be described by the Fischer-Tropsch (FT) process in which water undergoes an electrolysis reaction, in which the oxygen and hydrogen atoms are separated, the latter of which is mixed with CO₂ to form hydrocarbons that then undergo various syntheses and purification processes to arrive at the e-Fuel.

The major benefits of e-Fuels are its compatibility with the ICEs on the road, its ability to fully utilise the global network of petroleum pipelines as well as gas stations, and the substantial reduction in GHG emissions across its lifecycle.

Several limitations of e-Fuel plants are their dependence on being located in areas where the environmental conditions allow for renewable energy generation, such as solar energy or wind energy. The next location-related limitation is the ability to receive high-concentration feedstock of CO₂ to enable an efficient and

scaled production. Due to the novelty of this technology and the current low-volume production, the price of e-Fuel is substantially higher compared to regular gasoline. The recommendations propose key decisions needed to support the transition towards e-Fuel to make it a viable choice for global motorists.

To scale up e-Fuel production, the most impactful recommendation is to have governments fund petroleum companies to build pipelines capable of transferring highly-concentrated CO₂ from various power plants (coal, natural gas, etc.) to the e-Fuel processing plants. This would increase the e-Fuel production capacity, efficiency, affordability, and simultaneously reduce GHG emissions.

A further recommendation is to employ the knowledge and expertise of existing petroleum companies to transport e-Fuel to existing gas stations worldwide. This action utilises the existing petroleum infrastructure and avoids the trillion-dollar investments required to solve the infrastructure issues currently faced by electric and hydrogen fuel cell vehicles that lack charging and refueling stations.

Substantial capital investments by governments and other private corporations into new e-Fuel production plants will be required. Gradually increasing the e-Fuel admixture percentage can rapidly accelerate its scaled production to bring the prices down to widely affordable levels. Initiating more R&D into the e-Fuel production process and further development of ICEs to increase their efficiency will also be beneficial. For a social adoption of e-Fuel, it will be important to convey the benefits and lifecycle environmental impacts of e-Fuel to the public for them to consider their choice of transportation.

Overall, the e-Fuel is a promising and proven method to reduce the environmental impact and pollution emitted by the transportation sector in the most feasible way possible. Following the recommendations outlined in the report, will enable e-Fuel to successfully manifest itself because the bigger picture is significantly more valuable than the Mona Lisa.