

Position Paper on Synthetic Fuels: Study on Cost-Effective Options to Reduce Petroleum Use and Greenhouse Gas Emissions in Europe

Background

The EU Alternative Energy Policy requires a rapid and substantial reduction in petroleum use and the greenhouse gas (GHG) emissions associated with vehicle traffic. While numerous alternative fuels have been proposed to achieve the objective of a 20% substitution of traditional fuels in road transport by 2020, it is critical that we focus on those options that not only result in substantial reductions in petroleum use and GHG emissions, but are also the most cost-effective and easiest to implement.

About the study

A recent study by Jan Thijssenⁱ, LLC builds on previous well-to-wheels studies to address aspects of cost-effectiveness and implementation of alternative fuel scenarios in the EU for 2020. The study considered a wide range of alternative fuels (Exhibit 1) and vehicle types, including passenger cars, light commercial vehicles, and heavy duty trucks, capturing more than 75% of Europe's transportation energy use.

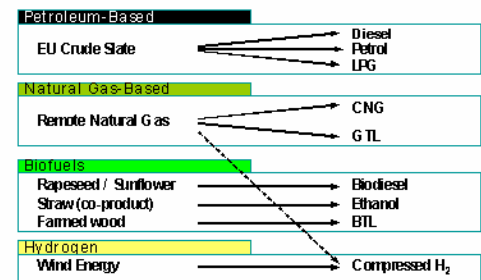


Exhibit 1 Alternative Fuels Considered

The J. Thijssen study demonstrates that the challenging EU targets for 2020 are achievable, with Synthetic Fuels (GTL- Gas to Liquids and BTL- Biomass to Liquids) offering the most practical solution.

Technically, a portfolio of fuels including CNG, biofuels, and hydrogen can achieve the targets, but require a massive investment in infrastructure and vehicles, at an added cost of about €145 billion/yr for the EU-25. However, a fuel portfolio scenario based on synthetic fuel produced from both natural gas and biomass plus cellulose ethanol would not only be much more cost-effective, but also quicker and easier to implement. Without the need for significant investment in infrastructure or vehicles, these same targets would be reached at a significantly lower incremental cost of around €3 billion/yr.

What are the options?

Resource / Fuel	GHG Emissions Reduction
Natural Gas /	
CNG	0 – 10%
GTL*	
Hydrogen	
Food Crops/	
Biodiesel	25 – 50%
Ethanol	
Biomass / (cellulose)	
Ethanol	75 – 90%
BTL	
Wind /	
Hydrogen	~100%

*If CO₂ emissions from the GTL plant were captured and reinjected GTL would result in a 20-25% GHG reduction, at a cost of ~30 - 70 €/ton CO₂ avoided

Exhibit 2 Well-to-Wheels GHG Reduction Potential

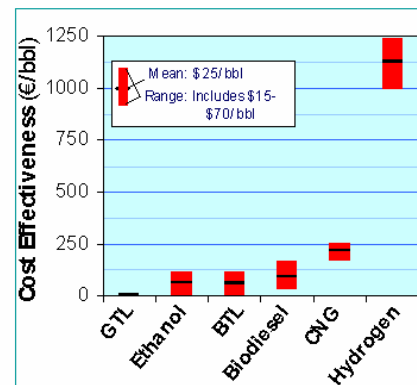


Exhibit 3 Cost-Effectiveness for Petroleum Savings

- *GTL fuel represents by far the most cost-effective means of reducing petroleum dependence (costing less than €5/bbl petroleum displaced)*
- *Second-generation biofuels provide the most cost-effective means of reducing GHG emissions (between €50-100/ton CO₂ equivalent avoided)*

On a well-to-wheels basis, each of the options considered could reduce petroleum use by 90% or more, but the impact on GHG emissions varies considerably (Exhibit 2), mostly because of the huge differences in net GHG emissions from fuel (and crop) production. Assuming crude oil prices of €40/bbl and identical levels of taxation on all fuel types, all alternative fuels, except GTL, are considerably more expensive to produce and use than petrol and diesel. Consequently, GTL is the most cost-effective in reducing petroleum consumption (Exhibit 3).

GHG emissions can be most cost-effectively reduced with biofuels, costing about € 50-100 per ton of CO₂ avoided. Gaseous fuels are substantially more expensive (more than €1000 per ton of CO₂ avoided) largely because of the relatively high cost of refueling facilities and on-vehicle fuel storage.

How do the options compare?

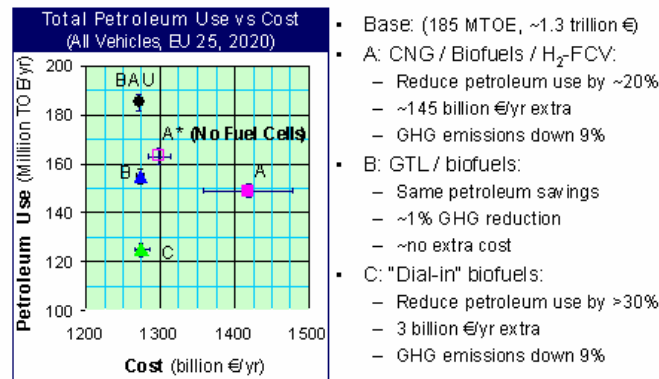


Exhibit 4 Comparison of Scenarios

- A fuel portfolio including synthetic fuels and cellulose ethanol will achieve at least a 30% reduction in petroleum use and a 9-15% reduction in GHG emissions at an incremental cost of approximately €3 billion/yr.
- A fuel portfolio including CNG, hydrogen, and biofuels will achieve a lower reduction in petroleum use (~20%) and a similar reduction in GHG emissions, but will cost around €145 billion/yr.
- A biofuels-only approach is likely to require significant biomass (or biofuels) imports to achieve similar reductions in both petroleum use and GHG emissions, but it would come at a cost of €5-10 billion/yr higher than the synthetic / biofuels option.

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ⁱ Link to the study: http://www.shell.com/home/content/shellgasandpower-products_and_services/what_is_gtl/benefits_of_gtl/gtlbenefit_0112_1630.html