Position Paper on Synthetic Fuels: Deployment

Introduction

Synthetic fuels can be produced from a range of feedstocks; biomass, coal and natural gas. Of the three synthetic fuel production pathways, Gas to Liquids (GTL) process is at the most advanced stage of commercial development. By 2010 synthetic fuels production via GTL process is expected to approach 100,000 barrels per day,. It is estimated that as many as ten large-scale GTL plants will be in operation by 2020, producing over 1 million barrels per day of GTL products. With the global development of both CTL and BTL, a combination of three technologies will be supplying increasing volumes of low emissions fuels to the transport market.

Regardless of the feedstock, all paraffinic Fisher Tropsch synthetic fuels made using the low temperature process have the same characteristics – they are high quality clean fuels that can be used in existing internal combustion (diesel) engines.

Synthetic fuels have excellent combustion characteristics with a very low propensity for exhaust pollutant formation, offering more efficient and cleaner burning in diesel engines. This results in reduction in hydrocarbon, carbon monoxide and particulate tailpipe emissions both in existing and future diesel vehicles. In short, synthetic fuels perform better in diesel engine due to their uniquely clean composition

Synthetic fuels can also be used as a high value blending component; when blended with diesel fuels derived from crude oil or biodiesel, the density, sulphur content, and aromatics content of the blend will typically be reduced, and the cetane number increased. All of these changes are directionally favourable in terms of availability of cleaner fuels and lowering of tailpipe emissions.

A number of potential market introduction scenarios can be envisaged for synthetic fuels. What will actually occur will depend on how and where synthetic fuel producers ultimately decide to market the product, but also on factors such as:

- Location of synthetic fuels production facilities,
- Availability of GTL, CTL, and in the future BTL fuels,
- Introduction of new vehicle technologies,
- Regulative framework in different regions including support to research and development and promotion of the use of synthetic fuels, taxation policies, fuel standards, etc.

These complex interdependences show that a holistic approach will be necessary to foster the market introduction of synthetic fuels in Europe in a cost-effective manner with fuel suppliers, automotive industry, and policy makers all having an important role to play.

Synthetic Fuels: Blend or Pure?

The first broad market introduction scenario is where synthetic fuels are used as a blending component to produce conventional diesel fuel meeting the existing diesel fuel standard, such as EN 590. Synthetic fuels can be used either to produce a high quality, differentiated, premium grade diesel fuel or to help refineries to satisfy an ever increasing diesel fuel demand by the optimization of refinery operations to improve yield, or fuel quality, or both. Used as a blendstock, lower density synthetic fuels can also enable greater inclusion of higher density biodiesel in the final diesel fuel blend, allowing further reduction of the greenhouse gas emissions without engine compatibility concerns or fuel labelling implications.

The second broad scenario is where synthetic fuels are used either neat, or blended in high concentrations, in order to provide an environmental or other benefit in a specific niche market or geographical location. Limited volumes could be targeted areas where they have maximum impact for example in large cities eg buses and taxis. As availability of synthetic fuels grows, this application could be expanded with the likely result that there is widespread availability of the fuel in a particular region, for example in Europe. This scenario would require a new fuel specification to be established, as the density of neat synthetic fuel is below the minimum stipulated in the current standard for conventional diesel fuels. This is purely a regulatory issue since synthetic fuels are technically compatible for use in existing diesel engines.

Finally, the widespread availability of synthetic fuels could facilitate the introduction of advanced, dedicated engines which have been optimized for operation with this fuel, with the aim of providing the most cost efficient integrated (engine + fuel) solution to meet future demands in terms of emission reduction and air quality improvements. This could be an attractive proposition for a number of users, for example captive (urban) fleets, such as city buses or taxis. As before, this scenario would also require establishment of a new fuel standard.

Vehicle and adaptation

A major advantage of synthetic fuels compared to other alternative fuels is that they can be used in existing diesel engines without any adaptation. When compared to a clean, so-called sulphur-free European diesel fuel (maximum 10ppm sulphur content), the use of synthetic fuels in unmodified vehicles enables significant reductions of hydrocarbon (HC), carbon monoxide (CO), and particulate matter (PM) emissions without compromising nitrogen oxide (NOx) emissions. Importantly, the use of synthetic fuels will have an immediate positive effect throughout the entire (diesel) fleet by reducing the pollutant emissions.

Very promising results can also be achieved by using synthetic fuels as blending component for conventional diesel fuels because the relationship between blend percentage and emission benefits can be “better than linear”. In some cases, blends of synthetic fuel and conventional diesel fuels may reduce emissions more than the blending ratio suggests. With a limited amount of synthetic fuel, blends will still provide some air quality benefits over a wider vehicle population.

Although the NOx reductions are minimal with the unmodified engine, significant reductions in NOx and soot are possible by re-tuning (software adaptation only) of any modern diesel engines. For neat synthetic fuels and optimised engines, a

conservative prediction projects possible simultaneous reductions of up to 45% in NOx and soot emissions.

There is significant unexploited potential for further reductions of exhaust emissions by fully optimizing engines around synthetic fuels. This will require further R&D with focus on software and hardware engine adaptation. By linking development of advanced engine concepts around unique properties of synthetic fuels it is expected that greater vehicle efficiency gains will lead to further reductions in fuel consumption and CO_2 emissions as well as vehicle performance improvements. However, market introduction of such optimized vehicles will likely require area-wide availability of neat synthetic fuel.

Infrastructure

Synthetic fuels can be supplied through the existing diesel distribution and refuelling infrastructure, avoiding costly investments often associated with the introduction of alternative fuels. Unlike alternative gaseous fuels, synthetic fuels can utilise tankers, pipelines, barges, railcars, trucks and tanks which are already in use for movement and storage of conventional diesel fuels. This makes synthetic fuels a cost-effective option for reducing petroleum dependency and diversifying clean energy supplies for the transport sector. When made from biomass, synthetic fuels also offer potential for large greenhouse gas emission reductions.