Renewable drop-in fuels – the key to decarbonising transport

On the fast lane

The EU targets a 40% reduction in greenhouse gas (GHG) emissions by 2030 and strategies, including reducing the carbon intensity of transport, are being shaped during this year. In July 2016, the European Commission (EC) released a communication paper for low-emission transport and set binding GHG emission targets for member states for the period 2021–2030.The decisions' goal is clear - by mid-century GHG emissions from transport will need to be firmly on the path towards zero and harmful air pollutants, such as nitrogen oxide, must be drastically reduced.

Decarbonising European transport requires effective use of all energy and technology options, efficiency of the transport system, low-emission alternative energy sources, and low- and zero-emission vehicles that support and reinforce each other. Low carbon, sustainable liquid fuels and electrification will have significant roles. It is also an opportunity for Europe to develop leadership in new products, such as advanced biofuels. However, as innovation is advancing rapidly especially in low-carbon fuels, any 2030 policy framework should have flexibility to allow novel feedstocks and fuel technologies to arrive on the market, provided that sustainability requirements are met.

Ready to invest

According to a recent evaluation of fuel and vehicle technologies by Roland Berger and a coalition of fuel suppliers and automotive companies, the road transport sector in the EU could significantly reduce well-to-wheel GHG emissions from today's 1,100Mton to 862Mton by 2030, and reduce emissions to levels targeted by the EC if the current regulations were extended to 2030.

The study suggests that increasing the penetration of optimised internal combustion engines (ICE) in the fleet could be a major contributor to this reduction. Based on modelling scenarios, efficiency technologies, such as improved diesel combustion employed in commercial vehicles including light commercials, buses, and trucks, as well as use of LNG, will likely overcompensate the effect of significant increases in transport volumes on GHG emissions. Biofuels also contribute significantly to the reductions in GHG emissions of both passenger cars and commercial vehicles.

Advanced drop-in biofuels made from non-food feedstocks represent one of the major industrial opportunities in the sustainable energy technology field. Provided the right long-term policy framework is in place, Leaders of Sustainable Biofuels (LSB), a consortium of leading European companies already investing in advanced biofuels, has stated that the companies stand ready to further deploy the most innovative technologies to produce advanced biofuels. The industry can contribute to the reduction of transport emissions, but also bring important additional benefits in terms of European investment, jobs, and energy security.

A cost-effective solution

The Roland Berger study concludes that to significantly reduce GHG emissions in road transport by 2030, biofuels and hybrid powertrains for passenger cars as well as biofuels and new truck concepts for commercial vehicles are the most cost-effective way of delivering GHG savings in transport. With supportive policies these means could deliver an extra 34Mton CO_2e by 2030. However, the study also calculated that bringing optimised engines as well as alternative fuel and vehicle technologies to the market could account for €380-390 billion powertrain costs from 2010 to 2030, and is a significant challenge for the oil and car industry. In addition, despite the expected reduction in cost of alternative technologies, their share of new car sales will remain relatively small and their influence on overall emissions currently remains marginal.

A recent study by the VTT Technical Research Centre of Finland and the VATT Governmental Institute for Economic Research concluded that the most cost-efficient way to reduce emissions is to invest in the production – and uptake – of domestic, advanced drop-in biofuels when the cost impact of the EU's 2030 climate objectives on Finland's energy system and national economy was assessed.

The main benefit of these drop-in biofuels is that they are already compatible with the existing distribution system and vehicle base. The high price of electric cars at present would mean a delay in large scale uptake until technology advancements bring down their price significantly. Also due to the slow pace of renewal in the car fleet, advanced liquid biofuels offer the most viable and fastest decarbonisation business opportunity up to 2030 and even beyond, though highly impacted by political decisions. Alternative powertrain scenarios in the study resulted in negative GDP development.

When driven, an electric car does not generate any emissions, but the CO_2 emissions of electricity

production may be high. When comparing total CO_2 emissions from well-to-wheel, advanced biofuels can achieve lower emissions than electric cars whose batteries are recharged with electricity produced by the average production methods in the EU. However, development of both low-carbon fuels and electric cars is needed to decarbonise transport.

A frontrunner

Finland has set ambitious 2020 renewable energy targets that have already been met. In road transport, the 20% target was surpassed by reaching a 22.3% share, and in general, a 39% share of renewable energy out of total energy end-use was achieved already in 2014. What is more, Finland´s 2030 renewable energy target in transport is among the highest in the EU – a 40% share of renewable energy by 2030 in transport and reduction of fossil oil-based energy by 50%.

In 2008, Finland set a long-term quota obligation for renewable energy in transport, increasing from 2% up to an ambitious 20% by 2020. Thus, Finland has seen the rise of a sizeable biofuel cluster and been a pioneer in sustainable advanced biofuels using residues, waste, and lignocellulose as raw material. The results of research and development (R&D) work in both privately held companies and in long-term collaboration projects with the government have proven successful.

One good example of UPM's own R&D work is the company's commercial-scale biofuels plant in Lappeenranta, Finland. Commercial production began in January 2015 with an annual production capacity of 120 million litres a year of wood-based renewable diesel for transport. The biorefinery uses crude tall oil, a residue of UPM´s pulp production, as its feedstock and is integrated into the existing UPM pulp and paper mill in Lappeenranta. The investment of €179 million was completed without public funding.

UPM invested €179 million in its advanced wood-based biorefinery in Lappeenranta, Finland

To further drive domestic investments and reach the new 2030 target, the Finnish government has assigned €100 million to investment grants for the demonstration of renewable energy technologies and projects. Grants will be awarded through a competitive tender in 2016-2018.

New innovations in biomaterials

There is also a growing need for certified renewable fuels in the biochemical and bioplastics industries, which are seeking replacements for fossil usage in their processes and end use. The alternative use for advanced drop-in biofuels and other output streams from modern biorefineries is within the new bio-based market segments, for example in bioplastics production as certified feedstock. Wood-based biorefineries therefore offer a possibility to expand the use of renewable materials.

Reflecting an innovative use of wood and biomaterials in the automobile industry is UPM's Biofore concept car. In the car the majority of parts that were traditionally made from plastic have been replaced with UPM's new biomaterials, such as thermoformable wood and biocomposites for injection moulding, and the vehicle runs on UPM's renewable wood-based diesel, UPM BioVerno. The wood-based materials can significantly improve the overall environmental performance of car manufacturing. The Biofore concept car demonstrates that we already have biomaterials and biofuels that are real alternatives to traditional oil-based materials.

No holds barred

In addition to changing the means and methods of transport and general improvements in the transport system, CO_2 emissions in transport can be reduced by improved energy efficiency and increased uptake of biofuels or electric vehicles. However, even with the most ambitious outlook from Bloomberg, which estimates that by 2040 electric vehicles will represent 35% of global new car sales, there will be liquid fuel demand in all transport modes, with heavy-duty road transport and shipping also likely to remain heavily reliant on liquid hydrocarbons. The development of diesel-substitute fuels is therefore a long-term priority, to be used alongside other solutions such as efficiency and electrification.

In road transport, the ICE will still be the dominant powertrain until 2030 and beyond. Even with more efficient combustion engines, successful deployment of electric drive technologies, and transfer of goods and passengers to more efficient modes, Europe will remain a consumer of liquid fossil fuels in 2050. There is a need to increase the use of renewable fuels, and use natural resources more efficiently. An integrated approach of technologies and fuel types will allow for low-carbon emissions in the road transport sector. A rapid increase in the demand for sustainable drop-in biofuels can be foreseen as they can be applied without changes in infrastructure. In fact, sustainable renewable drop-in fuels are a fast-lane solution for decarbonising transport. ●

For more information:
This article was written by Sari Mannonen, VP at UPM Biofuels.
Visit: www.upmbiofuels.com

The Biofore concept car represents a change in perspective and in the global approach to using renewable wood-based materials