High octane fuels

Engine efficiency improvement of ethanol blending

The engine efficiency improvement effect of increased ethanol blending is real phenomenon. It is perhaps the next big thing for ethanol policies.

The phenomenon

Modern engines require ever higher octane fuels as new designs increase engine efficiency. Higher-octane is the cure for "knocking", the inability of fuel combustion to match the timing needed by the engine. Ethanol has a high octane level (109), much higher than average petrol (87-92), so ethanol can be used as an octane-booster. When ethanol is blended in fuel the resulting fuel mix burns more efficiently resulting in extra energy in the engine. The engine is thus more efficient.

This effect can be maximised if engines are optimised for higher ethanol blends such as E20. Advanced strategies for increasing engine efficiency are enabled by higher octane number fuels provided by increased blending of ethanol. It allows for downsizing of engines, a promising way forward for more efficient vehicles bringing GHG and fuel economy benefits to consumers.

Refining high-octane fuels requires more energy and produces more GHG emissions. Ethanol is therefore a popular alternative to additives, such as MTBE, to increase octane level in petrol blendstock.

The scale of benefit

In blends such as E5 or E10, one MJ of ethanol replaces around 1.3 MJ of petrol. That translates into additional GHG saving, estimated around 28gCO2e/MJ, much larger than ethanol's iLUC impact (~13 gCO2e/MJ). The difference is that the impact is positive.

Current situation

Hardly any EU policy-maker, or other stakeholder is aware of this phenomenon let alone recognises its significance. There are no discussions, no debates. The US is ahead of the EU in high octane fuel science and policy debate[1]. We should tap their experience. The debate has reached the stage where the distribution of economic and fiscal benefits is in the focus, i.e. why should oil companies reap all the benefits, as is the case now?

Two things are needed for market penetration and optimal benefits: optimised engines and high octane fuels. Engines are not optimised to reap maximum benefits from higher octane fuels since the fuels standardisation process has been lagging behind. The car industry is not provided with the necessary fuel standards and related timetables of

[1] http://www.crcao.org/workshops/LCA%20October%202015/Session%204/Wang,%20Michael.pdf
http://www.crcao.org/workshops/LCA%20October%202015/Session%204/Anderson,%20Jim.pdf
http://www.crcao.org/workshops/LCA%20October%202015/Session%204/Speth,%20Raymond2.pdf

introduction of fuel blendstocks. It takes time to design optimised engines, and, furthermore, the replacement of vehicle fleet is slow.

High octane fuels are not on the market. When ethanol is blended, in theory octane level of the finished fuel should increase. However oil companies now use lower grade petrol as ethanol will anyway offset the decreased octane level, and there is no regulation in place that would require keeping the octane level of the petrol blendstock. Current practice allows for oil companies to use lower quality but cheaper petrol blendstock, given the premium qualities of ethanol blending will compensate for that. Thus, oil companies, for a financial benefit that is tiny, are every day engaged in a biofuel practice that is more than twice as bad for the climate as ILUC.

Way forward

What is needed are the following:

1. Discussions initiated in order for stakeholders to recognise and acknowledge the relevance of the phenomenon and its benefits.
2. Fuel standards taking for high octane fuels (E20 in particular) should be adopted to enable design of more efficient engines, bringing GHG reductions and better fuel economy and greater torque to consumers. The sooner manufacturers start introducing engines designed for higher octane fuel, the sooner the social benefits will be reaped.
3. EU policies should reflect the benefits provided by high octane fuels. One of the key areas is calculation of GHG emission profile of ethanol. Not just iLUC, but engine efficiency improvement is needed to include for comprehensive carbon accounting.

If all done well, it is reasonable to expect that ethanol will be increasingly recognised as way better than fossil fuels, an important tool in the fight to replace oil for the next two decades.

Zoltán Szabó