Could tougher specifications affect diesel supply?

The evaluation of the impact of various measures on the EU refining industry is generally based on the assumption that refiners will invest in order to meet both future demand and product specifications. Reality may be less clear-cut. While some refiners will indeed invest, others may resort to solutions such as changes to the crude diet, import/export of components or changes to the production pattern. In any business, the decision to invest has to be based on the judgement that a return can be made on the proposed investment and, if there are viable alternatives to investment, these decisions could be avoided or deferred.

In the face of a major change to product specifications, some refiners may consider the option of a volume reduction if it allows the new quality requirements to be met without investments. This is not always possible, but many specification changes offer that opportunity. Diesel density or T95 are such specifications, and new limits could be met by reducing production of diesel and jet fuel. In the context of the Auto/Oil II process, CONCAWE investigated the potential diesel volumes reduction that could be associated to a tightening of these two specifications.

DENSITY

The base case represented the 2005 Auto/Oil I scenario with the diesel density specification set at 845 kg/m^3 maximum. The specification was then reduced, first to 835, then to 830. For each density specification level the refinery blending target was reduced by 5 kg/m^3 in order to allow for the blending margin.

In the usual CONCAWE cost-modelling mode, all base case demands and crude supply are kept constant with the exception of one marginal crude (Kuwait) that provides the required degree of freedom. In this case, the diesel and jet fuel demands were allowed to fluctuate.

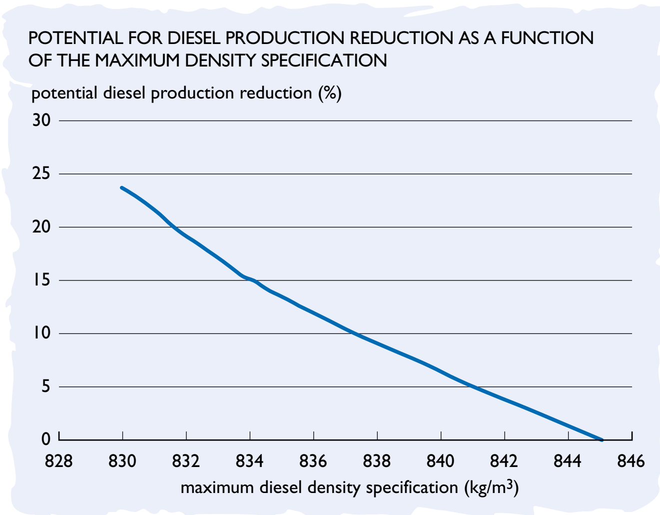
Table 1:
Dealing with diesel density reduction

Results of the CONCAWE investigation into potential diesel volumes reduction (global EU refining system)

	Base case	*no investment (worst case scenario)*		*normal investment*
Diesel density (kg/m^3)				
Specification	845	835	830	
LP maximum	840	830	825	
Present value of new plants (GEUR)	Base	None	None	7.8
Crude intake (Mt/a)	616	590	565	617
Main products (Mt/a)				
Gasolines	**143**	**143**	**143**	**143**
Jet/Kero	**47**	**31**	**35**	**47**
Diesel	146	136	112	146
IGO	76	76	76	76
HFOs	33	33	33	33
Worst case potential reduction Jet+Diesel		13%	24%	

The results pertaining to the global EU refining system are shown in Figure 1 and Table 1. The last column in the table represents the 'normal' investment case and shows that investing for a density of 830 kg/m^3 maximum would correspond to a present value of 7.8 GEUR for the EU-15 industry. The second and third columns represent scenarios where no investments are allowed, i.e. a 'worst case' scenario where all refiners decide against investment.

Figure 1
The potential effect of changes in density on production is not a linear function, mainly because the 845 specification is not universally constraining.



Low-density diesel production would therefore be possible without investment albeit at the cost of a diesel + jet fuel volume reduction of nearly 25% in the most severe scenario. The production volumes of all other products would be maintained.

Figure 1 shows that the effect is not completely linear. This is mainly due to the fact that the 845 specification is not universally constraining.

There would of course be some flexibility to swap between jet fuel and diesel although it must be noted that increasing jet volumes would increase the density of the diesel pool and therefore reduce the global volume even further. Similarly some gasoline reduction could be accepted in order to boost jet production. This is a likely scenario inasmuch as the base case includes gasoline exports out of the EU area. The scope is limited though, as short-cutting the straight-run naphthas is limited by hydrogen requirements (i.e. reformer intake) while kerosene flash point soon becomes a limit as EU refineries are not normally designed for maximum kerosene modes. Use of heavy FCC gasoline in diesel is extremely limited (if at all possible) because of the unfavourable properties of this stream.

The 25% reduction figure is an average. Local reductions would depend on specific conditions such as crude flexibility, refinery configuration and demand barrel. From a global point of view there appears to be little scope to improve on the average figure by varying the crude diet (within plausible boundaries).

T95

T95 stands for the temperature at which 95% of the diesel is evaporated (in the standard ASTM distillation procedure). It is a measure of the 'heavy ends' present in the fuel. The current specification for EU diesel fuel is 360°C.

Based on a recent CONCAWE internal survey, the current T95 market average is in the region of 350°C. This was our assumption for the base case, which was otherwise the same as for the density study. With the specification reduced to 340°C, the constraint would be much more significant and the give-away would decrease to maybe 5°C. Our assumption is therefore that the average would have to be reduced by 15°C (to 335°C) to meet a 340°C specification.

T95, like all ASTM distillation points, is difficult to represent accurately in a typical model that is invariably based on true boiling point (TBP) cuts. The relationship between the TBP cut-point and the ASTM T95 of a fraction is complex. Based on actual data, we considered here that a 10°C reduction of T95 would require a 13°C reduction of the cut point. For a 340°C T95 specification a cut-point reduction of about 15 x 13 /10 = 20°C would therefore be required.

In a no-investment scenario, all components removed from the diesel pool would have to find their way into IGO (industrial gasoil/heating oil) and HFO (heavy fuel oil). As the markets for both products are limited a reduction of crude intake to keep the IGO + HFO volume constant would be required (this is particularly true for inland refineries for which the bunker market for heavy fuel is not a practical option). The results are shown in the figure below where we have allowed both distillates and gasoline production to vary from the base case

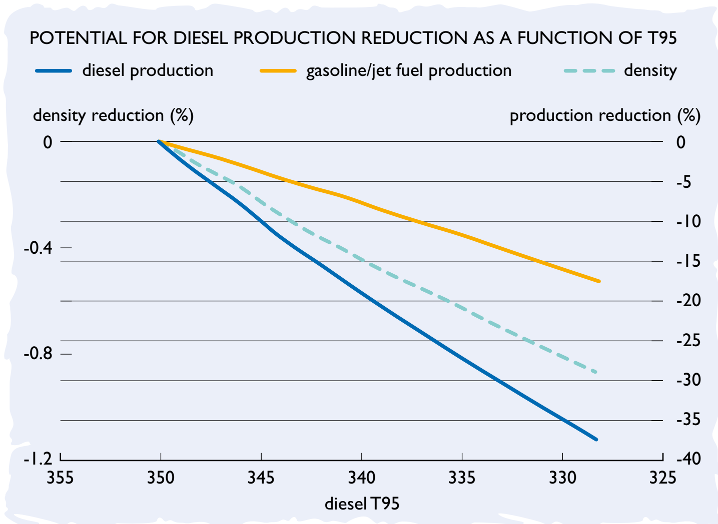


Figure 2
Potential yield reductions exceed 25% for diesel and are about 11% for both gasoline and jet fuel. Note that a reduction in T95 also has an impact on density.

The potential reductions exceed 25% for diesel and are about 11% for both gasoline and jet fuel. Again there would be some possibility of swaps between the pools. Blending additional kerosene into diesel would relieve the T95 constraint thereby somewhat increasing the total distillate pool. Whether it would be economic to do so would depend on the relative value of jet and diesel. Although such scenarios were not explored in this limited study, we do not believe the overall figures would be much affected. As illustrated in the graph, the T95 reduction also has impact on density.

SUPPLY IMPLICATIONS

Reductions in the diesel density and/or T95 specification, such as envisaged in the Auto/Oil II programme could be achieved by foregoing volumes rather than investing in new plants. At the level envisaged in the Auto/Oil II programme, the shortfall 'worst-case' potential is as much as 30% for diesel and, as a knock-on effect, about 10% for gasoline and jet fuel.

Although a shortfall of such magnitude is unlikely to develop in reality, these calculations highlight the potential for supply disruptions. In an expanding distillate market, the conclusion by some refiners that investment might not be economically viable could be sufficient to create a small but significant shortage. Other refiners, already stretching their production capabilities, would find it difficult to cover the deficit. The scope for imports is likely to be limited especially in a very low sulphur specification scenario. This was recently illustrated in the USA, where even marginal shortages (or the perception thereof) seems to have had disproportionate effects on the markets with severe price implications.