Cost of Low Sulphur Diesel Fuel in Asian Refineries

The Asian Development Bank commissioned a study on the cost of diesel fuel desulphurisation in refineries representative of the conditions of the countries in South East Asia, the People's Republic of China and the Indian Sub-Continent. The costs were calculated both for the average refinery structures of the 12 countries in question, and for 10 refinery configurations, typical of the Region, which are encountered across the 12 countries.

For refineries representing the average country structure, and manufacturing 2,000,000 t/y of diesel fuel each:

- The existence of Low/Medium Pressure Hydro-treating units in the base case is predicted to significantly reduce the need for capital investments mainly for diesel fuel sulphur limits above 500 ppm.
- For sulphur limits at or below 500 ppm, the presence of High Pressure Hydro-treating units and/or hydro-crackers becomes more important.
- Sulphur limits down to 50 or 10 ppm can only be satisfied through the deployment of hydro-cracking units of high capacity. Therefore only refineries with existing hydro-cracking capacity in the base case require sizeably lower investments to achieve the sulphur target.
- The use of low sulphur crude oils has an important impact in reducing the necessary capital investment, only for diesel fuel sulphur levels above 500 ppm. At or below this value, the delta between the investments required with high and low sulphur crude oils becomes relatively smaller, and the use of low sulphur crude oils becomes economically unattractive. This point is emphasised by the calculated diesel fuel cost increase, which is higher in the low sulphur crude cases.
- In the diesel fuel sulphur range between 500 and 250 ppm, the incremental capital costs, relative to the 250 ppm limit versus the 500 ppm limit, are 10% to 20% higher for the countries which refineries already include large hydro-treating and/or hydro-cracking capacity in the base case, but only 2% to 4% for the other countries. This is due to the fact that the refineries of the first group of countries could meet the 500 ppm diesel fuel sulphur limit with a lower level of new investments.
- Reducing the diesel fuel sulphur limit from 250 to 50 ppm represents a major change in terms of refinery processes required and capital investments. In fact the 50 ppm limit requires sizeable hydro-cracking capacities. As a consequence, the calculated investment costs for the refinery structures representative of the average conditions of the countries under study increased from a range of $ 150M to $ 185M, for the 250 ppm limit, to a range of $ 375M to $ 450M (i.e. by a factor of 2.5 about). The countries with refineries that have already invested in hydro-cracker units in the base case are predicted to require the lowest investments.
- These higher investment costs are reflected in the additional diesel fuel product costs, which are calculated to increase from a range of 0.95 to 1.58 cents per litre, for the 250 ppm case, to a range of 2.36 to 3.24 cents per litre, for the 50 ppm case (i.e. by a factor of 2.0 to 2.5).
- The investment required to satisfy a diesel fuel sulphur limit of 10 ppm is calculated to be up to 10% higher than that required to meet the 50 ppm limit.
- The data show that, for diesel fuel sulphur limits below 350 ppm, all refinery structures and configurations tend to converge towards a uniform approach, in order to achieve the sulphur target. For these severe sulphur limits, also the investment costs of the various refinery configurations considered in this study tend to become of the same order of magnitude.
- Overall, finding the capital funds necessary to invest in the severe diesel fuel desulphurisation units, which are needed to meet severe sulphur limits, appears to be the biggest obstacle to achieving low sulphur diesel fuels in the short range. However, for the most severe limits, also diesel fuel cost increases of the order of 3.0 cents of US dollar per litre or above cannot be ignored.