Energy use and CO_2 emissions in refinery operations

Processing requirements increase while energy efficiency improves.

Increasing the complexity and severity of refinery operations to meet new product specifications, necessarily leads to an increase in energy use. This can be (partially) offset by improved energy efficiency. What options are available to reduce overall CO_2 emissions?

Reducing CO_2 emissions would be a challenge to the oil industry and its customers. Some of the main trends that can be expected for the oil industry are:

- Impact of recent legislation regarding environmental product specifications. Individual refineries' responses may include solutions that rely on crude quality (e.g. increased use of low-sulphur crude), investment in new processing plants and abandoning part of the market.
- Improving energy efficiency both inside refineries and with customers. The overall effect aimed for is a reduced demand for fossil fuels. Member States may follow different strategies in terms of passenger car taxation, influencing the mix of fuels in the market and substitutions to gas or other alternative energy sources.
- Fuel switching in markets from coal to oil to gas, driven by considerations of SO_x, NO_x and CO_2 emissions. We may see a further increase in the use of natural gas replacing both heating oil and inland fuel oil.

Options for efficiency improvements that have already been implemented to a degree are:

- increasing heat integration inside process plants or across processes;
- combining activities so that process streams need less heating and cooling, e.g. combining desulphurization with distillation, or adding dewaxing capability to HDS catalyst system; and
- CHP (Combined Heat and Power) combining power generation with process heat needs.

The product demand effects are rather unclear; the political aim is to reduce CO_2 emissions (greenhouse gas) while limiting adverse effects on GDP growth. Generic options, with the potential to reduce specific carbon emissions, are the promotion of higher efficiency equipment (e.g. low energy use vehicles, light bulbs, etc.) or improving systems' efficiency. Creative thinking is required to develop cost-effective ways of contributing to the often-conflicting goals that society sets out to achieve.

Shifting to energy sources with a higher heating value/carbon content ratio may also contribute, and options include shifting from coal use to oil and gas. Reducing the carbon content of petroleum fuels by hydrogenation is not a viable option to reduce CO_2 emissions. The extra CO_2 emissions from hydrogen production will exceed the reductions in vehicle emissions. Alternative fuels are mostly not economic in themselves, therefore their contribution to the total energy supply will be determined primarily by fiscal measures, which distort competition.

In conclusion, the efforts to reduce energy use and shifts between fuel types will make the product demand mix hard to predict.