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Rolling waves of change for the refining sector from 2020 to 2050

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The refining industry has become known for its resilience and adaptability. These attributes will be essential to help it weather a perfect storm that is brewing, which will have far-reaching consequences for the sector through to 2050. The elements of the storm were discussed extensively at PRC Europe 2019 (<https://prceurope.com>) in Budapest, Hungary, on 20 and 21 of May. The congress attracted 400 participants from refineries and suppliers to the sector worldwide.

The storm will break on 1 January next year, with the implementation of the IMO 2020 regulations for marine fuels. But preparations for that milestone are already well under way. Presentations from refiners Galp in Portugal and Tupras in Turkey revealed the advanced stage of the preparations and investments that they have been making to secure their viability post IMO 2020. The challenge is that the shipping industry will begin to use more middle distillates and less heavy fuel oil to reduce sulfur emissions.

Refinery upgrade investments are required to ensure that the product mix remains relevant and profitable. One option is to invest in a 'delayed coker unit' to convert the heavy fractions to coke and marine gas oil (MGO). An alternative outlet for the heavy-ends is to process them in gasifiers which produce syngas for IGCC power generation. This is the option that has been taken at the Saudi Aramco Jazan refinery in their project to construct a 2.4 GW power plant which is integrated to the refinery.

Looking further to the future, the automotive sector will also drive changes in the refined



products fuels mix. The growth of electric vehicle usage and the emergence of hydrogen and LNG as transportation fuels will progressively erode the demand for diesel and gasoline. Capacity additions in Africa and the US will curtail export markets for gasoline produced in Europe. Despite the growth of new automotive fuels, the shortage of diesel in the European market is expected to deepen as it continues to be the fuel of choice for heavy vehicles and it will now also be diverted to marine applications as MGO. It all adds up to an uncertain dynamic in the product mix but clearly indicates over-capacity for gasoline production in Europe.

One alternative outlet for the surplus of lighter fractions in the European downstream arena will be to convert them to higher value petrochemicals. This was the topic of several keynote speakers who successively took the stage at the congress to emphasise the importance of refinery and petrochemicals integration.

Whilst the long-term threat of vehicle electrification to the refining sector was being discussed intensively in Budapest, some overseas participants were surprised at the extent to which these issues are getting attention in Europe. Tom Schachinger, Operations Director and Mechanical Engineer at F4 Engineering, commented that: “we work very closely with US refineries on the West and East coasts to provide them with routine maintenance and turn-around engineering services. Even the teams that we support in California, which has a reputation for being ahead of the curve on electric vehicles, are not talking about the need to use petrochemical production as an outlet for refinery products in the same way that I have experienced it here at the PRC Europe 2019 this week.”

Even further out are the Paris Agreement 2050 targets for carbon dioxide emissions reductions to slow down climate change. Refineries and other industrial activities will need to undergo a major transformation in their operations to play their part in reaching this goal. One option is to increase the quantity of bio-based feedstocks to the refinery to create renewable biofuels. A strategy that Neste Oil in Finland explained they have been pursuing for many years with great technical and commercial success.

Some operators reported carbon dioxide emission intensity reductions in the order of 20% in the past 5 years through a series of process equipment upgrades and the implementation of basic best practices, such as the use of additional steam traps. Production of the electrical power required for refining operations through renewable wind and solar routes is also an emerging strategy for de-carbonisation of refinery operations. More futuristic climate action mitigation strategies include re-use of carbon dioxide emissions to produce chemicals, such as the production of polyurethane via polyols. The pace of catalyst innovation in that sector and the recent steep rise in the cost of carbon dioxide emissions trading scheme credits may make that see that technology commercialise sooner than many had previously thought possible.

Written by Stephen B. Harrison, Principal, Germany at Nexant Energy & Chemicals Advisory.

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