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HP Viewpoint

JEAN SENTENAC, PRESIDENT AND CEO
Axens

Improved design practices can aid environment, energy transitions

JEAN SENTENAC was named Axens president and chief executive officer in 2002. Since that time, he has guided the development of Axens as a leading supplier to clients in the hydrocarbon processing industries.

Among Axens' and Mr. Sentenac's top priorities are ensuring client trust and satisfaction, advancing employee development and technical expertise, upholding safety in operations and maintaining respect for the environment.

Prior to his role as president and CEO, Mr. Sentenac was deputy CEO at Axens and deputy executive director of IFP's industrial division. He began his career in engineering and construction with Air Liquide, followed by 10 years of experience in the chemical industry with Rhone-Poulenc and Rhodia, where he managed life science and aroma organic chemicals business units.

Mr. Sentenac graduated from France's École Polytechnique and holds a post-graduate engineering degree from the IFP School.

During the first months of 2016, perspectives for a stabilizing oil market were being confirmed. Excess supply should curb, given the unforeseen high increase in global oil demand (1.3 MMbpd in 2016) and the decrease in the production of OPEC and non-OPEC countries. Decreasing investments in exploration and production since 2014 could translate to a production shortfall as we approach 2018–2020, leading to a new oil crisis.

The refining and petrochemical industries have been required to continuously innovate to overcome numerous challenges. One of these challenges is responding to volatile feedstock and product prices. Crude oil prices have ranged from $140/bbl in August 2008—just before the price collapse due to the economic crisis—to $40/bbl. Prices then recovered and stabilized at around $110/bbl for two years, before falling again to just above $30/bbl in early 2016.

In this ever-changing situation, our industry has continued to deliver mobility for a constantly decreasing environmental impact. Refining/petrochemical integration, the contributions of licensors and catalyst providers like Axens to the energy transition, and the improvement of air quality are focuses here.

Refining and petrochemical integration. This integration is an efficient way to mitigate risks related to raw material and product price variations, and to benefit from the stronger dynamic of the petrochemical market and improve asset profitability.

Numerous molecule streams can be exchanged between sites, improving the profitability of both assets. This ranges from lighter streams, such as refinery offgas, to low-market-value vacuum and atmospheric residues, which can be transformed into highly valuable molecules, such as olefins or paraxylene. This transformation is made possible through a process scheme combining bottom-of-the-barrel conversion and petrochemical technologies. The majority of these transformations require ever-higher-performing catalysts.

Increasingly active and selective catalysts. Catalysts are of paramount importance to the refining and petrochemical industries, since they allow the execution of a desired reaction faster and more selectively than in a non-catalyzed manner. This process has huge economic benefits: higher desired product selectivity, lower operating costs through lower operating temperature and/or pressure, and higher energy efficiency and safety.

The downstream catalyst market has grown substantially over the past years, driven by several factors:

- An increase in global demand for refined products (mainly due to increases in gasoline and diesel demand) and petrochemicals
- The specifications for transportation fuels have tightened around the world, with more countries requiring ultra-low-sulfur levels
- The need to convert the bottom of the barrel results in increased demand for conversion catalysts.

As a result, increasingly active and selective catalysts will continue to be required.

Air quality. For more than 20 years, gasoline and diesel have been gradually reformulated to reduce the impact of their combustion on the atmosphere. This shift has been conducted in conjunction with improvements to automotive engine exhaust treatment devices, such as catalytic converters. Sulfur was a particular concern, as it results in SO_2 when burned and poisons the exhaust treatment catalyst.

Over this 20-year period, sulfur content in gasoline has been reduced by a factor of 200, considerably improving air quality, notably in large cities. These changes, implemented at first in OECD countries, are now being gradually applied around the world. For example, China recently announced that in 2017, its on-road fuels will contain less than 10-ppm sulfur.

Axens actively participates in this change by developing an innovative, simple process and selective catalysts to concentrate the relevant fractions of gasoline to treat them selectively down the line, thereby reducing octane losses. This process is now a market benchmark and has been sold more than 265 times.

The next challenge will be to decrease sulfur content in marine bunker fuels from 3.5% to a maximum of 0.5%.

Energy transition and energy efficiency. With ever-tightening environmental regulations, additional significant challenges are emerging from the energy transition and climate change to drive innovation.

According to the International Energy Agency, "Something is more energy efficient if it delivers more services for the same energy input, or the same services for less energy input." Humanity has finite hydrocarbon resources at its disposal. An optimized use of these resources is necessary to extend their lifespan. Improved energy efficiency of refining and petrochemical processes is a way to achieve this goal, as well as manage greenhouse gas emissions and create value.

Energy consumption represents 34% to 69% of a refinery's total operating costs, depending on its location and local energy costs. Therefore, every fraction of energy savings can translate to value creation.

Axens' experience as a licensor has taught us that during projects, a tight schedule and lack of time mean that energy efficiency is not sufficiently optimized. To take full advantage of the company's strong knowledge in process and technology, Axens has introduced its Custom and Efficient Early Design (CEED) methodology. During the early stage of the project, in close collaboration with refiners, alternate schemes are defined and carefully evaluated. The most appropriate option is selected, taking into account energy constraints, CAPEX, OPEX and plant operability.

The CEED methodology ensures that choices are made based on a sound knowledge of the various options available, and that they will provide the best possible return to the future plant.

For a new VGO hydrotreating unit in Europe, Axens applied the CEED methodology in the early phase of basic engineering. Several process schemes and heat integrations were studied during heat and mass balance, as well as during the PFD development initial phase, adding only three additional weeks to a standard basic schedule. This activity was performed in close collaboration with the refinery's team. It allowed the refiner to select the optimum scheme according to several criteria, including economics and energy efficiency.

As a result, three tailor-made options were proposed. Ultimately, refinery management made its final decision based on investment costs, utility operating costs and operational flexibility.

The CEED methodology can also be applied to the optimization of water consumption. It is important to bear in mind that approximately 60% of refining and petrochemical sites are subject to a water stress that is considered medium to high, and 25% are located in areas where precipitation is expected to decrease. For those regions, water consumption is already a concern; Axens believes that reduction of water consumption will soon become a priority. HP