

What are the important trends affecting the downstream processing industry this year? Executives and experts forecast challenges and prospects that could affect profitability

Rajeev Gautam
President & CEO
UOP LLC, A Honeywell Company

Our industry is poised to enter a new phase of growth and technology evolution, but there continue to be problems we must solve. The shift in product demand, tighter fuel specification regulations, the need to maximise the products we get from a barrel of oil and the emergence of new alternative feedstocks will present challenges to refiners around the globe and ultimately drive new solutions.



We are experiencing a shift in the mix of fuels consumed. The demand from emerging regions such as India, China and the Middle East, along with ethanol substitution for gasoline and enhancements in engine technology, are driving higher demand for diesel relative to gasoline. For our industry, this results in increased emphasis on hydrocracking technology and catalysts. For UOP specifically, it means continued enhancement to our Unicracking process technology and new catalyst solutions that will maximise distillate yields.

Many refiners will look to shift fuels production from gasoline to diesel or remain flexible to shift between the two as needed. The economic solutions to address these requirements are often not straightforward, but continued advancements in both process and catalyst technology will allow refiners to respond intelligently to changes in the market while maximising profitability.

This shift to diesel also drives an emphasis on bottom-of-the-barrel processing. Technology advances and improved configurations for heavy oil processing will drive higher distillate yields and give refiners a significant advantage when competing in a global market.

The tightening of fuel quality regulations around the world, including reductions in benzene, olefins and aromatics in gasoline and the global movement towards ultra-low sulphur fuels, will continue to be a driver for our industry. The recent implementation of MARPOL regulations has led to the creation of emissions control areas restricting SO_x emissions in the North and Baltic Seas, with future implementation in

North America occurring over the next few years. Refiners will need to convert high-sulphur bunker fuel to fuels that comply with these emissions control area requirements.

Additionally, the continued increase in global petrochemical demand, particularly in regions such as China and India, is driving rapid expansion in this sector. This demand also has refiners looking for new ways to improve the value of their existing product slate with petrochemicals production. The latest FCC technology enhancements can achieve more than 20 wt% propylene yield, but new ways to upgrade other FCC products to higher value petrochemical products can bring more profitability.

Of course, there continues to be a great deal of interest and many global drivers for renewable fuels. Technology improvements in the last several years and advancements in feedstock availability and processing are bringing efficient, cost-effective drop-in biofuels closer to commercial reality. We have successfully demonstrated technologies that maximise existing infrastructure, meet fuel specifications and address concerns around growing greenhouse gas emissions. These fuels have an enormous potential to contribute to our fuel supply.

There is a great deal of change happening in the refining industry today. The real key for all players will be to maximise the yield of valuable finished products from every single barrel of oil processed. This will include new processing solutions and optimisation projects that deliver strong returns.

Umberto della Sala
CEO, President and Chief Operating Officer
Foster Wheeler

We are certainly seeing increased activity in all of the hydrocarbon-related business sectors in which Foster Wheeler's Global Engineering and Construction Group operates: onshore and offshore upstream oil and gas, midstream/LNG, refining and chemicals. The global economy continues to recover, broadly in line with expectations. Product demand is also recovering, and is helping



to bolster client confidence in progressing their investment plans.

Certainly, we have a good prospects pipeline, although it is true that clients are in some cases taking longer to reach final investment decision or are releasing projects in phases. We have a number of projects that are going through the final investment decision-making process and for which we believe we are well positioned. And we are seeing new opportunities continuing to emerge, particularly in Asia, the Middle East and South America.

Looking forward into 2011, we see three key themes. First, client confidence in pursuing upstream oil exploration and development opportunities has returned. The offshore and onshore upstream sector remains a strategically important market for us and one in which we are further developing our skills and service portfolio. The award of the pre-FEED and FEED for the Cardon IV Perla Field Development, an offshore development by ENI and Repsol in the Gulf of Venezuela late in 2010, is a good example of our success in leveraging the offshore skills and expertise we have brought on board through acquisition.

Second, we are seeing increased emphasis on local service delivery. This has always been important to us and is becoming an even stronger area of focus for us and for our clients. We have made further strides forward this year, for example in Saudi Arabia, by developing our own resources and by building

relationships with local or regional contractors to enable us to deliver the Foster Wheeler product locally and competitively to our clients, in line with local content requirements and our clients' preferences.

The third theme relates to the size and complexity of projects. Large projects are getting even larger and more complex; for example, the planned Saudi Aramco/Dow petrochemicals complex in Saudi Arabia, the scope and scale of some of the planned investments in Iraq, and the planned investments in both upstream and downstream in Brazil. Size and complexity play to our strength.

As we have said before, competition remains strong everywhere. We are focusing on those opportunities where we believe we have differentiators, such as our technologies, our know-how, our client relationships, our global presence and our ability to work with clients from the very earliest phases of projects to help them shape their investment, and our proven track record of safely delivering technically complex and very large projects.

Based on our discussions with our clients regarding their investment plans, and the underlying supply and demand fundamentals, the outlook for the industries we serve is improving.

George Bright Chief Executive KBC Advanced Technologies

With global refining capacity far in excess of current demand and still more capacity under construction, a key question for the downstream energy industry in the next several years is: how will global markets find balance between this surplus refining capacity and post-recession demand recovery?



The dichotomy between regions is quite striking: lower demand, ageing assets and declining operating rates in Europe, North America and Japan vs GDP growth and increased demand in China, the Middle East and Latin America. With explicit national energy security and job creation objectives, growth markets are adding refining capacity despite an existing global glut. Like the collisional boundaries of two tectonic plates, the geographic shift in the supply-demand curve will have volatile consequences. KBC has just released its first *Global Energy Perspectives*, discussing our views on the global refining sector over the next several years, and the factors influencing returns on energy investment and economics.

While there are numerous factors determining the overall global balance, there are three trends we have identified that are particularly noteworthy:

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- Traditional rules of free market economics do not completely apply in the energy sector, yet they are not completely ignored either. Despite overcapacity, certain large-scale projects will likely progress. It is no longer solely about economic returns; decisions have also been made based on local job creation and “corporate social responsibility”. Only certain national oil companies and a very few, select independent oil companies can bear the financial burden of such projects alone, irrespective of economic returns. Third-party financing, however, does follow free market economics and to an extent certain projects progress, others may be delayed or cancelled until rates of return are adequate to justify their investment

- Capacity in mature markets is clearly at risk of closure or idling. Traditionally, the view has been that the bulk of this closure would occur in the Americas. However, while no geography is immune, KBC’s alternate view of the market as three vertical segments (vs the traditional Pacific-Atlantic Basin view) illustrates key issues that would suggest European capacity is at the greatest risk. The announced closure of two French refineries in recent months is an example of this

- Much focus has been placed on India and China. It is true that refined product demand in these geographies will drive overall growth for the next 20 years. However, less often discussed are the global impacts that Brazil, the Middle East and Russia will also have on world markets. With the completion of

planned projects in Brazil and the Middle East, both regions will become product powerhouses that can create significant shifts in the traditional industry dynamics. Furthermore, depending on future strategic actions, Russia has the potential to significantly influence both the European and Asian refining markets.

Bharat Srinivasan
Co-Managing Director
Chevron Lummus Global

For refining and the technology providers that support refining, the outlook for 2011 appears hazy with a chance of clearing. After the 2008+ downturn, 2010 did show some signs of life which varied regionally and within regions, locally. The Europe/Middle East region demonstrates this. Russia and other Eastern European countries continued with projects that had been sanctioned prior to the downturn but at a measured pace, as companies struggled with costs and ownership issues.



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Thus, projects that Chevron Lummus Global (CLG) had designed in Russia at multiple locations went into detailed design and construction, but with changes and some delays. The Kirishi plant that had been designed over a decade ago is gradually approaching mechanical completion. Meanwhile, several new plants designed by CLG in the same region are advancing at varied pace. For example, the new hydrocracking complex in Croatia at INA's Rijeka refinery went into commissioning mode and a similar complex at NIS Pancevo in Serbia moved into EPC.

Heading towards southern Europe, some projects contemplated by ENI in Italy were deferred, while others were commissioned successfully. Similarly, the Samir hydrocracker plant in Morocco was commissioned. GALP in Portugal continued the construction of its hydrocracker in Sines for a start-up in 2011. The Saudi projects progressed, with the Saudi Aramco-Total Jubail venture and its huge hydroprocessing complex on schedule, and the Yanbu project suffering a schedule setback when Conoco-Phillips pulled out, only to have Saudi Aramco decide to proceed on its own.

In contrast, the fate of the New Refinery Project (NRP) and Clean Fuels Projects (CFP) in Kuwait remain unclear. The Asia-Pacific region does show more vitality, but some of the same trends can be seen. Korean companies actually cancelled or deferred projects, although Hyundai advanced its RDS/RFCC project towards mechanical completion in 2010 and GS-Caltex plans to commission its HOU-3 project by the end of 2010. Both the RDS plant at Hyundai and the LC-Fining unit at GSC are CLG licensed. Japan's government is attempting to impose upgrading/distillation ratio controls and some capacity rationalisation will be the result.

China started out 2010 full of promise for more than a dozen projects, yet, through the year, the projects remain but their execution has been delayed. In some cases, Chinese companies are in joint ventures with upstream suppliers (eg, PDVSA or Rosneft) and getting agreements on configurations, product objectives and crude slates has been difficult. In other cases, there have been issues with environmental clearances and competing projects, but generally the major state-owned companies — PetroChina, Sinopec, CNOOC and Sinochem — appear to have slowed down their project execution schedules, although none of the projects has been cancelled. In the meantime, private companies seem to be filling some of the void. Fuel demand continues to grow at an impressive rate and, while supply at the moment appears to balance, over the next five years the projects will need to be executed to maintain this balance, which seems to be China's intent.

India appears for the time being to be in an overall product surplus mode and, with new plans by Reliance to expand its complex further, new projects over the next years may be limited to revamps and expansions in existing refineries. BORL (a joint venture between BPCL and Oman Oil Co) is

commissioning its first refinery in the middle of the country at Bina this year to address local product shortfalls. The rest of Asia-Pacific has projects under evaluation phase. A major decision will be made next year on Vietnam's third refinery project (NSRP), a joint venture between PetroVietnam and Kuwaiti and Japanese partners.

The Americas continue the storyline. Some small refinery shutdowns have been announced as well as

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refineries for sale. PBF Energy is picking up assets from Valero at Delaware and Paulsboro. Slow signs of revival in the Tar Sands of Canada are evident as deferred projects such as North West Upgrading and Nexen/OptiCanada look set to restart. Although Shell Canada announced cancellation of its Upgrader-2 project, it also opted to increase processing capacity gradually through a series of paced expansions at its existing facilities.

South of the US border, there is more action, as countries such as Bolivia, Costa Rica and Mexico

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revive plans to rectify their local product imbalances and product quality deficits, while Brazil's intention to refine its own growing crude production could lead to increased refining capacity.

Charles T Drevna
President
National Petrochemical & Refiners Association

President Barack Obama and congressional leaders in both parties agree that cap-and-trade schemes designed to reduce greenhouse gas emissions face too much opposition in Congress to become law in 2011 or 2012.



The cap-and-trade bill passed by the House of Representatives in 2009, and similar proposals that never even came to a vote in the Senate, would have been both economically prohibitive and highly ineffective in reducing global carbon dioxide and other greenhouse gas emissions.

Reducing greenhouse gas emissions in the US or any other developed nation will accomplish nothing if the emissions are just moved to developing countries in Asia and elsewhere, where they do not have strict emission controls. This is exactly what is happening as a result of the cap-and-trade restrictions being imposed in some developed nations.

As a result, the International Energy Agency says that more than 80% of the expected worldwide increase in greenhouse gas emissions between 2005 and 2050 will come from developing countries. These are primarily China, India and nations in Southeast Asia.

The only thing a US cap-and-trade plan would have created if it had become law would have been a complex and confusing trading system similar to a giant casino. Speculators would have wagered huge sums of money on the ups and downs of a new carbon market, benefitting no-one except those who made the right bets.

Where does America — and the world — go from here? Can the divide between environmentalists who rail against any energy source-emitting carbon and the petroleum refining and petrochemical industries ever be bridged? If we focus more on ideas and less on ideology, we can make important progress.

Nations around the globe can best deal with climate change and build a successful energy future by relying on three things that turned the US and most other industrialised nations into the productive, prosperous and advanced countries they are today: science, technology and the free market system.

The same creativity, inventiveness and entrepreneurial spirit that drove Alexander Graham Bell, Thomas Edison, Henry Ford and, more recently, Bill Gates and the pioneers of the internet to transform our world should be unleashed again to solve

energy challenges that some consider insurmountable.

Instead of focusing on picking winners and losers, governments should encourage “all of the above” solutions to the climate and energy challenges the world faces, utilising technology and a broad range of energy choices.

The world's energy and climate future should be built on a strong foundation of incentivising innovation and excellence. If nations around the world do this — focusing on creating a new prosperity with the creative power of our minds — there is no limit to what we can accomplish.

Suleyman Ozmen
Vice President, Refining and Chemical Licensing
Shell Global Solutions

Refiners globally will continue to face numerous challenges in the coming year, and principal among them is “the sulphur paradox” or the increasing need to manage sulphur to help increase margins, while simultaneously meeting legislative requirements. As the global population rises, we can expect limits on sulphur in retail and transportation fuels to become more stringent as the demand for these resources increases.



At a time when the economy is lagging and many refiners are short of cash, the need to meet or exceed changing product specifications will be an undoubted concern for refinery managers. For example, the economy in Russia remains extremely tight and, despite financial constraints, refiners must be in a position to meet the Euro III transportation fuel regulations beginning in January 2011 and prepared for Euro V by 2015. Also, while local product specifications need to be taken into account, export markets can bring different demands. With the Middle East now providing significant product to Europe, refiners must comply with 10 wppm sulphur product specifications even when it is not required for their own domestic market. In developing markets, tighter specifications for motor gasoline (mogas) or gas oil will also be imposed increasingly.

To confound the issue, with insufficient “easy” oil and gas to meet demand on a global scale, refineries will have to process heavier, sourer crudes. As such, during the next five years and beyond, refiners must look forward to find more viable solutions. Sour crudes have a greater sulphur content that after conversion comes out as more hydrogen sulphide (H₂S) and sulphur oxide (SO₂). Additionally, nitrogen oxide (NO_x) and carbon dioxide (CO₂) are emitted during the refining processes. One solution to this challenge can be found in the advanced hydroprocessing technologies that process heavier,



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more sour crudes into high-value transportation fuels. Additionally, depending on country emissions requirements, minimum amounts of SO_x and NO_x may be released via the stack. These hydroprocessing technologies can be combined with gas treating/absorption solutions to help cap these emissions.

In response to the sulphur management issues that are arising within the industry, Shell Global Solutions, Criterion Catalysts & Technologies and other alliances introduced The Sulphur Technology Platform, a comprehensive, customisable and integrated sulphur solution to meet emissions and product requirements and facilitate the processing of heavier, more sour crudes. This sulphur technology platform uses deep flash technology that cuts deeper into the bottom of the barrel, resulting in higher vacuum distillate yields compared to conventional vacuum units. These integrated solutions also include effective revamps, such as hydrocracking units converted to process resid feedstocks, optimised hydroprocessing of gasoline, kerosene and diesel components to low-sulphur products and gas treating technologies to remove refinery emissions.

Ultimately, innovative process and catalyst technology solutions are required for processing heavier, more sour crudes while meeting emission and clean transportation fuels specifications, specifically in relation to sulphur (although benefits in relation to other emissions are often achieved at the same time). The key is managing sulphur levels by employing hydroprocessing, conversion and sulphur recovery technologies. By using integrated technology solutions to optimise sulphur management strategies, we can face today's refining challenges head on.

Eric Benazzi Marketing Director Axens

The European refining industry is coping with declining domestic demand for fuels, while the imbalance between product supply and market demand persists. This especially applies with regard to a deficit in diesel supply and an excess in gasoline production. The European gasoline surplus in 2009 exceeded 0.75 Mbdoe (million barrels per day of oil equivalent), while the diesel deficit reached about 0.5 Mbdoe.



The US market presents a recurring gasoline deficit of about 0.7 Mbdoe and, since 2008, the refining industry has been exporting diesel.

What are the main causes of such a situation?

Although there is no fundamental shortfall between the structure of US production compared with the local demand structure when expressed as percentages, the

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main problem currently stems from insufficient gasoline throughput compared to US demand. As a result, the US is importing gasoline.

In Europe, meanwhile, the imbalance is structural. European refineries do not produce enough diesel but they do produce too much gasoline. As a result, Europe is importing diesel and exporting gasoline to the US. How will the situation evolve?

Our studies take into account product demand forecasts, including the potential impact of changes in the balance of on-road fuel demand. It is also necessary to study the effects of incorporation of biofuels and the reduction in refining capacity that will occur in the coming years.

Axens' 2020 Reference Scenario makes certain assumptions about the incorporation of biofuels and reduction in refining capacity. Our assumption is that regulatory levels of biofuels will be reached later than the expected schedule. By 2020, we estimate that biofuels content will reach 8% (energy basis) in Europe, well below the regulatory level of 10%, and for the US our assumption is 9.5% instead of 10.7% corresponding to the 30 billion gallons of renewable fuels by 2020 according to the RFS2 rule.

In addition, our Reference Scenario incorporates refining capacity reduction both in Europe and in the US.

The US demand forecast is based on passenger car sales of mainly gasoline models, with the implementation of new programmes aimed at reducing fuel consumption.

For Europe, our forecast is based on the following passenger car sales breakdown in 2020: diesel cars at

54%, gasoline cars at 36% and hybrid-gasoline cars at 10%. In such a scenario, on-road diesel demand will represent just above 70% of on-road fuels consumed in the EU in 2020. Our analysis shows that even a drastic change in new passenger car sales trends will not rebalance the on-road-fuel demand before 2020, mainly because about 55% of the on-road diesel demand in the EU is for commercial vehicles (freight and light trucks plus buses).

As a result, the European gasoline surplus will be inflated by the incorporation of ethanol in the gasoline

Technology and catalysts will play a major role on both sides of the Atlantic in adapting refinery production to market demand

pool and a declining demand. Strong cuts in refining capacity will not be able to suppress the gasoline surplus; meanwhile, they will deteriorate the diesel balance.

The US market presents a better fit between supply and demand, in which a gasoline deficit will be mechanically flattened by falling demand and further incorporation of ethanol.

At Axens, we are convinced that technology and catalysts will play a major role on both sides of the Atlantic in adapting refinery production to market demand.



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