

**ANALYSIS:** MOST OF THE APPLICATIONS OF VIRTUAL REALITY AND AUGMENTED REALITY IN THE PROCESS INDUSTRY ARE IN THE PILOT STAGE

# Refining & Petrochemicals

NEWS, DATA AND ANALYSES FOR THE PETROCHEMICAL INDUSTRIES

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## SPECIAL REPORT

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Meeting dynamic market demands through blending

### FIVE MINUTES WITH:

DR. GABOR KENESSEY, GENERAL MANAGER, SUPPLY CHAIN MANAGEMENT, ORPIC  
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## INTERVIEW

# NEW REFINING CAPACITY Advantage Middle East

SEVENTY FIVE PERCENT OF THE NEW GLOBAL REFINING CAPACITY OF 600 MILLION TONNES, BY 2030, WILL BE LOCATED IN THE MIDDLE EAST AND ASIA REGIONS, PREDICTS COLIN CHAPMAN, PRESIDENT, EURO PETROLEUM CONSULTANTS



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## Roadmap for Downstream Success

In the current scenario, refinery-petrochemical integration, incorporating renewables and digitalisation will be the key tools for future business optimisation in the refining and petrochemical industry, predicts **Colin Chapman, president, Euro Petroleum Consultants**

WORDS: MARTIN MENACHERY

**A**ll around, we have evidence of the positive impact the refining and petrochemical industry has had on our lives and way of living – from transportation fuels (cars, ships and aeroplanes), to providing energy for homes and different industries, right through to many of the appliances, materials and devices that we use every day – computers, cars, mobile devices, construction materials, packaging – all impossible to imagine without the use of chemical and petrochemical products.

The whole development of civilisation is based on growing energy consumption, and refining is a reliable and affordable energy supplier, namely, a producer of liquid fuels that are easily transported and usable in different ways. The role and importance of the refining and petrochemical industry in how daily human life has evolved cannot and should not be underestimated.

### The technological journey

“Although 50 years seems a long time in our industry, many of the original processes remain the foundation blocks of all refineries

today. We still see many processes very similar to 50 years ago, for example, delayed coking,” says Colin Chapman, president, Euro Petroleum Consultants, an independent consulting company in the oil, gas and petrochemical sectors, as well as a producer of specialised annual international conferences and training seminars, focusing on market trends, technological advances and business strategies for the petroleum industry.

“Naturally, energy efficiency and safety of operations have greatly improved. A key area where we have seen tremendous improvement and innovation is in the field of catalysts – for all the major catalytic processes, for example, FCC (fluid catalytic cracking), hydrocracking, catalytic reforming and hydrotreating, and this is an ongoing trend,” Chapman adds.

The size and complexity of individual refineries has vastly increased over the years – with huge refineries such as Reliance in India and also important integrated refining and petrochemical complexes in the Middle East and in Asia.

In today’s business climate, we see that competition in the refining and petrochemical

sectors continues to increase – year after year and in every region – and the Middle East is no exception. Companies in the region have continued exploring ways to maximise returns not only by investing on new and existing assets but also through investment in innovation and development activities for long-term growth.

There remains a clear drive and commitment on improving product specifications, increasing conversion, reducing emissions and increasing margins – technologies being at the centre of these developments and advances. We have seen many examples in the Middle East region – with a number of highly complex and highly integrated assets – all primed to achieve top-in-class performance.

“In the past decade, the Middle East refining industry has experienced a real boom period. In 2007, the total oil refining capacity in the region was nearly 7.5 million barrels per day (mbpd). It is now exceeding 9.5mbpd. Speaking of the impact of oil price on the industry, one key trend that we have witnessed is the shift to increased refining and petrochemicals integration – this was extremely significant for the local refiners after the oil



Digitalisation of the refining industry becomes particularly important for large companies with several sites and complex facilities.

price collapse in 2014,” comments Chapman. “We have seen some stability over the past 18 months in oil price; but, as we know, things can change quickly due to market conditions, or geopolitical factors. Current price levels seem to be favourable for both producers and consumers alike, offering a good balance.”

### Key innovations from the industry

Pointing out the prime innovations from the refining industry, Chapman states: “In terms of process innovations, I would like to mention firstly the delayed coking technology. It is the most implemented solution when looking in to maximising light petroleum products production. Innovation notably in the field of safety has greatly evolved in this technology, for example, automated slide valves.”

Another important process is hydrocracking. It is also a mature technology to maximise ultra-low sulphur diesel production to cover growing global demand in middle distillates. And finally, the continuous development of FCC technology – traditionally, this process was focused on gasoline production; but today, the importance of this process is increasing in terms of refining and

petrochemicals integration. There have also been significant developments in process control, data management, and advanced control systems, which have helped to improve efficiency and safety of operating units.

“Another area is the development of residue hydrocracking options, which is very topical these days. Several companies have developed improved technologies with high conversion of high sulphur fuel oil (HSFO). However, due to the relative lack of operating experience in such processes, there may be certain teething problems with certain critical pieces of equipment,” opines Chapman.

Modularisation is also an important development for optimisation of project implementation. This is particularly important in difficult isolated locations.

### Operational excellence

“We have seen recently that operational excellence (OpEx) and energy efficiency strategies are not only a part of sustainable development programmes of oil and gas companies, but also at the core of those – an essential element of success in today’s highly competitive, unpredictable and rapidly changing

environment. It has been proved that focusing on enhancing existing processes and designing new facilities, with optimisation already in mind, are showing significant results in our industry – in terms of costs, margins, reliability and safety,” Chapman discloses.

“Taking a position of both a consulting and a conference organiser company, we can reflect on OpEx in the Middle East. We have been organising OpEx events for this region for several years now, and it is clearly visible that interest in this area and related subjects is progressively growing.”

“The idea behind these conferences was to bring together key industry players and solution providers to initiate discussions, to update oil and gas companies on what is new in the world of excellence and what others do to reach the goals. Initially, it was more like a large-scale workshop for specialists deeply involved in this process and spoke the same ‘language’ in terms of methods, terminology, etc.”

“We did not actually expect it to expand on such a pace and scale within a couple of years – the reason for that was the interest of companies in operational efficiency and

all its elements. Today, it is a full-scale industry platform for almost everyone that is somehow connected with the idea of OpEx,” claims Chapman.

### Catalysts are the enablers

Catalytic processes are at the heart of all modern refineries and petrochemical complexes and with the recent drive for increased integration, the number of units using modern catalysts has increased significantly. The right catalyst can help improve margins, achieve better product quality, higher yields and longer cycle lengths – all this with relatively small investment.

Catalyst producers are continuing to develop enhanced versions of their products to meet not only changing regulations, but also the landscape of the refining and petrochemicals sector – changing feedstock, higher quality products, higher unit output to maximise profit, to name but a few – the latest generation catalysts will help meet these new challenges.

The Middle East region is one of the key global refining regions, and all ongoing and announced projects can be considered world-scale projects with high complexity, close integration with petrochemicals and a focus on providing support to other local industries. It is clear that the development of these Middle East refining centres will constitute a strong driver for local economic growth.

### The sustainability campaign

“As with all industrial sites, the environment, health, safety, security and quality aspects are and must remain top priority – refineries and petrochemical sites are no different. We have witnessed in our industry the investment made by companies both financially and in terms of effort and dedication to meet these challenges and goals. Looking more specifically at process safety – it plays a key role, helping businesses maintain stability and gain strength in the market place, including share growth from positive reputation and company image,” Chapman mentions.

A comprehensive safety system and approach should support management of companies to solve various important issues like understanding processes better, identifying hazards/threats and causes, determine credible consequences, evaluate risks and eliminate, or reduce those, highlight weak points, maintain asset integrity at all lifecycle and supply chain stages, prepare emergency



**“There are many potential game-changing steps to be adopted by the refining industry to keep pace with the progress of the world; but, I would like to highlight moving more towards petrochemicals as the key.”**

*Colin Chapman, president, Euro Petroleum Consultants*

response, encourage cultural changes, provide knowledge injection, increase visibility of safety, and many more.

The campaign for a shift to renewables is real and refiners should and will need to take it into consideration. It could constitute a potential threat for the traditional oil refining industry, and refiners should be ready to adapt their strategies as a result – because, without doubt, renewables will affect the refining industry and the way in which it is run.

“We have already seen many majors and other end-users evolve and branch out into other energy sectors, including renewables. The key will be to evolve to meet in the best way the future market demands and trends,” points out Chapman.

It is more than likely that Electric Vehicles (EVs) will have an impact on the refining industry; but, this is not likely to happen in the short term and as a result is unlikely to impact current investment decisions. There remain a number of uncertainties regarding

the EVs – including defining the ‘true’ energy footprint of EVs, the relative lack of infrastructure, and the cost barrier.

Most significantly, an electric vehicle is only as ‘clean’ as the way its electricity has been produced. If the power generation is nuclear, or renewable, the carbon footprint is indeed very limited. But, if electricity is produced, through a combination of coal, gas, nuclear and renewables, the ‘well-to-wheel’ comparison of diesel, or gasoline cars with EVs is much more balanced.

“I think we shall see in certain European countries more use of EVs in large cities such as London and Paris – to help reduce problems associated with pollution. A key issue will be the development of more efficient batteries, which will help to increase the gap between recharging,” Chapman remarks.

### The IMO regulations

The IMO Marpol VI regulation is rightly considered as the major upcoming challenge for

## FACTBOX

### New refining capacity of 600 million tonnes by 2030

The global refining capacity was around 3.6 billion tonnes in 2016 and is expected to rise to about 4.2 billion tonnes in 2030.

the refining industry. There are two industry sectors directly impacted – the shipping industry and the refining industry.

Between now and 2020, both ship owners and refiners will have to decide how best to comply with the proposed IMO regulations. There are a number of possible solutions with varying degrees of certainty and cost – scrubbers, use of blending agents, etc. The spread of low sulphur fuel oil to HSFO is likely to be significant in the short term.

“Refiners will look to invest in residue hydro processing – this will be critical for refiners, if they want to gain from this transition. The choice of technology is also critical here. Economic options for shippers are not clear and modelling scenarios is essential. Compliance strategies are very likely to evolve over time,” declares Chapman.

“The Middle East will also be affected – but the situation is slightly different as fuel

oil is used for power generation in the region. There will be an expected growth during the period through to 2025 – driven not only by the increased use of fuel oil in power generation but also the increase in bunker demand for ultra-low sulphur fuel oil.”

### The talent pool

The shortage of qualified specialists poses a real problem in many regions and this impacts ongoing and future operations. The lack of local experts means that companies are obliged to use the services of experienced contracted specialists from other regions. They are usually very expensive compared with local experts.

Lack of adequate training may lead to serious incidents, to important damage to assets and may impact the overall safe working environment, for example, poor maintenance procedures.

This problem can be solved by attracting and encouraging more talented young men and women into the science and engineering disciplines and hence into the oil and gas industry. Trainings need to be highly efficient with special attention to the information technology aspects to help young people understand how to manage the operations.

“In the Middle East region, a significant number of staff and operators come from

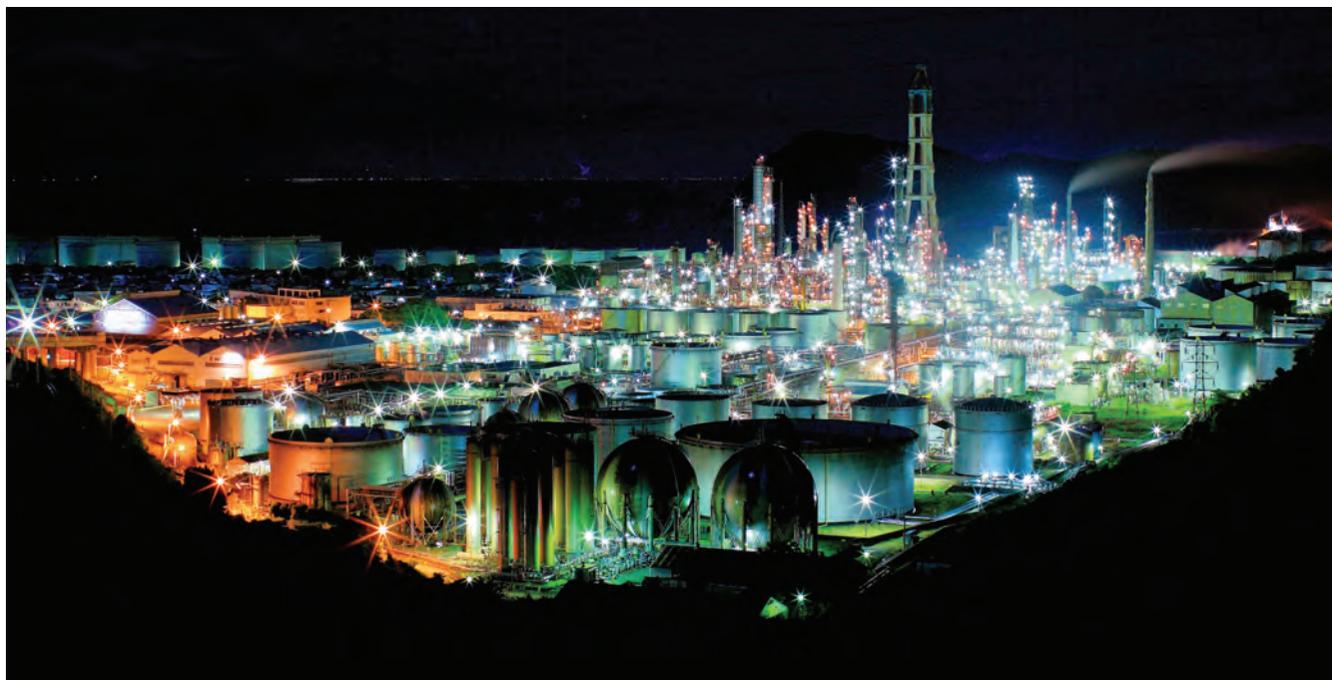
overseas and are made up of many different nationalities. This can lead to difficulties in keeping a stable workforce since many specialists tend to stay a few years, and then move to different locations for various reasons. It is also important to understand and take into account the different cultures when building teams to operate plants,” Chapman observes.

“Both millennials and baby boomers bring different attributes and skills to the table – this should be seen as a positive for the refining industry. It is very important that both parties be open to dialogue and receptive of the other. Through adapted training programmes, there is an opportunity for knowledge sharing. Many companies are busy implementing, or looking to implement programmes to facilitate this sharing of knowledge and experience.”

### Key challenges

One of the key challenges in front of the global refining industry is residue upgrading to reduce production of HSFO. In this, selecting the best option, which meets the specific market requirements of each refinery, is critical.

Another major challenge is the need to address the changing global markets for transportation fuel and shift away from diesel in



Refinery-petrochemical integration provides a real opportunity for refineries to increase margins and diversify their activities in the future. (Image for illustration only)



The size and complexity of individual refineries has vastly increased over the years. (Image for illustration only)

some regions, for example, Europe – especially, in large cities. Improving existing operations and enhancing safety in ageing units are also major concerns for the industry.

Digitalisation of the refining industry becomes particularly important for large companies with several sites and complex facilities. This helps to optimise production in individual units and across all facilities, taking into account market changes, supply and demand fluctuations, etc. Digitalisation will also help in collecting and analysing data – helping improve efficiency of operating the assets – monitoring, controlling, maintenance, etc.

### Refinery-petrochemical integration

Refinery-petrochemical integration is a proven route to maintaining competitive edge – the extent to which any of the technically feasible integration options can be implemented and produce economic benefit is dependent on a number of factors. Regional trends for feedstock availability, process economics and product demand as well as ownership issues potentially play a role. As a result, the extent of refinery-petrochemical integration varies from region to region.

Petrochemical feedstock is an important driver in majority of cases. Availability of NGL (natural gas liquid) feeds, such as ethane, reduces the need for refinery-based liquid feedstocks. The result is a lower degree of refinery-petrochemical integration and this was the trend in the Middle East – limited

## Renewables constitute a potential threat for the traditional oil refining industry, and refiners should be ready to adapt their strategies as a result - because, without doubt, renewables will affect the refining industry and the way in which it is run.

refinery-petrochemical integration. This situation has begun to evolve with reduced ethane availability for new projects and has been reduced with specific conditions being applied to new feedstock allocations. So, this has resulted in liquid feedstock starting to be used in the region. Future petrochemical growth in the Middle East will likely require further consideration of liquid feedstocks and therefore increased refinery-petrochemical integration.

“Future petrochemical industry investments within the Middle East are likely to be based on liquefied petroleum gas, mixed feed, or naphtha cracking. Diversification is also a key driver for the region. Liquid feedstocks produce a wider range of products, enabling a more diverse downstream portfolio,” asserts Chapman.

Refinery-petrochemical integration provides a real opportunity for refineries to increase margins and diversify their activities in the future. It will be important to select the right projects that meet the market opportunities and to understand which specific products should be prioritised.

### Moving forward

“The refining industry will continue to grow with the increased demand from the developing countries being the principal driver for that growth. The global refining capacity was around 3.6 billion tonnes in 2016 and is expected to rise to about 4.2 billion tonnes in 2030,” Chapman notes.

“Simply speaking, around 600 million tonnes of new refining capacity will be required globally by 2030 – resulting in a few new refineries. It is expected that 75% of these new capacity additions during the next 12 years, or so, will be located in the Middle East and Asia regions.”

“There are many potential game-changing steps to be adopted by the refining industry to keep pace with the progress of the world; but, I would like to highlight moving more towards petrochemicals as the key. Also, future development programmes should take into account the growing trend of incorporating renewables. And last but not least, digitalisation will, without doubt, be a key tool for future business optimisation,” concludes Chapman. **EPW**