



|| SPECIAL FEATURE ||

Petrochemicals

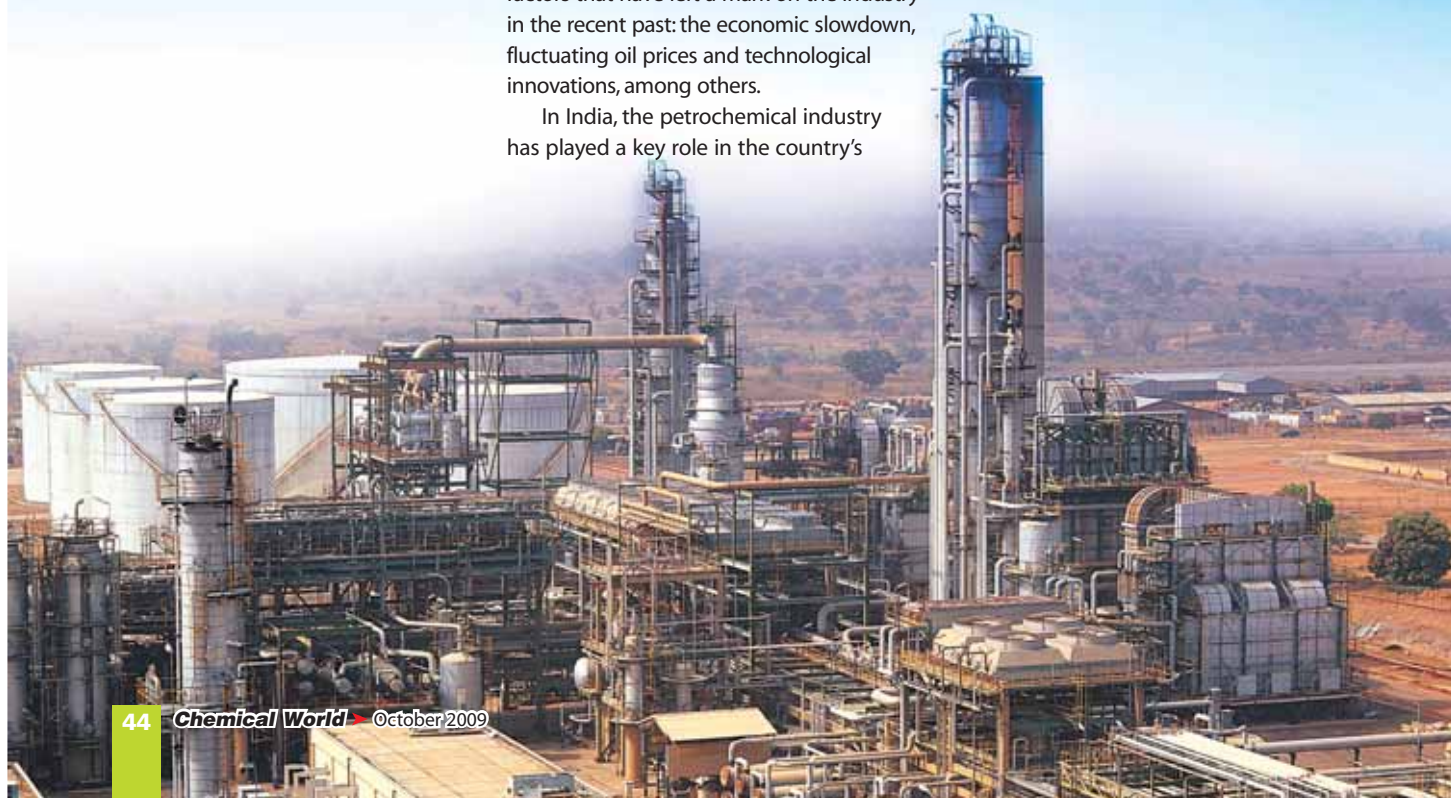
Cracking the growth code

Supported by a robust GDP growth, the Indian petrochemical industry has started showing a positive demand curve. Major challenges now are development of processes based on abundant alternative feedstocks and process efficient & environment-friendly products at an affordable cost. After the onslaught of global slowdown, the industry is now ready to tap new potential with the help of continuous innovation, new technologies and non-conventional manufacturing processes. K T P Radhika Jinoy narrates the growth story of this sector...

The petrochemical industry plays a vital role in shaping the global economy. Petrochemicals, which are extracted from crude oil and natural gas, form the base of manufacturing for other sectors like pharma, plastics, textiles, construction, etc. Rapid globalisation and changing technology have, in the recent times, increased the worldwide consumption and demand for petrochemical products, offering enormous opportunities for players in this sector. But not everything is in order in the sector – globally in general, and particularly in India. Hence, it is interesting to look at the factors that have left a mark on the industry in the recent past: the economic slowdown, fluctuating oil prices and technological innovations, among others.

In India, the petrochemical industry has played a key role in the country's

shift from an agrarian economy to an industry-based one. But, the recent years have been a tough period for this industry when the global economic downturn hit petrochemicals demand and production in a big way. Despite the blow, the sector is now slowly picking up. Reports suggest that the sector is witnessing a cyclical recovery through significant changes in the domestic industry. According to the Department of Chemicals and Petrochemicals, Government of India, the petrochemical sector is expected to grow at 6.5 per cent in the Eleventh Five-year Plan (2007-2011).



Reviving from the downturn doldrums

During the slowdown, the industry witnessed a steep fall in demand, cash flow and margins. Says Ujjal De, senior vice president & head - Marketing and Business Development, Haldia Petrochemicals, "Due to crash in the commodity prices and slowdown in global economic growth, the industry experienced a demand contraction. It also reported heavy losses due to inventory devaluation last year." Olefins were hit hard by economic downturn. Since the demand for polyester was stronger, the segment performed better than olefins. "In certain product categories, prices dropped by as much as 60-70 per cent, completely eroding profitability for some of the high-cost producers in Europe," informs K P Nanavaty, president - Cracker, Polymers and Chemicals Sector, Reliance Industries.

As a result of demand contraction in petrochemicals, operating rates have been reduced, resulting in intense competition and low profitability. "Global polyolefin consumption observed a demand contraction of 3.5 per cent (111 million tonne, against 115 million tonne) in 2008, compared to 2007. Even China, which has a high GDP growth rate, observed two per cent demand contraction," observes De.

However, the industry is now showing signs of recovery on the back of positive economic activities in major economies such as the US, Germany, the UK and China. Further, operating rates have started improving, and current profit margins are sufficient for the sustainability of operations. "This is clearly visible in Asian countries, where growth is led by China and India. It is primarily supported by the fiscal stimuli provided by respective governments," informs De. Polyolefins consumption in Asia during January-August 2009 showed remarkable growth over 2008, whereas in Europe it is still lower by 10 per cent year-on-year.

Ujjal De

senior vice president & head - Marketing & Business Development, Haldia Petrochemicals



Developments in new processes have proved to be effective. Today, the petrochemical industry is supplied with sufficient volumes of propylene. Prominent processes among these are metathesis, olefin conversion process, propane de-hydrogenation and high-severity catalytic cracking in refineries.

Crude oil price effect

As the supply chain of the global petrochemical industry depends on crude oil, increase in its price reflects an equivalent increase in product prices across the value chain. Again, an increase in the price of petrochemicals dampens the end-use demand. The petrochemical industry consumes less than 10 per cent of the crude oil globally. In 2009, the industry did not face any scarcity of crude oil. As a result, the downstream product prices have also recovered, and the industry enjoyed a relatively comfortable margin.

However, industry experts feel that speculating on crude oil prices is risky. "The recent increases in crude oil prices are relatively minor so far, compared to what the industry has witnessed in 2008. Demand is beginning to rebound and margins are expected to be better in 2010. The industry is, in a way, able to manage the crude oil price increases," avers Keith Aspray, director - Petrochemical Technology, UOP LLC, a Honeywell company. However, there have been some localised crude-based feedstock shortages. "Certainly there

are some concerns about short-term supply situations in other regions, but overall, we do not see gas and crude supply being an issue," he confirms. Moreover, increased exploration in crude oil feedstock following the rise in crude and gas prices in 2008, has increased feedstock availability considerably. As a result, countries like the US have seen an increase in gas supply, and a decline in gas prices, particularly in North America.

Innovation through technologies

The petrochemical industry is continuously innovating to increase the output of high-value-added products in order to improve productivity and meet the market dynamics. For instance, the flexibility in replacing naphtha with LPG as partial feedstock has been beneficial. De believes, "This switchover between partial usages of LPG depends on the price delta between naphtha and LPG."

Another area where the industry is actively striving is to produce olefins using methanol from cost advantaged raw materials like natural gas. Aspray explains, "The process is



Courtesy: Tesoro Corporation



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K P Nanavaty

president - Cracker, Polymers and Chemicals Sector, Reliance Industries



Global demand for petrochemicals is on the recovery path. The market in India has undergone definite and significant improvement. The current growth in most of the product categories is in mid-double digits, and we expect the industry to perform well in 2009-10.

based on proprietary UOP catalyst that has proven to provide high yields of olefins with minimal by-products. It is designed to offer flexibility to the quantity of each product, and thus, allows producers to adjust the levels to match the shifting market demands. "The industry is experiencing more demand for fully integrated technologies that offer maximum flexibility with faster implementation capabilities.

There is a demand for more integration of aromatics complex with refineries. Hence, instead of selling just the raw materials, value-added petrochemicals can increase profit and maximise production. "UOP has worked successfully with many customers over the last several years to integrate our Parex, CCR Platforming, Isomar and Tatoray technologies within the refinery," informs Aspray. Coal-based chemicals are other core areas for consideration. But currently, these projects are kept on hold due to the environment issues and comparatively depressed crude prices.

Another significant example is the process of catalytic dehydrogenation. This is the preferred process for the production

of short-chain (C3 & C4) as well as long-chain (C10-C14) paraffins. "Though more than 95 per cent of short-chain olefins are obtained through thermal cracking (naphtha/ethane/ propane) and from fluid catalytic cracking (FCC) of gases, increasing demand gap for this range of olefins has brought dehydrogenation into prominence," considers B Viswanathan, head - National Centre for Catalysis Research, Department of Chemistry, IIT-Madras. He adds, "Olefins production through dehydrogenation has several advantages over highly capital-intensive thermal cracking/FCC. In the case of long-chain olefins, catalytic dehydrogenation is the only viable route. A judicious combination of reactor design, catalyst composition and architecture helps in maximising olefin yields."

Latest developments

In the years to come, oil is likely to remain a major feedstock for the production of base chemicals. But, with the rising energy needs, there is a need to increase the production efficiency with minimal process costs. The industry is employing the latest technology and

developing more sophisticated chemical products & applications. Companies have started working on alternatives to reduce the feedstock cost and ensure sufficient availability. Four years back, based on the schedule of new crackers (majority of which are based on natural gas as feedstock), propylene availability was projected to be limited, and it was analysed that growth of polypropylene will be restricted due to insufficient feedstock.

Subsequently, industries took a number of steps that improved the propylene availability by non-conventional alternate processes of manufacturing. "Developments in new processes have proved to be effective. Today, the petrochemical industry is supplied with sufficient volumes of propylene. Prominent processes among these are metathesis, olefin conversion process, propane de-hydrogenation and high-severity catalytic cracking in refineries," De elucidates.

On the same lines, Viswanathan adds, "Development of processes based on abundant alternative feedstocks (use of paraffins in the place of olefins and renewable resources), improving process efficiency and its compatibility with the environment & development of niche products at affordable cost are key research areas in the petrochemical industry. Development of catalysts and processes have to pass through several stages like conceptualisation, laboratory and pilot plant experimentation followed by scale-up process design & development. Thus, the development cycle is long." Application of nanotechnology routes (for crystallite size and shape control) for the development of new processes will continue to improve the sector in future.

Keith Aspray

director - Petrochemical Technology, UOP LLC



The Indian petrochemical industry will grow faster than the developed regions of the world based on local and regional end-product demand. However, the feedstock will be different than those used in other regions based on local availability and cost.

Market correction

A major market trend in this sector is the changing focus from Western countries to the Asian countries. At present, activities from the US and Europe are shifting to Asia & other developing regions. The western market



has almost reached its maturity making way for the Asian market to emerge as industry leaders in the petrochemical business. Also, Middle East and African countries have shown positive growth in petrochemicals demand in 2009 over 2008. "Global demand for petrochemicals is on the recovery path. This is more pronounced in the developing market that has remarkably come out of the initial phase. Supported by robust financial sector and GDP growth, the Indian petrochemical industry has also started showing the signs of a positive demand curve. The market in India has undergone definite and significant improvement. The current growth in most of the product categories is in mid-double digits, and we expect the industry to perform well in 2009-10," affirms Nanavaty.

Last year, there was a demand contraction in polyolefins by around 3.5 per cent. But, according to industry experts, Asian polyolefin demand is impressive. China, the biggest importer of polyolefins, has already witnessed an increase in imports by 59 per cent for the period January-July 2009 at 7.28 million tonne, against 4.57 million tonne in January-August 2008. "The Indian petrochemical industry will grow faster than the developed regions of the world based on local and regional end-product demand. However, the feedstock will be different than those used in other regions based on local availability and cost," states Aspray.



Courtesy: Honeywell International Inc

B Viswanathan

head - National Centre for Catalysis Research, Department of Chemistry, IIT-Madras



Olefins production through dehydrogenation has several advantages over highly capital-intensive thermal cracking/FCC. A judicious combination of reactor design, catalyst composition and architecture helps in maximising olefin yields.

Challenges

However, the growth chart is not so smooth for the Indian petrochemical sector. Unlike the Indian market, there have been huge capacity additions in the Middle East and China during this period of slow growth. Statistics show nearly 13 million tonne of ethylene capacity is slated to come on stream in the Middle East. Another 15 million tonne of ethylene capacity is expected to come on stream in China and other Asian countries over the next four years. This is over 20 per cent of the current global capacity. "All capacities planned in the Middle East are based on low-cost feedstock decreed by the governments of these countries," explains Nanavaty.

Elaborating on this, Aspray says, "These new facilities will pose serious threat to manufacturers in other regions who source their feedstock on market-determined prices, often at six to seven times the cost at which Middle East producers have their supply contracts." Another challenge is the revival of demand in the developed economies. Though there are signs of an economic recovery, these are yet to make any significant impact. Further, addressing the public perception of the image of this industry is also a hurdle to cross.

"While products from the chemical industry, of which petrochemical is the largest segment, has fuelled progress and well-being of humanity, ironically, the industry is often perceived as major contributor to environment degradation," says Nanavaty. However, a recent study by McKinsey has found out that five out of ten top petrochemical products act

as savers in reducing Green House Gas emissions. This shows that the industry has to undertake a huge communication exercise to rectify the public perception of its value in the society.

Moreover, for the growth of domestic petrochemical industry, it is imperative that an investment-friendly environment is created and a world-class infrastructure provided. Considering the scenario in India, the import duty on petrochemicals is one of the lowest in the world. "But, on the other hand, Indian operations entail high logistics and operational costs, making it less competitive. As a result, many global producers are setting up facilities in Gulf countries, which provide low government-decreed feedstock costs. They are also setting up facilities in countries like Singapore, which has excellent infrastructure and low operating cost, and in Thailand, which has excellent government support, as compared to the Indian market," opines Nanavaty.

A bright future

Industry experts feel that despite the recent economic situation and setback, the future of the petrochemical industry is bright. For a country like India, which is pursuing a growth trajectory higher than the developed world, demand for petrochemicals is destined to grow at a healthy rate. Yet, industry experts feel Indian industry would benefit more from this growth if the government creates a conducive environment. Otherwise, the fruits of such growth would be tapped by overseas manufacturers. 