Solving the puzzle of India’s petrochemical-intermediates shortfall

The country’s upstream petrochemical and downstream specialties industries are expanding healthily. But a combination of moves will be needed to meet India’s fast-growing demand for petrochemical intermediates.

Avinash Goyal, Suyog Kotecha, and Theo Jan Simons

If India’s prime minister, Narendra Modi, is able to deliver on his pledges to restore the economic-growth rates of the 2000s, his country’s chemical industry should brace itself for a pickup in its already healthy growth rate. India continues to invest heavily in bulk petrochemical capacity to move closer to self-sufficiency, while the specialties sector remains a strong performer poised for further advances.

But what’s less recognized is the very limited development, to date, of India’s petrochemical-intermediates sector—the key link between the production of petrochemicals and specialty chemicals and one that’s essential to meet burgeoning consumer demand and to enable the emergence of higher-value-added industries. If India’s economy expands as projected, demand for petrochemical intermediates, such as acrylic acid, acetic acid, and propylene oxide (PO), will grow with it. Yet announced additions to capacity address only a fraction of that demand. Our analysis suggests that by 2025, a shortfall of as much as 25 million tons a year could emerge.
That missing link will pose important questions—and present new opportunities—for the chemical industry. International companies are the leading suppliers of petrochemical intermediates and control the most advanced production technologies. They need to decide on a strategy to address India’s demand. The country’s downstream chemical industry will have to decide how it should best cover its need for these products. India’s upstream petrochemical companies will have to decide if they want to move into this market. As the pace of investment in India picks up, it could be a good time for stakeholders to look again at how to address this issue, since fixing this missing link is likely to be essential for the development of a world-class chemical industry in India.

In this article, we look at the shortfall in petrochemical-intermediates production and the reasons for it. Then we outline possible development paths for Indian and international producers.

A challenge and an opportunity—both on a grand scale
In bulk petrochemicals, India is poised to make major additions in ethylene capacity in the next three years. Additional capacity of around three million tons a year is expected to start up, raising the country’s total to more than seven million tons a year (Exhibit 1).

Meanwhile, India’s specialties sector, having expanded at a compound annual growth rate (CAGR) of more

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**Exhibit 1**

**Additional ethylene production capacity is expected.**

<table>
<thead>
<tr>
<th>Company</th>
<th>Location</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
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<th>2018</th>
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<td>275</td>
<td>1,100</td>
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<td>–</td>
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</tr>
</tbody>
</table>

**Total for India**

|                  | 4,080 | 4,560 | 6,525 | 7,200 | 7,200 |

1ONGC Petro additions Limited.
Source: IHS Chemicals
than 10 percent over the past decade, continues to be a consistent bright spot for growth. Production of products such as coatings, construction chemicals, and pesticides for the domestic market continues to see double-digit growth. India’s specialty sector has also established a strong global position through exports of pesticides, pharma intermediates, pigments, and other products. A growth rate of 13 percent a year through 2020 seems likely as higher quality requirements and environmental quality-related demands help increase demand for specialties in India and export-oriented companies continue to expand.

In petrochemical intermediates, however, it is quite a different story. India currently imports around five million tons a year—45 percent of its requirements, which add up to approximately 11 million tons a year. Consumption has been growing steadily over the past five years. Most significantly, if India’s economy follows a healthy growth trajectory, our analysis suggests that demand for petrochemical intermediates will expand to between 33 million and 38 million tons a year by 2025. If these projections pan out, by 2025 India’s demand for important petrochemical intermediates will consume the output of multiple world-scale plants for each product. Exhibit 2 summarizes the main capacity requirements India faces in petrochemical intermediates through that year.

For example, demand for acetic acid and for acrylic acid will be equivalent to the output of more than three and four world-scale plants, respectively. Indian companies have announced around two million tons a year of capacity additions in a limited number of product areas, such as ethylene oxide (EO) and ethylene glycol (EG). That leaves 25 million to 30 million tons a year of demand that would not be covered domestically—an import dependency of 75 to 80 percent.

These projected figures are so large that India’s needs are becoming a major issue for a number of participants in the chemical industry. The leading global producers of petrochemical intermediates must include India’s needs as they plan how to serve their existing and emerging markets over the next decade and how to build up their businesses. Consumers of petrochemical intermediates in India face increased reliance on imports. As for India’s upstream petrochemical producers, if they build out in the way the sector did in other countries in the past, petrochemical intermediates should be an attractive growth business.

The issue is also an important policy issue, since addressing this missing link is of paramount importance to the development of a strong, world-class chemical industry. Its significance extends to a societal level: the chemical industry plays a special role as the enabler of so many other industries that make the products sought by the aspiring, upwardly mobile middle class. These consumers will propel India’s economic growth by stimulating demand for autos, polyurethane foam mattresses, baby diapers, and innumerable other products that are essential to the lifestyle they desire and that need petrochemical intermediates for their manufacture.

Why has the missing link opened up?
As the numbers suggest, India has been facing a challenge in building up its petrochemical-intermediates capacity. The sector is much smaller than the country’s overall chemical industry compared not only with established national industries, such as those of the United States, Europe, or Japan, but also with those of other emerging markets, such as China.

There are a number of reasons for the lack of growth in India’s petrochemical-intermediates production capacity. First, the country has been a latecomer in building up its supply of the olefin and aromatic building-block chemicals that underlie the production of petrochemical intermediates. For example, India’s ethylene capacity now totals around 4.5 million tons a year, a little ahead of Singapore’s but about the same as Taiwan’s. Currently, most building-block chemicals in India are consumed in the production of basic polymers such as polyethylene and polypropylene. Demand growth for basic polymers in India has been strong, and so polymer production has been the priority, constraining expansion in petrochemical intermediates.
Small pockets of intermediates production do exist, but the quantities are limited. For example, Manali Petrochemicals recently announced plans to increase its current output—50,000 tons a year—of polyols at Manali, near Chennai.

Second, India’s overall production infrastructure for petrochemicals remains at a relatively early stage of development. The industry is mainly growing up based around a limited number of oil refineries that have added an ethylene cracker, or stand-alone ethylene crackers. This setup is far from the kind of cluster structure, with multiple crackers, that exists on the US Gulf Coast, in Singapore, and in Rotterdam and Antwerp. At the same time, the pipeline infrastructure is minimal, so intermediates plants depend entirely

### Exhibit 2 Meeting India’s demand: Projected capacity opportunities in 2025.

<table>
<thead>
<tr>
<th>Petrochemical intermediate value chain</th>
<th>Demand-supply gap, million metric tons</th>
<th>Key constraints</th>
</tr>
</thead>
</table>
| Acetic acid | Vinyl acetate, acetic anhydride, acetate esters | 2.5–3.5 | • Availability of syngas  
• Only 4–5 players with technology (need for joint ventures) |
| Ethylene oxide | Glycols, surfactants, glycol ether, ethanolamines | 2.5–3.5 | • Domestic ethylene primarily converted to polyethylene  
• Difficult to transport ethylene over long distances |
| Propylene oxide | Polyether polyols  
Polypropylene glycols | 2.5–3.0 | • Limited sharing of propylene with downstream players; primarily used for making polypropylene |
| Acrylic acid | Acrylic acid esters  
Superabsorbent polymers | 0.8–1.5 | • Technology with only 4–5 players  
• Joint-venture attempts have not succeeded |
| Ethylbenzene | Styrene  
ABS/SAN\(^2\) resins | 6.0–7.0 | • Domestic ethylene primarily converted to polyethylene  
• Difficult to transport ethylene over long distances |
| Cumene | Phenol, acetone  
Phenolic resin, epoxy resin, polycarbonate | 3.5–4.0 | • Limited supply of propylene to downstream players; primarily used for making propylene |

\(^{1}\) PBR: polybutadiene rubber; SBR: styrene-butadiene rubber; EPDM: ethylene propylene diene monomer rubber; NBR: nitrile rubber; PCR: polychloroprene rubber; HMDA: hexamethylene diamine; IR: isoprene rubber; SIS: styrene-isoprene-styrene rubber.

\(^{2}\) ABS: acrylonitrile-butadiene-styrene; SAN: styrene-acrylonitrile.

Source: Interviews with experts; McKinsey analysis

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20–25
Equivalent to 70–90 plants at viable scale
on the host cracker to provide feedstocks. That creates problems and constraints for the intermediates producer if the cracker runs into operating difficulties, and also makes it hard to settle contractual agreements on issues such as exit clauses.

There has been a recognition by government and industry in India for some time that the development of large production centers anchored by an ethylene cracker could facilitate the development of the chemical industry. To this end, over the past decade the government has been promoting the development of a number of Petroleum, Chemicals, Petrochemicals Investment Regions (PCPIRs) across the country. But the four now under way are coming onstream more slowly than had been originally expected.

Third, a small group of international chemical companies closely hold the most advanced process technology required to make petrochemical intermediates. While they have negotiated over the past two decades with Indian companies, finding mutually acceptable terms has been hard. The international companies tend to ask for a majority shareholding in any venture—a condition the Indian oil companies that could provide the raw materials find difficult to grant. On top of this, there has been a widely shared perception among foreign players that even once a project is approved, numerous obstacles generated by various stakeholders can significantly slow it down and adversely affect its economics. This perception has set India at a disadvantage to other important investment destinations, notably China and the Middle East.

A limited number of ventures have progressed to construction and start up. One of them is the Indian Oil, Marubeni, and TSRC project (which started up at Panipat in 2013) to make 120,000 tons a year of emulsion SBR. However, a number of projects to make, for example, acrylic acid, acetic acid, and their various derivatives have gone through extensive negotiations but were then dropped. Building a plant at a large enough scale to be globally competitive is essential, say international company representatives. Most of them add that the level of demand they are seeing in India for many petrochemical intermediates is not yet high enough to fully load a world-scale plant. Due to lack of a particular cost advantage, exporting surplus production would not be an attractive option.

Faced with these challenges, international producers of petrochemical intermediates have preferred to go on shipping product to India to cover its demand. The current tariff structure in fact encourages this: duties are higher on olefin and aromatics (precursors for petrochemical intermediates) than on petrochemical intermediates themselves.

**Paths forward for petrochemical-intermediates supply in India**

What steps are required to assure that the supply of petrochemical intermediates to India meets the growth of demand?

1. Clearly, international producers could choose to go on exporting large quantities of petrochemical intermediates to India from other locations, such as the Middle East or the United States, if production there is more competitive. But while these producers may not yet be selling volumes that would load a world-scale plant, this is likely to change within five years as India’s market develops. Since it typically takes three to five years to launch production in India, now is the time for companies to start considering such projects if they want to be well placed to serve the market.

   International companies could consider a phased strategy: initially continuing with imports while building up derivatives capacity or acquiring a small Indian derivatives producer in, for example, the acrylates chain to manufacture butyl acrylates and thus ensure a foothold in the market. Some companies say that finding the right clusters of downstream users can be challenging, which makes
it important to build relationships. Working with local distributors can help substantially.

International companies should also cultivate relations with Indian petrochemical companies, which could become feedstock providers should they decide to build plants. Although certain feedstocks could in principle be imported, this is likely to be less attractive, from a logistical perspective, than getting access to local supply. That will make international companies better informed for the next stage: a rigorous market assessment to evaluate whether production in India, possibly in a joint venture with a local feedstock supplier, would meet their cost criteria and strategies. Our assessment suggests that the cost basis could be viable. New Indian petrochemical plants are typically second or third quartile in the lineup of world production, since competitive capital costs and in-market locations that reduce distribution costs (compared with those of imports) partly offset the lack of advantaged feedstocks.

2. A second important shift that could help to solve the puzzle would be an awakening, on the part of Indian upstream petrochemical companies, to the importance of the petrochemical-intermediates sector as a way to develop their long-term business successfully. This is how the industry has evolved in mature markets, and a number of petrochemical companies in Asian emerging markets are already making such moves as they seek to develop more differentiated businesses. PTT Global Chemical, for example, has diversified beyond polyolefins and makes a range of EO derivatives, phenol and bisphenol-A, and recently announced PO and polyols investments that will complement acquisitions already made in the isocyanates/polyurethanes chain. It’s also worth noting that the financial performance of the Indian companies making petrochemical intermediates is superior to the market average, so this could be a lucrative downstream development.

Indian upstream petrochemical companies could improve their chances of getting access to the leading technologies by reconsidering their negotiating position vis-à-vis the international companies that own them. As noted, the Indian players have tended to seek majority control of the ventures, with the right to control the technology after a finite number of years. The international players find these demands unattractive, and that has been a factor in the failure of negotiations over the past decade. A change in these positions could be a major factor in facilitating the creation of domestic capacity for petrochemical intermediates.

3. Recent government statements suggest a renewed focus on the fact that production of petrochemical intermediates represents an opportunity for the expansion of the country’s chemical industry and also recognition that there is pent-up or latent demand for these products in India. When the country’s capacity for acrylonitrile-butadiene-styrene (ABS) resins increased from 60,000 tons a year in 2004 to 80,000 tons a year in 2006, consumption jumped to 75,000 tons, from 48,000, within a year. The lack of a local supply of petrochemical intermediates could constrain India’s economic development.

A number of initiatives are under way to help the industry move forward. First, the government is starting to think about modifying the import tariff structure, which currently favors imports of petrochemical intermediates over building-block petrochemicals and in effect discourages local production of the former.

Second, the government is considering steps to streamline permissions for petrochemical-intermediates projects. It is also thinking about regulations that would facilitate investment in the organizations and infrastructure (such as pipelines around big olefins plants) to facilitate
the production of petrochemical intermediates. These moves could be linked with a push to further expedite the development of the PCPIRs. There are also proposals for government financial support in building a pipeline network. Such investments would resemble initiatives that have contributed to the successful development of Belgium’s petrochemical hub at Antwerp.

Third, the government is starting to consider ways to address the unavailability of ethylene, propylene, and other building-block chemicals required to produce petrochemical intermediates. One approach to assure 85 percent self-sufficiency could be to develop a master plan for the supply of and demand for key building-block chemicals across the industry as well as measures to ensure availability. Such measures could include, for example, a requirement that a cracker operator reserve a percentage of its output of ethylene and propylene for the production of petrochemical intermediates. This approach to granting permits is not unprecedented: it is already being implemented in Singapore and certain locations in China to assure a supply of intermediates and to help achieve broader economic-development goals.

The players involved in solving the puzzle of India’s petrochemical-intermediates supply have plenty of options but face a long road. What’s clear is that getting this right will be a key component of efforts to move industrial production to a new level and to help the country meet the aspirations of its huge population to enjoy the full range of products for a modern lifestyle.

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The authors wish to thank Pinak Dattaray, Ashok Kumar, Ankit Rawat, Rebecca Somers, and Vipul Tuli for their contributions to this article.

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