Disruption in Aromatics,

How will unprecedented capacity growth impact the market in 2019?

What is happening

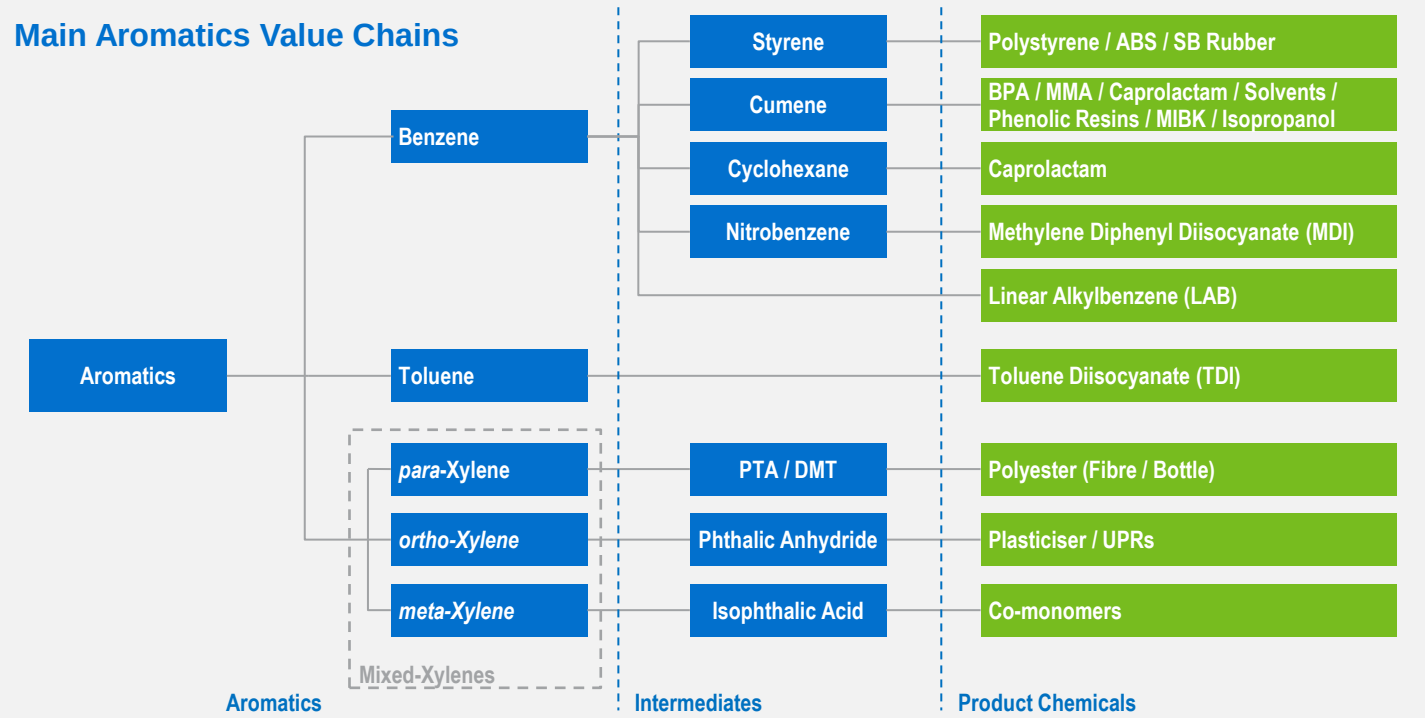
Aromatics are one of the basic building blocks of the petrochemical industry, with benzene, toluene, and xylenes the most important of these chemicals commercially. Over the past 3 years, aromatics producers have seen good profitability on the back of relatively low oil prices and a strong demand in China for both para-xylene (PX) and to a lesser extent benzene.

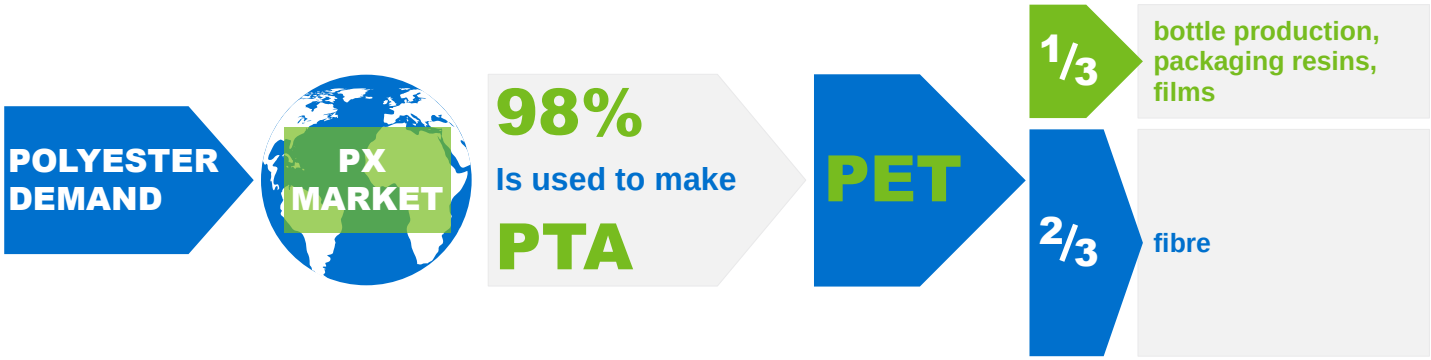
The PX market is expected to experience huge disruption in 2019 with the commissioning of new integrated aromatics facilities in China which represent a step change in world scale plant capacity and will boost global PX capacity by almost 20 percent in a single year and 38 percent to 2021.

The scale of this capacity build is expected to narrow the immense supply deficit in China, transforming global trade flows and triggering a massive fall in operating rates for non-integrated producers. The new 'crude to PX' plants will bring excess benzene and additional refined products to the market, leading to an impact across the aromatics supply chain.

Aromatics sources and value chains

The commercial aromatics; benzene, toluene, xylene, and ethylbenzene are primarily extracted from either reformate (produced by oil refineries), pygas (product of naphtha steam cracking) or coal tar (mostly in inland China). These processes all produce a range of aromatics, but as benzene and PX have the highest commercial value, these are the main aromatics traded on a large scale. The majority of toluene and mixed-xylenes often remain in the gasoline pool to improve octane rating or are converted through dealkylation or isomerisation to benzene and PX.





The global PX market is almost entirely driven by polyester demand. 98 percent of production is used to produce purified terephthalic acid (PTA) which is a precursor to polyethylene terephthalate (PET) plastic. PET has uses in bottle production, packaging resins and films, but the major driver for growth is in fibres, which make up two-thirds of the market.

Benzene has the most diverse end uses of the aromatics, being used to produce intermediate chemicals that include styrene, cumene/phenol, cyclohexane, and nitrobenzene. These chemicals have final uses in packaging, resins, coatings, appliance housings, fertilizers and more. Although the largest end use in polystyrene is seeing limited growth, the broad range of end uses keeps consumption linked to overall economic performance.

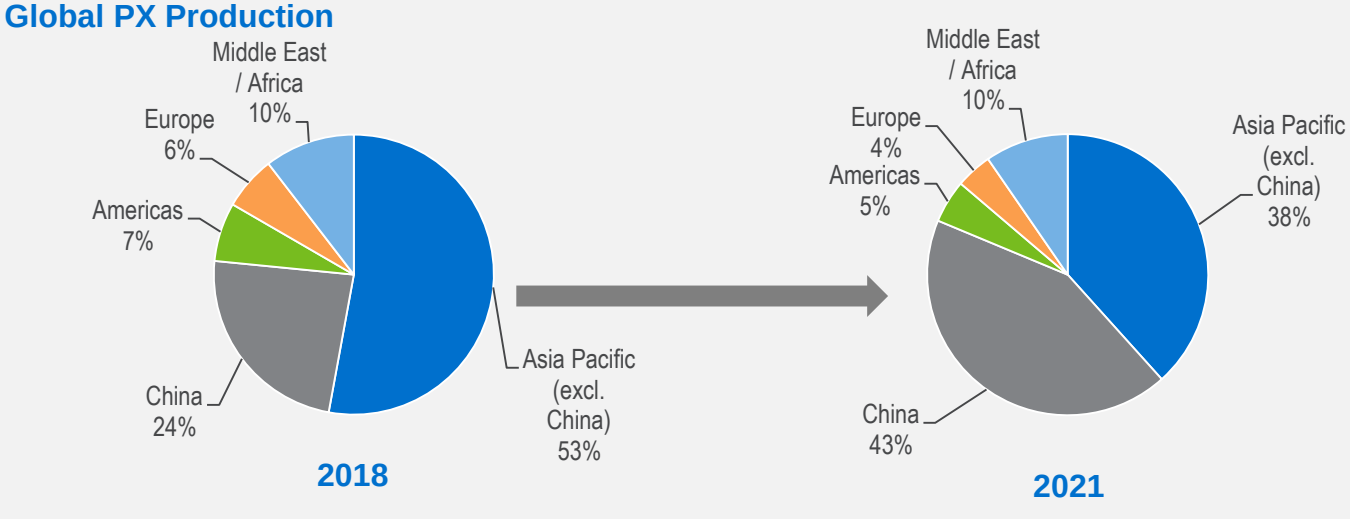
How is aromatics production changing?

The major change impacting the aromatics market is a huge increase in Chinese PX capacity through the construction of world-scale crude oil to chemicals complexes focused on aromatics. Traditionally aromatics supply has been viewed as a co-product of processes focused on ethylene, gasoline, or coke (for steel) production, but these new facilities are focused on PX.

The new PX facilities are configured to maximise PX yields from feedstock crude oil at much higher rates than traditional refinery production. PX yields on crude oil by weight are typically from five to ten percent, but these new plants are expected to yield over 20 percent by converting heavy crude oil fractions as well as diesel to naphtha to feed to the reformers. For example, the new Hengli plant will produce 4.5 million tons per year of PX from a 400 thousand barrels per day refinery compared to a typical 200 thousand barrels per day refinery that might produce 0.5 to 1.0 million tons per year PX.

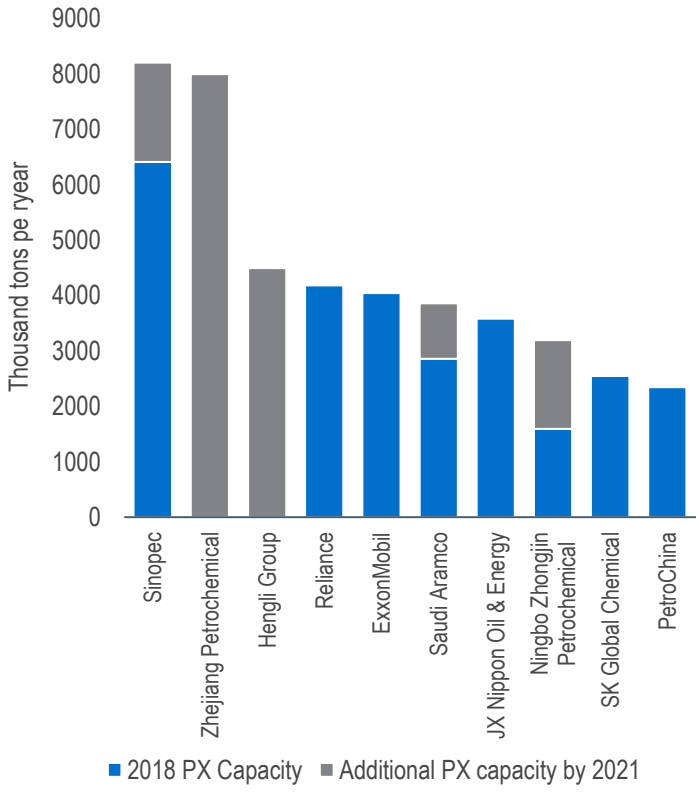
The new complexes are significantly larger than the previous world scale, raising this scale from 1.5 to 4.0 million tons per year (although this may include multiple trains). As one such plant would supply approximately 9 percent of global consumption, the arrival of several new world scale plants in the next three years will dramatically shift the global PX market. China will bring over 10 million tons of capacity online in 2019 alone, reaching almost 45 percent of the world's PX market by 2021.

Global PX Production



What is behind this expansion?

Global PX Capacity



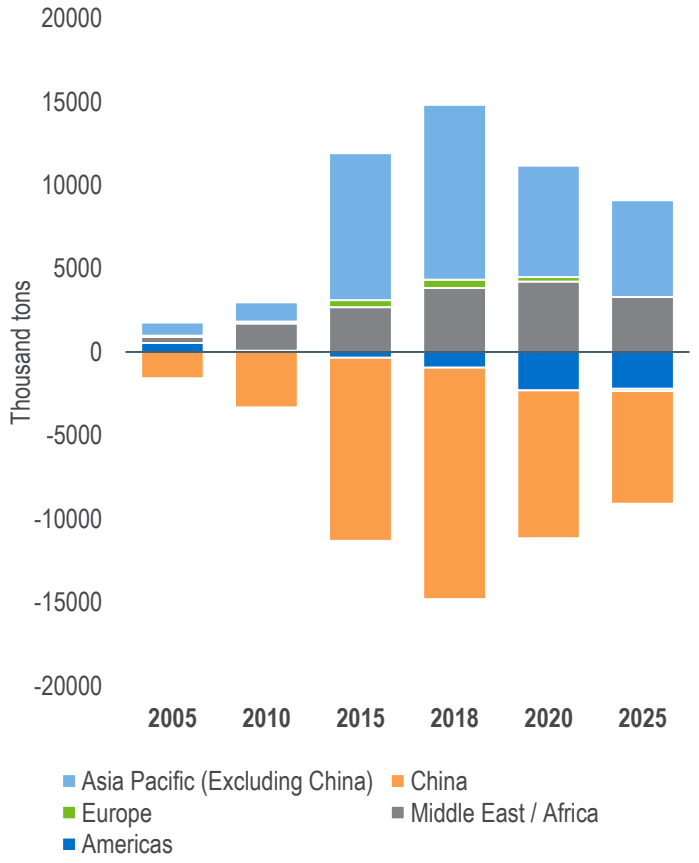
The expansion in PX capacity is being driven by back integration by the major Chinese polyester producers. This industry grew significantly through the past two decades, with producers progressively back-integrating through garment manufacture to textiles, PET fibres, and polymers.

Between 2011 and 2013 these producers added 15 million tons of PTA capacity, and the incremental demand through the PET value chain led to a massive PX supply gap. China accounts for over 70 percent of the total global polyester fibre production and over half of total polyester demand but currently has less than a quarter of worldwide PX production. China's existing need to import approximately 60 percent of its PX requirement has penalised domestic polyester producers in a highly competitive global market with thin margins.

The new plants will promote new entrants into the top ten largest global PX producers, with Zhejiang Petrochemical and the Hengli Group behind only Sinopec in 2021 by capacity.

How will *para*-xylene trade be affected?

PX Net Trade – Exports / (Imports)



China currently absorbs almost all the global net imports of PX, with a net import requirement of over thirty percent of the total global consumption. This trade comes primarily from established producers in Asia Pacific, and Middle Eastern countries that have steadily built export capacity to cater to high Chinese demand.

While demand growth has been higher than expected, the arrival of the new production complexes in China will put severe pressure on the existing suppliers of PX to China. Some capacity closures of PX appear inevitable, and the capacity of current leading companies may decline at least temporarily.

The countries that are expected to be worst hit through the potential drop in Chinese import requirement are other North East Asian producers.

Some of the Japanese and Korean supply, along with that of the Middle East is expected to be exported to Europe and the Americas, and will lead to pressure to rationalise capacity in those regions and offer little opportunity for new investment.

What is the outlook for consumption in the longer term?

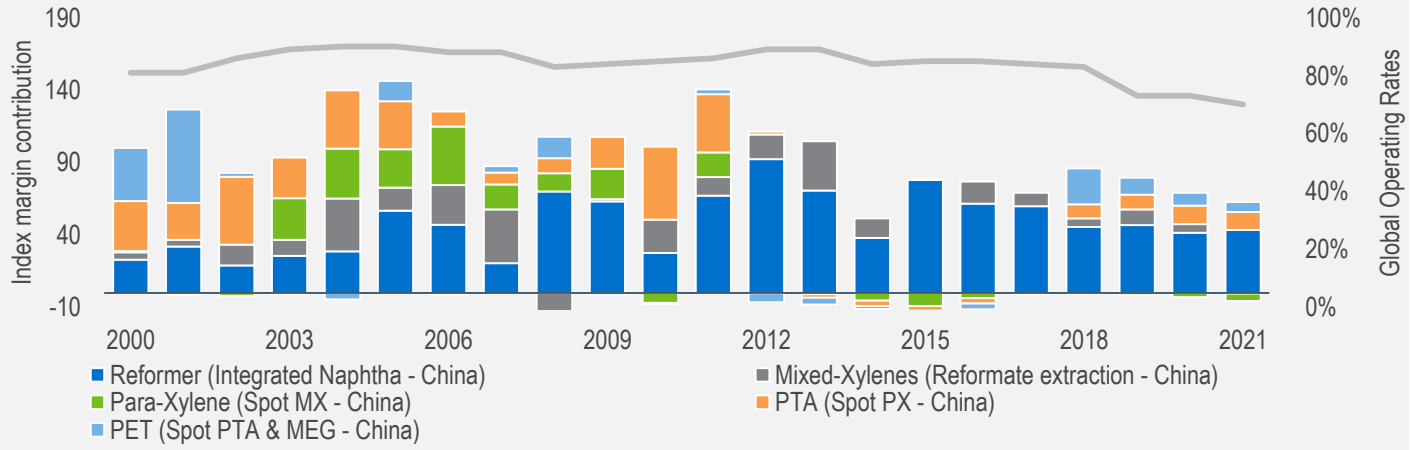
Following the large capacity build that will occur from 2019 to 2021, consumption in Asia Pacific is expected to outpace further capacity growth to 2030. This is expected to be driven by demand growth in two countries, China and India. Indian consumption is expected to almost triple by 2030, the largest growth rate globally for the period, resulting from similar downstream PET trends to those seen in China this decade.

Recycling is a further trend that may impact PX consumption as PET is the easiest commodity plastic to recycle. Current recycling measures primarily focus on bottle grade PET, which is a smaller demand of PET in China, and have been affected by legislation (including a Chinese ban on importing plastic waste). As a result recycling does not significantly impact the PET chain currently but could limit long term growth rates to some extent.

How will the *para*-xylene build affect margins?

After extensive integration along the entire polyester value chain, the current investment in crude to PX represents the final point of this backward integration process. The below graph shows how the cash margins per ton of PET are distributed back to the reformer over time (2000 index basis).

Relative PX Cash Margins (China) and global operating rates



PET margins have been extremely thin with steady, large capacity builds through 2003 to 2009 eroding profitability for non-integrated producers. Between 2011 and 2013, PTA experienced a sharp shock through a rapid growth in PTA capacity which led to PTA margins being destroyed. During both of these capacity growth periods the underlying PX price remained more steady (or increased), although in general profits shifted upstream towards the reformer units and margins for PX extractors disappeared from 2011 onwards.

This PX margin gained by integrated producers will decrease from 2019 as a result of the capacity expansion, with Nexant expecting PX cash margins to drop by nearly 25 percent to 2021. This will fall primarily on the mixed-xylene and PX extractors rather than at the reformer, which is expected to see a smaller decrease in profitability. PTA and PET producers will see some recovery as PX prices drop, increasing cash margins.

The new plants being brought online will operate on a massive scale, and as most of the new Chinese capacity will remain captive to the major consumers, will operate at the maximum achievable rates to reduce external purchasing requirements. The fully integrated crude to PX technology plants may also produce ethylene from naphtha crackers, which will be converted to MEG to produce PET, further improving plant competitiveness.

The capacity growth will therefore have a significant impact on existing PX producers that export into China. It can be expected that there will be significant capacity rationalisation, with margins dropping to levels which may result in closure of Laggard facilities. Global operating rates can be expected to drop over 10 percent from 2018 levels, and are not expected to recover until the second half of the next decade, significantly inhibiting further capacity growth in the medium term.

How does this impact the wider aromatics markets?

Although tightly focussed on the production of PX, the integrated units coming online from 2019 onwards will bring excess benzene supply from refinery reformate extraction and de-alkylation, and from naphtha steam crackers. This benzene supply surge is around a third of the corresponding new PX capacity which can be expected to lead to smaller but still notable relative decreases in benzene margins and operating rates.

Before the announcement of these major PX supply developments, ethylene supply dynamics had been more influential on benzene markets. As these new units come on-stream, previously feared risks of short benzene supply will ease. Benzene derivative producers will see new opportunities as increased quantities of benzene reach the market at competitive prices.

For toluene, over 70 percent of global consumption is benzene and mixed xylenes via toluene hydro-dealkylation (HDA), toluene disproportionation (TDP) and transalkylation processes, which tend to be highly opportunistic and dependent on production economics. The expected PX oversupply will decrease the attractiveness of TDP for a time, creating the potential for significant excess toluene availability although price decreases will be limited compared to that of PX.

Mixed-xylene producers will come under more significant pressure. Aromatics operators reliant on merchant sale or purchase of mixed xylenes are expected to face diminished margins as a result of the decrease in large scale mixed xylenes trade.

Although the new complexes are focused on PX, they will still produce more refined products than petrochemicals. The surge in oil refining capacity which accompanies the new PX plants will maintain pressures on margins at refineries. Attrition of refinery margins would be most pronounced in China, where new major independent refiners risk closure of older smaller refiners.

Summary

PX markets face unprecedented disruption from 2019, as Chinese PET producers finish the process of back integrating through the value chain. PX capacities will expand by nearly 38 percent to 2021. This has the potential to dramatically decrease the import requirement of the dominant Chinese market by up 7.4 million tons per year and drop global operating rates by up to 13 percent. The previous shift in polyester value chain margins to PX will extend upstream, particularly harming independent PX producers. The coming oversupply will have additional but more limited effects beyond PX, as the co-product benzene from the integrated aromatic refinery complexes lengthen ahead of derivative demand.

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