The global refining industry is going through dramatic structural shifts in demand and supply trends that are reducing margins and putting capacity at risk of closure. These trends will only accelerate going forward. This creates a clear imperative for refiners to shift toward a more nimble and efficient operating model to survive and, ultimately, to thrive.

SUPPLY OUTPACING DEMAND

Since the “Golden Age” of refining came to an abrupt end in 2008, the global downstream industry has seen dramatic shifts in fundamental supply and demand trends. The 2009 crisis lowered global demand for oil products, and while global demand has rebounded since, it is at structurally lower rates of growth. At the same time, refining capacity continues to grow at a strong pace, especially east of Suez. The result is growing overcapacity and downward pressure on utilization and margins.

Asia has become the engine for global product demand growth, led by developing countries such as China and India. Economic growth continues to translate into higher demand for light products such as diesel and gasoline. However, the rate of growth has begun to slow as economic growth rates have fallen in these developing countries. Also, developed countries such as Korea and Japan are seeing outright demand
declines. Europe is seeing a prolonged decline in demand due to an aging population and a strong commitment to the Kyoto protocol that is forcing car makers to produce lower-emission vehicles.

New refinery construction in Asia has also been strong, with growth countries such as China adding new capacity to meet new local demand, without regard for the excess capacity already available from nearby developed countries such as Korea and Japan. High growth countries that are short on local refining capacity (e.g., China, Vietnam) continue to build new refining capacity to satisfy local market demand despite readily available spare capacity in the surrounding region. The Chinese industry has shown a willingness to slow down or defer new projects in reaction to a slowdown in demand growth, and we think this behavior will continue. This avoids the threat of China becoming a major net exporter. However, the unwillingness to rely on available spare capacity across the region (in Korea, Japan and Taiwan) keeps Chinese demand growth from solving the problem of over capacity more broadly.

Major crude exporters in the Middle East continue to add refining capacity, motivated by a number of factors. Firstly, ensuring security of domestic supply remains a top political priority, despite the relatively abundant supply of fuel imports. Second, Middle East players are motivated by maintaining their competitiveness in the global crude market. NOCs are investing in refining capacity that is well suited to process domestically produced heavy crude grades and monetize them in the form of export refined products. Finally, most new investments have a greater degree of integration into petrochemicals, aromatics and lubricants, and entail building new marketing assets and capabilities, which not only improve the economic fundamentals of their new investments, but also their existing asset portfolio, despite overall lower refining margins and utilization for the industry.

EXHIBIT 1

Global refining capacity is growing at historically high rates, and its complexity is increasing

Global refining capacity and capacity additions

<table>
<thead>
<tr>
<th>Mb/d</th>
<th>2012</th>
<th>2012-2020 increase</th>
<th>2020</th>
<th>2025</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NA</td>
<td>93.0</td>
<td>-0.8</td>
<td>102.9</td>
<td>105.1</td>
</tr>
<tr>
<td>LatAm</td>
<td>1.6</td>
<td>-0.1</td>
<td>2.2</td>
<td>2.2</td>
</tr>
<tr>
<td>EUR</td>
<td>0.8</td>
<td>0.7</td>
<td>4.2</td>
<td></td>
</tr>
<tr>
<td>FSU</td>
<td>0.2</td>
<td>0.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arab</td>
<td>0.2</td>
<td>0.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gulf</td>
<td>10.0</td>
<td>1.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Africa</td>
<td>0.5</td>
<td>0.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asia</td>
<td>28.0</td>
<td>0.2</td>
<td>31.9</td>
<td>39.6</td>
</tr>
<tr>
<td>Pacific</td>
<td>1.6</td>
<td>1.0</td>
<td>21.6</td>
<td>23.0</td>
</tr>
</tbody>
</table>

Global conversion/distillation ratio is expected to grow faster than distillation

1 Barrels per stream day

SOURCE: McK Global Refining database

Global refinery construction is still growing despite low margins and growing over supply. In order to absorb this additional capacity before 2020, hydrocarbon demand growth would have to be at historically
high levels. With refining capacity growing at 1.3% pa, light product demand would need to increase from the currently forecast 1.1%pa just to keep up. This seems unlikely in the near to medium term. As a result, most regions will see overcapacity and lower utilization.

LOWER UTILIZATION GLOBALLY

We expect crude throughputs in the European coastal market to fall to levels in line with about 70% of current capacity. This is unsustainable operationally and should force further rationalization of capacity.

EXHIBIT 2

We estimate that a quarter of the Western European refining capacity is currently margin negative and that almost half is cash negative when taking into account turnaround and sustaining capital. But a shake out of over capacity is likely to take years to materialize. Many refiners are part of larger corporations under pressure from national governments and labor unions to keep operating even when unprofitable. Some refineries have sold at bargain prices, reducing the capital stock of the buyers, but this has not yet resulted in a significant change the overall capacity in the market.

The impact that this outlook will have on Europe is particularly stark, with 25% of capacity margin negative and 40% cash negative. Europe suffers from a number of structural disadvantages that won’t be going away. Demand is falling in the developed countries of Western Europe, and this is set to accelerate. The existing refining capacity is less complex than the Middle Eastern and US Gulf Coast refineries that are competing to place product in the European market. Finally, the supply of local crude is declining, keeping crude expensive relative to competitors.
The Asia outlook is only marginally better, with growing overcapacity forcing utilization down further over the next several years. However, by later in the decade we expect slowing growth in new capacity, largely in reaction to these lower margins, to start to bring utilization back up.

EXHIBIT 3

European refining system has overcapacity and structural disadvantages that make it uncompetitive in the longer term

In contrast, the North American refining industry has actually seen a resurgence in profitability and utilization. This has been driven, not by growing demand, but by a growing availability of cheap crude. The dramatic growth of unconventional oil has oversupplied the market. Combined with restrictions on crude oil exports, this has led to lower crude prices in the US relative to the rest of the world. This allows US refiners to profitability compete in the export market, sending diesel to Europe and gasoline to Latin America. This advantage has declined recently as the local crude market has tightened, but still remains significant.

NARROW LIGHT/HEAVY DIFFERENTIALS WILL PERSIST

Fundamentals are also working to keep the light heavy differential narrow. Conversion capacity is growing faster than distillation capacity, increasing the industry’s ability to destroy resid. At the same, the global crude slate is getting lighter as light unconventional oil grows at the expense of medium sour and heavy crude. Together, these trends keep resid markets tight, and resid prices high relative to crude. This makes investment in new upgrading capacity (such as coking) extremely unattractive.

Tightening specifications for bunker fuel have some potential to improve the market, but this is uncertain and only possible post-2020. The introduction of new MARPOL regulations on bunker fuel sulfur have the potential to reduce fuel oil demand and increase light product demand. Beginning in 2017, international shipping is required to shift to fuel with less than 1% sulfur. Effectively, this requires either shifting from residual fuel oil to marine diesel, or installing expensive emission scrubbers. If these new regulations were implemented and enforced as planned, this would eliminate ~3 million bpd of residual fuel oil demand, and add about the same in marine diesel demand. This would be enough of a shift in the global resid balance to send the market long on resid and widen the light/heavy differential. However, MARPOL will be revisited in 2018 and given the trepid outlook for the global economy introduction by 2020 is unlikely with a
postponed date to 2025 more likely. Also, the experience thus far with enforcement of tighter standards has not been great. Compliance in Europe with regional sulfur restriction has been about 50%, which doesn’t bode well for broader international compliance in the future.

EXHIBIT 4

**OPPORTUNITIES IN A CHALLENGED MARKET**

Despite the challenged outlook for the industry as a whole, there are still a number of actions that individual refining companies can take to protect their position.

- **Improve position on the supply curve** - There is still room for many players to move to the left side of the supply curve, but you must be willing to invest to get there. There are recent examples of refiners investing in complex capacity. This includes new refineries in North Asia and the Middle East, but also in existing refineries in Europe. It is likely that these assets will be long-term survivors in their respective markets, but it is unclear that the return on capital will be positive. That will depend on how efficiently these projects can be done, and whether the market outlook is slightly more positive than it currently appears.

- **Flexibility is the name of the game** - The larger availability of crudes and intermediate feed stocks is creating an opportunity to optimize assets. Asia in particular will see a much more diverse crude slate, including supplies from new regions (Latin America and North America) and of new grades (condensates and extra-heavy crude). Assessing and running these will require a much faster and more nimble crude change process. While trading organizations and merchant refiners have shown great agility, more traditional technical organizations have struggled to do this in an expedient way.
Low cost is not an option but a necessity – Low-cost operations is a requirement in the new environment. The refiners that survive will have a sustained, low cost structure; reducing cost at every opportunity, increasing time on tools, employing low-cost country sourcing, and minimizing shift positions and rigorous SG&A reduction. The times of large corporate efficiency offices and programs are past. Gold plating of turnaround and capital projects cannot be tolerated. This will require a much larger appetite for (economic) risk taking from the operating teams.

Supply reliability is overrated - With an over-supply of capacity and crude in every region, the paradigm of supply reliability needs to be challenged. Inventory levels are generally set to ensure maximum crude intake and 100% market supply security. With margins lower, slowdowns of the refinery are less costly. With ample supply of product, additional hydrocarbons can be sourced from the market at a fairly low cost.

Securing access to end markets for products – For the growing number of refiners who are long on products, securing end markets can provide a significant premium. Traders have led the way in investing in distribution and marketing assets to capture local market premiums and to build a short position to trade around. Refiners should be looking at investment opportunities to gain access to markets with growing imports (i.e., Southeast Asia, Africa, Latin America).

All of these actions will require a nimble organization, where decisions are made on a local basis and there is limited room for the slow, overarching global processes and standards that the global majors have been used to. This will be a major hurdle for many of the incumbent players, and could be the key determining factor of who will emerge as winners, and who as losers.

Tom Janssens (Tom_Janssens@McKinsey.com) is a Partner with McKinsey’s Oil and Gas Practice in Houston. Tim Fitzgibbon (Tim_Fitzgibbon@McKinsey.com) is a Senior Expert with McKinsey’s Oil and Gas Practice, also in Houston.