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# CRUDE OIL MARKETS IN 2015: THE BATTLE FOR MARKET SHARE

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## INTRODUCTION

Since the OPEC meeting on November 27, 2014, world attention has focused on the U.S. shale oil producers, their financiers and how quickly they will throttle back their production due to low oil prices. U.S. producers are now considered by many to have taken over the role of the major marginal supplier of oil, replacing OPEC. Clearly, the rapid growth of shale production in the U.S. has been a major disruptive factor in global oil markets over the past few years. Although at first American tight oil production cancelled out unplanned disruptions elsewhere in the world and kept prices relatively stable for a number of years, its spectacular growth also altered crude and oil product flows—leading to a new globalization of the oil product market—and shifted the perceived situation in the oil market from scarcity to abundance. African light oil producers had to seek other markets for their oil, while producers of sour crudes also saw their North American market shrink. With demand for crude and oil products weakening in the summer of 2014, and Libyan production resuming (though this proved to be temporary), the global market was in oversupply.

High and stable crude prices, in combination with the low interest rates resulting from the U.S. Federal Reserve's policy of Quantitative Easing (QE), have supported the financing of the smaller entrepreneurial companies in the U.S. light tight oil (LTO) sector. Only lower oil prices could stop the growth of shale oil production.

Low prices will constrain financing for the more leveraged U.S. shale players, although many of them have so far maintained their access to capital. It should also be noted that in the low interest rate environment new sources of non-bank capital, including private equity, have played an important role in financing the U.S. shale boom. The timing of the U.S. Federal Reserve's decision to end QE and raise interest rates will now impact the industry's

more exposed companies. The boom years are over and a more constrained period in the U.S. shale industry has commenced. Maintaining production levels, particularly in a period of lower oil prices, will be a major challenge not just for the U.S. shale industry but also for the large international oil companies (IOCs) and national oil companies (NOCs) that have more expensive sources of conventional oil projects in their portfolio.

While the low price environment has led to a sharp drop in rigs operating in the U.S. shale industry, the link between the number of operating rigs and U.S. LTO output has been reduced by a number of factors. Hedging future output, improving efficiencies in fracking (hydraulic fracturing) operations, and cost compression—as the oil services industry increasingly reduces its service fees in response to the falling-off in upstream activity—have all worked to keep U.S. LTO output higher than industry observers had earlier expected. Many U.S. LTO producers hedged their price risk positions, delaying the impact of declining prices on their earnings. In addition, the ability to cut costs quickly by lowering fees for drilling and other service companies and focusing on sweet spots has allowed U.S. production to continue to grow, even in a much lower price environment. It was only in April 2015 that U.S. production in the shale basins showed signs of stabilizing output. The expectation is that some basins will now actually decline in output, finishing the year with little growth compared with the year before.

An aspect not often considered in other analyses is that supply commitments for natural gas and NGLs could have continued to drive production of light tight oil in the winter months. Just as natural gas was a 'by-product' of light tight oil in the years before, light tight oil could also have fulfilled this function in relation to natural gas and NGLs in the cold

winter months. Nevertheless, the price elasticity of American tight oil production has been much lower than anticipated in late 2014.

In fact, American tight oil producers have been cutting their budgets and they are holding off on completing their wells until prices recover. Instead they are focusing production on the best oil plays, such as the Permian. The fall in the number of drilling rigs and the number of people forced out of the industry shows that the shale industry did respond rapidly to falling prices, but the impact on output was much slower to materialize. The question is how the industry will respond to price recovery to levels above \$65 a barrel. With the service sector in oversupply, contracting rigs should be relatively easy and at much lower costs than before.

This strategy could keep prices depressed for a longer period than anticipated. The International Energy Agency (IEA), which had previously predicted prices would recover soon as tight oil was shut in, now also admits that the adjustment in output was slower than anticipated. If the strategy of the U.S. LTO producers works and they can successfully turn the tap on and off without much pain to their business models, they will be able to aggressively compete for market share against other oil producers in the years to come.

### SHORT-TERM SUPPLY RESPONSES?

The initial expectations after the OPEC meeting were that tight oil production would soon have to adjust to the new market reality of lower oil prices. Although the U.S. Department of Energy predicted that oil production would continue to grow because of earlier investments, others in the market expected production to tail off very quickly. In February 2015, U.S. oil production reached 9.4 million barrels per day (MMbbl/d), despite the substantial fall in the number of drilling rigs. While industry observers

expected in December 2014 that global supply would grow by about 1 MMbbl/d for 2015, the consensus is now that non-OPEC supply growth will reverse into a decline after the summer of 2015, leaving global growth at 0.7 MMbbl/d for the year.

Yet this assessment on a mid-year return of market stability could turn out to be overly optimistic. Although U.S. tight oil production growth is now tapering off, OPEC production in the first half of the year had increased to over 30 MMbbl/d. The IEA Oil Market Report (OMR) of April 2015 predicts supply for 2015 as around 95.2 MMbbl/d, still in surplus over demand for the year and about 3.5 MMbbl/d higher than in 2014. And, with the lifting of sanctions on Iran a distinct possibility this year, OPEC production might rise further, leaving prices at the current \$55-65 per barrel level for much of the year. It should be noted, however, that much of the expected growth in OPEC capacity over the next few years is expected in Iraq, where sectarian strife and the unstable political and security environment puts a significant downside risk on the Middle East production outlook. The outlook for Libyan production also looks ever more uncertain, while politically stable countries such as the UAE and Kuwait are finding it increasingly difficult to meet their ambitious targets of raising capacity due to a range of challenges.

Meanwhile, in the last six quarters, too much oil—on average more than 1 MMbbl/d—is being produced and must be stored in tanks and on tankers, causing a deep contango in the futures market. Many expect that by the summer of 2015 the market will begin to rebalance and inventories will begin to drain, resulting in a slow but gradual recovery of the oil price and a return to the marginal cost of supply. With the growth spurt in American tight oil possibly over and service sector rates down, the response of the tight oil producers might be more price-elastic to increasing prices than it was to falling prices.

## DEMAND RESPONSES?

There are some early signs that global demand growth has been responding to the current lower oil price environment. For instance, in the year to April, global products demand has risen by more than 1.7 MMbbl/d. While crude demand has also grown—albeit at slower rates—it is difficult to ascertain how much of this has gone to stockpiling in places like India and China. Indian demand is growing strongly, but it cannot (yet) compensate for lower growth in China. Also, U.S. demand is currently growing and the outlook for the pace of U.S. economic recovery will play a key role in the outlook for global oil demand growth. Some Asian governments have used the opportunity provided by low oil prices to retire or reduce subsidies on oil products and increase taxes on petroleum products. The strength of the U.S. dollar also translates to a much smaller oil price fall in local currencies, dampening short-term demand growth. Nevertheless, oil demand is predicted to grow in 2015 by more than 1 MMbbl/d to 93.6 MMbbl/d, mostly in emerging markets. Despite this demand response, robust global oil supply growth in 2014 and the first half of 2015 has meant that stocks continued to accumulate, but at a slower rate than initially expected.

## ATLANTIC FRAGMENTATION

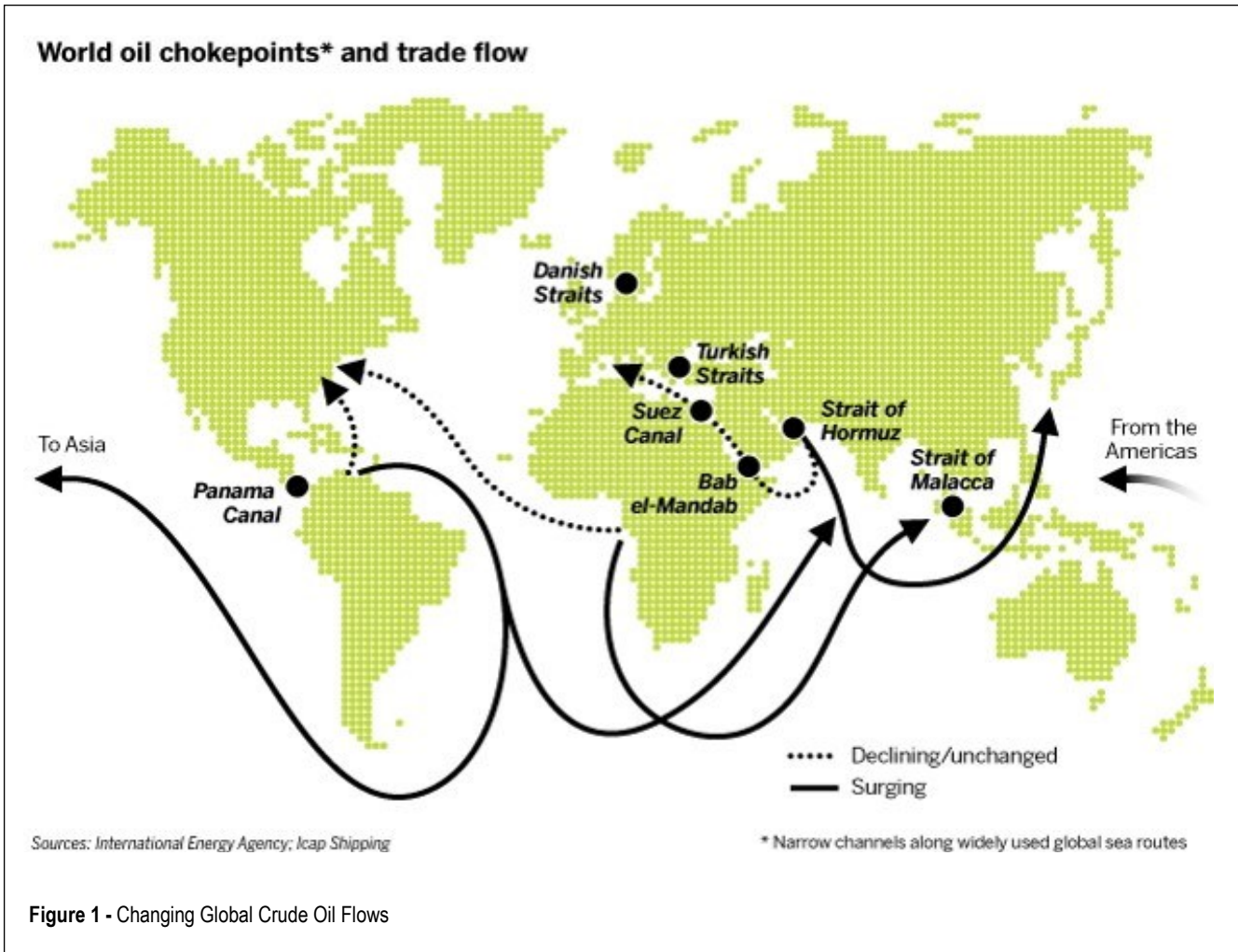
In the wake of the U.S. surge in LTO production, shifts in global crude oil flows, in terms of volumes, qualities and destinations, look set to be of a structural, long-term nature. Global crude oil trade, for example, is believed to have peaked in 2012, and has rapidly declined from its peak of 36 MMbbl/d in 2012 to 34.1 MMbbl/d in 2014. About 1.2 MMbbl/d more of the crude formerly traded in the Atlantic Basin will by 2020 flow into the Asia-Pacific Basin, reaching a total of 4.8 MMbbl/d.<sup>1</sup> The trade in crude oil worldwide is expected to keep declining in volume, though more slowly than before. By the end

of this decade inter-regional crude trade is forecasted at 33.8 MMbbl/d.

The ongoing contraction of the crude trade market is primarily caused by the declining import needs of North America, resulting from the increase in production of light, tight oil in the U.S. and rising Canadian oilsands output. These growing volumes of domestic sources of oil have displaced foreign imports, and will continue to do so. At the same time, American oil product exports have increased substantially, fundamentally altering the gasoline-diesel balancing trade with Europe.

Steeply rising growth in the U.S. liquids production (up by 4 MMbbl/d since 2010, of which 1.6 MMbbl/d was in 2014 alone)<sup>2</sup> has in recent years dramatically transformed the oil market. One of the consequences of surging volumes of regional oil production in North America has been the sharply reduced need for overseas imports, which in turn has altered the entire global oil trading map.

Although the U.S. is not in a position to directly export its LTO production because of a ban on crude exports, the country has been able to do so indirectly through refined product exports. Surging volumes of LTO and oilsands have to a considerable extent been absorbed by the large and sophisticated refining cluster in the U.S., largely concentrated along the Gulf Coast. As a direct consequence of rising domestic crude oil supplies and relatively flat domestic demand for products, the U.S. is now the world's largest gross exporter of oil products (3.8 MMbbl/d in 2014).<sup>3</sup> Global sales of middle distillates (diesel and fuel oil) have grown tenfold in the past decade and now reach well over 1 MMbbl/d. About two-thirds of those volumes are shipped to Latin America—mainly to Mexico, Chile and Venezuela—while about one-third is sold to Europe<sup>4</sup>, where the diesel deficit is expected to grow to almost 2 MMbbl/d by 2020.<sup>5</sup>



Exports of light distillates (naphtha and gasoline) from the U.S. have more than tripled in the past decade, to well over 0.5 MMbbl/d, and have also found their way mainly to Mexico and Latin America.<sup>6</sup> It is interesting to note that the U.S. is likely to switch from a net importer of light distillates to a net exporter as early as 2017.<sup>7</sup> This will eventually lead to a situation by 2020 in which both North America and Europe have about 0.5 MMbbl/d of gasoline for sale on a net basis. Competition in gasoline-short markets in the Atlantic Basin is therefore expected to increase significantly. This new competition might result in a further capacity reduction or fall in utilization rates among the refineries in Europe.

U.S. refining activity and the country's reliance on product exports in order to accommodate ever growing flows of domestically produced liquids which, at least for now, cannot be exported, represent a clear argument in favor of challenging the view that North America is developing into some sort of petroleum independent 'fortress'. The continent is certainly becoming less dependent on crude imports from outside North America, in particular of light crude oil. But this will partly be offset by its increasing need to find new outlets for its surplus volumes of both light and middle distillates, a growing portion of which will likely have to be exported far beyond its traditional customers in the Atlantic Basin. Hence the surge in U.S. LTO



production can be seen as responsible to a large extent, not only for a relative contraction in the crude trade, but also—and perhaps most importantly—for a globalization of the oil product market.

On the other side of the Atlantic, European imports of crude continue their gradual decline. Europe's refining sector will be forced to continue shedding capacity due to a structurally lower demand outlook at home and stiffer competition from U.S., Middle East and Asian refiners in export markets. This means the crisis in the European refining industry will likely continue. Although margins have been high recently due to lower prices for feedstock crude, the outlook in the longer term looks far from rosy.<sup>8</sup> All told, this will reduce Europe's need for imports of crude by another 1 MMbbl/d, to 8.2 MMbbl/d by 2020. The FSU will remain Europe's largest foreign supplier of crude (down by 0.6 MMbbl/d to 3.5 MMbbl/d), followed by Africa (down by 0.6 MMbbl/d to 1.9 MMbbl/d) and the Middle East (up by 0.1 MMbbl/d to 1.7 MMbbl/d).<sup>9</sup>

Together, these developments will result in reduced demand for crude in the Atlantic Basin. Almost all the exporters of crude oil will thus increasingly have to change focus and shift their supplies instead to the Asia-Pacific basin, the world's largest market in terms of oil demand growth. Increasing exports of Middle Eastern crude to China (up by 0.7 MMbbl/d) will constitute the largest single growing flow of oil, according to the IEA's 2015 medium term outlook. The organization also foresees exports to Asia from producers in Africa (up by 0.4 MMbbl/d), Latin America (up by 0.4 MMbbl/d) and the FSU (up by 0.3 MMbbl/d) growing substantially. More than offsetting those increases, however, are the declining volumes of African (down by 0.6 MMbbl/d) and FSU (down by 0.6 MMbbl/d) oil going into Europe, as well as declining exports of Middle Eastern shipments of crude (down by 0.5 MMbbl/d) to OECD countries in the Asia Oceania region and African (down by 0.3 MMbbl/d) oil to the Americas.<sup>10</sup>

## PACIFIC ORIENTATION

Among the first effects of the surge in U.S. LTO output was to displace imports of light West African crude. This increasingly forced unsold cargoes of West African crude to head towards Asia. Latin American crude oil exports to Asia have also increased as Asian buyers such as India and Korea have ramped up imports from Latin American producers including Mexico, Colombia, Ecuador and Brazil. While Mexico is the only Latin American producer to have Asian pricing formulas, other producers from that continent are increasingly pricing their crude on a Brent basis and offering discounts to penetrate Asian markets. As Asian refiners are planning to add over 5 MMbbl/d in capacity over the next five years or so, many of the new plants are being built to process cheaper oils to increase margins, raising demand for heavier crudes from Latin America. Indeed, the oil glut has also encouraged North Sea crudes—usually shipped to European buyers—to be increasingly exported to refineries in Northeast Asia despite the significantly higher shipping costs.

In contrast to the forced and relatively fast eastward reorientation of West African and Latin American crude oil exports, Russia's export strategy to Asia has been in the making for over a decade. Growing concerns over the country's near absolute export dependence on Europe gave way to the construction of large pipeline infrastructure designed to transport increasing volumes of Siberian crude both directly into China, via a spur pipeline, and to a variety of other Asian customers, via the Kozmino export terminal, along Russia's Pacific Coast. The Eastern Siberia Pacific Ocean (ESPO) pipeline, which was commissioned in 2010-11, has a total capacity of 1 MMbbl/d<sup>11</sup>—which will be expanded to 1.6 MMbbl/d by 2020—and thus has the potential of boosting Russia's stature as Asia's pre-eminent alternative to rising Middle Eastern supplies. According to the Russian Academy of Sciences, the Asia-Pacific region will eventually overtake Europe as Russia's largest

crude export outlet by 2040.<sup>12</sup> Impressive progress has been made in recent years by Russia towards increasing its eastern footprint, but it is highly unlikely that the European oil market will cease to play the role of Russia's preferred cash cow in the medium term at least. The continued importance of Europe as Russia's (only) buyer of higher quality products, which are intended to add value to exports of raw materials, is a good example.

Another reason why the crude trade is believed to have peaked, in volume terms, is the increasing amount of crude being refined domestically in new build refineries in the Middle East, especially in Saudi Arabia. Saudi oil products, for instance, have been gaining a share in total exports since 2013 from below 10 percent to 15 percent in 2015, with new capacity coming on stream soon.

It is not only in the Middle East, however, where new, large-scale refining capacity and/or capacity additions are being built closer to the wellhead. Russia and the U.S. also combine large crude oil production with oil product export capacities. As a result, it is expected that the oil product market, unlike the crude market, will expand as a growing number of producing countries seek to add more value to their exports.

In its 2015 Medium Term Oil Market Outlook, the IEA therefore notes that: "the net results of those upstream and downstream changes will be a continued shift of the global oil market from crude to products, with contraction and fragmentation in crude markets mirrored by expansion and globalization in product markets."<sup>13</sup>

### CRUDE POWER OR PRODUCT PLAY?

How then do the changing dynamics in the crude and product markets impact on the operations of various upstream players? In the last decade, international oil companies had invested heavily in strengthening their position in crude supplies. The emphasis was on large and complicated offshore

projects and other technically-challenging oil plays, such as oilsands, deep offshore and the Arctic. At the same time, they optimized their refining and petrochemical operations, shedding capacity in markets such as Europe. Before the shale revolution, American refining capacity was also under pressure and capacity was either scrapped or upgraded, depending on the location. Most upgraded refineries were optimized for heavier crudes and a preferred product slate, but the global crude oil supply slate has lightened.

Most IOCs were late in participating in the U.S. shale revolution, although some entered that part of the industry through acquisitions. Nevertheless, the crudes available for U.S. refinery operations changed markedly when LTO production increased. Initially, Midwestern simple refiners benefitted from the new production, but soon U.S. light crude also found its way to Gulf refiners, replacing African light crudes for blending. Imports of heavier crudes to match the specific gravity requirements of refinery feedstock demand continued. The 1980s U.S. crude export ban, which had been irrelevant for decades, gained increasing scrutiny among industry observers and regulators although it remains unclear whether the ban will be lifted under the current administration. U.S. crude production could only find international markets through the refining window, changing the fortunes of this segment of the U.S. oil industry as domestic refiners saw the benefit of cheap U.S. crude supplies. The spread between WTI and Brent widened as a result of rising supplies and infrastructure bottlenecks in evacuating the new oil to the market. In addition, gasoline imports began to decline and instead U.S. refiners needed to find export markets for their products.

The relatively high cost of the supply portfolio of IOCs (and shale suppliers)<sup>14</sup> led to marked reductions in investment at the beginning of 2015 to bring the portfolio closer to a \$60 barrel cash flow neutral level. The capital expenditure plans of the



upstream oil industry are being re-calibrated to the lower oil price environment, taking into account the structural changes in the market of the past few years. The \$100-plus oil price levels prior to mid-2014 had delayed the changes made by some players in order to structurally adjust to the new supply dynamics in both crude production and refining and have encouraged the entry of new sources of supply.

### COMPETITION FOR MARKET SHARE

Without the comfort of Saudi Arabia's reducing production to balance the market and support prices, the cuts in supply are now coming from many producers with high break-even costs. Such adjustments on the supply side to lower oil prices have taken much longer to work themselves out than some industry observers expected. Almost a year after the decrease in prices that began in mid-2014, production is now declining in the most marginal basins, although in volume terms the reduction is small. Competition for market share among the large oil producers has intensified and is now the defining characteristic of global oil markets.

Dramatic capital expenditure cuts among the large IOCs and NOCs as well as smaller upstream players will lead to the cancellation or deferral of many of the larger, more expensive, planned upstream projects. Cost deflation has already emerged in the oil services sector and large employment cuts there have already begun to gain momentum. Meanwhile, U.S. tight oil producers will be able to further lower their costs and improve efficiency, putting pressure on the oil majors with exposure to Canadian oilsands and deep-water projects. The substantial collateral damage from the heightened competition in global oil markets will be in these segments of the industry and subsequently in the offshore services and contracting industry at large.

The widely-used 'call on OPEC crude oil' statistic is much less of a determining factor in the direction of

crude oil prices in the current context, where production cuts by leading OPEC producers are no longer the preferred policy. Increasingly, the state of the oil markets will be a function of competition among the large producers—Saudi Arabia (and the core Gulf States), Iraq, Iran, Venezuela, the U.S., Canada, Russia, Brazil, the FSU and the large African producers Nigeria and Angola.

Asia is the only region, apart from the Middle East itself, where demand for oil is forecasted to increase substantially, although the pace of U.S. economic recovery will also play a major role in the outlook for global oil demand in the medium term. Because regional production of liquids in the Asia Pacific region is expected to remain flat in the medium to long term outlook, the need for imported crude will rise in line with the region's demand growth. That growth, however, will not be as strong as it has been in the past decade, mainly because of China's transition to lower growth rates as it shifts increasingly away from manufactured exports towards the services sector. The oil exporters of the Middle East, led by the Gulf countries—Saudi Arabia (6.9 MMbbl/d)<sup>15</sup>, Iraq (3.4 MMbbl/d)<sup>16</sup> and the UAE (2.5 MMbbl/d)<sup>17</sup>—will also have to take into account the increasingly stiff competition in serving the Asian oil market. Indeed, exporters from Africa, Latin America and the FSU are reorienting part of their flows towards Asia as a result of their declining exposure to their traditional export markets.

All these countries will compete head-on for market share. This competition will drive the marginal cost curve down in the coming years, producing a larger market share for the lower cost OPEC producers. Meanwhile, Saudi Arabia and the Gulf States are rapidly expanding their refinery industry as a means of reducing refined product imports, adding value to their heavier crude oil streams and for refined product export. Increasingly, refineries in specific markets are becoming part of a trading portfolio rather than processing oil for certain markets. In

2013, the Gulf Cooperation Council region added almost 1 MMbbl/d of greenfield refining capacity, with another 1.7 MMbbl/d of capacity coming online by 2020.<sup>18</sup> The construction of large-scale new build refineries in Saudi Arabia, Kuwait and the UAE will increase the region’s total capacity to 10.3 MMbbl/d. Domestically sourced crudes, especially the heavier streams, will feed these refineries. Apart from the

structural changes in crude oil supply and demand, oil product markets are thus also rapidly changing, creating even more complex import and export relationships among countries. As refined product exports increasingly displace crude exports among some of the major producers, producers and end-consumers will be bound by more varied chains of trade in refined products.

## REFERENCES

<sup>1</sup>IEA (2015). Medium Term Oil Market Report.

<sup>2</sup>EIA (2015).

<sup>3</sup>EIA (2015).

<sup>4</sup>Ibidem.

<sup>5</sup>IEA (2015). Medium Term Oil Market Report.

<sup>6</sup>EIA (2015).

<sup>7</sup>IEA (2015). Medium Term Oil Market Report.  
EIA (2015).

<sup>8</sup>WSJ (2015). “Refiners Need More Help”.

<sup>9</sup>IEA (2015). Medium Term Oil Market Report.

<sup>10</sup>IEA (2015). Medium Term Oil Market Report.

<sup>11</sup>Reuters (2014).

<sup>12</sup>The Energy Research Institute of the Russian Academy of Sciences (2014).

<sup>13</sup>IEA (2015). Medium Term Oil Market Report.

<sup>14</sup>Wood Mackenzie, presentation at IRO meeting Rotterdam, Corporate positioning at \$60bbl.

<sup>15</sup>Reuters (2014).

<sup>16</sup>Trading Economics (2015).

<sup>17</sup>EIA (2015).

<sup>18</sup>IEA (2015). Medium Term Oil Market Report.

## ABOUT THE WORKSHOP

In collaboration with KAPSARC and OIES, Clingendael International Energy Programme (CIEP) hosted a workshop in the Hague in March 2015. It was conducted under the rule of capturing the discussion on a non-attribution basis. Thirty eight international and local experts participated, as follows:

- Shahad AlArenan - Research Analyst, KAPSARC
- Samer AlAshgar - President, KAPSARC
- Ziyad AlFawzan - Research Analyst, KAPSARC
- Nader Al-Kathiri - Senior Research Analyst, KAPSARC
- Yazeed Al-Rashed - Senior Research Analyst, KAPSARC
- Hamad Al-Sayari - Former Governor, Saudi Arabian Monetary Agency (SAMA)
- Alessandro Bartelloni - Policy Director, FuelsEurope
- Jason Bordoff - Director, Center on Global Energy Policy, Columbia University
- Anne-Sophie Corbeau - Research Fellow, KAPSARC
- Mohamed Daoudi - Head of Market & Technology Intelligence, Aramco Overseas Company (AOC)
- Richard de Caux - Head of Refining Analysis, BP
- Tilak Doshi - Program Director, KAPSARC
- Rodrigo Echeverri - Research Fellow, KAPSARC
- Bill Farren-Price - CEO, Petroleum Policy Intelligence
- Bassam Fattouh - Director, Oxford Institute for Energy Studies
- Luca Franza - Researcher, Clingendael International Energy Programme (CIEP)
- David Fyfe - Head of Market Research & Analysis, Gunvor Group Ltd
- Antoine Halff - Head, Oil Industry & Markets Division / Editor, Oil Market Report, International Energy Agency (IEA)
- Jan Hein Jesse - Consultant, Jesco
- David Hobbs - Head of Research, KAPSARC
- Bob Levin - Managing Director of Energy, CME Group
- Giacomo Luciani - Professor, Institut de Hautes e Etudes Internationales et du developpement
- Marwan Masri - President Emeritus, Canadian Energy Research Institute (CERI)
- Hamad Mehthel - Head of Technology and Engineering, Aramco Overseas Company (AOC)
- Ke-Xi Pan - Professor, Fudan University
- Pieter Platteeuw - Global Business Director Aromatics, Dow Hydrocarbons
- Daan Rutten - Researcher, Clingendael International Energy Programme
- Amrita Sen - Chief Oil Analyst, Energy Aspects
- Adnan Shihab-Eldin - Director General, Kuwait Foundation for the Advancement of Sciences (KFAS)
- Sammy Six - Researcher, Clingendael International Energy Programme
- Pier Stapersma - Senior Researcher, Clingendael International Energy Programme (CIEP)
- Karen Sund - Founder and Partner, Sund Energy
- Tharwat Talhouni - Corporate Advisor, Saudi Aramco Overseas (AOC)
- Aad van Bohemen - Energy Envoy, Ministry of Economic Affairs, The Netherlands
- Coby van der Linde - Director, Clingendael International Energy Programme
- Cyril Widdershoven - Researcher, TNO
- Frans Wieleman - Directorate General for Energy, Telecommunications and Competition, Ministry of Economic Affairs, The Netherlands
- Hanxiong Zhu - Post-doctoral researcher, School of Social Development and Public Policy, Fudan University.

## Notes