



Crude and Refined Oil Products Markets: Transient shocks or secular change?



About KAPSARC

The King Abdullah Petroleum Studies and Research Center (KAPSARC) is an independent, non-profit research institution dedicated to researching energy economics, policy, technology, and the environment across all types of energy. KAPSARC's mandate is to advance the understanding of energy challenges and opportunities facing the world today and tomorrow, through unbiased, independent, and high-caliber research for the benefit of society. KAPSARC is located in Riyadh, Saudi Arabia.

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Summary for policymakers

The map of world oil flows is changing. It is not only the flows of crude oil that have been affected by surging US light tight oil production, but product flows are also undergoing significant change. Whether these trends will represent a transient shock or a secular change depends on policy decisions in North America, among other factors. These include the depth and persistence of the current global economic slowdown, the impact of the current low oil price environment on the US production outlook for light tight oil, and US and European regulatory interventions in oil price reporting and over-the-counter (OTC) oil derivative markets. The contours of structural change are still matters of debate, but the consequences of US light tight oil output will continue to reverberate across the global crude oil and refined product markets.

Most discussions of security relating to oil revolve around security of supply. However, KAPSARC's oil markets research focuses through the lens of the less researched "security of demand" for net exporters. It addresses questions about the costs and benefits of maintaining diversity among consumers, the case for downstream integration as a means of securing demand, and the consequences of changed flows of crude and refined products on price setting and trading norms.

On the supply side of the equation, West African crudes have been displaced from North American markets. Unexpected resilience in supply from politically unstable Middle Eastern and North African (MENA) countries has heightened competitive pressures on suppliers to Asian and West European markets. But this is not simply a crude oil story. Over-capacity in global refining, planned new refineries in major producing countries that can match product specifications in any market, and an increasing trade in intermediate products and

blendstocks pose new questions. This increased flexibility challenges assumptions that consumers are locked into a particular grade of crude, and potentially a particular relationship, for the long term. However, changes that rely on new infrastructure do not happen overnight – tightened product specifications are normally phased in to allow for smoother transitions, de-sulfurizers do not come cheap or quickly, larger product tankers require port upgrades, etc.

The demand side of the equation is equally important. The assumption that Chinese growth was unstoppable appears to be no longer valid. Diesel/gasoil has long been the premium cut of the barrel: the fuel of industry and commerce. This status may not last, as China's rebalancing of economic growth towards domestic consumption and away from industry has boosted gasoline demand growth. Naphtha demand is under pressure from growing ethane and propane volumes, particularly associated with North America's tight gas boom. Fuel oil has been in long-term retreat, especially as marine bunkers become subject to tighter sulfur specifications.

Price, as ever, provides the fulcrum. Aggressive pricing, by sellers seeking market share in the largest remaining growth markets, is accompanied by pressures in the mechanisms for price discovery itself. Increasing volumes competing for markets East of Suez are placing pressures on price formation processes, as market geography departs further from the two most liquid benchmarks (Brent and WTI). Asian consumers are seeking a benchmark that is "fixed and flat" and closer in shipping distance and time to the new center of gravity of demand in Asia. For major Middle Eastern producers to continue pricing their crude against benchmarks rather than setting prices themselves, they and their Asian customers may end up having to support a trading exchange hub in North East Asia.



Changes in benchmarks are not gradual. When they happen, transitions are rapid e.g. WTI making way for the Argus Sour Crude Index (ASCI) as the benchmark for Saudi crudes delivered into the US Gulf coast, or the abandonment of TAPIS blend pricing in favor of price formulae linked to Brent prices.

The US has been a driver of global change thanks to its surge in domestic oil and natural gas liquids supply. It could be even more so. The ban on US crude oil exports has resulted in a five-year swing of 4 million barrels per day (bpd) in the net product balance – between imports of 2 million bpd and exports of 2 million bpd. A lifting of this ban would likely result in a further reconfiguring of trade flows. Furthermore, US regulation of banks with a US presence in proprietary commodity trading following the global financial crisis has removed liquidity from energy financial markets; a void that has not yet been entirely filled by the large trading companies. In the search for liquidity and transparency in commodity markets, it is quite possible that new hubs and benchmarks will appear, but only seem inevitable with the benefit of hindsight.

Background to the workshop

KAPSARC co-hosted a workshop with the Clingendael International Energy Programme (CIEP) and the Oxford Institute for Energy Studies (OIES) on November 10, 2014 in Riyadh, Saudi Arabia. This was the first in a series of collaborative workshops with subsequent sessions to be held in The Hague, The Netherlands and Oxford, UK. The overarching question for this series of workshops is the ramifications of the way changing patterns of supply and demand are reshaping crude and refined product flows, and the extent to which these changes

represent a short-term deviation or secular change from the norm.

The global market for crude oil and refined products is rapidly changing. The US surge of light tight oil production resulting from hydraulic fracturing of shale formations is one factor. But other less publicly visible trends have equally far reaching consequences. Europe's oil refining industry, already suffering from over-capacity and its lack of complexity, risks being squeezed by investments in upgrading capacity in Russian refineries, additions of new, complex refining capacity in the Middle East, and the prospects of product flows from US East Coast refineries. China and other parts of Asia have also added flexible, deep conversion refineries capable of meeting the most demanding product specifications.

Low cost shale gas in the US is fundamentally altering the comparative advantage of regional petrochemical industries. Naphtha-feedstock based plants are losing competitiveness to those based on natural gas derived feedstocks. Crude oil trade flows are impacted both by the extraordinary turnaround of US refined product exports and by expansions of Middle East refining that may replace crude oil exports with refined oil product exports.

The workshop focused on three key areas:

- The changing geography of crude and refined oil product markets
- The impact of these changes on NOC strategies for security of demand, international downstream integration, and the effects on inter-regional price differentials
- The suitability of existing crude pricing approaches in these changing markets and implications for price discovery, formula prices, swaps, and forward markets



Changing geography of oil markets

Rising US oil production has, at least in the short term, increased global supply above expected levels because capital invested in such projects provide production with shorter lead times than conventional oil and gas projects elsewhere in the world. In the medium term, the net impact on overall supply will only be positive if the efficiency of capital spending in light tight oil is higher (in barrel/day per dollar invested) than larger conventional projects elsewhere. In any case, the increase in US supply of light sweet crude has completely displaced West African crudes from the US market. These are now seeking homes in Europe and Asia, the former a traditional market for Russian and Middle East crudes, and the latter dominated by Middle East producers.

Global demand growth has (until recently) been relatively stable. Demand continues to grow, but at a slower pace. Major Middle East crude oil producers have begun reducing Official Selling Prices to maintain market share as the call on OPEC production is forecasted to drop. Within OPEC volumes, Libyan supplies have been surprisingly resilient, while there is some expectation of a return of Iranian supplies if sanctions are scaled back. Iraqi exports also seem to be stepping up following accommodations between the KRG and the central government in Baghdad, and greater confidence in their ability to maintain political stability than just a few months ago.

Further supply/demand uncertainties surround:

- how far upstream investment plans will be scaled back in a lower price environment
- acceleration of field decline rates if maintenance expenditure is reduced
- the extent of substitution of natural gas for diesel in heavy duty vehicles

- whether energy efficiency improvements (driven by climate change and energy security concerns) will stay on the agenda in a period of falling prices

For the time being, at least, European refining has found some reprieve in the steep discounts available for light sweet West African crudes displaced from the US market. This may not result in a new “golden age” of European refining, but serves to illustrate how difficult it is to justify investment in upgrades in a refining system oversupplied with simple distillation capacity. It is unclear whether current profitability will withstand the consequences of Russian policy to promote restructuring of its domestic refining to export high quality products to Europe and Asia, rather than lower quality fuel oil (“Mazut”) and other unfinished products.

The US oil supply phenomenon is more than just a crude story, despite its role in a rebalancing of the Atlantic and Pacific basin crude oil markets. The 4 million bpd reversal of the US net petroleum product balance is, for now, also transforming the global oil product trade. The US East Coast is closer to product markets in Europe than to the US Gulf Coast. Where once Europe sent its excess gasoline to the US and imported diesel from the US and Russia, now America’s new net export capability has even led to US gasoline deliveries into China during the winter months.

One factor that would prevent these new flows becoming a secular phenomenon would be if the US government reversed its current ban on US crude oil exports – in place since the 1970s with the exception of Alaskan oil production and crude supplies to some Canadian refineries. There is a predominant view among analysts that lifting the ban would serve the wider interests of the US economy at large (and domestic producers in particular) rather than the current situation. The ban favors a narrow section of US industry –



independent oil refiners and petrochemical manufacturers are both enjoying windfall gains on depressed domestic prices of US produced feedstocks.

There are various estimates of the impacts of removing the export ban. At one end of the spectrum, there are suggestions that it would lead to an increased US crude oil supply of about 1.5-2 million bpd as a result of US crude prices rising to international levels. At the other end of the spectrum, and particularly if the Jones Act were no longer to be applied to oil product shipments, the closure of the East Coast US refining industry is foreseen. Adherents of this latter view suggest that the optimum outcome would be to ration exports such that full utilization of East Coast refineries is assured. However, it is not clear how such an arrangement would work in practice.

Regardless of whether, or when, the US crude oil export ban is lifted, producers are beginning to work around the ban by exporting minimally processed well production streams, claiming them to be exempt from the ban. “Stabilized” condensates (clear liquids with a specific gravity above 45 degrees API) are considered a refined oil product and may be exported. Short-term uncertainty about the validity of this interpretation may give way to long-term confidence as precedents become accepted.

There is a broader trend supporting the general growth in the relative share of oil that is shipped as refined products rather than as crude. Gasoline and diesel specifications are becoming more uniform in terms of sulfur content and, for markets in similar latitudes (or at least comparable climates), other factors such as vapor pressures and cloud points are also becoming more homogenous. On its own, this development would not be transformative but, coupled with an increasing trade in intermediate products and blendstocks, the trend is for growth in

the share of oil traded as products. To be sure, this will not be realized overnight. There are infrastructure constraints including terminal facilities capable of handling the larger product carriers that will ply this trade.

Other conditions seeding the product market include short-term “quality giveaways” (higher quality products supplied by refiners to markets with lower specification thresholds) becoming more common. Newer refineries are geared towards products with the highest specification to preserve the option to supply all available markets, including those with high specification requirements.

NOC Downstream integration and security of demand

The recent increase in refining capacity, particularly in the Middle East and Asia, is expected to continue during the next five years. Lead times for refinery projects typically extend beyond oil market price cycles. Many of the recent expansions and new builds that will come to fruition in the next few years were based on pre-2008 analyses when oil markets were tight, refined products demand was booming, and the outlook for refining margins bright.

Slowing demand growth, even in high-growth economies such as China, will likely weigh heavily on refinery margins going forward. This will be even more the case as refineries in the Middle East are being built to reduce reliance on imports of refined products. An additional driver of such investments is the major producers’ pursuit of investments that “add value” to their raw commodity exports and support domestic job creation.

Before the advent of spot markets and liquid traded markets, vertical integration between upstream and



downstream (from production all the way to distribution and retail) was perceived as an essential risk management tool. It allowed transfer prices to be selected that optimized the allocation of profits between upstream and downstream and between jurisdictions. As producer countries took control of their resources, it was believed to be in the national interest to secure interests downstream to provide “market access”. But these international integration efforts might be viewed as a throwback to the past, rendered less necessary by the transparency of spot markets and regulatory oversight of transfer prices.

However, it may be too soon to dismiss downstream integration. Trends towards dismantling vertically integrated oil companies, typified by ConocoPhillips, Marathon, and Hess, among others, have not been seriously tested in an environment of weak global demand. Such restructuring has been set against a backdrop of rapid demand growth and the presumption that markets can clear on price alone. Perhaps the real options, deriving from vertical integration, will turn out to deliver value when integrated companies have more choices than standalone crude suppliers. Alternatively, investments downstream may face a prolonged low-margins outlook, as increasingly more crude exports are replaced by a deluge of refined products exports from the new refining capacity recently built or coming on-stream in China, other non-OECD Asia, and the Middle East.

It is well understood that maximum economic efficiency is achieved by optimizing the configuration of a refinery for the particular crude quality it runs. To a refinery owner, value is only maximized if the quality of the crude feedstock for which it is optimized is consistently available and the producer does not extract too great a share of the added value. Gulf OPEC producers are unique in the way they develop fields in their choosing to adopt

low depletion rates, which provides the ability to guarantee a consistent crude quality for the long term. Under the right circumstances, perhaps the value chain can be optimized through both the highs and lows of the cycle, delivering higher returns to an integrated owner. The next few years will either prove or disprove the hypothesis.

For much of the past two decades, the gasoil/diesel cut was the “profit in the barrel” as the key fuel for industrialization in the rapidly growing non-OECD countries. Most refineries being built or recently constructed are geared towards maximizing yields of middle distillates such as diesel and jet-fuel. However, as industrial growth slows in Asia and, in particular, China “re-balances” away from a dependence on manufactured exports towards domestic demand, the growth in demand for gasoline has begun outstripping that of diesel. Indeed, diesel may even become the new “resid”—with margins for making diesel now approaching poor levels more typical for fuel oil.

The bottom of the barrel has been a burden since the global move away from using residual fuel oil for power generation after the oil price shocks of the 1970s. This has driven significant investments in cokers and other upgraders. The decreasing relative value of naphtha has already challenged the margins in the light end of the barrel. It is possible that changes in the part of the barrel that holds higher relative value will become more geographically specific – a possible problem for established crude pricing norms.

Crude oil pricing norms

Short term or transient changes in the margins associated with specific product streams may pose challenges in selecting the value of quality adjustments for crudes that will be refined in very different markets than the underlying benchmark.



Unless the quality adjustment is reflective of typical refinery configuration in the specific region, the risk is that it will yield a very different product slate than assumed in the price adjustment calculation.

For a crude stream to be defined as a benchmark it requires sufficient volumes to be available, stability of quality over time, many sellers and buyers, no trade restrictions (such as destination clauses), and little or no political risk – among other factors. The vast majority of crude oil grades trade off a handful of benchmarks, priced at differential to the relevant benchmarks. However, whether a particular crude stream meets the conditions or not, benchmarks are ultimately consensual and the result of historical circumstances. If a particular grade of crude oil trades at a “fixed and flat” price, markets coalesce around it, other grades are priced off it at a differential, and the practice becomes the norm in that particular market.

The flows between the Middle East and Asia account for a large proportion of global physical crude trades, and are priced under contracts linked to price benchmarks provided by PRAs. Depending on one’s point of view, PRAs either compete with the commodity exchanges or complement them in the price discovery process. They do not, theoretically, influence trading norms; rather, they attempt to report prices to clients who pay for price reporting services. However, it is impossible to please all the customers all of the time.

Today, the largest volumes of crude are traded off the WTI, Brent, and Dubai-Oman benchmarks. There are exchanges that trade swaps, futures, and other instruments around these benchmarks. The Dubai-Oman benchmark has become increasingly linked to the Brent market through swaps instruments, and it is unclear to what extent the former is actually a benchmark in its own right or whether it simply provides a relative price to Brent.

Non-price competition between sellers

Faced with a buyer’s market, major crude suppliers are competing on all fronts, not just price. Examples include extended repayment terms on credit facilities and the relaxation of destination restrictions. There has been no repeat of 1980’s style netback pricing so far, but participants in the market are only now beginning to confront the possibility that the current reconfiguration is of a long-term nature and that the resulting competitive pressures will endure.

Current stresses in the global oil market may well reveal whether the two are indeed independent.

Perhaps reflecting the steps that Middle East sellers are taking to protect market share, Asian buyers are becoming more assertive in price formation in East of Suez markets. There is evidence of the Asian NOCs and refiners participating more actively in PRAs’ price discovery mechanisms. China recently announced the planned establishment of a strategic trading hub for crude oil and products in Shanghai and appears determined to support its growth. Experience with the Qinhuangdao coal pricing hub, and its role in setting global seaborne coal prices, suggest that the ambition should not be lightly dismissed.

The history of pricing benchmarks has been marked less by evolution than by discrete and sudden shifts. As a particular benchmark has ceased to play a constructive role in price discovery, key players in the market have recognized the dysfunction and replaced it with another benchmark, or with altering existing benchmark norms. Examples include Saudi Aramco’s switch from WTI to ASCI, the abandonment of TAPIS pricing formulae, the revision of Brent (from one stream at Sullom Voe, then combined streams, and then the addition of



Forties pipeline blend, Oseberg and Ekofisk etc) among others.

The desire of major Asian oil consumers to play an active role in price discovery for their crude oil purchases from the Middle East may represent one of those secular moments when a large player decides the current system is not working for its needs and attempts to drive change in the marketplace. Such endeavors are not always successful. The failure to introduce a Urals benchmark for Russian exports illustrates the problem of attempting to create a trading hub unilaterally.

There is another aspect of regulatory changes affecting commodity markets in general, and oil markets in particular. Major US banks engaged in commodity trading have all but withdrawn from that market following the Dodd-Frank Act that imposed the “Volcker Rule” on proprietary trading. This has led to a loss in liquidity in paper and derivative markets, and made it harder for market participants to diversify away from oil prices risks. Refiners, petrochemical manufacturers, airlines, and other such parties now have to depend on non-bank entities such as large oil traders who are able to step into market-making roles like the banks, but at a higher premium. The loss of liquidity has come at a cost to those dependent on risk-taking services, previously provided by the large banks. However, the increased returns being earned by the large oil traders have not yet attracted sufficient new capital into the market to expand capacity to previous levels, and there is no guarantee that this will ever be the case.

Conclusion

It is too early to tell whether the shock to the patterns of crude oil and refined product trade resulting from the reality of US light tight oil production will be another transient event that fades over time, or represent a lasting structural change. The answer rests in the outcome of debates about crude oil exports from the US, the duration of the global demand growth slowdown, and emerging regulatory oversight for price reporting and risk management services. Perhaps the only secular change is that the oil markets risk becoming less predictable than ever.



About the workshop

The workshop was held by KAPSARC in November 2014 with over 28 international experts and was conducted under the Chatham House Rule of capturing the discussion on a non-attribution basis. Participants included:

Hisham Akhonbay – Collaboration Specialist, KAPSARC

Shahad AlArenan – Research Analyst, KAPSARC

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Jason Bordoff – Director, Center on Global Energy Policy, Columbia University

Joel Couse – Trading and Shipping Vice President Market Analysis, Total

David Daniels – Chief Energy Modeler, Energy Information Administration (EIA)

Mike Davis – Director of Market Development, ICE Futures

Tilak Doshi – Program Director, KAPSARC

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Ziyad AlFawzan – Research Analyst, KAPSARC

Jonathan Fischer – Deputy Economic Counselor, Embassy of the United States of America

Rolando Fuentes – Research Fellow, KAPSARC

Koen Groot – Researcher, Clingendael International Energy Programme

Howard Gruenspecht – Deputy Administrator, Energy Information Administration (EIA)

Antoine Halff – Head, Oil Industry & Market Division / Editor, Oil Market Report, International Energy Agency (IEA)

David Hobbs – Head of Research, KAPSARC

Owain Johnson – Chief of Products and Services Officer, Dubai Mercantile Exchange (DME)

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Imtenan Al-Mubarak – Data Analyst, KAPSARC

Frederic Murphy – KAPSARC Visiting Fellow, Temple University

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Esa Ramasamy – Global Director, Oil Market Development, Platts

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Emma van der Veen - Researcher, Clingendael International Energy Programme

Eric Watkins – Visiting Researcher, KAPSARC

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About the team



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Ziyad AlFawzan is a Research Analyst focusing on oil markets. He holds a BSc in Industrial Engineering from King Saud University.

About the Security of Oil Demand Research Project

Since the oil price shocks of the 1970s, the security of oil supply has been the main concern in academic and policy circles. The goal of this research project is to study the other side of the coin – the security of oil demand from the net-exporters perspective. How do large oil exporters trade off risk and rewards in ensuring security of demand?

In the first phase of this research project, the project develops a comparative static model of global oil trade to empirically measure the impacts of alternative crude oil market shares across segmented markets; to assess the strategic choice NOCs have in valuing alternative sales market portfolios in the context of the trade-off along the risk-reward frontier; and to compare IOC behavior as a benchmark for NOCs.

More specifically, this project will attempt to specify a parsimonious model of regionally-segmented global oil trade calibrated to 2012 benchmark data which would allow comparative static exercises to simulate equilibrium impacts of alternative placement of term-contracted crude oil, including impacts on total revenues for crude oil producers. The model focuses on three fundamental variables that determine relative crude oil prices: transport costs, crude oil quality, and refinery flexibility.

In line with KAPSARC's overall objectives, the intent is to produce policy-relevant insights that help actors in the oil industry understand the consequences of decisions taken by large exporters.

The workshop series fits into the overall project by providing a continuing dialogue that raises key issues, provides feedback on current work, and sets future directions. The workshops are an open collaborative forum that enables the discussion of particular themes that feed into identified research questions.