THE CHANGING OIL LANDSCAPE
Foreword

The changing oil landscape – introduction
This concise report looks at the structural transformation of the oil industry and trends in the price of oil. It highlights five common oil market misapprehensions and describes the new global oil refinery landscape, in which refinery operations are consolidating into regional ‘mega’ hubs. It also outlines developments in refined product markets and describes the outlook for midstream and downstream operations and the implications for trade, storage and infrastructure.

Oil market developments
While the oil market is undergoing a period of rapid transformation and structural change, old mind-sets that risk a misunderstanding of market prospects remain. Traditional assumptions that OPEC was a stable cartel, oil wells were becoming exhausted, oil came only from deep wells, oil had few substitutes, and that energy conservation was not a subject of policy no longer apply. Even the sharp fall in the price of oil over the past 18 months can be placed in the historical context of the price of oil oscillating in a $10-$40 per barrel range (today’s prices), for 118 of the past 155 years.

Global refining operations
The global oil refining landscape is undergoing structural transformation, with refinery operations increasingly consolidating into regional ‘mega’ hubs. Smaller refineries across the developed world are closing, often being converted into terminals and storage facilities for refined products. The new ‘super’ refineries have at least three distinct advantages: economies of scale; flexibility to handle up to 50 types of crude oil; and the capacity to meet the growing demand for a wider range of refined products.

International refined product markets
The market for refined products is growing. In Asia the demand for refined crude is rising particularly rapidly, while in Europe and North America, regulations are driving demand for lighter, higher-quality, products with reduced sulphur content. Local oil markets today need to be connected to the (fewer) global super refineries which are increasingly serving them. There is a growing role for physical infrastructure development, particularly in fast-growing underdeveloped markets, but also in mature markets, where existing refineries are being converted to storage and distribution facilities.

Puma Energy and the oil landscape
Puma Energy, with the support of its shareholders, continues to invest heavily in markets where oil demand is growing, markets where demand is already large, and in countries where transformative infrastructure is needed. With access to an expansive global supply network, the Company has built up a well-positioned and efficient distribution network, enabling delivery of high-quality fuel safely, quickly and reliably, at a fair price. Having established operations in the world’s fast-growing new and emerging markets, Puma Energy is now expanding into European markets, which are mostly well developed and slow-growing, but are large and likely to remain so. Europe is the world’s largest importer of both crude oil and refined products and Puma Energy is well positioned to compete in these mature markets, on the basis of both scale and efficiency.
The past year has seen a further major decline in the price of oil (together with many ‘below-the-ground’ commodities). This has taken place at a time when, in any case, the oil industry is transforming, driven by structural as well as cyclical factors. Upstream there has been a reduction in investment, in large part due to lower oil prices. Elsewhere however, midstream and downstream operations, while less impacted by lower oil prices, are undergoing significant structural change. One key element is the consolidation of the global refinery landscape which has important implications for refined product markets and global operations.

— The oil industry is going through a structural transformation, a consequence only in part of the fall in the oil price
— Today’s structural changes have many causes, including technology; globalisation; and regulation
— Refinery operations are increasingly consolidating into regional ‘mega’ hubs; smaller refineries are being closed
— ‘Super’ refineries offer economies of scale, technical flexibility, and meet mounting environmental requirements
— Demand for refined products is growing, driven by emerging markets and global needs for higher grade fuels
— Growing markets and regional hubs imply increased global trade: infrastructure development will be key
— Global oil companies with well-established trade, storage, and distribution networks, stand to prosper
Oil market developments

The substantial falls in the price of oil can be attributed approximately to a prolonged period of slower-than-expected economic growth at the global level. But more fundamentally it owes to the prior decade of consistently high (relative) oil prices, which brought forth strong investment and thereby greater supply, greater energy efficiency, and substitution.

Technological innovation, both in terms of finding new reserves and effecting more efficient extraction, including new hydraulic fracturing and horizontal drilling techniques in the US and beyond, has been substantial. Greater energy efficiency has also been incentivised, in a number of countries, by government-led initiatives.

In petrochemicals and transport, which make up the bulk of oil demand, not least because of transport’s need for high energy density fuel, hydrocarbons will continue to dominate for many years. In other sectors, more abundant alternatives, most notably natural gas, offer greater opportunity for substitution.

The oil price in historical context

While much has been made of the sharp fall in the price of oil over the past 18 months, historically the price of oil has oscillated in a $10-$40 per barrel (today’s prices) range, for 118 of the past 155 years. In fact, only following two massive shocks — the US becoming a net oil importer in 1973, and China enjoying a period of rapid, energy-intensive growth post 2000 and entry into the World Trade Organisation (WTO) — did the oil price break out of that channel (figure 1).

FIGURE 1 — CRUDE OIL PRICE, INFLATION-ADJUSTED, 1861-2015

Source: BP Statistical Review of World Energy 2015, Macrobond, and Llewellyn Consulting
Note: 2014 prices, except 2015 which is the Brent spot price average over the year
Five oil market misapprehensions

Even though the oil market is undergoing a period of rapid transformation and structural change, old mind-sets, that risk a misunderstanding of market prospects, remain. Below are five of the more common oil market misapprehensions, together with reasons why they no longer hold.

1. Energy intensity falls only slowly

It used to be reckoned — it was a common view in the 1970s, for example — that world energy use had to grow more or less in lockstep with world output, in what was considered to be an essentially fixed technological, or engineering, relationship. However, following the quadrupling of oil prices in 1973/74, and the subsequent doubling in 1878/79, ways started to be found to use oil more efficiently. After some years, world energy usage was growing somewhat less rapidly — by 1 percentage point per year on average — than global GDP. And this energy saving progressively gained momentum. By 2014 the difference had increased to 2.3 percentage points. The future is of course uncertain, and recent lower oil prices could dampen this progression; but equally, policy initiatives following the Paris Agreement could well continue to propel the rising trend of energy efficiency.

2. World oil markets reflect only fluctuations in demand

The 2015 oil price fall was due not only to demand-side factors, including the slowdown in China and the emerging markets. The supply factors were also — and remain — quantitatively important, and will likely outlast any cyclical upswing in demand.

3. The old wells are played out

Historically only about $\frac{1}{3}$ of the oil in a well has typically been extracted. New recovery techniques however — principally thermal recovery, gas injection, and chemical injection — are enabling the extraction of a further $\frac{1}{3}$ or so.

4. Capping and uncapping oil wells is time-consuming, and reduces potential output

The fracking process enables wells to be capped and uncapped relatively easily and, importantly, with little (if any) loss to future production. Reportedly more than 4,000 drilled oil and natural gas wells across the US, with a potential capacity of around 0.5 mb/d, are ready to be brought into production quickly if prices rise.

5. OPEC is a cartel

A 1% reduction in world oil output increases the oil price by around 10% in the first year, diminishing thereafter. For a single producer to increase its revenue by cutting back production therefore requires a market share significantly in excess of 10%. No single OPEC member is that sufficiently dominant. Moreover, OPEC members today will not collaborate. OPEC is a secretariat.

The future (lower) price of oil

Deciding what oil prices are likely to be in the future requires taking due account of the many forces, both short-term and longer term, that are likely to bear on the energy balance not just for oil but for energy as a whole.

For the reasons given above, the thinking that was appropriate in earlier epochs — that OPEC was a stable cartel, oil wells were becoming exhausted, oil came only from deep wells, oil had few substitutes, energy conservation was not a subject of policy — in our judgement no longer applies.

It is, naturally, far from possible to be wholly confident about the implications for price. But what is clear is that some of the older reasoning still being applied today is wrong-headed.

In our judgement it would be far from surprising to see the price of oil oscillate, for a number of years at least, within its historical long-term range of between $10 and $40 per barrel (in today’s prices). Conversely, for oil prices to rise substantially higher would likely require something very large to happen, on a scale comparable with the two massive shocks in the 1970s or China’s entry into the WTO in the early 2000s. Perhaps rapid energy-intensive growth in India could be one such development that could have the necessary scope and scale; but this does not seem particularly likely.
Global refining operations

New global landscape

At the same time as oil prices have fallen, the global oil refining landscape is changing fundamentally. The refinery network is undergoing structural transformation, with refinery operations increasingly consolidating into regional ‘mega’ hubs. The world’s twenty largest (often newly-built) ‘super’ refineries today are located in: Asia (nine); the US (five); the Middle East (four); Latin America (one); and Europe (one), (figure 2)

Smaller refineries across the developed world — which historically has refined crude locally — are closing in many countries, including Australia, Canada, and the United Kingdom.

As refineries close, so does national refinery capacity, each country in turn importing increasingly greater quantities of refined products from regional hubs. The now-closed domestic refineries often being converted into terminals and storage facilities for refined products (figure 3).

In the United Kingdom, major operating refineries have been reduced from nine to six: Teesside refinery closed in 2009, and now operates only as a terminal and storage facility; Coryton ceased production in 2012, and is now a distribution terminal; and Milford Haven closed in 2014 and is now a petroleum storage and distribution terminal operated by Puma Energy.

In Australia, major operating refineries have been cut from eight to four since 2000, with three closures since 2012: Port Stanvac refinery was mothballed in 2003, closed in 2009, and is now being demolished and cleaned up; Clyde refinery closed in 2012 and was converted into a fuel import facility; Kurnell closed in 2014 and is being converted into an import terminal for fuels; and Bulwer island closed in 2015 and is being converted into a jet-fuel import terminal.

FIGURE 2 — WORLD’S LARGEST REFINERIES

Source: Oil & Gas Journal, December 2014
Canada, for its part, has also experienced continual refinery consolidation. The number of major operating refineries has almost halved since 1980; there have been four closures since 2000 — reducing the number from 21 to 17: Oakville, Ontario, closed in 2005 and now operates as a terminal facility; Shell Montreal, Quebec, closed in 2010 and is now a distribution terminal; Bowden, Alberta, closed in 2012 and is now a terminal facility; Dartmouth, Nova Scotia closed in 2013.

**Reasons for consolidation**
Reasons for refinery consolidation are many and various. ‘Super’ refineries have at least three distinct advantages:

— First, they provide the benefits of economies of scale: some of the super refineries have capacity of up to one million barrels per day, with commensurately lower unit costs: many smaller refineries can handle only around one-tenth of this amount.

— Second, whereas older refineries can typically process only up to 10 types of crude, modern flexible and technically-capable refineries can handle up to 50 types. This is increasingly important as the sources of crude oil widen and types of crude input thereby become more varied.

— Third, the new super refineries meet the growing demand for a wider range of refined products: complex refineries have the capacity to crack and coké crude ‘bottoms’ into high-value products, as well as to remove sulphur in order to meet increasingly stringent transport fuel regulations and requirements.

The economics of the move towards refinery hubs is reinforced by trends in shipping costs which, like refineries, also exhibit powerful ‘engineering’ or ‘volume’ economies of scale. Moreover, the increased unit value of the oil product transported further reduces the (proportionate) cost of transport.

**FIGURE 3 — CLOSED REFINERIES IN UK, AUSTRALIA AND CANADA**
International refined product markets

Outlook for midstream and downstream operations

To the extent that, as we judge likely, the world price of oil stays within its historical $10 to $40 range (in today’s prices), valuations of up-stream-oriented companies stand to fall relative to down-stream-oriented companies, for two principal reasons: the price effect, and the income effect.

1. The price effect — a fall in the oil price tends to increase the aggregate (world) demand for oil, and thereby increases traded volume, boosting earnings. It also tends to reduce the viability of exploration activity that is profitable only when oil prices are high.

   The price effect is likely to be reinforced by the growing geographic diversity of supply. As countries outside of the US adopt new extraction methods, supplies will likely increase in various regions around the world. This will reduce transport costs for midstream and downstream distributors, and potentially increase margins.

2. The income effect — the extent to which the world economy picks up from a drop in the oil price, and growing economic activity increases traded volume.

   Midstream and downstream operators tend to function in markets that are variously regulated, semi-regulated, and free. This provides them with the opportunity to hedge and arbitrage between markets, thereby supporting margins notwithstanding fluctuations in the oil price. In most cases, margins in regulated markets are defined as a fixed return on investment ratio. In addition, there are opportunities to also arbitrage across semi-regulated and free markets.

Growing refined product markets

The market for refined products is growing. In Asia the demand for refined crude is rising particularly rapidly — the reason why many of the new refineries are being located there. In particular, Asia’s burgeoning vehicle numbers are leading to increasing demands for gasoline and diesel, most notably in China.

In Europe and North America, by contrast, it is increasingly stringent fuel regulations that are largely responsible for driving demand — for lighter, higher-quality, products with reduced sulphur content.

Globally, the sulphur content in maritime fuel is being limited by the International Maritime Organization. Ship operators will progressively be obliged to use less unrefined (residual) grades, and correspondingly more of the higher grades of refined products similar to diesel.

Implications for trade, storage, and infrastructure

Local oil markets today, unlike in the latter part of the 20th century, need to be connected to the (fewer) global super refineries which are increasingly serving them. That super refineries are often many thousands of miles away from the ultimate market for refined product meaning that significantly more refined product has to be moved around the world.

Transportation and storage roles are thereby increasingly becoming a mainstay of the global oil market. Products need to be shipped reliably and safely over large distances. Efficient hub-and-spoke refinery network and global operations offer great flexibility, allowing quick adjustments to increases or decreases in demand, as well as resilience to supply shocks and other market changes. Such operations can also maintain stability of supply in local markets.

Developments in refined product markets imply a growing role for physical infrastructure development across countries and regions. Building fuel import infrastructure is an essential element for energy-thirsty countries to be able to handle increasing distribution and storage of refined products.

Demand for infrastructure development is particularly strong in fast-growing underdeveloped markets with inadequate oil infrastructure. It is also however important in mature markets, in Europe and beyond, which also require infrastructure development to convert existing refineries to storage and distribution facilities.
End notes

2 Kraus, C., 2015., Hoping for a Price Surge, Oil Companies Keep Wells in Reserve.
   business/energy-environment/hoping-for-a-price-surge-oil-companies-keep-wells-in-
   reserve.html?ref=topics&_r=0 [Accessed 03 January 2016]
3 For estimates of the short-run price elasticity of demand for crude oil, see Hamilton,
   understand_oil.pdf and the references therein.
4 World oil production is currently of the order of 90 mb/d. The largest producers, in
   mb/d; US: 12, Saudi Arabia: 12, Russia: 11, China, Canada, Iran, UAE: 4 each, Iraq, Mexico,
5 “Stability requires that individual cartel members be willing to voluntarily accept the
   reduction in output implied by their membership in the cartel.” … “Strategies are
   necessary to induce individual cartel members to adhere to the cartel agreement.
   Typically, such strategies involve some sort of threat. If a single [firm] produces
   more output than the cartel plan calls for it to produce, other [firms] are committed
   to expand output in a way which leaves the defector worse off than it would be if
   Encyclopedia of Economics ed. Greenwald, D.

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