"A Cinderella Story?"

Restructuring of the European Refining Sector

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Executive Summary

In recent years the European refining sector has been going through a period of intense restructuring. Between 2008 and 2012 around 30% of total European refining capacity changed hands, was mothballed or was converted. Early 2012, the largest independent European refiner had to file for insolvency. It is unclear what the outcome of this restructuring of the European refining landscape will be.

Dismal market conditions and lack of global competitiveness

The key underlying dynamics of the restructuring of European refineries are weak local market conditions and uncertain future perspectives. Since the 'golden years' of profit margins in the refining sector (2004-2008), European refining margins have been razor thin mainly as a result of 1) declining European demand for oil products and 2) higher prices of crude oil feedstock. The 3) pre-existing overcapacity in the European refining sector has lowered margins even further. To make matters worse, the predominantly gasoline-producing European refineries are unable to profit from the high spreads for diesel, gasoil and jet fuel. In the tight global oil product markets for middle distillates, and given the overcapacity in gasoline, European refiners are finding it difficult to sell their gasoline production abroad. For them to become more in tune with international product markets would require investments in upgrading capacity.

Against the background of changing international oil product markets, refiners in Europe must also contend with changing market perspectives due to the presence of alternative (bio)fuels, electric vehicles, stricter EU environmental and carbon legislation and strong consumer bargaining power. Refiners in emerging markets, however, enjoy considerable locational advantages over European companies, ranging from strong growth in domestic oil product markets and large tax breaks for refiners and oil products, to cheap credit facilities, cheap feedstock contracts, an absence of the NIMBY effect and less stringent environmental requirements. This results in a substantial competitive advantage for Asian and Middle Eastern refiners and a 'non-level playing field' for European refiners. Hence, the European refining sector is being forced to restructure and invest for the future in a situation of great competitive pressures, small margins and large uncertainties.

No viable successor of international oil companies

With market dynamics this grim, few if any are willing to make medium- to long-term investments in the European refining sector. Moreover, which European refiner can shield itself from these adverse market dynamics or has the financial capabilities to upgrade its refining capacity, necessary in order to compete with state-of-the-art refining capacity being built in emerging markets? Again a bleak picture arises.

The most financially and technically capable owners, the International Oil Companies (or IOCs), are divesting European refining capacity and are increasing their refining exposure in non-OECD countries. Moreover, on average, the IOCs spend only 15-20% of their total investments in the downstream part of the oil value chain. The most committed refiners are the European, formerly state-owned, refiners, or 'National Champions'. Yet these refiners have limited financial resources to become competitive in the short term and remain bound to their – often national – captive markets. Other, more financially capable, owners are the National Champions from

Emerging Markets and the National Oil Companies (or NOCs) from producing countries. These oil companies are important investors, but they are currently small players. Moreover, it remains to be seen whether they will be long-term investors, due to their strong home bias. The remaining group of companies, the pure-play refiners, seem to be too exposed to the current unfavourable market dynamics and have limited financial capabilities. Recent events show how vulnerable these pure-play refiners are. As a result, CIEP is sceptical as to whether there is a category of refinery owners able and willing to invest in European refining assets on a scale and (long-term) time frame that could boost the competitiveness of the European industry.

An impetus for security of supply concerns

Given the current pace of capacity closures, the prospect that Europe will become net importer of oil products seems a likely scenario, even after decades of refining overcapacity. Therefore, the potential dependence of Europe on overseas refiners and relatively illiquid oil product markets is an issue that (European) policy makers should urgently include in their deliberations on security of crude oil supply. As described, the market for oil products, on the supply as well as the demand side, displays a number of characteristics that suggest it to be problematic in providing credible signals for (dis)investment of (European) refining capacity.

The lack of credible investment signals is a consequence of the nature of this type of infrastructure investments, the evolution of demand, and of the type of competition the EU refiners are confronted with in the world market and the market regime in the EU. The combination of 1) market imperfections in the refining sector, 2) the dilemma's of sunk costs for refiners, 3) the need to confront environmental externalities, 4) the use of oil products as vehicles for tax collection, 5) uncertainties about future demand for fuels, and 6) (the latent variation in) public intervention in the sector are all creating a rather vulnerable and uncertain situation in Europe. In such a situation, committing to large long-term investments is unlikely. Once an investment is made in a refinery, it has to earn a reasonable return for at least some decades with some certainty.

European and national policy makers should determine how to deal with structural problem of short-term market uncertainties and long-run horizons of refinery investments. This dilemma will not directly be solved on favourable terms by the market. As a result, we argue that there are a number of possible 'families' of policy interventions to be considered. The first of these involves a review of the current impact of levies, including differentials in the sales tax on diesel- and gasoline-fuelled cars, on the demand for the various fuels. Secondly, attention should be paid to the competitive position of the European refining industry versus external refiners with respect to differences in local regulation and locational advantages. A third family of instruments is geared towards supporting those refiners that are not able to adjust on their own, through lowering entry and especially exit barriers for uncompetitive European refineries.

A crucial prerequisite, of course, is that the benefits of intervention outweigh the costs over the longer term. A fourth type of solution, for the longer term, could be to substitute fuels, particularly light and middle distillates with biofuels, fuels from coal or natural gas (LNG or GTL), to balance the amounts of fuels required and to reduce the necessary throughput of crude oil. It is crucial for Europe to have an innovative and adequate oil and/or renewables-based industry to provide its future materials and fuels needs in an efficient, effective and environmentally friendly manner, one which also provides security of supply.

1

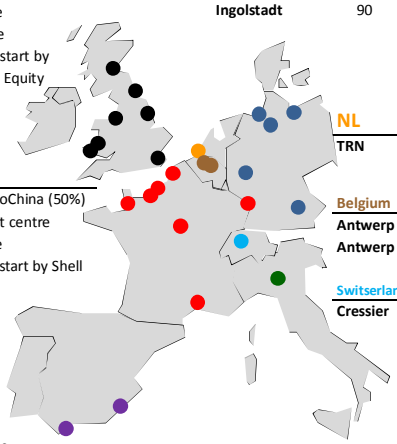
Introduction

Currently, the very fabric and commercial structure of Europe's refining industry is changing: around 30% of European refining capacity has changed hands the last few years, with 20% in the last two years alone. In January this year, Petroplus, Europe's largest independent owner, had to file insolvency and is now attempting a major restructuring. International oil companies (IOCs) such as Shell, Total and ConocoPhillips (and previously BP) are selling or shutting down their European refineries. At the same time, PetroChina, Essar and Lukoil, all National Champions of Emerging Markets, are buying European refineries. Most of the restructuring is taking place in Northwest Europe, as can be seen in Figure 1.

Figure 1: Northwest European refineries for sale recently sold or closed (2008-2012)

UK	(k/bd)	Owner	Status
Grangemouth	200	Ineos	to PetroChina (50%) ('11)
Stanlow	272	Shell	to Essar (Mar '11)
Pembroke	210	Chevron	to Valero ('11)
Lindsey	223	Total	for sale
Milford haven	105	Murphy	for sale
Teesside	117	Petroplus	Storage
Coryton	172	Petroplus	Idle, restart by Private Equity

Germany	(k/bd)	Owner	Status
Heide	91	Shell	to Kletch & Co ('10)
Ruhr Oel	392	PDVSA	to Rosneft (50%) ('10)
Harburg	83	Shell	for sale
Wilhelmshaven	260	Conoco Phillips	to Hestya Energy ('11)
Ingolstadt	90	Bayernoil	Idle



France	(k/bd)	Owner	Status
Fos Lavera	201	Total	To PetroChina (50%)
Dunkirk	140	Total	support centre
Berre 'd Etang	80	Lyondell	for sale
Pt. Couronne	162	Petroplus	Idle, restart by Shell
Gonfreville	173	Total	shut in
Normandy	80	Total	shut in
Reichstett	82	Petroplus	Idle

NL	(k/bd)	Owner	Status
TRN	147	Total	to Lukoil ('09)

Belgium	(k/bd)	Owner	Status
Antwerp	115	Petroplus	to Vitol ('08)
Antwerp	110	Petroplus	to Gunvor ('12)

Switserland	(k/bd)	Owner	Status
Cressier	68	Petroplus	Idle

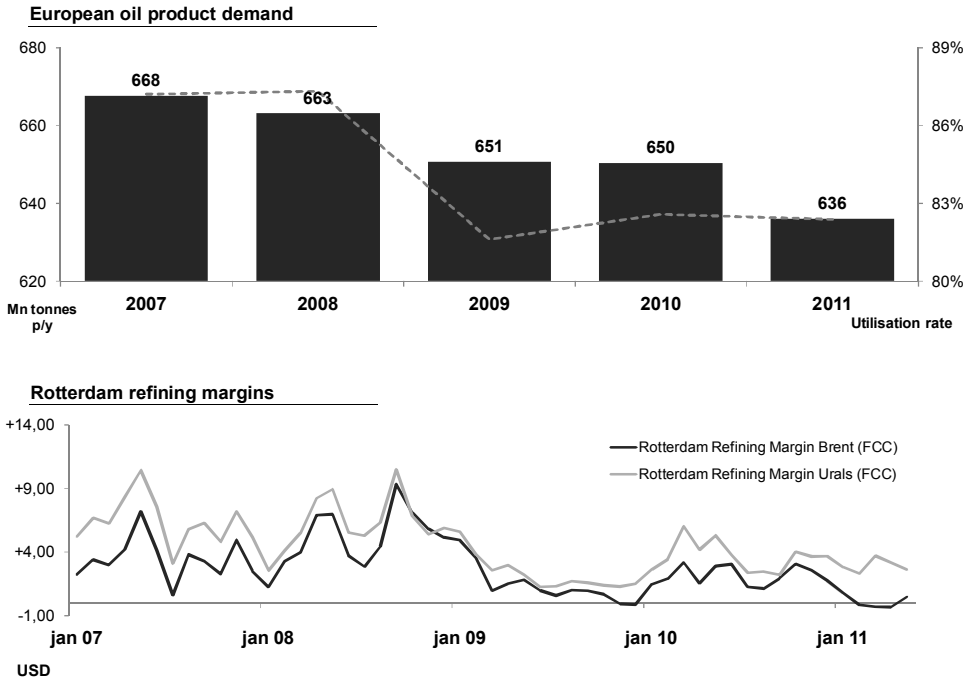
Spain	(k/bd)	Owner	Status
San Roque	240	CEPSA (Total)	53% to Abu Dhabi´s IPIC → sole
La Rabida	100	CEPSA	shareholder ('11)
Tenerife	93	CEPSA	

Italy	(k/bd)	Owner	Status
Cremona	96	Tamoil	storage

Source: CIEP Analysis, Purvin & Gertz, WGI, OGJ, IHS Global Insight, Bloomberg, Barclays Capital, FT

The main drivers behind the restructuring of the European refining sector are the decline in European oil product demand and the razor thin European refining margins from 2009 onwards. From figure two we can see that from 2009 onwards European oil product demand fell for an average of 1.9% per year. As a result, the historical overcapacity in the European refining market fell further to just above 82% in 2011. The resulting low to negative refining margins, even for complex refineries in the Rotterdam area, add to the dismal conditions for European refiners in recent years.[2] The industry's brief golden age of high margins (2005 to 2008) has turned into a period of adjustment and decline. 2009 was, as Petroplus CEO Tom O'Malley coined it, the "perfect storm" for European refiners.

Figure 2: European oil product demand and Rotterdam refining margins (2007-2011)



Source: Purvin & Gertz (2010), Bloomberg (2011), IEA (2011), CIEP Analysis

In the short- to medium term, European refiners face a number of issues that affect their profitability. Firstly, there are regional challenges, including: 1) the mature and weakening demand for oil products in Europe; 2) the changing pattern of crude supply; 3) outdated refining plants in the context of increasingly stringent European environmental legislation; and 4) EU low-carbon policy goals that will push petroleum fuels out of the energy mix in future.[3] Secondly, more efficient international competition is entering the world's refining industry, mainly from the Middle East and emerging economies. In this context, as suggested by Figure 2, European refining margins will most likely remain thin and highly variable. This awkward situation will hamper

[2] Bloomberg refining margins. Complex refineries here are referred to include Fluid Catalytic Crackers (FCC).
[3] Including the EU Roadmap 2050 (60% decarbonised transport in 2050), EU Fuels Quality Directive (more heavy and sour crude qualities are more heavily taxed), IMO Marine Fuel Changes (no more than 0.5% sulphur content in bunker fuels in 2020), CAFE requirements, etc.

refiners' commitments to the long-term investments that could enable them to cope with the market dynamics in both the crude and oil product market(s).

In recent years the challenges and impact of the changing supply and demand dynamics in the European downstream sector have been well documented. For instance, Pieterse and Correljé (CIEP 2008) argued that as a result of an increasing regional discrepancy between a heavier and sourer crude oil supply and an increasing demand for middle distillates, there is a need to increase local conversion capacity.[4] Similar observations have been made by, among others, the International Energy Agency (IEA) in 2007[5] and the representatives of European refiners in Brussels, CONCAWE and EUROPIA.[6] Whereas oil product demand in Europe has declined, there remains a need for investments to increase European refineries' relative yields of middle distillates and to allow them to adapt to environmental rules.[7]

Security of supply of oil and oil products: an issue?

Alarmed by the widespread changes in ownership and sell-outs of European refineries, authorities at the European and national levels are becoming increasingly worried about the potential consequences for the European security of supply of oil products. This concern is reflected in the call by the French Minister Eric Besson, in July 2011, to discuss a "national action plan" to strengthen the competitiveness and sustainability of the French refining sector as a result of divestment plans, predominantly those of Total.[8] Additionally, industry associations such as EUROPIA and CONCAWE[9] are calling for massive investments in the European refining sector in order to strengthen the competitiveness of the European refining sector. The European Commission (EC) also considers the petroleum refining industry to be a strategic industry.[10] In November 2010, the EC stated that *"Security of supply depends on the integrity and flexibility of the entire supply chain, from the crude oil supplied to refineries to the final product distributed to consumers"*.[11] Yet at the same time, the Commission is working toward a phase-out of fossil fuels.

The many challenges facing the sector as a whole seem to be producing a variety of strategies among the different companies active in the European refining industry. On the one hand, the vertically integrated IOCs, like Total, Shell, BP and ConocoPhillips, seem to be continuing their strategies of rationalising their downstream divisions by divesting and even spinning off their refining divisions while directing more of their capital expenditures (CAPEX) upstream in the oil value chain. Shell's adage of "more upstream, profitable downstream" illustrates this strategy. As

[4] Wouter Pieterse and Aad Correljé, 'Crude Oil Demand, Refinery Capacity and the Product Market: Refining as a Bottleneck in the Petroleum Industry', in: *CIEP Energy Paper* (The Hague 2008).
[5] The International Energy Agency (IEA) is the oil watchdog of the OECD. International Energy Agency (IEA), *Medium-term Oil Market Report July 2007* (Paris 2007).
[6] CONCAWE, *Oil Refining in the EU in 2015* (Brussels 2007).
[7] Europia, *White Paper on European Refining* (Brussels 2010).
[8] The French call was sparked by recent divestment plans of Total and the announcement of LyondellBasell to sell its 105 kb/d French Berre refinery in southern France. Last year Total idled its 141 kb/d Dunkirk refinery, and the shutdown of Petroplus's 84.8 kb/d refinery in Reichstett is pending. (Doris Le Mond, 'French Minister Wants "National Action Plan" for Refiners', in: Oil & Gas Journal (June 22, 2011).
[9] See Europia, *Europia Contribution to EU Energy Pathway to 2050* (September 2011); Europia, *White Paper on European Refining* (September 2010); and Concawe, *Oil Refining in the EU in 2015* (2007).
[10] See European Commission (EC), *Priorities for Infrastructure Priorities for 2020 and Beyond* (November 2010), and European Commission (staff working paper), *On Refining and the Supply of Petroleum Products in the EU* (November 2010).
[11] EC 2010.

stated, independent refiners, such as Petroplus, are being squeezed out. On the other hand, we see National Champions from emerging (net-importing) markets such as China and India investing in downstream assets in order to gain a toehold in the sizable European oil product market. For instance, in January 2011 PetroChina acquired 50% of the UK Grangemouth and the French Fos Lavare refineries, with a combined conversion capacity of 420 thousand barrels per day (kb/d), from the independent European refiner INEOS for a value of 1.015 billion US dollars. This observation begs for a better understanding of how different categories of refiners react to the pressures mentioned and what investment strategies they will develop.

In assessing the value drivers behind the investment strategies of oil companies, the present literature mainly focuses on either market-specific or asset-specific drivers (primarily for individual refinery plants). These include, according to Bacon (1990): firstly, the *location*, which determines the regional market demand, access to open seas, the location vis-à-vis competing refineries and the connection to crude, feedstock and product pipelines; secondly the *conversion capabilities*, including scale, complexity, flexibility in processing different crude qualities and flexibility in product slate; and thirdly, the *regulatory scrutiny* to which a refinery is exposed.[12]

In addition to market or asset value drivers, however, we argue that in reaction to the changing market dynamics, company-specific strategic drivers also play a major role in company investment decisions and thus in the current ownership changes taking place in the European refining sector. Hence, in this paper we will also look at the oil companies' strategic and risk management approaches, as well as their financial capabilities to execute their preferred strategies in their refining segments.

Furthermore, we will use the Porter[13] perspective (in Chapter 3) to analyse the recent developments in the European refining sector. Furthermore, we will examine whether and to what extent the changing supply and demand conditions affect the global competitiveness of the European refining sector. Yet the main question of this paper is not whether there is a need for investment in the European refining sector, as this has already been positively established. The question is which companies (or type of companies) are able and willing to commit the capital for restructuring in the context of global competitive pressures in the downstream oil sector. Therefore, this paper will focus, from an actor perspective, on the investment drivers of different types of companies operating in the European refining sector, in the context of changing market dynamics, global competition and the increasing concern surrounding the security of oil product supply in Europe.

In Chapter 4 we will study the investment and divestment trends of European refiners by type from the perspective of vertical integration (market risk management) and financial capabilities. We identify six categories of firms in the European refining sector, namely International Oil Companies (IOCs), National oil companies (NOCs) of producer countries, European National Champions, National Champions of emerging markets, pure-play refiners, and "others" mainly involving private equity. The main question is which oil companies can be expected (to become) long-term investors in the European refining sector. As such, the question must be raised as to

[12] Bacon (1990).
[13] Michael Porter (2008) *The Five Competitive Forces That Shape Strategy*, Harvard business Review, January 2008.

what consequences the changes in ownership of European refineries and the strategies of the firms have for European security of supply of oil and oil products.

In Chapter 5 this question is addressed, applying a New Institutional Economics perspective. This perspective brings together the issues of a) committing substantial investments, b) specific market conditions, and c) the appropriate institutional context in which this should take place. We will discuss the extent to which the ownership changes in the European refining sector, the market developments and the (lack of) inclination to invest may pose a threat to European oil and oil product supply security. Finally, we comment on the issue of the policy space that exists within the EU context with which this (potential) threat can be confronted.

2

Changing market dynamics in the European downstream sector

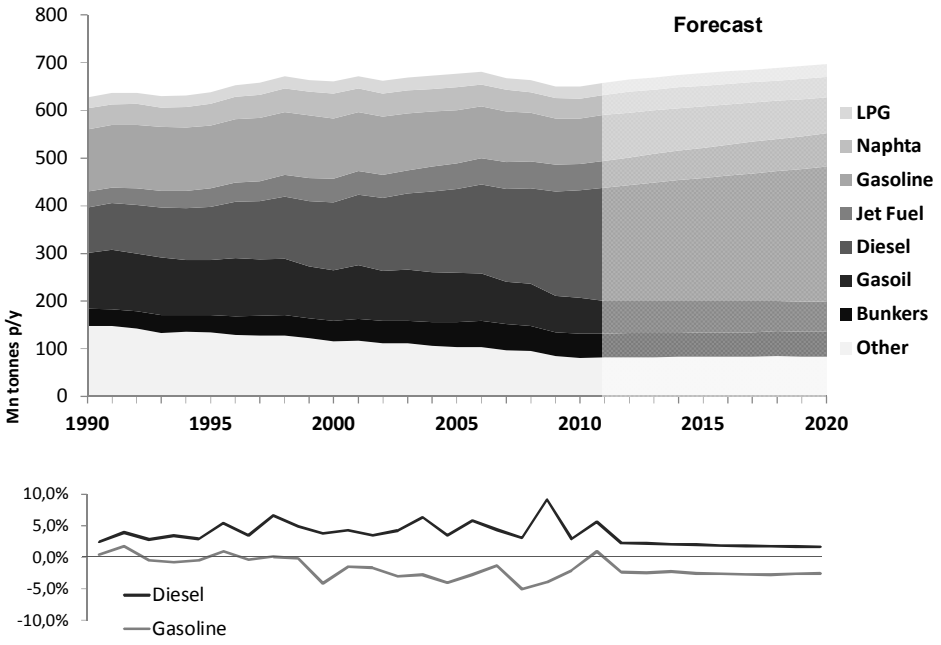
The current intensity of restructuring within the European refining sector is a direct result of changes in its regional (European) market and global sectoral challenges. Central to this chapter are the questions which challenges European refiners face from a European and global perspective and to what extent these challenges affect the global competiveness of the European refining industry.

In this chapter we would like to emphasise this duality of influences on the European refining sector. First, we examine recent developments in the European downstream sector from a supply and demand fundamentals perspective, including changes in European fuel demand and crude supply. Second, we analyse the multitude of global challenges the European refining sector faces from a supply chain perspective. Here we employ the 'Five Forces' framework of Michael Porter (1980) in order to structure the various global challenges European refiners face.

Oil product demand: the importance of middle distillates

Generally speaking, the European oil product market is widely considered to be a mature market with marginal future demand growth in line with the general economic development within the European Union. Since 1990, as a result of changing economic activities, significant changes have also occurred in the demand for certain oil products, and this trend is expected to continue. The changing demand for individual oil products (also called product slate) between 1990 and 2020 is shown in Figure 3 below.

Figure 3: Changes in demand for specific European oil products and for diesel and gasoline (1990–2020)



Source: Purvin&Gertz, CIEP Analysis

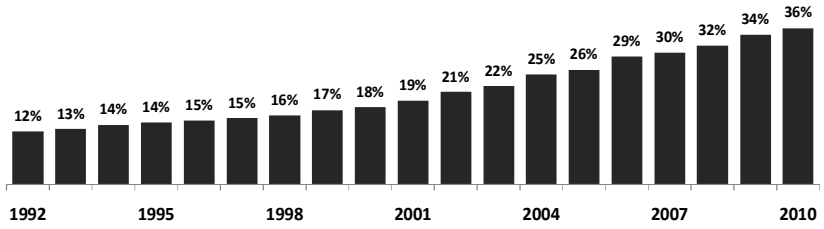
Firstly, **demand for middle distillates**, namely diesel (predominantly for transport) and jet fuel, **almost doubled between 1990 and 2010**[14] as a result of the increased dieselisation of the European car fleet[15] (as can be seen in Figure 4), the increased commercial road transport, and the sharp rise in air transport of both goods and people. The increased use of diesel as a transport fuel (for both goods and people) is mainly the result of different levels of taxation for gasoline and diesel. In many European countries, the main exception being the UK market, gasoline is priced as a luxury fuel, while the lower tax level for diesel reflects its economic importance for transport and for primary (fisheries, agriculture) and secondary (industry) sectors.[16] Also, demand for bunker (marine) fuels grew by 39% between 1990 and 2010, reflecting the growth in international trade and associated increase of sea and inland maritime transport.

Secondly, the **popularity of diesel** as a transport fuel (see Figure 4) has reduced gasoline consumption, as can also be seen in Figure 3. The proliferation of diesel-powered cars and highly efficient and powerful diesel-fuelled combustion technology has lowered overall gasoline demand in the mature European market. With diesel becoming a more efficient fuel in terms of emissions, stringent European environmental rules also promote diesel-powered cars at the

[14] Between 1990 and 2008 demand for middle distillates (in this case diesel and jet fuel) increased by 82%. Oil and Gas Journal (OGJ), *Special Report on EU Refining* (January 2011).
[15] Penetration of diesel-fuelled transport vehicles rose in the European car fleet from 12% in 1990 to 36% in 2010. Wood Mackenzie (2011).
[16] Purvin & Gertz, 'Study on Oil Refining and Oil Markets', prepared for the European Commission (2008).

expense of gasoline.[17] As a result, oil product demand for middle distillates is forecast to grow around 2% per year while gasoline demand is estimated to decline by about 2.5% per annum until 2020 (Purvin & Gertz 2009).[18]

Figure 4: Dieselisation of the European car fleet (1992-2010)



Source: Wood Mackenzie

Thirdly, **environmental legislation** (coming mainly from the EU level) increasingly impacts oil product demand. In this respect two items are key: the continued effort to reduce CO_2 emissions of oil products and the continued downward revision of sulphur content in liquid fuels. The (A) EU Fuels Quality Directive, (B) the International Maritime Organization's (IMO) revision of the allowable sulphur content of marine fuels and (C) the *EU Energy Roadmap 2050* are worth noting.

A: The **EU Fuels Quality Directive** applies greenhouse gas default values to different crude oil qualities in order to quantify the CO_2 emissions from the production of these oils.[19] In short, heavier and sour crude qualities will be taxed more than light and sweet crudes. This will impact the profitability of non-complex refineries built for heavy crudes (for instance Central and Eastern European refineries, which are physically linked to the Russian Dhruzba crude oil pipeline which transports heavy and sour Russian Ural crude oil). Additionally, as heavy and sour crude qualities will be taxed more than light sweet crude qualities, potential imports of crude oil from Canadian oil sands will become more expensive for European refiners. In effect, the EU Fuels Quality directive puts an additional levy on the feedstock of European refineries in a European oil product market suffering from declining oil product demand.

B: For maritime transport, the changing **IMO** regulations will significantly affect the market for bunker fuels. IMO regulation currently requires the use of marine fuel with a maximum content of 0.1% in Sulphur Emission Control Areas (SECAs): presently the Baltic Sea

[17] Aside from the popularity of middle distillates, other significant trends are lower demand for oil for residential heating as well as lower demand for heavy oil as a feedstock for power generation. Once again, these trends stem from stricter environmental regulation. The role of oil in residential heating and power generation has been mainly taken over by an increased use of natural gas and renewables (primarily wind and solar power).

[18] Purvin & Gertz (2009).

[19] European Commission (EC), *EU Fuels Quality Directive 2012 Review* (forthcoming 2012). The EU Fuels Quality Directive was voted upon in February 2012 by the European Commission. Of the EU's 27 nations, 12 were in favor, eight were against and seven abstained under a system of weighted voting. The directive will now be considered by environment ministers from EU countries who will give a final decision reportedly by July 2012.

and from 2015 onwards also the North Sea and English Channel. Additionally, there are ongoing negotiations about reducing the sulphur content for marine fuels globally to 0.5% by 2020.[20] Environmental regulation requires that crude characteristics of oil products increasingly become sweet and light (with lower sulphur contents and higher API) at the expense of heavier and more sour oil products Box 1 presents a sketch of the main questions for European refiners as a result of the changing IMO regulation.

Box 1: IMO regulation and the market for marine bunker fuels

The International Maritime Organization (IMO), the body that regulates emissions from international shipping, adopted a revision in 2008 of Annex VI which will trigger significant changes to marine fuels specifications, as mentioned. The question is what this new regulation means for European refiners, especially since the EC seeks, under the forthcoming EU fuel quality directive, to 'gold plate' the IMO proposals for EU waters and aims to create even stricter marine fuel regulations. This creates a challenge for European refiners. The heavy residues in their product slates effectually become an unsellable waste product in the EU market and are harder to sell on the global marine fuel market.

On a micro level, refiners have in principle two response options: (1) make changes to the production process and/or (2) stop producing marine fuels. In the first option, the refiner will have to invest in desulphurisation and/or conversion or even destruction of heavy residues. In the latter case, the refiner theoretically could choose a light, often more expensive, crude oil; or the refiner could find an alternative outlet for the heavy residual streams. In practice we see that alternative light crude sources are difficult to come by in substantial amounts. Overall, crude supply has been becoming heavier and more sour since the 1970s and producers use light crudes for their domestic refineries, leaving little for the open market.

From a macro perspective we see that European refiners will likely have a hard time exercising their (micro) options due to a lack of available volumes of light crude oil as a feedstock (which produces a lighter product slate and less heavy residue) or sufficient alternative outlets for heavy residues (as ships can no longer use heavy residues). Especially the question of available outlets for heavy residues in a global refining market experiencing overcapacity is worrisome.

Investment in upgrading sophisticated conversion capacity therefore looks like the only eligible option for European refiners, as processes for hydrogen addition, coking or gasification of heavy residues are available. However, all of these measures pose enormous technological and economic challenges involving huge capital investments (running into billions of euros) and furthermore result in additional CO_2 emissions at the refinery.

Source: CIEP Analysis, Purvin & Gertz (2011, 2009).

[20] Purvin & Gertz, 'Impacts on the Refining Industry and Markets of IMO Specification Changes and Other Measures to Reduce the Sulphur Content of Certain Fuels', prepared for: *DG Environment* (2009).

C: The ***EU Energy Roadmap 2050***, as presented in December 2011, citing a requirement of 60% decarbonised transport by 2050, will further lessen the consumer appetite for oil products and will result in an even further rationalisation of European refining capacity.[21] Interestingly, and seemingly in contrast of the previous point, the *EU Energy Roadmap 2050* also includes a reference to the European refining sector. Here it is mentioned that *'maintaining a foothold in the global oil market and keeping a European presence in domestic refining – though one that is able to adapt capacity levels to the economic realities of a mature market – is important to the EU economy'.* The notion that the European refining sector is strategic for the wellbeing of the EU economy is something new, and seems to be in contrast with the previous point on the role of the European refining sector in a low-carbon economy. The consequences for European oil (product) supply security will be explored in Chapter 5.

The steady rise in oil prices from 2004 onwards (with the exception of 2009) and the lower economic growth and purchasing power of European consumers during the financial and economic crises have negatively affected post-2008 oil demand, as can be seen in Figure 3. Nevertheless, on an oil product level the trends described above have persisted. Between 2009 and 2010 demand for diesel grew by 2.9%, compared to a 2.1% decline in demand for gasoline; and between 2010 and 2011 diesel demand grew by 5.6% while gasoline demand dropped by 0.1%. The acceleration in the growth of middle distillate demand at the expense of gasoline in recent years led Purvin & Gertz (2011) to forecast that demand for middle distillates, jet fuel and diesel/gasoil will increase from an estimated 50% of total product demand in 2010 to 59% by 2030, while they project that the share of gasoline demand over the same period will fall from 14% to 9%.[22]

Crude oil supply: light-sweet scarce and heavy-sour abundant

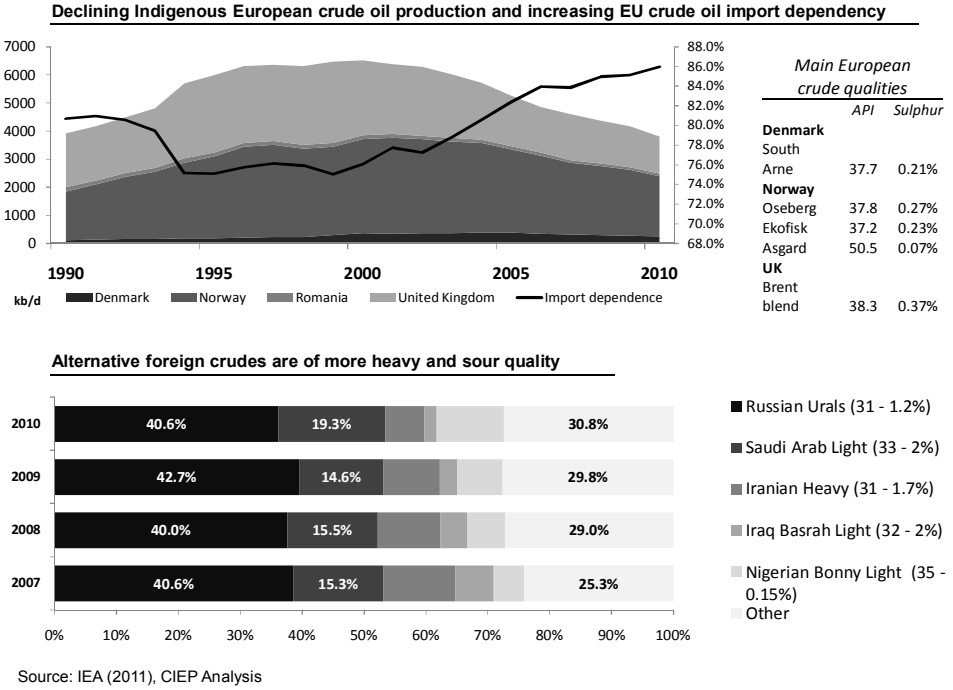
Alongside shifts in oil product demand, the quality of imported crude oil as a feedstock of European refineries has been changing. The main observation is that the European refining sector increasingly processes heavy and in particular sour crudes, substituting for light and sweet crudes, as shown in Figure 5 (reflected in a lower API and higher percentage of sulphur content).

This trend has mainly resulted from a decline in indigenously produced crude oil, predominantly from the North Sea. In order to meet European oil demand increasing volumes of crude were imported from outside of Europe, in particular from Russia (mostly the heavier Urals quality) and Venezuela, as a result of diversification away from Middle Eastern crude sources. Russian crudes became especially popular in the '90s since they were discounted due to falling domestic demand in the Former Soviet Union (FSU) and the need for US dollars and other foreign currencies after the fall of the Soviet Union. As a result, Urals are currently the predominant imported crude overall in the EU, as we can see in Figure 5.[23] Heavier and particularly more sour crude oil blends,

[21] European Commission (EC), *Energy Roadmap 2050* (December 2011).
[22] Purvin & Gertz, *Developments in the International Downstream Oil Markets and Their Drivers* (June 2011).
[23] Here we have to note that there are regional differences in the EU with regard to the level of imports of Russian and other crude qualities from the FSU. Central and Eastern Europe is traditionally more focused on Russian crude supply and Northwestern Europe also seems to source much of the Russian export of crude

i.e., crude supplied by a multitude of oil fields and therefore consisting of several different crude oil qualities, dominate incremental imports from outside Europe such as the Russian crude oil blends: Urals (mainly Northwest Europe) and CPC Blend (mainly Southern Europe).[24]

Figure 5: Lower light-sweet indigenous oil production offset by increasingly heavy-sour crude imports



Source: IEA (2011), CIEP Analysis

The main imported crudes are significantly heavier (having a lower API) and contain substantially more sulphur than North Sea oil. All main imported crudes, except for Nigerian Bonny Light (which has its own logistical difficulties)[25], have sulphur contents of more than 1%.[26] A notable exception is Libya's main export crude Es Sider, which is light (API 37) and sweet (0.39%), and which is mainly imported by South European refiners, especially Italy.

According to Purvin & Gertz (2011) the decline of North Sea crude production and increasing imports of heavier grade crude will result in a 7% reduction of light-sweet crudes processed by European refiners by 2020. A notable exception to the trend described above is the growing prominence of Natural Gas Liquids (NGLs) in the global crude oil supply as a result of resurgent

oil. Southern Europe mainly sources its imports from Africa and the Middle East. See also IEAs Monthly Oil Report (2012) for the most recent updates on EU crude oil import sources per region.

[24] **Urals** is a mixture consisting of Siberian Light with high-sulphur oils produced in Russia's European regions. **CPC** Blend is a light crude oil that entered the market at the end of 2001 with the commissioning of a 1,580 km pipeline by the Caspian Pipeline Consortium (CPC), linking major oil fields in Western Kazakhstan to a Black Sea export terminal near Novorossiysk in Russia. At the end of 2004, CPC Blend consisted of seven crude oil streams: Tengiz, Aktobe, Kumkol, Martyshi, Arman, Karachaganak and Siberian Light.

[25] The 2009 CIEP energy paper 'Gambling in sub-Saharan Africa' by Bas Percival et. al. shows the difficulties of crude oil production in Nigeria (pag. 15-29), which persist today,

[26] IEA, *Medium Term Oil and Gas Markets* (2011).

prospects of natural gas production[27]. Due to the very light and sweet nature of NGL, it has the potential to make the crude oil import mix for European refiners sweeter and lighter. The extent to which this might happen is beyond the scope of this paper but would be interesting food for thought in further research.

Replacing light-sweet crudes with heavier and especially more sour crudes as a feedstock for refiners places more pressure on the conversion and desulphurisation capacity of European refiners, especially considering the European legislative requirements to increasingly produce oil-based fuels that have ultra-low sulphur emissions and low CO_2 emissions. Turmoil in countries which produce light and sweet crudes, such as Nigeria and more recently Libya, show the vulnerability of simple European refiners in reacting to supply shocks (see also Box 2).

Box 2: Turmoil in Libya and the effect on (Southern) European refiners

The recent turmoil in the oil market, due to for instance the Libyan revolt, spells trouble for European refiners. Declining production of light-sweet crudes from the Libyan Sirtre and Murzuq basins, such as the Es Sider export crude, represented approximately 5% of European crude imports but had to replaced by predominantly Saudi OPEC spare capacity, mostly consisting of heavier crude qualities.

The absence of Libyan oil production has tightened the market for light-sweet crude types, such as Algerian Saharan Blend, and pushed up demand and prices for the remaining light-sweet crudes, as European refiners with simple refineries are unable to switch between crude qualities. A case in point are Italian refiners who have been forced to replace their 400 kb/d import of short-haul Libyan crude by long-haul Azeri and/or Nigerian crude at a premium. Due to the resulting negative refining margins, refinery runs have been reduced and refineries have idled in anticipation of returning Libyan crude production.

Inversely, prices for heavy-sour crudes have been pushed down, which is especially notable by the remark of Mr. Salem El-Badri, OPEC's Secretary General, that 'available supply of OPEC spare capacity still outstrips the loss in demand of Libyan oil production'. This seems to indicate that the market for heavy-sour crudes is still well-supplied and that incremental Saudi crude has to be marketed at a discount.

With Libyan crude slowly coming back online since the end of 2011, the problems for European refiners have grown less acute. However, the Libyan crisis showed the vulnerability of non-complex European refiners which are not easily able to switch between crude qualities during supply shocks of their main feedstock crudes.

Source: CIEP Analysis, various newspapers incl. PIW, *Refiners take Libyan Loss in their Stride* (March 7th, 2011).

[27] Natural Gas Liquids (NGLs) are components of natural gas that are liquid at the surface in field facilities or in gas processing plants. Natural gas liquids can be classified according to their vapour pressures as low (condensate), intermediate (natural gasoline) and high (liquefied petroleum gas) vapour pressure. Natural gas liquids include propane, butane, pentane, hexane and heptane, but not methane and ethane, since these hydrocarbons need refrigeration to be liquefied. Source: Schlumberger (2011).

As a result of the inability of European refiners to replace Libyan crudes with other crude types or even profit from record-high sweet-sour crude price differentials or spreads, such as between Saharan Blend (sweet-light) and Dubai (sour-light), prices for light-sweet crudes have been rising. For instance, prices for Dated Brent (the premier light crude quality in Northwest Europe) jumped by nearly 20 USD per barrel between February and April 2011. Heavy-sour crudes are abundantly available and are subsequently traded at a discount. Most European refineries have been built to process light-sweet crudes and are not complex enough to easily switch to sour and/or heavy crude types without additional investments.

Consequently, the expensive feedstocks and higher margins for competitors who due their complexity are able to profit from the increasing differentials between heavy-sour crudes are destroying the refining margins of the less complex European refineries. However, this trend has also increased price differentials between crude qualities, resulting in a hefty premium for light-sweet crudes and significant refining margins for complex refineries that are able to switch between crude qualities and make use of the discounted heavy-sour crudes, such as the Shell refinery in Pernis.

Oil product asymmetry: gasoline path-dependent and diesel in short supply

The demand trend towards middle distillates and the supply trend towards heavier and more sour crudes impact the European refining sector in two ways. First, there is a growing asymmetry between the product slate of European refineries and European demand for oil products. This has led to increasing trade in oil products between the world's regional oil product markets. Second, due to the maturity of the European oil product market and the relative illiquidity of the global product market (with the exception of transatlantic gasoline/diesel trades), refineries have a hard time adjusting to these asymmetries by restructuring their product slate through investments or intercontinental fuel trade.

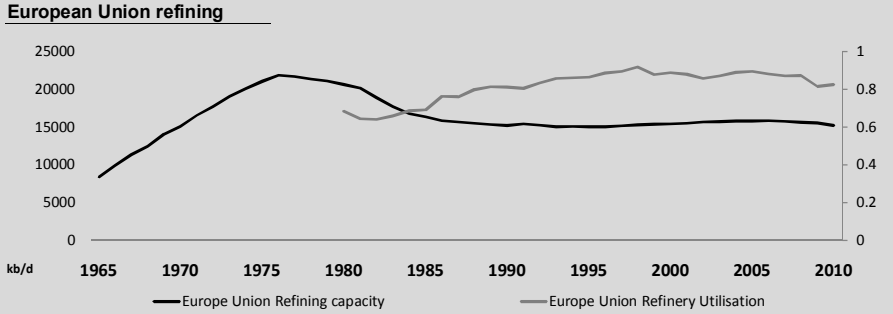
The growing asymmetry of oil products in Europe and the shift in oil product trade flows, as can be seen in Figures 6 and 7, has resulted in a trade surplus of gasoline and a trade deficit in diesel and kerosene. Apart from current and recent supply and demand dynamics, this trade surplus is also due to an historical development. The expectation of continued growth in oil product demand (especially for gasoline) in the 1960-1970s resulted in a massive ramp-up of European and US refining and conversion capacity, skewed towards producing gasoline using catalytic crackers, as is elaborated upon in Box 3.[28] Restructuring of European conversion capacity in the 1980s, before the boom in middle distillate demand, was primarily aimed at closing old refineries and upgrading conversion capacity of existing refineries, which led to an increase in lighter products which had higher margins, especially gasoline (Bacon, 1990).

[28] There is a substantial amount of literature which focuses on the causes and effects of the restructuring of the European refining sector in the 1980s, including the ramp-up of gasoline focused conversion refining capacity in the 1960 and 1070s. See, among others: Molle (1984) Bacon (1990), Van der Linde (1990), Molle (1984), CIEP (2008).

Box 3: Path dependency: Coping with historical excess capacity in a mature oil product market

Historically, European refiners have had to cope with excess refining capacity. The expectation of continued demand growth during the 1960s and '70s, especially for gasoline, resulted in a massive ramp-up of refining and conversion capacity in Europe and the United States, skewed towards producing gasoline using catalytic crackers. As a result of the 1973 OAPEC oil boycott and the 1974-1975 OECD recessions, oil demand in Europe declined for the first time since the Second World War, particularly with regard to demand for fuel oil.

However, due to the long lead times (usually 7-10 years) between the time of investment and actual production of oil products (as is symptomatic for infrastructure and heavy industry projects), refining capacity continued to become operational in the 1980s. Consequently, a classic case of capacity overshoot emerged, and Europe (and to a lesser extent the US) was engulfed in refining capacity, which lowered utilisation and destroyed refining margins as can also be seen in the Figure below by the low rate of refinery utilisation in the European Union in the 1980s.

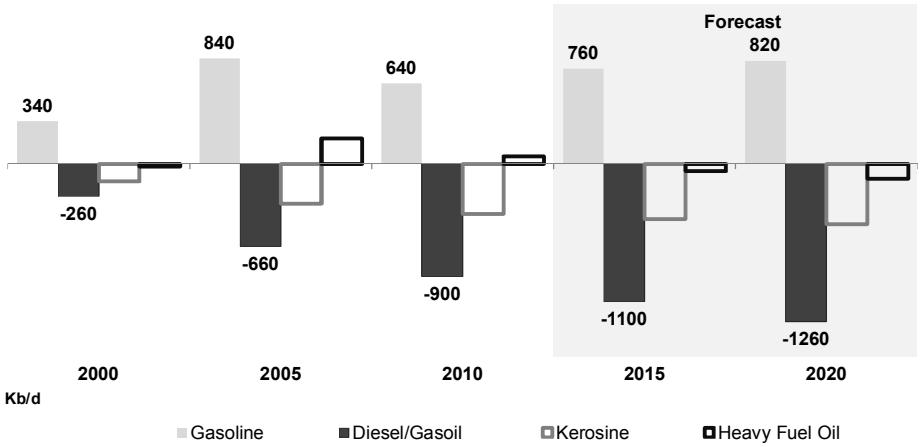


Source: BP Statistical Review of World Energy 2011, CIEP Analysis

EU-led restructuring commenced in the early 1980s and significantly changed the face of the European refining sector. First, the total number of refinery sites in Europe dropped from 174 in 1976 to 123 in 1986 (this happened mainly after 1982). Secondly, the proportion of upgraded refining capacity increased. Thirdly, refining capacity was increasingly dispersed among a growing number of companies involved, resulting in a lower Herfindahl-Hirchmann Index. And fourthly, National Oil Companies (NOCs) from oil-producing countries entered the European refining sector, such as the Kuwait Oil Company subsidiary Q8. However, overall surplus refining capacity in Europe remained, resulting in low profitability and a lack of investment drivers for further upgrading refineries. This is illustrated by the fact that since the 1980s no new Greenfield refinery has been built in Europe.

Sources: Robert Bacon, *Demand, Prices and the Refining Industry* (1990); Coby van der Linde, *Dynamic International Oil Markets* (1990); and BP, *Statistical Review of World Energy 2010* (2011).

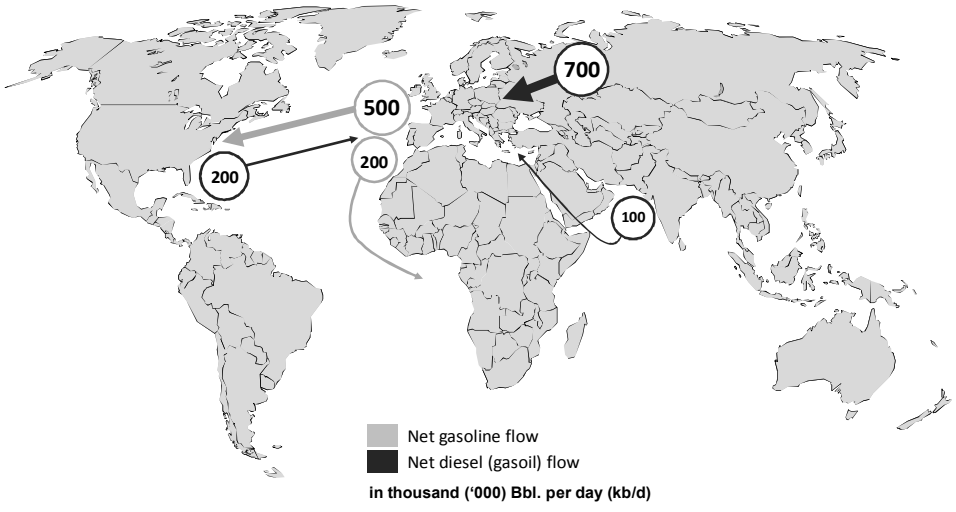
Figure 6: European oil product imbalance



Source: CIEP Analysis, IEA, Wood Mackenzie, Purvin & Gertz

As a result of this imbalance in European oil product markets we see that Europe is dependent on intercontinental oil product flows to match its diesel deficit and sell it gasoline surplus.

Figure 7: European gasoline and diesel trade flows in 2010 (in kb/d)



Source: CIEP Analysis, Wood Mackenzie, Total

Geographically, as shown in Figure 7, we see that the US gasoline market is the main outlet for European gasoline exports, amounting up to 500 kb/d. Africa imports up to 200 kb/d of European

gasoline.[29] It is questionable as to whether the US oil product market will remain in a gasoline deficit. The increasing volumes of US-grown biofuels (primarily ethanol) blended into gasoline, a growing penetration of diesel-powered vehicles, the increasing fuel efficiency of cars and the continued upgrading of US refineries, including the installation of catalytic crackers, is lowering demand for imported gasoline in the mature US oil product market.

The hefty premium of the European crude oil benchmark Brent over the US crude oil benchmark Western Texas Intermediate (WTI) that has existed since early 2011 and results in a lower feedstock price for US refiners also allows US refiners to undercut European gasoline prices.[30] Additionally, with the ramping up of complex refining capacity in countries in the Middle East and Asia is it questionable whether Europe will be able to market its excess gasoline in the medium- to long-term future at a profit. The uncertainty around the future of European gasoline exports may in turn lead to lower gasoline prices in the oversupplied European gasoline market in the short term, but could potentially raise prices in the medium term when domestic demand in emerging markets picks up and the oversupplied European oil product market becomes undersupplied.[31] We will review this argumentation later in more detail when concentrating on the global competitiveness of the European refining sector.

European diesel and gasoil imports are mainly sourced from Russia (approximately 700 kb/d in 2011) and the US (200 kb/d in 2011), with incremental volumes of diesel being imported from the Middle East and India (amounting up to 100 kb/d in 2011). Interestingly, the bulk of imported diesel from the Middle East and India originates from newly built and highly complex refining capacity, such as the Jamnagar II refinery, commissioned in 2008.

Russian refineries generally do not share the characteristics of the newly built export refineries from India and the Middle East. The 2008 50% reduction of sulphur content in European diesel from 0.2% to 0.1% resulted in some trade deflection away from Europe of diesel and gasoil imports from Russia. Not all export-oriented Russian refineries were sophisticated enough to produce 0.1% sulphur containing diesel. Reducing the sulphur content in diesel to 10 parts-per-million (PPM) in the medium-term future will require massive investments in Russian middle distillate production capacity, potentially jeopardising the reliable import flow of Russian diesel to Europe.

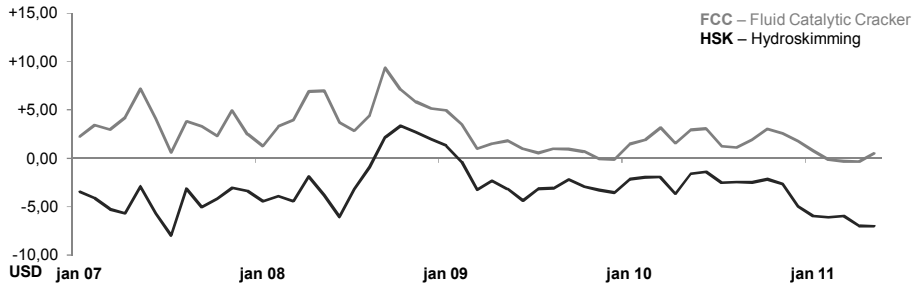
Clear investment drivers for individual European refiners?

As a result of the supply and demand trends and imbalances described above, we see that there are clear investment incentives for individual European refineries to upgrade conversion capacity, and in particular to upgrade heavy residue into middle distillates. In Figure 9 we see that complex refineries (with Fluid Catalytic Crackers – FCC) have a continual advantage in overall refining margins over Hydroskimming (HSK) refineries.[32] This is only natural, since if an FCC refinery upgrades, its product slate can be tweaked to produce the most profitable fuels. Figure 9 in particular shows us that from January 2007 onwards only complex refineries have been able to

[29] Total (2010) and EIA (2011).
[30] Platts, *WTI – Brent Spread Impacting NWE Refiners* (June 15, 2011).
[31] Tradition in the European oil product market and taxation regimes make it also likely that the discount in oil products will be taxed away by governments in order to lower demand and fill treasury coffers.
[32] Here we use Rotterdam margins in which Brent is used as a feedstock. Source: Energy Intelligence (2011).

reap positive refining margins. As a result, for the majority of the period since 2007, simple refineries have been operating at a loss.

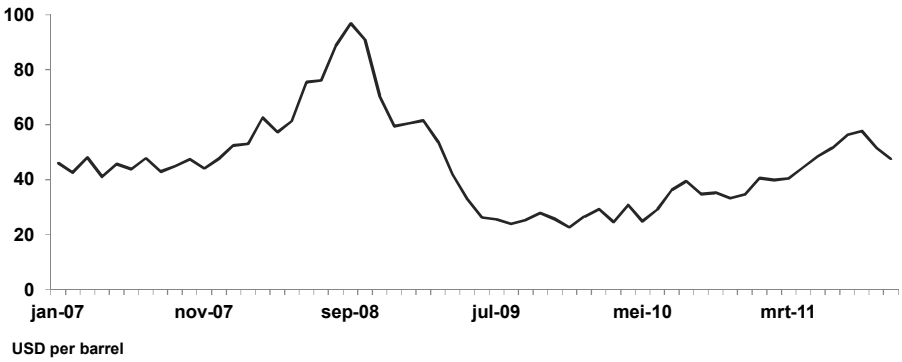
Figure 8: Rotterdam (NWE) Brent refining margins of complex (FCC) and simple (HSK)



refineries Source: Energy Intelligence

Additionally, the tight European market for middle distillates, particularly diesel, is a reason for refineries to invest in increasing middle distillate production. A result of this European fuel trend is an ongoing large price difference between Ultra Low Sulphur Diesel (ULSD) and heavy residues (High Sulphur Fuel Oil, or HSFO, containing at least 3.5% sulphur), as can be seen in Figure 9. Refineries that are able to upgrade heavy residues to middle distillates profit from this price difference, and investments in refineries are often based on this spread. For instance, in 2011 ExxonMobil completed the installation of new hydrotreater units which boost middle distillate output. Looking at the spread in Figure 10, we see that there has been an investment push to upgrade European refineries in order to boost middle distillates production.

Figure 9: Northwest European Spread between Diesel and High Sulphur Fuel Oil[33]



Source: Bloomberg (2011)

[33] For this figure we used Bloomberg's Ultra Low Sulphur Diesel (ULSD) 10 PPM North West Europe Spot Cargoes (DIEN10CF) and High Sulphur Fuel Oil (3.5%) North West Spot Cargoes (NF03FCAR).

The above described investment drivers should create investment in European refineries and are therefore the focus of European refining action groups like Europia, UKpia and Concawe. The industry associations argue that the EU and governments of European countries should stimulate investment in individual European refineries and allow less sophisticated refineries which are operating at a loss to close down. Such policy measures would increase production of middle distillate fuels and at the same time lighten the chronic overcapacity currently experienced by the European refining sector.

However, the European refining industry does not operate in splendid isolation. Development of non-traditional refining centres in recent years, mainly in Emerging Markets and the Middle East, has increased overall global refining capacity. Furthermore, this expanded state-of-the-art refining capacity is complex and produces a large amount of middle distillates. This development affects the European fuel market as well: for example, refineries from West India have started, albeit at a small scale, to export middle distillates to the European market.

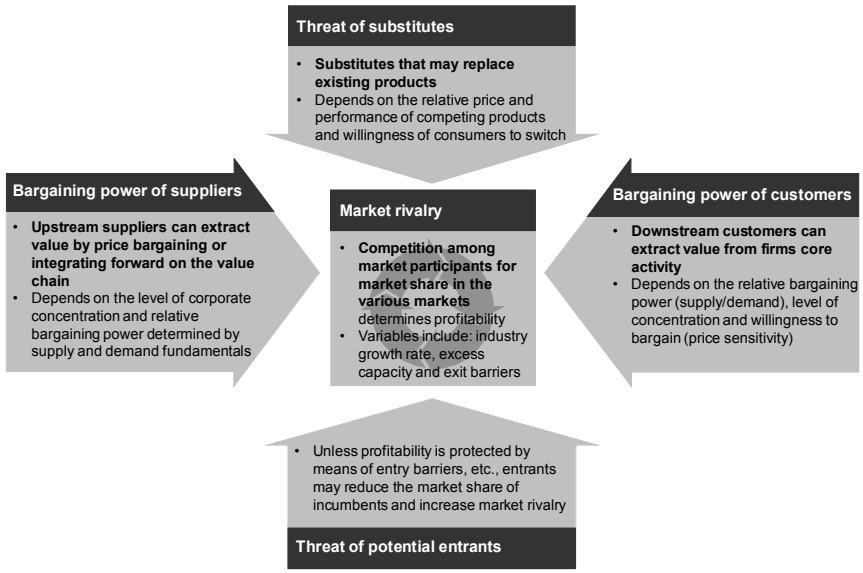
With the European refining industry feeling the weight of global competition, an analysis of European refining and fuel market trends alone would not suffice in answering the question of how to restructure the European refining sector. The global competitiveness of the European refining industry vis-à-vis its international competitors is a topic which must be included.

3

Global competitive pressures on the European refining sector

It can be concluded that the European refining sector is facing a number of adjustment challenges related to changes in regional supply and demand dynamics. The main question remaining is why the clear asymmetry between the gasoline surplus and diesel deficit does not provide European refineries with a clear arbitrage opportunity in which they can profit through new investments. As the European refining sector does not operate in isolation, we argue that international pressures also significantly affect investments in the restructuring of the European refining sector. However, these myriad pressures on the European refining industry are often hard to value individually. In order to structure and further analyse potential changes in global competitiveness of the European refining sector aside from regional European supply and demand dynamics, we will use Porter's five forces model (Porter, 1980). It empirically shows the level of competitive pressure and challenges an industry can face. In Figure 10 we present a brief description of the five forces that determine the competitiveness of an industry.

Figure 10: Porter's five forces model: industry and competitive environment



Source: Porter (1980)

Market rivalry is the internal force that determines the level of competition in the industry itself and the propensity to earn profits above the cost of capital (which is zero in a fully and mature competitive market). Profitability is determined by the amount of competition among market participants who vie for market share. Variables that determine market rivalry include industry growth rate and phase (expanding or mature), excess capacity or utilisation rate, and entry and exit barriers or the number of (likely) market competitors.

The threat of substitutes and potential entrants refers to the probability that products or actors outside your own business value chain are able to enter the industry and lower product demand (through substitution) or add more players to the same sized industry (through entrants). Substitutes are able to replace existing products. Successful penetration of substitutes depends on the relative price and performance of competing products and the willingness of customers to switch. Potential entrants are attracted by the industry's economic rents and market power prospects. Unless profitability is protected by means of entry barriers, new entrants to the industry may reduce the market shares of incumbent market players and reduce overall economic rents by adding production capacity.

The bargaining power of customers and suppliers determines the ability of players upstream or downstream on your industry's value chain to extract value or profitability from your industry. Vertical integration strategies of upstream and downstream competitors are central in this part of the analysis. Suppliers can extract value through price bargaining in supply contracts and/or integrating forward on the value chain.[34] Industry supply and demand fundamentals and corporate concentration largely determine the (financial) ability of suppliers to move forward on the value chain. On the other side of the value chain buyers are also able to extract value by moving backwards on the value chain and/or renegotiating offtake contracts. Not surprisingly,

[34] By integrating forward on the value chain suppliers can also be regarded as new entrants. However, since suppliers were already part of the industry value chain, we see this as a result of supplier's bargaining power.

also here the corporate concentration and market fundamentals (a seller's or buyer's market) determine the ability of buyers to extract value.

With the five forces of Porter (1980) we are able to systematically organise the global competitive challenges European refiners face. In the remaining part of this chapter we will assess the impact of each force on the European refining sector in order to analyse and illustrate the competitiveness of the industry in a global setting.

Market rivalry: low investment drivers in a mature oil product market

The combination of a mature European oil product market which experienced a yearly average of 0.04% between 1991 and 2011 (see Figure 11) and historical overcapacity has led to there now being little incentive for investment in Greenfield refining capacity or upgrading existing refining capacity.[35] The low correlation between the EU's refining capacity and its utilisation rate (20% between 1990 and 2010) as opposed to the high correlation of EU refining capacity and utilisation rate to EU demand patterns, respectively 69% and 76% for the same time period[36], seems to suggest that at an aggregate level EU fuel demand patterns are dominant in affecting EU refining utilisation and even EU refining capacity.

The European case is in line with other mature oil-consuming countries such as the US and Japan, which respectively had 0.47% and -0.76% yearly average growth between 1991 and 2010.[37] The inability to achieve market capture by adding refining capacity is also reflected by the low amount of refining capacity added through investments, only 240 kb/d or around 1.4% for the whole European refining sector in 2011 and 2012[38]. A case in point, as mentioned earlier, is the fact that since the beginning of the 1980s no new refinery has been built in either the US or Europe.

Figure 11: Regional differences in oil demand growth OECD and Emerging Markets (1991-2010)

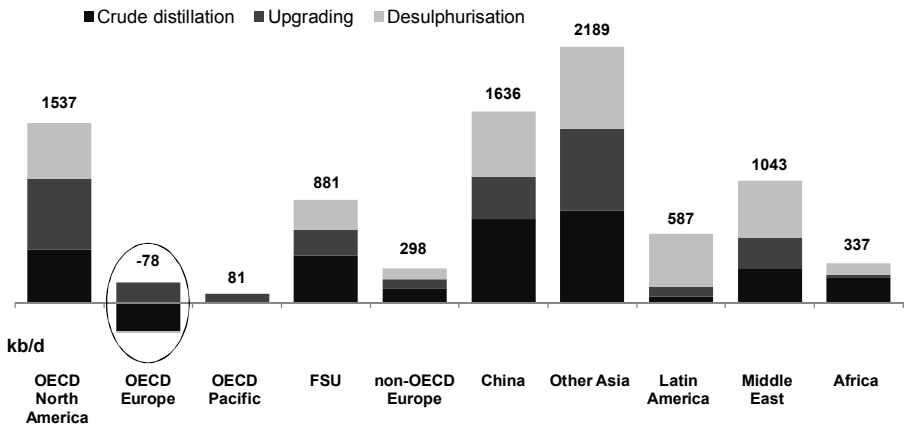
Source: BP Statistical Review of World Energy (2011)

[35] BP, *Statistical Review for World Energy 2011* (London 2011).
[36] Using data from the BP, *Statistical Review for World Energy 2011* (London 2011) and Pervin & Gertz (2011).
[37] BP, *Statistical Review for World Energy 2011* (London 2011).
[38] Goldman Sachs, 'Strong Demand Drives Margins, Reiterate Bullish View on Refiners', in: Goldman Sachs Equity Research (January 2011).

Regional demand patterns for oil markets are very different when looking at the growing markets of the Middle East and Asia, as shown in Figure 11. The IEA estimates in its *World Energy Outlook* that emerging markets, with China and India in the lead, will account for 86% of growth in global oil demand between now and 2030[39], allowing Greenfield refineries to be built employing the latest refining technologies. Oil demand such as in China, with a yearly average of 7.12% oil demand growth between 1991 and 2010, highly incentivises refiners to add refining capacity in order to profit from this growth.[40] The advantage of Greenfield refining capacity is that it is (1) built for the most recent crude oil supply and product demand patterns and (2) state-of-the art and often highly complex, enjoying low operational costs. Additionally, the financial and economic crisis only put a temporary dent in oil demand growth, with 2010 marking, especially for China, record oil demand growth (in volume).

As a result, we see that there are big differences between present investments in refining capacity by the OECD and those made by emerging markets, be it in crude distillation, upgrading or desulphurisation, as can be seen in Figure 12. Especially investments in European refining capacity are hurt by the uncertain and meagre demand outlook. The International Energy Agency (IEA, 2011) estimates that between 2011 and 2012 there will be a net 78 kb/d decrease in European refining capacity due to minor additions in European refining capacity and closures of European refining capacity. European investments in refining capacity concentrate on producing additional middle distillates, in line with European oil product dynamics, as can also be seen in Figure 12.

Figure 12: Regional investments in refining capacity (2011-2012)



Upgrading European refining capacity (2011-2012)

Date	Company	Refinery	Capacity
End 2011	Repsol	Cartagena, Spain	120 kbpd CDU, hydrocracker, coker
End 2011	Repsol	Bilbao	40 kbpd hydrocracker
End 2011	Galp	Sines, Portugal	40 kbpd hydrocracker
Begin 2012	Hellenic	Elefsina, Greece	40 kbpd hydrocracker , 20 kbpd coker

Source: IEA (2011), Goldman Sachs (2011), CIEP Analysis

[39] IEA, *World Energy Outlook 2010* (Paris, 2010).
[40] See Figure 11.

Due to the fact that European refineries are not being upgraded, they are losing competitiveness vis-a-vis overseas refineries in terms of complexity (the ability to use a wide variety of crude qualities as feedstock) and refining margins (the ability to produce high-quality and low-sulphur oil products at low costs). But the internal market dynamics are not the only competitive pressure facing European refiners in the global refining sector.

Threat of substitutes: alternative fuels and stricter environmental regulation

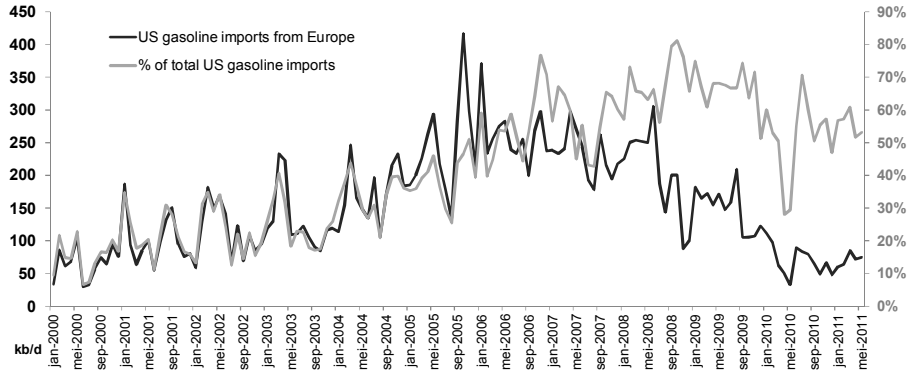
The threat of substitutes in Porter's model refers to the potential for substitution of the original product by alternative products, possibly manufactured in a different industry, as a result of technological advancement incentivised by regulation and price levels. In the case of oil, the refined products of which have various applications in different markets, there are two main trends that impact the European refining sector: alternative fuels and environmental regulation.

The first trend involves the substitution of refined oil products in the transport market by first generation biofuels (mainly ethanol and biodiesel) and electricity. Both substitutes are enjoying rapid growth but are still costly and will depend on technological improvements and government support to become competitive with – still less expensive – oil products. In the case of biofuels, the European Commission has declared that by 2020 a minimum of 10% of all motor fuel energy content should come from biofuels. This replaces the current directive, adopted in 2003, which had the objectives of replacing 2% (by energy content) of gasoline and diesel used for transport with biofuels by 2005, and 5.75% by 2010.[41] The fact that the 2005 and 2010 targets were not met reflects the limited ability of the biofuel supply to be scaled to such a level that it could replace substantial volumes of oil products used for transport, around 60 million barrels per day globally.[42] This is mainly due to competition for scarce arable acreage in Europe for first generation biofuels with that for food production and the still experimental nature of more advanced biofuels such as algae.

One of the direct effects of biofuels – especially corn-based ethanol – making an entry in the US transport fuel mix is that the gasoline import needs of the US oil product market are dwindling. Due to a slowdown in US gasoline demand since 2007 (previously the US gasoline market grew by an average of 3%)[43], we see that more than 90% of incremental gasoline demand is being met by the growing production of US-grown ethanol and updated refineries. For the summer of 2011, the US Energy Information Agency (EIA) estimated that US consumers used 5% more ethanol than in the summer of 2010, amounting to up to 842 kb/d and accounting for 9.3% of gasoline supply. At the same time overall US gasoline demand is at a ten-year low, with 9.02 Mb/d.[44] Combined with the upgrading of US refineries to meet the US gasoline production deficit, the US in increasingly able to domestically meet its gasoline demand at the expense of imports from Europe.

Figure 13: Rise and fall of US finished motor gasoline imports from Europe

[41] Purvin & Gertz, 'Study on Oil Refining and Oil Markets', prepared for: *European Commission* (2008).
[42] Around 70% of the total crude volumes are eventually consumed by the transport sector.
[43] Purvin & Gertz, 'Study on Oil Refining and Oil Markets', prepared for: *European Commission* (2008).
[44] Energy Information Agency (2011).



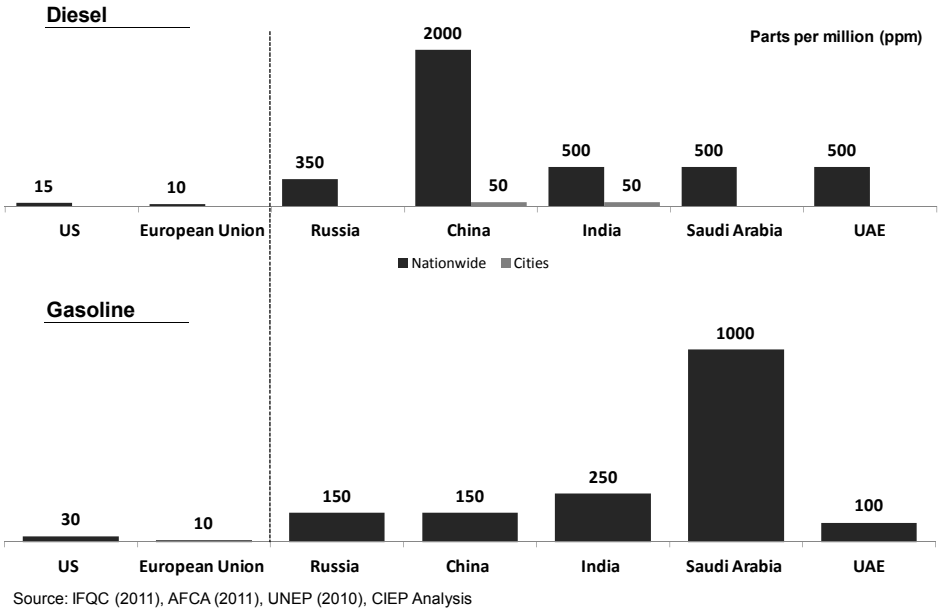
Source: Energy Information Agency (EIA, 2011), CIEP Analysis (2011)

As can be seen in Figure 13, in 2006 and 2007 the US imported around 250 kb/d of finished motor gasoline from Europe. Between 2008 and 2010 these volumes dropped to around 50-75 kb/d and stayed at that level in 2011, while the share of European gasoline on total US gasoline imports remained relatively stable.[45] Total US gasoline imports, finished and components ran at 893 kb/d in 2010 and declined from the peak year, 2007, when 1170 kb/d of gasoline and blending components was imported.[46] With gasoline export volumes to the US dwindling, European refiners are looking for new export markets in the Middle East and Africa. However, taking into account the relatively high spare capacity of Middle Eastern and Asian refineries and the refining capacity projected to come on stream in the near future (Figure 14), it is questionable whether these markets will absorb significant European gasoline volumes despite their high growth potential.

The second trend is related to the more stringent EU sulphur requirements and CO_2 pricing. As discussed earlier, this primarily makes heavy and sour oil crudes more expensive as a feedstock for power generation and residential heating. As a result, we see a substitution of natural gas for heating oil and fuel oil. This trend, among others, led the IEA to conclude in a recent study that in the medium-term future there will be a "golden age of gas".[47]

Figure 14: Regional differences in sulphur requirements (max. PPM) for diesel and gasoline (2010)

[45] Energy Information Agency (2011).
[46] Martin Quinlan, 'Refining Sees an Upturn', in: *Petroleum Economist* (September 2011).
[47] IEA, 'Golden Age of Gas', in: *Supplement to the 2011 IEA World Energy Outlook (WEO) 2011* (June 2011).



Source: IFQC (2011), AFCA (2011), UNEP (2010), CIEP Analysis

For the European refining sector the threat of substitutes is always more prevalent than elsewhere, since EU environmental legislation is traditionally more stringent than in other parts of the world; this is true for US refiners as well. As can be seen in Figure 14, the European Union is, together with the US, a regional frontrunner in lowering the amount of sulphur allowed in gasoline and diesel fuels. For instance, while Euro V requires European ultra-low-sulphur diesel (ULSD) to contain a maximum of 10 PPM, the Chinese planned to adopt a maximum of 350 PPM in 2010.[48] These plans were not executed, however, thus leaving in place the 2002 requirement of 2000 PPM nationwide and 50 PPM in the major cities (such as Beijing). Prospective EU legislation for CO_2 emissions for all industrial branches will add further costs to the European refining industry. As a result we will see a widening of the gap between environmental regulation in the EU and US refining sectors on the one hand and in emerging economies on the other.

Not surprisingly, regional environmental legislation raises the costs for European refineries to produce refined oil products. Additionally, the mandatory blending of usually more expensive biofuels with oil products requires costly adjustments and raises the prices of refinery feedstock. As such, refineries in countries with less strict environmental legislation have a lower regulatory cost base, making them more price competitive in relation to European refineries which have a high cost base.

Consumer bargaining power: market consolidation, lower gasoline exports

Bargaining power in Porter's model refers to the ability of buyers to exert control over prices and therewith to determine the margins in upstream parts of the value chain. In the mature European oil product and fuels market there are currently two trends impacting the bargaining power of consumers with respect to European refiners: (1) an increasingly consolidated retail

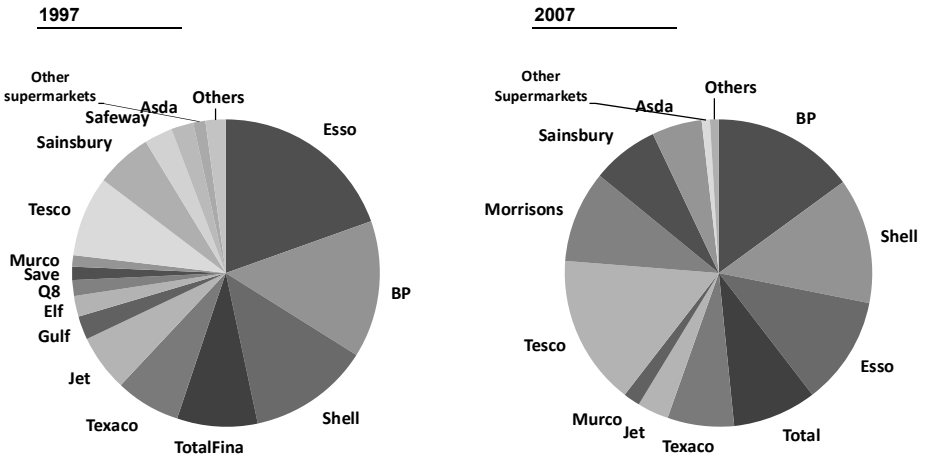
[48] UNEP, *Asia-Pacific 50PPM Diesel Sulphur Matrix* (2010).

market with a growing presence of supermarkets and (2) declining gasoline exports to US retailers.

Firstly, European oil product distribution and retail markets are becoming increasingly concentrated. This is the result of exits by oil companies with small market shares and a growing market presence of existing hyper- and supermarkets operating in the European retail market. Additionally, the rapidly growing market share of supermarkets at the expense of oil companies is changing the integrated nature of the downstream part of the value chain. Supermarkets use retail gas stations as a means to attract customers for their core products: retail food and non-food. Supermarkets usually discount oil products to near cost price in order to attract customers, pushing margins in the retail oil product market further down.

For example, in the UK retail market, between 1997 and 2007 the market share of supermarkets increased from 21.5% to 39% and the number of present oil companies declined from 11 to 7, as can be seen in Figure 15[49]. Supermarket Tesco has become the second biggest seller of fuel products after BP, and the market shares of Morrisons, Sainsbury and Asda have all grown. In the UK retail market we can clearly see the increasing concentration of the market structure and the growing presence of supermarkets. This pattern of increased market share by supermarkets can be witnessed across Europe, including France, Spain and Germany. In countries with less presence of filling stations operated by supermarkets, such as in the Netherlands, this is mainly due to a high number of existing filling stations and public opposition to large-scale supermarkets. Secondly, as discussed, European refiners are finding it increasingly more difficult to market their excess gasoline production overseas. As a result of domestically produced corn-based ethanol and the dieselisation of the US car fleet, present and future potential for the transatlantic export of European gasoline to the US is dwindling.

Figure 15: Market structure UK retail fuels market 1997 and 2007



Source: Wood Mackenzie

All in all we see that European refiners are confronted with the increasing market power of oil

[49] Wood Mackenzie, *UK Downstream Oil Infrastructure* (2010).

product distributors and retailers which have adopted a low (or below) cost price model in order to attract customers to their other, core products. Due to the bargaining power of supermarkets in the oil product market, this low cost play is also laid upon refiners, driving refining margins down. From a competition point of view, while supermarkets do not have the ambition to integrate backward on the value chain, we see that producing countries, as in the 1980s, are again striving to integrate forward into their home and European downstream oil markets.

Bargaining power of suppliers: forward integration of Middle East producers and product exports

Bargaining power in Porter's model refers to the ability of suppliers to position economic rents upstream in the value chain and/or exert credible threat to integrate forward to capture more rents.[50] In the case of European refiners, the key question is whether producer countries in the concentrated upstream part of the oil value chain, mainly those in the Middle East, will be able to extend their market power downstream in the value chain and impact the European refining sector by differentiating crude prices for European refineries relative to Middle Eastern ones.

The main trend and threat to European refiners visible is the tremendous amount of refining capacity being added to Middle East refining capacity in the short- to medium term, as seen in Figure 12. Figure 16 shows that there are plans to add 1043 kb/d per day of Greenfield refining capacity in the Middle East in 2011-2012 alone and 2645 kb/d in the medium term of Greenfield refining capacity is planned to be added in the Middle East, as can be seen in figure 16.[51]

Figure 16: Planned Greenfield refineries in the Middle East

[50] For an elaboration of economic rent on the oil and gas value chain, see Appendix I of 'Competition and Cooperation of Eonomic Agents in Natural Resource Markets: A Dynamic Market Theory Perspective', in: POLINARES. http://www.polinares.eu/docs/d1-1/polinares_wp1_dynamic_market_theory.pdf.
[51] International Energy Agency (2011), Petroleum Economist (2010).

Kb/d	Shareholders	Capacity	Completion
Iran			
Bandar Abbas	NIORDC	360	2012
Shiraz	NIORDC	120	2012
Tabriz	NIORDC	150	2012
Iraq			
Nasiriyah	Government	300	unknown
Kuwait			
Al-Zour	KNPC	615	unknown
Oman			
Al-Duqm	Oman Oil (60%) / International Petroleum Investment Company (UAE) (40%)	300	unknown
Saudi Arabia			
Jubail	Saudi Aramco (37.5%) / Total (37,5% / free-float (25%)	400	2013
Yanbu	Saudi Aramco	400	2014

Source: Petroleum Economist (2010), CIEP Analysis (2011)

New projects include several large refineries that are being co-financed by European-based oil majors such as Saudi-Arabia's Jubail refinery with Total. The main investment rationale revolves around fast-growing Middle Eastern (domestic) oil (product) demand, in both the transport and power generation sectors (60% of Saudi Arabia's power generation capacity is fuelled by crude oil, gasoil and fuel oil).[52] For example, in July 2011 Kuwait announced that it will construct a new refinery, Al-Zour, with a capacity of 615 kb/d and that it will upgrade 736 kb/d of existing refining capacity at an estimated cost of 14.5 bn USD.[53] The main purpose of the investment is to meet rapidly growing regional demand. However, considering other planned refinery additions in the region, also Al-Zour may become export-focused.

Due to the massive investment programmes and projected overcapacity in Middle East refining capacity and the low utilisation rate of existing refineries, an average of 82% from 2001 through 2010, we can conclude that some of the new Middle Eastern refineries will be export-oriented.[54] This utilisation rate is far lower than that in the US (86.9%) and Europe (86.7%) for the same period. Consequently, if Middle Eastern oil product demand growth in the coming decade is lower than anticipated, the Middle Eastern refining utilisation rate will drop even further. Lower global refining utilisation rates will result in lower margins and most likely in a ramping up of discounted oil product exports from the Middle East, for instance to Europe. Consequently, European refiners will then have to compete with discounted oil products from low-cost Middle Eastern refiners in the European market, worsening their competitive position.

[52] Unlike in OECD countries, Middle Eastern power generation capacity still relies on crude oil and fuel oil as major feedstock fuels, especially in Saudi Arabia. Saudi Arabia is the main reason for the region's heavy use of fuel oil. The kingdom relies on oil for nearly 60% of its power generation. Of the 20% of Saudi oil demand that applies to power generation, 39% is gas oil, 35% direct-burn crude, and 27% fuel oil. 'Middle East Set to Eclipse Asia in Refining Capacity' in: *Oil and Gas Journal* (November 2011).
[53] Eric Watson, 'Kuwait's Al-Zour Refinery Gets Approval', *Oil and Gas Journal* (July 1st, 2011).
[54] BP, *Statistical Review of World Energy 2011* (2011), CIEP Analysis (2011).

Additionally, Greenfield and updated complex Middle Eastern refineries are significant competitors to European refineries, since they (1) can process a variety of heavy and sour crude qualities (2) at low operating costs, (3) usually take advantage of cheap feedstock contracts from the upstream division of their National Oil Companies (NOCs), (4) can rely on the ample availability of private and especially public financing sources at low cost and (5) enjoy strong government support. These five elements may allow these refineries to overcome the difference in transport costs (European refineries are closer to market and have lower transport costs) and supply European customers with high-quality oil products. While taking into account the growing regional demand for oil products, expectations are that the Middle East will become a key exporter of oil products and especially middle distillates to Europe.

Similar trends are not widely visible in other oil-producing countries exporting crude to Europe, such as Russia, since they are not ramping up refining capacity to the extent that the Middle East is. In Russia, only one Greenfield refinery currently has been built recently, namely Tatneft's 140 kb/d Nizhnekamsk refinery which was completed at the end of 2011.[55]

Interestingly, as we will see later in more detail, the NOCs of producing countries currently do not develop or acquire downstream assets in Europe as they did during the restructuring of the European refining sector in the 1980s.[56] The notable exception is IPIC (Abu Dhabi's International Petroleum Investment Fund) which became the sole owner of the Spanish downstream oil company CEPSA after acquiring all remaining shares in 2011; it had already owned 47% of shares in the company.[57] As a result, between 2009 and 2011 IPIC bought 96% of CEPSA's shares, representing an investment of around 7 bn USD. However, it is questionable as to whether IPIC, in essence an investment fund, enjoys the same competitive advantages of the refining divisions of the NOCs and therefore whether it poses a direct threat to European refiners.

Overall we see that producer states exporting to Europe, and particularly Middle Eastern countries, are building up domestic refining capacity and do not integrate forward on the value chain in the European refining market itself. This highly complex refining capacity is increasingly becoming a low-cost competitor to European refiners, as it may give Middle Eastern producing companies an incentive to market their oil products in Europe.

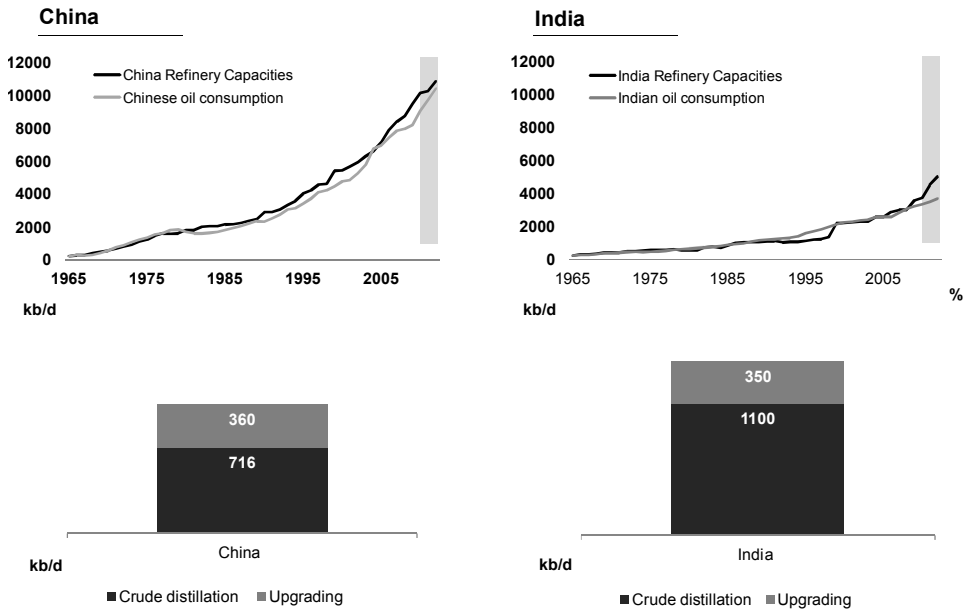
Threat of potential entrants: emerging oil product markets and their state-of-the-art export refining capacity

Despite significant entry barriers to the mature and consolidated European refining sector, including highly capital-intensive assets, high economies of scale and low margins, European refiners are increasingly challenged by the entry of new competitors to the global and European refining markets. Refiners from net oil-importing emerging economies wield low-cost, highly complex, state-of-the-art refining capacity and fast-growing demand in their home oil product

[55] Tatneft, *OAO Tatneft Annual Report 2010* (2011).
[56] Kevin Bacon, et. al., 'Demand, Prices and the Refining Industry: A Case Study of the European Oil Products Market' (Oxford 1990).
[57] CEPSA press release, *CEPSA Begins New Era After Total's Exit* (August 2nd, 2011).

markets, the prime examples coming from India and China (and, as we saw above, from Middle Eastern refiners).

Figure 17: Chinese and Indian refining balance (1965-2012) and distillation additions up to 2012



Source: BP Statistical Review of World Energy 2010 (2011), IEA (2011), Pertroleum Economist (2010), CIEP Analysis

Traditionally when we think about new entrants from emerging markets we picture **China**. But it is unlikely that China will become a serious competitor to European refiners, since Chinese refining capacity additions (716 kb/d in 2011-2012 as can be seen in Figure 17) will predominantly be consumed by its domestic market, assuming it maintains its veracious oil demand growth pattern, which has averaged 7.22% since 1991.[58]

China's projected oil product exports for 2012 of 0.4 Mb/d will mainly find its market in South and East Asia. However, China has oil product asymmetries similar to those of Europe, as it has been diesel short and gasoline abundant since the summer of 2011, putting more pressure on the availability of middle distillates and margins for gasoline exports.[59] Despite the fact that Chinese oil product exports are unlikely to compete with products from European refiners, the well described ambition and government policy for Chinese companies, including in the oil sector, to "go overseas" and establish themselves as global oil companies is having an impact in the European refining sector. A case in point is PetroChina's 50% stake in INEOS's Grangemouth and Fos Lavera refineries. We will talk about the effect of Chinese companies on the ownership structure of the European refining sector in more detail in Chapter 4.

India, on the other hand, is establishing itself as a major global exporting hub of oil products. This ambition is explicitly stated in its 11th Five-Year Plan, both by instructing oil marketing companies

[58] BP, *Statistical review of World Energy 2010* (2011).
[59] Goldman Sachs (2011).

to take a more outward-oriented operating stance and by encouraging private-sector refiners to invest in export-oriented refining capacity.[60] The export-oriented Jamnagar I and II refineries, owned by Reliance Petroleum in West India and having an aggregate refining capacity of 1.24 million barrels of oil products per day and a Nelson complexity of 14.0, is one of the prime examples of this strategy.

In 2011-2012, India is adding another 1.1 Mb/d of Greenfield refining capacity, ramping up domestic refining capacity to around 5 Mb/d.[61] As a result, India is projected to have 1.5 Mb/d of excess refining capacity in 2012 and is projected to export around 1.4 Mb/d of oil products, up from 1 Mb/d in 2010, as can also be seen in Figure 17.[62] This will make India the largest exporter of refined products in Asia, even surpassing the traditional Asian refining stronghold Singapore, which is expected to export around 1.2 Mb/d in 2012.[63] India's dominance as an oil product exporter is reinforced by the high level of oil products it produces, such as high-octane gasoline, ultra-low sulphur diesel and Petcoke. However, it is questionable whether India's excess refining capacity will remain in the long run, as according to the IEA WEO 2010, projected demand for oil products will reach 7.5 Mb/d by 2035.[64]

Where will short- to medium-term export capacity be marketed? In 2009, around 75% of oil products exported from Sikka port at Jamnagar was destined for countries bordering the Indian Ocean. The remaining 25% was exported to various markets such as the US, Europe, West Africa and East Asia. Indian refiners have therefore indicated that is likely that around a quarter of their projected 1.5 Mb/d excess capacity will continue to be marketed in Europe, US and Africa.

Apart from the positioning of privately owned Lukoil on the European refining sector, we leave Russia out of this analysis since it is a an established crude and oil product exporter to Europe and is not currently building up new refining capacity, as reflected by the problems Russian refiners now have in meeting new fuel standards in the European Union. Notwithstanding, Russia is and will remain, due to its abundance of crude oil resources, a major crude and oil product exporter to Europe.

Overall, refiners from emerging economies such as China and India, but also private oil companies from Russia (Lukoil), employ predominantly local competitive advantages. Firstly, solid demand growth perspectives in domestic markets, especially in China and India, promise a steady home market for additional capacity.

Secondly, refineries are usually located in special economic zones (SEZ) enjoying exemptions on various taxes such as income, corporate, sales, export and dividend distribution,

[60] Kieran Clarke, 'India's Downstream Petroleum Sector', in: *IEA working paper* (2010), Indian Ministry of Petroleum and Natural Gas, *Report of the Working Group on Petroleum and Natural Gas Sector in the XI Plan – 2006-2012* (2006).
[61] IEA, 'Refinery Capacity Investments Back with a Boom in 2012', in: *Oil Market Report* (July 2011).
[62] Platts, *India is Top Exporter of Refined Petroleum Products in Asia* (2010), Kieran Clarke, 'India's Downstream Petroleum Sector', in: *IEA working paper* (2010).
[63] Kieran Clarke (2010).
[64] IEA, *World Energy Outlook 2010* (Paris 2001).

and streamlined procedures. For instance, the infamous Jamnagar refineries are located in their own SEZ with tax incentives skewed towards exporting refined oil products.[65]

Thirdly, refining investments enjoy cheap financing due to the wide availability of (government) funds for infrastructure investments in emerging economies through local state banks (China), government guarantees (India) or oil and gas export revenues (Russia).

Fourthly, refiners profit from lower taxes for oil product exports than for crude oil exports. For instance, the Russian tax regime stated that in 2011 the export duty for light products was set at 66% of the duty for Urals, Russia's main export crude oil blend, and 46.7% for heavy products.[66] The tax differential allows for domestic refiners to enjoy cheap (non-taxed) crude oil feedstock (as compared to European refiners) for Russian oil. As a result, Russian refiners currently enjoy refining margins of around 15-20 USD per barrel (with an average of 10 USD per barrel in netback costs); these dwarf average European refining margins, which are in the lower single digits.[67]

Fifthly, in general all refiners from emerging economies enjoy strong government support through industrial policies aimed at building up domestic heavy infrastructure.

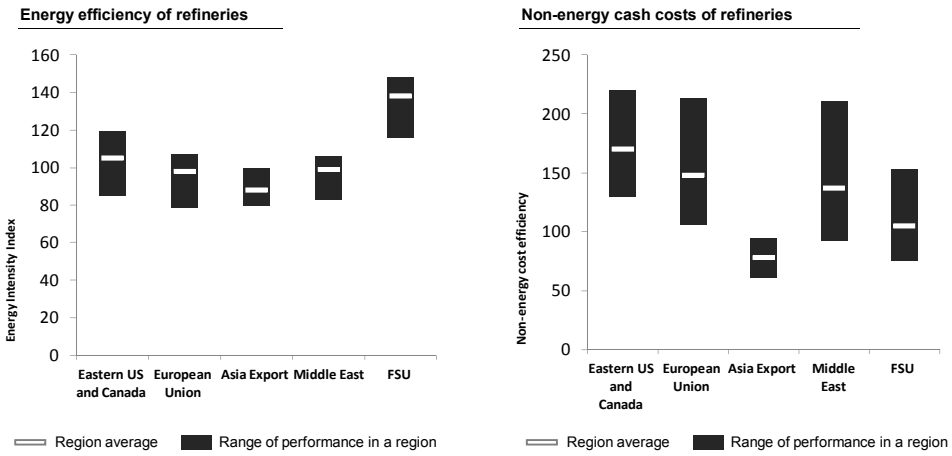
The locational advantages of refineries in emerging markets as described above translate themselves, even if individual refineries are not energy efficient (a measure of cost competitiveness), in significant comparative advantages compared to European refineries. In Figure 18 we see that European refineries are highly energy efficient in comparison to refineries in other regions, while the non-energy cash costs of European refineries are among the highest in the world. Asian export and Russian (as part of the FSU) refineries seem to profit most from locational advantages.

Figure 18: Energy-efficient EU refineries have high non-energy cash costs

[65] Indian Ministry of Petroleum and Natural Gas, *Report of the Working Group on Petroleum and Natural Gas Sector in the XI plan – 2006-2012* (2006).

[66] A new tax formula is designed to equalise export duties for light and heavy products at 60% of the duty for crude by 2013. Jake Rudnitsky, 'Russia's New Oil Product Export Duty Formula to Start Feb 1', in: *Platts* (January 24th, 2011).

[67] However, the tax break Russian refiners currently enjoy over European refiners is potentially impacted by the new Russian downstream regime which aims to standardise export duties for light and heavy oil products at 66% of crude export duties. This incentivises the overall unsophisticated Russian refineries to upgrade their installations, hurting margins in the short- to medium term. PIW, 'Russian Refining Reforms Put Margins at Risk', in: *Petroleum Intelligence Weekly* (December 5th, 2011).



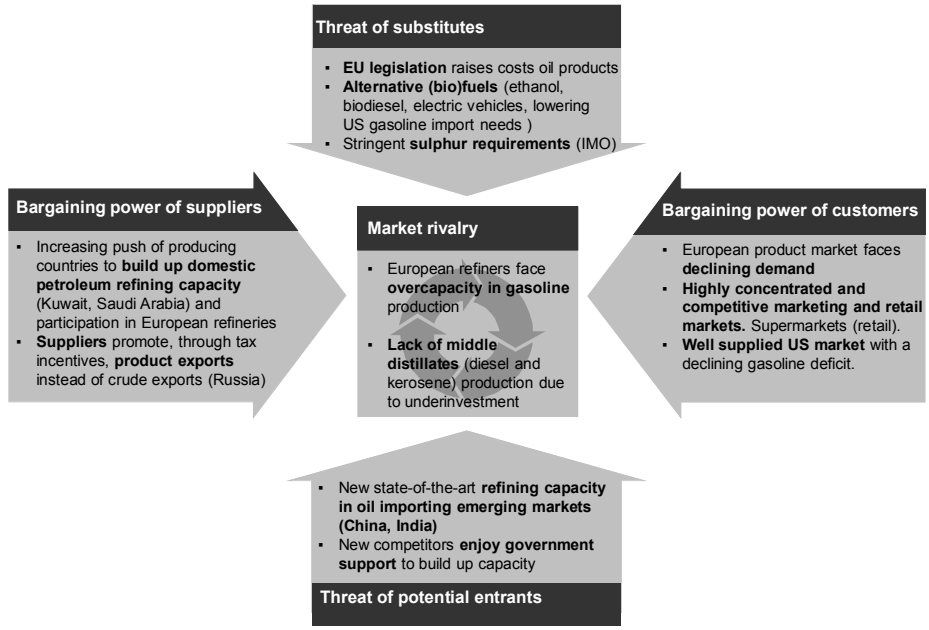
Source: Solomon Associates (2011)

All in all, as described, new refiners from emerging economies have significant competitive advantages as compared to their European counterparts. However, the question is to what degree these competitive advantages translate into the ability and appetite of mainly Chinese and Indian refiners to export their valuable products to the remote and mature European product market, which is already enjoying relatively low oil product netback values and margins.

European refining sector under pressure

European refiners are in a tight spot. On the one hand we see that changing oil product demand patterns, with increasing middle distillate consumption and lower demand for gasoline, fuel oil and other heavier fuel types are forcing the European refining sector to upgrade its refining capacity. On the other, the slow-growing, mature nature of the European oil product market, with its thin and volatile margins, gives little incentive to make these needed investments to adjust for the asymmetry between the product yield and product demand of European refiners. As a result we see that a growing diesel deficit and gasoline surplus is making the aging European refining sector more and more dependent on intra-regional oil product trade, especially diesel imports from Russia and gasoline exports to the US.

Figure 19: European refiners and their global competitive environment



Source: CIEP analysis, Porter (1980)

From the five forces of Porter we see that all the challenges and threats point in the wrong direction for European refiners, as is shown in Figure 19. Low downstream margins in Europe, dwindling European gasoline exports to the US, the build-up of state-of-the-art refining capacity in the Middle East and Asia (including export-oriented refineries), biofuels and European environmental legislation are all impacting the competitive position of European refiners, mainly in relation to its competitors from emerging economies.

Within the European refining sector, **market rivalry** is strong as a result of an historical refining overcapacity (predominantly non-complex) and the mature nature of the European oil product market. We see that only supply and demand dynamics outside of Europe, especially the US and emerging markets, result in an upswing in refining margins such as in the period 2004-2008. Due to high market rivalry the European refining sector has few incentives to invest in complex refining capacity.

With the increasing penetration of **substitutes** in the European oil product markets, such as ethanol-based gasoline/diesel and electric vehicles, demand for oil products in the European and export markets for European refineries, such as gasoline demand from the US, is declining. EU-level legislation supports these alternatives. For instance, legislation focused on emission standards and sulphur requirements also raises the costs for European refineries vis-à-vis competitors, lowering their global competitiveness.

In the mature phase of the European oil product and refining market, **buyers** of European oil products have consolidated and are now concentrated in the highly competitive marketing and retail markets. The presence of supermarkets in the oil product retail market has increased these competitive pressures, as they are low-cost operators who push margins down.

The absence of a global outlet for European gasoline production increases the market power of these players.

On the other side of the value chain, **suppliers** are building up competitive pressures against European refiners as they, flush with cash and growing domestic demand for oil products, are ramping up complex, partially export-driven, domestic refining capacity. Some suppliers, such as Russia, promote, through tax incentives, the global export of oil products instead of crude oils. There have been only sporadic instances in which suppliers have actually bought assets from European refiners. .

Last but not least, potential **entrants** are knocking on the door of the global petroleum refining industry. With strong demand growth in their home oil product markets, emerging markets such as China and India are ramping up refining capacity for their domestic but also export markets. Refining is often tagged by governments as one of the industries which can facilitate the development of economic conditions. As a result, these new competitors enjoy strong government support in building up state-of-the-art, complex and large-scale domestic and export-oriented refining capacity, adding to a potential overcapacity in the global refining market.

The multitude of competitive challenges European refiners face, as illustrated through Porter's five forces, is a typical case of comparative advantage asserting itself in increasingly open international energy markets. For slow-growing, mature markets (such as in Europe and the US but also Australia), it is increasingly difficult to undertake costly, lengthy, labour- and regulation-intensive refinery investments (and even upgrades) to meet changing crude quality supply and regional oil product demand patterns.[68] Consequently, apart from their domestic comparative advantages, Middle Eastern and mainly South Asian refiners aim to fill this refinery investment gap in Europe. The demand effects of the financial and economic crisis have painfully exacerbated this trend.

Interestingly, the challenges of the European refining sector are interpreted differently among various companies active in the European market. Company-specific drivers and constraints, apart from market drivers and constraints, also steer the strategies of oil companies to decrease or increase their exposure to the European refining sector. In the next chapter we will look at the changing ownership structure of the European refining sector, various company types active in the European refining market and their specific investment drivers and constraints.

[68] Kieran Clarke (2010).

4

The changing ownership structure of the European refining sector

The tumultuous times that European refiners find themselves in have, from the viewpoint of supply–demand and global competition, placed the individual owners of European refineries in a dilemma. On the one hand, refining has traditionally been an integral part of the company strategies of many oil companies, as vertical integration along the value chain ensures market access to downstream parts of the oil value chain and mitigates market price and other business risks. On the other hand the refining market is, as described in the previous chapter, one that often has razor thin and volatile margins in which only the most complex and cost-competitive refineries survive. The main challenges are how to ensure survival for high-cost, long-term fixed (infrastructure) assets in the short- to medium- term market dynamics and how to overcome resulting financing barriers in order to keep the refining sector up to date.

Where some companies see obstacles, others find that the European refining sector offers opportunities that will create value in the future. In assessing value drivers for the investment strategies of oil companies, the current literature, for instance Purvin & Gertz (2011)[69], mainly focuses either market or asset-specific drivers. According to Bacon (1990) and others, **asset-specific value drivers** include: **location** (regional market demand, access to high seas, location of competing refineries, connection to crude as feedstock, and product pipelines), **conversion capabilities** (scale, complexity, flexibility in processing different crude qualities, and flexibility in product slate) and the **amount of regulatory scrutiny** to which a refinery is exposed.[70]

Apart from market and asset value drivers, company-specific or strategic drivers also play a major role in the investment decisions of oil companies. Specifically, when examining the strategic approaches of oil companies towards managing the various risks associated with operating along the oil value chain and their financial capabilities to execute a preferred strategy in the refining sector, we can explain in more detail the current patterns of ownership changes within the European refining sector in reaction to changing market dynamics.

[69] Pervin & Gertz, *Developments in the international downstream oil markets and their drivers* (June 2011),
[70] Bacon (1990), Willem Molle, E. Wever, *Oil refineries and petrochemical industries in Western Europe: buoyant past, uncertain future* (Amsterdam 1984), Coby van der Linde, *Dynamic International Oil Markets; Oil Market Developments and Structure 1860-1988* (Leiden, 1990),

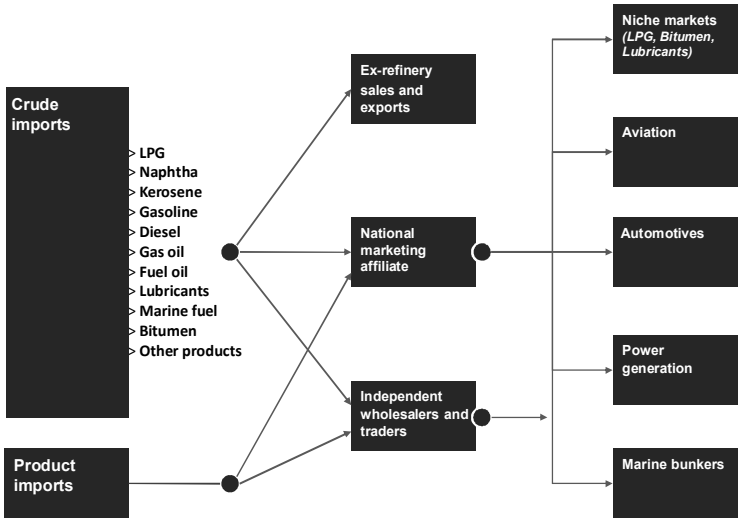
The oil value chain and company-specific investment drivers

The oil value chain

The exploration, transport, refinement and marketing of oil along the oil value chain is a complex matter, owing to the capital-intensive nature of required infrastructure and the various risks (market, price, regulatory) for the involved players. The process from extraction to delivery of oil can be divided into two components: upstream and downstream. The physical flow of gas starts upstream, including exploration and production as well as the initial treatment of crude oil in order to prepare it for the refinement process. After being transported from its country of origin, the oil is run through a refinery which

produces oil products ready to be sold to their main consumer markets: transport vehicles, automotives, aviation and marine bunkers (around 70%), feedstock for power generation (around 25%) and feedstock for the petrochemical industry (around 5%)[71]. Figure 20 presents an overview of the main players in the downstream oil value chain.

Figure 20: Downstream oil value chain



Source: CIEP Analysis, WoodMac (2009)

All in all we can distinguish six phases in the oil value chain. The upstream part of the oil value chain consists of exploration and production. In the downstream part of the value chain are transport, refining, distribution and sales. As we will come back to later in more detail, companies active in the oil value chain have positioned themselves along various parts of it. An historical analysis of the positing of oil companies along the value chain is outside the scope of paper.[72]

[71] These percentages are for Europe as a whole, while markets for oil products diverge per country. For instance, due to the high penetration of natural gas for residential heating in the Netherlands, heating oil has no market,

[72] A clear historical analysis of the structure of the oil sector along the value chain can be found in Correljé, Van Geuns, *The structure of the oil market: A dynamic helix* (forthcoming 2011),

Of the main commercial players in the oil market, apart from other stakeholders such as governments, regulators, service companies and financial players, we currently see that in terms of exposure to the global oil value chain:

- **International oil companies (IOCs)** such as ExxonMobil, Royal Dutch Shell, BP, Total and Chevron are positioned in all parts along the oil value chain. However, we see that the upstream and downstream divisions are less and less integrated along the oil value chain, creating a widening commercial split between their upstream and downstream divisions. For instance, Shell International Trading and Shipping Company (STASCO), which is responsible for supplying Shell's refineries and petrol stations, also sources non-Shell crude for its Shell refineries and fuels not produced at Shell refineries for its petrol stations.

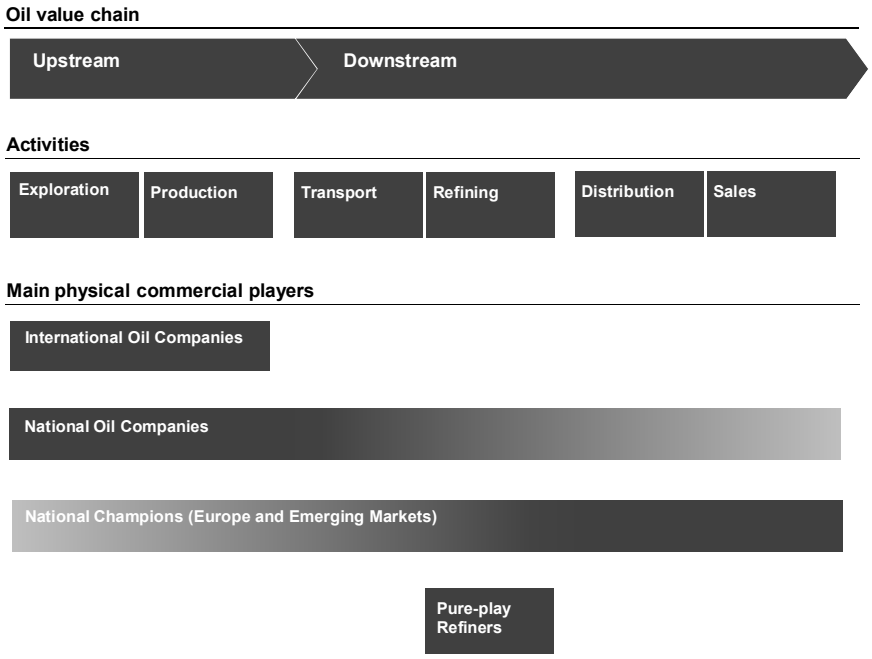
- **National oil companies (NOCs) of producing countries** predominantly own upstream crude oil reserves and have, in terms of international refining and sales capacity, less exposure downstream in the international oil value chain. However, as we will see later in more detail, producer NOCs are increasingly building up domestic refining capacity to feed their growing home demand for fuels and to export oil products instead of crude oil. Refineries abroad are usually strongly vertically integrated and are usually built to process domestically produced crude qualities.

- Incumbent oil companies or "**National Champions**", often the former state-owned oil companies, **in Europe** (from for instance Italy and Spain) and **emerging markets** (from for instance China and India) state that they are predominantly dependent on crude oil imports and that their main downstream assets are located in their national home markets. For emerging markets, with China being the main example, it is evident that the National Champions seek to increase their international presence not only in the upstream, but increasingly also the downstream part of the oil value chain.

- Finally, **independent refiners**, like the Swiss-based Petroplus, predominantly operate in a single part of the oil value chain. Some of the independent refiners also own marketing or retail outlets but are never present in the upstream part of the value chain.

In Figure 21 we see an overview of the oil value chain and the main physical players. Figure 22 also specifies the actors that are active in the downstream part of the oil value chain.

Figure 21: Oil value chain and the main physical players



Source: CIEP Analysis

Risk management and vertical integration

Companies, including energy companies with refining assets, use vertical integration along the value chain for multiple purposes ranging from (1) buffering negative earnings in one market with the earnings in other up- or downstream markets, (2) securing supply, in the case of companies that lack upstream oil reserves, or (3) securing demand, in the case of companies from producing countries that lack access to fuel markets. Vertical integration, defined as the degree to which a firm owns and controls its upstream suppliers and downstream buyers along the oil product value chain, is in essence a risk management tool to hedge for market risks and to ensure ample market access along the oil value chain (security of supply and security of demand).[73]

Due to the long investment horizons of capital-intensive assets, such as refineries, it is important to note that aside from a strategic outlook on future risk management, the historical legacies of refiners also explain their current positioning along the oil value chain.[74] In short, oil companies can either opt to be pure-play refiners (i.e., concentrating on refining only), which would expose them to various risks along the value chain, or to adapt a vertically integrated approach, which would buffer them against risks along the down- and upstream segments of the oil value chain.

An example of gaining market access was the positioning of NOCs from Middle Eastern producer countries on the European refining market in the 1980s. Naturally, NOCs from producer countries

[73] Vertical integration refers to the degree to which a firm owns it upstream suppliers and downstream buyers along the product value chain. (J. Tirole, *The theory of industrial organization* (Cambridge (US) 2003),
[74] The relation between strategies of European energy companies and strategies on the energy value chain has been analysed by CIEP, *Energy company strategies in the dynamic EU energy market (1995-2007)* (The Hague 2010),

are predominantly positioned upstream on the value chain, as they are the agents of nations that possess vast amounts of crude oil reserves and that produce and market this natural resource. In order to be able to access the global oil products market, secure demand outlets for their crude oil production and rely less on the downstream capacities of the IOCs, NOCs began building up domestic and international refining capacity.

Adversely, the nationalisation of upstream assets in the 1970s left IOCs with a surplus of downstream assets which they subsequently began to divest, starting in the 1980s. For IOCs and especially their host governments, primarily those of import-dependent OECD countries, as is widely described (Yergin 1991), security of the supply of crude oil immediately became a source of concern. This further stimulated the development of upstream oil production in non-OPEC oil provinces, such as the North Sea and Africa. Forward (upstream) vertical integration along the oil value chain here was as much an effort to gain access to upstream reserves as it was a method to not be over-reliant on the downstream part of the oil value chain.

The intensity with which vertical integration was applied within the corporate structure differs, however, between IOCs and NOCs. Key here is the level to which a company wishes to rely on the open market in order to supply and source crude oil and oil products for its assets (mainly oil fields), refineries and petrol stations. Dependence on the open market allows for the flexibility of individual assets to profit from short- to medium-term changes in the oil markets while still being able to shield other corporate divisions from adverse market developments. However, assets are still exposed to market, price and liquidity risks and therefore come at the expense of security in supply and demand. In its most extreme form, vertical integration means to supply your own refineries with your own crude oil and market your oil product slate in your own petrol stations.

The differences between the Kuwait National Oil Company (KNOC), Shell and Petroplus exemplify the variety of strategic approaches towards vertical integration. The crude oil **KNOC** produces is refined in its own refineries (such as its Rotterdam refinery) and subsequently sold at its own Q8 gas stations. While not all KNOC crude oil is processed in KNOC refineries, KNOC refineries process only KNOC crude oil. From a refining perspective we see that **Shell's** supply and trading arm (STASCO) also sources non-Shell oil for their refineries. Shell relies on the open market to source crude for its refineries. The open crude oil market is made and remains liquid partly as a result of Shell's 1.6 Mb/d of oil production.[75] Pure-play refiner **Petroplus** is, without upstream crude oil production, obliged to source its crude from the open market and sell its products to distributors. Therefore Petroplus is fully exposed to the – sometimes asymmetrical – market dynamics of both the crude and oil product markets.

The increased market and price risks of a pure-play refiner are, among other risk indicators, also reflected in its credit rating, such as Petroplus's B+ rating which is lower (and therefore deemed more likely to default) than the AA (stable) credit rating of Royal Dutch Shell.[76] Also, vertical integration lowers the integrating companies' costs through the elimination of double

[75] Shell, 'Q4 2011 financial results', in: *Shell Corporate Website* (2011),

[76] Standard&Poor's (2011), "AA" refers to 'Very strong capacity to meet financial commitments' and "B" is defined as the corporation being 'more vulnerable to adverse business, financial and economic conditions but currently has the capacity to meet financial commitments.' Last credit rating action Royal Dutch Shell (Foreign and Local long term, 3 September 2009), Petroplus (23 February 2010),

marginalisation (lower transaction costs between the various parts of the value chain).[77] Additionally, vertical integration allows companies to exercise market power, for instance by being discriminatory in the pricing of products,[78] resulting in higher costs for prospective and incumbent competitors. Furthermore, vertically integrated companies create less liquid open markets, as volumes are kept within the vertically integrated company structure.[79]

However, vertical integration can come at a cost not only due to the trade-off between flexibility and security of supply/demand, but from a managerial perspective as well. The main root of these costs lies in the managerial diseconomies linked to the inefficiencies of organising production within a large vertically integrated company. The argument centres on the ability of corporate management to retain a strategic focus despite the complexity and the fact that the degree of differentiation increases with vertical integration.[80] When control over the organisation is looser, various agency problems arise, leading to diseconomies of production. Thus, the decision to integrate vertically is driven by the promises of better risk management, lower transaction costs and the ability to contain diseconomies of production. However, in order to vertically integrate (i.e., take over supplier or off takers), a company also needs to have the financial capability to execute its preferred corporate risk management strategy.

Therefore, the approach refiners take towards vertical integration relies on their risk appetite, shareholder and stakeholder views towards managerial inefficiencies, and historical legacy.

Financial strength and the ability to (re-)position or execute

The ability of a corporation to buffer market dynamics and execute its preferred investment strategy along the value chain is typically determined in part by its financial strength. While from an historical perspective this factor is intertwined with vertical integration, as a successful vertically integrated strategy can create substantial financial assets, from a current and outward looking perspective the two can be analysed separately as a result of relatively modest transaction costs between the different segments of the oil value chain.

When examining the refining sector, financial strength refers to the ability of a company to buffer adverse changes in market dynamics and refining margins, as this determines a company's ability to upgrade its refineries to become competitive again by deploying available capital. Capital-constrained oil companies must sell refineries in order to free up capital before they can upgrade remaining refineries. Capital-abundant oil companies can use future cash flows, internal capital such as cash and marketable securities or raise additional short- and long-term external capital debt in order to upgrade their refineries. Coming back to Royal Dutch Shell and Petroplus, the

[77] Oliver Williamson, 'The Economics of Organization: The Transaction Cost Approach', in: *The American Journal of Sociology* 87:3 (1981),

[78] George Yarrow, 'Vertical Supply Arrangements: issues and applications in the energy industries', in: *Oxford review of economic policy* 7:2 (1991),

[79] Fernando Barrera-Rey, 'The effects of vertical integration on oil company performance', in: Oxford Institute for Energy Studies (1995). Waterson (1993) makes the argument that vertical integration is associated with higher costs for incumbent competitors.

[80] M.E. Canes, 'The vertical integration of firms', in: Allingham and Burstein (eds.), *Resource allocation and Economic policy* (London 1976),

companies' respective credit ratings of AA and B+ also determine the costs of raising external debt and thus their ability to do this.[81]

For instance, in September 2009 Shell, with its Standard & Poor AA rating, was able to attract investors willing to buy corporate bonds with a 10-year maturity worth 2 bn USD at an annual coupon rate of 4.3%.[82] In comparison, Petroplus in September 2009 had to offer a coupon rate of 9.375% per annum on its 10-year high yield or "junk" bonds in order to attract 400 mln USD in external debt.[83] The differences in coupons reflect the viewpoint of the 'market' on the future prospects and riskiness of the respective companies. The financial costs of raising debt to execute future investment strategies also impact the strengths of these respective companies and illustrates the differences in being able to actually execute preferred investment strategies.

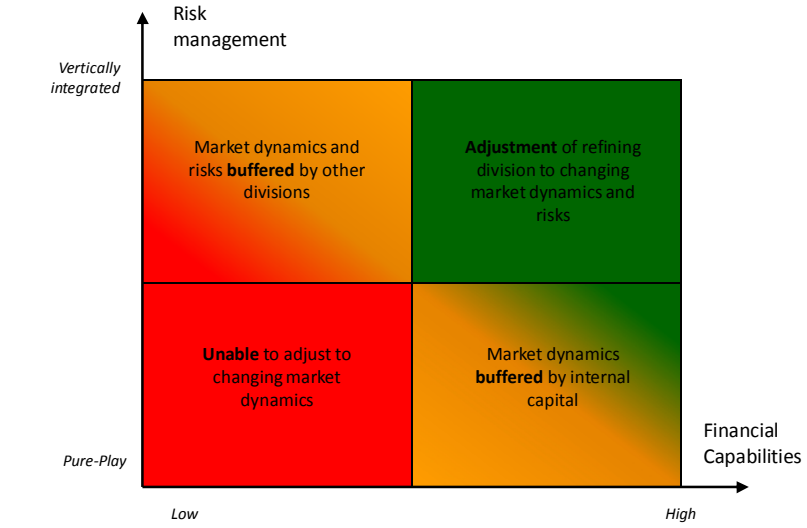
All in all, we see that the level of a company's financial strength is determined by (1) future cash flows from existing operations, (2) previously retained earnings not yet deployed as capital expenditures (CAPEX) and (3) the creditworthiness of the company, which impacts the costs of attracting debt or raising additional capital through an Initial Public Offering (IPO) or Seasoned Equity Offering (SEO) and thus the company's ability to carry this out. These three items determine, from a financial perspective, the ability of oil companies, as with any other company, to execute their preferred investment strategies.

Risk sharing and upgrading?

When looking at the refining sector and employing the lens of vertical integration and financial strength, we can distinguish four areas in which refining companies can be positioned in relation to 'external' market dynamics, as can be seen in Figure 22.[84]

[81] Standard & Poor's (2011),
[82] Shell, 'Royal Dutch Shell plc bonds and credit ratings information', in: *Shell Website* (2011). The bond that is referred to runs from 22/9/2009 – 22/9/2019 at a par value of 2 bn. USD. (ISIN: US822582AJ10),
[83] Petroplus, 'Petroplus successfully prices USD 400 million high yield corporate notes', in: *Petroplus Press release (September 2011),*
[84] By 'external' we mean that due to the oligopolistic nature of the oil and refining industry actions of single major companies can have a significant market and price affect, as opposed to a market with perfect competition where market dynamics can hardly be influenced by a single company and are therefore truly external,

Figure 22: Ability of a refining company to execute its preferred strategy



Source: CIEP Analysis, concept only

Firstly, **pure-play refineries with low financial strength** are unable to pass on the risk associated with changing market dynamics and legislative (environmental) requirements to other company divisions. Additionally, without financial capabilities such as cash, marketable securities or low-interest debt, pure-play refining companies have a hard time buffering adverse market dynamics. They are often forced to sell off assets in order raise liquidity and subsequently must restructure and/or upgrade their refineries.

Secondly, **pure-play refineries with high levels of financial strength** are able to buffer the investment needs of changing market dynamics in the short- to medium term, for instance with the revenues built up during the 2004-2008 'golden years' of high refining margins. However, because of their pure-play nature, these refiners remain highly exposed to various market and price risks, possible impairing their long-term capabilities to compete in the global refining market.

Thirdly, **vertically integrated oil companies with low financial strength** are able to buffer the various market risks with revenues from other (upstream) divisions and are able to secure demand by keeping downstream distribution channels open. Generally, vertically integrated oil companies have more sizable balance sheets, allowing them to buffer adverse market dynamics and risks in the short term more easily than smaller, pure-play companies. However, the revenues from their 'captive markets' often do not generate enough revenues to upgrade refining assets. While keeping presence in the short- to medium term, these companies are sitting ducks and are bound to lose their competitiveness in the medium- to long term.

Fourthly, **vertically integrated companies with high levels of financial strength** are mainly able to buffer and share risks along the value chain with their upstream divisions. The cash flow available from other corporate divisions (primarily upstream production) allows the refining

division to be shaped and upgraded according to the preferred overall corporate strategy.

Restructuring of the European refining sector by ownership type

When adopting the perspective of vertical integration and financial capabilities, as described above and pictured in Figure 22, we see various types of companies operating within the European refining sector that are trying to balance their risk exposure in the refining sector with their operational and financing competences and by spreading their business opportunities among different parts of the oil value chain and different geographic locations. Overall, we can distinguish six different types of owners of European refineries, as can be seen in Figure 23, based on the (1) level of vertical integration and main focus on the oil value chain, (2) geographical location of the 'home' market, (3) level of current and previous state and private ownership, and (4) level of government support.

Figure 23: Ownership types in the European refining sector

Type	*Description*	*Examples*
IOC	Vertically integrated (from upstream to downstream) and international companies with privately dispersed ownership floating on international exchanges.	*ExxonMobil, Shell, BP, Total*
Producer NOC	Vertically integrated (mainly upstream) companies from oil-exporting countries with a majority of voting power controlled by state entities. Strong downstream home bias.	*KPC, Saudi Aramco, PDVSA, Rosneft, Tamoil*
National Champions (Europe)	Formerly state-controlled oil companies with predominantly downstream assets, often having loose ties with home government.	*ENI, Statoil, OMV, MOL, Repsol, PNK Orlen*
National Champions (Emerging Markets)	Predominantly downstream companies from emerging economies, either state-controlled or enjoying government support .	*Lukoil, PetroChina, Essar*
Pure-Play Refiners	Specialists in refining operations with occasional retail activities. Private ownership (often with large block holders) and dependent on open market and associated risks.	*Petroplus, Valero, Ineos*
Other	Variety of companies ranging from conglomerates to petrochemicals (inexpensive feedstock) and niche oil product producers.	*Lyondell Basell, Nynas, Koch, Saras, ERG , Kletsch&Co*

Source: CIEP Analysis

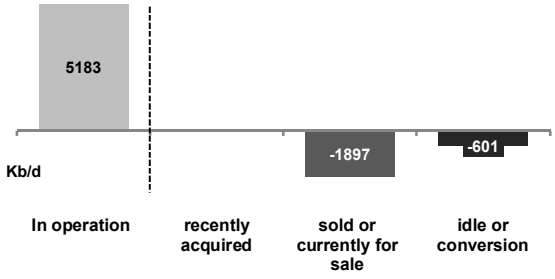
For each ownership type we can distinguish a different restructuring pattern in the period 2008-2011 as given by their strategic (risk) outlook and financial capabilities. Annex A provides an overview of all European refineries by ownership type, current status, Nelson complexity (where possible), type and refining capacity.

International oil companies (IOCs): divestment and consolidation

International oil companies (IOCs) operating in the European refining sector, such as ExxonMobil, Shell, BP and Total, currently own and operate a total of 5,183 kb/d or about 35% of total

European refining capacity. This makes IOCs the largest owner type of European refining capacity in 2012.[85]

Figure 24: Restructuring of European refineries owned by IOCs (2008-2011)[86]



Source: CIEP Analysis, Purvin & Gertz, various newspapers

As we can see from Figure 24, between 2008 and 2012 IOCs divested or tried to divest 1,897 Kb/d and idled 601 Kb/d of European refining capacity. While upgrading increased conversion capacity of IOCs slightly, they did not increase any European refining capacity through acquisitions.

From the mid-2000s onwards, IOCs have been restructuring their significant exposure to the European refining sector towards a core of large-scale, highly complex and integrated refineries in key European markets, such as the Amsterdam-Rotterdam-Antwerp (ARA) region. As a result we have seen a selloff and idling by IOCs of less complex and smaller refineries. A point in case is the 102 kb/d Shell refinery in Harburg that is currently for sale and projected to be converted into a storage terminal in 2012. In Figure 24, we see that since 2008 IOCs have sold and mothballed substantial parts of their European refining capacity. ExxonMobil and Shell are most prominent and execute this strategy most dominantly. BP historically has had less refining capacity, while Total traditionally has had a strong home refining bias, which hampers its ability to execute an IOC-style rationalisation, as shown in Box 3.

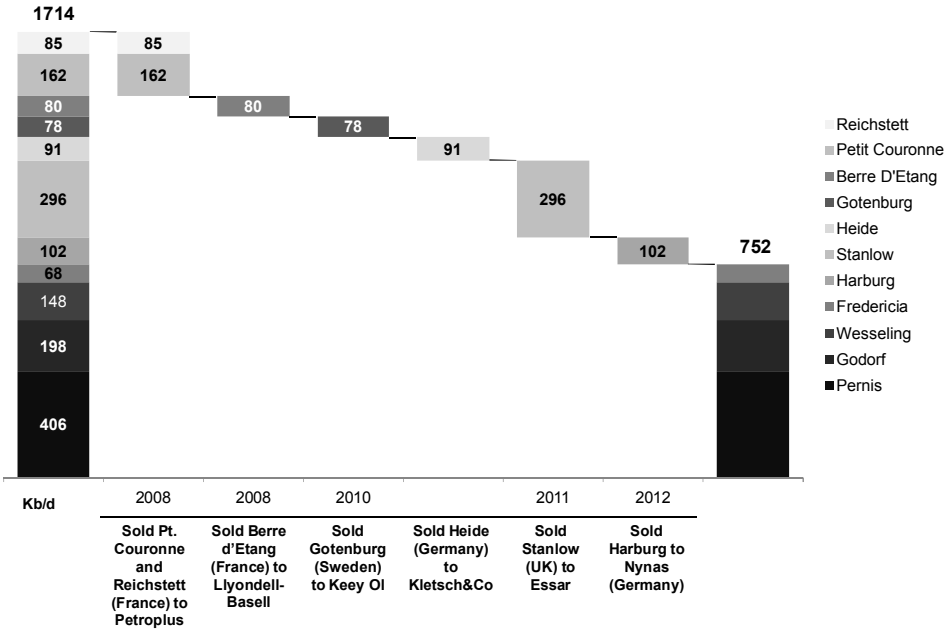
Lower downstream exposure and up- and downstream divergence

The divestments of vertically integrated IOCs in the European refining sector reflect the global trend of IOCs increasing their investments in the upstream part of the oil value chain and lessening their exposure to the various thin and volatile margins in the downstream. Besides ExxonMobil, Shell is a good example of the divestment and consolidation trend of the IOCs in the downstream part of the value chain, as can be seen in 25.

[85] See Annex A for an overview of refining capacity by ownership type.

[86] This figure does not include the tolling agreement of Shell to run the idled Petroplus Petit Couronne refinery since this does not include an actual change of control event.

Figure 25: Shell divestitures of European refineries



Source: CIEP Analysis, Shell

* Excluding minority shares and refineries with a capacity of under 20 kb/d

Since the end of 2006 Shell has sold more than 700 kb/d of refining capacity globally, with the most recent divestment being the 296 kb/d Stanlow refinery in the UK in March 2011 to the Indian refiner Essar. At the same time, Shell made significant investments in complex large-scale refineries and in emerging markets, such as the upgrade of the US Port Arthur refinery (Shell interest 50%) to 600 kb/d refining capacity and investment in CNOOC's Huizhou refinery with an estimated total CAPEX of 7.5 bn USD.[87] In the European refining sector we can see that from 2006 to 2011 Shell sold nearly all its small-scale refineries, with the exception of the 68 kb/d Fredericia refinery in Denmark. Fredericia remains in Shell's portfolio because it is physically connected to the Shell GORM oil field via a 20-inch oil pipeline in the Danish Economic Zone in the North Sea. After these divestments, the remaining Shell refineries in Europe are the Dutch 406 kb/d Pernis refinery in Rotterdam and the German 346 kb/d Rheinland refinery, consisting of the 198 kb/d Godorf and 148 kb/d Wesseling refineries, and the mentioned 68 kb/d Fredericia refinery in Denmark.[88]

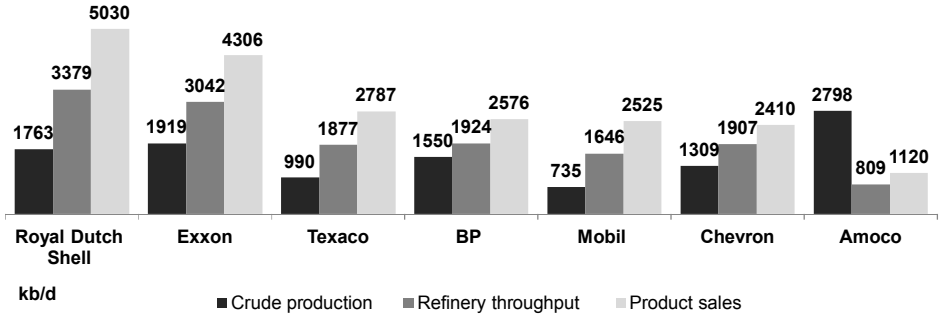
While the market developments in the European oil product market, as described in Chapter 2, and especially the rising prominence of middle distillates at the expense of gasoline, have forced IOCs to reconfigure and even upgrade their refineries, we also see that investment drivers specific to IOCs allow them to lower their exposure to the European downstream industry.

[87] Shell, *Factbook investments 2006-2020* (2011),

[88] The Godorf and Wesseling refineries, located 5 km from each other, are highly integrated via crude oil and oil product pipelines and can be considered as one refinery.

Firstly, due to their spread across the oil value chain, IOCs are increasingly positioning the majority of their capital expenditures in exploring and producing crude oil. The consistently higher margins and hence returns of the upstream part of the value chain in comparison to downstream have incentivised the publicly listed IOCs to invest upstream on the value chain. Additionally, as a result of these nationalisations the downstream capacity of the IOCs has become far larger than upstream crude production. Even after the restructuring of the refining and product sectors in the 1980s, the overexposure of the IOCs to the downstream part of the oil value chain relative to upstream reserves persisted, as can be seen in Figure 26.[89] The main exemption is the US Major Amoco.

Figure 26: IOC global crude production, refinery throughput and product sales (1988)



Source: Bacon (1990), CIEP Analysis

Secondly, as discussed in Box 1 of Chapter 2, the European refining industry has suffered from chronic overcapacity since the 1980s and posts lower returns then other prospective downstream players, for instance those from emerging markets. Due to their geographical spread, IOCs are able to position their capital expenditures globally. This ability is increasingly reflected in their corporate strategies.

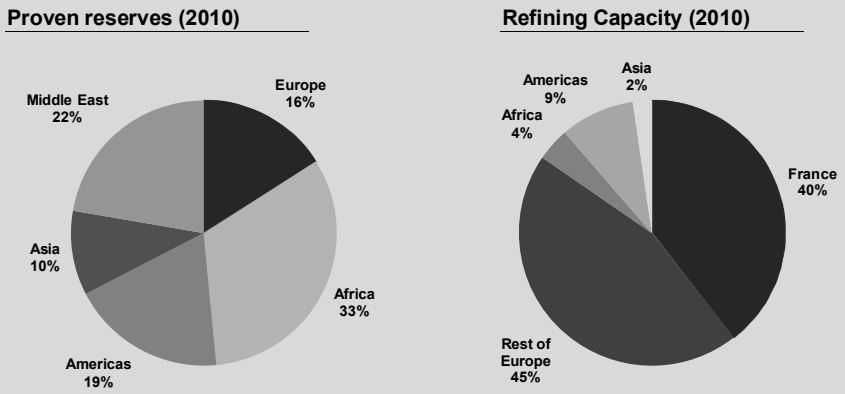
As a result, since the 1980s IOCs have slowly abandoned their tightly vertically integrated strategies and have decentralised decision-making power to the individual up- and downstream divisions, while keeping specific corporate functions, such as financing, integrated. Therefore companies such as ExxonMobil and Shell are far less integrated than public perception would expect. Although volumes of oil processed through refineries are coordinated with marketing and upstream divisions and vice versa, crude oil and later refined products are offered to the open market at every stage (after production and after refining). For example, ExxonMobil refineries do not exclusively process crude oil from the ExxonMobil E&P division. Similarly, oil product output from ExxonMobil refineries is not sold exclusively to ExxonMobil's main European retail brand, Esso.

[89] Bacon (1990),

Box 4: Two-faced Total

In the European refining sector, Total, owner of around 2 Mb/d of European refining capacity, has an atypical position. On the one hand, Total is an IOC with a diversified portfolio of global upstream reserves and production, with the goal of lowering its downstream exposure, in line with global downstream IOC strategy.

On the other hand, Total is a European and in particular French refiner, with 85% of its refining capacity located in Europe, of which 40% in France alone, as can be seen in the figure below. Yet global IOC refining capacities traditionally have a home bias lower than Total's. For example, around 40% of the refining capacities of both Shell and ExxonMobil are located in their home markets: respectively in Europe and North America.



Source: Total (2011)

With such a strong home bias in its refining portfolio, Total, from a downstream perspective, looks more like a European National Champion, questioning whether the profile of Total fits that of an IOC for this study, particularly since most of Total's refineries in Europe derive from the portfolios of state-owned predecessor Elf Aquitaine. This legacy results in French political opposition (incl. unions) to Total's restructuring its French refining portfolios, impairing Total's ability to execute an IOC-style strategy.

Nevertheless, the dominance of Total its global upstream exploration and production division in terms of capital expenditures (>80%), average capital deployed (>65%) and corporate strategy focus renders Total overall more an IOC than a European National Champion.

Source: CIEP analysis, Total (2011), Shell (2011), ExxonMobil (2011)

The rationale behind the decentralisation of refineries in the IOC value chain strategy is that complex refineries are able to process different types of crude oil and should not rely on the upstream division of the company, which only produces a limited number of crude qualities. The

freedom to contract crude oil intake from the global marketplace allows these refineries to arbitrage between changing crude quality spreads, lowering the market risk of specific crude qualities and therefore optimising refining margins. Corporate coordination along the oil value chain between different up- and downstream divisions only occurs with regard to volume.

Highly complex refineries can therefore be dubbed as "trading refineries" as opposed to traditional throughput refineries. For example, the 400 mln USD upgrade of ExxonMobil's Antwerp refinery in 2011, installing a High Pressure Hydro Treater (HPHT) to produce 138 kb/d more low-sulphur diesel fuel, was part of a global investment in allowing ExxonMobil refineries to produce more middle distillates from heavy and sour crude qualities and take advantage of the wide gap between the profits from heavy crudes and middle distillates.[90]

Box 5: Downstream spinoff ConocoPhillips

ConocoPhillips announced on July 14th, 2011 that it will split into two companies by spinning off its refining business. The company will become two separate, publicly traded entities by the end of June 2012, ten years after the creation of ConocoPhillips through a 25 bn USD merger in 2002. ConocoPhillips's announcement came only two weeks after Marathon completed its own downstream spinoff, creating the new Marathon Petroleum Co., raising questions as to whether a new industry trend towards 'de-integration' is emerging.

The news from ConocoPhillips does not come as a surprise. Management's decision to split the company in two is the culmination of a restructuring programme started in 2009 and accelerated earlier this year. Even before the announcement, ConocoPhillips had committed to shedding underperforming assets. According to the company, it expects to divest 10 to 12 bn USD company-wide.

Following the split, ConocoPhillips's fuel business will become the largest independent US refiner, with more than 1.8 Mb/d of processing capacity. Valero will then be the US's second independent refiner, with a total capacity of 1.7 Mb/d. Marathon completed the spinoff of its large oil refining business at the end of June 2011 and created a much smaller upstream oil company. Marathon's 2008 plans to restructure were postponed in 2009 amid the global financial collapse and only revived in January of this year.

Source: International Energy Agency, 'ConocoPhillips Spins Off Downstream to Become Largest Independent Refiner in US', in: *Oil Market Report* (August 10th 2011)

Recently, in reaction to low downstream margins, vertically integrated companies such as Marathon Oil and ConocoPhillips have gone as far as to spin off their downstream divisions in order to unlock value in the upstream divisions, as we can see in more detail in Box 4. What these

[90] The final investment decision for the global investment program of ExxonMobil to install High Pressure Hydro Treaters (HPHT) in various refineries across the world was taken in 2007 at the height of global and European refining margins. Despite low refining margins from 2009 onwards, ExxonMobil decided to continue the investment due its outlook of a tightening diesel market in at least the short- to medium term.

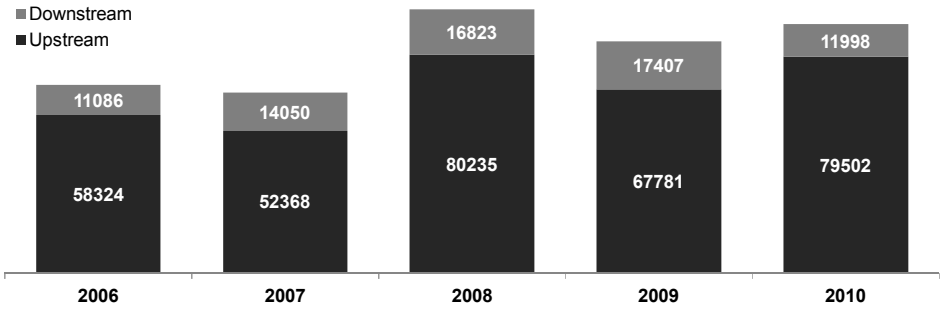
companies have in common is that their balance sheets were weak prior to the spinoff announcement, making them vulnerable to the demands of public shareholders. The jury is still out on whether the freedom of capital allocation for the upstream division outweighs the increased risk exposure of the individual up- and downstream divisions.

Upstream capital allocation

In general, we see that due to their strong balance sheet and large free cash flows, low debt-to-equity ratio (average 25%) and significant cash and marketable securities, IOCs have ample financial resources with which to keep investment cycles going while maintaining shareholder dividend and committing to share buy-backs.

For example, despite sometimes volatile market dynamics, ExxonMobil's capital expenditures increased annually between 2006 and 2010 by an average of 12.5%, and by 32 bn USD in 2011 alone. From 2006 through 2010, ExxonMobil distributed almost 40 bn USD in dividends and bought back 114 bn USD of its shares.[91] Uniquely, ExxonMobil's dividends have grown at an average annual rate of 5.7% over the past 27 years. The combination of increasing capital expenditures, dividends and share buy-backs indicate that despite vast swings in crude oil prices – the main variable earnings for an oil company – ExxonMobil, as an extreme example of an IOC, has substantial financial capabilities. This shows that IOCs in general are able to invest in their downstream divisions to remain competitive. However, when looking at the CAPEX of IOCs per division, we see that it is skewed heavily towards upstream part of the value chain, as shown in Figure 27.

Figure 27: IOC capital allocation (2006-2010) heavily skewed towards upstream part of the oil value chain



Source: CIEP Analysis, BP, ExxonMobil, Shell, Total

* BP, ExxonMobil, Shell and Total are the companies included

On average, between 2006 and 2010 ExxonMobil, Shell, BP and Total allocated only 17.6% of their total global capital expenditures to downstream divisions.[92] In this context it is important to mention that IOCs often employ a common internal rate of return (IRR) for their up- and

[91] ExxonMobil, *presentation 2011 Annual Shareholders Meeting* (May 2011),
[92] Shell, ExxonMobil, BP and Total, *Financial and Operational Information 2006-2010* (2011),

downstream investments, also called the "hurdle rate premium".[93] Refining investment projects in mature markets coping with overcapacity, like Europe, have to compete with other upstream projects for corporate funding and have a hard time meeting the hurdle rate premium. Traditionally and recently upstream projects have on average been more profitable than downstream projects in terms of Return on Average Capital Employed (ROACE), respectively 22% upstream and 12% for downstream projects in mid-2011.[94] Consequently, while having ample financial capabilities, IOCs are divesting and consolidating their exposure in downstream developed markets and reinvesting upstream in global developed markets and downstream in emerging markets with higher growth rates.

All in all, IOCs generally have the means to execute their preferred strategies by deploying their cash flows from other parts of the oil value chain. However, IOC refining divisions are increasingly working together with their trading departments and independently from their upstream divisions to allow for the supply flexibility of their refineries. The global geographical spread, the level of vertical integration and the financial capabilities of IOCs to invest along the value chain allows IOCs to optimally execute their preferred corporate investment strategies. Strong upstream margins, significant potential in non-OECD downstream industries and dismal conditions in OECD downstream markets are resulting in a slow retreat of IOCs from the European refining industry. Consequently, IOCs are divesting their small and least competitive refineries in the OECD downstream markets and investing in complex, large-scale refining capacity that is flexible and optimised for changing downstream market conditions.

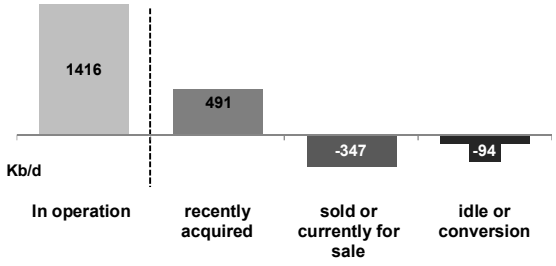
National oil companies (NOCs) of producer countries: a focus on other markets

National oil companies (NOCs) from net-exporting oil-producing countries, such as Rosneft, Kuwait Petroleum Company (KPC) and Gazprom, are small players in the European refining sector, with a group total of 1,416 Kb/d of operational European refining capacity, amounting to only 10% of total European refining capacity. Interestingly, as opposed to public conviction, in recent years NOCs from producer countries have not positioned themselves in the European refining sector on a grand scale. In Figure 28 we see that NOCs overall divested approximately the same amount as what they acquired in European refining capacity.

[93] The hurdle rate premium, or internal rate of return (IRR), is often adjusted for risk by a single discount rate to calculate a project's return or Net Present Value (NPV) and is alleged to be around 12% for the major oil companies,

[94] Barclays Equity Research (July 2011),

Figure 28: Restructuring of European refineries owned by producer NOCs (2008-2011)



Source: CIEP Analysis, Purvin & Gertz, various newspapers

This picture is radically different from the 1980s, when several Middle Eastern NOCs bought European refining assets in an ambitious strategy to integrate their vast oil reserves from well to wheel in the main consumer countries in the EU and the US. For instance, in February 1983 the Kuwait Petroleum Company purchased Gulf Oil's refining and marketing networks in the Benelux countries. With the low crude oil prices and low refining margins of the 1990s, producer NOCs slowed down their increasing exposure to the European downstream market.

From the 2000s onwards, rising prices and rising demand in both domestic and emerging markets for oil products forced NOC to rethink their "security of demand" prerogative away from downstream OECD markets towards Asia and especially their domestic markets. With domestic markets able to sustain substantial refining capacity, NOCs, with strong government support, began ramping up domestic refining capacity which could serve both the local and global markets. Especially in the Middle East, sizeable export-oriented refineries were built that could compete with the most sophisticated refineries in the world in terms of cost, flexibility and quality. Key in this respect is the mandate NOCs have from their host governments.

For instance, Saudi Aramco aims to own and operate refining facilities for fifty percent of its total crude oil production, amounting to around 5 to 5.5 Mb/d, or one-third of total European refining capacity. In Kuwait, a total of 20 bn USD is being invested in the local downstream sector, including the Al-Zour refinery, as part of the drive by Middle Eastern NOCs and their main state sponsors to meet domestic and Asian oil product demand. From an oil export perspective, US and European markets have taken a back seat to Middle Eastern NOCs in competition for market shares of oil consumers in the East. Currently, 60% of the crude oil exports of Saudi Aramco (the Saudi Arabian NOC) are destined for Asia (China, India, Japan and South Korea), as are the majority of its refined oil products.[95]

Exceptions to this trend are three recent acquisitions of producer NOCs or related investment vehicles of European refining capacity:

- In 2011, the Kuwaiti Sovereign Wealth Fund (SWF)'s **International Petroleum Investment Company (IPIC)** acquired the remaining 48% of shares in the Spanish

[95] Saudi Aramco corporate website,

downstream company CEPSA from Total. IPIC became full owner of CEPSA's three Spanish refineries, representing an investment of 7.5 bn in total.[96]

- In 2009, Russian NOC **Rosneft** acquired PDVSA's 50% share in the 50-50 Ruhr Oel joint venture with BP.
- In 2008, Russian **Gazpromneft** acquired the Serbian state energy company NIS and its refineries.

In all three cases it is interesting to see that the NOCs do not represent future core assets of the acquiring companies but are often part of either a strategic (Rosneft and Gazprom) or an asset management deal (IPIC). The Ruhr Oel deal can be seen as a prelude to the then prospective cooperation between Rosneft and BP in terms of working together in joint ventures. The proposed strategic alliance eventually broke in 2011 over a deal involving offshore blocks in the Arctic. Gazpromneft's NIS refineries were part of a Gazprom deal to bail out ailing Serbian energy infrastructure and create a market for the prospective South Stream gas pipeline.[97] Consequently, the IPIC, Rosneft and Gazprom acquisitions represent non-core assets for the new buyers that are bought as part of wider strategic considerations, for instance a diversified investment portfolio or gas, and not the European refining sector in particular.

All in all, the strategic downstream considerations of producer NOCs, focused on the local and Asian markets, do not lead us to expect that these players will invest some of their formidable wealth, either through state budget allocations or SWFs, in the European refining sector. Downstream integration of producer NOCs will most probably result in investments in emerging markets, as the intensifying Saudi-Chinese ties indicate. In future, a notable exception may be Russian oil companies as a result of the significant presence of Russian oil in mainly the Northwest European oil market. However, as we will see later in more detail, it is mainly Lukoil and not the Russian state companies that is positioning itself in this market.

European National Champions: holding their ground

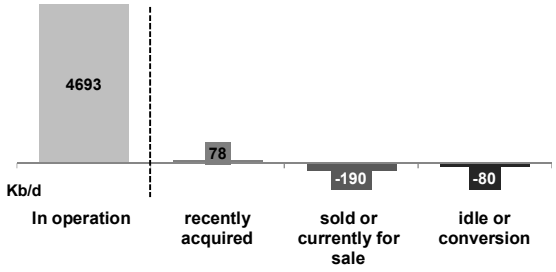
European National Champions are defined as formerly state-controlled oil companies with predominantly downstream assets and strong ties with their home governments. They are a diverse group which together own around 4.6 Mb/d, representing about 33% of European refining capacity. This makes them the largest group of European refinery owners by type. The National Champions in Europe are primarily located in Southern and Eastern European countries; the Northwest European refining market has traditionally been dominated by IOCs. As can be

[96] CEPSA was IPIC's first investment when it bought 9.6% of the company's stakes in 1988. In 2009, IPIC bought
Banco Santander's and Union Fenosa's stakes, a deal that made its share increase up to 47.1% of the company's capital. IPIC's total investment in CEPSA has been valued at approximately 7,500 million euros, which is the most important investment within IPIC's current portfolio, as well as one of the
largest investments made in Spain during the last few years. CEPSA, 'CEPSA begins a new era after Total's exit', in: *CEPSA press release* (August 2011),

[97] Gazprom, as part of the deal, committed to invest 396 mln euros in order for the ailing NIS refineries to modernise and produce cleaner fuels as mandated by European legislation (taking into account Serbia's road to enter the European Union), Ivana Sekularac, 'Serbia's NIS to invest 396 mln euros in refinery', in: *Reuters* (September 17th, 2009),

seen from Figure 29, companies such as MOL (Croatia), ENI (Italy), Repsol (Spain) and Neste Ol (Finland) are holding their ground; only PKN Orlen is trying to sell its 190 kb/d Lithuanian refinery in Mazeikiai.[98]

Figure 29: Restructuring of European refineries owned by European National Champions (2008-2011)



Source: CIEP Analysis, Purvin & Gertz, various newspapers

Upstream diversification and downstream home bias

During the liberalisation wave of European markets in the late 1980s and 1990s, the national downstream oil sectors, namely refining and marketing (R&M), gradually opened up to private and sometimes foreign ownership. Previously, as Contín-Pilart and Correljé (2009) describe for the Spanish retail market, downstream oil markets experienced heavy state intervention and were often state-owned due to the political sensitivity of gasoline prices.[99] With the trend in Europe to wholly or partially privatise downstream assets – for instance, the Italian government now owns only around 30% of ENI's voting power – former state-owned oil corporations were increasingly exposed to competition in European and global oil markets.

The increasing competitive pressures on national downstream oil sectors have incentivised the National Champions, their financial capabilities permitting, to diversify geographically. This has occurred mainly in their upstream divisions. For instance, Total has expanded its upstream oil operations beyond its traditional provinces in the North Sea, Africa and the Middle East towards Asia Pacific and South America, which in 2010 represented respectively 11% and 8% of its international average daily production of crude oil.[100] However, other National Champions, among others MOL and PNK Orlen, have retained a regional focus (Central and Eastern Europe). While the upstream exposure of National Champions has become slightly more international, this is not at all true for their downstream divisions. With oil product prices remaining high on the

[98] The sale of the Lithuanian refinery in Mazeikiai by PKN Orlen is a remarkable case since the sale was initiated due to a cut-off of the refinery from its Russian pipeline that was supplying Russian crude oil to the refinery (representing nearly 100% of its feedstock). Consequently, Mazeikiai is now sourcing its crude by sea, resulting in a steep decline in utilisation (from 93 to 87%) and consequently also in value.

[99] Ignatio Contín-Pilart, Aad Correljé, 'Competition, regulation and pricing behavior in the Spanish retail gasoline market', in: *Energy Policy* 37 (2009) 219-228,

[100] In 2010 Total's average daily production of crude oil was located in: Europe (27%), Africa (33%), the Middle East (19%), Asia-Pacific (11%), South Africa (8%), North America (1%), and the CIS (1%). Source: Total website, *Upstream operations* (September 2011),

political agenda in various European countries, downstream oil markets have remained relatively closed. The incumbent oil companies, or National Champions, have thus remained dominant.

Significant barriers of entry and exit such as subsidised refining capacity, often via oil product pricing, and expensive closure procedures have lowered competition and have not incentivised National Champions to rationalise and diversify their downstream assets. As a result, the large National Champions such as Total and ENI have retained a strong home bias in their downstream oil portfolios, and this is even more the case for smaller National Champions, as can be seen in Figure 30.

Figure 30: ENI's upstream diversification and downstream home bias in 2010

	Exploration & Production			Refining & Marketing		
	A	*B*	*C*	*A*	*D*	*E*
Italy	**38%**	**11%**	**3%**	**77%**	**73%**	**71%**
Outside Italy	**62%**	**89%**	**97%**	**23%**	**27%**	**29%**

A: personnel
B: proven oil and gas reserves
C: capital expenditure
D: distillation capacity
E: oil product sales (retail and wholesale)

Source: CIEP Analysis, ENI, *Annual Report on Form 20-F 2010* (2011)

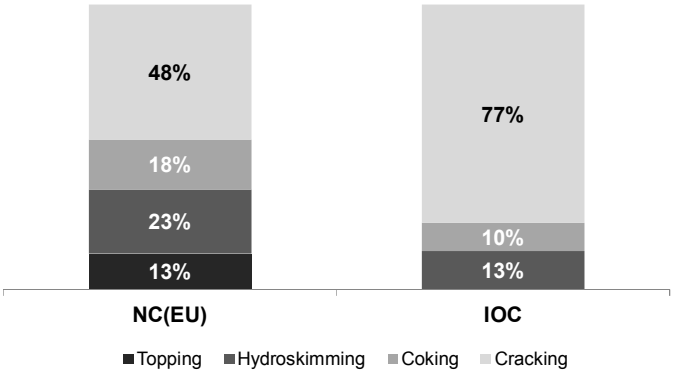
From Figure 30 we see that ENI's upstream risks in terms of personnel, proven oil and gas reserves and capital expenditure are heavily skewed towards "Outside Italy". Downstream in the home market ("Italy") the picture completely changes: there personnel, distillation (refining) capacity and oil product sales are very dominant. As a result, there is an intimate relation between National Champions and their governments, characterised in relation to ENI by Bonanno (2008) in his statement that "ENI's leaders give priority to the political role played by the corporation within the Italian system" when taking strategic corporate decisions.[101]

Operating simple refineries with weak balance sheets in 'captive markets'

Because National Champions play a central role in issues surrounding security of national oil supply and as a result work in 'captive markets' without significant international competition, the incentives to invest in and upgrade domestic refining are generally low. As a result, we see that National Champions currently operate relatively aging and simple refining capacity in Europe as compared to IOCs, as can be seen in Figure 31 by looking at the percentage of simple (topping) and more complex (cracking) refineries.[102]

[101] Alessandro Bonanno, Douglas H. Constance, *Stories of Globalization: Transnational Corporations, Resistance, and the State* (2010) 91,
[102] CIEP Analysis and Purvin & Gertz,

Figure 31: European Refineries per complexity type for National Champions (EU) and IOCs



Source: CIEP Analysis, Purvin&Gertz

Coupled with operating relatively simple refineries, National Champions in Europe do not seem to have the financial means to upgrade their aging refineries. Looking at several financial indicators for some medium-level European National Champions in 2010, including return on equity (ROE), debt ratio and income sensitivity (in EBITDA)[103], we see that these companies share a low ROE and relatively high debt ratio compared to the IOCs' average of approximately 25%, as can be seen in Figure 32.

Figure 32: Financial indicators of medium National Champions (Europe)

	2010	*(%, 2010)*	*(%, 2011E)*	*('000 USD, 2010)*
	ROE	***Net debt / equity***	***ebitda sensitivity to 1 USD change in refining margin***	***EV / Complex capacity***
Hellenic Petroleum	7.4	66%	11%	0.5
MOL	8.9	48%	4%	3.3
Neste Oil	0.1	113%	11%	1.5
PKN Orlen	0.1	44%	9%	1.7
Europe median	7.4	47%		1.3
Asian median	15.6	42%		2.9
US median	5.8	42%		0.8
Petroplus	*-1.8*	*93%*	*31%*	*0.5*

EBITDA = Earnings Before Interest, Taxes, Depreciation and Amortisation
ROE = Return On Equity (ebitda / equity)

EV = Enterprise Value

Source: Goldman Sachs Research (2011), CIEP Analysis

On the other hand, the low ROE seems to be compensated by lower risk, as the incomes of

[103] EBITDA = Earnings Before Interest Taxes, Depreciation and Amortization

various National Champions are not as sensitive to changes in refining margins as those of independent, or 'pure-play' refiners, such as Petroplus. Additionally, we see that the European National Champions from this sample have low complex refining capacity. A notable exception is the Hungarian oil company MOL, which operates two of the most sophisticated Central European refineries: the Hungarian Duna (10.6 Nelson Complexity) and Slovakian Bratislava (11.5 Nelson Complexity) refineries.

All in all we see that the National Champions in Europe are stabilising their refining operations and keeping a low profile from an ownership restructuring perspective. Arguably, operating simple, low-margin refineries in relatively captive home downstream oil markets with high entry barriers (often set by government) gives European National Champions some protection from international competitive pressures but does not allow for significant room to manoeuvre due to constricted financial capabilities. This limited ability to adjust to any future changing market dynamics places especially small National Champions in a vulnerable position, allowing EUROPIA to conclude in its assessment of the European refining sector that "roughly half of the capacity of the 100 oil refineries in Europe will be shut down by 2050.[104] At the same time, as incumbent National Champions have difficulty surviving, another type of National Champion is seemingly eager to enter the European refining sector.

National Champions of emerging markets: gaining a foothold

The new kids on the block in the European refining sector are state-supported National Champions from emerging economies such as China, India and Russia. With the Chinese oil and gas company PetroChina purchasing a 50% stake in both the Grangemouth and Fos Lavera refineries from INEOS in January 2011, the European refining sector welcomed its first Asian owner. Since 2008 the National Champions of emerging economies have been on an acquisition hot streak, adding 1,064 Mb/d, or +362%, of European refining capacity to their downstream portfolios, as can be seen in Figure 33. As of September 2011 National Champions from emerging markets owned a total of 1358 kb/d, or approximately 9%, of European refining capacity.

Figure 33: Restructuring of European refineries owned by National Champions from emerging markets (2008-2011)

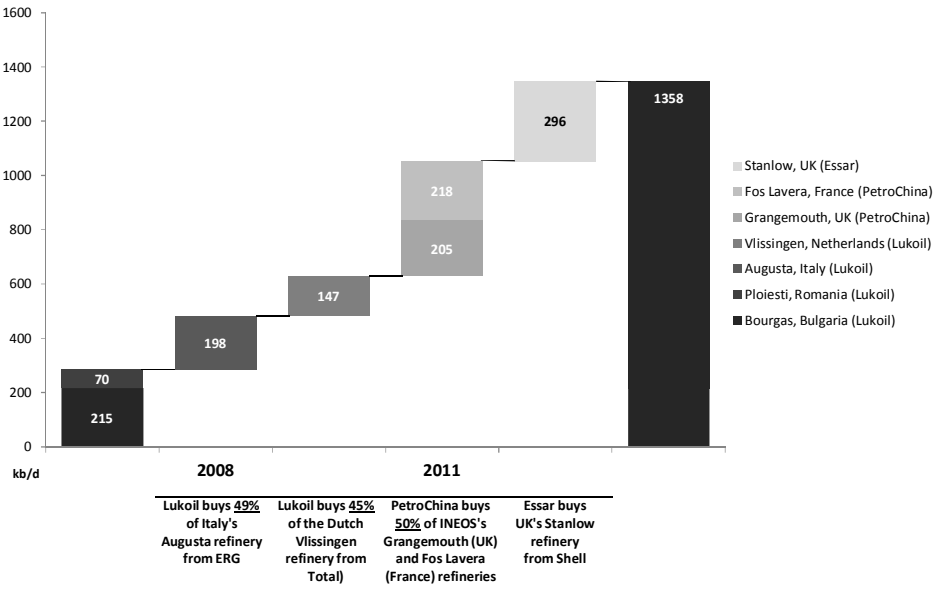
Source: CIEP Analysis, Purvin & Gertz, various newspapers

[104] Europia, *EUROPIA contribution to EU energy pathways to 2050* (September 2011),

Strategic positing in the international downstream oil sector…with a little help

As opposed to IOCs or, as we will later see, to pure-play refiners, National Champions from emerging economies are adopting a business strategy which embraces vertical integration along the oil and energy value chains as opposed to concentrating on a particular part of the oil value chain. The three companies involved – the Russian oil company Lukoil, the Chinese PetroChina and Indian downstream conglomerate Essar – have taken on a 'going global' strategy in order to become globally competitive oil companies.[105] In recent years this ambition has translated into acquiring downstream physical assets in major oil product markets such as European refineries, as can be seen in Figure 34.

Figure 34 National Champions of emerging markets: 'going global' with European refineries (2008-2011)



Source: CIEP Analysis, Lukoil, Essar and Petrochina Corporate websites

Lukoil

The privately owned Russian National Champion Lukoil is the most present emerging market National Champion in the European refining sector. With stakes in four refineries (Bourgas, Ploiesti, Augusta and Vlissingen), Lukoil currently operates 530 kb/d of European refining capacity. We also count the minority shares due to fact that Lukoil is increasingly present in the day-to-day operations and main investment decisions of its Augusta (49%) and Vlissingen (45%)

[105] Julie Jiang and Jonathan Sinton, Overseas investments by Chinese National Oil Companies', in: *International Energy Agency Information Paper* (2011),

refineries. In 2007 Lukoil outlined an aggressive international downstream expansion plan which includes the goal to increase its total refining capacity to 2 Mb/d by 2017.[106]

Lukoil's investment rationale can be summarised in two arguments: forward integration and diversification. Capturing additional rent downstream of Russian crude oil exports, with Urals crude oil being the Russian crude oil export benchmark, seems to be key in this respect. With Russian crude dominantly present in the European market it is only natural that Russia's biggest crude oil producer should position itself in the country's main downstream export market, Europe. Lukoil's Central European refineries are connected to the Russian Druzhba pipeline, which exports Russian Urals export blend quality.[107]

Secondly, and related to downstream rent capture, we see that diversification of export market outlets is also a strong reason for Lukoil to expand into Europe. For instance, the integration of the Vlissingen refinery – in which Lukoil acquired a 45% stake in 2008 – into its production chain allows the company to expand its territory, as that refinery is capable of processing Urals blend crude oil as well as significant volumes of straight-run fuel oil and vacuum gasoil (the much prized middle distillates). At the same time, Lukoil, according to a press statement, will also be able to use its Vlissingen refinery "to supply and develop its retail presence in Western Europe. The location of the refinery close to the main Western oil product market will enable Lukoil to reinforce its trading positions in Northwest Europe and realize significant synergies."[108] Aside from vertical integration, diversification into the Western European oil product market is also a key investment driver for Lukoil. The European refineries acquired by Lukoil therefore represent a core part of its asset portfolio and are likely to remain so in the medium- to long term.

PetroChina

Chinese National Petroleum Company (CNPC) subsidiary PetroChina[109] is the most vocal of the emerging market National Champions concerning its ambitions to position itself as a globally competitive energy company through vertical integration including a physical presence in the European downstream and refinery sectors. It states that it will "pursue a sustaining leading role in the [oil] market by making full use of the advantages in economy of scale and integrated operations from upstream to downstream businesses, solidifying mature market, expanding high efficiency market, exploiting strategic market, developing international market, and continuously promoting its competitive power in both domestic and foreign market."[110] The main rationale to integrate vertically revolve around gaining access to upstream resources, diversifying energy supply sources, partnering with other NOCs and IOCs and utilising strong financial resources and government policy support.[111]

And utilising government policy support and employing strong financial resources PetroChina does. In a recent study on overseas Chinese energy investments, the IEA (2011) concluded that

[106] Isabel Gorst, 'Lukoil: Russia's largest oil company', in: *Series Rice University: The changing role of National oil Companies in International Energy Markets* (March 2007),
[107] Isabel Gorst, 'Lukoil: Russia's largest oil company', in: *Series Rice University: The changing role of National oil Companies in International Energy Markets* (March 2007),
[108] Lukoil, 'Lukoil completes acquisition of 45% in refinery in Holland', in: *Lukoil press release* (1 September 2009),
[109] Currently CNPC owns 97.43% of PetroChina its outstanding common ("A") shares with voting power
[110] PetroChina corporate website (September 2011),
[111] PetroChina corporate website (September 2011),

the strategy of Chinese National Champions to become global competitive energy companies "is now supported at the highest levels of government". However, in the specific overseas investments, "commercial motives play a large and perhaps the largest part", and "despite some instances of co-ordination, there seems to be a high degree of independence of the (Chinese) National Champions from government".[112] Government support therefore seems to derive mainly from the strong financial positions of Chinese state banks, and Chinese banks are willing partners. The China Development Bank (CDB) and the China Export-Import Bank (CEIB) are the two main banks that provided funding for China's long-term loans for oil and gas. For example, CDB agreed to provide 30 bn USD in loans to CNPC at low interest rates over the next five years to support CNPC's expansion abroad. These two banks are experienced in overseas investments.[113] The support of Chinese state banks provides PetroChina with ample financial resources to execute its investment strategy.

However, the main examples of Chinese companies' investments in the energy sector abroad are their upstream investments in resource-rich countries, such as the widely described investments in African countries, and not in mature (European) downstream oil product markets far from home. Additionally, the presupposed "market-for-resource strategy" of Chinese National Champions, i.e., co-operating downstream with resource-rich NOCs such as on the Chinese Fuijan refinery with Saudi Aramco, hardly applies to PetroChina's acquisition of European downstream assets. Partnering with INEOS, for instance, hardly gives PetroChina the upstream clout to gain access to upstream resources, its main objective in meeting increasing Chinese demand for natural resources.

The question is what position the European refineries have in PetroChina's corporate strategy. Regarding the acquisition of its 50% stakes in the Grangemouth and Fos Lavera refineries, PetroChina argues that "the deals are consistent with PetroChina's strategy of building a broader business platform in Europe and of becoming a leading international energy company".[114] The emphasis of this corporate statement should be on the latter part of the sentence because PetroChina previously had no existing presence in the European downstream oil sector.

Speculatively, one may argue that the aim behind the acquisition of a part of the Grangemouth refinery, the landing point for North Sea oil fields including BP's Forties field and one of the main physical sources of the Dated Brent (the physical part of the 'Brent' oil price benchmark), is to gain intelligence on oil price formation in one of the largest oil markets in the world and not to upgrade European refineries to become internationally more competitive. Be as it may, we argue that PetroChina's acquisition has more to do with gaining a foothold in the European downstream market that provides market intelligence than with an investment strategy to firmly integrate vertically.

[112] Julie Jiang and Jonathan Sinton, 'Overseas investments by Chinese National Oil Companies', *IEA Information Paper* (Paris 2011),
[113] Julie Jiang and Jonathan Sinton, 'Overseas investments by Chinese National Oil Companies', *IEA Information Paper* (Paris 2011),
[114] PetroChina, 'PetroChina and INEOS announce plans for new trading and refining JV in Europe', in: *PetroChina press release* (10 January 2011),

Essar

The privately owned Indian National Champion Essar has a less vocal ambition to vertically integrate across the oil value chain but mainly focuses on the downstream part of the energy value chain. According to Naresh Nayyar, Essar Energy's chief executive, Essar's acquisition of the UK Stanlow refinery "takes Essar substantially closer to our objective of a global refining capacity of one million barrels daily."[115] Stanlow specifically "fits very well with our strategy of providing options for the export of high quality products from our Vadinar refinery in India", according to an Essar press statement on the Stanlow acquisition.[116]

The Indian Vadinar refinery, with Brownfield investments adding 75 kb/d and Greenfield investments ("Vadinar II") adding 400 kb/d of refining capacity in 2012, also reflects India's and Essar's ambition to become a major global oil product exporter. This ambition results in firm government support for Essar's investment strategy as shown by the fact that the Vadinar refinery is located in a dedicated special economic zone (SEZ) with preferential (mainly export-oriented) taxation rules. In line with this strategy, oil product exports have increasingly begun to flow to the European oil product market. In this respect, Stanlow is the first physical asset of an already present Indian oil product exporter.

Similar to PetroChina's case, the question is how long-term Essar's presence in the European refining sector will be, as its main competitive advantage is derived from domestically based high-scale and complex refineries. The main rationale behind the ramping up of domestic refining capacity is primarily to meet growing national oil product demand, as supported by national governments. Providing the global product market with 'surplus' volumes of oil products including overseas acquisitions is then an additional revenue generator, but not a long-term strategy or core competence. In this respect it is questionable whether the Indian government is willing to support Essar in the long run if it is mainly focused on the international market. As a result, we argue that Essar's acquisition of the Stanlow refinery from Shell in 2011 represents non-core assets and serves as a test to see whether physical assets in Europe can provide more market for its 'surplus' volumes of oil products from its refineries in India.

Risk of overpaying?

Overall we see that National Champions from emerging markets are increasing their presence in the global downstream oil sector and as a derivative are entering the European refining sector. The main arguments for doing so concentrate on capturing downstream rents in the oil value chain and diversifying export markets. All National Champions are supported on a government level through cheap funding, preferential tax treatment and/or regulatory protection, creating competitive barriers for competitors.

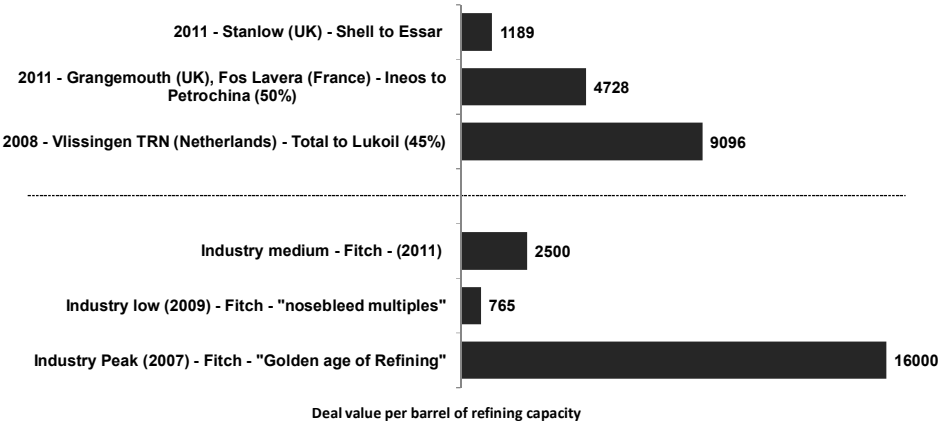
The main risk National Champions from emerging markets face is the fact that the explicit and government supported overseas investment strategies and ample (government supported) financial resources result in the companies overpaying for European refineries. The value that these National Champions attach to European refineries may diverge from that seen by others who value different things such as synergies gained from vertical integration. This results in

[115] Essar, 'Essar Energy completes acquisition of Stanlow oil refinery', in: *Essar press release* (1 August, 2011),

[116] Essar, 'Essar Energy completes acquisition of Stanlow oil refinery', in: *Essar press release* (1 August, 2011),

National Champions paying more than 'market prices' for European refining assets, as can be seen in Figure 35.

Figure 35: Risk of overpaying for European refineries by National Champions from emerging economies



Source: CIEP Analysis, Fitch (2011)

* Note: The multiples are based on the total take-over price as announced by the deal partners. There is no distinction between the price paid for the assets itself and the products stored in the refinery.

Figure 35 seems to shows that National Champions from emerging markets pay relatively low multiples for their acquired European refineries as compared to the multiples quoted by Fitch (2011). However, Lukoil's Vlissingen acquisition happened during a steep decline of European refining margins, raising questions about the 9036 USD paid per barrel of refining capacity for the relatively complex Dutch refinery. In 2011, PetroChina paid 4728 USD per barrel for the stakes in the Grangemouth and Fos Lavera refineries, well above the market medium of 2500 USD. Only Essar seems to have gotten a bargain from a divesting IOC, at 1189 USD per barrel; for others the risk of overpaying for assets may come to haunt their balance sheets in the medium- to long term.[117]

All in all, the main competitive advantages of National Champions from emerging markets are located in their home markets and not in Europe. As a result, it is hard to say whether these oil companies will be long-term investors in the European downstream sector or that they overpaid simply to gain a foothold in the European refining sector. Additionally, from a vertical integration perspective, security of supply is the main international investment driver for emerging market National Champions whose host governments are import-dependent. Investments in European

[117] Note: The multiples are based on the total take-over price as announced by the deal partners. There is no distinction between the price paid for the assets itself and the products stored in the refinery. In particular, the liability of the – often polluted – soil on which the refinery is located is often hefty and can significantly influence the value (negative) of the asset. Due to the non-disclosed nature of the majority of asset purchases, we see that the details of related transactions cannot be taken into account.

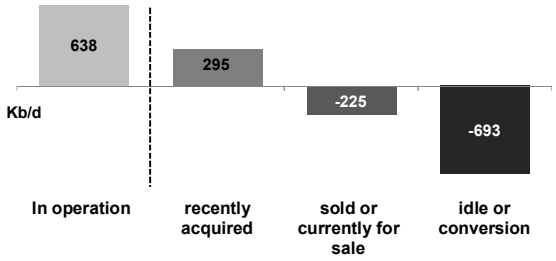
downstream oil assets hardly fit the profile. This is especially true for PetroChina and Essar. European refineries will stay at the fringe of the corporate strategies of National Champions from emerging markets.

The main exception is Lukoil. With Russian crude oil being overly present in the Europe, Lukoil seems genuinely able to utilise synergies from vertical integration and secure demand for its Russian crude oil production by operating European refining capacity.

Pure-play refiners: riding the market cycle

Pure-play, or independent, refiners active in the European refining sector operate, as their name suggests, predominantly in the refining part of the oil value chain and usually have no retail stations that market their oil products. Pure-play refiners source crude oil and sell their oil products in the open market. This exposes them fully to changing market dynamics and refining margins such as the popularity of middle distillates, environmental legislation and heavier, sourer crude oil qualities. With a total of 638 kb/d, pure-play refiners own and operate 4% of Europe's total refining capacity. Between 2008 and 2012 we have seen significant shifts in the positions of pure-play refiners in the European refining sector, as can be seen in Figure 36.

Figure 36: Restructuring of European refineries owned by pure-play refiners (2008-2012)



Source: CIEP Analysis, Purvin & Gertz, various newspapers

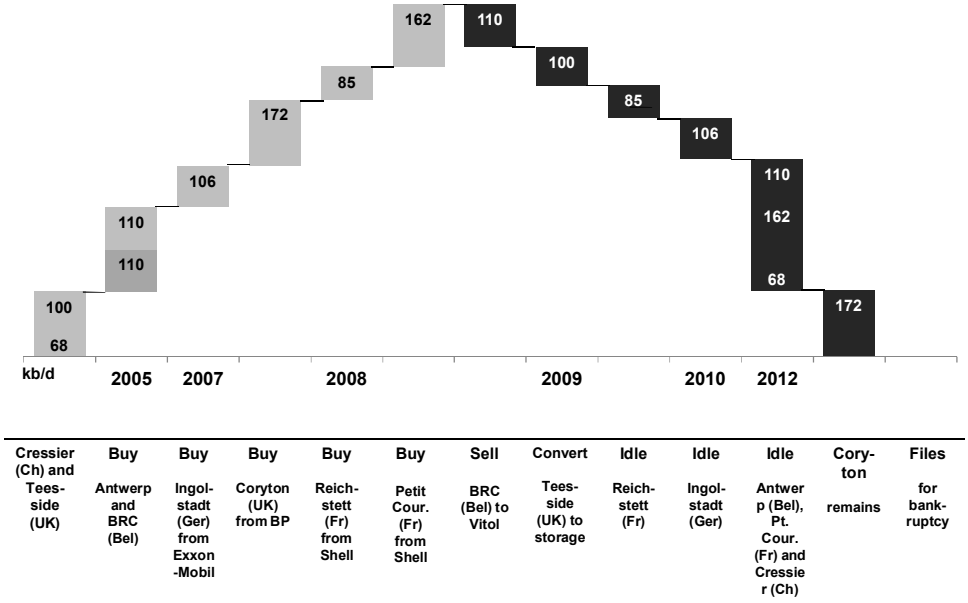
From Figure 36 we see that between 2008 and 2011 pure-play refiners idled 49% of their refining capacity. The only refineries that are sold in the 2008 – 2012 period by pure-players are both owned by Petroplus and both located in Antwerp. The buyers, Vitol (2008) and Gunvor (2012), are oil trades looking for more physical assets to complement their trading activities. As will be elaborated upon, we see that the full 693 kb/d of idling or conversion by pure players in the European refining sector derives from the Swiss-based Petroplus. Valero's acquisition of the 295 kb/d UK Pembroke refinery is the exception to the downward trend of European pure-play refiners.

Full market exposure

Albeit small players, pure-play refiners are, from an ownership restructuring point of view, among the most dynamic companies in the European refining sector. Since 2008 pure-play refiners have divested a substantial part of their refining capacity as a result of thinning refining

margins and deteriorating financial results. The demise of the largest European pure-play refiner, Swiss-based Petroplus, is reflective of the vulnerability of European independent refiners operating in the European refining sector. Figure 37 shows the build-up and breakdown of the European refining capacity of Petroplus, which at its top operated 913 kb/d of European refining capacity.[118]

Figure 37: Petroplus and its exposure to market forces



Source: CIEP Analysis, Petroplus

Between 2004 and 2007 Petroplus acquired the Belgian BRC, German Ingolstadt, UK Coryton and French Petit Couronne and Reichstett refineries.[119] The main counterparties in the deals were the IOCs, which, as we have seen earlier, were already executing their strategies to divest smaller, less complex European refineries. Petroplus argued that its acquisitions made strategic sense because as a result of its corporate focus and excellence ("a pure player") it could operate the refineries in its portfolio more efficiently and at lower cost than the IOCs did.[120] Helped by high refining margins in 2004-2008, Petroplus prospered financially and kept adding refining capacity

[118] The current (2011) refining capacity of Petroplus includes the refineries in Petit Couronne, Reichstett (idled), Ingolstadt (idled), Cressier, Coryton Essex and Teesside (idled). In the beginning of 2012 Gunvor took over the Antwerp refinery and the Coryton and Petit Couronne refineries each got restarted under a temporary tolling contract by respectively Morgan Stanley in combination with private equity partners and Shell. Source: International Energy Agency*, Oil Market Report: Petroplus Back in Action* (March 2012),

[119] The counterparts in the sale were ExxonMobil (Ingolstadt), BP (Cotyton), Shell (Pt. Couronne, Reichstett) and the Daewoo group (BRC),

[120] In this period Petroplus also acquired US refining capacity. In 2008, Petroplus was looking to take on the US refining market with a 2 bn. USD acquisition fund, together with private equity firms such as Blackstone and First Reserve, at a time when the IOC like BP and Shell were selling US refinery assets to concentrate on more profitable ventures. Lionel Laurent, 'Petroplus Prospects In U.S. Market', in: *Forbes* (February 2008),

to its portfolio. Also, the pure-play strategy by Petroplus was supported and funded by private equity, including the Carlyle Group and Riverstone.[121]

However, pure-play refiners are also highly sensitive to market dynamics. When in 2008-2009 refining margins collapsed, Petroplus felt the full weight of its price exposure to both the crude oil and the oil product markets. With a product slate slightly skewed towards producing middle distillates above the European average, with gasoline representing 22% and middle distillates 47% of its oil products, Petroplus had initially argued that it could profit from increasing European demand for middle distillates.[122] This was indeed relevant, but with overall European product demand down, overcapacity in European refining capacity destroyed refining margins across the board. Consequently, the relatively low scale and complexity of its refineries meant that Petroplus was unable to compete with large and highly complex European IOC refineries.[123] As a result, Petroplus's refining utilisation dropped sharply to 70% in 2009 and 79% in 2010, well below the European refining utilisation averages of 81.6% in 2009 and 82.6% in 2010.[124] As the earnings of Petroplus were very sensitive to changes in refining margins (a 31% change in EBITDA per 1 USD change in refining margins), profits plummeted.[125] Chairman Thomas O'Malley concluded that "2009 was the perfect storm which negatively affected the world's refining industry."[126] However, the adverse refining market conditions seemed to impact Petroplus far more than other oil companies.

Low capital buffers force pure-players to 'ride the market wave'

Making matters worse, Petroplus financed its 2004-2008 acquisition spree mainly with external money and cash flows generated by previous acquisitions, amounting up to 1,750 mln USD of high yield and convertible bonds and 2,575 mln in revolving credit facilities for liquidity purposes. As a result, Petroplus's highly leveraged capital structure was barely able to cope with the sector's downswing in 2009. In 2009 Petroplus's financial results noted a negative income of 260 mln USD; cash and short-term deposits dropped to 11 mln USD, and short-term borrowings rose to 150 mln USD.[127]

On a total balance sheet of 6.7 bn USD, this indicated that Petroplus was low in liquidity, and uncertainty rose as to whether it would be able to pay its creditors if it were to have another year of low refining margins. In the same period Petroplus's credit rating was downgraded by S&P to B+, indicating that the company was a "speculative investment" and had become "more vulnerable to adverse business, financial and economic conditions but currently has the capacity to meet financial commitments".[128]

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[121] Petroplus corporate presentation at the Credit Suisse Energy Summit (February 2011),
[122] Petroplus corporate presentation (February 2011),
[123] For instance, in 2011 we see that Petroplus had an average 139 kb/d capacity per refinery as compared to Shell's average of 205 kb/d,
[124] Petroplus corporate presentation at the Credit Suisse Energy Summit (February 2011), BP Statistical Review of World Energy 2011,
[125] Goldman Sachs Research (2011),
[126] Petroplus, ' Petroplus announces first quarter 2010 results', in: *Petroplus corporate press release* (May 2010),
[127] Petroplus corporate presentation at the Credit Suisse Energy Summit (February 2011),
[128] Standard & Poor's (2011),

After initial success with the sale of Belgian refinery BRC to oil trader Vitol in 2008, the mandatory sell-off in abysmal sector conditions ground to a halt in 2009. As a result, in 2009 and 2012 Petroplus mothballed the UK Teesside, French Reichstett and German Ingolstadt refineries in order to lower operational costs, free up working capital and lift its refining utilisation. Whereas Petroplus acquired its refineries at the peak of the market, it tried to sell its refineries at the (temporary) bottom of the market, without success.[129] In January 2012 concerned creditors, a syndicate of 13 banks, withdrew Petroplus's 2.1 bn USD revolving credit facility that had provided working capital to its refineries.[130] As a result, the once proud "largest independent refiner of Europe" filed for bankruptcy in January 2012.[131]

Similarly, pure-play refiner INEOS announced in 2011 that it had entered into a 50-50% joint venture with PetroChina including the Fos Lavera and Grangemouth refineries (effectively selling a 50% stake), also in an effort to prop up its weak balance sheet.

A notable exception to the overall grim story for pure-play refiners is Valero's acquisition of the 210 kb/d UK Pembroke refinery for 730 mln USD in the summer of 2011. The highly complex UK refinery, boasting an 11.8 Nelson complexity, was sold for 2048 USD per barrel, well below the prevailing market deal multiples for complex refineries. However, Pembroke will not supply the European market since it substitutes the three US East coast refineries that Valero closed over the past two years, which ended Valero's ownership of US East Coast refining capacity.[132]

In the US the high market and price exposure of pure-play refiners has led to a new business model in which independent refiners can offload all risk except operational risk (running the plant) to third parties such as investment or merchant banks. For example, in 2011 the US independent refiner Valero and US investment bank Morgan Stanley agreed that Valero would receive a fixed compensation for running the refinery, while all supply, offtake, market and other risks would be borne by Morgan Stanley. Whether this is a viable long-term refining strategy remains to be seen, but under market pressures novel solutions are found by vulnerable refiners to cope with volatile market conditions.

All in all, pure-play refiners are having a hard time consolidating their positions in the European refining sector due to their high risk exposure and limited financial capabilities, as reflected by the rollercoaster asset restructuring of Petroplus over the past 7 years. We see that the cyclical nature and volatility of refining margins have a significant impact on pure-play refiners, exposing them to substantial market, price, volume and even (as we saw with Petroplus) liquidity risks. Without a balance sheet big and resilient enough to invest through market (and refining margin)

[129] This is reflected by refining deal multiples which were an average of 16,000 USD per barrel of refining capacity in 2007 and "nosebleed multiples" of 765 USD per barrel of refining capacity in 2009 Fitch (2011),

[130] PIW, 'Banks Suspend Credit for Swiss Refiner Petroplus', in: *Petroleum Intelligence Weekly* (January 9, 2012), Petroplus, 'Petroplus provides update regarding its revolving credit facility and operations of the Petit Couronne, Antwerp and Cressier refineries', in: Petroplus news release (December 30, 2011),

[131] In the beginning of 2012 we see that the assets of Petroplus is coming back in action with Gunvor taking over the Antwerp refinery and the restart of production at the UK Coryton and French Petit Couronne refineries under tolling agreements with respectively Morgan Stanley in combination with private equity partners and Shell. Source: International Energy Agency*, Oil Market Report: Petroplus Back in Action* (March 2012),

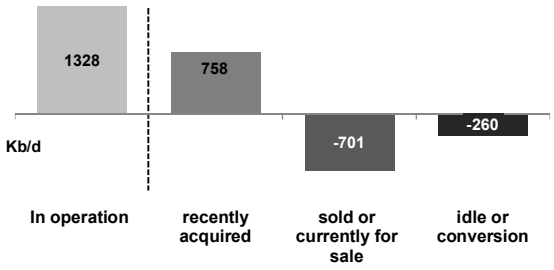
[132] This included the Paulsboro, New Jersey refinery that was sold to PFB Energy for 707 mln USD, worth $4,419 a barrel in refining capacity.

cycles and relying heavily on high-yield debt facilities to execute their investment strategies, pure players in essence leverage bets on refinery market conditions. At the same time we see other leveraged bets being played out with private equity entering the European refining sector.

Others: trying to time the bottom of the market

Other types of European refining owners, though diverse, consist mainly of three types of companies. Firstly, niche refiners such as Nynas, Asfaltos Espanoles and Petrolsub operate small refineries producing specific oil products such as asphalt and bitumen. Secondly, a slew of refineries are owned and operated by a diverse group of conglomerates and marketers, such as Vitol, ERG, SARAS and LyondellBasell, which see the refineries either as a physical asset with which to enter into (crude) oil (product) arbitrage, as Vitol and Gunvor do, or as a way to move upstream on the value chain and further diversify their conglomerate portfolios of companies, such as ERG and SARAS do. Thirdly, private equity funds are adding refineries at bargain prices to their natural resources portfolios, seemingly at the bottom of the market. Collectively, with the main volumes of refining capacity found in the second and third groups, these 'others' own and operate around 1,328 Mb/d of refining capacity, or about 9% of the total European refining capacity. From Figure 38 we can see that between 2008 and 2012 the 'others' acquired significant amounts of refining capacity but also divested significant amounts. These 'others' are very involved in the current restructuring of the European refining sector.[133]

Figure 38: Restructuring of European refineries owned by 'other' refiners (2008-2012)



Source: CIEP Analysis, Purvin & Gertz, various newspapers

Timing the market

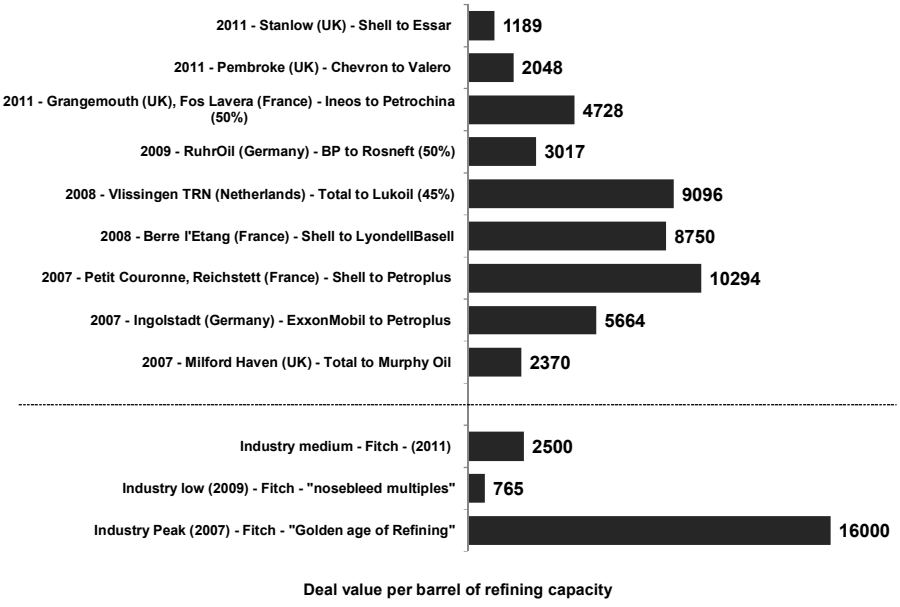
The main thing in common among the different companies in this group active in acquiring or divesting European refineries, mainly oil trader Vitol and private equity funds Klesch&Co and Hestya, is that they try to 'time' the market and enter into arbitrage opportunities with either the produced products (as Vitol does) or with the value of the refinery itself (as done by private equity funds). With market timing we mean the strategy of a company to try to 'buy low and sell high' with either oil products or physical (refineries) assets.

[133] CIEP Analysis (2011) based on Purvin & Gertz (2009) and various newspaper articles,

The 2011 acquisitions of the German 91 kb/d Heide and 260 kb/d Wilhelmshaven refineries by private equity firms Klesch&Co and Hestya Energy from Shell and ConocoPhillips, respectively, exemplify the attempts of financially powerful investment funds to buy refineries on the cheap, as reflected by the low deal multiples for other refinery acquisitions in 2011. This can be seen in Figure 39. In 2011, apart from the National Champions from emerging economies, private equity funds were the only 'companies' willing to buy assets in the European refining sector. The 2012 acquisition of Petroplus its 107 kb/d refinery in Antwerp by independent commodity trader Gunvor, in order to strengthen its ability to handle a large amount of Russian Urals crude, seems to confirm the picture that non-traditional parties are entering the European refining scene at low entry costs.[134]

From Figure 40 we see that since 2009, the apparent 'industry low', the value paid per barrel of refining capacity has continued to deteriorate. With refining margins already recovering in Europe in 2010-2011 but refining assets seemingly still losing value, this lag may result in a window of opportunity to buy the physical assets underlying the refining margins, the refineries themselves, in anticipation of recovering asset prices as a result of recovering European refining margins.

Figure 39: Take-over deal multiples, 2007-2011: value over amount of refining capacity



Source: CIEP Analysis, Fitch (2011), various newspapers (2007-2011)

* Note: The multiples are based on the total take-over price as announced by the deal partners. There is no distinction between the price paid for the assets itself and the products stored in the refinery.

The main investment rationale of private equity firms might not be the revenues generated from operating the refineries themselves but from employing parts of the refineries that were previously auxiliary, such as oil storage capacity. A case in point is the 260 kb/d German

[134] Petroleum Intelligence Weekly, *Refining Update on the European refining sector* (March 12, 2012),

Wilhelmshaven refinery, which was recently sold by ConocoPhillips to Hestya Energy, a private equity firm based in Amsterdam. The simple nature of Wilhelmshaven's refining capacity, coupled with low refining margins, does not render its refining capacity commercially viable. However, Wilhelmshaven's 1.1 metric tonnes of oil storage capacity does. Hestya Energy's CEO, Christian Cleret, stated that "with the current market economics we believe there is no way we can operate such a site and make a margin." Also according to Cleret, "today our priority is to make the platform commercially viable as a terminal".[135]

Oil storage services have the additional advantage that they generate relatively stable cash flows, allowing private equity companies to significantly increase the amount of debt a company .[136] Refining capacity then serves as a real option which can be exercised when refining margins become positive for the particular refinery (depending on its oil product yield). However, it is questionable whether Hestya Energy actually placed a value on Wilhelmshaven's refining capacity, since its valuation was clearly focused purely on cash flows coming from oil storage services. Therefore, Conoco Philips's 600 mln USD upgrade commitment (part of the initially planned 2.4 bn USD) is unlikely to have been included in the value Hestya Energy paid for the Wilhelmshaven complex.[137]

As a result, it is questionable whether private equity funds will invest at all in the refining capacity they acquired. Coupled with the limited time span of their investment perspectives (usually 7-10 years), private equity is not a long-term investment source willing to upgrade simple refineries to meet the needs of changing European crude diets and oil product demand. In short, the strategy of private equity funds seems to be to hunt the market for bargains and distressed assets and create value by turning around the use of the asset (refinery) by employing a different business model.

The remaining types of companies, niche refiners and conglomerates, maintain a stable presence in the European refining sector. A notable exemption is the French petrochemical company LyondellBasell and its 80 kb/d Berre l'Etang refinery. Acquired in 2007 at the top of the market, LyondellBasell paid Shell a high deal multiple of 10294 USD per refining capacity for the refinery (cracking, 6.75 Nelson Complexity) at the top of the market in an effort to move upstream on its value chain and secure supply by one of its main feedstock suppliers. Distressed by the low refining margins, LyondellBasell decided in May 2011 to put the Berre l'Etang refinery up for sale again. However, after reaching out to 85 potential buyers the company did not receive a single bid for its refinery. In October 2011 LyondellBasell decided to close the plant.[138] Most probably private equity with turnaround models will be eying to buy Berre l'Etang at a bargain.

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[135] Nidaa Bakhsh, 'Hestya to use Wilhelmshaven as Terminal, not refinery, CEO says', in: *Bloomberg* (August 15th, 2011)

[136] This debt then can subsequently pay for the capital expenditures of the turnaround project, like laying pipelines and environmental assessments (and most likely pay out the investors),

[137] Industry experts summarize Hestya Energy's business model in short as follows: oil storage is the main revenue driver and refining capacity is regarded as a real option depending on refining margin outlook. No refining specific capital expenditures (CAPEX), only CAPEX related to oil storage conversion and environmental requirements. Conversion will take place in the next 2-3 years, and there is no fixed exit date for Hestya Energy.

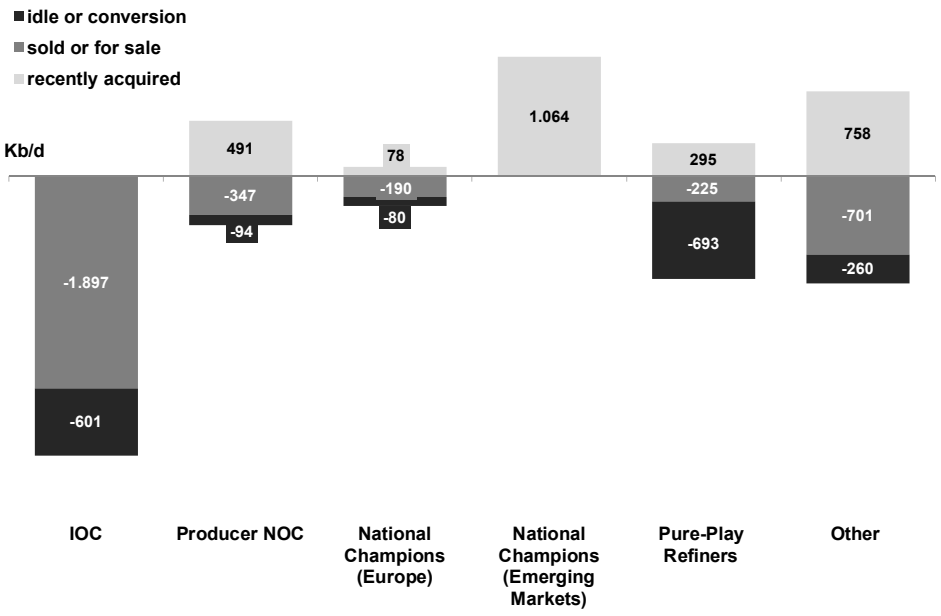
[138] Noemie Bisserbe, 'LyondellBasell French Refinery Workers Vote To Extend Strike', in: *Dow Jones Newswires* (September 2011),

All in all, this motley crew of 'others' consists mainly of stable niche refiners and marketers or short- to medium term value investors which bet on turnaround cases based on the auxiliary elements of the refineries and the real possibility of improving market dynamics. These 'others' have a common denominator of using the currently low incentives to invest in upgrading refining capacity to make their products competitive in a global refining environment.

Towards new core owners in the European refining sector?

Although often portrayed as such in popular media, the restructuring of the European refining sector does not only refer to the giving way of incumbent European refiners to state-owned global competitors, or in other words an 'Asian invasion'. While all ownership types described in this chapter struggle with the changing market dynamics in the European refining sector and global challenges, the manner in which they do this differs per type. The strategies employed by the various European refiners are strongly characterised by their current and future market risks (outlooks) and their financial abilities to cope with and adjust to the changing market conditions.

Figure 40: Changing ownership structure of the European refining sector (2008-2012)



Source: CIEP Analysis, Purvin & Gertz, various newspapers

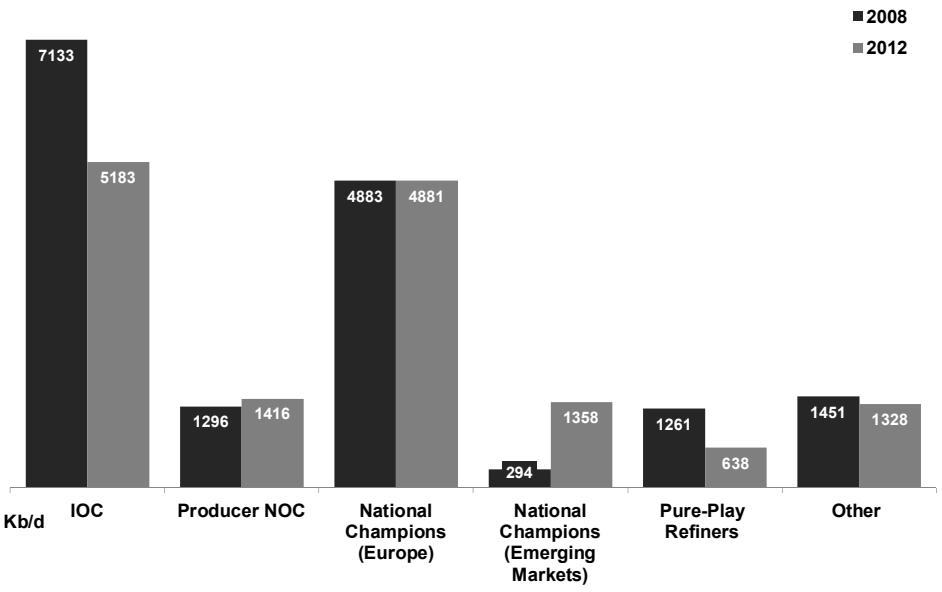
Divestments, investments and retrenchment

From Figure 40 we see that the main owners divesting European refineries were and continue to be IOCs and independent refiners. However, the rationales and strategies behind this divestment are strikingly diverse. IOCs like Shell and ExxonMobil have a deliberate strategy, formulated in the 2000s and supported by ample financial capabilities, to lower their downstream exposure and concentrate on high-scale complex downstream assets and upstream reserves. Between

2008 and 2011 the IOCs divested 25% of their European refining capacity. Pure-play refiners, like Petroplus, were forced to divest some European refineries to buffer their weak balance sheets due to high market and price exposure. Between 2008 and 2011 Pure-play refiners divested 49% of their total European refining capacity, as can be seen in Figure 41.[139]

The counterparties of the divestitures are three types of owners which each have different strategic outlooks. Firstly, National Champions from emerging markets raised their exposure to European refining capacity between 2008 and 2011 by 362% and are trying to gain a foothold in the European refining sector. The notable exception is the Russian oil company Lukoil, a significant portion of whose refining capacity is positioned in Europe. However, Lukoil its strategy can be attributed to the positioning of downstream assets alongside the significant presence of Russian crude supplies to Europe. . Secondly, NOCs from producer markets are integrating forward in order to secure demand, though at a slower pace than in the 1980s. The NOCs have added 9% of European refining capacity to their portfolio of existing European refineries. Thirdly, private equity funds, from the type category 'other' have purchased significant volumes of European refining capacity, employing 'turn-around' business cases, while niche players like INEOS have sold large stakes of refining capacity to National Champions from emerging markets. Overall, the 'others' have divested 8% of their European refining capacity.

Figure 41: European refining capacity in operation per type (2008 and 2012)



Source: CIEP Analysis, Pervin&Gertz, various newspapers

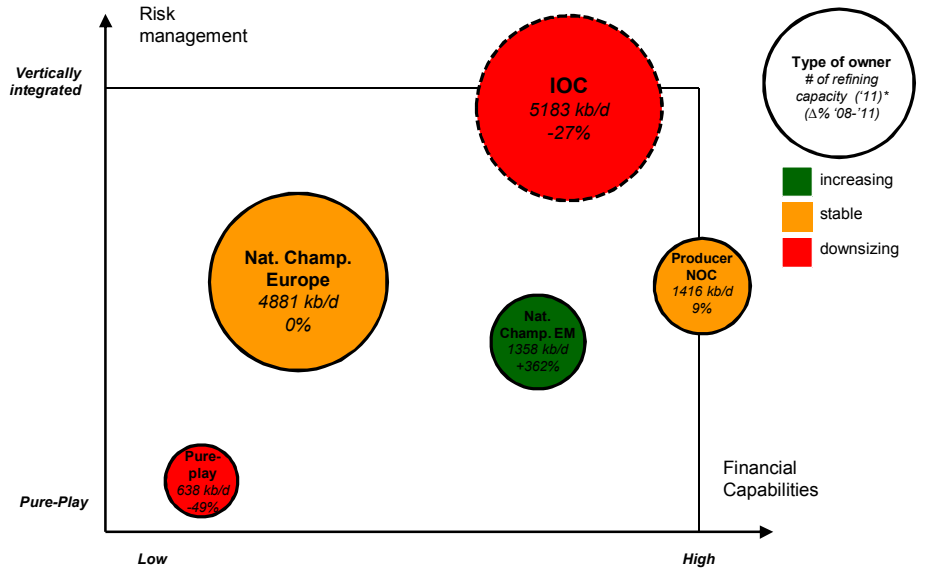
In figure 41 you can see the absolute levels of operating capacity of the different types of European refiners. What is striking is the absolute level of divestment of European refining

[139] Note: if we exclude Valero's acquisition of the Pembroke refinery, the divestment by pure-players of their capacity in European refineries would be 47%.

capacity by the traditional European refiners versus the somewhat lower level of capacity additions by non-traditional partners. This not only shows that new refiners only partly replace the position of traditional European refiners and that in the period 2008 – 2012, as already concluded, overall European refining capacity is declining.

Since 2008 European National Champions have kept a low profile and have neither divested nor invested in their European refineries, as indicated by the 2 kb/d change in their total portfolio between 2008 and 2012. Shielded from competitive pressures by government support and relatively captive markets, National Champions in Europe have so far been successful in operating their relatively low-scale and simple refineries at low to medium returns. However, the question remains as to whether this strategy of retrenchment can prove to be sustainable in the medium- to long term.

Figure 42: Owners of European refineries and their investment potential (excl. "Other")



Source: CIEP Analysis, conceptual only

* 2011 refining capacity is calculated as being operational, therefore we include refineries that are for sale and exclude capacity from idled (also partly idled) and converted (also announced) refineries.

"Other" is excluded due to the heterogeneity of the owners in this type

New core owner of European refining capacity?

From the perspective of vertical integration and financial capabilities we also see a diverse pattern in the European refining sector, as shown by Figure 42. One the one hand the most exposed and financially weak European refiners, such as Petroplus, and the most vertically integrated and financially strong owners of European refining capacity, the IOCs, are divesting their European refineries. On the other hand we see that moderately vertically integrated and financially capable companies, NOCs from producing countries and especially National Champions from emerging markets, are increasing their exposure in the European refining sector.

Subsequently, the question is which players are long-term investors in the European refining sector committed to significant investment programmes in their refineries? From Figure 41 we see a bleak picture. The most capable and committed owners, the **IOCs**, are divesting on a massive scale. The most committed but less capable, the **European National Champions** have no financial means to become competitive in the short term and remain bound to their captive markets.

The other financially capable owners, **National Champions of emerging markets and NOCs from producing countries**, are significant investors, but it is questionable as to whether they will be long-term investors due to the priority they give to their home markets. Due to their strong home bias we may assume that these investors will allocate the majority of their investments to their prime refineries and other assets at home.

The main remaining groups, **pure-play refiners and private equity**, seem not to be long-term investors in terms of upgrading European refineries but more speculators of European refining margins through the physical assets. Private equity focuses in particular on refineries that are viable for turnaround projects, predominantly away from refining and towards auxiliary functions such as oil storage.

All in all, in increasingly dynamic and uncertain markets for oil and oil products, the margin for error in the refining market is thin. Investments by risk-exposed parties are therefore highly unlikely. Vertical integration and fully risk-shifted pure plays are likely to persist. Only large vertically integrated and diversified companies, especially those with government support, are likely to be long-term investors in the slowly growing but still volatile European refining sector. National Champions of emerging markets and NOCs from producing countries are currently the most likely candidates to fill the gap left by the IOCs. The question is whether these investors will be able to replace the core owners of European refining capacity, the IOCs, and whether these trends and new investors will impact the security of supply of European oil and oil products.

5

The European refining sector: a security of supply concern?

Chapter 2 and 3 showed that European refiners are in a tight spot. Refineries are being forced to upgrade their capacity to meet the newly emerging oil product demand patterns, while slow growth in the mature European market renders only thin and volatile margins. Moreover, some observers foresee a significant decline in the use of petroleum products in the transport sector as a consequence of the transition to green energy. Chapter 4 placed these developments in the context of ownership structures in the refining sector being the determining factors for the financial capabilities and business strategies of the companies involved. Hereby, we addressed the question of which parties can be expected to commit to the substantial investment programmes required at their refineries.

The outcome of our analysis suggested that, actually, none of the six types of firms that own European refineries can be counted on in a straightforward manner. Moreover, we observed a tendency among the companies, mainly IOCs, to disinvest refining capacity, whereas there are only very few signs of investments being undertaken to upgrade the refineries.[140] The consequence may be that the European market for oil products will become increasingly dependent on intra-regional oil product trade and imports of important fuels, like automotive diesel, aviation fuels and gasoil.

As stated, this situation recently inspired industry associations such as Europia, Concawe and UKPIA[141] to call for new investments in order to strengthen the international competitiveness of the European refining sector. The supply/demand outlook plus shifts in ownership and possible closures is also worrying policy makers at the national and European levels. In July 2011, responding to the divestment plans of Total[142], the French Minister of Industry and Energy Eric Besson announced that he intended to discuss a 'national action plan' to strengthen the competitiveness and sustainability of the French refining industry. Also the European Commission (EC) seems to once again consider the oil industry as strategic. In November 2010, the EC stressed that *"Security of supply depends on the integrity and flexibility of the entire supply chain,*

[140] See also Figure 3 of Chapter 1 for more details (source: IEA (2011), Goldman Sachs (2011),

[141] See Europia, Europia contribution to EU energy pathway to 2050 (September 2011), Europia, *White Paper on European Refining* (September 2010), Concawe, *Oil Refining in the EU in 2015* (2007)

[142] Doris Le Mond, 'French minister wants 'national action plan' for refiners', in: Oil & Gas Journal (June 22, 2011),

from the crude oil supplied to refineries to the final product distributed to consumers".[143] In its EU Energy Roadmap 2050, published in December 2011, the Commission also signals the "strategic importance of oil infrastructure in the current market conditions, including downstream oil infrastructure".[144] This statement is in line with the growing unease surrounding the restructuring of the European downstream oil sector and concerns about European oil supply security.

A main issue at stake is whether or not the restructuring in the European refining industry poses a pan-European security of supply threat, as described in Section 2 of this chapter. Section 3 addresses the meaning of 'security of supply' in the oil industry and how this is changing as a consequence of the new developments in the world oil industry and on the demand side. Section 4 analyses the particular nature of the security of supply problem in Europe. On this basis, Section 5 proposes a number of options for European policy makers in countering the possibly adverse effects of the restructuring of the European refining industry?

Is there a security of supply problem?

To establish whether Europe is facing a security of supply problem with respect to oil products, a number of questions are relevant. The first question to be answered is to what extent dependence on fuel supplies from abroad actually constitutes a 'security of supply' problem for the EU countries.

To **start** with, it may be considered un-problematic that Europe will have to import growing volumes of fuels from refineries located in the Middle East, Russia and the US. **Secondly**, if it is believed that the international product markets are working effectively in supplying Europe, then there is no market failure that warrants any intervention from the state(s) or EU Commission, apart from providing an effective competition policy to deal with potential market failures and the abuse of market power by refiners, (importing) wholesale traders and retailers. **Thirdly**, it has to be accepted that the European industry will go through a possibly lengthy period of restructuring. Eventually, refineries in Europe that are globally inefficient will be closed down and others will be upgraded, and a new pattern of supply will emerge. In the end, this will most likely involve a partial dependence on fuels produced outside Europe and a dependence on the liquidity of the local international fuels markets. **Finally**, if it is believed that the EU is moving forward in a transition towards a sustainable energy system, then the use of petroleum products will decline anyway in the foreseeable future. **Overall**, this may be considered an unproblematic outcome of an economic process of industry restructuring in the EU and the shift of the supply function to the more efficient refining industry abroad.

If, in contrast, Europe is hesitant to become dependent on extra-EU supplies for part of its crucial fuels requirements, the analysis is different. The reason for concern may be economic if it is believed that the international fuels markets will not work effectively due to market failures of various kinds. If the goal is security of supply of oil products, it has to be remembered that the global crude oil market is much larger and more flexible than the more local markets for the

[143]European Commission (EC), *Priorities for infrastructure priorities for 2020 and beyond* (November 2010), and European Commission (staff working paper), *On refining and the supply of petroleum products in the EU* (November 2010).
[144] European Commission, *EU Energy Roadmap 2050* (December, 13, 2011),

individual oil products. This is because their size is smaller, in terms of the number of buyers and sellers and the fact that much of the product flows constitute intra-firm movements.[145] More structural arguments are provided in Section 4.

Lower volumes of internationally traded oil products can cause higher price volatility and sky-rocketing prices when product scarcity kicks in for whatever reason. In that case, the risk of price spikes as a result of low liquidity in global oil product markets – and the ensuing cost of high fuel cost to the EU economy as a whole – may constitute a market externality for the EU, which *may* warrant some form of public intervention. On the other hand it may not, as the basic economic principle is that in the long run the social and economic gains of state intervention in correcting market externalities should be higher that the costs of the externality,[146] and that remains to be seen.

An essential aspect is the nature of the demand side. If demand is price elastic and consumers have the option to adjust their consumption in reaction to price fluctuations, then the market may work in establishing a new supply-demand equilibrium at a reasonable price. Yet particularly in the short run, most consumers are not in the position to adjust their demand or substitute other products, for technical or economic reasons. Public transport for commuters and the transport of goods by rail or water are often not feasible alternatives. Hence, demand for fuels like gasoline, kerosene and diesel is fairly inelastic, and thus consumers and economic sectors are economically vulnerable to price fluctuations. Obviously, this translates into serious social-economic and political consequences, as can be observed in the reactions of truckers, fishers and farmers to recent fuel price spikes.

In theory, in the long term there will be alternatives to oil products, like biofuels and electricity. Yet in many applications these technologies are still inferior in terms of their efficiency, their energy content, the impracticalities of storage, and the associated action radius of the vehicles, ships and airplanes. Significant advances in efficiency are foreseen in the new technologies, but also in classical petroleum-based technologies. This suggests that high gasoline and diesel prices may stimulate a transition towards other forms of propulsion in certain user segments. However, the speed of such a transition will be dependent to a large extent on the developments in the technologies, the perspective of the automotive industry and the strategy of the electricity industry in providing the required distribution infrastructure on a sufficiently large scale. Yet for others there are no feasible alternatives at hand and they will become even more vulnerable. Indeed, such a development would not only reduce the overall consumption of oil products, but it would also concentrate demand with those consumers which really have no alternative. This would reduce the price elasticity of demand even further. As these vulnerable sectors, including long-distance (road and naval) haulage and goods distribution, air transport and agriculture, will remain essential components of the economy, it is obvious that a strategic issue is at stake here, one which concerns society as a whole.

[145] In order to assess liquidity in crude oil and oil product markets, we can use absolute levels of international trade volumes per region as a proxy. For Europe (EU-27), we see oil products amounted to only 56% of total crude oil imports in 2010. Per fuel, we see that the most popular imported oil products, gasoil and diesel, combined are only 21% of imported crude oil. As a result, we see that even the most frequently traded oil products are only a small portion of crude oil being traded internationally.

[146] Bohi, D.R., Toman, M.A. (1993), 'Energy security: externalities and policies', *Energy Journal,* November 1993, pp. 1093-1109.

Finally, apart from the purely economic cost/benefit analysis and the social-economic implications, the reluctance to become dependent on product supplies from abroad could also be based on the political argument that a high level of dependence on external suppliers for the supply of any strategic good, like energy or even diesel oil, is not acceptable. Indeed, a high degree of dependence on third parties, or countries, for a strategic good reduces a country's relative 'freedom' to deal with those parties on many other policy issues, sometimes even those unrelated to energy supply. In this way the 'geopolitical' argument is at stake. We leave the outcome of this political decision-making process for the moment but will return to it later on.

Security of supply: past conceptions and present challenges

Security of supply is about risk management. The risk of discontinuity and disruption in the oil product supply chain lies in the supply of crude oil (production and transport), in the refining of crude oil and in the primary and secondary transport of oil products. This means that all steps in the supply chain have to be considered.

Security of supply: a well-functioning market?

Common modern approaches to security of supply, in the general sense, refer to 'the market' as the most effective means of co-ordinating the transactions between buyers and sellers to achieve static efficiency.[147] Standard economic theory argues that a 'well-functioning' market supplies the optimal amounts of goods to those willing to pay the market price for them, which is set by competition among many suppliers. The goods are produced at the lowest possible cost, by stimulating the exit of the less efficient providers and the entry of new more competitive ones. Moreover, in situations of scarcity relating to developments on the supply- and/or the demand side, the price mechanism is seen as the most efficient instrument to reallocate the available goods to those consumers that gain the largest utility from them, while high prices also invite new suppliers to the market, to alleviate the scarcity.

Hence, for most goods and services, a well-functioning market is seen as a precondition to guaranteeing security of supply as well as security of demand. As is well-known, the pre-requirements of a well-functioning market are: homogeneous goods; competition between as many suppliers as possible; a large number of buyers with freedom of choice of supplier(s); price liquidity which instantly reflects supply and demand conditions; and forward markets that reflect expectations about future supply and demand conditions, as a signal for investments and closures of capacity.

Building upon this framework, attempts to ensure security of energy supply generally include diversifying suppliers and supply routes and, if feasible, making it possible for end-users to switch energy sources as signalled by their relative prices. This implies that the provision of security of supply requires having multiple suppliers of *primary* energy, like coal, gas, crude oil and others; as well as of *secondary* end-use energy carriers, like power, gas and the several petroleum fuels. In terms of infrastructures, the n-1 approach is advocated, meaning that an alternative route of transport and supply should always be made available when a main artery is failing.

[147] Bohi, D.R., Toman, M.A. (1996), *The economics of energy security,* Kluwer Academic Publishers, Boston, Dordrecht, London.

A focus on crude supply?

With regard to security of supply in the oil industry, attention has long been focused on the supply of crude oil and the functioning of the world oil market.[148] The balance between OPEC-controlled crude supply, the supply from non-OPEC producing countries, and the possibility of a supply interruption of whatever nature, have been the traditional parameters of analysis. Since the mid-1970s, two main instruments have been applied to solve short-term supply problems: 1) a call for OPEC to make up the 'missing' volumes of crude to balance the market at an acceptable price level; and 2) recourse to the stocks of strategically stored non-OPEC crude oil in times when OPEC's contribution is not sufficient to be able to provide for at least 90 days of consumption. Although parts of these stocks have been held in the form of fuels, a potential lack of sufficient crude oil in the world market has been seen as the main source of insecurity.[149]

The local availability of sufficient refining capacity was considered a given. This is because since the mid-1970s the problem of the European industry had become excess refining capacity. Anticipating continued growth in the demand for both light and heavy fuels, many oil companies had been expanding their refining capacity when the first oil shock hit the market in 1973.[150] Demand for oil started to fall, however, as heavy fuel oil was replaced by natural gas, coal and nuclear energy; a trend that was reinforced by the second oil shock. De-industrialisation contributed to the shift towards lighter fuels and s further decline in demand. Over the 1980s, refineries were closed and others were upgraded to produce a lighter yield, particularly that of gasoline. Yet there was never scarcity in refining capacity anymore. The strategy of the European Commission was essentially to leave the sector's restructuring to the industry,[151] as is also demonstrated in Box 6, below.

So, for a long time, the world's oil industry was characterised by excess capacity in crude supply as well as in refining. In the EU there was diversity in sources of crude oil, including the indigenous production in the North Sea, and the n-1 problem in downstream refining assets was non-existent. As long as there was crude, the products could be provided. Both the aggregate production potential and the qualitative breakdown of the per fuel output of the refineries were generally far beyond the level of demand. Hence, output levels could (and had to) be adjusted and tuned at will by relatively 'simple' decisions by OPEC about crude supply and by refinery operators with regard to the manufactured products. Disturbances in day-to-day market outcomes could be addressed immediately by corrective political and commercial decision-

[148] European Commission(96) 143 final, Report on the Situation of Oil Supply, Refining and Markets in the European, Community Brussels, 03.04.1996, p. 7, 16.
IEA (2007) Oil supply security: Emergency response of IEA countries, IEA, Paris.

[149] Luciani, Giacomo (2011) The Functioning of the International Oil Markets and its Security Implications CEPS Working Document No. 51/ May 2011;
Aad Correljé and Lucia van Geuns (2011) The oil industry: a dynamic patchwork of approaches?. Ch 12 in: International Handbook of Network Industries The Liberalization of Infrastructure (*Eds.* Matthias Finger, Rolf W. Künneke), Edward Elgar**,** Cheltenham, UK • Northampton, MA, USA

[150] Michel Bacchetta (1978) The crisis in oil-refining in the European Community, *Journal of Common Market Studies*, Volume 17, Issue 2, pages 97–119, December 1978.

[151] Bacon, Robert, Margareth Chadwick, Joyce Dargay, David Long and Robert Mabro. Demand, prices and the refining industry. Published by Oxford University Press for Oxford Institute for Energy Studies, 1990.
Reinaud, Julia. (2005) The European refinery industry under the EU emissions trading scheme: competitiveness, trade flows and investment implications. IEA information paper, November 2005.

making, by OPEC and/or the oil companies, as illustrated by the evolution of the market during 'large' shocks such as Iraq's invasion of Kuwait.

So, in the context of a functioning world market for crude – in which the excess production capacity was co-ordinated by OPEC – and functioning local/regional market for fuels, after the early 1980s strategic stocks were considered the most adequate means to solve potential supply problems in the oil industry. Yet it must be stressed that the abundantly available refining capacity in the EU was not a consequence of intentional planning by the industry or public authorities; it was a consequence of the unforeseen fall in demand, post-1974.[152]

What's different today?

In this paper, we maintain that the two main preconceptions are being challenged today, these being: 1) that the market ensures an efficient supply of products; and 2) that the security of supply of crude oil is the only thing that matters,. The refining industry is entering a phase in which overcapacity and excess gasoline yields are weakening the future perspective of the European industry, as is shown in Chapter 2. A potential qualitative capacity 'undershoot' may arise, which jeopardises the refiner's ability to produce the right amounts of the several fuels to meet the pattern of demand, given the array of crude oil inputs at the existing refineries. Firstly, there is the slow shift towards the production of heavier types of crude oil, which thus yields smaller amounts of light fuels and also translates into a larger price difference between light and heavy crudes. Secondly, as is shown in Chapter 4, investments in conversion capacity at the European refineries are not likely to come forward. As a result, the industry's ability to react to short-term supply/demand fluctuations is gradually weakening. This situation may be aggravated if the current recourse to exporting excess gasoline is hampered in future by a restructuring of the US refining industry.[153]

The issues at stake in the current situation go beyond questioning the static efficiency of the market. This static perspective applies when the production capacity is readily available and a given. It deals with refiners' decisions about the ways in which to use the available capacity and whether to offer products on the market or not, considering the price and given market imperfections. Dynamic efficiency, in contrast, deals with the adequacy of the market in providing sufficiently strong incentives to the industry to restructure and to invest in quality-enhancing (new) technologies. A dynamic perspective involves two elements, namely the entry and exit determinants of firms and their refining plants, and those behind investment commitments in refinery upgrades in an uncertain market situation. The problem identified in this study points to the inadequacy of the current European market to provide refinery owners with effective signals to adjust their refining capacity to changing market conditions, because of its ownership structure and its being part of an imperfectly operating world market for oil products.

[152] IEA (2007) Oil supply security: Emergency response of IEA countries, IEA, Paris.
[153] US Energy Information Agency (2011),

Box 6: History repeats itself…

History repeats itself but is never quite the same. As mentioned in Box 3 in Chapter 2, from the mid-1970s to the mid-1990s, the EU refining industry went through a similar period of fundamental imbalances between its capacity, the evolution of product supply and demand, input cost and wholesale prices. As a consequence, over most of this period the industry experienced weak margins, while at the same time developing the current surplus of motor gasoline production capacity and coping with the tight diesel supply.

Since the 1973 oil crisis a number of developments have influenced the EU oil products market. **Firstly**, the economic recession of the 1970s caused an overall decline in EC oil product demand, initially for heavy fuel oil and later also for gasoline. Obviously, fear of being dependent on OPEC oil also stimulated consumers to move to other sources of energy. This brought about, **secondly**, an excess in crude oil distillation capacity, relative to oil product demand. Over the 1980s, considerable reductions were made in crude distillation capacity by refinery closures, from 920 Mt per year in 1980 to 595 Mt in 1995. A number of operators, like Gulf, Amoco, and Chevron, left the EU market. Yet at the same time, new secondary conversion capacity was built in order to adjust supply to the lightening demand pattern. A **third factor** was the unforeseen increase in the production of light crude oils, particularly from the North Sea and from Saudi Arabia, which has made it possible to manufacture additional light products without having to utilise all of the available refinery conversion units. **Fourthly**, in road transport there was switch in fuel demand from motor gasoline to diesel, driven in part by fiscal disparities in many member states between diesel and gasoline. **Fifthly**, environmental constraints, like the introduction of unleaded gasoline, required investment in additional refinery units, which also added to the light fuels manufacturing capacity.

As a consequence, over most of that period, many refiners – even those with conversion capacity – were operating at low levels of throughput (60 to 70%) while generating only very small refining margins. It was reported by the Commission that the industry was facing an unusual degree of uncertainty, and it adopted a 'wait-and-see' position vis-à-vis capacity adjustments and investment.[1]

From 1977 onwards the Commission held regular consultations with oil companies, unions and governments. The Council adopted the approach recommended by the Commission in its successive reports.[1] These stated that the industry was responsible for taking decisions about the closure of surplus capacity and about the investments necessary to adapt facilities to the structure of demand. It endorsed a positive attitude by the governments of the Member States towards the measures of rationalisation taken by the industry. It advocated an open policy regarding product imports, provided that other industrialised countries do likewise and suppliers observe fair trading practices. It advocated continued monitoring of developments in industry.

They further stated that in the interests of supply security and international competitiveness the Community should maintain an efficient and viable refining industry operating at high utilisation rates but having a margin of spare capacity to meet unforeseen increases in demand, and that the Community should make every effort to reduce differences in environmental standards in the various Member States which could significantly affect industry costs. Governments are expected to assume an active role in identifying and removing obstacles to the rationalisation of the industry posed by their national regulations or practices, and to promote mergers and joint ventures of refining companies not viable on their own.[1]

Meanwhile, however, the industry complained about the fact that some EU Member States maintained minimum price systems and other barriers to liberalisation, while export refineries from abroad were flooding the EU market with their products. It was also argued that long-term supply contracts and co-operation models where partners share risks should be given preference above spot markets in a surplus situation.[1]

It could be argued that the necessary process of restructuring has never been brought to a close. Actually, the fundamentals of today's situation are slightly different from those in the past. Excess capacity and qualitative imbalances continue to exist. The main differences today are that the refiners are facing, first of all, a move towards a heavier crude slate instead of the light North Sea oil that was made available in the 1970s and '80s. Moreover, the EU has become significantly more dependent on international product trade, exporting its gasoline surplus to the US while importing deficits in diesel and kerosene from abroad. This implies a much greater impact from external factors like the construction of new capacity in emerging economies and the Middle East.

In 1996, the Commission concluded that "necessary reductions in crude distillation capacity have not yet happened because of the uncertainty as to if/when demand will pick up again, the on-going trend to reduce costs which has allowed refiners to remain cash-positive, and the reluctance of individual refiners to face the strategic and operational implications as well as the substantial costs of refinery closures". After the more favorable period at the start of the new millennium, the EU refining sector seems to be back in a similar position these days.

Source: European Commission (96) 143 final, Report on the Situation of Oil Supply, Refining and Markets in the European, Community Brussels, 03.04.1996,

What is the nature of the security of supply problem?

The question thus arises as to what the actual problems are that should be solved. Is it a relatively simple issue of 'correcting market externalities' by creating transparency, or is it sufficient to provide more effective price signals by adjusting national fuel taxes, providing subsidies for environmental investments, and/or setting EU-border import levies to compensate

for EU fuel quality standards? Above we have highlighted the main problems as being the determinants of refiners' entries and exits and of making investment commitments in an uncertain market situation. So, it is possible that the problem is more complex and that a simple correction of the market externalities may not suffice.

Is a different perspective needed?

Our analysis in this paper suggests that the problem is caused by the interaction of a number of fundamental characteristics of the oil industry, and particularly of the refining sector. Whereas we do not discard the impact of the large variety of common external effects on the situation of the EU refining industry, like taxation and differences in the stringency environmental regulation, we argue that it is more insightful to first consider the fundamental characteristics of the refining industry. Oil refineries are economically delicate ventures, on the one hand as a consequence of their huge sunk costs, long repayment periods and their vulnerability to uncertain variations in the crude input prices; and on the other, in product supply and demand and the associated price risk. Hence, a market driven by short-term interests with volatile prices fails to generate reliable signals for investment and withdrawal over the medium to longer term. It is a high-risk business with a volatile margin. In the past, at the time of the 7 Sisters, this problem was dealt with by vertical and horizontal integration and co-ordination of supply with demand, long-term contracting and/or some degree of public regulation of the national markets.[154]

The ratio behind using these co-ordinative devices is explained by the New Institutional Economics (NIE). NIE differs from the traditional neo-classical economic (NCE) theory on industrial organisation. NCE considers the structure of markets as a crucial driver for the conduct of firms and their eventual economic performance. In NCE the configuration and relative size of the firm itself is seen merely as a means to acquire economies of scale and scope through vertical and horizontal integration. Too much vertical and horizontal integration is seen as a problem, as it is considered an attempt by the firms in the industry to achieve market power in up- or downstream markets (Scherer 1980). Hence, NCE focuses on bringing about competition in an industry to foster efficiency. As long as the industry is able to adapt instantaneously in terms of output and the ease of producers to enter or exit of the market, this does not seem to represent a problem in adjusting to market conditions.

If, however, adjustment involves more friction as a consequence of strong entry and exit barriers, other variables become important. The NIE, or transaction cost approach, takes a broader perspective in respect of the rationale of vertical integration and co-ordination. It considers the shape and size of firms and the associated structure of the markets as alternative arrangements of internal and market governance for dealing with the risk associated with transacting. Therefore, the preferable governance structures in a specific market are those that best fit the character of the transactions involved and the risk context in which these take place in the market. Hence, sellers and buyers do not only trade and – particularly – do not (dis)invest on the basis of their evaluation of the 'simple' production costs, or their utility, and the market price,

[154] Frankel, Paul (1976) The Essentials of Petroleum: A Key to Oil Economics. 2nd ed. London: Frank Cass. Adelman, M.A. (1972), The World Petroleum Market, Baltimore: The John Hopkins University Press.

but also take into account the transaction costs of 'managing the transaction' in a specific market.[155]

These transaction costs include not only the direct costs of writing, monitoring and enforcing contracts but also involve the costs associated with covering the risk of ex-ante investments having an ex-post performance that is possibly lower than anticipated. Uncertainty brings about contractual hazards of various types. The larger the investment, and the higher the uncertainty, the higher the risk becomes. The adequacy of particular transactional arrangements, like vertical integration, long-term contracts or the spot market, is seen as dependent on the attributes of the transactions between buyers and sellers in a specific market and the associated investments and how that affects the overall cost of a transaction. If the particular transactional arrangements in a market are not seen as adequate by the firms involved, no (new) investments and transactions will be made.

Oil refineries as economically delicate ventures: high entry and exit barriers

Chapters 1 and 2 have analysed the European oil product market using the perspective of Porter's five forces model. This analysis provided insights in the main determinants of the market environment in which the EU refiners operate and take their investment decisions. In this section we will link those determinants in terms of the NIE transaction cost framework, to underscore the fundamental problem that exists in adapting and investing in the industry. The main characteristics of the transaction involve the extent to which parties to a transaction are locked in as a consequence of the specificity of their assets. Yet uncertainty, product complexity and information asymmetries play important roles as well.

Firstly, the refineries are highly *site*-specific.[156] They are built at certain locations and can't be moved. Hence, they are confronted with local market situations, taxation and environmental rules, and their accessibility for transport. This brings in the uncertainty caused by the potential intervention of the European governments on behalf of fiscal and environmental policy. On the one hand, the policies with respect to the levies on fuels (mainly gasoline and diesel) matter, as they influence the relative attractiveness of these fuels to consumers and thus the pattern of demand. In most European countries, these policies have been favouring the use of diesel oil in automotive uses. On the other hand, there is the potentially huge impact of policies by which governments and the EU Commission will stimulate the use of 'green' transport fuels. Moreover, emission and fuel quality standards play an increasingly important role in the degree to which the output of external and EU refineries can be sold in the EU market. So, on the demand side of the refining industry, both types of policies may have large influences. Yet, to date, future policies and their consequences are uncertain. To be sure, such interventions may increase the problems, but they may also solve them. This reduces the size of the window of opportunity for making new investments in refining capacity.

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[155] Among others: Williamson, O. (1971) "The Vertical Integration of Production: Market Failure Considerations," *American Economic Review*, 61: 112-123; Williamson, O. (1975). *Markets and Hierarchies: Analysis and Antitrust Implications*. New York: Free Press.

[156] While chapter two of this paper mainly focuses on the corporate level of refiners, site specificity, as previous literature also shows, has a large impact on market structure and competitiveness of European refineries. See Chapter 5 of Bacon et. al. (1990), 'The propensity of European Refineries to Shut between 1976 and 1986' for key literature on asset specific variables of refining competitiveness,

Secondly, oil refineries exhibit a high degree of *physical* asset specificity. They are fairly dependent on a crude oil mix of a specific composition. Moreover, refineries yield a multi-product output, in which the different fuels emerge as relatively fixed proportions of the amount of crude processed, depending on the complexity of the specific refinery. This implies that adjusting the supply of one fuel to a shift in its demand (or its price) automatically involves a change in the production of the other fuels as well. The market for these other fuels may be oversupplied already, causing their prices to fall and thus reducing the overall revenues of refining the extra barrel. So far, the EU market is undersupplied with diesel and gasoil and over supplied with the other fractions. Hence, a further shift in demand to middle distillates will force the refiners to export the other fuels produced to highly the competitive world market.

Thirdly, investments in refinery capacity constitute long-term outlays of huge amounts of capital that cannot be deployed otherwise once the investment is made. Furthermore, capital may be scarce. So new entries, or even the additions of specific processing units to adjust the output yield of existing plants, are precarious. Hence, there are high barriers to entry. Exit from the sector is also difficult, not only as a consequence of the clean-up costs of the refinery sites, but also due to the first-mover disadvantage, which means that the advantages of closing down a refinery are harvested by those refiners which continue their operations. Indeed, they may receive higher prices. Moreover, there is the 'threat of potential entrants' that may enter the market, neutralising the effect of closures. A second exit barrier constitutes the fact that the ratio of fixed versus variable costs is heavily tilted towards the latter. If variable cost is covered by revenues, refiners will continue production, as the fixed costs are incurred anyway. Hence, there are huge barriers to both entry and exit in the refining industry.

Fourthly, *uncertainty* with respect to market volumes and prices and to policy and product standards plays a crucial role. Deciding to invest or to withdraw is particularly difficult in a context of high uncertainty regarding the future costs of crude and other inputs, with revenues being a function of supply, demand and resulting prices. Currently, the European refining sector is operating under high uncertainty. Demand for fuels is uncertain as a consequence of the 'threat of substitutes' like biofuels and electricity in response to environmental legislation. Moreover, there is a strong 'bargaining power of customers'; downstream wholesale and retail competition are driving down the price level to the marginal, or variable, costs of production. Uncertainty is also caused by the fact that the European market is open to imports of fuels from other regions: the 'bargaining power of suppliers'. Whereas it is clear that refinery construction is taking place in those growth regions, it is less clear whether and (until) when the output of these refineries will be made available for trade on the world market or consumed at home. Hence, for some time, Europe may be flooded with competitively priced fuels, while thereafter the market may dry up, as the home markets of these refineries will have grown sufficiently to absorb their full output.

A non-level global playing field for the European refining sector

One of the main insights from the analysis of the international competitive position of the European refining sector in Chapter 3 is that locational advantages of refineries in emerging markets, even if individual refineries are not cost-competitive, provide significant comparative advantages vis-à-vis the European refineries (see also Figure 19). Indeed, largeness of scale, refinery complexity and efficient refining schemes do not provide much competitiveness in a

highly mature market when confronted with locational advantages abroad, such as tax breaks in Russia and India, low-cost feedstocks in the Middle East, and cheap financing arrangements. This creates an unequal playing field for European refineries, regarding both their exports to the world market and their need to compete with imported fuels in their relatively open home-markets.[157] Moreover, this is a typically local European problem, as these comparative advantages apply only to the home markets of these refiners. The take-over of European refineries by Essar and PetroChina will therefore not make much of a difference. They remain uncompetitive, and their owners will not be inclined to invest significantly in their European refineries.

Taking the above into consideration, a key question would be to what extent the current EU and national governance regimes reflect the characteristics of today's oil products markets and the refining industry. Referring to the characteristics, it may emerge that the efficient development of markets of a different nature, maturity and risk profile may require different structures of governance and co-ordination, instead of just striving for a fully competitive EU market for oil products. This, of course, very much depends on the extent to which the EU considers its import dependency problematic.

Coordination mechanisms in the European refining sector: a full menu or a la carte?

The issue at stake is how to bridge the gap between short- to-medium term (0-10 years) market dynamics and the long-term investment rationale of refineries, considering the economic (30 years) and technical (50 years) lifespan and given the characteristics of the firms currently active in the EU market. As we argued in Chapter 4, the capacities of the different types of refiners in Europe and their inclinations to invest or divest vary strongly. Indeed, those oil companies that have the financial or risk-buffering capacity to invest in the European refining sector are counter-intuitively the most unlikely to invest, given their overall strategies and capacities to invest globally. And those firms that may well be inclined to invest are unable to do so under current conditions.

If policy makers want to intervene in the market in order to make the European refining sector more competitive and to secure an adequate supply of oil products, the question arises as to what they can do within the context of an increasingly globalised refining market. Also in the context of the EU, the question is how much policy space the Commission may have to address the risk (real or perceived) to the security of supply. As is shown in Box 6, in the beginning of the 1980s, the Commission left the restructuring to the market and the governments of the Member States. It could be argued that since then the structural problems of the European refining industry have never been really solved.

Assuming that an import dependency for oil products constitutes a European 'security of supply' problem, selecting the appropriate form(s) of governance may help the industry to adjust, by modifying the direct cost and the transaction costs of (dis)investment and its exposure to ex-post

[157] See also: Barclays Capital, *Oil products and refining outlook: refining closures – too little, too late?* (London 2012).

risk. This paper suggests the need for a careful reassessment of the situation and dynamics in the refining sector and the local oil products markets. It suggests (re)consideration of what constitutes 'security of supply' for oil products in the context of the emerging international market for oil products. This should also involve an analysis of the actual and potential market distortions, within the EU but also in the external markets. A further step would be to analyse the pros and cons of the potential co-ordination mechanisms and the tradeoff between the several alternative instruments.

It should be possible to achieve a 'workable' balance between the required investments, the anticipated profits and risk and the costs of governance, while preferably maintaining a 'credible' pressure of the competitive market. This may either involve combinations of the spot market, specific contracts or vertical or horizontal restructuring, public support, loans, and other instruments. If the refinery owners fear ex-ante that the costs of adjustment are not manageable at an acceptable level, or if there is no hope for an enhanced profitability, no investment will materialise and/or refineries will go broke.

The current European market model, however, is fully focused on bringing about competition and reducing market power in the industry, while the potential for state aid is constrained. By limiting the options for particular business models and forms of co-operation, it could very well be that the EU will impede the necessary adjustment and restructuring, as happened in the 1980s and '90s. Moreover, the focus on an all-embracing, EU-wide approach to achieve a level-playing field may ultimately have the opposite effect, as the consequences will vary with the nature of the firms involved. Obviously, given their differing strategic perspectives, the six groups of refiners also will have their preferences.

It will also vary in respect of the effects in several European regions: the Northwest, the Mediterranean and Central Europe. It is precisely because of these effects that un-coordinated political interference may emerge, as is suggested by the French initiatives referred to above. History shows that some countries do have a stronger tradition of government intervention than others. France, Spain, Italy, Portugal and Greece have considerable track records of state intervention in their refining sectors. Moreover, the structure and capabilities of the refining sectors show a huge variance. No single analysis and solution will work in every country or region.

There are a number of 'families' of policy interventions, or instruments, which may be taken into consideration. The **first** of these involves a review of the current impact of levies, including differentials in the sales tax on diesel- and gasoline-fuelled cars, on the demand for the various fuels. Currently, the use of diesel is clearly favoured in most countries, while gasoline is used less. Balancing the demand side, a revision of the economic incentives to consumers may help. Such a review should also involve the relative impact on demand of fuel emission standards and other requirements, like energy efficiency measures. To guide investments in refining capacity, clear and consistent longer-term goals should be stated with respect to environmental regulation and future requirements.

Secondly, attention should be given to the competitive position of the European refining industry versus external refiners. When it appears that there is a serious lack of a level playing field, for whatever reason, measures should be considered to repair this problem. This will require a

thorough analysis of the causes of this situation and the consequences. However, it also requires an analysis of the impact of measures like EU external tariff barriers, technical barriers and taxes and of how these measures might impact the future fuels market. A balance has to be found between a mercantilist policy towards the European refining sector and the correction of market imperfections and external effects, for instance through protection of new refineries in emerging markets and the Middle East. European oil companies could also be stimulated to (co)invest in refinery capacity outside Europe in order to strengthen ties with these producers and to balance revenues.

A **third** family of instruments is geared towards supporting those refiners that are not able to adjust on their own. If appropriate, given the location and environment of refineries, consideration may be given to stimulating investments so as to adequately adjust conversion capacity and enhance the crude intake flexibility while bringing the environmental impact up to standards. This may also involve mergers and the integration of relevant plants. Alternatively, small, less complex and inconveniently located refineries could be closed using controlled defaults, for instance with living will constructions. Joint ownership of refineries by different companies was a solution in the past and may offer a perspective for the future as well. This should increase the rate of utilisation of refineries throughout Europe while making the remaining large complex refineries more internationally competitive and environmentally acceptable. In the current, difficult, economic situation the availability of capital is a serious impediment to restructuring for many firms. Therefore, a role could be envisaged for particular financing institutions, like the European Investment Bank (EIB), to provide financing for upgrading projects, or even for the reconversion of refinery sites for other uses.

A **fourth** type of solution, for the longer term, could be to make fuel substitutions, particularly light and middle distillates with biofuels, fuels from coal or natural gas (LNG or GTL), to balance the amounts of fuels required and to reduce the necessary throughput of crude oil. The use of more first generation biofuels is not recommended, as they compete with the food chain supply security, but second and third generation biofuels could provide an acceptable solution in future. Such deep shifts require new perspectives on future processes in petroleum refining and petro- or bio-based chemical manufacturing. These perspectives are highly relevant in light of the provision of energy and materials to the future economy, as environmental pressures and fossil scarcity will require new and different solutions. The most likely providers of such solutions are the current petrochemical firms, but only if they are in the position to invest and to innovate in new technologies. Only a financially healthy sector and economically viable market will place the companies in positions to do so. Fostering ‘workable’ competition in the EU market and an adequate industry structure are prerequisites to investments and innovation. Cutthroat competition and continued operation at a marginal cost level, which is essentially the history of the sector over the past decades, is the best way to block any significant new developments in this strategic European industry.

An impetus for security of supply concerns

We conclude that the issue of security of supply for oil products should be high on the agenda of the European Union and its Member States. The market for petroleum fuels and products, on the supply as well as the demand side, displays a number of characteristics that suggest that the

short-term-oriented market is problematic in providing credible signals for investment or disinvestment. This is a consequence of the nature of the investments, the evolution of demand, and of the type of competition with which the EU refiners are confronted in the world market.

The combination of the market imperfections in the sector, the sunk cost problem and the asset specificity, the need to confront environmental externalities, the use of oil products as vehicles for tax-raising, uncertainties in future demand for fuels, and (the latent variation in) public intervention in the sector are creating a rather vulnerable and uncertain situation. Of great importance are lock-in and path-dependency effects. Once an investment is made in a refinery, it will be there for a long time and has to earn a reasonable return with some certainty. Yet once a refinery is really closed and not mothballed, it will most likely never come back.

A crucial pre-requisite is that the benefits of intervention outweigh the costs over the longer term. As stated, in this respect, a main question is the extent to which Europe will consider dependency on import as a security of supply risk. This is an economic issue related to the development of the world's fuels markets, as well as a (geo)political issue related to the possible impact of this dependence in other policy fields. In the end, however, it also affects Europe's ability to develop an innovative and adequate petroleum and/or bio-based industry to provide its future materials and fuels needs in an efficient, effective and environmentally friendly manner.

6

Conclusion

After the golden years of 2004-2008, the European refining sector entered a period of low and volatile refining margins. These developments triggered a wave of closures, conversions and sales of European refineries by incumbent market participants, with predominantly International Oil Companies (IOCs) selling their non-complex and smaller refineries. With refining capacity closed or changing hands to new market entrants, the subsequent question is whether these developments render concerns from a perceived security of oil supply problem for Europe.

The European refining sector is facing a multitude of global challenges

As we concluded in Chapter 3, European refiners are not only constrained by European market dynamics, but also by global competitive pressures.

Changing market conditions, stringent regulatory requirements and a highly mature European oil product market impacts the profitability of European refiners. Key in this respect is the increased dieselisation of oil product demand and the intake of heavier and sourer crude qualities by European refineries. However, European refineries are on average old and historically built to maximise gasoline production. With European refineries subsequently unable to keep up with growing middle distillate demand, we see that for the past ten years the European oil product market has been structurally short on middle distillates and long on gasoline. This asymmetry obviously should force European refiners to upgrade refining capacity in order to yield more middle distillates to take advantage of high middle distillate spreads. However, the slow-growing, mature European oil products market, with its thin and volatile margins, provides only weak drivers for the required investments. Moreover, over the medium term, the EU carbon abatement policy foresees a fairly radical phasing out of fossil fuels, thus reducing the longer term perspective for such large, long-term investments.

Without a solid business case for upgrading, European refiners will have an increasingly high exposure to global product markets and will need to fill their growing middle distillates deficit, mainly with imports from Russia, and export their gasoline surpluses, mainly to North America. However, with a global product market switching more and more towards middle distillates and bio-components, the European gasoline surplus will prove increasingly difficult to sell, thus destroying European refining margins even further. Meanwhile, on the other side of the European oil product asymmetry, middle distillates will also prove increasingly difficult and expensive to source.

With aging and non-complex plants, European refiners are already facing stiff competition from overseas refiners, mainly ones from emerging markets, and are questioning the long-term profitability of their assets. The multitude of competitive challenges European refiners face, as illustrated through Porter's five forces, is a typical case of comparative (dis)advantage that appears in an increasingly open international energy market. For slow-growing mature economies (such as in Europe and the US, but also in Australia), it is increasingly hard to undertake costly, lengthy, labour-intensive and regulation-intensive refinery investments (and even upgrades) to meet shifts in crude quality supply and regional oil product demand patterns. Consequently, supported by their domestic comparative advantages, Middle Eastern and mainly South Asian refiners aim to fill this refinery investment gap in Europe. The demand-side effects of the financial and economic crisis on the fuel market painfully exacerbate this trend.

From the five forces of Porter we see that the challenges and threats all point in the wrong direction for the European refiners. Low downstream margins in Europe, dwindling European gasoline exports to the US, the build-up of state-of-the-art refining capacity in the Middle East and Asia (including export-oriented refineries), the introduction of biofuels and European environmental and carbon legislation are all affecting the competitive position of European refiners.

Corporate restructuring of European refineries

Interestingly, as concluded in Chapter 4, the challenges of the European refining sector are interpreted differently among the various companies active in the European and global oil and oil product markets. The tumultuous times that European refiners find themselves in, from the perspective of supply-demand forces and global competition, place the individual owners of European refineries in a dilemma. Where some companies see obstacles, others perceive the European refining sector to offer future opportunities for value creation. Thus, when looking at the corporate restructuring of the individual companies, we see different strategies for value creation among the market participants.

From Chapter 4 we conclude that the valuation of the drivers by the owners of refining assets differs and that it is strongly characterised by their current and future market risks (outlooks) and their financial abilities to adjust to the changing market conditions. As a result, vertical integration (as a form of risk management) is one of the main determinants in corporate restructuring in the European refining sector.

The main owners divesting European refineries were and will remain IOCs and independent refiners. However, the rationale and strategies behind divestment are strikingly different for these two groups. IOCs such as Shell and ExxonMobil have a deliberate strategy, formulated in the 2000s and supported by ample financial capabilities, to lower their downstream exposure and concentrate on large-scale, complex downstream assets and the exploration and production of upstream gas and oil reserves. Between 2008 and 2011 the IOCs divested 33% of their European refining capacity. Independents, like Petroplus, were forced to divest some European refineries to buffer their weak balance sheets due to high market and price exposure. Between 2008 and 2011 independents divested 23% of their European refining capacity, some of which they had bought only recently from the IOCs.

The counterparties of the divestments are three types of owners, each of which have different strategic outlooks. Oil and gas companies from emerging markets, like Essar, PetroChina and Lukoil, seem to be eager to establish themselves in the European refining sector. Accepting lower returns and an uncertain future, these new market entrants arguably follow a more vertically integrated and strategic approach to their refining investments. Firstly, national champions from emerging markets raised their exposure to European refining capacity between 2008 and 2011 by 362% and are trying to gain a foothold in the European refining sector. Secondly, NOCs from producer markets are integrating forward in order to secure demand, however at a slower pace than in the 1980s. The NOCs added 40% of European refining capacity to their collective portfolio. Thirdly, private equity funds from the category 'other' purchased significant refining capacities in Europe in an effort to speculate on the value of lower refining multiples while the refining margins are slowly recovering.

From the perspective of vertical integration and financial capabilities we also see a diverse pattern in the European refining sector. One the one hand the most exposed and financially weak European refiners, such as Petroplus, and the most vertically integrated and financially strong owners of European refining capacity, the IOCs, are divesting European refineries. On the other hand we observe that moderately vertically integrated and financially capable companies, NOCs from producing countries and especially National Champions from emerging markets, are increasing their exposure in the European refining sector.

In an increasingly dynamic and uncertain oil product market, the margin for error in the refining segment is thin. Investments by risk-exposed parties like Petroplus are therefore highly unlikely. Strategies that embrace vertical integration and pure players that fully shift their risk to other (financial) players are likely to grow. Only large vertically integrated and diversified companies, especially those with government support, are possible long-term investors in the slow-growing but still volatile European refining sector. Currently National Champions from emerging markets and NOCs from producing countries are the most likely candidate to fill the gap left by the IOCs. The question is whether these investors will be able to replace the core owners of European refining capacity, the IOCs, and whether these trends will affect the European security of oil and oil product supply.

Implications for the security of supply of oil and oil products?

We argued that in order to establish whether Europe is facing a security of supply *problem* with respect to oil products, the first question to be answered is the extent to which dependence on non-European fuel supplies actually constitutes a security of supply problem for the EU countries. We provided a number of economic and geopolitical arguments but concluded that in the end it is a political decision. A crucial pre-requisite for intervention is that the benefits thereof outweigh the costs over the longer term. As stated, in this respect, a main question is to what extent Europe will consider import dependency to be an unacceptable security of supply *risk*. This is in part an economic issue, related to the development of the world's fuels markets, and also a (geo)political issue, related to the possible impact of this dependence in other policy fields. In the end, however, it will also affect Europe's perspective about having an innovative and economically viable petroleum and/or bio-based industry to provide its newly developed materials and fuels in the future in an efficient, effective and environmentally friendly manner.

We maintain that the issue of security of supply for oil products should be high on the agenda of the European Union and its Member States. The market for petroleum fuels and products, on the supply as well as on the demand side, displays a number of characteristics that suggest that the short-term orientation of the market is problematic in providing credible signals for investment or disinvestment. This is a consequence of the nature of the investments, the evolution of demand, and of the type of competition with which the EU refiners are confronted in the global market.

We addressed the issue of how the meaning of 'security of supply' in the oil industry is changing as a consequence of the shifts in the world's oil industry and on the demand side. We argued that two main preconceptions are challenged these days, namely: 1) that the market ensures an efficient supply of products; and 2) that the supply security of crude oil is the only thing that matters.

After analysing the particular nature of the security of supply problem in Europe, we stated that the issues at stake in the current situation go beyond the static efficiency of the market. Dynamic efficiency is what matters today, referring to the adequacy of the market in providing sufficiently strong incentives to the industry to restructure and to invest in quality-enhancing (new) technologies. This involves two main elements, namely the entry and exit determinants of companies and their refining plants from the market, and those behind committing long-term investments in refinery upgrades in an uncertain market situation. Oil refineries are economically delicate ventures as a consequence of their huge sunk costs, long repayment periods and their vulnerability to uncertain variations in crude input prices on the one hand, and to product supply and demand and the associated price risk on the other. The problem identified points to the inadequacy of the current short-term drivers of the European market to provide the refinery owners with effective signals to adjust their refining capacity to changing market conditions, because of its ownership structure and its being part of an imperfectly operating world market for oil products. Moreover, the longer-term perspective of the EC involves a reduction in the use of fossil- and petroleum-based fuels.

A key question that comes out of the analysis therefore concerns the extent to which the current EU and national governance regimes reflect the characteristics of today's oil products market and the refining industry. It may emerge that the efficient development of markets of a different nature, maturity and risk profile require different structures of governance and co-ordination, instead of just striving for a fully competitive EU market for oil products. This, of course, very much depends on the question of to what extent the EU considers its import dependency to be problematic.

We argue that the combination of the market imperfections in the sector, the sunk cost problem and the asset specificity, the need to confront environmental externalities, the use of oil products as vehicles for tax-raising, uncertainties in future demand for fuels, and (the latent variation in) public intervention in the sector are creating a rather vulnerable and uncertain situation. Of great importance are lock-in and path-dependency effects and the issue of co-ordination. Even if we were able to do without fossil fuels in future, we will need them along the way to that future, and in sufficient quantities and qualities. But as we have shown in this paper, even that path may require considerable investments in upgrading capacity. The key question is whether this co-ordination will be provided by the market as it is currently institutionalised in the EU. And, to

repeat, once an investment is made in a refinery, it will be there for a long time and has to earn a reasonable return with some certainty. Yet once a refinery is really closed and not mothballed, it is unlikely to come back.

Finally, assuming that a problem does exist, we proposed a number of options for European policy makers in countering the possibly adverse effects of an uncoordinated restructuring of the European refining industry. To start with, we suggest a careful reassessment of the situation and of the dynamics in the refining sector and the local oil products markets. We also suggests a (re)consideration of what constitutes 'security of supply' for oil products in the context of the emerging international market for oil products. We also identified a number of 'families' of policy interventions, or instruments, which should be taken into consideration.

The first of these families involves a review of the current impact of levies, including differentials in the sales tax on diesel- and gasoline-fuelled cars, on the demand for the various fuels. Such a review should also involve the relative impact on demand of fuel emission standards and other requirements, like energy efficiency measures. To guide investments in refining capacity, clear and consistent longer-term goals should be stated with respect to environmental regulation and future requirements regarding carbon emissions.

Secondly, attention should be given to the competitive position of the European refining industry versus those of external refiners. When it appears that there is a serious lack of a level playing field with extra-EU competitors for whatever reason, measures should be considered to repair this problem. This will require a thorough analysis of the causes of this situation and the consequences. A balance must be found between a mercantilist policy towards the European refining sector and the correction of market imperfections and external effects, possibly including the protection of new refineries in emerging markets.

A third family of instruments is geared towards supporting those refiners that are not able to adjust on their own. If appropriate, given the location and environment of refineries, consideration could be given to stimulating investments to adequately adjust conversion capacity and enhance the crude intake flexibility, while bringing the environmental impact up to standards.

A fourth type of solution, for the longer term, should be to develop new perspectives on introducing and supporting innovative processes in petroleum refining and petro- or bio-based chemical manufacturing. The most likely providers of such solutions are the current oil and petrochemical companies, but only if and when they are in the position to invest and innovate in such new technologies. Only a financially healthy sector and economically viable market supported by the right institutional framework will place the companies in positions to do this.

Fostering 'workable' competition in the EU market and an adequate industry structure are prerequisites for investments and innovation. Cutthroat competition and continued operation at a marginal cost level, which is essentially the history of the sector over the past decades, is the best way to block any significant new developments in this strategic European industry. The current European market model is fully focused on bringing about competition and reducing market power in the industry, while the potential for state aid of any nature is constrained. By limiting the options for particular business models and forms of co-operation, it could very well

be that the EU will impede the necessary adjustment and restructuring, as happened in the 1980s and '90s.

Moreover, the focus on an all-embracing EU-wide approach to achieve a level playing field may ultimately have the opposite effect, as the consequences will vary with the nature of the companies involved and the areas in which they operate. Obviously, given the differing strategic perspectives, the six groups of refiners will have their own preferences and possibilities. It will also vary with respect to the effects in several European regions: the Northwest, the Mediterranean and Central Europe, as a consequence of the local structure of the refining industry. It is precisely because of such effects that uncoordinated political interference may emerge, as is suggested by the French initiatives referred to above. Given the differences in the nature of the demand side in the countries of those regions and in the local socio-economic impact of supply shocks, striving for a level playing field as the one and only means of economic co-ordination of a crucial industry may be come close to the flat-earth conception of the world as it existed in the Middle Ages.

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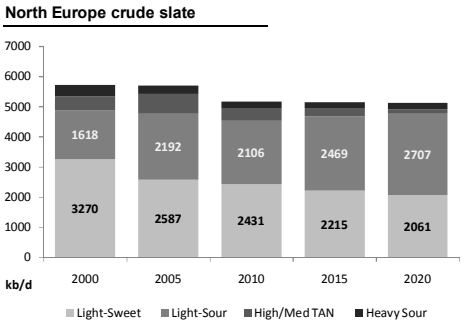
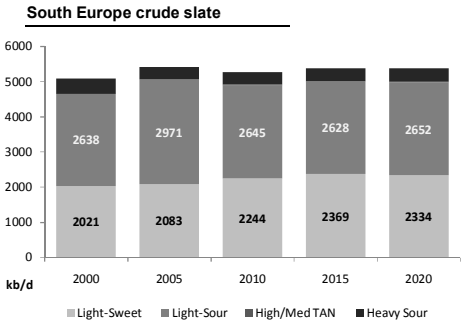
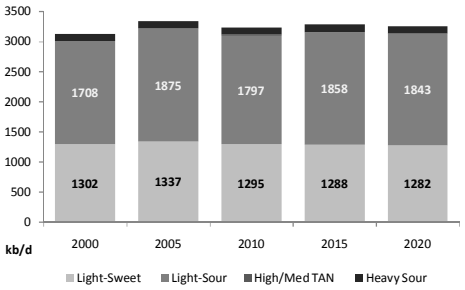
Annex

Annex A: Regional crude slate for European refiners (2000-2020)







Source: Pervin&Gertz, CIEP Analysis

Crude qualities and regions

	API	*Sulphur %*	Examples
Light-Sweet	>30	<1	Brent, Ekofisk, Saharan blend
Light-Sour	>30	>1	Urals, CPC blend, Tengiz
High/Med	<30	<1	Captain
Heavy-Sour	<30	>1	Arabian heavy, Maya

North	*Central*	*South*
Belgium	Austria	Former Yugoslavia
Denmark	Bulgaria	France (South)
Estonia	Czech Republic	Greece
Finland	Germany	Italy
France (North)	Hungary	Portugal
Iceland	Poland	Romania
Ireland	Slovak Republic	Spain
Latvia	Switzerland	Turkey
Lihuania	Netherlands	Sweden
Luxembourg	Norway	UK

Annex B: Refineries in the EU-27

Country	*Location*	*Owner*	*Type*	*Status*	*Type*	*bl/d ('000)*
Austria	Schwechat	OMV	National Champion (EU)		Cracking	175
Belgium	Antwerp	Total	IOC		Cracking	367
Belgium	Antwerp	ExxonMobil	IOC		Cracking	330
Belgium	Antwerp	Vitol	Other	from Petroplus (2008)	Hydroskimming	115
Belgium	Antwerp	Gunvor	Other	from Petroplus (2012)	Topping	110
Bulgaria	Bourgas	Lukoil	National Champion (EM)		Cracking	215
Bulgaria	Pleven (Note 1)	PLAMA	National Champion (EU)		Topping	30
Bulgaria	Ruse (Note 1)	Government	Producer NOC		Topping	2
Croatia	Rijeka	MOL	National Champion (EU)		Cracking	90
Croatia	Sisak	MOL	National Champion (EU)		Coking	44
Czech Republic	Litvinov	PNK Orlen (Unipetrol)	National Champion (EU)		Cracking	103
Czech Republic	Kralupy	PNK Orlen (Unipetrol)	National Champion (EU)		Cracking	62
Czech Republic	Pardubice	PNK Orlen (Paramo)	National Champion (EU)		Topping	20
Denmark	Kalundborg	Statoil	National Champion (EU)		Hydroskimming	110
Denmark	Fredericia	Shell	IOC		Hydroskimming	68
Finland	Porvoo	Neste Oil	National Champion (EU)		Cracking	206
Finland	Naantali	Neste Oil	National Champion (EU)		Cracking	58
France	Gonfreville L'Orcher	Total	IOC	idle (2011)	Cracking	345
France	Port Jerome/NDG	ExxonMobil	IOC		Cracking	233
France	Donges	Total	IOC		Cracking	230

France	Lavera	PetroChina	National Champion (EM)	from Ineos (2011)	Cracking	218
France	Petit Couronne	Petroplus	Pure-Play refiner	idle (2012), start up by Shell (2012)	Cracking	162
France	La Mede	Total	IOC		Cracking	158
France	Dunkirk	Total	IOC	conversion (2011)	Cracking	137
France	Fos sur Mer	ExxonMobil	IOC	idle (2010)	Cracking	119
France	Feyzin	Total	IOC		Cracking	116
France	Reichstett	Petroplus	Pure-Play refiner	from Shell (2008), idle (2010)	Cracking	85
France	Grandpuits	Total	IOC		Cracking	99
France	Berre l'Etang	LyondellBasell	Other	from Shell (2008), for sale (2011)	Cracking	80
Germany	Karlsruhe	Miro	IOC		Coking	302
Germany	Gelsenkirchen	BP - Rosneft	Producer NOC	from PDVSA (50%) (2010)	Coking	277
Germany	Ingolstadt	BayernOil	Pure-Play refiner		Cracking	262
Germany	Wilhelmshaven	Hestya Private Equity	Other	conversion, from ConocoPhillips (2011),	Hydroskimming	260
Germany	Leuna	Total	IOC		Cracking	227
Germany	Schwedt	JV (Shell, BP etc)	IOC		Cracking	220
Germany	Godorf	Shell	IOC		Cracking	198
Germany	Wesseling	Shell	IOC		Cracking	148
Germany	Ingolstadt	Petroplus	Pure-Play refiner	idle (2010)	Cracking	106
Germany	Harburg-Grasbroo	Nynas	Other	from Shell (2011)	Cracking	102
Germany	Harburg	Tamoil	Producer NOC		Cracking	94
Germany	Heide	Klesch & Co	Other	from Shell (2010)	Cracking	91
Germany	Lingen	BP	IOC		Coking	91
Germany	Burghausen	OMV	National Champion (EU)		Coking	72
Greece	Aspropyrgos	Hellenic Petroleum	National Champion (EU)		Cracking	147

Greece	Aghii Theodori	Motor Oil (Hellas)	Pure-Play refiner		Cracking	100
Greece	Elefsis	Hellenic Petroleum	National Champion (EU)		Topping	100
Greece	Thessaloniki	Hellenic Petroleum	National Champion (EU)		Hydroskimming	67
Hungary	Duna	MOL	National Champion (EU)		Coking	161
Ireland	Whitegate	ConocoPhilips	IOC		Hydroskimming	71
Italy	Priolo	ERG	Other		Cracking	368
Italy	Sarroch	Saras	Other		Cracking	300
Italy	Milazzo	ENI - Kuwait	National Champion (EU)		Cracking	241
Italy	Sannazzaro, Pavia	ENI	National Champion (EU)		Cracking	200
Italy	Augusta, Siracusa	Lukoil	National Champion (EM)	from ERG (2008)	Cracking	198
Italy	Sarpom Trecate	ExxonMobil	IOC		Cracking	174
Italy	Gela	ENI	National Champion (EU)		Coking	105
Italy	Cremona	Tamoil	Producer NOC	conversion (2011)	Hydroskimming	94
Italy	Rome	Total	IOC		Hydroskimming	89
Italy	Livorno	ENI	National Champion (EU)		Hydroskimming	84
Italy	Taranto	ENI	National Champion (EU)		Cracking	84
Italy	Falconara, Marittima	API	Other		Hydroskimming	83
Italy	Porto Marghera	ENI	National Champion (EU)	idle (2011)	Hydroskimming	80
Italy	Mantua	MOL	National Champion (EU)		Cracking	69
Italy	Busalla	IPLOM	National Champion (EU)		Topping	40
Lithuania	Mazeikiai	PNK Orlen	National Champion (EU)	for sale (2010)	Cracking	190
Macedonia	Skopje	Hellenic Petroleum	National Champion (EU)		Hydroskimming	50
Netherlands	Pernis	Shell	IOC		Cracking	406
Netherlands	Europoort	BP	IOC		Cracking	380
Netherlands	Rotterdam	ExxonMobil	IOC		Cracking	188
Netherlands	Vlissingen	Lukoil	National Champion (EM)	from Total (2008)	Cracking	147

Netherlands	Rotterdam	KPC	Producer NOC		Hydroskimming	81
Netherlands	Rotterdam	Koch	Other		Topping	80
Netherlands	Amsterdam	Smid & Hollander	Pure-Play refiner		Topping	10
Norway	Mongstad	Statoil	National Champion (EU)		Coking	200
Norway	Slagen-Valloy	ExxonMobil	IOC		Hydroskimming	110
Poland	Plock	PNK Orlen	National Champion (EU)		Cracking	377
Poland	Gdansk	Lotos	National Champion (EU)		Cracking	120
Poland	Dziedzice	Lotos	National Champion (EU)		Topping	14
Portugal	Sines	Galp	National Champion (EU)		Cracking	213
Portugal	Leca da Palmeira Porto	Galp	National Champion (EU)		Hydroskimming	98
Romania	Midia	Kazmunaigaz	Producer NOC		Coking	105
Romania	Pitesti	Kazmunaigaz	Producer NOC	for sale (2010)	Cracking	70
Romania	Ploiesti	Lukoil	National Champion (EM)		Coking	70
Romania	Ploiesti	Petrom - OMV	Producer NOC		Coking	69
Romania	Ploiesti	Astra	Pure-Play refiner		Coking	56
Romania	Onesti	Rafo	National Champion (EU)		Coking	70
Romania	Darmanesti	Petrom - OMV	Producer NOC		Coking	16
Romania	Ploiesti	Kazmunaigaz	National Champion (EM)		Topping	9
Romania	Barcau	Petrolsub	Other		Topping	8
Serbia	Pancevo	Gazprom (NIS)	Producer NOC		Cracking	98
Serbia	Novi Sad	Gazprom (NIS)	Producer NOC		Hydroskimming	117
Slovakia	Bratislava	MOL	National Champion (EU)		Cracking	115
Spain	San Roque (Cadiz)	CEPSA	Producer NOC	sold 49% to Abu Dhabi's IPIC	Cracking	240
Spain	Somorrostro Vizcaya	Repsol	National Champion (EU)		Cracking	220
Spain	Tarragona	Repsol	National Champion (EU)		Cracking	160

Spain	Puertollano, Ciudad Real	Repsol	National Champion (EU)		Coking	157
Spain	La Coruna	Repsol	National Champion (EU)		Coking	120
Spain	Castellon de la Plana	BP	IOC		Cracking	105
Spain	Cartagena Murcia	Repsol	National Champion (EU)		Hydroskimming	100
Spain	La Rabida Huelva	CEPSA	Producer NOC	sold 49% to Abu Dhabi's IPIC	Cracking	100
Spain	Tenerife	CEPSA	Producer NOC	sold 49% to Abu Dhabi's IPIC	Hydroskimming	93
Spain	Tarragona	Asfaltos Espanoles	Other		Topping	21
Sweden	Brofjorden-Lysekil	Preem	National Champion (EU)		Cracking	220
Sweden	Gothenburg	Preem	National Champion (EU)		Hydroskimming	113
Sweden	Gothenburg	Keey Oy	National Champion (EU)	from Shell (2009)	Hydroskimming	78
Sweden	Nynashamm	Nynas	Other		Topping	28
Sweden	Gothenburg	Nynas	Other		Topping	13
Switzerland	Cressier	Petroplus	Pure-Play refiner	idle (2012)	Hydroskimming	68
Switzerland	Collombey	Tamoil	Producer NOC		Cracking	54
United Kingdom	Fawley	ExxonMobil	IOC		Cracking	326
United Kingdom	Stanlow	Essar	National Champion (EM)	from Shell (2011)	Cracking	296
United Kingdom	Lindsey	Total	IOC	for sale (2011)	Cracking	221
United Kingdom	Humber	ConocoPhilips	IOC	for sale (2011)	Coking	221
United Kingdom	Pembroke	Valero	Pure-Play refiner	from Chevron (2011)	Cracking	210
United Kingdom	Grangemouth	Petrochina (50%)	National Champion (EM)	from Ineos (2011)	Cracking	205
United Kingdom	Coryton Essex	Petroplus	Pure-Play refiner	Idle, start up by private equity	Cracking	172
United Kingdom	Milford Haven	Murphy	IOC	for sale (2010)	Cracking	106
United Kingdom	Teesside	Petroplus	Pure-Play refiner	conversion (2009)	Topping	100
United Kingdom	Eastham, Cheshire	Nynas	Other		Topping	27

United Kingdom	Dundee	Nynas	Other	Topping	12

Source: Purvin & Gertz (2009, 2011), A Barrel Full (2011), CIEP Analysis

Annex C: Types of refineries. From simple to complex: a stylized example

Topping (simple)

Crude is a mixture of petroleum products. The topping refinery just separates the crude into its constituent petroleum products by distillation, known as Atmospheric Distillation. Topping Refinery produces naphtha but no gasoline.

Hydroskimming

The hydroskimming refinery is defined as a refinery equipped with Atmospheric Distillation, naphtha reforming and necessary treating processes. Hydroskimming refinery is more complex than a topping refinery and it produces gasoline. Hydroskimming refinery produces a surplus of fuel with unattractive price and demand.

Cracking

The cracking refinery is, in addition to the above, equipped with vacuum distillation and catalytic cracking. The cracking refinery adds one more level of complexity to the hydroskimming refinery by reducing fuel oil by conversion to light distillates and middle distillates.

Coking (complex)

The coking refinery refers to the one which is equipped to process the vacuum residue into high value products using the Delayed Coking Process. The coking refinery adds further complexity to the cracking refinery by high conversion of fuel oil into distillates and petroleum coke.

Catalytic Cracking, Coking and other such conversion units are referred to as secondary processing units. The Nelson Complexity Index, captures the proportion of the secondary conversion unit capacities relative to the primary distillation or topping capacity. The Nelson Complexity Index typically varies from about 2 for Hydroskimming refineries, to about 5 for the Cracking refineries and over 9 for the Coking refineries.

Refineries, with high Nelson Complexity Index have the necessary flexibility in processing a wide variety of crudes and are capable of achieving higher value addition.

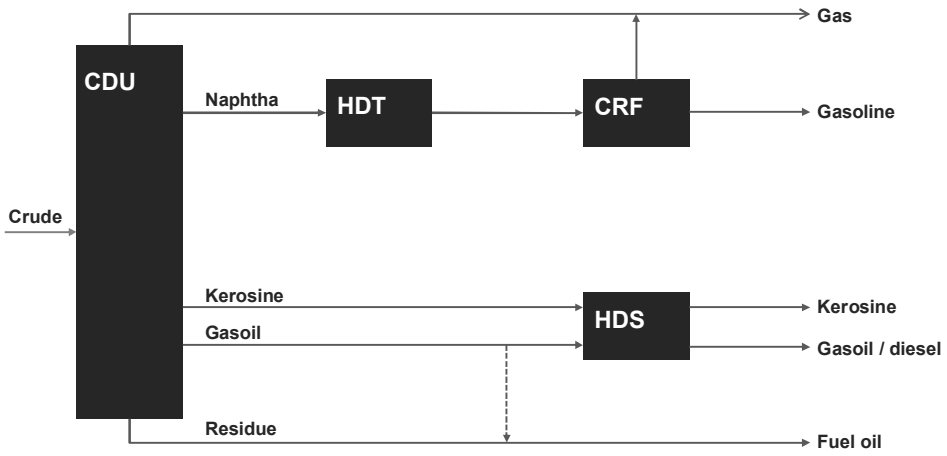
Annex D: Graphic representations of simple, semi-complex and complex refineries

Refinery units

Simple refinery		
CDU	Crude Distillation Unit	*Separating fuels from crude oil in a column using different boiling points*
HDT	Hydrotreater	*Removing sulphur, nitrogen, and aromats*
CRF	Catalytic Reformer	*Conversion of Naphtha in gas*
HDS	Hydrodesulphurisation	*Removing sulphur from oil products*
Semi-complex refinery		
+ **THC**	Thermal cracker	*Conversion of residue in gasoil*
Complex refinery		
+ CCU	Catalytic cracker	*Conversion into gasoline*
+ HCU	Hydro cracker	*Conversion into middle distillates (gasoil/diesel)*
+ HVU	High-vacuum distillation unit	*Provides vacuum gasoil as feedstock for Catalytic (CCU) and Hydro cracker*

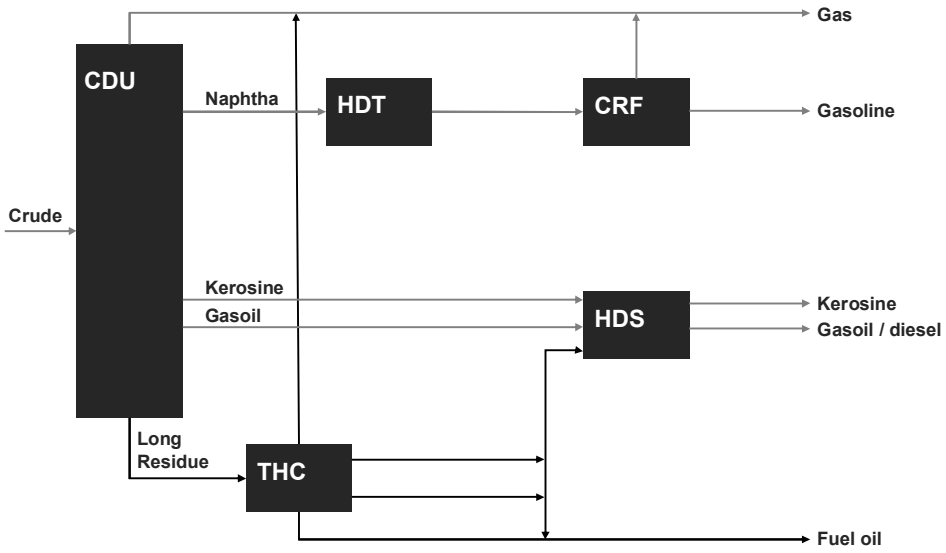
Source: Bacon (1990),

Simple refinery



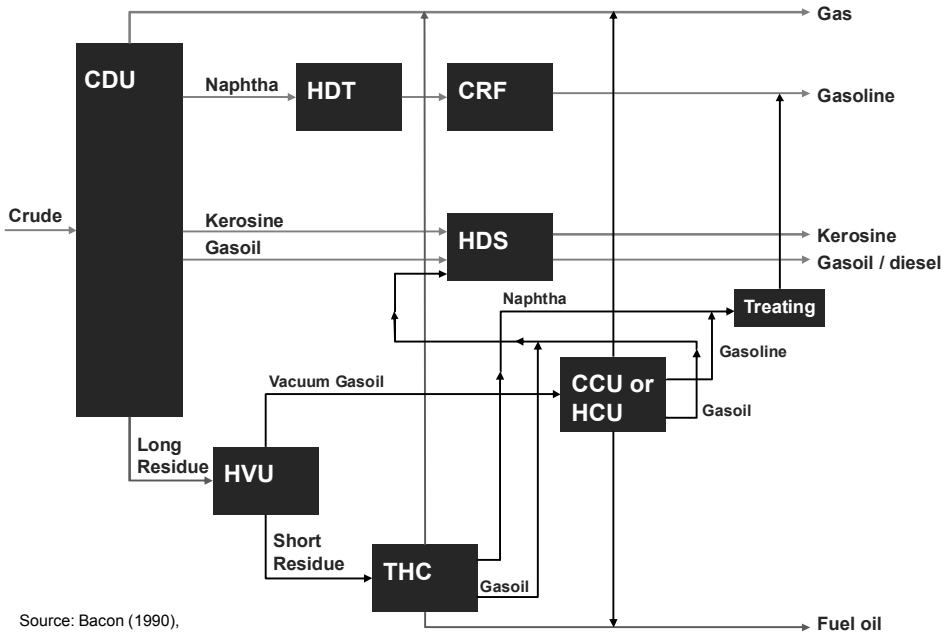
Source: Bacon (1990),

Semi-complex refinery



Source: Bacon (1990),

Complex refinery



Source: Bacon (1990),