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CCSI Policy Paper

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Key Messages

1. Dutch oil downstream owes its success to an integrated cluster model of industry organized in and around the port city of Rotterdam.
2. Rotterdam's well-developed logistical capacity and its connectivity to key markets have helped the Netherlands maintain prime relevance in Europe's oil and gas sector.
3. The development of the downstream oil sector is due to the early decentralization and empowerment of local authorities and municipalities for economic development, provision of infrastructure and fiscal enablers, industrial linkage with the petrochemical market and private capital to fund refining assets.
4. Passenger fleet dieselization in Europe has adversely affected northwest Europe's refineries. Wider adoption of diesel cars has led to a market capture from Russian refiners specializing in producing and supplying low sulphur diesel
5. As it becomes more expensive to maintain refineries in Europe (owing to various direct and indirect costs), international oil companies are shifting their capital to more productive and profitable assets in Asia and Africa.

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CCSI Downstream Beneficiation, Refined Petroleum Case Study: The Netherlands

This paper aims to illustrate the trajectory of Dutch refining, storage, and petrochemicals industries from their inception to the current scenario they face. Through this story, it hopes to flag key historical moments and establish critical factors behind the success and record important challenges to the sustenance of industrial growth going forward.

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Background

The Netherlands' downstream oil sector is predominantly geared towards export (63 per cent). The country exported 689 thousand barrels of petroleum products in 2017, with key destinations being Germany, Belgium-Luxembourg, France, Nigeria and Singapore. This compares to imports of 106 thousand barrels of crude1 from Russia, Norway, Nigeria and Iraq.

The Netherlands' main refineries are located around the Rotterdam industrial zone. They include:

- Shell Pernis Refinery[2] (Royal Dutch Shell), 416,000 bpd[3]
- Botlek Refinery (ExxonMobil), 195,000 bpd
- BP Rotterdam Refinery (BP), 400,000 bpd
- Europoort Refinery (Kuwait Oil Company), 80,000 bpd
- Koch HC Partnership Refinery (Koch), 80,000 bpd
- Vlissingen Refinery (Total/Lukoil), 149,000 bpd

These refineries have a total capacity of 1,294 thousand b/d, representing about 1.3 per cent of global capacity today. [4] In 2017, these refineries saw a throughput[5] of 1,179 thousand b/d[6]. They produced a total of 429 thousand barrels of refined petroleum. The downstream petrochemicals industry generated about 27 thousand barrels of product. [7]

The Netherlands' history in oil refining dates back to 1902 when the native Royal Dutch Shell opened its first refinery in Rotterdam. However, the inchoate industry lay largely dormant until the second World War. Following the war, the industry was put in motion as oil replaced coal as an energy source for transportation.[8] As demand for gasoline and refined products gained momentum in Europe, so did

[1] Statistics Netherlands (CBS), "Petroleum products balance sheet; supply, consumption and stock".
[2] Shell Pernis enjoys the distinction of being Europe's largest refinery.
[3] Bpd and b/d are used interchangeably to connote barrels per day (volume).
[4] BP Statistical Review of World Energy (June 2018).
[5] According to Petropedia, "refining throughput is the maximum volume of crude oil which is converted into more useful petroleum products in large volumes or large refinery throughput, thereby providing higher gross refinery margins."
[6] BP Statistical Review of World Energy (June 2018).
[7] Statistics Netherlands (CBS), "Petroleum products balance sheet; supply, consumption and stock".
[8] Molle, W. (1993). Oil refineries and petrochemical industries: coping with the mid-life crisis. The Structure of European Industry, 43-63.

refining and downstream activities in the Netherlands. Oil companies saw an opportunity in Rotterdam's positioning and port capacity within Europe.

1930s: Kick-starting industry in Rotterdam

The Netherlands' prolific oil refinery sector owes part of its success to the Government's approach towards agglomerating industry to achieve production synergies and reduce operational costs. Such clustering when realized in proximity to convenient distribution channels (such as a port) results in high levels of business activity and competitiveness.[9] To achieve this clustering, the Dutch Government realized that it would have to decentralize and localize to develop industry. As part of its industrial strategy, it ceded more power and authority to bodies at the local and municipal levels. As Jan van Landen notes, "Every province set up an institute for economic development (economisch technologisch institut) after the model developed in the 1930s, with the explicit aim to increase industrial employment in the region."[10] This bottom-up approach benefited both Rotterdam and Schipol, which developed as important logistics hubs and the "main engines of economic growth in the Western part of the Netherlands."[11] These local authorities created economic zones, mobilizing capital and collaboration from international firms in order to establish highly productive and integrated industrial clusters. In fact, Rotterdam stands out as a successful example of the Government's strategy to concentrate economic activity into a region with access to trading and supply routes.

1940s-60s: Building Rotterdam

From humble beginnings of fishing village in 1328, Rotterdam grew into one of Europe's top commerce centers, particularly for petroleum, energy, and chemicals companies. Providing a formidable refining and shipping hub in Europe, Rotterdam gained importance in Dutch industrial policy. In the 1940s, the Dutch Government recognized Rotterdam's ability to play a central role in strategizing and realizing development and economic growth.

Hoping to develop an export-oriented economy capitalizing on water routes, the Government invested in the expansion of Rotterdam's deep water harbours, creating infrastructure along the ports of

[9] See World Bank report on SEZs (2008).
[10] Van Zanden, J. L. (2005). The Economic History of the Netherlands 1914-1995: A Small Open Economy in the 'long'Twentieth Century (Vol. 1). Routledge.
[11] Van Zanden, J. L. (2005), op cit.

Maashaven, Rijnhaven, and Waalhaven.[12] This induced large volumes of merchant trade attracted oil companies that needed a well-developed port city in Europe to expand their business through the continent. Most notably Shell began operations in full swing, building on the foundations laid by its founding refining company, The Royal Dutch Petroleum Company. By 1949, Shell, had expanded into petrochemicals with Teepol and PVC fabrics. In 1959, Shell created, a subsidiary petrochemical company called Shell Nederland Chemie (SNC) with 5,500 employees.

However, the Netherlands' economic success story was rocked by the second World War. Rotterdam was bombed heavily, losing most of its infrastructure. By the end of the war the Government rebuilt the city within 10 years, even expanding its port facilities. The city developed port and industrial complexes in the Europoort, Botlek, and Maasvlakte regions. It welcomed international oil corporations like BP, who wanted to tap into Europe's newfound thirst for oil and chemical products including plastics and synthetic rubbers. As European economies began to ramp up post-war reconstruction projects and develop new industries, fuel demand skyrocketed. Oil refiners began ramping up operations in Rotterdam, taking advantage of its trade and shipping networks within Western Europe. By the 1960s, the refining industry in Rotterdam had expanded: Rotterdam's three refineries produced 24 million tons of oil per year, surpassing its European peers.[13]

The 1960s also saw the rise of the Netherlands' natural gas sector with the discovery of fields in Groningen. Concerted policy-making around gas has made Netherlands the largest supplier of natural gas in Europe and the fifth largest natural gas supplier in the world. The oil refining and petrochemicals sectors in the Netherlands have benefited from access to a robust pool of resources, investments, and interlinkages originally intended to develop the gas sector.

But more importantly, the Dutch petrochemicals industry was able to leverage the growing chemical demand in Germany which opened up a complementary market for the Dutch Petrochemical industry. Manufacturers of organic chemicals were switching from coal to cheaper petroleum as the primary input for specialty chemicals.[14] Demand for chemicals, such as synthetic rubbers and plastics, also

[12] Otgaar, A. H., Van Den Berg, L., & Feng, R. X. (2016). Industrial tourism: opportunities for city and enterprise. Routledge.
[13] Hein, C." Analyzing the Palimpsestic Petroleumscape of Rotterdam", *Global Urban History*, available at, https://globalurbanhistory.com/2016/09/28/analyzing-the-palimpsestic-petroleumscape-of-rotterdam/
[14] Frijhoff, W., & Spies, M. (2004). Dutch Culture in a European Perspective: 1950, prosperity and welfare. Uitgeverij Van Gorcum.

spiked in the UK and other parts of Europe.[15] These served as raw materials for a plethora of industries, including a booming automobiles industry. The Government saw the synergies from the clustering petrochemicals and petroleum products as petrochemicals are downsteam products of the refining of petroleum products. It supported the development of the Pernis-Botlek-Europoort complex in the Rotterdam-Rjinmond harbour-front area, which eventually hosted most of the Netherlands' oil refining and downstream activities.

1970s-80s: Oil crises and regional linkages

The 1970s signaled difficult times for Dutch refineries due to the first oil crisis of 1973. Oil demand in Western Europe fell from 750 million tons to 650 million tons16 and Saudi Arabia, Netherlands' key source of crude faced political blockade. As a result, Dutch refining capacity fell by 21 per cent. [17]

The Government policy at this time was oriented towards promoting regional linkages to foster the inflow of foreign capital and expand Dutch exports capacity.[18] The Government decided to leverage Rotterdam's oil storage and port capacity to extend its international trade networks. This move instigated two key infrastructure developments, the development of a port-side industrial zone Europoort in Rotterdam, and the Amsterdam-Rotterdam-Antwerp (ARA) pipeline network. The Maasvlakte (Meuse-plain) project successfully extended the south side of the port by reclaiming land and creating more space for industrial development and storage. In addition, the two pipelines connecting Rotterdam with Antwerp (Belgium) and Rhine (Germany) were instrumental to strengthening the Netherlands' ties with its two main trading partners. By linking Amsterdam's Mobil refinery to the oil pipeline network, the ARA became a critical supply chain in the whole region. However, owing to weak oil demand, economic turbulence in greater Europe, and slumped imports, the convenient pipeline system as well as Rotterdam's well-equipped ports were underutilized through the late 70s.

[15] Gielen, D. J., Vos, D., & Van Dril, A. W. N. (1996). The petrochemical industry and its energy use. Prospects for the Dutch energy intensive industry (No. ECN-C--96-029). Netherlands Energy Research Foundation (ECN).
[16] Pinder, D.A. (1986). Crisis and survival in western European oil refining. Journal of Geography, 85(1), 12-20.
[17] Pinder (1986), op cit.
[18] Van Zanden (2005), op. cit

Netherland's refinery capacity, 1979-86

Company	Capacity 1979 (m tonnes)	Capacity reduction 1979-86 Closure (m tonnes)	Capacity reduction 1979-86 Downrating (m tonnes)	Total contraction (%)	Capacity 1986 (m tonnes)
Shell	26.1	—	4.6	17.6	21.5
BP	24.3	—	2.8	11.5	21.5
Chevron/Texaco	14.8	—	4.6	31.1	10.2
Esso	8.7	—	1.0	11.5	7.7
Total (Dow)	7.4	—	—	0	7.4
Mobil	6.1	6.1	—	100	—
Gulf (Kuwait PC)	3.7	—	—	—	3.7
All refineries	91.1	6.1	13.0	21.0	72.0
Refinery averages	13.0	—	—	—	12.0

During the period:
1. Chevron holding sold to Texaco.
2. 20 per cent holding in Total Vlissingen purchased by Dow Chemicals.
3. Gulf refinery purchased by Kuwait Petroleum Corporation.

Source: Pinder (1986)

The 1980s brought more challenges. The 1979-80 oil shock cut Dutch crude imports by 40 per cent and seaborne oil export trade by 75 per cent. Oil consumption in the key client states of West Germany and Belgium also fell, spelling misery for Dutch refiners and logistics providers. In this period of crisis, the utilization rate of Dutch refineries fell from 63 per cent in 1975 to 46 per cent in 1981. As the above chart demonstrates, IOCs rationalized existing refining assets in the Netherlands, cutting capacity. Facing high oil prices in the wake of the 1979 Iranian revolution, Western European nations took steps to reduce their dependence on OPEC crude imports.[19] In order to recalibrate their strategic priorities, IOCs in Western Europe responded with "restructuring", an organizational strategy of cutting losses by down-rating or eliminating surplus refining capacity.[20] Between 1979 and 1984, Western Europe saw a decline in capacity by 187 million tons aided by the closure of 31 refineries. The industry that consistently employed around 11,000 people through the 70s shed jobs in the 1990s due to low profitability and refinery closures. At the time, BP, Texaco, Esso, and Shell alone shed 13 million tons of capacity as shown in the figure above.[21] BP significantly reduced investments in most of Europe operations during this time, but divested the least from its assets in Netherlands[22] (see figure below).

[19] van der Linde, J. G. (1991). Dynamic international oil markets: oil market developments and structure 1860-1988. Kluwer Academic Publishing.
[20] Pinder (1986), op cit.
[21] Pinder (1986), op cit
[22] Pinder (1986), op cit

The change geography of enterprise

	Percentage change, 1979-1984			
	BP	Shell	Esso	Mobil
West Germany	−71	−13	−27	0
France	−39	−20	−15	−19
UK	−48	−15	−42	−17
Italy	*	*	−15	0
Belgium	*	0	−14	*
The Netherlands	−12	−18	+5	−100
Denmark	*	−5	−4	*
Norway	*	0	−19	*
Sweden	+3	−9	*	*
Ireland	−100	−100	−100	*
Greece	*	−13	*	*
Switzerland	0	0	*	*
Company average	−38	−16	−22	−23
Total capacity (million tonnes) 1979	100	132	122	40
Total capacity (million tonnes) 1984	62	111	95	31

Notes: Data include cessation of crude intake to Hamburg refinery that continues to process feedstocks. *No investment 1979.

Source: Cantrell (1978, pp. 153-88; 1983, pp. 119-39).

Source: Pinder (1986)

For the rest of the 1980s, the oil majors remained preoccupied with restructuring to recover from the economic turmoil. This was also motivated by changing patterns of demand in the European market[23] and an increase in environmental regulations. In order to survive in this new environment of increased regulatory pressure and rising cost, oil companies continued their way down the restructuring route: Mobil, for instance, shut down its inefficient Amsterdam refinery in 1983. This period also illustrated the tense relationship between oil companies and the Dutch state: Shell threatened to divest unless the emissions target was negotiable.[24]

The latter half of the 1980s saw the Dutch Government solidify the National Environmental Policy Plan (NEPP). This policy reform set forth requirements aimed at curbing carbon, sulphur, and nitrogen emissions from refineries. Putting aside past disagreements with the Government, oil companies made considerable investments to upgrade their refineries to meet emission standards and changing demand patterns and achieved efficiencies through vertical integration of subsidiary petrochemical companies. Many oil companies made investments to increase their complexity and increase their conversion capacity by installing catalytic cracking capacity over thermal cracking.[25] By the end of the 1980s, BP and Shell had spent over $1.9 billion on advanced upgrading technologies capable of handling heavy residues. They also identified value in integrating petrochemicals production and oil refining operations. Undertaking this vertical integration helped them reduce transport costs, generate

[23] At this time, Europe experienced lower demands for heavy fuel oil (in the face of a surplus) and higher demands (and profitability) for lighter products, such as gasoline. As Pinder shows, in 1982, heavy fuel oil was selling at $165 per tonne whereas gasoline was selling at $295 per tonne (Pinder, 1986).

[24] Van der Straaten, J. (2001). Oil Refineries in the Netherlands. In Green Industrial Restructuring (pp. 385-402). Springer Berlin Heidelberg.

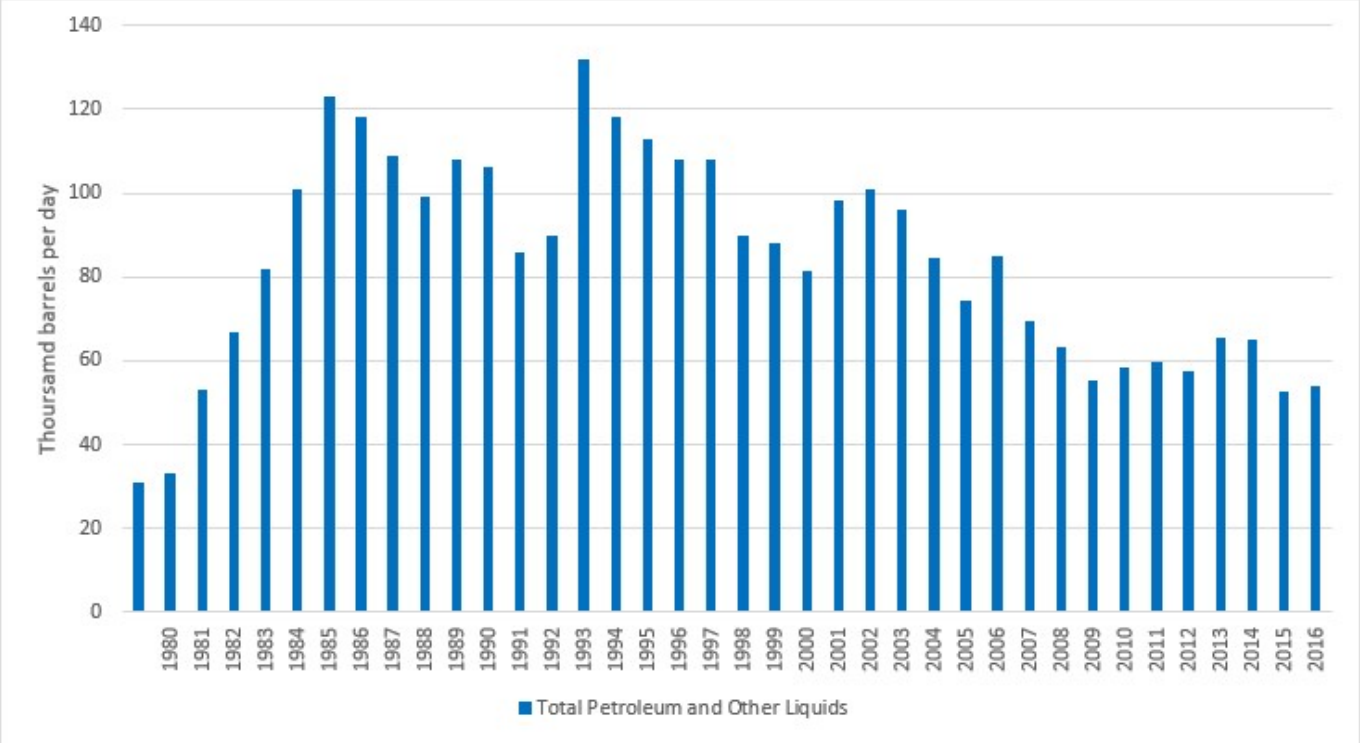
[25] Pinder (1986), op cit.

efficiency gains, reduce pollution from extraneous activities, and more effectively utilize raw material and working capital.[26]

1990s-2000s: Staying competitive in Europe

By the 1990s, following a period of heavy consolidation, key players in the Netherlands' downstream sector had achieved their main value propositions: high refining capacity and a petrochemicals-integrated production model that resulted in large efficiency gains and lower costs. Shell had invested $2.2 billion into rejuvenating its Pernis refinery, adding a new hydrocracking unit and residue-gasification unit. [27] From the mid-90s on, the Netherlands' labour market, particularly in oil downstream, began to see signs of stability: According to a Statistics Netherlands dataset, the refinery sector has employed around 6,000 people consistently since 1996.

Total petroleum and other liquids

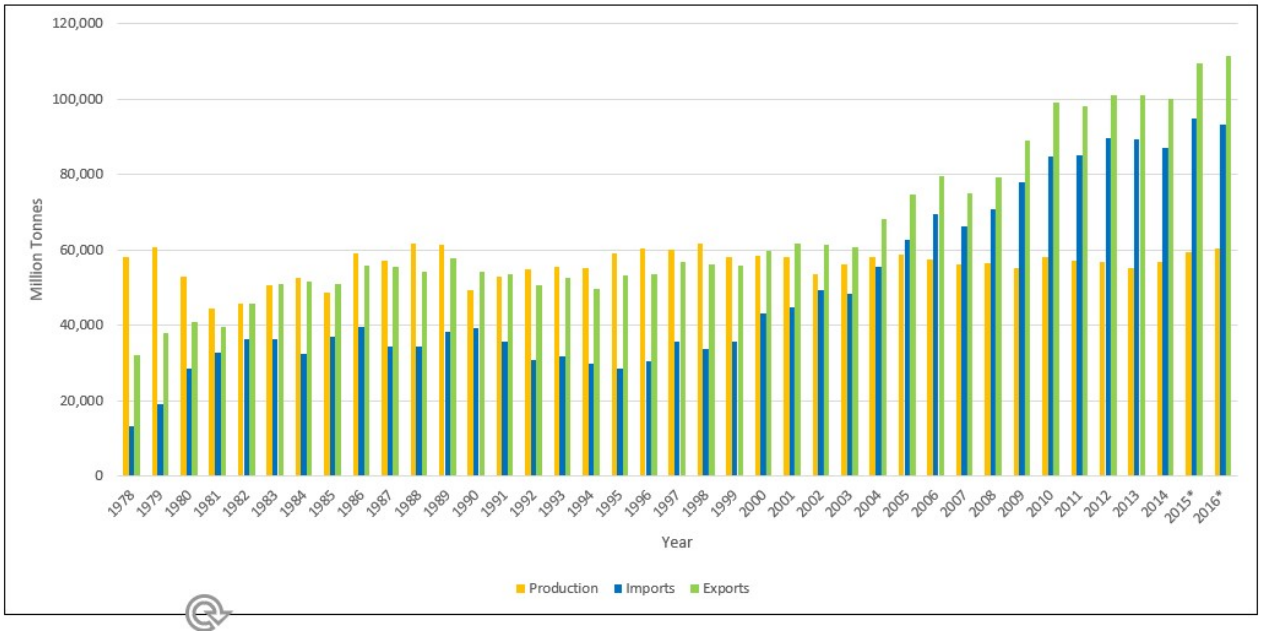


Source: US Energy Information Administration

[27] "Shell plans $2.2 billion renovation of Dutch refinery," *Oil and Gas Journal,* (April, 26, 1993), available at: http://www.ogj.com/articles/print/volume-91/issue-17/in-this-issue/refining/shell-plans-22-billion-renovation-of-dutch-refinery.html

In the 2000s, the Netherlands was producing upwards of 1.5 million b/d in petroleum products. Dutch oil downstream found positive returns to investments in petrochemicals and found customers for its surplus gasoline output in America.[28] The country exported 75 million tons of petroleum products in 2005, more than any other European nation. Petroleum exports displayed a sharp upward trajectory in the 2000s, steadily climbing from $11.5 billion (2001) to $23 billion (2005) to $44.9 billion (2010).[29]

Netherlands production balance – Production, Imports and Exports



Source: CBS Netherlands

Adapting to Today's challenges

Environment

As evidenced before, the Dutch Government has a history of setting down stringent environmental standards.[30] Since the mid-2000s, the Netherlands Government, in line with its commitments to the EU,

[28] "Europe refiners pump up US sales margins," *Financial Times*, available at: https://www.ft.com/content/9d8220e2-6ca5-11e2-b73a-00144feab49a
[29] World Integrated Trade Solution database.
[30] Van der Straaten (2001), op cit

31 has rolled out a set of aggressive clean fuel regulations affecting operators in the downstream sector.[32] After initial difficulty (especially with NOx), Dutch refiners have been able to reduce nitrogen emissions and meet desulphurization standards (see below figure). [33]

Annual emissions by the Dutch Refinery Industry

Source: Krebbebkx et al. (2011)

Additionally, all Dutch refineries must adhere to the Long-term Agreement on Energy Efficiency for companies adhering to the Emissions Trading System (ETS) Enterprises.[34][35] The, Dutch refineries have

[31] According to EC (2016) working paper checking the fitness of the refining sector, EU refineries accounted for 12 per cent of SOx, 5.6 per cent of NOx, and 6.6 per cent CO_2 emissions in 2012. The paper also notes that the EU's refining sector has made laudable strides in reducing emissions over time.
[32] Barry (2015), op cit.
[33] Krebbebkx, J. A., Postma, B., Wolf, W. J., & Lenselink, J. (2011). "Enterprise under restraint: A transition perspective for Dutch refineries towards 2030". Pre Study MEE. Agentschap NL.
[34] Introduced in 2009, "The Long Term Agreements (LTAs) are agreements negotiated between companies and the Netherlands government that aim to promote energy savings in industry. Known as the LEE, the LTA on Energy Efficiency is intended specifically for enterprises that participate in the EU Emissions Trading System (EU ETS) (…). Each participating company is required to create an Energy Efficiency Plan and to implement all profitable measures (with payback periods of five years or less). Within the Plan, there is a soft target of 2% annual energy efficiency improvement but no binding targets as companies already have CO2 reductions obligations under the EU ETS. Aside from the Energy Efficiency Plan, enterprises are to investigate at the strategic level what the energy-saving possibilities are in the long term. (..) In return, the government agrees not to impose additional specific national measures aimed at energy conservation or CO2 emission reductions on the participating companies. Also, companies acting under the covenants are automatically granted compliance with the energy-related provisions of their permits under the Environmental Management Act." (source: http://iepd.iipnetwork.org/policy/long-term-agreement-energy-efficiency-eu-ets-enterprises-lee)
[35] Krebbekx. (2011) op cit.

done a good job of controlling emissions through carbon capture and storage (CCS) projects.[36] However, this has hit the downstream business with higher operating costs and lower net cash margins.[37]

Changing markets, growing competitions

Heavy environmental regulation and weak gasoline demand[38] in Europe have prompted IOCs, such as Shell, BP, and Total, to redirect their investments to more productive, cost-effective, and competitive assets in Asia and the Middle East.[39] The IOCs' eastward shift is also motivated by a desire to tap into the healthy demand trends and higher profitability forecasts demonstrated by emerging markets, such as China, India, and a host of rapidly industrializing Southeast Asian economies.[40][41] Moreover, in Europe, oil refiners have to face a changing fuel mix in the region with the growing popularity of renewable and biofuels.

In addition, the emergence of aggressive international players with competitive offerings has been troublesome. Since Dutch refiners are highly dependent on foreign trade and exports as their main revenue stream, they see America's self-sufficiency with gasoline and Russia's foray into the European market as major threats. Russia has already asserted itself in Europe, taking stock of the cleaner fuel standards adopted by the EU and flooding the market with ultra-low-sulphur diesel (ULSD).[42]

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[36] See ROAD (Rotterdam Capture & Storage Demonstration Project), a $390 million project financed by the EU and Dutch Government intended towards storage and re-selling of CO_2 emissions is being piloted by two companies, Uniper and Engie.
[37] European Commission, (2016). "EU Petroleum Refining Fitness Check: Impact of EU Legislation on Sectoral Economic Performance," (2015), op cit.
[38] Though it must be mentioned that the recent Volkswagen emissions scandal (https://www.bbc.com/news/business-34324772) has tainted diesel demands in the region. Analysts predict a medium-term rebalancing towards gasoline from diesel in the European passenger fleet.
[39] European Commission, (2016). "EU Petroleum Refining Fitness Check: Impact of EU Legislation on Sectoral Economic Performance," (2015), op cit.
[40] IEA, "IEA Medium Term Oil Market Report," Report, (2016), available at https://www.iea.org/publications/freepublications/publication/MTOMR2016.pdf
[41] According to Shell's latest annual report (2016), oil demand growth has mainly been driven by Asia's emerging economies. Naphtha cracker margins have also shown growth in Asia while showing stagnation in Europe.
[42] "Flood of Russian diesel inflicts pain on European Refineries," *Financial Times,* available at: https://www.ft.com/content/17424454-f173-11e3-9fb0-00144feabdc0

All these trends and challenges have reduced refinery utilization rates to approximately 80 per cent[43] and led to some refinery closure: see for instance Shell's recent announcement of massive job cuts in the Netherlands.[44]

Strengthening of Netherlands' competitive advantage: Rotterdam as a logistics and economic hub

Despite the challenges mentioned above, the country has continued strengthening its main competitive advantage: the Rotterdam port. The port has played a key role in the competitiveness of the sector and has gained prominence as an integral node in most European supply chains, opening up more markets for Dutch refineries. The economic and transportation hub accounts for 20 per cent of value added to Dutch industry.[45] The port and industrial cluster is currently home to the country's 6 main refineries, 9 oil terminals, and 45 chemical companies.[46] Its capacity[47] to support jobs and industry has been central to the petrochemicals and refining industry cluster's ability to remain competitive. Handling over 466 million tons of throughput every year, Rotterdam's superior port abilities remain vital to the oil storage and trade sectors in the Netherlands. In 2013, Rotterdam completed the first phase of Maasvlakte 2, a $1.8 billion extension to its port facilities. The second phase of this ambitious expansion is estimated to cost another $1.2 billion.[48] It also posted employment numbers to the tune of 3,271 in oil refining and 6,167 in chemicals manufacturing.[49] In 2016, recognizing the port's importance in the refining and chemicals space, ExxonMobil announced a $1.16 million investment into expanding its hydrocracker to generate higher-value products.

Rotterdam is also Europe's largest oil and gas trading hubs. This has resulted in the attraction of some of the world's largest commodity trading houses such as Vitol basing its headquarters in Rotterdam. While Switzerland continues to maintain its pole positioning as the preferred European base for traders, the Netherlands has strong credentials to challenge this title. The country's liberal tax regime

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[43] Ybema, R., & Plomp, A. (2015). Refinery emissions from a competitive perspective. Wood Mackenzie, ECN. Presentation.
[44] "Shell to slash 2000 Netherland jobs," *Netherland Times,* (April, 2016), available at: http://nltimes.nl/2016/04/20/shell-slash-2000-netherlands-jobs
[45] Port of Rotterdam Facts & Figures (2015).
[46] Port of Rotterdam Facts & Figures (2015).
[47] Facilities in Rotterdam can accommodate 170 million barrels, sharing the country's gross capacity of 210 million barrels. The industrial cluster in petrochemicals and refining is estimated to have supported over 13,000 direct jobs and 60,000 indirect jobs (source: Port of Rotterdam Facts and Figures (2015)).
[48] "Rotterdam opens first phase of 3 billion Maasvlakte 2 project," *Port Technoligy,* (May, 2013), available at: https://www.porttechnology.org/news/rotterdam_opens_first_phase_of_3_billion_maasvlakte_2_project
[49] Port of Rotterdam Facts and Figures (2015).

and robust financial sector linked to the oil downstream business have historically garnered the attention of price-setters, particularly those dealing with bunker and marine fuels. Though it must be noted that the Netherlands has seen more success in gas trading than oil trading with the creation of Endex/APX exchange and Title Transfer Facility (TTF) spot market facility that have shaped the gas trading business in Europe for instance.[50] As competition increases, current trends show a broader shift of petroleum trading away from Europe to the Middle East and Asia-Pacific.[51]

Conclusion

In conclusion, the oil refining and petrochemicals industries in the Netherlands have shown remarkable resilience. They have withstood multiple challenges, including two major oil price hikes, increasing operating costs, product demand slumps, onerous emissions regulation, and fierce competition. Their willingness to restructure and adapt operations to promote efficiencies, leverage an integrated "cluster" production model, generate export opportunities through the Rotterdam port, and adapt to market trends and regulation have enabled them a competitive edge in the European refining market.

Dutch refineries have shown a historical dependence on trading partners, Germany and Belgium for generating export revenues. However, the demand structure for refined petroleum and related products has transformed on a global level. Equipped with strong storage capacity and vast shipping networks, the Dutch downstream market should begin to look beyond the EU market to other emerging markets. Opportunities exist around the world: Demand for middle distillates and petrochemicals is projected to rise in Asia and Africa, while ethylene demand is projected to rise in America.[52]

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[50] "The Netherlands – The Energy Hub of Europe,", *Oil and Gas Journal,* Report, available at: http://www.ogfj.com/articles/print/volume-7/issue-4/focus-reports/the-netherlands-the-energy-hub-of-europe.html, (last accessed on November 20, 2018).
[51] "Oil trade shifts from crude to refined product," *Financial Times,* available at: https://www.ft.com/content/9223b454-bc91-11e2-b344-00144feab7de, (last accessed, November 20, 2018)
[52] Stratas Advisors (March 10, 2016). *Global Refining Outlook: 2016-2035*.

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