The Hague Centre
for Strategic Studies

European tank storage in global value chains

Outlook to 2030

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Table of Contents

Executive summary

The European tank storage sector will be impacted by decarbonization efforts up to 2030, which is an important milestone in the carbon neutrality path to 2050. The mid-term will be characterized by the simultaneous decrease in demand for fossil fuels and increase in the use of low-carbon energy carriers. Sustaining this transition requires a balancing act of the two systems, old and new. Players in energy infrastructures are caught in between, on the one hand fulfilling the slowly decreasing demand of oil and gas, and on the other hand engaging in decarbonization activities.

Crude oil, refined products and natural gas will gain more relevance in non-European regions in the mid-term. New trade hubs could emerge outside of Europe, bridging supply and demand at closer geographical distances. The pressure of decarbonization that European companies are exposed to will lead to decreasing investments on their ends compared to the Middle East or Russia. Decreasing dependence on Europe's main oil and gas supplier, Russia, while also ensuring sufficient and affordable supplies in the mid-term, is both a technical and geopolitical challenge. Replacing 155 billion cubic metres (bcm) of natural gas or 40% of European consumption[1], is challenging in terms of global prices of gas, reliance on the spot market and decreasing long-term contracts, as well as European liquefied natural gas (LNG) infrastructure and interconnections. But significantly decreasing this dependency is possible. In the meantime, tank storage is central in fulfilling domestic demand and securing strategic reserves of oil as well as of natural gas once such a policy is passed. Coordinated releases of strategic reserves can also bring some stability in global energy markets as they mitigate shortages and decrease prices.

Tank storage companies contribute to Europe's resilience and energy security of supply. Europe's increased dependence on pipeline gas and LNG imports will make countries more vulnerable to supply disruptions, price fluctuations and overall market volatility. At the same time, the European refining and chemical sectors are losing competitive margins compared to low-cost producers like China and Middle Eastern countries. As such, an important part of European domestic demand of oil products, natural gas and chemical products will be fulfilled through imports, making tank storage increasingly important for domestic security of supply.

The storage sector is simultaneously engaging in the decarbonization process, which lays at the center of Europe's priorities for the next decades. Decarbonization of road transport in the mid-term relies on blending conventional fuels such as gasoline and diesel with sustainable ones, like biofuels and synthetic fuels. The maritime and aviation sectors are similarly dependent on fuel blending to reduce emissions, as carbon neutral technologies are still premature. Increased reliance of European economies on new energy products will likely cause a shift in obligations for strategic and military stocks. New products could eventually dominate global commodity trade. Uncertainty is visible in the adoption process of new energy carriers in Europe, but it is evident that hydrogen in all its forms, carbon capture, utilization, and storage (CCUS) efforts as well as electricity storage are indispensable to accelerate decarbonization.

Despite large uncertainty, waiting is not an option. Storage companies should develop a strategy for change, expanding expertise and knowledge, cooperating with policymakers and stakeholders, increasing transparency of the sector's activities, and showing their role in the European economy. These will all ensure that the sector becomes a driver of change and contributes to shaping the next decades.

1 'How Europe Can Cut Natural Gas Imports from Russia Significantly within a Year', IEA, 2022, https://www.iea.org/news/how-europe-can-cut-natural-gas-imports-from-russia-significantly-within-a-year.

Executive summary (NL)

De Europese tankopslagsector zal tot 2030 worden beïnvloed door het terugdringen van het gebruik van fossiele brandstoffen, een belangrijke mijlpaal in de transitie naar CO_2-neutraliteit in 2050. De middellange termijn zal worden gekenmerkt door de gelijktijdige afname van de vraag naar fossiele brandstoffen en toenemend gebruik van CO_2-neutrale energiebronnen. Het doorvoeren van deze transitie vereist een evenwichtsoefening tussen het nieuwe en het oude systeem. Spelers in de toeleveringsketens van olie en gas bevinden zich in een spagaat; zij staan voor de uitdaging enerzijds te blijven voldoen aan de langzaam afnemende vraag, en anderzijds CO_2-reductie mogelijk te maken met nieuwe energieproducten.

Ruwe olie, geraffineerde producten en aardgas zullen op middellange termijn belangrijker worden in regio's buiten Europa. Nieuwe handelsknooppunten kunnen buiten Europa ontstaan, wat kansen zal bieden voor vraag en aanbod op kleinere geografische afstanden. De druk om CO_2-neutraliteit te bereiken, waaraan Europese bedrijven worden blootgesteld, zal leiden tot afnemende investeringen aan hun kant in vergelijking met het hun tegenhangers in het Midden-Oosten. Het verminderen van de Europese afhankelijkheid van Rusland als belangrijkste gas- en olieleverancier, en tegelijkertijd zorgen voor voldoende en betaalbare voorraden op de middellange termijn, is zowel een technische als geopolitieke uitdaging. Het vervangen van 155 miljard kubieke meter (bcm) aardgas of 40% van het Europese verbruik is veeleisend voor de wereldwijde gasprijzen, afhankelijkheid van de spotmarkt en afnemende langetermijncontracten, en bovendien vanwege een gebrek aan Europese LNG-infrastructuur en interconnecties. Maar het is mogelijk om de afhankelijkheid aanzienlijk te verminderen. In de tussentijd is tankopslag cruciaal om aan de binnenlandse vraag te kunnen voldoen en om strategische reserves van olie en gas te kunnen waarborgen. Gecoördineerde levering van strategisch opgeslagen voorraden kan ook bijdragen aan de internationale energiemarkt, doordat de tekorten kunnen worden aangevuld en prijzen worden gedrukt.

Tankopslagbedrijven dragen bij aan Europese veerkracht en energievoorzieningszekerheid. Europa's vergrote afhankelijkheid van gas geleverd via pijpleidingen, en de invoer van vloeibaar aardgas (LNG), zal landen kwetsbaar maken voor verstoringen van de bevoorrading, prijsschommelingen en algemene marktvolatiliteit. Tegelijkertijd verliezen de Europese raffinage- en chemische sectoren concurrentiemarges in vergelijking met goedkope producenten zoals China en landen in het Midden-Oosten. Zo zal een belangrijk deel van de Europese binnenlandse vraag naar olie en chemische producten worden vervuld door import, waardoor tankopslag steeds belangrijker wordt om de toeleveringszekerheid van energiebronnen voor binnenlands gebruik veilig te stellen.

De opslagsector is ook bezig met het bijdragen aan decarbonisering - een Europese prioriteit voor de komende decennia. Het CO_2-neutraal maken van het wegvervoer op middellange termijn is met name afhankelijk van het mengen van conventionele brandstoffen als benzine en diesel met hernieuwbare bronnen als synthetische- en biobrandstoffen. De maritieme- en luchtvaartsector zijn eveneens afhankelijk van het bijmengen van brandstoffen om de uitstoot te verminderen, aangezien CO_2-neutrale technologieën in deze sectoren nog in de kinderschoenen staan. De groeiende afhankelijkheid van Europese huishoudens en industrieën van nieuwe energieproducten zal waarschijnlijk leiden tot een verschuiving in de verplichtingen voor strategische en militaire voorraden. Nieuwe producten kunnen op termijn de wereldwijde handel in grondstoffen gaan domineren. Er is onzekerheid over de mogelijke invoering in Europa van nieuwe energiedragers als waterstof, maar het is duidelijk dat waterstof in zijn verschillende verschijningsvormen, naast *Carbon Capture Utilization* en *Storage* (CCUS) en elektriciteitsopslag, onontbeerlijk zijn om de CO_2-uitstoot versneld terug te dringen.

Het gebrek aan regulering met betrekking tot deze technologieën veroorzaakt grote onzekerheid, maar wachten is geen optie. Opslagbedrijven moeten een strategie ontwikkelen, waarin zij expertise en kennis uitbreiden, samenwerken met beleidsmakers en belanghebbenden, de activiteiten van de sector transparanter maken en hun rol in de huidige economie laten zien. Dit alles zal ervoor zorgen dat de sector een aanjager van verandering wordt en bijdraagt aan het vormgeven van het energielandschap van de komende decennia.

Implications of the Russian invasion of Ukraine for Europe's energy policy

This report has been written at the beginning of 2022 and finalized shortly after the Russian invasion of Ukraine (11.03.2022). It has quickly become clear that the expected mid-term developments under various scenario studies, such as Russia supplying the European oil and gas markets for at least another decade, could be strongly affected by this conflict. European energy policy has for a long time balanced security of supply and strategic autonomy with climate goals and energy affordability. Currently, European energy policy is led by geopolitical concerns and security of supply, but affordability and climate goals remain key considerations.

Despite geopolitical issues of European dependency on Russia gaining importance since the annexation of Crimea, this dependency has been on the rise ever since. In 2021, Russia accounted for 40% of European natural gas consumption, or 155 bcm.[2] Europe is also dependent on Russian oil, but the mature global oil market and possibility to bring oil from other suppliers makes this dependency relatively less salient compared to gas.

In March 2022, when Russia invaded Ukraine, the European gas market was already tight.[3] Within the first weeks of Russian aggression, European governments had already announced measures to decrease Russian dependence. Adding to the remaining sanctions from 2014, the European Union imposed new severe sanctions on Russia's economy.[4] European companies such as Shell, BP and Equinor are imposing self-sanctions by pulling out of energy projects in Russia.[5] German regulators stopped (or postponed) the opening of Nord Stream 2 and announced the construction of two LNG terminals. The EU announced the introduction of new regulations for strategic storage of natural gas, as well as a plan to reduce dependence on Russian energy products, named "REPowerEU". This plan is partly based on the acceleration of the energy transition but also on shorter term actions to bring in LNG from different suppliers and increase the production and consumption of hydrogen and biomethane.[6]

2 'How Europe Can Cut Natural Gas Imports from Russia Significantly within a Year'.

3 The 2021 price crisis in Europe, caused by several different factors like speedy recovery in demand after Covid, weather events, accidents at LNG production facilities etc., put European consumers and policymakers under significant stress.

4 European Council, 'EU Restrictive Measures in Response to the Crisis in Ukraine', 4 March 2022, https://www.consilium.europa.eu/en/policies/sanctions/restrictive-measures-ukraine-crisis/.

5 Neil Hume and Tom Wilson, 'Shell Joins BP and Equinor in Pullback from Russia', *Financial Times*, 28 February 2022, https://www.ft.com/content/cf7f4bc0-f3a1-4863-809f-c08f6e48642a.

6 'Press Conference on the REPowerEU Communication', Text, European Commission, 8 March 2022, https://ec.europa.eu/commission/presscorner/detail/en/SPEECH_22_1632.

Discussions of reducing dependence on Russian gas as well as a global ban on Russian oil, have come to the forefront of public debate.[7] The prospects of reduced Russian oil and gas in global markets and uncertainty regarding new sanctions and future developments, led to global oil and gas prices reaching record highs.[8] The International Energy Agency (IEA) members have agreed to a release of 60 million barrels of oil from strategic reserves on March 1st, to mitigate the shortage of oil supply and contribute to the stabilization of prices.[9]

Whereas this paper tries to distinguish longer term global trends in energy markets from shorter term crises like the one we are in today, its contents remain subject to future developments, which are intrinsically uncertain. Eventually, Europe might rely on demand destruction and shutting off certain industries to reduce dependency, or might bring in more expensive energy products from suppliers other than Russia. Security of supply concerns have also led to European policymakers to discuss the possibility of maintaining coal and nuclear power plants open for a longer period of time, instead of switching to natural gas as a transition fuel.[10]

The continued volatility in energy markets and tensions between security of supply, price and climate, can be mitigated by strong and well developed infrastructure, such as an energy storage sector. Tank storage companies safeguard strategic stocks and provide a degree of stability in a highly uncertain world. This paper shows how different developments could affect European tank storage in the coming decades and, in turn, how tank storage can support European goals of strategic autonomy and climate neutrality.

7 Kate Davidson, 'Zelenskyy Adviser: Global Ban on Russian Oil Would End Putin's Attacks', POLITICO, 7 March 2022, https://www.politico.com/news/2022/03/07/zelenskyy-adviser-global-ban-russian-oil-00014710.

8 Faisal Islam, 'Ukraine Conflict: Petrol at Fresh Record as Oil and Gas Prices Soar', *BBC News*, 7 March 2022, sec. Business, https://www.bbc.com/news/business-60642786.

9 'IEA Member Countries to Make 60 Million Barrels of Oil Available Following Russia's Invasion of Ukraine - News', IEA, 1 March 2022, https://www.iea.org/news/iea-member-countries-to-make-60-million-barrels-of-oil-available-following-russia-s-invasion-of-ukraine.

10 Karl Mathiesen, Zosia Wanat, and Zia Weise, 'Coal Not "Taboo" as EU Seeks Russian Gas Exit', POLITICO, 3 March 2022, https://www.politico.eu/article/coal-not-taboo-as-eu-seeks-russian-gas-exit-says-green-deal-chief/.

European tank storage in global supply chains

Outlook to 2030

The international oil market up to 2030

United States & Brazil are expected to increase their oil supply up to 2030

European crude oil and oil product demand is expected to decline

Russia faces challenges to maintain its oil production levels up to 2030

China & India account for the majority of increase in global oil demand

Iran & Iraq have large conventional oil reserves and could contribute significantly to global oil supply

Saudi Arabia & UAE are investing in oil production capacity, downstream diversification and infrastructure

Trends affecting European tank storage

- Decarbonization of transport
- Increasing dependence on gas imports
- Emerging technologies: hydrogen, carbon storage, electricity storage
- European refinery closures
- European chemical industry losing competitive advantage

OPPORTUNITIES

MORE DIVERSIFICATION: There is an increasing need of specialized storage services for diversified products.

EXISTING CAPABILITIES: Existing knowledge and infrastructure can support the deployment of new fuels.

INTEGRATION & ENERGY HUBS: The added value of storage companies can increase by integrating services.

REFINERY CLOSURES: The storage sector becomes more important in securing European energy supplies.

STRATEGIC STORAGE: The storage sector is key in securing strategic and military supplies, and in supporting the decarbonization of defense.

NEW COMMODITIES: Low costs, integrated services and infrastructure will determine the location of new trade hubs.

FIRST MOVER ADVANTAGE: Companies that innovate and act quickly can shape the transition and gain first mover advantages in emerging markets.

THREATS

MINDSET: Strategic vision and willingness to learn and expand expertise are essential.

PUBLIC OPINION: Increase transparency to gain a sustainable license to operate.

LICENSING: New safety and environmental protocols are still unclear.

SPACE: Industry has no space to build new facilities and continue operating existing ones.

WAITING GAME: Storage companies must be proactive and play a role in shaping the next decades.

Table 1. Mid-term outlook for tank storage

Product	European storage requirements	European trends	Global trends	Implications for European tank storage	
				Opportunity	Threat
Crude oil	↓	European demand and production of crude and refined oil products are reduced due to the expected decrease in demand for road transport fuels (gasoline and diesel).	The global production center of crude oil is even more concentrated in the Middle East, with Saudi Arabia and UAE reaping benefits from the lack of investments elsewhere. China becomes the largest refiner in the world and leads petrochemical production. The global consumption center moves toward Asia Pacific and Africa due to increasing living standards and population growth.	Increased need for blending services for transport in the mid-term. As European industry weakens, storage becomes more important for imports and domestic security of supply.	Trading slowly moves toward larger oil production and consumption centers, outside of Europe. Blending is an intermediate solution before complete electrification.
Gasoline	↓				
Gasoil/ diesel	↓				
Fuel oil (shipping fuel)	↔	Aviation and shipping will not be fully decarbonized in the mid-term. Blending synthetic with conventional fuels is essential in reducing emissions.		Aviation and shipping continue requiring oil products as fuels, with increasing blending targets.	Blending is an intermediate solution before complete decarbonization.
Kerosene	↔				
Naphtha	↔	European chemical and petrochemical industries are struggling to maintain profitability due to international competition from China and the Middle East.		In the mid-term, naphtha continues to be the main feedstock for industry.	In the long-term, industries will start using alternative types of low carbon feedstock.
LNG	↑	Europe is increasingly dependent on LNG imports.	Qatar and UAE are investing in new infrastructure for the production of natural gas. It is unclear whether Russia remains Europe's main supplier. Consumption moves toward Asia Pacific, with China as the world's largest gas consumer.	More LNG will be traded toward and via Europe. More storage is required to satisfy demand.	Permitting and building necessary infrastructure for LNG takes time and is often opposed by the public.
Biofuels	↑	The requirements for blending biofuels with conventional ones are expected to increase. Advanced biofuels are preferred.	The US and Brazil are the largest producers of biofuels, but domestic policy support determines adoption.	Blending is essential in the decarbonization of transport.	Blending is an intermediate solution.
Hydrogen	↑	European ports are aiming to become hydrogen hubs. Most hydrogen will either be imported via pipelines in a compressed form or by using different energy carriers.	Large-scale domestic production of green hydrogen is likely in e.g. North Africa and the Middle East, where low-cost solar electricity can be easily generated.	Proactivity and investments in innovation and pilot projects are beneficial.	Lack of action could prevent companies from gaining a sustainable license to operate.
Electricity storage	↑	Large-scale battery storage is still in an early development phase.	Large-scale battery storage is still in an early development phase.		
Carbon storage	↑	Carbon storage is still in an early development phase.	Carbon storage is still in an early development phase.		
Chemicals	↑	The European chemical industry loses competitive advantage to China and other low-cost producers.	China, Saudi Arabia, Russia diversify their downstream services and become more active in chemical production.	Chemical facilities could become important in hydrogen storage through ammonia or methanol. Investing in low-carbon and circular techniques could re-establish European production.	Technological advancement is required for the chemical industry to start using new feedstock and energy sources.
Edible oils	↑	The European edible oil market is expanding.	Sustainability concerns make the production of palm or rapeseed oil less desirable.	No disruptive change is foreseen in the mid-term and long-term.	

List of abbreviations

ADNOC	Abu Dhabi National Oil Company
APS	Announced Pledges Scenario
ARA	Amsterdam-Rotterdam-Antwerp
bcm	Billion cubic metres
BP	British Petroleum
CCUS	Carbon capture, utilization and storage
CEFIC	European Chemical Industry Council
EOR	Enhanced oil recovery
ETS	Emissions Trading System
EV	Electric vehicle
FAME	Fatty Acid Methyl Esters
FETSA	Federation of European Tank Storage Association
GHG	Greenhouse gas
GW	Gigawatt
GWh	Gigawatt hour
HVO	Hydrotreated vegetable oil
IEA	International Energy Agency
IMO	International Maritime Organization
IOC	International oil companies
IRENA	International Renewable Energy Agency
JCPOA	Joint Comprehensive Plan of Action
LNG	Liquefied natural gas
LPG	Liquefied petroleum gas
m^3	Cubic meter
mb/d	Million barrels per day
mt	Million tonnes
mtpa	Million tonnes per annum
MW	Megawatt
NEA	National Energy Administration
NOC	National oil companies
NSR	Northern Sea Route
OECD	Organization for Economic Co-operation and Development
OPEC	Organization of the Petroleum Exporting Countries
OPEC+	OPEC and non-OPEC oil producing partners
PJ	Petajoule
R&D	Research and development
RED	Renewable Energy Directive
RED II	Renewable Energy Directive II
SABIC	Saudi Arabian Basic Industries Corporation
SDS	Sustainable Development Scenario
SPR	Strategic Petroleum Reserve
STEPS	States Policies Scenario
SUV	Sports utility vehicle
t	tonnes
UAE	United Arab Emirates
USI	Union of Tank Storage Operators (France)
UTV	Independent Tank Farm Association (Germany)
VCNI	The Royal Association of the Dutch Chemical Industry
VOTOB	Dutch Association of Tank Storage Companies
VRE	Variable renewable energy

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1. Introduction

Influenced by green, digital and industrial ambitions, the ecosystem in which tank storage companies operate is rapidly changing. By 2030, this system will be significantly altered. While the functions of the tank storage sector will remain centered around storing commercial inventories and strategic stocks, they will undoubtedly evolve to match new realities. The stored products, the infrastructural requirements, the interactions with other participants of supply chains and the tank storage companies' role in supporting national ambitions, will change.

Many actors involved in current supply chains are undertaking significant efforts to redesign their long-term visions and adapt to new realities. Yet the European tank storage sector is not just influenced by domestic ambitions. Equally relevant are international developments, given that energy, chemical and food supply chains remain global in nature. The changing role of fossil fuel supplier countries, the spatial shift of industrial clusters away from Europe and into Asia, and the newly emerging green supply chains, are crucially important developments for tank storage. This report provides a mid-term outlook for the tank storage sector: it analyses the main international and European developments that will affect European storage companies up to 2030. The objective is to identify ways to address the challenges that the sector must overcome in order to become an integral part of the energy transition. As such, the report identifies some of the main threats that should be mitigated and opportunities that could be expanded by the storage sector.

This is the third part of a series of four reports analyzing the role of tank storage in the energy transition. The first paper "The European tank storage sector and the global energy landscape" sets the scene by discussing broad developments in the global energy sector and their impact on tank storage. It is available here. The second paper "European tank storage in today's global value chains: What role does it play in our economy?" outlines the current role of the tank storage sector in maintaining Europe's prosperity, competitiveness, and geopolitical position. This paper is the third one, analyzing key European and international developments that will impact the European tank storage sector in the mid-term, up to 2030. The fourth paper "The European tank storage sector: 2050 and beyond" will look further ahead to 2050-2060 and map out the newly emerging role of the storage sector.

2. Background and rationale

Tank storage is one of the sectors that strengthen Europe's prosperous international position. Storage companies are part of a large ecosystem of producers, traders, shipping companies, as well as consumers. The sector's contribution to the European economy and geopolitical influence is often overlooked. FETSA, the Federation of European Tank Storage Associations, represents the European bulk liquid storage sector. National tank storage associations from seven European countries are part of FETSA, as well as four associated members from three other countries.[11] These national associations represent 141 companies across Europe. Together, these companies operate 125.7 million m^3 of storage capacity with a yearly throughput of 1 billion tons of liquid bulk.[12] For more information about the roles of European tank storage companies today, have a look at the previous paper of this series.

Tank storage companies store liquid energy products, chemicals and vegetable oils (Table 2). Liquid bulk is used to produce energy, but also as feedstock in the textile, paper and plastics sectors. Some chemicals contribute to personal care items like soap and toothpaste, laundry detergents, paints, candles and pharmaceuticals.

The energy sector is expected to significantly change, with new products, supply chains and infrastructures being established. In the mid-term, the old system will co-exist with the new one, ensuring sufficient energy supplies until the low-carbon carriers can do so independently. While the chemical industry will undoubtedly be impacted by decarbonization efforts as well, the types of chemicals used by our societies will remain the same in the mid-term. The key change centers around circularity efforts as the industry adopts a more sustainable production process. Lastly, the storage requirements for edible oils in the mid-term are unlikely to suffer any disruptive changes. For these reasons, the sections below are primarily focused on developments in the energy sector, although the chemical industry and edible oils are also touched upon.

11 For a closer look at FETSA members, see "European tank storage in today's global value chains: What role does it play in our economy?". https://hcss.nl/report/european-tank-storage-in-todays-global-value-chains/

12 FETSA, 'Tank Terminals in Europe - Key Figures', 2021, https://fetsa.eu/wp-content/uploads/2021/12/FETSA-TT-Key-Figures-2021.pdf.

Table 2. Examples of liquids stored by tank storage companies

Energy products	Chemicals	Edible oils
• Crude oil	• Specialty Chemicals	• Soybean oil
• Fuel oil	• Intermediate Chemicals	• Palm oil
• Gasoil/ Diesel	• Base Chemicals	• Rapeseed oil
• Gasoline	• Specialty Greases	• Sunflower oil
• Jet kerosene	• Lube oils	• Specialty Blended oil
• Naphtha		• Molasses
• Liquid petroleum gas (LPG)		
• Liquid natural gas (LNG)		
• Bioethanol		
• Biodiesel		

The coming decades will bring important challenges for tank storage. The European Green Deal[13] and Fit for 55 package[14] set clear goals for what Europe should look like in 2030 and up to 2050. Like many other participants in energy supply chains, storage companies must shift their focus from conventional fuels to renewable and low-carbon energy carriers. Technological innovations in hydrogen storage, e-fuels, biofuels or flow batteries in the next 10 to 15 years could create significant opportunities for the tank storage sector to take on an important role in the energy transition.

Broader geopolitical developments present European leaders with dilemmas. Discouraging domestic fossil fuel production but failing to reduce consumption and to introduce realistic alternatives will leave European countries more reliant on Saudi Arabia or the United Arab Emirates (UAE) for energy security of supply. China's control over entire supply chains for green technologies inhibits Europe's strategic autonomous goals. The path to carbon neutrality is characterized by the changing pre-existing dependency relations, as Europe will become import dependent on North Africa, South America and the Middle East for hydrogen. If left unaddressed, the uneven level playing field between European and foreign companies could leave EU industrial actors at a great disadvantage.

To mitigate such issues, European policymakers should act in close cooperation with tank storage companies and other players along energy supply chains. With the appropriate investments in innovation, resilience and adaptation, tank storage can be a part of the solution to next decades' transformation. This report provides a mid-term outlook of the future energy system and the associated geopolitical and technological challenges.

13 "A European Green Deal",European Commission, https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en.

14 European Commission, "'Fit for 55': Delivering the EU's 2030 Climate Target on the Way to Climate Neutrality," COM(2021) 550, https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52021DC0550&-from=EN.

3. Europe in 2030

Climate and digital ambitions drive not only Europe's industrial policy but also its strategic direction for the following decades. The EU's New Industrial Strategy[15], published in 2020, is focused on undertaking ecological and digital transitions through an innovative and competitive economic system. This transformation is taking place in an inherently geopolitical system, in which the EU is moving towards strategic autonomy.[16] The UK is undertaking significant steps toward reducing greenhouse gas (GHG) emissions by 2030, while also ensuring job provision and secure energy supplies.[17] By decreasing external dependencies, European countries seek to become more self-reliant in strategic sectors, such as critical minerals and technologies, food and infrastructure. Reaching these goals implies a whole-of-economy approach, through industrial transformation, cleaner transport fuels, and the decarbonization of the energy sector. The next decades will affect not only producers and consumers but all those service sectors that support the undisturbed functioning of global supply chains.

This section analyzes the European mid-term targets for three sectors: the energy transition, the chemical industry as well as edible oils. Most of the liquid bulk found in tank storage is oil, whether crude or refined, which is why section 3.1 is largely focused on oil-consuming sectors. Understanding the mid-term outlook for these fuels is essential in identifying the future role of tank storage in the energy transition.

15 European Commission, 'A New Industrial Strategy for Europe', COM(2020) 102 § (2020), https://ec.europa.eu/info/sites/default/files/communication-eu-industrial-strategy-march-2020_en.pdf.

16 European Commission, 'Strategic Dependencies and Capacities' (Brussels, 5 May 2021), https://ec.europa.eu/info/sites/default/files/swd-strategic-dependencies-capacities_en.pdf.

17 'Net Zero Strategy: Build Back Greener' (HM Government, 2021), https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1033990/net-zero-strategy-beis.pdf.

3.1. The energy transition

3.1.1. European targets

European climate goals are based on two key timelines, mid-term up to 2030 and long-term up to 2050. The 'Fit for 55' package encompasses mid-term ambitions, having been introduced in July 2021 as a revision of previous 2030 goals. Now, the EU has committed to reducing at least 55% of its net emissions by 2030 compared to 1990 levels, with the ultimate goal of becoming the first climate neutral continent by 2050.[18] Climate action in the UK is equally noteworthy, as the British government has decided to decrease GHG emissions by 68% in 2030, compared to 1990, and to fully decarbonize the electricity sector by 2035.[19]

Table 3. European decarbonization ambitions in main oil-consuming sectors
Data from Eurostat, 2021 and IEA, 2020

Sector	The EU today[20]	The EU in 2030 (ambitions)
Road transport	Road transport accounts for roughly half of oil consumption in the EU. Gasoline and gasoil/diesel are the oil products used in this sector.	The ambition is to power cars by blending biofuels into conventional fuels and through electrification
Aviation & Shipping	Air and maritime transport each account for around 9% of Europe's oil consumption when domestic and international voyages are included.	Complete decarbonization in the mid-term is unlikely but the EU aims to enhance fuel blending.
Households	As of 2019, 34% of consumed electricity in the EU was powered by renewables. About 5.5% of EU oil goes into households for electricity and heating. Natural gas provides almost 38% of heat across Europe.	65% of electricity for households and 40% of heating and cooling for buildings and industry should be generated by renewables. Natural gas is expected to continue being an important fuel.
Industry	The industrial sector uses up to 21% of oil products in the EU, with the majority being used for non-energy purposes in the chemical industry and construction sector.	The EU Emissions Trading System is the primary driver of industrial decarbonization, as well as energy efficiency measures and circularity.

Road transport, aviation and shipping

The EU Mobility Strategy[21] aims to decarbonize the transport sector, given that road transport is responsible for almost half of all demand of oil products within the EU.[22] By 2030, at least 30 million zero-emission cars should be used throughout the Union, the expectation being to virtually overtake petroleum powered ones by 2050.[23] In the UK, the zero emissions vehicle mandate is aimed at decarbonizing the road transport system by stopping the sale of petrol

18 European Commission, 'Fit for 55': delivering the EU's 2030 Climate Target on the way to climate neutrality.

19 'Net Zero Strategy: Build Back Greener', 19, 50.

20 Reference years are 2017-2019, given the strong impact of the Covid pandemic on consumption in 2020. Eurostat, 'Oil and Petroleum Products - a Statistical Overview', 2021, https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Oil_and_petroleum_products_-_a_statistical_overview; IEA, 'European Union 2020 - Energy Policy Review', 2020.

21 European Commission, 'Mobility Strategy', Mobility and Transport, 9 December 2020, https://ec.europa.eu/transport/themes/mobilitystrategy_en.

22 Eurostat, 'Oil and Petroleum Products - a Statistical Overview'.

23 European Commission, 'Mobility Strategy'.

and diesel cars by 2030.[24] This should lead to a significant downturn in gasoline and diesel consumption across Europe.

Petroleum consumption in the maritime and aviation sectors is also expected to decrease as a result of the 'Fit for 55' legislation package and British Net Zero Strategy. This is more difficult than in the case of road transport due to, among others, the lack of zero-emissions alternatives and long-term life cycle of aircraft and vessels. Nonetheless, increasingly high proportions of sustainable aviation fuels will be blended into existing jet fuel in European airports. To ensure that airports are well equipped to offer this service, they should take steps toward adapting their delivery and storage infrastructure.[25] By 2030-2035, zero-emission large aircrafts are expected to be market ready in the EU and UK, contributing to the decarbonization of the aviation sector. In the meantime, sustainable aviation fuels will play the most important role in reducing emissions in aviation. Maritime transport will transform too. Low-carbon fuels will play an increasingly important role, with the target of reaching 6-9% of the international maritime transport fuel mix by 2030 and 86-88% in 2050.[26] The Mobility Strategy aims to introduce zero-emission marine vessels by 2030 into the European market. Overall, the consumption of kerosene/jet fuel and maritime fuel oil will decrease substantially by 2050.

European countries give special importance to biofuels as a means of decarbonizing transport – including aviation and shipping in the long-term. Europe is a global leader in the production and consumption of biofuels for transport, especially biodiesel.[27] The UK is massively investing in sustainable aviation fuel (SAF) production plants to enable the increased blending of SAFs into conventional fuels.[28]

The EU's Renewable Energy Directive (RED) was adopted in 2009 and includes the goal of 10% renewable energy in the transport sector.[29] The share of biofuels in transport across the EU increased from 2% in 2005 to 8.9% in 2019, meaning that the EU was slightly below its initial ambition.[30] A new target was set with the Renewable Energy Directive II (REDII) that went into force on the 1st of January 2021 and set the target of 14% renewable energy for the transport sector, with the sub-target of achieving a share of 3.5% of advanced biofuels.[31] The 14% target could increase to 27-29% in the revised RED, a first proposal of which was published in July 2021.[32]

24 'Net Zero Strategy: Build Back Greener', 24.

25 European Commission, 'Proposal for a Regulation on Ensuring a Level Playing Field for Sustainable Air Transport', 14 July 2021, 17, https://ec.europa.eu/info/sites/default/files/refueleu_aviation_-_sustainable_aviation_fuels.pdf.

26 European Commission, 'Proposal for a Regulation on the Use of Renewable and Low-Carbon Fuels in Maritime Transport and Amending Directive 2009/16/EC' (Brussels, 14 July 2021), 1, https://ec.europa.eu/info/sites/default/files/fueleu_maritime_-_green_european_maritime_space.pdf.

27 'Biodiesel: The Green Fuel Bridging the EU's Climate Ambitions', Politico Studio, 14 June 2021, https://www.politico.eu/sponsored-content/biodiesel-the-green-fuel-bridging-the-eus-climate-ambitions/.

28 'Net Zero Strategy: Build Back Greener', 153.

29 Foreign Agricultural Service U.S. Department of Agriculture, 'European Union: Biofuels Annual', 22 June 2021, 3, https://www.fas.usda.gov/data/european-union-biofuels-annual-1.

30 European Environment Agency, 'Use of Renewable Energy for Transport in Europe', 2021, https://www.eea.europa.eu/data-and-maps/indicators/use-of-cleaner-and-alternative-fuels-2/assessment-2.

31 European Commission, 'Amendment Renewable Energy Directive 2030', 2021, 8, https://ec.europa.eu/info/sites/default/files/amendment-renewable-energy-directive-2030-climate-target-with-annexes_en.pdf.

32 European Commission, 15.

Electricity & heating

About 34% of the electricity consumed in 2019 in the EU came from renewables and biofuels.[33] Contrastingly, approximately 36% was generated by natural gas and coal.[34] Coal, and in some cases nuclear, phase-out plans across Europe will lead to other energy sources gaining a larger share in electricity generation. The expectation is that renewables will become increasingly important while fossil fuels will lose ground. By 2030, the EU aims at doubling its electricity generation from renewable sources, up to approximately 65% of the total.[35] The UK is more ambitious, aiming to decarbonize its electricity sector by 2035.[36]

In terms of heating and cooling buildings and industry, the ambition is to generate 40% with renewables in the EU.[37] Natural gas, which currently provides almost 38% of heat across the EU, could remain the most important fuel in the residential sector until at least 2030.[38] In England, 86% of homes rely on natural gas boilers, but energy efficiency and the deployment of low-carbon systems in new buildings across the UK is expected to support decarbonization in the next years.[39]

Industry

The industry is an important oil consuming sector in Europe, accounting for about 21% of total EU oil demand.[40] Industrial activity produces 15% of the UK's total CO_2 emissions and more than 25% of all of the EU's GHG emissions.[41] The EU Emission Trading System (EU ETS) is one of the primary drivers of the EU's decarbonization efforts. According to the EU ETS, European carbon emitters need to purchase allowances for their emissions. Each year, emitters need to have sufficient allowances to cover their emissions or pay a heavy fine.[42] However, some sectors, including the industry sector, can apply for free allowances to maintain the competitiveness of those industries internationally. These policies are prolonged until 2030.[43] The UK introduced its own Emissions Trading Scheme in 2021.[44]

33 Eurostat, 'Renewable Energy Statistics', 2020, https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Renewable_energy_statistics.

34 Eurostat, 'Energy Balance', 2021, https://ec.europa.eu/eurostat/databrowser/view/NRG_BAL_C__custom_938495/bookmark/table?lang=en,en&bookmarkId=3dd894c7-087c-418e-aa27-1e5945f5c705.

35 European Commission, 'Stepping up Europe's 2030 Climate Ambition', 2020, 8, https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52020DC0562&from=EN.

36 'Net Zero Strategy: Build Back Greener', 94.

37 European Commission, 'Stepping up Europe's 2030 Climate Ambition', 8.

38 PBL, 'Klimaat- en Energieverkenning 2020' (Den Haag: Planbureau voor de Leefomgeving, 2020), 93; Eurostat, 'Electricity and Heat Statistics', 2021, https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Electricity_and_heat_statistics.

39 'Net Zero Strategy: Build Back Greener', 137.

40 IEA, 'European Union 2020 - Energy Policy Review', 272.

41 McKinsey & Company, 'Europe's Path to Decarbonization', accessed 5 November 2021, https://www.mckinsey.com/business-functions/sustainability/our-insights/how-the-european-union-could-achieve-net-zero-emissions-at-net-zero-cost; Interreg Europe, 'Commission Launches the Fit for 55% Package', Interreg Europe, 22 July 2021, https://www.interregeurope.eu/policylearning/news/12610/commission-launches-the-fit-for-55-package/?no_cache=1&cHash=a371af17736f1f2f09030ee45e7dd6f2; 'Net Zero Strategy: Build Back Greener', 121.

42 European Commission, 'EU Emissions Trading System (EU ETS)', 2021, https://ec.europa.eu/clima/eu-action/eu-emissions-trading-system-eu-ets_nl.

43 European Commission, 'Allocation to Industrial Installations', 2021, https://ec.europa.eu/clima/eu-action/eu-emissions-trading-system-eu-ets/free-allocation/allocation-industrial-installations_en.

44 'Net Zero Strategy: Build Back Greener', 121.

New technologies

Apart from taking action to reduce the consumption of fossil fuels and increase energy efficiency, European countries are also active in developing new technologies. Governments rely on energy efficiency measures, increased circularity in industrial processes, but also capturing of emissions. The Hydrogen Strategy[45] places the wide scale deployment of hydrogen and the decarbonization of its production at the center of EU's climate policy. The European Raw Materials Alliance[46] seeks to secure supplies of critical raw materials needed for green energy technologies, while the European Battery Alliance[47] aims to make the EU the global leader in sustainable battery technology. These are examples of initiatives aimed to reshape the EU's industrial sector into one that is fit for a low-carbon, geopolitically tense world.

3.1.2. Scenarios & uncertainty

Europe is heading toward a low-carbon future, but the difference between sets of scenarios and regional circumstances is large. Developments in European countries are closely interlinked with the actions of major players in global energy markets such as China, the US, or OPEC+ (OPEC plus partners, including Russia) . While the ambition is to ensure a gradual and orderly exit of fossil fuels from Europe and the world, the 'delayed and disorderly' exit remains a real possibility.[48] Over time, governments have failed to reach their climate goals, and scenarios developed by different international institutions are constantly updated. The Russian invasion of Ukraine in early 2022 shows how quickly a situation can change the outlook for European energy policy. European policymakers are now looking into ways to replace Russian imports of LNG and oil with alternative sources, while also finding ways to deal with the possibility of sanctions on oil and gas. This is not only technically complex, but also very expensive. Whereas climate action remains Europe's main priority, the Russia-Ukraine conflict made geopolitics and security of supply take precedence over climate goals in the short term. This situation shows the uncertainty and unpredictability of the next decades.

Until now, European countries have been active in decarbonizing their energy and transport sectors, leading to a decrease in oil demand of 2 mb/d over the last 20 years.[49] Energy efficiency measures, the electrification of the European car fleet as well as the blending of biofuels into conventional fuels, led to this achievement. Newly introduced regulation, through the 'Fit for 55' package for instance, will further oblige national governments to obey the increasingly ambitious targets for 2030 and 2050. The consequences of COVID-19 are still unfolding, but changes in people's behaviors in relation to working and traveling could further negatively impact oil demand.[50] The EU has announced plans to accelerate the energy transition in order to decrease dependence on Russia following the Ukrainian invasion in 2022.

45 European Commission, 'A Hydrogen Strategy for a Climate-Neutral Europe', Pub. L. No. COM/2020/301, COM(2020) 301 (2020), https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52020DC0301.

46 'European Raw Materials Alliance (ERMA)', European Raw Materials Alliance (ERMA), accessed 23 August 2021, https://erma.eu/.

47 'Building a European Battery Industry', *European Battery Alliance* (blog), accessed 23 August 2021, https://www.eba250.com/actions-projects/priority-actions/.

48 BP, 'Carbon Emissions', bp global, 2020, https://www.bp.com/en/global/corporate/energy-economics/energy-outlook/carbon-emissions.html.

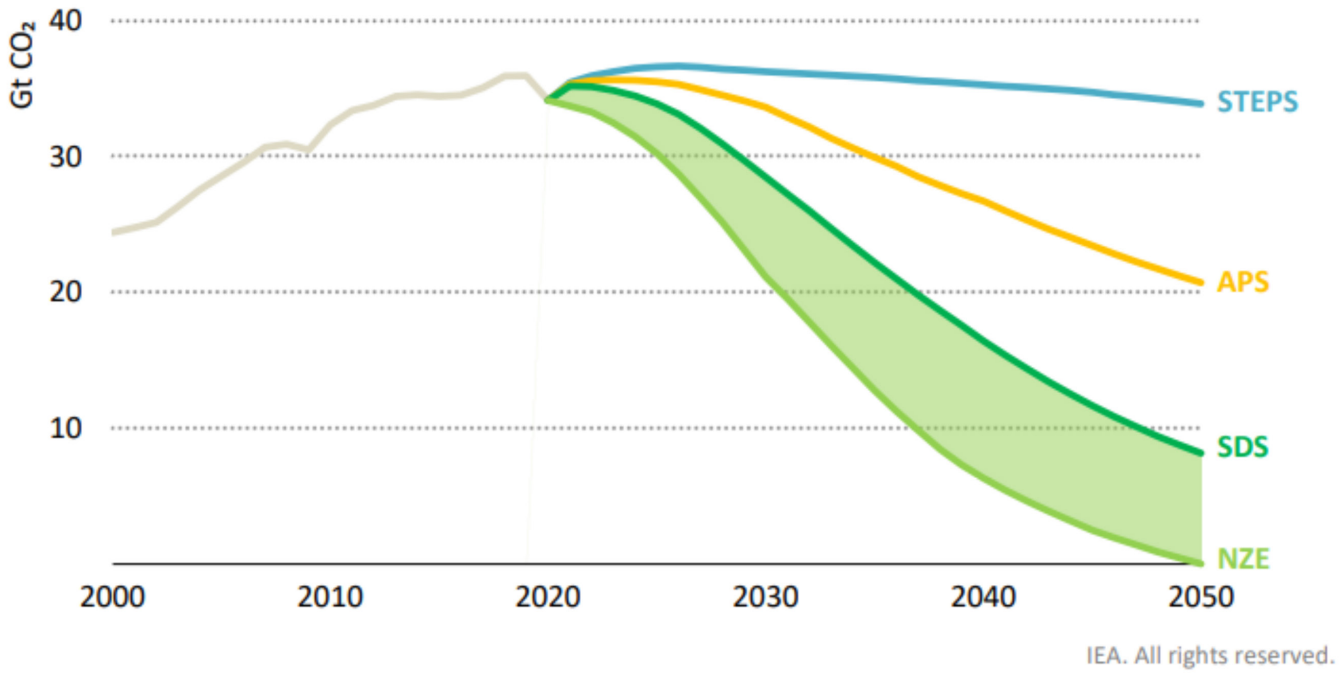
49 IEA, 'World Energy Outlook 2019', 2019, 134, https://www.iea.org/reports/world-energy-outlook-2019/oil.

50 IEA, 'Oil 2021' (Paris: IEA, 2021), 32, https://www.iea.org/reports/oil-2021.

There are many different predictions and scenarios for future fossil fuel demand, underlining the uncertainty that dominates the next decades.[51] The extent to which carbon emissions will decrease depends on various factors, including policies and legislation, technological development, investments, as well as the geopolitical scene. Different scenarios have been developed by institutions like the International Energy Agency (IEA), Equinor, or OPEC. Each of these is based on a distinct set of assumptions, which can have a large impact on the projected outcomes for 2030 and 2050. Figure 1 shows the different outcomes of the various IEA scenarios.

For example, the large difference between the IEA's Stated Policies Scenario (STEPS) and the Announced Pledges Scenario (APS), visible in Figure 1, is caused by the so-called "implementation gap". Governmental pledges need to be supported by clear, ambitious, and coherent policies, otherwise the ambitions might not be achieved due to failure to implement. According to the STEPS of the IEA's World Energy Outlook 2021, European oil demand will fall from 11.9 mb/d in 2020 to 10.4 mb/d by 2030, while the APS predicts a more steep fall to 9.0 mb/d.[52] By contrast, in its 2021 World Oil Outlook, OPEC projects that the oil demand of OECD Europe will go from 14.3 mb/d in 2019 to 11.6 mb/d by 2035.[53]

Figure 1. Carbon emissions in different IEA scenarios
From IEA, World Energy Outlook 2021, p. 33. STEPS – Stated Policies Scenario; APS – Announced Pledges Scenario; SDS – Sustainable Development Scenario; NZE – Net Zero Emissions by 2050 Scenario



51 For more information see Jilles van den Beukel et al., 'The European Tank Storage Sector and the Global Energy Landscape' (HCSS, 2021), 9–15.

52 IEA, 'World Energy Outlook 2021' (Paris: IEA, 2021), 315, https://www.iea.org/reports/world-energy-outlook-2021.

53 OPEC, 'World Oil Outlook 2045', 2021, 98.

When it comes to gas demand, the IEA's STEPS projects that Europe's gas demand will decline from 596 bcm/year in 2019 to 587 bcm/year by 2030. Contrastingly, the APS foresees a significantly larger drop to 504 bcm/year by 2030.[54] While there is undoubtedly significant pressure within the European community to decarbonize and measures are increasingly taken in that direction, gas demand is expected to only slightly decrease, up to 2030. One important reason for this expectation relates to nuclear phase-out and coal-to-gas switching programs across Europe. For instance, Germany is going to shut down all of its nuclear plants in 2022, while the country plans to phase out its coal-fired power generation by 2038, which currently still accounts for 12 % and 30 % of Germany's electricity production, respectively.[55] Similarly, many Central-, Eastern- and Southeastern European countries, which currently strongly depend on coal for their power generation, are increasingly compelled to switch from coal to gas by increasing carbon prices.[56] If security of supply and current tensions with Russia take precedence over climate goals, increasingly more countries might delay plans to close nuclear and coal power plants.

3.2. **Chemical industry**

The EU and UK aim to decarbonize chemical industry up to 2050, while also placing the safety of residents at the forefront of mid and long-term plans. Energy efficiency and carbon capture, utilization and storage (CCUS) are some key measures that European governments, both EU and British[57] ones, are focusing on. Replacing the feedstock and energy source within chemical industries with sustainable materials and ramping up recycling processes are additional measures for decarbonizing this sector.

The ambition is to reform the EU chemicals policy in order to develop more rapid and effective responses to hazardous chemical threats.[58] In this way, the chemical industry will become a sustainable sector that promotes green and digital transitions. The long-term approach is the development of a toxic-free environment.[59] The EU is already considered a leader in the production and use of safe chemicals.[60]

Maintaining a strong chemical industry throughout the green transition supports Europe's strategic autonomy. Resilient value chains and diversified suppliers for critical chemicals, such as those necessary for pharmaceutical production, together with increasing crisis response effectiveness, is essential.[61] The COVID-19 pandemic challenged the limited number of chemical suppliers for essential use, which could endanger the supply of medicine and the EU's ability to respond to health emergencies.[62] The pandemic emphasized Europe's need for

54 IEA, 'World Energy Outlook 2021', 317.

55 'Spelling out the Coal Exit – Germany's Phase-out Plan', Clean Energy Wire, 12 November 2019, https://www.cleanenergywire.org/factsheets/spelling-out-coal-phase-out-germanys-exit-law-draft; 'Germany Nuclear Phase-out on Course for Completion by 2022', accessed 20 August 2021, https://www.nsenergybusiness.com/news/germany-nuclear-phase-out-2022/.

56 Forrest Crellin, 'High Carbon Prices Prompt Coal-to-Gas Fuel Switching', Reuters, 22 April 2021, https://www.reuters.com/business/energy/high-carbon-prices-prompt-coal-to-gas-fuel-switching-2021-04-21/.

57 'Net Zero Strategy: Build Back Greener', 127.

58 European Commission, 'Chemicals Strategy for Sustainability Towards a Toxic-Free Environment', 14 October 2020, https://ec.europa.eu/environment/pdf/chemicals/2020/10/Strategy.pdf.

59 European Commission.

60 European Commission, 3; European Commission, 20.

61 European Commission, 'Chemicals Strategy for Sustainability Towards a Toxic-Free Environment', COM(2020) 667 § (2020), 3, https://eur-lex.europa.eu/resource.html?uri=cellar:-f815479a-0f01-11eb-bc07-01aa75ed71a1.0003.02/DOC_1&format=PDF.

62 European Commission, 'Chemicals Strategy for Sustainability Towards a Toxic-Free Environment', 8.

self-sufficiency in pharmaceutical production. Through strategic foresight and interregional cooperation along entire value chains, the EU aims to identify and mitigate dependencies for strategic chemical products. Strategic reserves and stockpiling are emphasized in the EU Chemical Strategy as ways to reduce vulnerabilities and increase strategic autonomy.

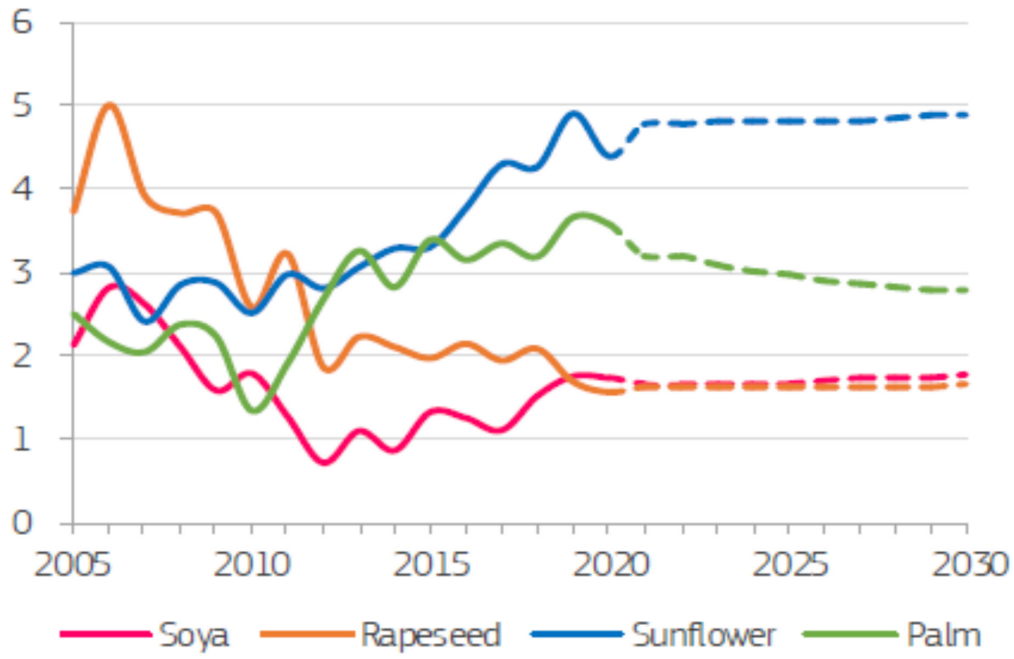
3.3. Edible oils & animal feed

3.3.1. Edible oils

Soya, rapeseed, sunflower and palm oil are the four main edible oils consumed in Europe. The consumption levels of these four oils in the food industry, measured in million tonnes (mt), is shown by Figure 2. The EU expects sunflower oil to remain the dominant vegetable oil for food use, with demand levels hovering around 5 mt by 2030 (Figure 2).

Ukraine is Europe's largest supplier of sunflower oil, with a 93% market share in 2020.[63] Ukraine is also the main supplier of soybean oil and rapeseed oil, with about 40% of European imports.[64] Russia is Europe's second supplier for both soybean and rapeseed oil. The war between Russia and Ukraine in 2022 has already had a significant impact on prices and could further lead to shortages of oilseeds, oils and therefore biofuels in Europe.

Figure 2. EU food use of oil (million tonnes)
From EU agricultural outlook for markets and income 2020-2030, 21



63 'Ukraine is the largest supplier of sunflower oil to EU', Ministerie van Landbouw Natuur en Voedselkwaliteit (Ministerie van Landbouw, Natuur en Voedselkwaliteit, 28 September 2020), https://www.agroberichten-buitenland.nl/actueel/nieuws/2020/09/30/ukraine-sunflower-export.

64 'Ukraine is the largest supplier of sunflower oil to EU'.

For biodiesel production, rapeseed oil is the primary ingredient in Europe, followed by palm oil.[65] Rapeseed oil is projected to remain the main feedstock for biofuels up to 2030, provided that exports from Ukraine are resumed swiftly.[66] Up to 2030 it is expected that palm oil will be used in an increasingly limited manner, for food processing.[67] In biofuel production, the share of palm oil will likely decrease from 23% in 2020 to 11% in 2030.[68]

The decrease in consumption of palm oil, both for biofuel production and human consumption, is the main trend affecting this industry.[69] European palm oil consumption increased rapidly in the 2010s (Figure 2), but sustainability concerns related to deforestation, pesticide usage and impacts on biodiversity are causing a decrease in European usage of palm oil.[70] In 2019, the EU was the third largest palm oil consumer, after Indonesia and India.[71] Increasing biodiesel requirements in Indonesia, the world's largest palm oil producer, will pressure global palm oil supplies in the next years.[72]

3.3.2. **Animal feed**

In the forecast period of 2020-2025, fats and oils are increasing in popularity for usage in animal feed products because of the health benefits for poultry and cattle.[73] Fats and edible oils deliver around 2.5 times more digestible energy than, for example, carbohydrates or proteins. Another reason why animals are fed fats and oils is the heat producing mechanism that oils provide the animals with during the digestion process. Oils and fats function as lubricants that promote feed intake, processing, pelleting, and the reduction of dust. In the past, mainly poultry and swine were fed with fats. Now, animal diets comprise higher energy levels, which is why the usage of oils and fats in animal nutrition has increased. Especially in periods of high grain prices, fat addition is more efficient for sufficient energy intake.[74] In 2021, the focus of the global feed outlook was sustainability. The industry aims to develop towards more sustainable ingredients, new production sites, processes and feeding technologies.[75] Consequently, this could translate into a higher reliance on more vegetable oil options in animal feed. Besides the sustainable focus in the animal food industry, no disruptive trends are observable.

65 European Commission. Directorate General for Agriculture and Rural Development., *EU Agricultural Outlook for Markets and Income 2020-2030.* (LU: Publications Office, 2020), 27, https://data.europa.eu/doi/10.2762/252413.

66 European Commission. Directorate General for Agriculture and Rural Development., 27.

67 European Commission. Directorate General for Agriculture and Rural Development., 22.

68 European Commission. Directorate General for Agriculture and Rural Development., 27.

69 European Commission. Directorate General for Agriculture and Rural Development., 22.

70 European Palm Oil Alliance, 'The Palm Oil Story', 2019, 8, https://palmoilalliance.eu/wp-content/uploads/2019/10/Brochure-Palm-Oil-Story-2019-FINAL.pdf.

71 European Palm Oil Alliance, 9.

72 OECD/FAO, 'Oilseeds and Oilseed Products', in *OECD-FAO Agricultural Outlook 2019-2028*, 2019, 143.

73 Mordor Intelligence, 'Fats and Oils Market | 2021 - 26 | Industry Share, Size, Growth - Mordor Intelligence', 2020, https://www.mordorintelligence.com/industry-reports/fats-and-oils-market.

74 Tennis Marx, 'Feeding Fats and Oils in Feedlot Diets', n.d., 5.

75 Treena Hein, 'Global Feed Outlook for 2021', All About Feed, 4 January 2021, https://www.allaboutfeed.net/market/global-feed-outlook-for-2021/.

4. The international playing field

The global oil demand and supply dynamics are changing, as countries all around the world are aspiring to phase out fossil fuels and replace them with low-carbon energy sources. The degree of success and speed of implementation differ dramatically per country. The EU is aiming to be a leader in green policymaking and become the first climate-neutral continent in the world. Whereas China has announced climate neutrality goals up to 2060, its natural gas and oil demand are expected to increase in the mid-term. Saudi Arabia and Russia have also recently announced their net-zero goals for 2060 and 2050 respectively, but at the same time plan to increase or maintain their oil output over the next decade.

Global energy markets are uncertain. Developments in the mid-term, up to 2030, will determine the role that European tank storage can have in the energy transition. This section will outline the trends in the fossil fuel sector up to 2030-2035 from the world's major producers and consumers, focusing on those that are most pertinent to Europe.

4.1. Oil & petrochemicals

4.1.1. Oil demand & storage capacity: China and India take the lead

Global consumption patterns of oil products are expected to change, shifting from Europe and North America towards East Asia, the Middle East, and Africa.[76] The global peak in gasoline demand has already passed, with consumption in OECD expected to fall dramatically

76 The exception is global jet fuel demand, which is unlikely to suffer any significant changes on the mid-term. See IEA, 'Oil 2021' for more information.

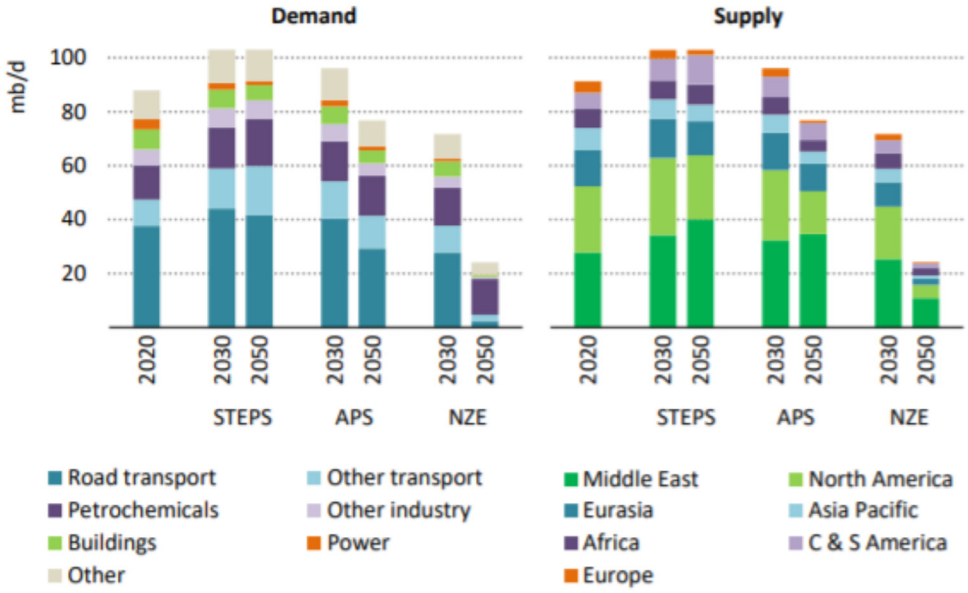
in the next 5-10 years as a result of the electrification of transport.[77] Similarly, after a small post-pandemic increase in diesel consumption in Europe and North America, it is expected to decrease significantly up to 2030.[78] Low-Sulphur marine fuel oil, as mandated by the International Maritime Organization (IMO), is steadily growing in importance compared to the heavy bunker fuel that was used until now.

Unlike in Europe and the US, the demand for oil products such as gasoline and diesel will continue to grow in the coming years in East Asia, the Middle East, and Africa due to increasing living standards and population growth.[79] The transport and petrochemical industries are expected to drive oil growth up to 2030 (Figure 3). Two-thirds of the growth in naphtha and LPG demand up to 2026 is stimulated by petrochemicals.[80]

Specifically, China and India are expected to account for the majority of the increase in oil demand in East Asia. China will likely add about 3-4 mb/d to its current oil consumption of 14 mb/d by 2040.[81] This is due to the continuous use of fossil fuel-fired passenger cars (19 million annually sold compared to 2 million EV sales) in China, the fact that sales of more energy-intensive SUVs are on the rise and that the petrochemical industry is rapidly expanding.[82]

Figure 3. Projected global oil demand and supply in 2030 and 2050

From IEA, World Energy Outlook 2021, p. 220



77 IEA, 'Oil 2021', 31.

78 IEA, 34.

79 IEA, 31.

80 IEA, 24.

81 'World Energy Outlook 2017: China – Analysis -', IEA, November 2017, https://www.iea.org/reports/world-energy-outlook-2017-china; Michal Meidan, 'Glimpses of China's Energy Future' (Oxford Institute for Energy Studies, September 2019), https://www.oxfordenergy.org/wpcms/wp-content/uploads/2019/09/Glimpses-of-Chinas-energy-future.pdf; Michal Meidan, 'China's Oil Demand in the Wake of COVID-19' (Oxford Institute for Energy Studies, September 2020), https://www.oxfordenergy.org/wpcms/wp-content/uploads/2020/09/Chinas-oil-demand-COVID-19.pdf.

82 Dawn Lee, 'EIG Article : China to Have Oversupplied Oil Market for Decades', Energy Intelligence, 18 December 2020, https://www.energyintel.com/pages/eig_article.aspx?DocID=1092970; Tsvetana Paraskova, 'Is China Headed To Peak Oil Demand?', OilPrice.com, 2 December 2021, https://oilprice.com/Latest-Energy-News/World-News/Is-China-Headed-To-Peak-Oil-Demand.html; 'China: Car Sales 2008-2019', Statista, accessed 31 October 2021, https://www.statista.com/statistics/233743/vehicle-sales-in-china/.

The situation in India is similar. The Stated Policies Scenario (STEPS) of the IEA predicts an increase from 4.0 mb/d to 8.7 mb/d by 2040, while the Sustainable Development Scenario (SDS) expects a 1.0 mb/d increase in India's oil demand.[83] As in China, India's increasing oil demand stems from its ambition to improve its living standards and reduce poverty.[84] Concretely, about 270 million people are anticipated to become part of India's urban population over the next two decades and therefore push up oil demand in the transport and petrochemical sector.[85]

Both countries have insufficient domestic production capabilities, with China providing about 4 mb/d of its 14 mb/d demand and India merely 0.8 mb/d of its 4.0 mb/d.[86] To ensure domestic security of supply, China and India will increase their oil imports over the next two decades, altering global oil supply chains.

But changes are not restricted to the development of oil demand. The significant expansion of China's refining capacity is expected to turn the country into the world's largest oil refiner. It would not only overtake Europe, but also the US, which has dominated this industry since the 19th century.[87] Investments over the past two decades have more than tripled China's refining capacity. By 2025, the country could process more than 20 mb/d of crude oil, according to China National Petroleum Corporation.[88] Sinopec, the largest player in the global tank terminal market and one of China's biggest oil companies, is planning expansions of its petro-chemical capacity up to 2030.[89] The primary driver of such expansion is plastic demand. Asia is currently a net importer of naphtha, LPG, ethylene, and propylene, despite being the fastest growing market of plastics.[90] As such, more than 70% of added refining capacity across Asia is aimed at streamlining the plastics supply chain.[91]

China holds significant strategic petroleum reserves (SPR), and inventories are believed to have been steadily filling up since 2016. Although China is not a member of IEA, its National Energy Administration (NEA) declared its goal of stocking 90 days' worth of imports, following IEA requirements. In 2019, the NEA confirmed the existence of 80 days' equivalent of stocks.[92] Inventory levels are rarely publicly announced but are estimated at approximately 300 million barrels, complemented by commercial stocks of 600 million barrels.[93] China is ramping up its storage capacity even further, being a main driver behind the current Asian terminal expansion, i.e., where capacity addition projects to existing terminals are in place. Since 2014, the Chinese government opened facilities in Tianjin, Huizhou, and Jinzhou as part

83 'India Energy Outlook 2021 – Analysis', IEA, 14, accessed 6 October 2021, https://www.iea.org/reports/india-energy-outlook-2021.

84 'India Energy Outlook 2021 – Analysis', 76.

85 'India Energy Outlook 2021 – Analysis', 88.

86 'China Crude Oil Production | 2021 Data | 2022 Forecast | 1973-2020 Historical | Chart', accessed 31 October 2021, https://tradingeconomics.com/china/crude-oil-production; 'India Energy Outlook 2021 – Analysis', 113.

87 Saket Sundria, Gerson Jr Freitas, and Rachel Graham, 'China to Take Oil-Refining Crown Held by US Since 19th Century', Bloomberg, 22 November 2020, https://www.bloomberg.com/news/articles/2020-11-21/china-is-set-to-eclipse-america-as-world-s-biggest-oil-refiner.

88 Sundria, Freitas, and Graham.

89 Oceana Zhou and Sambit Mohanty, 'Sinopec's Refining Roadmap to Feature Petrochemical Products, Cleaner Processes', 30 August 2021, https://www.spglobal.com/platts/en/market-insights/latest-news/energy-transition/083021-sinopecs-refining-roadmap-to-feature-petrochemical-products-cleaner-processes; Insights Global, 'Who Are the Biggest Players in the Tank Terminal Market?', *Insights Global* (blog), 5 December 2019, https://www.insights-global.com/who-are-the-biggest-players-in-the-tank-terminal-market/.

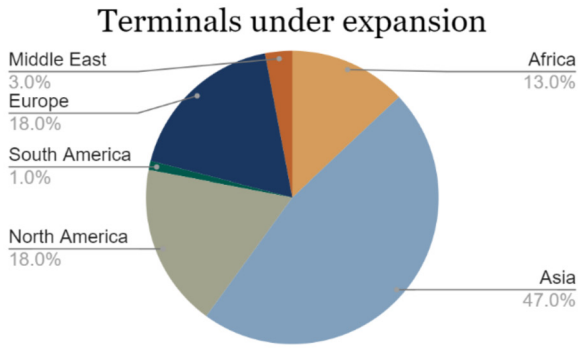
90 Sundria, Freitas, and Graham, 'China to Take Oil-Refining Crown Held by US Since 19th Century'.

91 Sundria, Freitas, and Graham.

92 Tom Daly, "China Has Enough Oil Inventories to Last about 80 Days: NEA," *Reuters*, September 20, 2019, https://www.reuters.com/article/us-china-energy-idUSKBN1W514V.

93 EIA, 'Country Analysis Executive Summary: China', 2020, 5.

Figure 4. Terminals under expansion per region
Data from Insights Global, 2021



of its second SPR expansion phase.[94] Figure 4 shows that 47% of the global expansion of tank terminals is taking place in Asia. A notable example is Oriental Energy, which increased its storage capacity in Ningbo, China by 500%.[95]

4.1.2. Oil supply: massive investments in the Middle East

The majority of additional oil supply until 2030 is set to come from the Middle East. Iraq, Iran, Saudi Arabia, and the United Arab Emirates (UAE) are four of the six producers expected to add most to their current production – next to the US and Brazil (Figure 5).

Figure 5. Expected changes in oil supply in the Stated Policies Scenario (STEPS) and the Announced Pledges Scenario (APS) of the IEA
From the World Energy Outlook 2021, 219

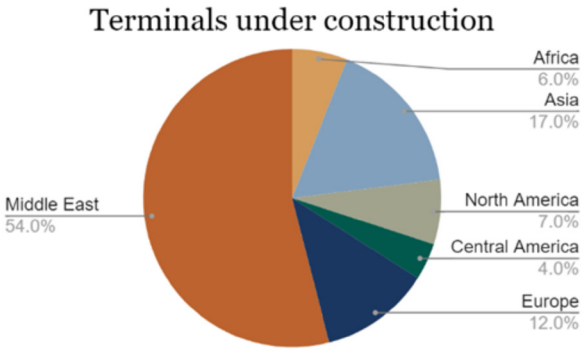
94 Oceana Zhou and Eric Yep, 'Analysis: China Puts Iranian Crude into Strategic Petroleum Reserves in June', SP Global, 30 July 2019, https://www.spglobal.com/platts/en/market-insights/latest-news/oil/073019-analysis-china-puts-iranian-crude-into-strategic-petroleum-reserves-in-june.

95 Jacob van den Berge, "Global Tank Storage Assets" (Insights Global, 2020), 6.

This is partially because energy transition goals have a less prominent role in Middle Eastern countries than in the EU or the US. Some of the world's largest oil and gas producers are nationally owned companies from the Middle East, such as Saudi Aramco, Qatar Petroleum, or the Abu Dhabi National Oil Company (ADNOC). Such national oil companies (NOCs) do not face the same public pressure to transition to sustainable energy sources as their international counterparts. Although clean energy plans have been announced in certain countries, they do not seem to go hand in hand with ambitions to decrease oil or gas production. This caused the enormous increase in tank storage capacity construction in the Middle East – the largest growth in the world, as seen in Figure 6.[96] Compared to capacity expansion, which refers to additional capacity in existing terminals, capacity construction refers to brownfield and greenfield projects.

Figure 6. Terminals under construction per region

Data from Insights Global, 2021



More oil: Saudi Arabia and the United Arab Emirates

Saudi Arabia is a very well-positioned oil producer in light of mid-term developments. The Kingdom is currently the second largest oil producer after the US, at about 12 mb/d, and possesses 17% of the world's proven reserves. The country also has the world's lowest lifting costs, second-lowest carbon intensity per unit of energy produced, and well-developed expertise and infrastructure within the oil industry.[97] Through enhanced technological efficiency and carbon capture and storage, the country aims to decrease its carbon intensity even further.[98] This is a significant competitive advantage if the EU or UK carbon border tax mechanisms are to materialize in the following years. Therefore, even as most other (international) companies are moving away from oil, nationally owned Saudi Aramco has the ability to be the "last one standing" in the global petroleum market.[99] Accordingly, the company intends

96 van den Berge, 8.

97 Bassam Fattouh, 'Saudi Oil Policy: Continuity and Change in the Era of the Energy Transition', 1, accessed 22 October 2021, https://www.oxfordenergy.org/publications/saudi-oil-policy-continuity-and-change-in-the-era-of-the-energy-transition/.

98 Rania El Gamal, Davide Barbuscia, and Marwa Rashad, 'Sole Survivor? Saudi Aramco Doubles down on Oil to Outlast Rivals', *Reuters*, 6 October 2020, https://www.reuters.com/article/us-saudi-aramco-strategy-insight-idUSKBN26R3PA.

99 Laury Haytayan et al., 'National Oil Companies and Energy Transition in the Middle East and North Africa' (Natural Resource Governance Institute, 2021), 2.

to increase its oil output, announcing a plan in 2021 to increase its capacity from 12 to 13 mb/d by 2027.[100]

Like Saudi Arabia, Abu Dhabi is taking visible steps to position itself in a favorable spot for the coming decades. Investments in crude production capacity, storage facilities as well as chemicals, point to Abu Dhabi (and the UAE) trying to reap the benefits of the oil demand in the Asia Pacific and to the slow exit of international players like BP or Shell from the oil market. The UAE emerged as a regional oil hub since the turn of the century through its Port of Fujairah. The geographical proximity to the Strait of Hormuz, through which approximately 20% of global oil supply passes, is a key asset.[101] Extensive investments in infrastructure led to a total storage capacity of 11 million m^3 in 2021.[102] The Fujairah oil infrastructure is continuously expanding in anticipation of important trade flows in the coming decades. The world's largest underground oil storage facility is being commissioned by ADNOC in Fujairah, with an expected capacity of 42 mb of crude oil by 2022.[103] The UAE's domestic oil reserves will continue being exploited as ADNOC announces the goal of increasing its production capacity to 5 mb/d by 2030, from its current 4 mb/d capacity.[104]

One key strategy to maintain profitability is to diversify into industries other than crude production, such as refining, chemicals, and petrochemicals. Saudi Aramco is already in close coordination with the refining sector, given that a third of its crude oil (about 3.9 mb/d in 2018) is sold to owned and affiliated refineries.[105] The company's vision is to become the "world's largest integrated energy and chemicals company".[106] In 2019, Aramco gained 70% equity in SABIC, a Saudi chemical manufacturing company with operations in over 50 countries, including the Netherlands.[107]

Downstream diversification is a strategy implemented by ADNOC in a similar fashion to its Saudi counterpart. Up to 2025, ADNOC will be investing up to $45 billion in refining and petrochemical industries. Gasoline production is increasing from 6 million ton per annum (mtpa) in 2016 to 10.2 in 2022, while petrochemical production is more than doubling from 4.5 mtpa in 2016 to 11.4 in 2022.[108]

100 Tsvetana Paraskova, 'Saudi Arabia To Boost Oil Production Capacity To 13 Million Bpd in 2027', OilPrice.com, 10 April 2021, https://oilprice.com/Latest-Energy-News/World-News/Saudi-Arabia-To-Boost-Oil-Production-Capacity-To-13-Million-Bpd-in-2027.html.

101 Anthony Di Paola, 'UAE's Brooge Petroleum Takes First Oil at Expanded Storage Site', *Bloomberg*, 2021, https://www.bloomberg.com/news/articles/2021-09-12/uae-s-brooge-petroleum-takes-first-oil-at-expanded-storage-site.

102 'Our Story | Port Of Fujairah UAE', *Port of Fujairah* (blog), accessed 16 September 2021, https://fujairahport.ae/about-us/port-of-fujairah-overview/.

103 Turkes, Hale. "ADNOC Announces Largest Underground Oil Storage Project." AA Energy, 2019. https://www.aa.com.tr/en/energy/general/adnoc-announces-largest-underground-oil-storage-project-/23666.

104 Roslan Khasawneh, 'Expecting Oil Trade Boom, Fujairah Oil Terminal Invests in VLCC Project', *Reuters*, 27 August 2021, sec. Energy, https://www.reuters.com/business/energy/expecting-oil-trade-boom-fujairah-oil-terminal-invests-vlcc-project-2021-08-27/.

105 Saudi Aramco, 'Prospectus', 2019, 62, https://www.aramco.com/-/media/images/investors/saudi-aramco-prospectus-en.pdf.

106 'Saudi Aramco Annual Report', 2019, 16, https://www.aramco.com/-/media/publications/corporate-reports/saudi-aramco-ara-2019-english.pdf.

107 'Saudi Aramco Annual Report', 190.

108 'Supreme Petroleum Council Approves ADNOC's 2030 Strategy and Five Year Business Plan', 2016, https://www.adnoc.ae:443/en/news-and-media/press-releases/2016/spc-approves-adnoc-strategy.

Iran and Iraq: Wildcards

The two neighboring states are in a similar position when it comes to their oil industry. Both have enormous conventional oil reserves that can be produced at a relatively low cost, but both have fallen short of realizing this potential due to their own set of circumstances.

For Iran, the inhibiting factor has been its internationally isolated position, largely due to strict sanctions from western powers. While the Joint Comprehensive Plan of Action (JCPOA) or, short, the Iran nuclear agreement, reached in 2015 gave the prospect of sanctions being lifted, the Trump administration further intensified them after May 2019. Iran's oil production has been hovering at around 4 mb/d over the past three decades, with a drop of about 2.5 mb/d after the imposition of the sanctions of the Trump administration. Yet Iran unofficially continued to supply other countries – most notably China – despite the sanctions. This means that Iran's real production and export is likely substantially higher than reflected in its official numbers. In 2022, negotiations are taking place for the reestablishment of a nuclear deal akin to the JCPOA. If sanctions are lifted, Iran aims to increase its oil production by about 1.4 mb/d.[109] This could be used to replace a part of Russian crude oil imports, which amount for 5 mb/d.

For Iraq, the situation is even more complicated. Decades of political unrest and conflict have strongly inhibited the development of Iraq's oil industry and heavily damaged its oil infrastructure.[110] After approaching IOCs to become involved in Iraq's oil sector, the country's oil production grew tremendously, going from 2.5 mb/d in 2011 to about 4.5 mb/d in 2017. It has considerable potential, with observers pointing out that Iraq could rival Saudi Arabia in its production output at similar costs.[111] Nevertheless, many of the structural problems remain. Iraq's down- and midstream segments remain heavily underdeveloped. Water is needed to maintain or increase production in Iraq's oil fields. As such, water shortages have been one of the principal restricting factors to Iraq's ambition to increase its oil output.[112] The Iraqi state is also in a highly precarious financial position, and many IOCs such as BP, ExxonMobil, and Lukoil have been withdrawing their employees and canceling their contracts over the past years due to the insecure environment and a lack of reliability on part of the Iraqi state.[113] In other words, both Iraq and Iran could be a potential wildcard and add enormous volumes to the global oil supply chain.

109 Stephanie Liechtenstein, 'Russia Obstructs Iran Nuclear Deal as the Kremlin Frets over Its Oil Income', POLITICO, 5 March 2022, https://www.politico.eu/article/russia-obstructs-iran-nuclear-deal-as-the-kremlin-frets-over-oil-income/.

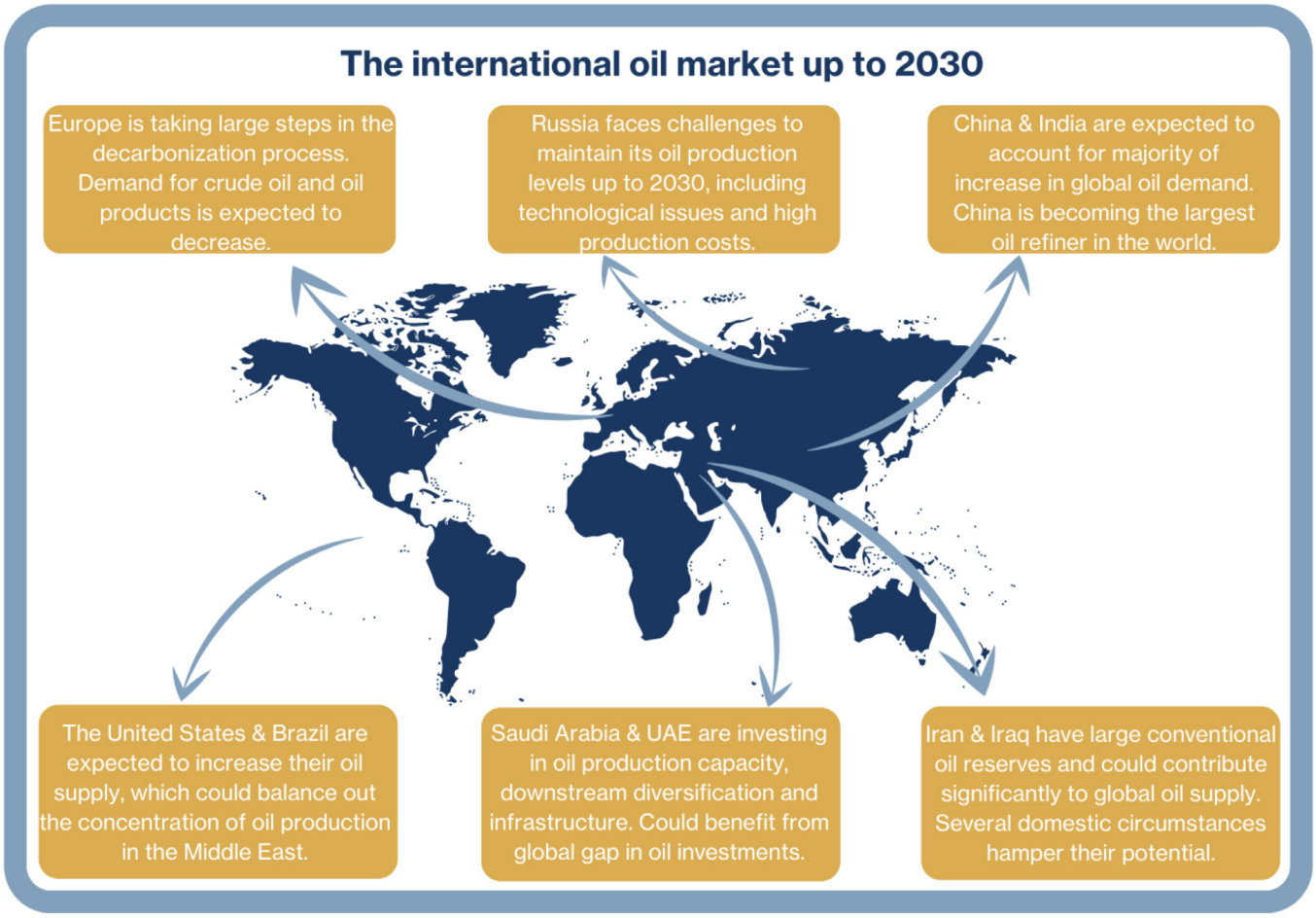
110 Ahmed Mehdi, 'Iraqi Oil: Industry Evolution and Short and Medium-Term Prospects' (Oxford Institute for Energy Studies, October 2018), 3, https://www.oxfordenergy.org/publications/iraqi-oil-industry-evolution-short-medium-term-prospects/.

111 Mehdi, 8.

112 'Iraq's Energy Sector: A Roadmap to a Brighter Future | En | OECD', 24, accessed 24 October 2021, https://www.oecd.org/publications/iraq-s-energy-sector-949e7e1e-en.htm.

113 'Foreign Oil Firms Seek Exit from Iraq over "Unsuitable" Environment |', AW, accessed 31 October 2021, http://thearabweekly.com/foreign-oil-firms-seek-exit-iraq-over-unsuitable-environment.

Figure 7. The international oil market up to 2030, considering main consuming and producing countries



Russia

Russia is the third largest oil producer, after the US and Saudi Arabia. Its oil output grew significantly over the past two decades, reaching almost 12 mb/d in 2019.[114] The country holds special importance for Europe, as it provides almost 27% of all of Europe's oil imports, which is more than Middle Eastern exports to Europe.[115] Russia's relationship with Europe came under significant stress due to the invasion of Ukraine in 2022. European energy policy seems to be heading toward replacing Russian oil, but the extent to which countries will choose to do so in the next decade depends on the evolution of sanctions, the availability of sufficient and affordable alternative supplies of oil, and the degree of continued tensions with Russia, among others.

Moreover, a set of technical problems will likely make it difficult for Russia to maintain its current level of oil production until 2030-2035.[116] Most importantly, Russia's operating oil

114 IEA, 'Oil Market Report', April 2020, 67.

115 Eurostat, 'From Where Do We Import Energy?', Shedding light on energy on the EU, 2019, https://ec.europa.eu/eurostat/cache/infographs/energy/bloc-2c.html.

116 See Jilles van den Beukel and Lucia van Geuns, 'Russia's Unsustainable Business Model: Going All In on Oil and Gas', (The Hague Centre for Strategic Studies, January 2021), https://hcss.nl/sites/default/files/files/reports/Russias%20Unsustainable%20Business%20Model.pdf.

fields are old and have a very strong decline rate as well as a very high water cut. This means that Russia will inevitably have to either increasingly bring new fields into operation or apply more enhanced oil recovery (EOR) to its operating fields. The majority of Russia's remaining large oil fields are unconventional oil reserves, which are not only technologically challenging to produce for Russia – especially as the country cannot resort to the equipment and technologies of international oil service companies since sanctions were imposed in 2014 – but also have substantially higher production costs. Additional sanctions from 2022 could further constrain Russia's production capabilities.

Baseline scenarios predict that Russia's oil output will drop to 8.5-9.6 mb/d by 2030, which contrasts with the rather optimistic prognosis of the IEA's 2021 World Energy Outlook that Russia will add about 0.6-0.7 mb/d to its output by 2030.[117] Nevertheless, in 2019 Russia's flagship oil company Rosneft launched the Vostok Oil Project, which is expected to add 2.0 mb/d to Russia's oil output by 2030. Progress on this megaproject is progressing steadily. 8.7 billion USD worth of contracts were handed out in 2021 for the development of the project and even global commodity behemoths Trafigura and Vitol (in tandem with Mercantile and Maritime Energy) have a 10% and 5% stake respectively in it.[118]

Russia's refining sector is rather unsophisticated. Its refineries have little secondary refining processes, and therefore the products they yield are usually of the heavier and lower-value type. As current demand patterns strongly favor light products, this puts Russia in a disadvantageous position.[119] Nevertheless, with a total refining capacity of 6.5 mb/d, Russia's refining industry is significant. Moreover, the Russian government has been implementing tax schemes that are favorable to lighter high-quality products, in order to spur Russian companies to upgrade their refineries.[120]

United States and Brazil

Despite more rigid climate policies under the Biden administration, the US is still expected to provide a bulk of the added oil supply over the next decade, with an anticipated increase of almost 3.5 mb/d through its shale oil production. US shale oil operators stated that they can lower the breakeven price of their projects down to 35 USD/barrel, making them more competitive.[121] The Biden administration has furthermore been more accommodating to the American fossil fuel sector than anticipated, even outpacing "the Trump administration in approving new permits to drill on public land."[122] Nevertheless, production growth in the

117 Tatiana Mitrova, Ekaterina Grushevenko, and Artem Malov, 'The Future of Oil Production in Russia: Life Under Sanctions' (Skolkovo Energy Centre, March 2018), https://energy.skolkovo.ru/downloads/documents/SEneC/research04-en.pdf; James Henderson and Ekaterina Grushevenko, 'The Future of Russian Oil Production in the Short, Medium, and Long Term' (Oxford Institute for Energy Studies, September 2019), https://www.oxfordenergy.org/publications/the-future-of-russian-oil-production-in-the-short-medium-and-long-term/.

118 'Rosneft Signs 73 Contracts Worth 616.5 Billion Rubles at St. Petersburg Economic Forum', 6 April 2021, https://www.rosneft.com/press/releases/item/206555/; Julia Payne and Dmitry Zhdannikov, 'UPDATE 2-Trading Firm Trafigura Buys 10% Stake in Rosneft's Vostok Oil', *Reuters*, 30 December 2020, sec. Integrated Oil & Gas, https://www.reuters.com/article/trafigura-beheer-rosneft-oil-vostok-oil-idUSL1N2JA0JI; Rosneft, 'Rosneft Agrees Heads of Terms to Sell a Stake in the Vostok Oil Project to a Consortium of Vitol and Mercantile & Maritime', 6 October 2021, https://www.rosneft.com/press/releases/item/206647/.

119 Vitaly Yermakov, James Henderson, and Bassam Fattouh, 'Russia's Heavy Fuel Oil Exports: Challenges and Changing Rules Abroad and at Home' (Oxford Institute for Energy Studies, April 2019), 5, https://doi.org/10.26889/9781784671358.

120 Alan Gelder, 'Why Russia Matters To The Refining Sector', Forbes, 19 November 2018, https://www.forbes.com/sites/woodmackenzie/2018/11/19/why-russia-matters-to-the-refining-sector/.

121 'USA Oil Production Outlook Set to Grow', accessed 31 October 2021, https://www.rigzone.com/news/usa_oil_production_outlook_set_to_grow-28-sep-2021-166559-article/.

122 'Biden Team Asks Oil Industry for Help to Tame Gas Prices', POLITICO, accessed 31 October 2021, https://www.politico.com/news/2021/10/13/white-house-biden-gas-prices-515957.

US is currently slow as many shale oil producers have neglected their shareholders over the past years, and now need to pay out dividends, which is diverting these financial means from investments.[123]

Brazil is also in a fairly auspicious position to further increase its oil output. The country already went from a 1.5 mb/d production in 2000 to 3.0 mb/d in 2020 and is projected to reach at least 4 mb/d by 2030.[124] This projected growth is due to Brazil's so-called enormous offshore "Transfer of Rights" (TOR) area, which is estimated to hold 6 to 15 billion barrels of oil and add 1.4 mb/d to Brazil's production by 2030.[125]

4.2. **LNG**

4.2.1. **LNG demand**

The decrease in Europe's domestic production of gas, especially in the Netherlands, could become problematic if this is not matched with a proportional decrease in demand. Securing supplies of natural gas until low-carbon sources can provide a stable energy source will become a key issue for the EU in the mid-term. The Netherlands is increasingly relying on the spot market to ensure supplies, unlike the other European countries which are still involved in more secure, long-term contracts.[126] While the global LNG market is steadily maturing, and prices in the major markets of the US, Europe, and Asia, are slowly converging, the spot market remains an uncertain energy source compared to long term contracts. Most scenarios to 2030 expected that most European natural gas demand will continue being satisfied through pipeline gas, largely from Russia, due to relatively low prices compared to the spot market and reliable supplies. However, European countries seem to be embarking on a different path due to the 2022 conflict, leading to alternative LNG supplies from the US or elsewhere, more volatility and higher prices. This might not lead to independence from Russian gas, but it would lead to a significantly lower share of Russian gas in the European energy mix.

Depending on the scenario considered, natural gas consumption varies significantly (Figure 8). In STEPS, EU natural gas demand will only slightly decrease, the bulk of imports coming through pipelines. Middle Eastern LNG could play a more prominent role in European imports in 2030 compared to 2021. Contrastingly, APS sees a significant decline in natural gas consumption, both pipeline and LNG.

Whereas European gas consumption is expected to decrease, developing countries in Asia as well as China will account for most of global increase in demand and imports. China is now

123 Matt Egan Business CNN, 'Big Oil Blasts Biden for Turning to OPEC for More Crude', CNN, accessed 13 September 2021, https://www.cnn.com/2021/08/13/business/gas-prices-biden-opec/index.html.

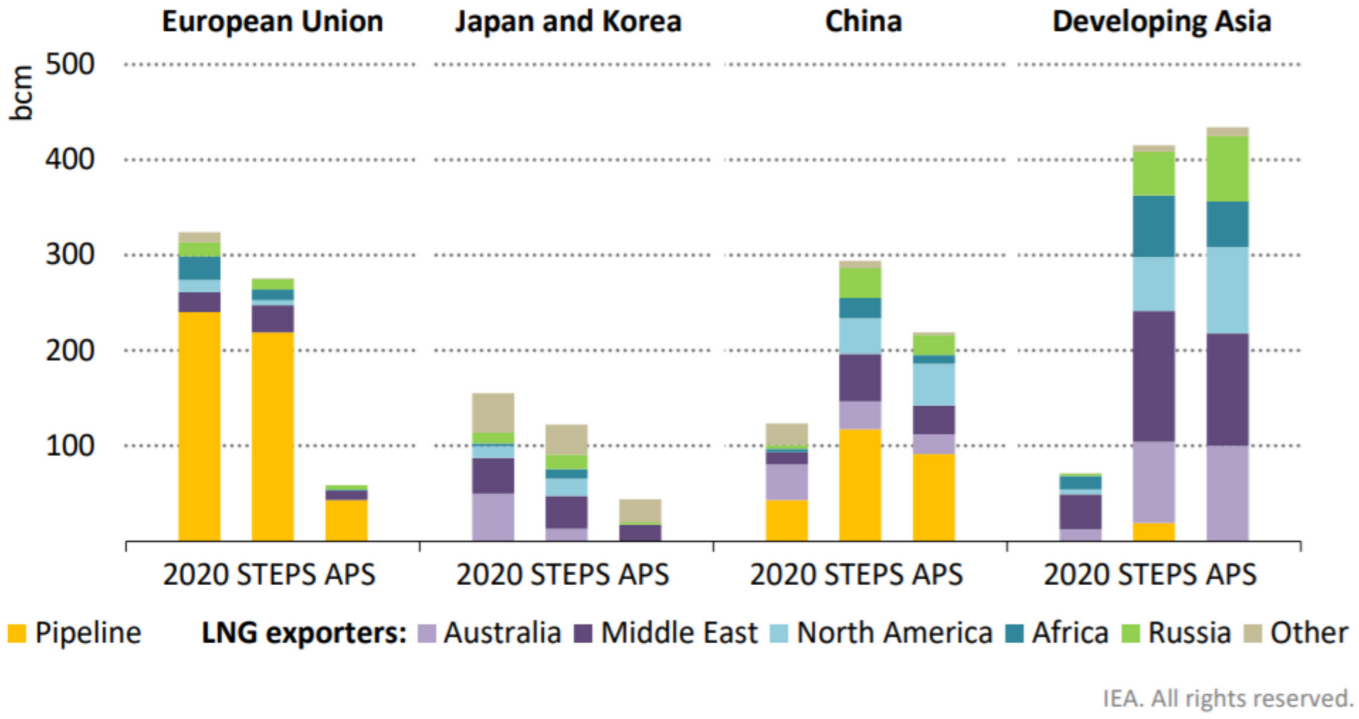
124 Jeff Fick, 'Commodities 2021: Brazil Eyes More Oil Industry Reforms to Lure Investors', 31 December 2020, https://www.spglobal.com/platts/en/market-insights/latest-news/electric-power/123120-commodities-2021-brazil-eyes-more-oil-industry-reforms-to-lure-investors.

125 Claudio Steuer, 'Brazil Upstream Bid Rounds - Evolve to Grow', The Oxford Institute for Energy Studies, December 2019, 1–3, https://www.oxfordenergy.org/wpcms/wp-content/uploads/2019/12/Brazil-upstream-bid-rounds.pdf.

126 Simon Blakey et al., 'The Swing in Dutch Gas: From Autonomy to Full Dependence', Strategic Report (IHS Markit, November 2018), 5, https://cdn.ihs.com/www/pdf/1118/IHS-Markit-The-Swing-Dutch-Gas.pdf.

Figure 8. Mid-term outlook (2030) for global natural gas imports

From IEA, World Energy Outlook 2021, 228



the world's largest natural gas importer and 62% of imports come in the form of LNG, primarily from Australia (29%) and Qatar (9%).[127]

Figure 8 shows that up to 2030, Chinese LNG imports will increase in both STEPS and APS, though there is a difference of about 80 bcm between the two. The Chinese government intends to increase its natural gas consumption to 12% of the energy mix by 2030, to mitigate the air pollution issues caused by the intensive coal burning.[128] The beginning of 2021 marked a particularly cold season in China, relying on LNG to meet the peak demand. An increase of 38% in LNG imports was recorded in January 2021 compared to 2020, which also marked the highest ever proportion of LNG within the total Chinese natural gas imports.[129] This corresponded to approximately 12 bcm of LNG.[130] A large issue affecting gas security of supply in China is the insufficient seasonal storage, which covers less than 5% of the country's consumption.[131]

127 EIA, 'Country Analysis Executive Summary: China', 7–9.

128 Reuters, 'China to Use More Natural Gas in Energy Mix to 2035 - CNPC', *Reuters*, 24 June 2021, sec. Sustainable Business, https://www.reuters.com/business/sustainable-business/china-use-more-natural-gas-energy-mix-2035-cnpc-2021-06-24/.

129 IEA, 'Gas Market Report Q4-2021', 2021, 14.

130 IEA, 15.

131 IEA, 14.

Table 4. Trends affecting main LNG consuming and producing countries up to 2030

	Type of actor	Actor	Trends
Liquefied natural gas	**Consumer**	European Union	Europe's decrease of domestic gas production does not match a quick decrease in demand. In the mid-term, many European countries rely on the international LNG spot market to secure supplies.
		China	China is the largest natural gas importer, 62% of its imports being LNG. By 2030, China aims to increase its natural gas consumption in an attempt to tackle massive air pollution issues.
		India	India is planning to expand its LNG capacities. By 2045, India's LNG demand could account for 110 mt, which is double than that of 2019.
	Producer	Australia	Australia is the largest LNG exporting country in the world (77.8 mt).
		Qatar	Qatar aims to continue expanding its LNG production capacity by developing its North Field. Large reserves and low costs place Qatari companies in an advantageous global position.
		United States	The US is third largest LNG exporter in the world and has been gaining an increasing share of the European market.
		Russia	While Russia is the world's second largest gas producer, its LNG capabilities are still under development. The evolution of Russia's role as an important European LNG supplier has become doubtful since the 2022 war in Ukraine. Russia will likely try to expand its LNG exports to the Chinese market.

LNG infrastructure expansions are being planned in India as well, and its 2019 LNG demand could double by 2045, from 62 million tonnes (mt) to more than 110 mt.[132] Overall, the largest regional increase in LNG imports in the following decades is expected in the Asia Pacific.[133] This could further consolidate Europe's position as a "market of last resort", as the Asian market and high prices will attract more LNG than the European one.[134]

4.2.2. **LNG supply**

The four major LNG exporting countries are Australia (77.8 mt), Qatar (77.1 mt), the US (44.8 mt), and Russia (29.6 mt).[135] The former global leader in LNG production, Qatar, has plans to retake its position by expanding its gas production capacity, maximizing upstream value and increasing energy efficiency.[136] The expansion of its North Field is the most significant development, as it will add a capacity of 58 mt/year, reaching 126 mt/year up to 2030.[137] Like in the case of Saudi Aramco, who due to huge reserves and low production costs has the potential of remaining the last one standing in the petroleum market, Qatari companies can do the same with (liquefied) natural gas.[138] Peak gas demand may arrive already in the 2030s but is more likely to happen in the 2040s, giving the remaining gas producers significant

132 OPEC, 'World Oil Outlook 2045', 67.

133 OPEC, 67.

134 Luca Franza, 'Outlook for LNG Imports into the EU to 2025', CIEP Paper, CIEP Perspectives on EU Gas Market Fundamentals (CIEP, 2016), 16, https://www.clingendaelenergy.com/inc/upload/files/CIEP_paper_2016_2D_LNG_web.pdf.

135 International Gas Union, 'World LNG Report 2021', 16–17, accessed 31 October 2021, https://www.igu.org/resources/world-lng-report-2021/.

136 'Qatar Petroleum Rolls Out New Corporate Strategy and Core Values', Qatar Petroleum, 2018, https://qp.com.qa/en/Pages/BannerAdvertisement.aspx?imgname=QP+Strategy+and+Values+Rollout+-+English.jpg.

137 Ahmed Mehdi, 'The Middle East and the Geopolitics of the Energy Transition: Myths and Realities' (Oxford Institute for Energy Studies, 2021), 3.

138 Haytayan et al., 'National Oil Companies and Energy Transition in the Middle East and North Africa', 5.

geopolitical and strategic advantages in the coming decades.[139] Qatar Energy's (formerly Qatar Petroleum) large investments in decreasing the carbon intensity of its gas production, primarily through carbon capture and storage, will place it in an even more advantageous position for importing countries that pledged to reduce emissions.[140] To support production capacity expansions, Qatar Energy is simultaneously investing in expanding current liquid products storage as well as greenfield facilities and infrastructure such as loading facilities and pipelines.[141]

Russia is the world's second largest gas producer and largest gas exporter. Russia is of particular importance to Europe when it comes to energy, accounting for almost 35% of its gas imports. However, the vast majority of this gas is in the form of pipeline gas, with only 15.1 mt delivered in the form of LNG. This equals about 10% of Russia's total gas export to Europe.[142] This rather small share of LNG in Russia's gas exports is no surprise, as the country has a well-established gas pipeline export infrastructure in Europe and only entered the LNG market in 2009 upon the launch of its Sakhalin-2 LNG project in the Far East.[143] It was only with the launch of the Yamal LNG project in 2018 that Russia became a large-scale LNG player. In 2020 Russia exported 29.6 mt of LNG.[144]

Yet Russia's LNG ambitions are a cornerstone of its Energy Strategy 2035. The country aims to increase its LNG production and export to 140 mt/year in 2035. The bulk of this production is planned to come from Novatek (60 mt/year by 2030) and Gazprom (30 mt/year by 2030) and to be located in Russia's Arctic region – on the Yamal Peninsula in particular, which not only holds a significant part of Russia's natural gas reserves but is also strategically located in the center between the European and Asian markets. As such, the development of Russia's LNG capacities is strongly connected to the development of its Northern Sea Route (NSR).[145] The Russian government strongly supports the development of its LNG production in the Arctic by providing tax breaks and regulatory support.[146] A large part of this LNG could go to the Chinese market in the mid-term, given that Russia is already China's third largest natural gas supplier (including pipeline and LNG).[147]

139 Mehdi, 'The Middle East and the Geopolitics of the Energy Transition: Myths and Realities', 4; Equinor, 'Energy Perspectives 2020: A Time of Great Uncertainty', 2020, https://www.equinor.com/en/sustainability/energy-perspectives.html.

140 'Qatar Petroleum Launches Sustainability Strategy', Offshore Technology, 2021, https://www.offshore-technology.com/news/qatar-petroleum-sustainability-strategy/.

141 'Qatar Petroleum Awards North Field Expansion Liquid Products Storage & Loading EPC Contract', QP, 2021, https://qp.com.qa/en/MediaCentre/Pages/ViewNews.aspx?NType=News.

142 Vitaly Yermakov, 'Russian Gas: The Year of Living Dangerously' (Oxford Institute for Energy Studies, September 2020), 3–4, https://www.oxfordenergy.org/publications/russian-gas-the-year-of-living-dangerously/.

143 'Russian LNG Aims High, Leveraging Big Reserves and Logistical Advantages', JPT, 1 September 2021, https://jpt.spe.org/russian-lng-aims-high-leveraging-big-reserves-and-logistical-advantages.

144 International Gas Union, 'World LNG Report 2021', 16–17.

145 'Liquefied Natural Gas in Russia' (Netherlands Ministry of Foreign Affairs, 2021).

146 Tatiana Mitrova and Vitaly Yermakov, 'Russia's Energy Strategy-2035: Struggling to Remain Relevant', December 2019, 35–36, https://www.ifri.org/sites/default/files/atoms/files/mitrova_yermakov_russias_energy_strategy_2019.pdf.

147 Michal Meidan, 'The Russian Invasion of Ukraine and China's Energy Markets' (Oxford Institute for Energy Studies, March 2022), 2–6, https://a9w7k6q9.stackpathcdn.com/wpcms/wp-content/uploads/2022/03/The-Russian-invasion-of-Ukraine-and-Chinas-energy-markets.pdf.

4.3. Key take-aways for European tank storage

Developments in oil and gas supply chains in other parts of the world will inevitably affect the European tank storage sector due to the globalized nature of energy markets. One important development is the shift toward East-Asia and the Middle East as the principal oil consumers and producers, respectively. The expansion of the refining sector in those regions is likely to further consolidate them as the linchpin of the global oil supply chain. In other words, crude oil, oil products, and natural gas will become more important in regions outside of Europe in the mid and long term. Middle Eastern suppliers could become the 'winners' of the coming decade, due to their huge petroleum reserves, low costs of exploitation, significant investments in infrastructure, and downstream diversification strategies.

The geographical shift of the refining industries and the enormous investments in infrastructure and production capacity in other countries could place Europe's tank storage sector in an advantageous position to support domestic consumption but a disadvantageous one from the perspective of trade. If European industrial activity slows down, imports of liquid bulk will be necessary to support European consumption. In this scenario, European economies would become more dependent on the storage sector for the necessary energy supplies. At the same time, safeguarding strategic stocks of oil and new energy carriers in Europe will be essential for quick recovery after global supply chain disruptions, particularly due to increased tensions with Russia. Tank storage plays a key role in this regard.

However, while Northwestern Europe is a trading hub for crude and oil products due to its geographical location, integrated infrastructure, and low costs, this position is not guaranteed to continue. Both physical and paper trade could shift to new locations, where supply and demand are closer geographically, extensive infrastructure is available, regulations might be less strict, and therefore profits larger.

5. Trends affecting European tank storage up to 2030

5.1. Decarbonization of transport

Up to 2030, road transport is the transportation sector most affected by decarbonization efforts in Europe, given that low-carbon aircrafts and vessels will not reach a sufficiently mature stage to significantly alter aviation and maritime transport. Apart from blending activities in the case of road transport, electric vehicles in Europe are expected to overtake the number of combustion engine cars by 2030. In the long term, electrification is the ultimate goal for decarbonizing road transport. For aviation and shipping, blending of sustainable aviation fuels (SAFs) and other types of biofuels, is expected to dominate decarbonization efforts.

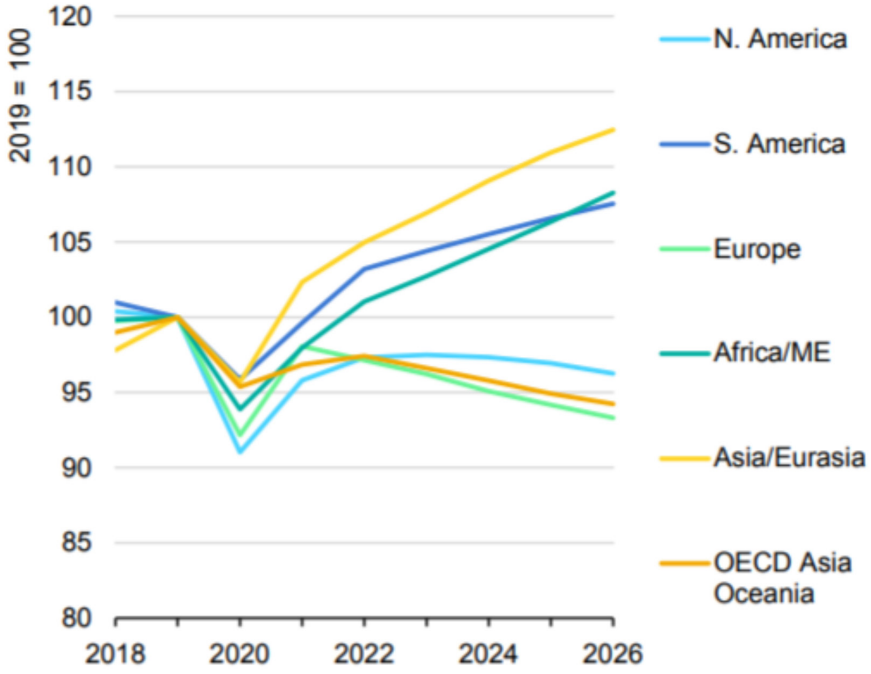
The global peak in gasoline demand is likely to have already passed, regardless of whether the electrification of transport is moving quickly enough. Gasoline consumption in Europe and other OECD countries is expected to fall dramatically in the next 5-10 years, and diesel consumption will likely follow a similar pattern.[148] Whether European demand for oil products for road transport will follow expectations or not, gasoline and diesel storage will, over time, become less needed for domestic consumption.

The blending target of biofuels into fossil fuels in the EU is 14% up to 2030 and is expected to become even more ambitious due to the expected revision of the Renewable Energy Directive.[149] Conventional fuels might be blended with low-carbon ones, and eventually fully replaced.

148 IEA, 'Oil 2021', 31.

149 European Commission, 'Amendment Renewable Energy Directive 2030', 15.

Figure 9. Regional gasoil/diesel demand projections
From IEA Oil 2021, p. 34



Biodiesel (HVO/FAME)[150] and e-diesel[151] represent alternatives for diesel, while gasoline might be substituted by bioethanol and e-gasoline.[152] Whereas existing fossil fuel storage infrastructure can be used with limited or no modifications for biodiesel, e-gasoline, and e-diesel, more significant changes are required for others like bioethanol, hydrogen, and methanol.[153]

The EU aspires to go from the 1.8 million electric vehicles (EVs) currently on the road in Europe to 30 million by 2030.[154] In 2021, the European Commission evaluated the existing legislation regarding the deployment of EV infrastructure and found it insufficiently ambitious compared to their 2030 objectives.[155] A 2021 study of the European Court of Auditors concludes

150 The Hydrotreated Vegetable Oils (HVO) and Fatty Acid Methyl Ester (FAME) biodiesel are biofuels that could substitute gasoil and diesel, respectively. The main difference between HVO and FAME stems from their chemical compositions. FAME is the most widely used biofuel in Europe, although using HVO yields less NOx emissions and has better storage stability. See Ondrej Cerny et al., 'Implications of the Energy Transition for the European Storage, Fuel Supply and Distribution Infrastructure' (Trinomics, 2021), p. 26.

151 E-fuels are renewable electricity-based liquids and have non-biological origins. The most commonly used such fuel is hydrogen, which can either be used directly as a fuel or in a different form, such as methanol or ammonia.

152 Ondrej Cerny et al., 'Implications of the Energy Transition for the European Storage, Fuel Supply and Distribution Infrastructure' (Trinomics, 2021), 16.

153 Cerny et al., 6.

154 Kate Abnett, 'EU to Target 30 Million Electric Cars by 2030', *Reuters*, 12 April 2020, sec. Environment, https://www.reuters.com/article/us-climate-change-eu-transport-idUSKBN28E2KM.

155 European Commission, 'Revision of the Regulation on the Deployment of Alternative Fuels Infrastructure', 14 July 2021, 2, https://ec.europa.eu/info/sites/default/files/revision_of_the_directive_on_deployment_of_the_alternative_fuels_infrastructure_with_annex_0.pdf.

that the EU is bound to miss its goal if current trends continue.[156] Recent years have seen a substantial rise in sales of sports utility vehicles (SUVs), which consume about 25% more fuel than regular-sized cars and are more difficult to electrify due to their size.[157] As a part of the 'Fit for 55' legislative package, the Commission put forward a proposal to revise current regulation which, at the time of writing, is in the process of adoption.[158] The new regulation would require member states to revise their national policy frameworks, in a way that would support the development of alternative fuels and EV markets.[159]

Key take-aways on the decarbonization of transport for European tank storage

Blending conventional with sustainable fuels will be an important transition step in road, aviation and maritime transport up to 2030, before complete decarbonization. Since blending and bringing products to specific user requirements are core tasks of tank storage companies, they will play a key role in supporting the decarbonization of transport. The stricter the European blending targets, the quicker the demand for blended products will grow. In turn, this will increase the complexity of end products that different customers require, leading to an expanding need for highly specialized services. The expertise and infrastructure of tank companies can facilitate this process in the mid-term.

5.2. European refinery closures

At the center of the European economy are fuels and feedstocks. Yet over the last decade, European refinery capacity has been decreasing. This trend is projected to continue. The competitive margins of European refineries are declining due to the expansion of capacity in other regions like the Middle East and Asia. The spatial shift of industrial clusters away from Europe, into Asia Pacific, creates further challenges for European refineries to remain profitable. European policy frameworks are discouraging any further developments based on fossil fuels and the uncertain future has led to a poor investment climate. Given that refined products will still be needed for another decade, tank storage and other supply chain players will support the import of oil products and chemicals to satisfy demand.

While gasoline and diesel demand is expected to decrease significantly due to the electrification of road transport, other refined products will remain essential for the European economy. The aviation and maritime sectors are not decarbonizing as quickly as road transport is, so kerosene and maritime fuel oil remain economic and strategic fuels for Europe in the mid-term. The chemical and petrochemical industries will continue relying on naphtha as feedstock.

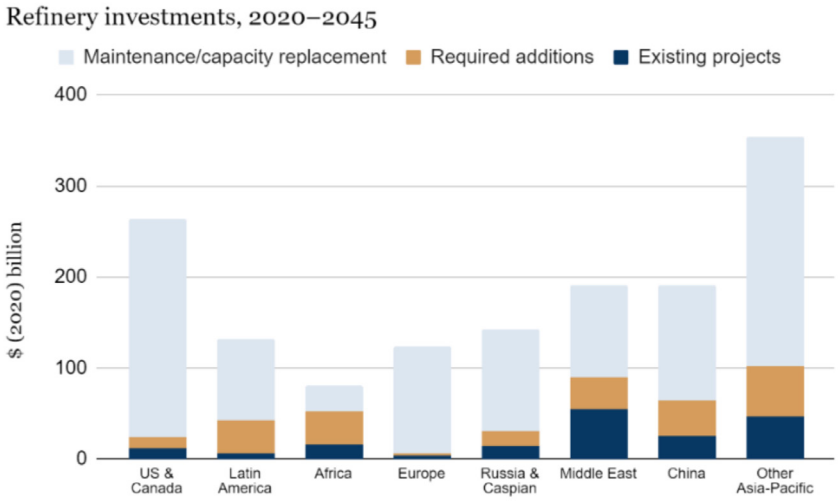
156 Marine Strauss, 'Deployment of EU Electric Vehicle Charging Stations Too Slow, Auditors Say', *Reuters*, 13 April 2021, sec. Technology News, https://www.reuters.com/article/us-eu-autos-electric-charging-idUSKBN2C023C; European Court of Auditors., 'Infrastructure for Charging Electric Vehicles: More Charging Stations but Uneven Deployment Makes Travel across the EU Complicated. Special Report No 05, 2021.' (Publications Office, 2021), https://data.europa.eu/doi/10.2865/651152.

157 IEA, 'World Energy Outlook 2019', 150–51.

158 European Union, 'Procedure 2021/0223/COD', accessed 5 October 2021, https://eur-lex.europa.eu/legal-content/EN/HIS/?uri=CELEX%3A52021PC0559.

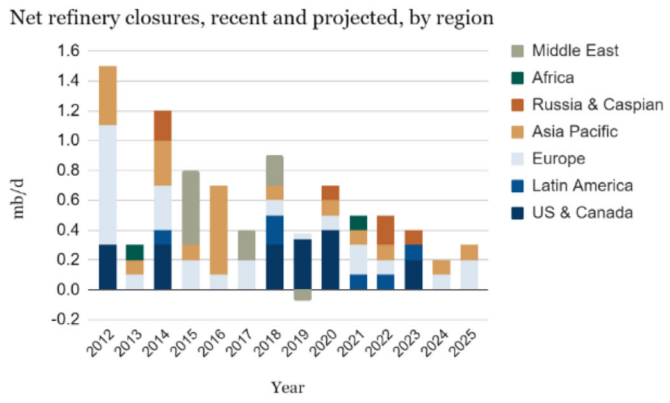
159 European Commission, 'Revision of the Regulation on the Deployment of Alternative Fuels Infrastructure', 2.

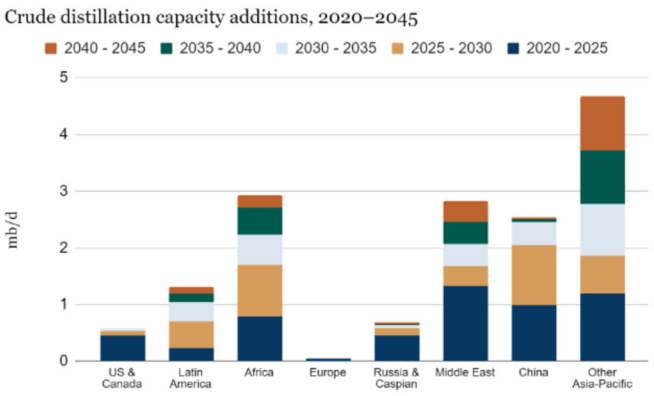
Figure 10. Current and projected refinery investments, divided by region
Data from OPEC, 2021



Whereas governments in the Asia Pacific and the Middle East are investing in additional production capacity of crude oil, oil products as well as petrochemicals, European countries are refraining from such actions. Most current investments in Europe, worth $116 billion, are focused on maintenance or capacity replacement of pre-existing facilities, whereas new projects are negligible (see Figure 11). Figure 11 (right) shows the results of regional investment patterns; Europe and the US & Canada are the regions that will experience the most refinery capacity closures in the world up to 2025. A notable case is Spain, where the refining industry has been expanding in the last 10-15 years.

Figure 11. Recent and projected net refinery closures, 2012-2025 (left) **Crude distillation capacity additions 2020-2045** (right)
Data from OPEC, 2021





The Middle East, China, and the rest of Asia Pacific are projected to continue investing in new refining and storage capacity, as discussed in section 4. China is expected to become the world's largest refiner in the coming years.[160] In 2021, the Middle Eastern region was the largest investor in new refining projects, but it will be overtaken by China since 2025.

The decrease in refining capacity will negatively affect those economic sectors which have not yet decarbonized but which are essential to the European economy, such as aviation, maritime transport, and industry. The latter is particularly difficult to decarbonize and will continue requiring petroleum in the mid-term.[161] At the same time, about 75% of Europe's industry oil demand is used as feedstock in the petrochemical and construction industries.[162] These feedstocks cannot (yet) be substituted by low-carbon energy sources and retrofitting existing industrial facilities to switch to alternative low-carbon sources is very costly.[163] For processes that depend upon temperatures beyond 400 degrees, directly using renewable heat or electricity for heating is difficult.[164] Reaching those temperatures is essential in the steel, cement, and chemical industries, which together account for the overwhelming share of fossil fuel demand in the industry.[165]

Key take-aways on European refinery closures for tank storage

Even though Europe is heading toward an uncertain future regarding its refining sector, tank storage companies will remain important in fulfilling domestic demand. If the trend that was observed in the last decade continues, certain European refineries will lose their competitive margin and even close. While cost-effective and well-developed industrial clusters are likely to remain active, more secluded facilities might face increasing difficulties. It is uncertain whether the decrease in European refining output will be matched by a sudden decrease in demand. The supply gap caused by the decrease in European production will be fulfilled by imports, in which case storage companies will play an even more important role in balancing supply and demand and ensuring European security of supply.

Over time, Europe has played a central role in the global gasoline market, the Port of Amsterdam being the largest gasoline port in the world. The EU could continue playing an important role in international trade in the mid-term, despite decreasing domestic consumption. A large part of storage capacity could be used for blending and re-export rather than domestic use, and hence require extensive storage facilities. Eventually, in the long term, other locations that are closer to supply and demand centers like the Middle East or East Asia will become more profitable for trade. In the mid-term, however, Europe will likely still facilitate trade.

160 Sundria, Freitas, and Graham, 'China to Take Oil-Refining Crown Held by US Since 19th Century'.

161 Samantha Gross, 'The Challenge of Decarbonizing Heavy Industry' (Brookings, 24 June 2021), https://www.brookings.edu/research/the-challenge-of-decarbonizing-heavy-industry/; Stephen J. Naimoli and Sarah Ladislaw, 'Climate Solutions Series: Decarbonizing Heavy Industry' (Center for Strategic & International Studies, 10 May 2020), https://www.csis.org/analysis/climate-solutions-series-decarbonizing-heavy-industry.

162 IEA, 'European Union 2020 - Energy Policy Review', 272.

163 Arnout De Pee et al., 'Decarbonization of Industrial Sectors: The next Frontier', June 2018, 7.

164 Gross, 'The Challenge of Decarbonizing Heavy Industry', 16.

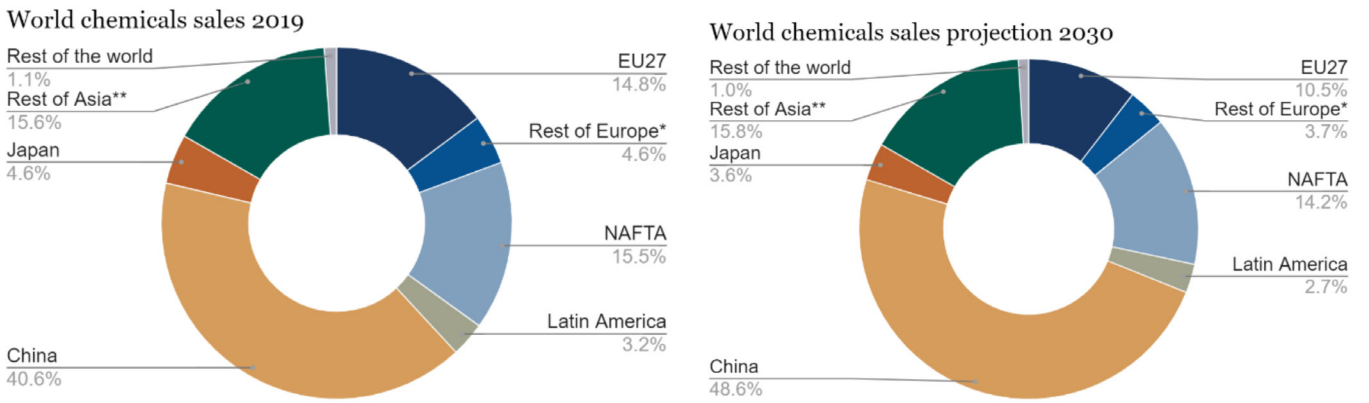
165 Gross, 1–16.

5.3. **European chemical industry losing competitive advantage**

The growth rate of Europe's chemical industry is declining.[166] A mature market, stable population growth, and decreasing domestic resources are some of the reasons for Europe's chemical industry shrinking.[167] In 2019, the EU accounted for 14.8% of global chemical sales (see Figure 12). The European Chemical Industry Council (CEFIC) expects that this share will further decrease to 10.5% by 2030. Contrastingly, China provided 40.6% of global chemical sales in 2019 and its share is expected to reach 48.6% in 2030 (Figure 12).

The international (petro)chemical market is increasingly led by emerging regions of the world, where demand will continue to rise in the mid-term. Middle Eastern companies like Saudi Aramco, ADNOC, and Qatargas could secure significant economic gains in the next decades, given their flexibility to produce low-cost and relatively clean oil.[168] A large part of these crude oil producers is diversifying their businesses downstream, by investing in chemical and petrochemical production in addition to oil refining. Their large assets and oil reserves could turn them into the largest integrated chemical companies in the world, as Saudi Aramco aims to become.[169] On the other side of the spectrum is China. Unlike Middle Eastern countries, China lacks vast reserves of crude oil, but the massive investments in infrastructure will likely turn it into the main player in refining and petrochemical production.[170] This subject is discussed in more detail in section 4.

Figure 12. World chemicals sales in 2019 and 2030
Data from CEFIC, 2021



166 'Growth and Competitiveness', cefic.org, accessed 11 October 2021, https://cefic.org/a-pillar-of-the-european-economy/facts-and-figures-of-the-european-chemical-industry/growth-and-competitiveness/; Cefic - Competiveness of European Chemical Industry, 'Competitiveness of the European Chemical Industry - How to Regain Ground in the Global Market', January 2015, 3, https://cefic.org/app/uploads/2019/01/Competitiveness-of-the-European-chemical-industry-BROCHURE-Trade.pdf.

167 Jasper Meijering and Jabbe van Leeuwen, 'The Dynamic Development of Organic Chemistry in North-West Europe', Cracking the Clean Molecule (The Hague, The Netherlands: CIEP, 2021), 25, https://www.clingendaelenergy.com/publications/publication/the-dynamic-development-of-organic-chemistry-in-north-west-europe.

168 Haytayan et al., 'National Oil Companies and Energy Transition in the Middle East and North Africa', 2.

169 'Saudi Aramco Annual Report', 16.

170 Sundria, Freitas, and Graham, 'China to Take Oil-Refining Crown Held by US Since 19th Century'.

The technological capabilities and innovative products of European chemical companies can support the industry's competitive margins.[171] The EU is the second largest investor in research and development according to CEFIC, and many European companies are dedicating resources to circular initiatives like plastic recycling into pyrolysis oil. The production of various chemical substances would therefore no longer heavily rely on petroleum products as feedstock. Instead, a circular approach, possibly complemented by carbon capture technologies (discussed in 5.6), would ensure a more sustainable production process. Europe currently has a total of 10 commercial scale pyrolysis plants that are either build or currently under construction.[172] In the Netherlands, SABIC and Pryme are building two plants, intended to convert 20.000 ton and 60.000 ton of plastic waste into pyrolysis oil annually, respectively.[173] Since this technology is not deployed on a wide scale yet, circular approaches to European industry will likely become dominant after 2030.

Key take-aways on the chemical industry for European tank storage

Europe's chemical industry is no longer rapidly growing as a result of competition from low-cost producers like China. While European production might decrease, consumers will still require chemical products for their daily lives. As such, tank storage will continue being important in storing chemicals. Decarbonization efforts and technology developments are expected to change the way chemicals are produced and stored. Circularity and replacing petroleum-based feedstock and energy flows will be key to a more sustainable chemical industry, especially in the long term.

5.4. Increasing importance of LNG imports for European security of supply

The bulk of European natural gas (43.4% of the total) in 2020 came from Russia.[174] Natural gas is the largest energy source in the residential sector and second-largest source in industry, after oil.[175] Germany, the UK, Italy, France, the Netherlands and Spain, Europe's largest natural gas consumers, account for about 75% of the EU's total gas consumption in 2017.[176] The Netherlands, the EU's largest natural gas producer, has decided to stop the exploitation of its

171 'Growth and Competitiveness'.

172 Interreg North-West Europe, 'Designing Value Chains for Carbon Based Elements from Sewage', December 2020, 21, https://www.nweurope.eu/media/12964/201230_market-potential-study-final_01.pdf.

173 'Sabic Pioneers First Production of Certified Circular Polymers', 13 February 2019, https://www.sabic.com/en/news/17390-sabic-pioneers-first-production-of-certified-circular-polymers; Carina Oliveira, 'Technology Factsheet: Pyrolysis Oil Production from Plastic Waste' (TNO, 28 September 2020), https://energy.nl/wp-content/uploads/2020/09/Pyrolysis-oil-production-from-plastic-waste_28-09-2020.pdf; 'Pryme Builds Pyrolysis Oil Production Plant', Port of Rotterdam, 17 November 2021, https://www.portofrotterdam.com/en/news-and-press-releases/pryme-builds-pyrolysis-oil-production-plant.

174 Eurostat, 'Natural Gas Supply Statistics', 2020, https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Natural_gas_supply_statistics.

175 IEA, 'European Union 2020 - Energy Policy Review', 238.

176 IEA, 240.

Groningen field.[177] The consequences of this decision affect other EU member states and the Union as a whole, as it ramped up the import dependency to 89.5% in 2019.[178]

Europe's increased dependency on foreign actors, particularly on Russia, can have geopolitical consequences. Security of supply concerns come to the fore, particularly in light of the conflict in Ukraine in 2022. European households and industry depend on Russia to fulfill their demand. Given that Russian oil and gas companies are state-owned, their economic strategies tend to be intertwined with Moscow's political agenda of exerting influence in Europe.[179] The importance of LNG in Europe's energy mix has been increasing over the last decade, and gained momentum in 2022 when European leaders announced ambitions to reduce their dependency on Russian gas and even possibly impose sanctions on energy imports from Russia. The long-term consequences of the conflict are yet to unravel, but concerns over security of supply will likely guide European energy policy, together with the Green Deal goals. This will also lead to high volatility in the gas spot markets and recurring high prices for European consumers.

Key take-aways on gas security of supply for European tank storage

Gas security of supply concerns can be mitigated in two ways: by increasing the share of (non-Russian) LNG in European imports and therefore diversifying suppliers; and by securing strategic storage. Both solutions depend on sufficient storage capacity, whether that refers to tanks or underground storage. The global LNG market is dominated by volatility and uncertainty. The more integrated the European, American, and Asian spot markets become, the more vulnerable they are to global events. Technical difficulties at production plants, cold winters in Asia, high carbon prices in the EU Emissions Trading System (ETS), can strain the global LNG supply. Geopolitical issues also arise from high import dependency on energy products. The EU is working towards strategic autonomy but cannot do so while dependent on a few suppliers to fulfill natural gas demand. To mitigate situations like the one in 2021, when spot market gas and electricity prices in Europe reached historical highs, or in 2022, when concerns arose due to Russia's invasion of Ukraine, sufficient buffer stocks should be available domestically. Mitigating the vulnerabilities that come with an increased gas import dependency requires an expansion of gas/LNG storage capacity and its introduction in emergency stockholding obligations. Underground storage would be particularly important in this regard.

177 For more information about this topic, see HCSS papers: Jilles van den Beukel and Lucia van Geuns, 'Groningen Gas the Loss of a Social License to Operate' (The Hague Centre for Strategic Studies, 2019); Jilles van den Beukel and Lucia van Geuns, 'The Deteriorating Outlook for Dutch Small Natural Gas Fields' (HCSS, January 2020); Irina Patrahau and Lucia van Geuns, 'Gas Supply Security in the Netherlands: Geopolitical and Environmental Dilemmas' (HCSS, 2021).

178 Eurostat, 'EU Imports of Energy Products - Recent Developments', 2021, https://ec.europa.eu/eurostat/statistics-explained/index.php?title=EU_imports_of_energy_products_-_recent_developments.

179 See van den Beukel and van Geuns, 'Russia's Unsustainable Business Model: Going All In on Oil and Gas'.

5.5. **Europe emerging as a hydrogen hub**

In Europe, hydrogen is projected to serve as a means to decarbonize heavy industry.[180] The EU has ambitious goals for hydrogen for 2030 and 2050, aspiring to reach 40GW and 500 GW of electrolyzer capacity, respectively – up from 60MW currently.[181] Even with a massive increase in domestic hydrogen production capacity, it is expected that most hydrogen will be imported into Europe. However, different European regions display particular advantages and disadvantages for becoming important players in hydrogen trade.

Northwestern Europe is home to some of the most ambitious and technically pioneering EU member states when it comes to low-carbon hydrogen.[182] The region is well-suited to become a hydrogen trading hub due to its large industrial ports, well-developed storage systems, and natural gas pipelines that can be partially retrofitted to transport hydrogen.[183] Contrastingly, Southern Europe is strategically located in places that are easier to access by those countries expected to emerge as major hydrogen producers, particularly in the Middle East and South America.[184] Moreover, the weather conditions in Spain or Italy would allow them to produce hydrogen from relatively cheap solar power and export it to the rest of Europe. Green hydrogen produced in Spain would be more cost competitive than that produced in the North Sea.

In June 2020, several European energy companies jointly produced the "European Hydrogen Backbone" vision, a 6800 km hydrogen pipeline network created by 2030, which would be 75% based on pre-existing natural gas pipelines.[185] By 2040, this European hydrogen pipeline system would have extended to 23000 km and run from North- to South- Europe, encompassing Austria, Belgium, Czech Republic, Denmark, France, Germany, Italy, Netherlands, Norway, and Spain.[186]

It is not certain which part of Europe will become more active in trading hydrogen. Germany, the UK, France, and the Netherlands, have published hydrogen strategies for the long-term, especially focusing on the contribution of green hydrogen to their energy mix.[187] The former three countries have larger ambitions than the Netherlands for domestic hydrogen production.[188] It is expected that by 2030, green hydrogen will not reach large-scale production in the North Sea.[189] Green hydrogen is, across the EU, preferred over the blue version, but it is

180 Martin Lambert and Simon Schulte, 'Contrasting European Hydrogen Pathways an Analysis of Differing Approaches in Key Markets' (Oxford Institute for Energy Studies, March 2021), 12, https://www.oxfordenergy.org/wpcms/wp-content/uploads/2021/03/Contrasting-European-hydrogen-pathways-An-analysis-of-differing-approaches-in-key-markets-NG166.pdf.

181 Michael Libreich, 'Liebreich: Separating Hype from Hydrogen – Part One: The Supply Side', *BloombergNEF* (blog), 8 October 2020, https://about.bnef.com/blog/liebreich-separating-hype-from-hydrogen-part-one-the-supply-side/.

182 IEA and CIEP, 'Hydrogen in North-West Europe: A Vision towards 2030', 5 March 2021, 9, https://www.iea.org/events/hydrogen-in-north-west-europe-a-vision-towards-2030.

183 IEA and CIEP, 5.

184 "Decarbonised hydrogen imports into the European Union," .

185 Enegas et al., 'European Hydrogen Backbone: How a Dedicated Hydrogen Infrastructure Can Be Created', June 2020.

186 Enegas et al.; Guidehouse, 'European Hydrogen Backbone'.

187 Lambert and Schulte, 'Contrasting European Hydrogen Pathways an Analysis of Differing Approaches in Key Markets', 2.

188 IEA and CIEP, 'Hydrogen in North-West Europe', 36.

189 Hans Cleijne et al., 'North Sea Energy Outlook (NEO)' (DNVGL, 2020), 79.

also more expensive to produce and transport.[190] Transporting hydrogen via trucks or ships is significantly more expensive than via pipelines. Even under optimal conditions, with hydrogen being transported as ammonia, the total transportation, conversion, and storage costs could be three times as high as the costs of producing the hydrogen itself.[191]

Key take-aways on the future of hydrogen for tank storage

The large-scale adoption of hydrogen in Europe up to 2030 is dominated by uncertainty. Which energy carriers will be leading in hydrogen transport and storage remains unclear. However, it is expected that all hydrogen carriers will play a role, depending on the end user: ammonia, methanol, liquid organic hydrogen, cryogenic hydrogen. Compressed hydrogen could also be delivered via pipelines from North Africa. They all have pros and cons. For instance, liquid organic hydrogen would be the easiest to absorb by current infrastructure as it could be stored in diesel tanks. Yet this form of hydrogen cannot be used directly as a fuel, it would need to be processed upon arrival in Europe.

The role of tank storage companies in mitigating this uncertainty is to invest in innovation and pilot projects as well as support the development of policies that will level the playing field between market actors. Factors such as production and transportation costs, the deployment of technologies to decarbonize industrial sectors and the building infrastructure remain primary determinants of the role of hydrogen in the mid-term. Sufficient available infrastructure could decrease the costs of using (green) hydrogen, but technological developments and supportive policies are essential to reduce uncertainty. Informed and coherent policies are needed to provide a roadmap for market players and stimulate the demand for hydrogen.

5.6. The (limited) development of carbon capture, utilization and storage

Carbon capture, utilization, and storage (CCUS) is considered to be a cornerstone of the decarbonization of Europe's energy-intensive industries. CCUS is also essential to produce blue hydrogen. However, CCUS is not expected to be deployed on a large scale before 2030.[192] Total global CO_2 capture capacity as of 2021 stands at 40 mt.[193] The IEA's SDS Scenario predicts a growth up to 840 mt by 2030.[194] Current trends confirm an upcoming

190 For more information, see the first part of the HCSS/VOTOB/FETSA paper series: van den Beukel et al., 'The European Tank Storage Sector and the Global Energy Landscape'.

191 Libreich, 'Liebreich'.

192 Milan Elkerbout and Julie Bryhn, 'An Enabling Framework for Carbon Capture and Storage (CCS) in Europe: An Overview of Key Issues' (Center for European Analysis (CEPA), 23 September 2019), 1, https://www.ceps.eu/wp-content/uploads/2019/09/RB2019_03_An-enabling-framework-for-carbon-capture-and-storage-in-Europe.pdf.

193 'Carbon Capture, Utilisation and Storage - Fuels & Technologies', IEA, accessed 12 November 2021, https://www.iea.org/fuels-and-technologies/carbon-capture-utilisation-and-storage.

194 'A New Era for CCUS – CCUS in Clean Energy Transitions – Analysis', IEA, 2020, 49–50, https://www.iea.org/reports/ccus-in-clean-energy-transitions/a-new-era-for-ccus.

increase in CCUS capacity, but also suggest that the scope of this expansion remains limited. In 2020, there were 21 operating CCUS facilities globally. 17 more are in a stage of advanced development, 24 of early development, and 3 are already under construction.[195] If all those projects become operational, global CO_2 capture capacity would rise to 130 mt per year.[196]

Progress in Europe is picking up speed. In Europe, there are currently only 5 operating CCUS facilities, namely in Croatia, Iceland, and Norway. However, as of November 2021, a total of 44 new CCUS facilities in Europe have an expected starting date up to 2028, with an additional 21 being planned but not having an indication for their starting date. All those projects together would amount to 70 mt of capture capacity by 2030.[197]

Still, the discrepancy between progress over the past years and goals set by the IEA give little reason to believe that CCUS deployment will be anywhere close to the 840 mt outlined by the SDS. The 2020 CCUS target (300 mt) set by the IEA in 2009 was reached for only 13%. This limited progress has been the result of the weak commercial incentive and lack of adequate policies for CCUS.[198]

It is also important to note that the maturity of different CCUS technologies differ.[199] Hydrogen production from natural gas with CCUS, which is one of the prospected main usages of CCUS in Europe, is still at an early adoption stage.[200] This means that significant R&D investments will have to be made to bring many CCUS technologies to a mature stage and enable their widespread usage.

Key take-aways on carbon storage for tank storage

CCUS has an important role to play in Europe's decarbonization efforts. While currently being deployed only to a very limited extent, there are many planned projects that might significantly expand Europe's carbon capture capacity up to 2035. At the same time, the track record of expanding CCUS capacity up to today as well as the limited technological maturity for CCUS for blue hydrogen production suggest that one should be cautious about such predictions. CCUS will expand in the next decade and tank storage companies could play a role in this field, but the years after 2030 might see the largest development of this technology.

195 'Carbon Capture, Utilisation and Storage - Fuels & Technologies'.

196 'A New Era for CCUS – CCUS in Clean Energy Transitions – Analysis', 29.

197 International Association of Oil & Gas Producers, 'Map of EU CCUS Projects', November 2021, https://www.oilandgaseurope.org/documents/map-of-eu-ccs-projects/.

198 'A New Era for CCUS – CCUS in Clean Energy Transitions – Analysis', 28.

199 'A New Era for CCUS – CCUS in Clean Energy Transitions – Analysis', 93.

200 'A New Era for CCUS – CCUS in Clean Energy Transitions – Analysis', 96.

5.7. **Electricity storage**

Battery storage is essential for electric vehicles (EV), phones and other electric devices. It is also playing an increasingly important role as a grid balancer as the share of variable renewable energy (VRE) in the electricity mix grows.[201] Generally, the development of battery storage up to 2035 seems quite likely, with production costs showing a clear declining trend.[202] A 2021 study of the National Renewable Energy Laboratory analyzing different projections on future battery costs finds that by 2030, battery costs are expected to decrease by 58% (low case), 42% (medium case) or 28% (high case).[203]

The improvements of batteries for EVs have a strong spillover effect on these stationary applications. In other words, the push for electrification of Europe's road transport will likely also bring down the costs for batteries for stationary applications.[204] Driven by technological progress and the scale-up of production, EV lithium battery costs have fallen 90% since 2010, while for stationary applications they have decreased by two thirds.[205]

Much battery storage is needed in the mid-term to balance the growing share of VRE. According to the IEA's SDS Scenario, global battery storage would need to increase from 6 GW in 2019 up to 550 GW by 2040 to accommodate the increasing share in VRE.[206] IRENA provides a more modest growth path, stating that battery storage capacity needs to increase 17-fold by 2030 compared to 2017 to allow for a doubling of VRE capacity globally.[207] In Europe, about 60 GW of battery storage would be needed by 2030 to support the doubling of VRE capacity, with the majority of flexibility still being provided by gas-fired power plants.[208] Current trends suggest that Europe is well underway to significantly increase its stationary battery storage capacity in the mid-term. Its capacity has already grown ten-fold between 2016 and 2020 to reach 5.26 GWh.[209] By the end of 2021, cumulative capacity in Europe is expected to hit 9 GWh, indicating a clear accelerating trend in the addition of new battery storage capacity.[210] Falling costs will further spur the expansion of stationary battery storage.

201 'Innovation in Batteries and Electricity Storage – Analysis', IEA, 4, accessed 10 November 2021, https://www.iea.org/reports/innovation-in-batteries-and-electricity-storage.

202 'Battery Pack Prices Cited Below $100/KWh for the First Time in 2020, While Market Average Sits at $137/KWh', BloombergNEF, 16 December 2020, https://about.bnef.com/blog/battery-pack-prices-cited-below-100-kwh-for-the-first-time-in-2020-while-market-average-sits-at-137-kwh/.

203 Wesley Cole, A. Will Frazier, and Chad Augustine, 'Cost Projections for Utility-Scale Battery Storage: 2021 Update' (National Renewable Energy Laboratory, June 2021), https://www.nrel.gov/docs/fy21osti/79236.pdf.

204 'Innovation in Batteries and Electricity Storage – Analysis', 7.

205 'Innovation in Batteries and Electricity Storage – Analysis', 5.

206 'Innovation in Batteries and Electricity Storage – Analysis', 33.

207 'Electricity Storage and Renewables: Costs and Markets to 2030', October 2017, 8–9, https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2017/Oct/IRENA_Electricity_Storage_Costs_2017_Summary.pdf.

208 European Commission - Directore General for Energy, *Study on Energy Storage: Contribution to the Security of the Electricity Supply in Europe* (LU: Publications Office of the European Union, 2020), 47–48, https://data.europa.eu/doi/10.2833/077257.

209 Andy Colthorpe, 'Europe Predicted to Deploy Nearly Twice as Much Electrical Storage in 2021 than Last Year', Energy Storage News, 24 March 2021, https://www.energy-storage.news/europe-predicted-to-deploy-nearly-twice-as-much-electrical-storage-in-2021-than-last-year/.

210 Wood Mackenzie, 'Americas to Lead Global Energy Storage Market by 2025', 20 April 2021, https://www.woodmac.com/press-releases/americas-to-lead-global-energy-storage-market-by-2025/.

Key take-aways on electricity storage for tank storage

Battery development is an important enabler for the expansion of the European EV fleet and for its VRE. Continued and accelerating price decreases will facilitate the shift away from fossil fuel-based cars to EVs as well as the increasing uptake of VREs in the mid-term. The share of VRE in the European electricity mix is also unlikely to necessitate battery storage in the mid-term, with gas-fired power still remaining important and offering needed flexibility. As such, developments in battery storage itself are conducive to the falling oil demand in Europe, but are not a strong driver reducing oil demand up to 2035. As in the case of CCUS, electricity storage will remain an emerging technology up to 2030, in need of investment and wider spread adoption, and likely not become dominant until after 2030.

6. Threats and opportunities for tank storage

The next 10-15 years bring both threats and opportunities for the tank storage sector. Decarbonization policies will decrease the European consumption of fossil fuels, but it is uncertain to what extent and at what pace. In the mid-term, tank storage will have to balance the remaining demand for fossil fuels with the steadily increasing use of low carbon sources. Hydrogen consumption and electrification are set in motion but will not develop quickly enough to already dominate the European energy market in the mid-term (2030-2035). Imports of natural gas are becoming essential for European energy security of supply.

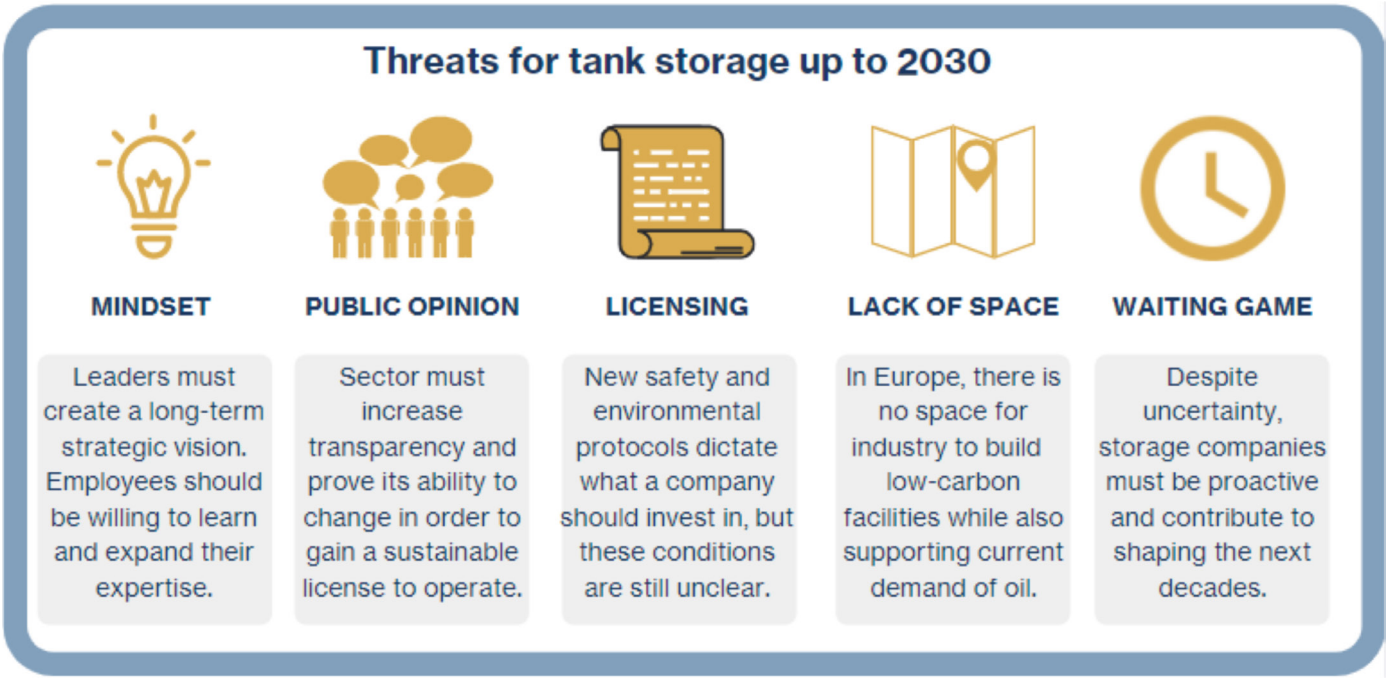
While Europe's refineries and its chemical industry are losing competitive margins, China is expected to become the world's largest refiner. The Middle East is ramping up oil production and investing in downstream diversification. Significant reserves and low production costs could allow countries like Saudi Arabia and Qatar to remain 'the last man standing' in global oil and gas markets. Europe's trading position in oil and gas will slowly decline in importance as traders move toward the primary production and consumption centers, i.e., in the Middle East, East Asia, and Africa.

Based on these broad conclusions, this section identifies specific threats and opportunities that the next 10-15 years will bring to the tank storage sector. Proactivity, long-term planning, and transparency are key recommendations for storage companies to develop a sustainable license to operate. Existing capabilities and know-how can be used to mitigate the threats and enhance the opportunities. Working together with the sector and other key stakeholders is essential in creating predictability in the market, reducing uncertainty, and facilitating investments.

6.1. Threats

Five threats are identified as the main concerns of tank storage companies in the mid-term, summarized in Figure 13.

Figure 13. Threats affecting the European tank storage sector up to 2030



Leadership and personnel mindset

Apart from physical assets and financial aspects like investments and infrastructure, the energy transition requires human capital. The uncertainty dominating the next decades can discourage managers and employees from developing ambitious goals or concrete long-term strategies. While tank storage companies are well versed in the oil industry, new energy products will bring about new challenges in terms of their physical characteristics, handling requirements, and international markets. The know-how, experience, and network of oil companies are useful in supporting change, but the coming decades will be learning curves for all actors involved. It is essential that employees are willing to learn, adapt and change their working habits in order to facilitate change.

Public opinion

The lack of transparency of the tank storage sector damages the public image of the sector. For years storage companies have provided key services in the energy and manufacturing supply chains, supporting Europe's economic development, industrial production, and securing emergency stocks. Being a service sector, public relations have not been necessary and thus, lacked for many companies. Now, tank storage is associated with the old

conventional system that needs to be replaced by a new sustainable one. Yet in the mid-term, the old and new systems will co-exist. Up to 2030-2035, storage companies will have to accommodate both the continued demand for oil products and the increasing demand for low-carbon energy carriers. The experience gained and networks developed over time can be used by tank storage companies in the new energy system. New technologies and investments can provide opportunities for storage companies to change their business models and support the energy transition. However, investments and policy support are highly dependent on public opinion. This is one of the main challenges that tank storage companies need to overcome: proving to the public their ability and willingness to change.

Licensing & regulation

As Europe is constantly updating its climate ambitions, a new legislative framework regulating the production, storage, handling, and consumption of new energy products is yet to be developed. While the tank storage sector is licensed to handle conventional fuels, it is unclear what kind of requirements will become necessary for a company to be involved in the new energy system. New safety and environmental protocols will, to a certain extent, dictate the changes that companies should make in order to be licensed to handle a certain type of hydrogen carrier or e-fuel. Ammonia, for instance, is considered an important hydrogen carrier and a fuel in itself, yet its high toxicity levels might prevent governments from allowing it to be handled in highly urbanized areas. A clear legislative framework that accommodates change would give the private sector more certainty regarding the necessary future investments.

The lack of clear legislative requirements is compounded by the uneven international playing field with countries that have less strict environmental standards. European companies can hardly maintain their competitive margins as it becomes much more expensive and difficult to perform a task that foreign companies can do with minimal obstacles. The European carbon border tax is one instrument aimed to mitigate this inequity, but successful implementation of such a disputed policy will take time.

Lack of space

In Europe, land is scarce. Large ports like Amsterdam and Rotterdam have nowhere left to expand and can therefore hardly support two parallel energy systems. In the mid-term, lack of space is a large threat for conventional industries: they are required to fulfill the continuing demand for fossil fuels so they cannot dismantle assets, but they do not have much additional space to build new facilities. Competition between companies is fierce. If one were to make a speculative investment in a new hydrogen facility that they cannot yet fully use because of lack of regulation and low demand, they would lose market share to their competitors. Moving facilities away from the Port of Rotterdam, for instance, will have large implications for transport modalities: the distance to import hubs or industry will increase, and so will the handling and transport costs. At the same time, the new carriers also require a lot of space not only for storage but also in terms of transportation and handling, as they tend to have different properties and higher energy densities compared to traditional fuels. Close cooperation with policymakers and port authorities is required in order to plan a coordinated strategy and support the efforts of companies that are trying to change.

Overcoming the waiting game: uncertainty and unfavorable investment climate

The uncertainty associated with long-term developments in the energy sector makes financial decisions challenging. The demand for certain low-carbon fuels like diesel or gasoline blended with synthetic fuels has been increasing in the last decade, albeit at a slow pace. The blending requirements are expected to increase with the revised Renewable Energy Directive. However, other fuels are still at a very early stage. Hydrogen could start being imported across Europe in the next 5 years, but only in the long term will it become truly prominent. Therefore, storage companies find themselves in a dilemma: they could build new infrastructure, but the market is not mature enough and licensing requirements unclear. On the other hand, available infrastructure might accelerate the transition and stimulate demand by lowering costs. It becomes apparent that incremental change in both infrastructure and market development is required simultaneously.

The uncertainty caused by the above-mentioned unclear regulations, lack of space, and premature markets for new products leads to an unfavorable investment climate. The negative public opinion and the limited proactivity of the sector further exacerbate this issue. The EU Taxonomy will ensure that only companies with realistic long-term plans and willingness to change will be able to secure investments. The Taxonomy is a classification system meant to help investors find those companies that substantially contribute to environmental objectives. Attracting new investors and aligning with the Taxonomy require a combination of different actions. Developing a real strategy for change, expanding expertise and knowledge, cooperating with policymakers and stakeholders to reduce uncertainty, increasing transparency of the sector's activities, and showing their role in today's economy, will all ensure that the sector becomes a driver of change.

6.2. Opportunities

Nine opportunities are identified as the main avenues to explore by tank storage companies, summarized in Figure 14.

More diversification in storage

Unlike crude oil, which could either be directly used or refined into gasoline, diesel, or jet fuel, the new energy carriers are very different from each other. Products are becoming more diversified, and their physical properties require specialized types of storage. To satisfy this demand, the enormous tanks used to store crude oil must be replaced by smaller tanks for different fuels. The increase in blending requirements for biofuels and conventional fuels will lead to a wide range of specifications that end-products must adhere to. All these slightly different products must be stored separately. Flexibility and preparedness are key for storage companies to succeed in developing such a new business model. From a technical point of view, crude oil tanks can be transformed or split into two or four smaller tanks. From a business perspective, the decision must be taken at the right moment to capture the new emerging market.

Figure 14. Opportunities for the European tank storage sector up to 2030

Leveraging existing infrastructure

To a certain extent, storage companies already have some of the needed infrastructure for certain low-carbon energy carriers. On the one hand, existing fossil fuel facilities can be re-used for alternative fuels (specifically e-fuels) with minimal modifications.[211] Even if the tank itself cannot be used for storing an alternative product, it is likely that at least some of the surrounding facilities might be fit for purpose and therefore the required investment to overhaul infrastructure is minimized. On the other hand, many companies already have facilities to store methanol or ammonia, which are two of the main contenders to become dominant hydrogen carriers in the next years. Storage companies have been involved in blending biofuels with road transport or aviation fuels for years already, therefore having not only the infrastructural capacity but also the knowledge to handle such products. It is largely the lack of price competitiveness of new fuels over conventional ones that inhibits demand and prevents storage companies from selling it. The role that storage companies already have in decarbonization should not be underestimated. Rather, they should explain and emphasize the fact that a large part of the infrastructure can rapidly be overhauled to respond to new demand.

211 Cerny et al., 'Implications of the Energy Transition for the European Storage, Fuel Supply and Distribution Infrastructure', 7.

Innovative workforce: careers, training, skills and competence

As they contribute to the energy transition, tank storage companies require new skills and expertise from their employees. Investing in innovative mindsets and solutions for mainstreaming the consumption of new energy carriers should be a key priority of tank storage companies. One way to do so is opening up new positions and career pathways requiring expertise in emerging technologies and logistics. The competencies of current employees can certainly be improved and trained, but storage companies should also welcome alternative mindsets within the workforce, focused on areas like environmental science, marketing and cybersecurity. This will expand the knowledge base of companies and place them in a ripe position for welcoming change.

Integration of services & energy hubs

Spatial proximity and sharing resources have so far been successful in lowering costs, improving efficiency, and streamlining processes. Industrial clusters such as the ARRRA (Antwerp-Rotterdam-Rhine-Ruhr-Area) region are the prime example of this. New products will require different technical processes than those used so far in industrial clusters. Storage companies should strive to capture a larger part of the supply chain than they have until now: they should focus on becoming (small) energy hubs. Isolated storage facilities that cannot transition fast enough will likely lose competitive advantage compared to those offering more integrated services. The further diversification of the services that they provide will increase the added value of these companies. For instance, storage companies could take on a larger role in product handling, transport, and processing. Building a small plant for processing hydrogen would ensure that storage companies not only store a specific type of carrier but also process and prepare it for the end user. It is essential that storage companies find ways to expand into other areas of the supply chains and offer more diversified services in order to maintain their competitive advantage.

Closing domestic refineries

European oil refineries have been on a downsloping trajectory in the last 10 years, which is expected to continue. Not only are European companies not investing in new capacity, but the existing capacity is likely to decrease in the next years. However, a supply-demand oil gap is expected in the mid-term: while European production is decreasing, demand is not following suit at the same rapid pace. As a result, European countries will become more dependent on imports of oil products in the mid-term. The responsibility of tank storage in satisfying domestic consumption is therefore increasing. This counterintuitive opportunity means that end users, both private individuals and industry, will become more dependent on storage companies to fulfill their energy needs.

New requirements for strategic storage

Tank storage plays a key role in ensuring energy security and resilient supply chains of oil. Today, countries obey stockholding obligations only in regard to crude oil and refined products, due to the historical importance of petroleum-based fuels.[212] However, the steady decrease in oil consumption in Europe coincides with new energy carriers gaining traction.

212 For more information about strategic storage today, see PAPER 2.

Natural gas is already essential in household and industrial consumption yet there is no governmentally mandated obligation for strategic storage. The European 2021 and 2022 price and geopolitical crises could have been mitigated if strategic reserves were kept. In the long term, new products will support domestic energy consumption. The ambition is to replace oil products with hydrogen carriers like ammonia and methanol, biofuels, or synthetic fuels. However, geopolitical tensions might impact the scarcity of supply of new energy carriers. Therefore, tank storage companies should emphasize the necessity of fast-paced policy development that matches today's reality.

Defense pipelines & infrastructure

Efforts are being made to decarbonize the defense sector. Following European Renewable Energy Directives, military vehicles in the Netherlands are now fueled by diesel blended with biofuels. However, a large part of the defense sector functions under NATO supervision and obeys the 'single fuel policy', i.e., the capability to store, transport and use kerosene and/or diesel through the same pipeline network and use it for all NATO missions.[213] Countries like Germany announced increases in defense spending after the 2022 war in Ukraine, which could lead to an increased need for fuels, whether conventional or low carbon. Storage companies across Europe could play a role in supporting the defense sector and its decarbonization, by providing sufficient blended fuels for military use that can be transported through NATO's pipeline network systems.

Changing commodity markets

The main production and consumption centers of oil are shifting away from Europe, into the Middle East and, respectively, Africa and East Asia. In the mid-term European trading power will likely fade and traders will move closer to the main oil consumers. Instead, new markets are emerging: companies like Vitol are now developing their expertise in power trading, while Ports across Europe aim to become trade hubs for hydrogen. Electricity, ammonia, methanol, or cryogenic hydrogen could therefore become important not only for European consumption but also for international trade. Low costs, well-developed infrastructure, integrated services, and flexible transportation modalities are factors that will determine where the new trade hubs will emerge.

First mover advantage: hydrogen, carbon & energy storage?

Any disruptive technology brings about challenges and opportunities. Forward-looking companies that innovate and act quickly can shape the transition and gain first mover advantages in the emerging market. They will be the "winners" of the energy transition. Companies that adhere to the status quo may opt for a 'last man standing' strategy and continue providing fossil fuels in the energy transition. By the time that the new market develops, they will not have sufficient time and knowledge to change their business and secure a profitable position in the new market. Uncertainty does not only affect the storage companies: it affects consumers, producers, policymakers, and traders. Within this constantly changing environment, the tank storage sector must try to overcome the threats and maximize its opportunities.

213 NATO, 'Synthetic Fuels: Alternative to Petroleum-Based Fuels?', 2017, https://www.sto.nato.int/SitePages/newsitem.aspx?ID=3531.

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