The Hague Centre
for Strategic Studies

# Securing European Military Fuels in a Tense Security Environment

## Supply, Distribution and Storage

**Ron Stoop, Irina Patrahau and Ciaran Cassidy**

April 2025

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**Authors:**
Ron Stoop, Irina Patrahau and Ciaran Cassidy

**Contributors:**
Lucia van Geuns and Michel Rademaker

**Peer review:**
Energex

**Cover photo:**
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# Summary

## Revitalising the readiness of European Allies' military fuel infrastructure

The security architecture of European members of the North Atlantic Treaty Organization (NATO)[1] faces its greatest challenge in decades. The efforts of Putin's Russia to extinguish Ukrainian sovereignty on the one hand, and a Trump administration increasingly hostile towards its allies and partners on the other, have found European Allies unprepared to effectively withstand global geopolitical and security tensions.

This paper investigates the readiness of a key enabling factor of European defence: fuel infrastructure. No modern army can operate without large quantities of a variety of petroleum products being delivered where they are needed. Driven by a decades-long deficit of investment in military logistics infrastructure, European NATO members face a large variety of challenges to their fuel logistics, especially along the Eastern Flank.[2] Geographically, the paper focuses on the European NATO members, including European Union (EU) members, Norway, the United Kingdom (UK), and Türkiye (see NATO members in Figure 1). The timeline considered is short-to-medium term (5-10 years).

The military fuel infrastructure in European NATO members mainly consists of national and multi-country assets, centralised under the NATO Pipeline System (NPS). This comprises several national storage and distribution systems and two multi-country systems: the Northern European Pipeline System (NEPS) and the Central European Pipeline System (CEPS). The total storage capacity of the NPS is 4,100,000 m³, of which CEPS is its most important component with a storage capacity of 1,200,000 m³.[3] To compare, the members of the Federation of European Tank Store Operators (FETSA) store about 120,000,000 m³ of bulk liquids, primarily petroleum products.[4] While the NPS has a clear mandate to prioritise military users, it remains unclear to what extent and how other types of civilian infrastructure and strategic stocks would be repurposed for military use across different national legislations.

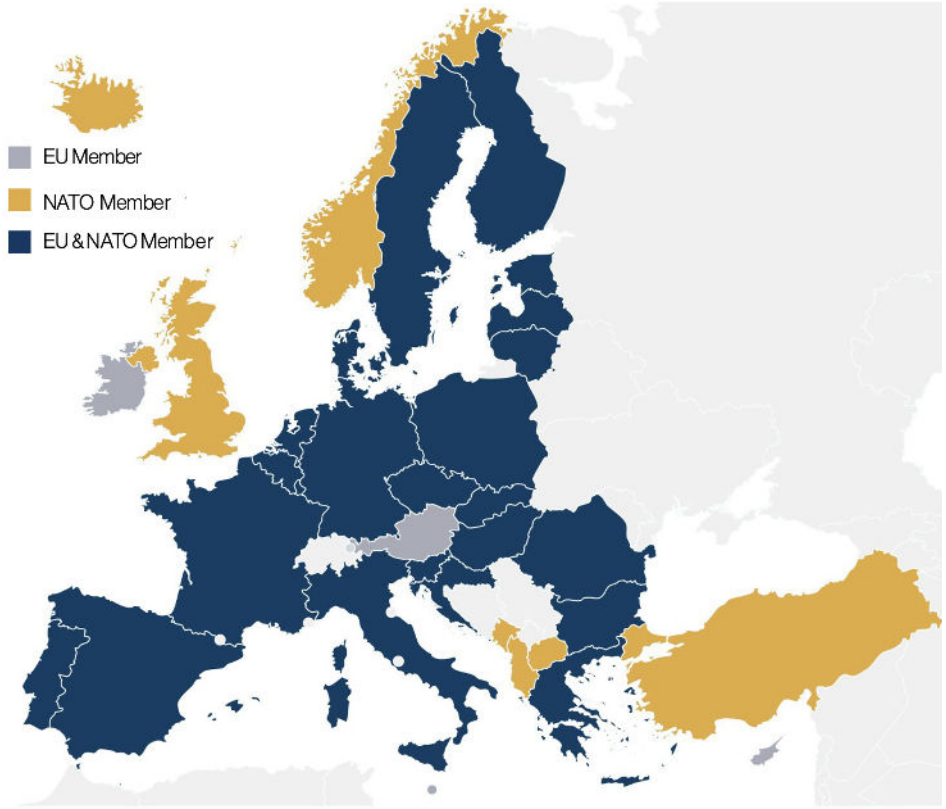
1 We refer to 'European NATO members' as all Allies except for the United States and Canada. This is used interchangeably with 'European Allies'.

2 NATO's Eastern Flank comprises Finland, Estonia, Latvia, Lithuania, Poland, Slovakia, Hungary, Romania, Bulgaria.

3 NATO, 'Central Europe Pipeline System (CEPS)', NATO, accessed 14 March 2025, https://www.nato.int/cps/en/natohq/topics_49151.htm.;
NATO, 'NATO Pipeline System', NATO, 9 March 2017, https://www.nato.int/cps/en/natohq/topics_56600.htm.

4 FETSA, 'Federation of European Tank Storage Associations', accessed 25 March 2025, https://fetsa.eu/.

## Figure 1. Map of EU and NATO members




Recently, there has been increasing recognition from the EU that current transport and fuel infrastructure on NATO's Eastern Flank and fuel connectivity between East and West is insufficient for a potential high-intensity conflict. Apart from potential capacity challenges, troops in combat assigned to protect fuel convoys are often targeted during wartime. The EU's 2022 Military Mobility Action Plan, the 2024 Niinistö report, and the 2025 "White Paper for European Defence" highlight that Europe's military preparedness calls for a more detailed consideration of fuel infrastructure, the challenges posed to fuel supply by war conditions, and the means by which deficiencies can be addressed in a timely manner.[5] The EU is also taking steps to improve its cybersecurity strategy, with the 2022 NIS2 directive identifying energy as one of seventeen key sectors in need of greater action on cybersecurity including oil production, storage, and transmission pipelines.[6]

5 'Military Mobility', European Commission, accessed 1 April 2025, https://defence-industry-space.ec.europa.eu/eu-defence-industry/military-mobility_en.;
Niinistö, Sauli. 'Safer Together: A Path towards a Fully Prepared Union'. European Commission, October 2024. https://commission.europa.eu/topics/defence/safer-together-path-towards-fully-prepared-union_en. Pg. 23.;
European Commission. 'Commission Unveils the White Paper for European Defence and the ReArm Europe Plan/Readiness 2030'. Text, March 2025. https://ec.europa.eu/commission/presscorner/detail/en/ip_25_793. Pg. 8.

6 EUR-Lex. 'Cybersecurity of Network and Information Systems (2022)', December 2022. https://eur-lex.europa.eu/legal-content/EN/LSU/?uri=oj:JOL_2022_333_R_0002.

# Five bottlenecks to European Allies' military fuel supply in the event of a full-scale war

Challenges for European Allies to secure military fuels can arise at different stages in the supply chain in the event of a full-scale war. This paper identifies five key bottlenecks, summarised below.

1. **Crude oil import dependence**: European NATO members are vulnerable to supply shocks due to their large imports of crude oil from unfriendly states. Allies' domestic supply capacity, particularly in Norway, the diversified supply base and the liquidity of the global market make it unlikely that a complete halt in supplies would occur. Still, the external positioning and domestic stability of key suppliers, along with potential maritime chokepoints on critical supply routes, pose strategic vulnerabilities for European Allies. In combination, they can trigger cascading effects.

2. **An unequally distributed and shrinking refining capacity**: The refining capacity of European Allies is highly concentrated in Germany, Italy, the Netherlands and France, while countries on the Eastern Flank have very limited capabilities within their borders. At the same time, refining capacity is being scaled down across Europe, driven by the lack of competitiveness in the global market and the anticipated decline in demand from the commercial sector due to the energy transition.

3. **Inadequate distribution lines**: The military fuel pipeline systems across European Allied countries lack in geographical scope, especially towards the Eastern Flank. This is particularly problematic given that these countries lack diversified energy supplies and sufficient domestic refining and storage capacity to sustain their militaries in the event of a full-scale war.

4. **Insufficient storage**: Fuel storage capacity is limited on the Eastern Flank. Moreover, there are no clear and coordinated non-military/military fuel policies in place across the different countries to apportion fuel supplies to the military in times of conflict.

5. **Challenges to maintaining two energy systems:** Fossil fuel capacity will remain important for military operations in the upcoming decades, even though fossil fuel systems are being phased out. It is essential to effectively manage the transition without restraining NATO military readiness.

# Recommendations

To increase the military readiness of European NATO members and secure military fuel supplies, five policy actions are recommended to the European Commission and NATO in collaboration with member states, the civilian and military logistics sectors:

1. **Coordinate a comprehensive assessment of military needs and potential bottlenecks at the European level** to gain a granular understanding of challenges and develop tailored solutions.

2. **Acknowledge the centrality of the collaboration between the military and civilian fuel logistics sectors considering current geopolitical and security challenges, and enter into dialogue** to discuss potential solutions for the various bottlenecks in securing military fuel supply.

3. **Develop and coordinate clear policies between Allies regarding the use of strategic stocks in wartime** to enhance readiness and speed of action in case of a full-scale war.

4. **In the short term (1-5 years):**
   - **Monitor strategic vulnerabilities along critical oil supply routes and develop contingency plans** to ensure supplies during a full-scale war.
   - **European NATO members should ensure that oil terminals and refineries maintain sufficient capacity** to support military logistics.
   - **Additional fuel storage capacity on the Eastern Flank is key** to help provide the needed supply at a short notice in the event of military conflict.

5. **In the medium term (5-10 years):**
   - **Develop an effective military fuel distribution system connecting the Eastern Flank with the other European Allies** to strengthen military logistics and increase readiness.
   - **Investigate and identify ways to ensure military supply security whilst transitioning away from fossil fuels** to maintain readiness and contribute to climate goals.

# 1. Introduction

For the last thirty years, European members of the North Atlantic Treaty Organization (NATO)[7] have been operating under the assumption that no large-scale war would return to the continent. Defence spending decreased and a significant part of military infrastructure was mothballed or repurposed. After decades under the United States' (US) security umbrella enjoying the benefits of the so-called 'peace dividend', the Russian invasion of Ukraine in 2022 caught European Allies off guard. Its vulnerable position was exacerbated by actions of the second Trump administration in 2025, pointing to the urgent need to strengthen European autonomy and military readiness.

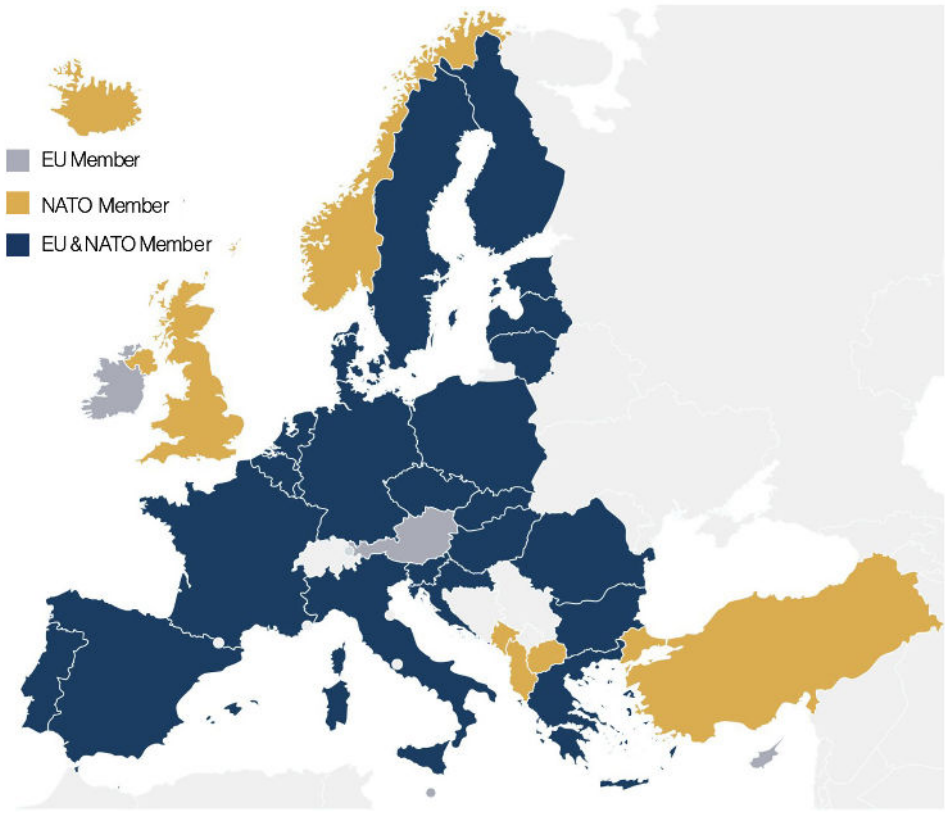
Despite the growing security threats, most military infrastructure in European NATO countries is not prepared for wartime. The success of any military operation depends in a large part on effective supply lines that deliver fuel, food and other logistical support. Fuel is vital to power tanks, armoured vehicles, and reconnaissance vehicles (diesel/kerosene); fighter jets (kerosene); and fleets (marine diesel). Moreover, the effective distribution and storage of these fuels is key for military readiness. The fuel market and its distribution channels in Europe are almost exclusively geared towards civilian usage. Until now this has not been a major issue: military fuel use in peacetime is relatively low. However, an army at war consumes vastly more oil products, reaching levels comparable to a large country's civilian usage for certain fuels. This means that in times of war the existing fuel infrastructure will come under increased strain as military and civilian needs will compete with each other.

Simultaneously, European Allies are in the midst of a climate transition that necessitates the switch to cleaner energy. Old fuel systems will be phased out as new fuel infrastructure and markets are being developed. Despite the progress made on the greening of electricity generation for the civilian sector – via nuclear, solar, wind, hydro and biofuels – militaries still primarily rely on fossil-fuel based energy. NATO has also set climate neutrality goals for 2050, but low-carbon fuels remain too risky and unreliable to use in military operations, leaving militaries dependent on oil for the next decades. Allied governments will have to simultaneously navigate the intricacies of ensuring supply for their armies whilst transitioning away from fossil fuels.

This paper analyses the implications of a full-scale war involving NATO on the European continent, specifically regarding fuel logistics and infrastructure. Geographically, the paper focuses on the European NATO members, including European Union (EU) members, Norway, the United Kingdom (UK), and Türkiye (see NATO members in Figure 2). The timeline considered is short-to-medium term (5-10 years). Five bottlenecks that can impact European military fuel security in times of war are discussed. To address these bottlenecks, the conclusion proposes avenues for cooperation between relevant stakeholders in the civilian and military sectors.

[7] Throughout this paper we refer to 'European NATO members' as all Allies except for the United States and Canada. This is used interchangeably with 'European Allies'.

## Figure 2. Map of EU and NATO members



# 2. Geopolitical and security challenges for European Allies

The switch from a unipolar, US-led liberal world order to a multipolar world order of power competition has implications for global security. New rivalries, alliances and political blocs are being formed. The China-Russia axis has emerged as an 'anti-Western' force, with especially Russia challenging the existing world order through its invasion of Ukraine in contravention of principles of national sovereignty. Meanwhile, the existing western-led global order has been weakened by the increasing political and economic clout of non-Western countries like BRICS members Brazil, Russia, India, China and South Africa; and the growing geopolitical divergences between the US and the EU.

This tense geopolitical landscape is directly affecting European Allies' security. The most urgent threat is the full-scale war that Russia is conducting against Ukraine. The Russian military is waging a war of destruction against Ukraine. The severity and scale of the war crimes committed by Russia have served as a painful wake-up call for European countries. There is a real possibility that the war could spread to other areas such as the Baltics or Poland. Furthermore, the maritime supply lines to the Baltic Sea through the Denmark Straits could be strained due to the shallow depth of the Straits and the location of Kaliningrad adjacent to key ports, leading to possible denial of maritime movements.

Another major threat is the unfolding US-China competition for global dominance, with significant implications for European Allies. Under the Trump presidency, the so-called 'pivot to Asia' is being accelerated, prompting the US to scale back its support for Europe in favour of the Indo-Pacific theatre. Since most European Allies are dependent on the US for strategic military capabilities, this severely undermines their security position. Additionally, the US has become a large oil and Liquefied Natural Gas (LNG) exporter to European NATO members, increasing supplies in the wake of the Ukraine war and resulting sanctions on Russia.[8] If US tensions with China escalate, especially simultaneously to a conflict in Europe, the US could prioritize military support as well as fuel exports to Indo-Pacific partners (Japan, South Korea, Australia, New Zealand), impacting the military readiness of European Allies.

Tensions are also growing on the edges of the European continent. In 2023, Azerbaijan regained control over the Armenian enclave of Nagorno-Karabakh, displacing over 100,000 Armenians.[9] In the northern Georgian separatist regions of Abkhazia and South Ossetia, the

8 "U.S. Crude Oil Exports Reached a Record in 2023 - U.S. Energy Information Administration (EIA)." March 18 2024. Accessed March 19, 2025. https://www.eia.gov/todayinenergy/detail.php?id=61584.

9 Council on Foreign Relations, 'Nagorno-Karabakh Conflict | Global Conflict Tracker', 20 March 2024, https://www.cfr.org/global-conflict-tracker/conflict/nagorno-karabakh-conflict.

frozen conflict fomented by Russia could also spiral into regional instability.[10] Additionally, the North Caucasus – with regions such as Chechnya, Dagestan and Ingushetia – are known for frequent terrorist attacks, violence and political unrest.[11] The precarious balance of power in the Middle East, including the transitional government in Syria, the tense ceasefire in the Libyan civil war and the Israel-Palestine conflict, are also environments that harbour potential for considerable instability. All these regions play a key role in oil deliveries to European Allies. If any of these conflicts were to escalate, supply lines could be affected and potentially impact fuel availability in wartime.

These geopolitical and security challenges have led European Allies to revitalize military readiness. NATO has expanded to include Sweden and Finland, while Poland is vigorously rearming itself, buying batches of heavy equipment from European and non-European suppliers.[12] Simultaneously, the Baltic countries are reinforcing the *Baltic Defence Line,* to deter aggressive action by Russia and if invasion occurs to slow down the Russian military advance in the region.[13] The EU has recognized this threat, and in March 2025 announced the ReArm Europe Plan/Readiness 2030, which aims to leverage up to 800 billion euro in military spending.[14] The whitepaper underlying the ReArm Europe Plan also mentions military fuel infrastructure as a 'strategic enabler' of European security.[15] If an escalation of the war on the European continent were to occur, the military fuel infrastructure should be ready to support a high-intensity conflict.

10 S. Neil MacFarlane, 'Frozen Conflicts in the Former Soviet Union – The Case of Georgia/South Ossetia', *OSCE Yearbook 2008*, 14 July 2009, https://ifsh.de/file-CORE/documents/yearbook/english/08/MacFarlane-en.pdf.

11 CEPA, 'Russia Seeks to Quash the North Caucasus Terrorist Threat', CEPA, 22 June 2022, https://cepa.org/article/russia-seeks-to-quash-the-north-caucasus-terrorist-threat/.

12 Francesco Bortoletto, 'Poland's Rearmament (Including Nuclear)', 10 March 2025, https://www.eunews.it/en/2025/03/10/polands-rearmament-including-nuclear/.

13 Euronews, 'Baltic Defence Line in Latvia Gets Its "Dragon's Teeth"', euronews, 6 August 2024, https://www.euronews.com/my-europe/2024/08/06/construction-is-underway-on-the-first-elements-of-the-baltic-defence-line-in-latvia.

14 European Commission, 'Future of European Defence', 19 March 2025, https://commission.europa.eu/topics/defence/future-european-defence_en.

15 European Commission, 'White Paper for European Defence and the ReArm Europe Plan/Readiness 2030', Text, European Commission - European Commission, 19 March 2025, https://ec.europa.eu/commission/presscorner/detail/en/ip_25_793.

# 3. Fuel use and infrastructure

The civilian sector dominates fuel demand and related infrastructure in European NATO countries, given that military fuel use is relatively low in peace time. The military has its own infrastructure, part of which has been mostly used for civilian purposes in recent decades. This section offers a concise overview of European Allies' fuel consumption and infrastructure as of 2025, both in the civilian and military sectors.

## Civilian fuel infrastructure and consumption

The civilian fuel infrastructure of European NATO members consists of a vast network of import terminals, refineries, storage sites and multimodal distribution systems. As domestic crude oil production has severely declined in Europe, the region is dependent on imports. The majority of crude and refined oil enters Europe via sea, with the exception of the landlocked countries, who receive their oil via pipelines, waterways, road, and/or rail. After the crude oil and oil products have arrived, they are stored in tanks and/or refined. Germany, Italy, Spain and the Netherlands have the largest refining capacities, converting seaborne crude into several downstream oil products that are used across European countries and, to a lesser extent, exported further.

The largest oil consumer among European Allies is Germany, accounting for almost 20% of the EU's total final consumption (see Table 1). France has roughly the same final oil consumption as the UK, followed by Türkiye, Italy, and Spain. Road transport accounts for about half of the final consumption of oil across the EU NATO members, with about 65% diesel consumption and 25% gasoline consumption.[16] Other important consumers are the maritime, aviation, and industrial sectors.

[16] Eurostat. 'Oil and Petroleum Products - a Statistical Overview', 25 March 2024. https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Oil_and_petroleum_products_-_a_statistical_overview.

## Table 1. European NATO members by Final Consumption of Oil Products 2023 (Measured in thousand tons of oil equivalent). Data from Eurostat[17]

| Country | Oil Consumption (thousand tons of oil equivalent) |
|---|---|
| **Germany** | 75,949 |
| **France** | 61,208 |
| **United Kingdom** | 59,608 |
| **Türkiy**e | 44,849 |
| **Italy** | 42,377 |
| **Spain** | 40,985 |
| **Poland** | 29,922 |
| **Netherlands** | 21,599 |
| **Belgium** | 17,514 |
| **Romania** | 10,523 |
| **Czechia** | 9,165 |
| **Greece** | 8,171 |
| **Sweden** | 7,850 |
| **Portugal** | 7,610 |
| **Norway** | 7,396 |
| **Hungary** | 7,129 |
| **Finland** | 6,474 |
| **Denmark** | 4,790 |
| **Bulgaria** | 3,948 |
| **Slovakia** | 3,508 |
| **Croatia** | 3,279 |
| **Lithuania** | 2,393 |
| **Slovenia** | 2,178 |
| **Luxembourg** | 1,656 |
| **Latvia** | 1,425 |
| **Estonia** | 1,011 |
| **Iceland** | 562 |

Beyond storage units integrated with refineries or large industrial consumers, independent tank storage companies manage the remaining capacity. France and the Netherlands have the largest storage capacities in Europe, but with different focuses: France primarily serves domestic consumption, while the Netherlands functions as a key fuel hub. Other countries, including Italy, Spain, Belgium, and the UK, have comparable storage capacities, though significantly smaller than those of France and the Netherlands.[18]

17 Eurostat. "Complete Energy Balances", 2025, Accessed March 21 2025. https://ec.europa.eu/eurostat/databrowser/view/NRG_BAL_C__custom_16050673/default/table?lang=en..; "Digest of UK Energy Statistics (DUKES): Petroleum", July 2024, Accessed March 31 2025. https://www.gov.uk/government/statistics/petroleum-chapter-3-digest-of-united-kingdom-energy-statistics-dukes.

18 For an overview, see https://hcss.nl/wp-content/uploads/2022/03/Tank-storage-v3.pdf

The independent storage sector also stores strategic fuel supplies, as mandated by the EU and the guidelines of the International Energy Agency (IEA). Every country must hold at least 90 days of net oil imports or 61 days of consumption, whichever is larger, to ensure self-sufficiency in an emergency.[19] These stocks can help balance out market fluctuations and increase energy security. These stocks are frequently held in the form of crude oil, posing difficulties if refineries do not have the requisite capacity to increase the rate of refining. The main objective is to maintain economic activity, and they are not to be used for military purposes outside of extraordinary circumstances.

# Military fuel infrastructure and consumption

Military fuel consumption is divided between operations, whereby the navy, air force and army use fuels to support their missions; and installations, whereby military bases use fuels for transportation, heat and electricity. Moreover, militaries use fuels for trainings and exercises. In peacetime military fuel use is relatively small, except for instances where a military is deployed abroad.

There are two major fuel types used in wartime: diesel and jet fuel (kerosene). Diesel is mainly used for land-based vehicles such as battle tanks, armoured vehicles and support/reconnaissance vehicles. These vehicles are more fuel intensive than non-military vehicles, but the volume required for land-based vehicles is only a fraction of the fuel needed for air assets. In accordance with NATO's Single Fuel Concept that aims to ensure interoperability by using the same fuel, almost all NATO forces use a variety of Jet A-1 kerosene fuel called F-34 or JP-8 for their air platforms, which includes de-icing additives, static dissipators and corrosion inhibitors.[20] Many NATO ground vehicles can be run on modified jet fuel in addition to diesel or gasoline.[21] While this entails benefits in terms of simplification of supply chains, this could further exacerbate kerosene fuel demand if jet fuel is also used for ground vehicles in a combat scenario.

The military fuel infrastructure in European NATO members mainly consists of national and multi-country assets, centralised under the NATO Pipeline System (NPS). The NPS was set up during the Cold War to ensure secure supplies for NATO countries. It consists of several national storage and distribution systems and two multi-country storage and distribution systems. The total storage capacity of the NPS is 4,100,000 $m^3$.[22] The system contains storage depots, air bases, civil airports, pumping and loading stations, refineries and entry and discharge points. To compare, all members of the Federation of European Tank Store Operators (FETSA) store about 120,000,000 $m^3$ of bulk liquids, primarily petroleum products, for non-military purposes.[23]

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19 European Commission. "Security of Oil Supply," 2025. https://energy.ec.europa.eu/topics/energy-security/security-oil-supply_en.;
IEA. "Oil Security and Emergency Response - About.", May 2024, Accessed March 4, 2025. https://www.iea.org/about/oil-security-and-emergency-response.

20 'NATO Logistics Handbook: Chapter 15: Fuels, Oils, Lubricants and Petroleum Handling Equipment'. October 1997. Accessed 2 April 2025. https://www.nato.int/docu/logi-en/1997/lo-15a.htm.

21 'Go4 | Aviation Fuel Additivation for Jet Aircraft and Ground Vehicles'. Accessed 2 April 2025. https://cbi.dk/aviation.html.

22 NATO, 'NATO Pipeline System', NATO, 9 March 2017, https://www.nato.int/cps/en/natohq/topics_56600.htm.

23 FETSA, 'Federation of European Tank Storage Associations', accessed 25 March 2025, https://fetsa.eu/.

Next to the national pipeline systems in Greece, Iceland, Italy, Norway, Portugal and Türkiye there are two cross-border pipeline systems: the Northern European Pipeline System (NEPS) between Denmark and Germany and the Central European Pipeline System (CEPS) which runs between France, Belgium, Luxembourg, the Netherlands, and Germany. In addition, allies hold military strategic stocks, as available prepositioned fuel supply is essential for immediate support in the first operational phases, while supply lines are being established. Apart from national stockholding in each European country, the United States Department of Defence also pre-positions materiel in Europe, including equipment and munitions as well as fuel.[24]

The CEPS is by far the largest military pipeline system in Europe (see Figure 3). It is controlled by the CEPS Programme Office, a multi-country cooperation within the NATO structure. The CEPS pipeline system has a combined length of roughly 5,300 kilometres. The CEPS alone has a storage capacity of 1,200,000 $m^3$.[25] Although the CEPS network can also transport diesel, gasoline and domestic fuel, it mainly transports jet fuel (JET A-1). The CEPS storage system works with a 'banking-like' structure.[26] Customers can request to draw fuel from the network, and after delivery have to refill the network with the amount borrowed. As such, the CEPS works as an intermediary, delivering fuel quickly while maintaining strategic stocks across its depots. In peacetime the CEPS primarily services non-military fuel users. The deliveries to civilian airports make up the majority of total deliveries.[27]

Since most European Allies are dependent on the US for strategic military capabilities, this severely undermines their security position.

[24] Cameron M. Keys, 'Defense Primer: Department of Defense Pre-Positioned Materiel', Congressional Research Service, 2024, https://www.congress.gov/crs-product/IF11699.

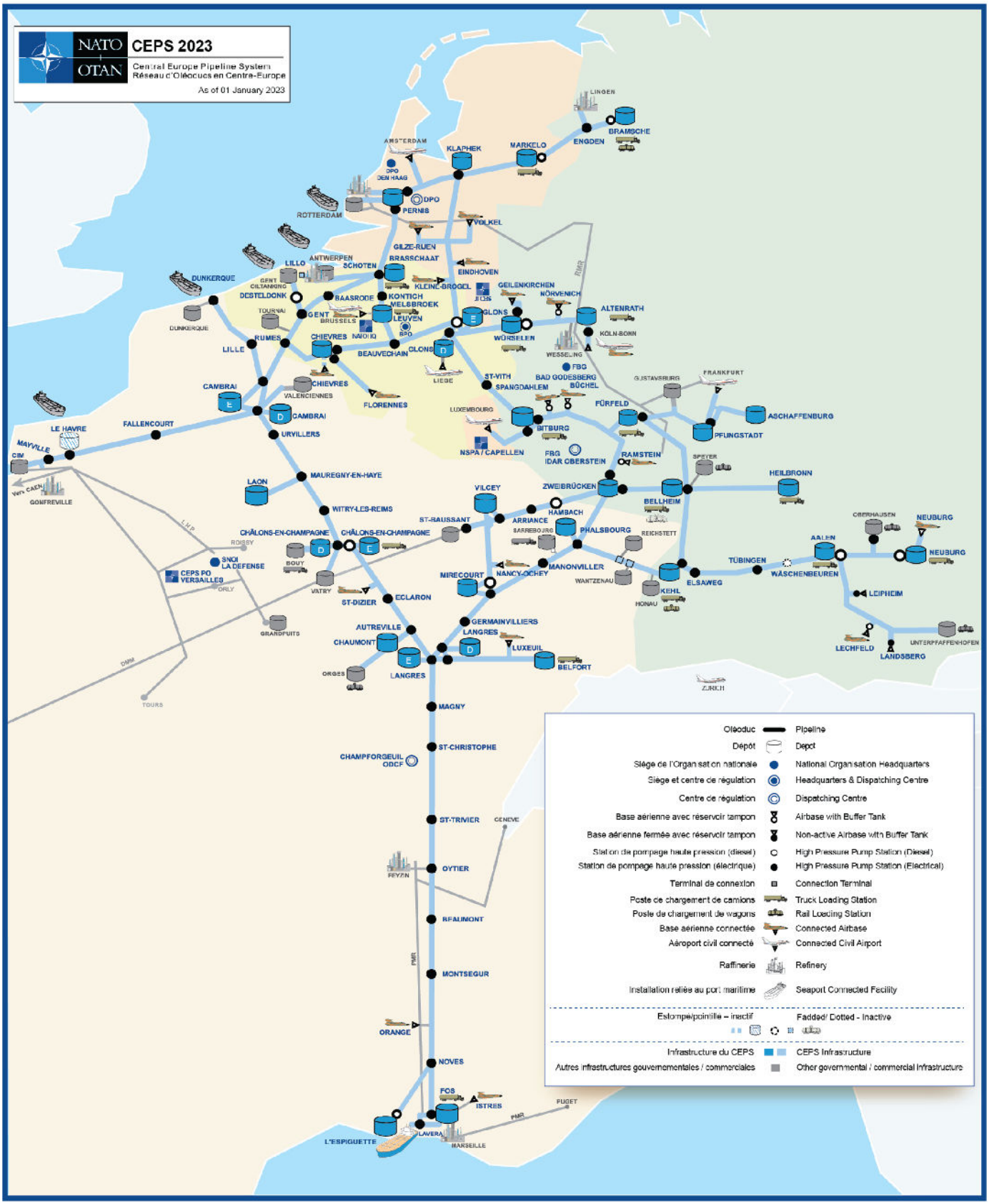
[25] NATO, 'Central Europe Pipeline System (CEPS)', August 2021, accessed 14 March 2025, https://www.nato.int/cps/en/natohq/topics_49151.htm.

[26] International Air Transport Association, 'CEPS PO', accessed 14 March 2025, https://www.iata.org/en/about/sp/partners-directory/.

[27] International Air Transport Association.

## Figure 3. The Central European Pipeline System (CEPS) in 2023.

Source: NATO Support and Procurement Agency/Central Europe Pipeline System Office.



# 4. Bottlenecks in securing military fuel supplies

Recently, there has been increasing recognition from the EU that current transport and fuel infrastructure on NATO's Eastern Flank and fuel connectivity between East and West is insufficient for a potential high-intensity conflict.

European Allies' fuel infrastructure has been evolving for the last decades to match civilian uses and sustainability obligations, while military functions have received less attention. Although the NPS has a clear mandate to prioritise military users, it remains unclear to what extent and how other types of civilian infrastructure and strategic stocks would be repurposed for military use in a coordinated way across national governments. In addition to capacity challenges, fuel supply chains are highly vulnerable to attacks, which can impact military readiness. Apart from physical- and cyberattacks on fuel infrastructure, troops assigned to protect fuel convoys are also often targeted during conflict.

Recently, there has been increasing recognition from the EU that current transport and fuel infrastructure on NATO's Eastern Flank[28] and fuel connectivity between East and West is insufficient for a potential high-intensity conflict. The EU's second Military Mobility Action Plan was released in 2022 and aimed to improve cross-border interconnectedness and shorten reaction times by 2026.[29] The Niinistö report, released in October 2024 by the European Commission highlighted the need for the EU to improve its preparedness for external armed aggression.[30] Critical to this is the preparation of "military transport corridors" between East and West, consisting of the requisite road, rail, and fuel infrastructure links for rapid deployment of troops and logistical support of said troops.[31] The necessity of such preparation was again highlighted in the Commission's "White Paper for European Defence" in March 2025.[32] These developments highlight that European Allies' military preparedness calls for a more detailed consideration of fuel infrastructure, the challenges posed to fuel supply by war conditions, and the means by which deficiencies can be addressed in a timely manner.

The EU is also taking steps to improve its cybersecurity strategy, with the NIS2 directive promulgated in 2022 establishing a common regulatory framework for the improvement of cybersecurity across the Union.[33] This law identified energy as one of seventeen key sectors in need of greater action on cybersecurity including oil production, storage, and transmission pipelines. Under this regulation member states must set up national cybersecurity strategies

28 NATO's Eastern Flank comprises Estonia, Latvia, Lithuania, Poland, Slovakia, Hungary, Romania, Bulgaria. See https://www.nato.int/nato_static_fl2014/assets/pdf/2022/3/pdf/2203-map-det-def-east.pdf

29 'Military Mobility', European Commission, November 2022, accessed 1 April 2025, https://defence-industry-space.ec.europa.eu/eu-defence-industry/military-mobility_en.

30 Niinistö, Sauli. 'Safer Together: A Path towards a Fully Prepared Union'. European Commission, October 2024. https://commission.europa.eu/topics/defence/safer-together-path-towards-fully-prepared-union_en. Pg. 23.

31 Niinistö, 'Safer Together: A Path towards a Fully Prepared Union', pg. 134.

32 European Commission. 'Commission Unveils the White Paper for European Defence and the ReArm Europe Plan/Readiness 2030'. Text, March 2025. https://ec.europa.eu/commission/presscorner/detail/en/ip_25_793. Pg. 8.

33 EUR-Lex. 'Cybersecurity of Network and Information Systems (2022)', December 2022. https://eur-lex.europa.eu/legal-content/EN/LSU/?uri=oj:JOL_2022_333_R_0002.

to protect entities within these sectors. Given the prevalence of Russian cyber-attacks on critical infrastructure these efforts are essential to strengthen and coordinate cybersecurity policy across jurisdictions and in cooperation with commercial infrastructure companies.[34]

Barriers to securing military fuels can arise at different stages in the supply chain, from the import of crude oil and its conversion into kerosene or diesel, to fuel storage and distribution to the battlefield. An emerging bottleneck is also related to the shifting European civilian energy mix in light of climate goals, affecting fossil fuel infrastructure availability and readiness. The five bottlenecks identified by this paper are discussed below.

# Bottleneck 1: Crude oil supply

Most European NATO countries, especially EU members, are large net importers of both crude oil and refined oil products making them vulnerable to potential supply disruptions. In 2023, EU-27's main oil import partners were the United States, Norway and Kazakhstan, followed by relatively lower deliveries from Libya, Saudi Arabia, Nigeria, Iraq, the UK, Azerbaijan, Brazil, Algeria, and Russia (Figure 4).[35] As Norway and the UK are NATO members and enjoy short and secure supply lines, volumes coming from the two countries are considered secure in the event of a conflict on the European continent. Supplies in North Africa also have relatively stable relations with European NATO members, in addition to short supply lines.

The most vulnerable supply lines are Russia, Kazakhstan, the Caucasus region, the United States and the Middle East. These supply routes are vulnerable to disruption by regional conflict, deliberate armed attacks by governments or non-state groups, or trade disputes.

While the oil market is characterised by a large number of suppliers and supply routes, some of these supply lines could come under serious pressure (Figure 5). Blockades may arise due to great power rivalries or piracy and armed robbery against ships in the Strait of Malacca and Bab al-Mandab Strait; littoral rivalries and regional instability around the Strait of Hormuz; or even climate hazards and other logistics issues around port areas, demonstrated by the Suez Canal obstruction in 2021 and Houthi attacks on shipping since the beginning of the Israel-Palestine conflict.[36] Particularly in a scenario in which more than one major supply region were to be simultaneously disrupted, very severe oil supply limitations and price spikes could occur, harming Europe's military operational readiness and civilian economy.

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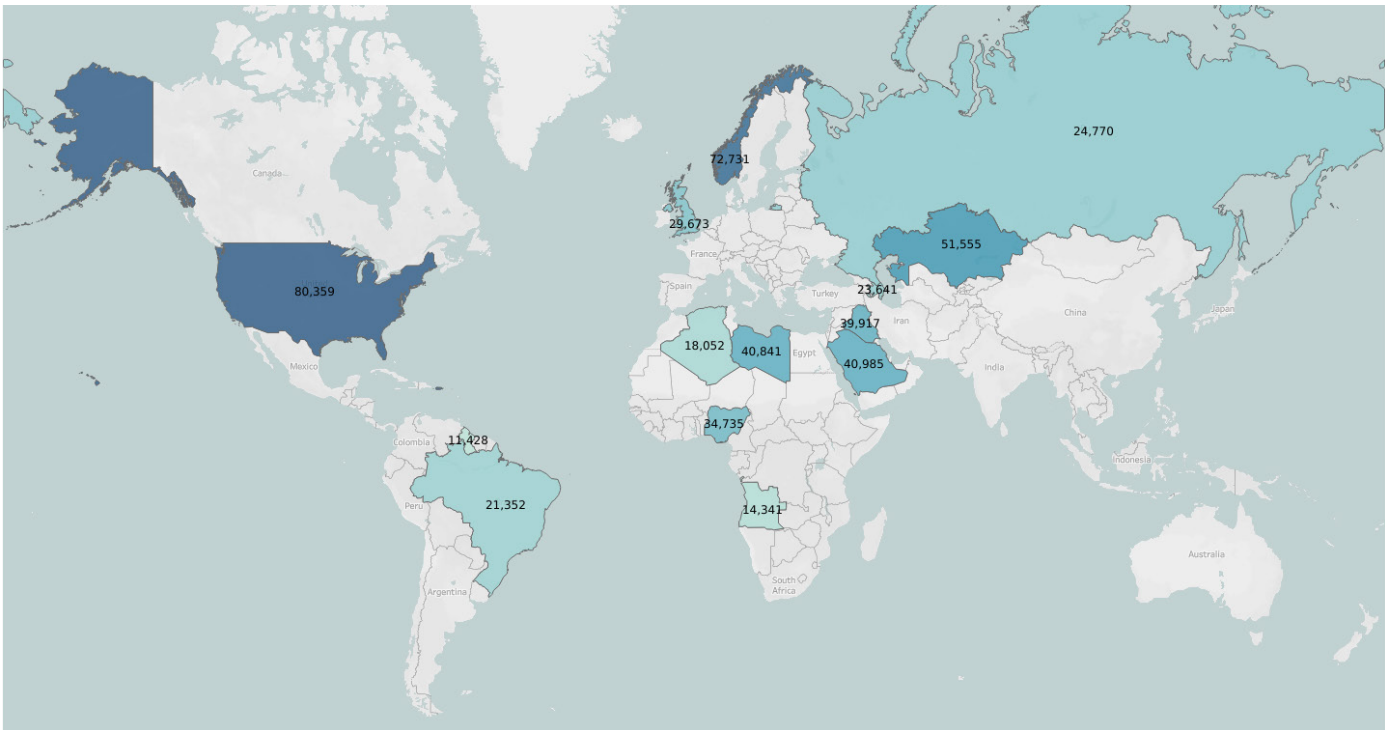
34 Cybersecurity & Infrastructure Security Agency. 'Russian Military Cyber Actors Target US and Global Critical Infrastructure', September 2024. https://www.cisa.gov/news-events/cybersecurity-advisories/aa24-249a.

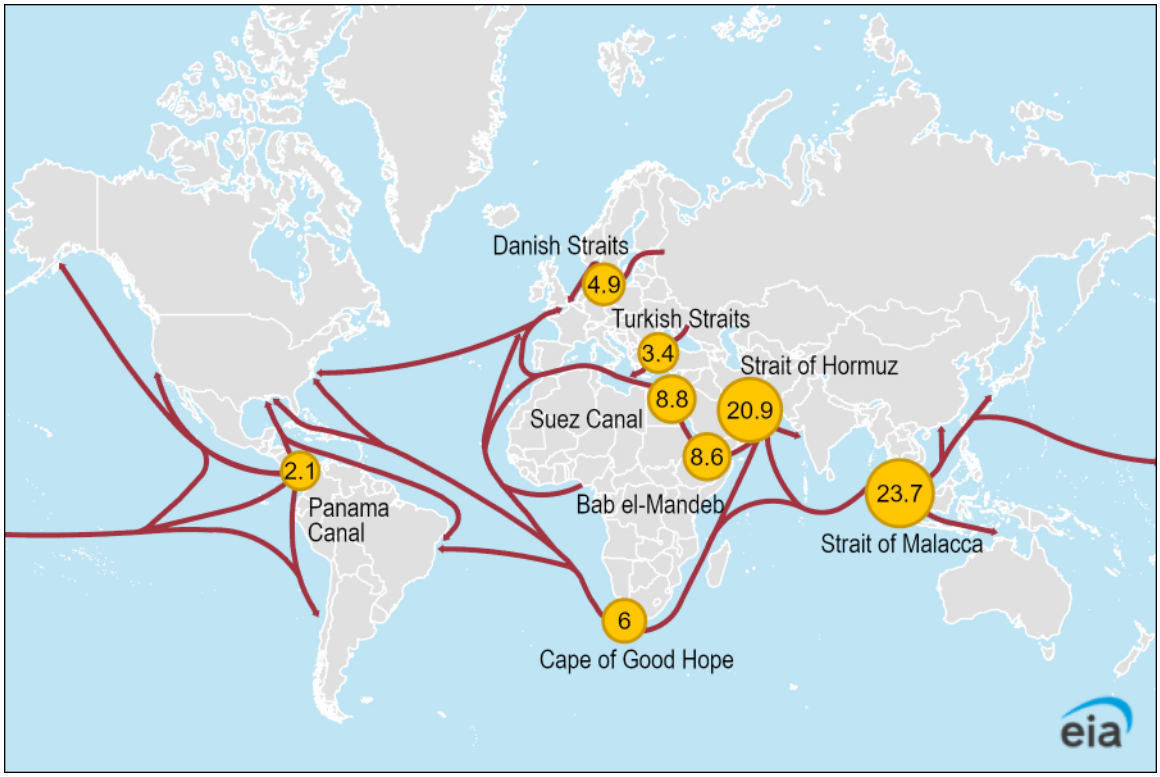
35 "UN Comtrade Trade Data", Database, UN Comtrade. Accessed March 10 2025, https://comtradeplus.un.org/ TradeFlow Amounts in million USD: US: 45,869; Norway: 39,806; Kazakhstan 27,879; Libya 22,593; Saudi Arabia 22,923; Nigeria: 19,709; Iraq: 19,348; UK: 16,229; Azerbaijan: 13,398; Brazil: 11,130; Algeria: 10,555; Russia: 10,007.

36 Benedetta Girardi, Paul Van Hooft, and Giovanni Cisco, 'What the Indo-Pacific Means to Europe: Trade Value, Chokepoints, and Security Risks', 2023, https://hcss.nl/report/what-indo-pacific-means-to-europe-trade-value-chokepoints-security-risks/.;
'Who Are the Houthis and Why Is the US Targeting Them?', *BBC News*. 25 March 2025. https://www.bbc.com/news/world-middle-east-67614911.

## Figure 4. Map of EU Crude Oil Import Partners (UN Comtrade) (000s of $m^3$) (2023)




## Figure 5. Daily Transit Volumes of Petroleum and Other Liquids Through World Maritime Oil Chokepoints[37] (million barrels per day) (2023)




37 U.S. Energy Information Administration (EIA). 'World Oil Transit Chokepoints', June 2024. https://www.eia.gov/international/analysis/special-topics/World_Oil_Transit_Chokepoints. Pg. 2

## Russia

Although the dependence on Russian oil has decreased following the 2022 and 2023 European boycott on maritime crude oil and oil products (European countries imported 15 times less Russian oil in terms of value in November 2024 than in the same month in 2021), a relatively small number of Central and Eastern European countries still heavily rely on Russian pipeline crude (see Table 2).[38] As of October 2024, Slovakia relied on Russia for 87% of its oil imports, Hungary for 69.2%, the Czech Republic for 39.1%, and Latvia for 24.8%.[39] Poland, which in November 2022 relied on Russia for 28.2% of its oil imports, has been an outlier in managing to reduce its imports from Russia to 2.3% in October 2024.

## Table 2. Dependence on Russian crude and refined oil – selected countries

| Country | Dependence on Russian Crude Oil (2023) | | Dependence on Russian Refined Petroleum (2023) | |
|---|---|---|---|---|
| **Slovakia** | 87% | 5,331,000m³ | Negligible | Negligible |
| **Hungary** | 74% | 5,511,000m³ | Negligible | Negligible |
| **Bulgaria** | 86% | 6,457,000m³ | 36% | 558,000m³ |
| **Czech Republic** | 49% | 4,922,000m³ | Negligible | Negligible |
| **Poland** | 3% | 1,340,000m³ | 3% | 358,000m³ |
| **Türkiye** | N/A | N/A | 57% | 20,108,000m³ |

*Source: UN COMTRADE*

For Hungary, Slovakia and the Czech Republic diversifying away from Russian oil from the Druzhba pipeline is more difficult, as they lack the maritime oil terminals that Poland has used to diversify away from dependence on Russia. Instead, they at least partly rely upon imports via the Druzhba oil pipeline delivered directly from Russia.[40] However, the Czech Republic, Hungary and Slovakia have alternative pipeline connections. For the Czech Republic this supply runs via Germany from oil terminals in Trieste with the Czech government planning to divest from Russian oil in the summer of 2025.[41] While Hungary and Slovakia also have an alternative route via Croatia, they have thus far been reticent to end their dependence on Russian oil in favour of this route.[42] Similarly, Türkiye, which runs a significant refining deficit imports 57% of its refined petroleum from Russia.

As a result of this dependence, Russia can wield significant influence over the Slovakian, Turkish and Hungarian fuel supplies. In event of a war Russia could cut crude supplies to their

38 "UN Comtrade Trade Data", Database, UN Comtrade. Accessed March 10 2025, https://comtradeplus.un.org/TradeFlow

39 IEA. "Monthly Reliance on Russian Oil for OECD Countries - Data Product." 2025(a). Accessed February 4, 2025. https://www.iea.org/data-and-statistics/data-product/monthly-reliance-on-russian-oil-for-oecd-countries.

40 Gizinska, Ilona, and Paulina Wankiewicz. 'Better from Russia than via Croatia: The Future of Oil Supplies to Hungary and Slovakia'. OSW Centre for Eastern Studies, 9 September 2024. https://www.osw.waw.pl/en/publikacje/analyses/2024-09-09/better-russia-via-croatia-future-oil-supplies-to-hungary-and

41 "TAL Upgraded: Czechia Decoupling from Russian Oil This Summer," January 15, 2025. https://ceenergynews.com/oil-gas/tal-upgrade-czechia-decoupling-russian-oil/.

42 OSW Centre for Eastern Studies. 'Better from Russia than via Croatia: The Future of Oil Supplies to Hungary and Slovakia', 9 September 2024. https://www.osw.waw.pl/en/publikacje/analyses/2024-09-09/better-russia-via-croatia-future-oil-supplies-to-hungary-and.

refineries and exports of refined petroleum, severely hampering both their economies and their ability to support a NATO war effort.

## Kazakhstan

Kazakhstan is an important source of crude oil for EU NATO members. Romania depended on Kazakhstan for 63.5% ($2.8bn) (5,614,000 m³) of its crude oil imports in 2023. Germany relied on Kazakhstan for 11.6% ($5.3bn) (9,937,000 m³) of its crude oil imports.[43] Kazakh oil is exported primarily via the Caspian Pipeline Consortium through Russian territory to the Black Sea or via the Russian Druzhba pipeline system.[44] Kazakh oil supplies could therefore easily be cut off in the event of a conflict involving the Eastern Flank. While efforts are being made by Kazakhstan to diversify away from dependence on Russian transport links, there is currently no alternative route that could carry the volumes going through the current oil pipelines.[45]

While the oil market is characterised by a large number of suppliers and supply routes, some of these supply lines could come under serious pressure.

## Azerbaijan and the Caucasus

Azerbaijan is a significant source of crude oil for the EU ($27.8bn) (23,641,000 m³) and is one of the countries on the alternative trade route from Kazakhstan (the Middle Corridor) to Europe, alongside Georgia.[46] Escalating conflict in the Caucasus region could affect the supply of both The Baku-Tbilisi-Ceyhan (BTC) pipeline, which transports crude oil from Azerbaijan via Georgia to oil terminals in Türkiye, and the Baku-Supsa pipeline, which transports Azerbaijani crude oil to Georgian terminals. All these pipelines supply crude to European Allies, especially since direct deliveries from Russia have diminished sharply after the full-scale invasion of Ukraine in 2022. Once again, Russia is a significant actor in the region, possibly choosing to escalate tensions to cut off additional supplies to European Allies.

## The Middle East

Germany relied on Iraq, Saudi Arabia, and the United Arab Emirates (UAE) for 10.2% ($4.6bn) (8,854,000 m³) of its crude oil imports in 2023.[47] France similarly depended on Iraq, Saudi Arabia and the UAE for 16% ($4.6bn) (8,969,000 m³) in the same year.[48] Poland imported 45.2% ($7.0bn) (13,163,000 m³) of its crude oil from Saudi Arabia. Lithuania imports 39.6% ($2.1bn) (4,153,000 m³) of its crude oil from Saudi Arabia.

The oil exports from Saudi Arabia, Iraq and the UAE that flow through the Gulf of Hormuz could be sensitive to the actions of Russia's ally Iran, which has the theoretical ability to close this maritime chokepoint, carrying about 21% of global oil consumption.[49]

43 Un. "UN Comtrade Database" Accessed 25 February 2025. https://comtradeplus.un.org/TradeFlow .

44 S&P Global Commodity Insights. "Kazakhstan's Oil Supply Reshaping: Is There a Viable Alternative to the CPC Pipeline?," September 10, 2023. https://www.spglobal.com/commodity-insights/en/research-analytics/kazakhstans-oil-supply-reshaping-is-there-a-viable-alternative.

45 S&P Global Commodity Insights. "Kazakhstan's Oil Supply Reshaping: Is There a Viable Alternative to the CPC Pipeline?," September 10, 2023. https://www.spglobal.com/commodity-insights/en/research-analytics/kazakhstans-oil-supply-reshaping-is-there-a-viable-alternative.

46 UN. "UN Comtrade Database" Accessed 25 February 2025 https://comtradeplus.un.org/TradeFlow .

47 UN. "UN Comtrade Database" Accessed 25 February 2025 https://comtradeplus.un.org/TradeFlow .

48 UN. "UN Comtrade Database" Accessed 25 February 2025 https://comtradeplus.un.org/TradeFlow .

49 "The Strait of Hormuz Is the World's Most Important Oil Transit Chokepoint - U.S. Energy Information Administration (EIA)." Accessed February 24, 2025. https://www.eia.gov/todayinenergy/detail.php?id=61002.

### United States of America

Due to the 2022/23 G7 boycott on Russian crude oil and products, the US has emerged as a large crude and refined oil exporter (80,359,000 m³ crude; 9,298,000 m³ refined) to Europe. In light of the Trump presidency, the trade relationship between the US and Europe has become more unstable. The application of tariffs and the generally unpredictable nature of the current US president makes oil from the US a less secure supply line than in previous years. The US 'pivot to Asia' strategy could potentially exacerbate these problems, given that crude or refined oil that is currently exported from the US to Europe could in case of conflict be rerouted to the Indo-Pacific to support military operations, leaving Europe short on essential fuel supplies.

## Bottleneck 2: Refining capacity

The greatest challenge for military fuel security will likely concern aviation fuel due to high air force fuel usage.

The greatest challenge for military fuel security will likely concern aviation fuel due to high air force fuel usage, relatively low levels of jet fuel storage, and the limited portion of refining capacity dedicated to jet fuel production. In modern large-scale conflicts, air forces use significantly larger quantities of fuel than other military branches. For example, during the 1990-1991 Gulf War, the US Air force used roughly five times (3,785,000 m³) as much fuel as was used by the US Army (783,000 m³).[50] More importantly, while the ground forces can switch to using diesel, which is consumed in large quantities by the civilian sector and is thus more readily available, aircraft must use kerosene/jet fuel which is consumed in lower amounts by non-military sectors.[51] Germany, the EU's largest consumer of kerosene, consumes 9,470 thousand tonnes of kerosene per year (11,837,500 m³).[52] The amount of kerosene used in the Gulf war is equivalent to 32% of Germany's annual kerosene consumption. During the most active phase of the war in February 1991, 42,293,590 (42,294 m³) litres were used per day or roughly ten times Poland's average daily consumption.[53] Meanwhile, the land forces usage of the Gulf War would only be 1% of Germany's annual diesel consumption.

Moreover, only around 9% of crude oil is split into kerosene on average, with a potential maximum of around 20.5% of crude oil being refined into jet fuel.[54] This relatively low fraction of refinery output that can be refined into kerosene should be borne in mind as an additional hurdle for the prospect of Europe being able to fuel a high intensity air war.

50 Stucker, James P., John F. Schank, and Bonnie Dombey-Moore. "Assessment of DoD Fuel Standardization Policies." RAND Corporation, January 1, 1994. https://www.rand.org/pubs/monograph_reports/MR396.html. Pg. 45

51 IEA. "Monthly Oil Statistics - Data Product," 2025(b). https://www.iea.org/data-and-statistics/data-product/monthly-oil-statistics.

52 IEA. "Monthly Oil Statistics - Data Product," 2025(b). https://www.iea.org/data-and-statistics/data-product/monthly-oil-statistics.

53 Stucker, James P., John F. Schank, and Bonnie Dombey-Moore. "Assessment of DoD Fuel Standardization Policies." RAND Corporation, January 1, 1994. https://www.rand.org/pubs/monograph_reports/MR396.html. Pg.47;
IEA. "Monthly Oil Statistics - Data Product," 2025(b). https://www.iea.org/data-and-statistics/data-product/monthly-oil-statistics.

54 Breakthrough Fuel. "Breaking Down Crude Oil Refined Products.", November 2024 Accessed March 4, 2025. Breaking Down Crude https://www.breakthroughfuel.com/blog/crude-oil-barrel/.;
Stucker, James P., John F. Schank, and Bonnie Dombey-Moore. "Assessment of DoD Fuel Standardization Policies." RAND Corporation, January 1, 1994. https://www.rand.org/pubs/monograph_reports/MR396.html. Pg. 60.

The entire CEPS pipeline contains around 1.2 billion litres of kerosene (1,200,000 m³), or enough to fuel roughly one month of the high-intensity period of Operation Desert Storm which is used in this paper as a broadly indicative example of fuel usage during a high-intensity modern war. Moreover, this amount cannot be totally drawn from the pipeline network without adding new kerosene into the system due to the minimum fuel requirements for the pipeline to function effectively. This means that significant amounts of kerosene should be refined from crude oil or procured directly from outside Europe.

This is particularly evident on NATO's Eastern Flank, where only Finland, Bulgaria, and Lithuania can produce enough refined petroleum to meet their domestic needs (see Table 3 and Figure 6).[55] Estonia and Latvia primarily import their refined oil products from Lithuania, which possesses the only refinery in the Baltic region (see Table 3).[56] Latvia imports 64.6% (1,119,000 m³) and Estonia 53.7% (796,000 m³) of their petroleum products from Lithuania.[57] Poland does have significant refining capacity but runs a daily deficit of nearly 200,000 barrels (31,797 m³) of refined oil per day and must import the shortfall.[58] This could be related to the increased competition from larger and more efficient refineries outside the EU.[59] For Spain and Italy, refining activity is roughly equivalent to consumption.

Outside the Eastern Flank, the Netherlands, Greece, Sweden, and Belgium have the largest net refining surpluses after meeting their own domestic consumption (see Figure 6).[60] In 2023, Europe ran a deficit of over 2,000,000 barrels (379,975 m³) of refined petroleum a year.[61] Due to around 3,000,000 (476,962 m³) barrels of unutilised refining capacity Europe could be capable of being self-sufficient in terms of oil refining if it would start up its currently inactive refining production capacity. Germany, Italy, and Spain particularly have large excesses of unused capacity that could be employed under an emergency scenario. This excess capacity is a sign that Europe can increase its production in response to either a limitation of refined petroleum imports or a rapid increase in consumption.

Still, this is dependent on refineries being able to maintain operations despite competitive price pressures from non-European players that can refine crude more cheaply, and a secure supply of crude oil to feed said refineries. The trend of refinery closures has been ongoing for more than two decades, with around 30 refineries in Europe having closed down or been transformed in this period, and more potentially expected in the coming years.[62] Beyond the challenges to refining capacity, additional challenges are posed by the need to transport fuels from refining locations to their consumption destination.

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55 Energy Institute, *Statistical Review of World Energy 2024* (London: Energy Institute, 2024), https://www.energyinst.org/statistical-review/home

56 IEA. "Lithuania Oil Security Policy – Analysis." August 2022. Accessed February 4, 2025. https://www.iea.org/articles/lithuania-oil-security-policy.

57 UN Comtrade. "UN Comtrade Database". 2025. Accessed 31 March 2025. https://comtradeplus.un.org/

58 Energy Institute, 2024

59 "Straight Talk on the European Refining Industry: A Q&A with Shell Experts | Shell Global," June 12, 2024. https://www.shell.com/business-customers/catalysts-technologies/resources-library/q-and-a-with-shell-experts-on-the-european-refining-industry.html.

60 Energy Institute, 2024.

61 Energy Institute, 2024.

62 Benedict George, 'Viewpoint: Europe's Refiners Eye Support from Closures', Argus Media, 23 December 2024, https://www.argusmedia.com/en/news-and-insights/latest-market-news/2641265-viewpoint-europe-s-refiners-eye-support-from-closures.

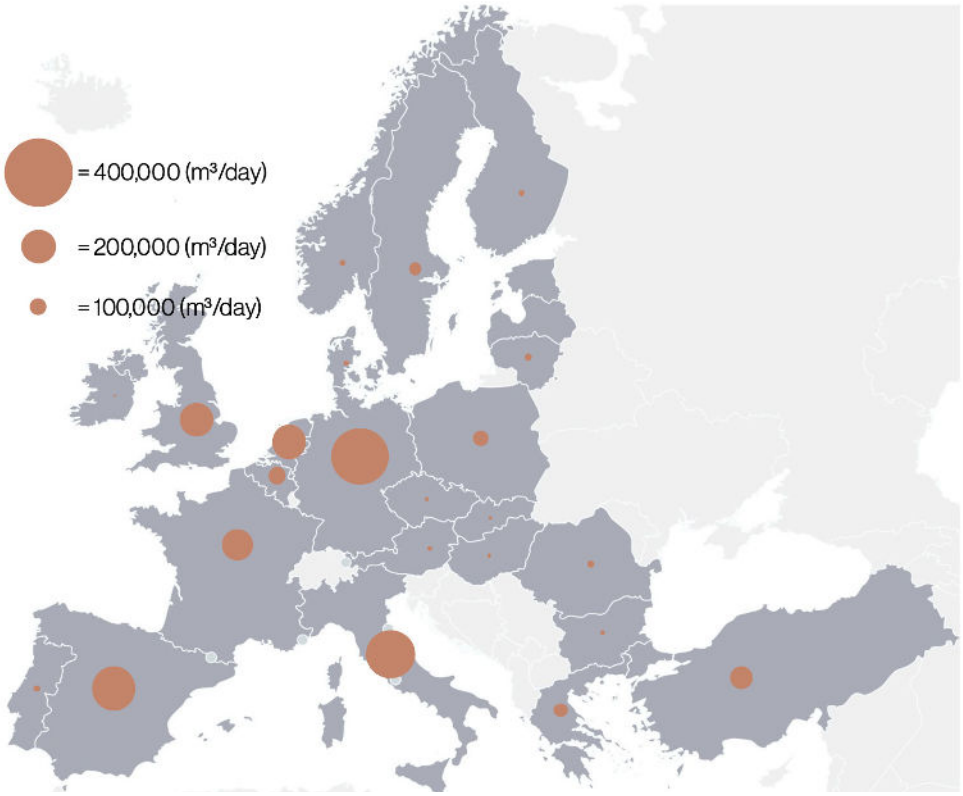
## Table 3. European NATO countries by daily refining capacity and consumption (2023).

Data from the Statistical Review of World Energy 2024.

| Country | Capacity m³ | Utilised Refining Capacity m³ | Consumption m³ | Net Oil Refining m³ |
|---|---|---|---|---|
| **Belgium** | 102,547 | 96,346 | 91,259 | 5,088 |
| **Bulgaria** | 31,002 | 20,032 | 17,648 | 2,385 |
| **Czech Republic** | 27,823 | 23,848 | 33,864 | -10,016 |
| **Denmark** | 28,777 | 23,848 | 25,279 | -1,431 |
| **Finland** | 32,751 | 31,320 | 27,505 | 3,816 |
| **France** | 182,040 | 145,155 | 227,351 | -82,196 |
| **Germany** | 330,057 | 254,061 | 323,062 | -69,000 |
| **Greece** | 83,945 | 74,565 | 48,173 | 26,392 |
| **Hungary** | 26,233 | 22,099 | 27,823 | -5,724 |
| **Italy** | 285,223 | 205,411 | 198,416 | 6,995 |
| **Lithuania** | 38,157 | 28,936 | 10,811 | 18,125 |
| **Netherlands** | 197,303 | 190,943 | 139,909 | 51,035 |
| **Norway** | 35,931 | 25,120 | 35,931 | -10,811 |
| **Poland** | 92,689 | 79,970 | 115,743 | -35,772 |
| **Portugal** | 35,772 | 29,413 | 35,613 | -6,200 |
| **Romania** | 40,065 | 32,910 | 37,203 | -4,293 |
| **Slovakia** | 19,396 | 16,694 | 14,627 | 2,067 |
| **Spain** | 252,948 | 197,621 | 201,437 | -3,816 |
| **Sweden** | 72,180 | 55,963 | 43,721 | 12,242 |
| **Switzerland** | 10,811 | 9,062 | 30,684 | -21,622 |
| **Türkiye** | 130,687 | 115,425 | 181,086 | -65,662 |
| **United Kingdom** | 193,805 | 149,130 | 219,561 | -70,431 |

**Data for Albania, Croatia, Estonia, Iceland, Latvia, Montenegro, North Macedonia and Slovenia was unavailable, which is why they are excluded from the table.*

**Figure 6. Crude oil refining capacity in Europe in 2023.**
Data source: Statistical Review of World Energy, 2024




# Bottleneck 3: Distribution

After the fuel is produced or imported and, if needed, refined, the systems of distribution are essential to bring it into the war theatre. The CEPS stretches from France to Western Germany.[63] Moreover, there are no eastward flowing refined oil pipelines between the largest net refiners in Europe and the Eastern Flank, i.e. the Baltics, Finland, Poland, Romania, Hungary, Slovakia, and Bulgaria. Thus, according to NATO doctrine, the NATO Supply and Procurement Agency will be required to use maritime, road, rail, and barge transport to bring fuel supplies to military units.[64] In 2023 US supplies of ammunition to Ukraine suffered severe delays due to problems with German railways highlighting the potential pitfalls of relying on such infrastructure during wartime.[65]

There are measures being considered to address this issue. The plan to expand the CEPS pipeline system to the Czech Republic and Poland would go a significant way towards strengthening NATO's defensive posture on its Eastern Flank. However, the project is

63 Jankowski, Dominik P. "The NATO Pipeline System: A Forgotten Defence Asset." NATO Defense College, 2020. https://www.jstor.org/stable/resrep25101. Pg. 2

64 "NSPA | Fuel Supply Chain." Accessed March 4, 2025. https://www.nspa.nato.int/about/support-to-operations/operational-energy/fuel-management.

65 Skove, Sam. 'Problems with a German Railroad Contract Slowed US Munitions to Ukraine, IG Says'. Defense One, 24 October 2024. https://www.defenseone.com/policy/2024/10/problems-german-railroad-contract-slowed-us-munitions-ukraine-ig-says/400551/.

estimated to cost 21 billion euros and is not expected to be completed until 2035, meaning that other solutions must be found to ensure military preparedness until then.[66]

In comparison to recent large scale wars conducted by Western militaries in the Middle East, NATO's Eastern Flank will pose intense challenges to fuel logistics. During the Gulf War petroleum products were sourced directly from large refineries in Saudi Arabia, with the country providing almost 500,000 barrels (77,601m³) of fuel per day to Allied forces based there.[67] Equally, during the 2003 Iraq war Kuwaiti fuel refineries were connected directly by pipeline to fuel storage that could hold over 173,800 barrels (27,632m³) of fuel beside the Iraqi border.[68] Further, during these wars the US and allied airforces were able to station their fighter jets at airbases within oil-rich regional countries such as Saudi Arabia and the UAE, roughly 900km from the area of operations.[69] The length and complexity of supply chains for aviation fuel on NATO's Eastern Flank would be several times longer and more complex. If the Gulf War's positioning of fighters (roughly 900km from the theatre of operations) is taken as a benchmark, only Poland, the Baltics, Romania, Finland and Sweden are within range of Russia. This implies a significant reliance on the infrastructure and pre-existing supplies of NATO's easternmost members. This raises the prospect of relatively limited fuel supplies having to meet large demand for key military fuels in the days and weeks following the outbreak of war.

A further challenge for NATO logistics in event of a war is Russia's anti-ship and anti-air missile systems positioned on the Baltic Sea. Anti-Access Aerial Denial (A2/AD) is a doctrine of the Russian military which entails the usage of long-range missile systems to prevent the entry of military or civilian air or sea traffic during wartime.[70] The threat to supply lines posed by such area denial systems is debated by policy experts, with some touting this as an extreme threat to NATO forces and logistics in event of a war in Russia, while others downplay the importance of this capability due to the high costs of A2/AD missile systems and their lower than posited effectiveness effectiveness.[71] Nevertheless, Russia's Kaliningrad exclave is located less than 100km from both Gdansk in Poland and Klaipedos in Lithuania, the largest maritime oil terminals in each country, with Gdansk being the EU's second most important oil terminal in terms of throughput, serving refineries in East Germany as well as Poland.[72] Russian weaponry located in this exclave could pose a serious threat to oil transport vessels headed to either port, further exacerbating logistical bottlenecks in the early stages of a war.

66 Mazzeo, Simona. "NATO to Expand Fuel Pipeline for Eastern Defence," February 22, 2025. https://brussels-morning.com/nato-to-expand-fuel-pipeline-for-eastern-defence/68069/.

67 Steve R. Waddell. *United States Army Logistics : From the American Revolution to 9/11*. Vol. 1st ed. PSI Reports. Santa Barbara, Calif: Praeger, 2010. https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=319115&site=ehost-live&scope=site. Pg. 177.

68 *Perry, Walter L., Richard E. Darilek, Laurinda L. Rohn, Jerry M. Sollinger, Jefferson P. Marquis, Walter L. Perry, Andrea Mejia, et al. "Operation IRAQI FREEDOM: Decisive War, Elusive Peace." RAND Corporation, January 4, 2016. https://www.rand.org/pubs/research_reports/RR1214.html.*

69 Cohen, Eliot A., ed. *Gulf War Air Power Survey*. Vol. V. Washington, D.C: Office of the Secretary of the Air Force, 1993.

70 Häggblom, Robin. 'Myths and Misconceptions around Russian Military Intent | Myth 5: "Russia Creates Impenetrable 'A2/AD Bubbles'"'. Chatham House, July 2022. https://www.chathamhouse.org/2022/06/myths-and-misconceptions-around-russian-military-intent/myth-5-russia-creates-impenetrable.

71 Häggblom, Robin. 'Myths and Misconceptions around Russian Military Intent | Myth 5: "Russia Creates Impenetrable 'A2/AD Bubbles'"'. Chatham House, July 2022. https://www.chathamhouse.org/2022/06/myths-and-misconceptions-around-russian-military-intent/myth-5-russia-creates-impenetrable.

72 Grzybowski, Marek. 'EU oil market. The Port of Gdansk is among the leading importers – iM'. *Internet Manager* , 6 March 2024. https://www.im.org.pl/?p=3079.

# Bottleneck 4: Storage

As fuel distribution to the Eastern Flank is challenging, military operations will have to rely on pre-existing stocks of fuel for a period of days or weeks into a conflict before lines of supply can adequately react to increasing demand. Since the total storage capacity on the Eastern Flank is relatively low compared to other Allies, this will likely be a key bottleneck in the event of a conflict. In 2020, Poland had an oil storage capacity of roughly 55 million barrels (mb) (8,744,000 m³), of which around 33mb (5,247,000 m³) is dedicated to refined fuel products.[73] Around 40mb (6,359,000 m³) of this storage is in underground salt caverns, with the remainder in above ground tank farms.[74] By contrast, all of Lithuania's 18.1mb (2,878,000 m³) of storage is located above ground, largely in the north and west of the country.[75] Hungary has storage capacity of 32.5mb (5,167,000 m³).[76] As an indicative comparison, France possesses 290mb (46,106,000 m³) of storage capacity, of which around 182mb (28,936,000 m³) is used for refined oil products.[77] The disparity in oil storage capacity between Western and Eastern Europe is particularly problematic if fuel distribution infrastructure is inadequate.

Since the total storage capacity on the Eastern Flank is relatively low compared to other Allies, this will likely be a key bottleneck in the event of a conflict.

Apart from having the physical storage capacity, ensuring that oil stock levels are high is another key determinant of readiness in case of a military conflict. Storage levels of diesel and kerosene, the two main fuels used by the military, differ across European NATO members (see Figure 7 and Figure 8). Some countries such as Latvia, Hungary, Romania, Lithuania, and Bulgaria hold almost no kerosene stocks at all.[78] These low levels of supply are not necessarily caused by fuel storage tanks standing empty, but rather by a lack of tank storage and a lack of designation of space for storage for jet fuel. For example, Poland's 2025 emergency oil storage level of roughly 62mb (9,857,000 m³) of oil and oil products, exceeding its 2020 capacity levels by 1,100,000 m³, has only been made possible by expanding storage infrastructure.[79]

73 IEA. "Poland Oil Security Policy – Analysis," June 30, 2022. https://www.iea.org/articles/poland-oil-security-policy.

74 IEA. "Poland Oil Security Policy – Analysis," June 30, 2022. https://www.iea.org/articles/poland-oil-security-policy.

75 IEA. "Lithuania Oil Security Policy – Analysis," August 18, 2022. .

76 IEA. "Hungary Oil Security Policy – Analysis," August 10, 2022. https://www.iea.org/articles/hungary-oil-security-policy.

77 IEA. "France Oil Security Policy – Analysis," June 30, 2022. https://www.iea.org/articles/france-oil-security-policy.

78 Eurostat. "Stock Levels for Oil Products- Monthly Data." Eurostat, 2025. https://doi.org/10.2908/NRG_STK_OILM.

79 Eurostat. "Stock Levels for Oil Products- Monthly Data." Eurostat, 2025. https://doi.org/10.2908/NRG_STK_OILM.;
Brodacki, Dominik, Dominik P Jankowski, Przemysław Ogarek, Dariusz Rafał, Mariusz Ruszel, and Paweł Turowski. "Directions for the Development of Poland's Critical Infrastructure in the Face of Regional Security Challenges and Energy Transformation" Ignacy Lukasiewicz Institute for Energy Policy, 2023. Pg. 7-9

**Figure 7. Kerosene Stock levels (November 2024) (Opening Stock).** Data from Eurostat.

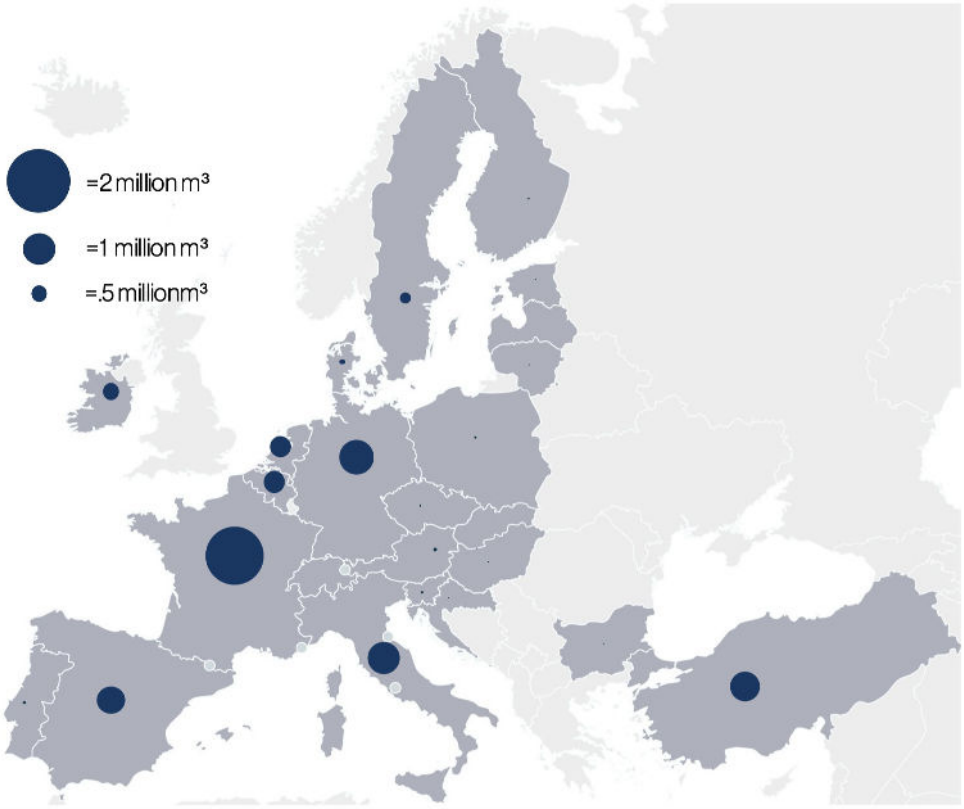
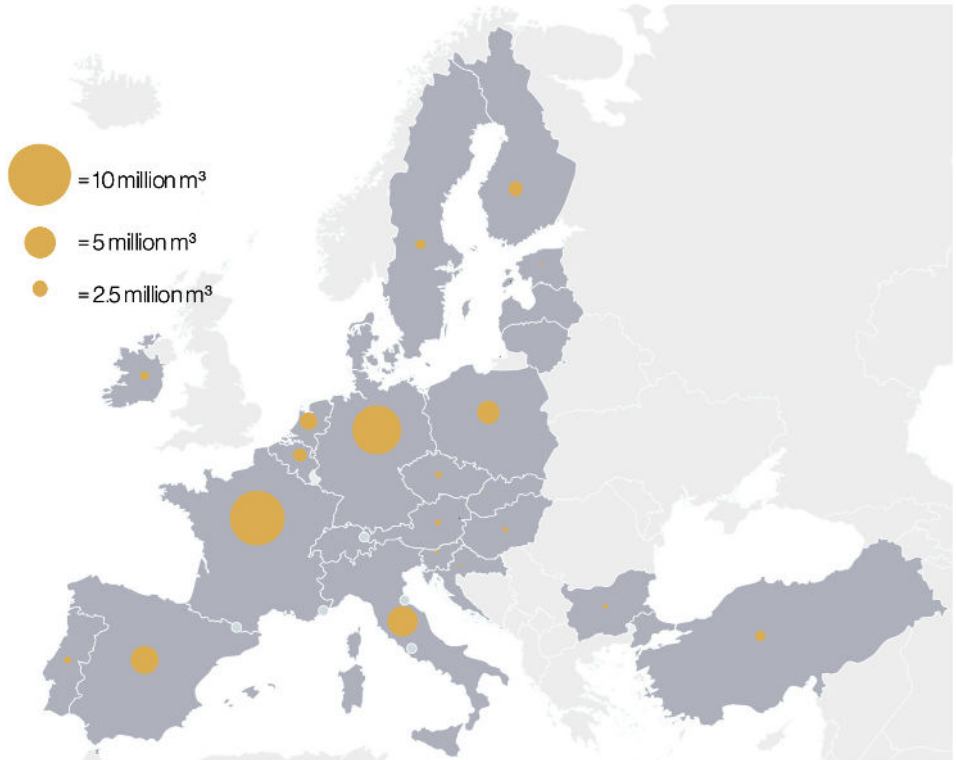



**Figure 8. Road Diesel Stock Levels (November 2024) (Opening Stock).** Data from Eurostat.



According to EU legislation, every member state must hold strategic stocks equivalent to at least 90 days of net oil imports or 61 days of consumption, whichever is larger, to ensure self-sufficiency in an economic emergency.[80] Almost all countries possess laws that allow for the use of emergency stocks in case of war, which given sufficient military need would likely be invoked to commandeer civilian fuel supplies,[81] in the Netherlands for example, the declaration of martial law would allow for the usage of civilian emergency stocks. However, even if existing economic strategic stocks were to be used for military purposes, there may not be sufficient stocks of kerosene to sustain military operations.[82] Most countries hold far less than 90 days' supply of jet fuel, gasoline, and diesel consumption. Eurostat indicates that at the beginning of November 2024, Poland held a total stock of only 75,242 tonnes (94,052m³) of kerosene, or 4.68% (17 days) of Polish annual consumption, roughly 1.8% of US Air Force usage during the Gulf War, or around two days of usage at the highest intensity phase of the war.[83] Even Germany, which holds 1,103,651 (1,379,563 m³) tonnes of kerosene has only 11.64% of their annual consumption (42 days), or 35% of US Airforce's Gulf War usage.[84]

While information on fuel consumption in the Ukraine war is classified,[85] a report from 2023 estimated Russian fuel use at roughly 2.367 million tonnes (2,955,000 m³) in the first year of the war, or 197,250 tonnes (246,286m³) per month, of which perhaps two thirds is jet fuel.[86] This can be used as an additional benchmark for an alternative war scenario in which air superiority is not established and lower levels of air power are utilised. Even by this benchmark, Poland possesses only 58.3% of monthly usage in storage. It is worth noting that such a scenario would entail critical failure of NATO's doctrine of air superiority.

In light of the possible 2035 completion date of the Eastern European expansion of the CEPS system, there is a significant need for measures to alleviate the low storage levels on NATO's Eastern Flank to ensure military preparedness. This time horizon mismatch between a present military threat and a relatively long-term project to improve supply could be significantly reduced through the expansion of oil storage in Eastern Flank countries, in particular storage of jet fuel kerosene. Oil storage tanks have construction times of several weeks to several months or somewhat longer for larger designs,[87] provided that permits are rapidly approved, potentially allowing for quick scaling of storage capacity as a measure to bridge the time horizons of possible military conflict and the extension of CEPS to the Eastern Flank.

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84 Eurostat. "Stock Levels for Oil Products- Monthly Data." Eurostat, 2025. https://doi.org/10.2908/NRG_STK_OILM.

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87 Phillips Tank & Structure. "Storage Tank Construction" Accessed March 21, 2025. https://www.phillipstank.com/is/storage-tank-construction.

# Bottleneck 5: A new energy mix

The prospect of a significant shift towards the usage of energy sources other than fossil fuels in the near future presents both opportunities and challenges to the military fuel supply of NATO's Eastern Flank. On the one hand, new vehicle fuel sources such as sustainable aviation fuel, hydrogen, and electricity have the potential to improve some of the supply chain issues outlined above. On the other hand, given the long development processes and service lives of military equipment there is a tendency for military technology to lag the civilian sector in the adoption of new energy sources. This means that in the next 10-15 years new types of fuels for military use will play a marginal role. This will pose an increasing challenge as availability of fossil fuel expertise, parts and supply from the civilian sector decreases, making military positions more expensive and difficult.[88]

The rise of sustainable aviation fuel (SAF) for commercial and military usage is likely to be most impactful on European fuel availability in the mid-to-long term (10-15 years). These fuels can be directly substituted in engines built to utilise traditional fossil fuels and are produced at refineries using biomass, captured carbon, or green hydrogen instead of crude oil.[89] Equally, they can be stored in pre-existing aviation fuel storage after some conversion measures are taken. The easy substitutability alleviates the problem of long military technology lead-in times as it does not require new platforms. The Norwegian, Swedish, and British air forces have successful trialled SAF for the F-35 and the JAS 39 Gripen.[90] The capability of making this fuel using biomass could alleviate the fuel supply challenges outlined in previous sections. However, SAF production is still small relative to overall demand, with less than 2% of global aviation fuel being produced in this way.[91] Furthermore, SAF can only be used if mixed 50/50 with traditional jet fuel.[92] Finally, the magnitude of the sustainability benefits and scalability of the most utilised SAF production methods is debatable as they often require large amounts of land in order to produce the requisite biomass for their production, or rely on waste products with limited supply.[93] In sum, SAF could be a promising option for increasing Europe's fuel supply in the long term, but in the next 5-10 years the chances of SAF overtaking traditional fuels are negligible.

In the short term, there is little prospect for large military platforms such as tanks, jets, and armoured personnel carriers using non-fossil fuels. The US Army plans to utilize a hybrid tactical vehicle by 2035 and a fully electrified platform by 2050, though these will be light

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91 Fly a jet fighter. "Norwegian F-35s Switch to Sustainable Fuels," January 22, 2025. https://www.flyajetfighter.com/norwegian-f-35s-switch-to-sustainable-fuels/.

92 Conger et al. 2024. Pg. 39

93 Susanne Becken, Brendan Mackey, and David S. Lee, 'Implications of Preferential Access to Land and Clean Energy for Sustainable Aviation Fuels', *Science of The Total Environment* 886 (15 August 2023): 163883, https://doi.org/10.1016/j.scitotenv.2023.163883.

vehicles and there are no plans for an electrified battle tank.[94] Meanwhile, manned commercial or military electrified flight is still decades away.[95] Thus, while there has been some movement towards less reliance on fossil fuels, they will not be significantly divested from in this study's period of interest. This contrasts with Europe's ambitions in the civilian sector, which aims to reduce emissions through electrification among other methods by 2050.[96]

Since militaries procure their fuels through civilian trade channels, a loss of civilian supply and infrastructure could deepen supply problems.[97] Headwinds from the energy transition are already leading to the downsizing of the oil refining industry in Europe.[98] An estimate of up to 1-1.5 million barrels a day of refining capacity potentially closing by 2030 and a decline of up to 32% of Western European refining throughput by 2035.[99] There does not seem to be an easy fix to this mismatch between civilian and military usage trajectories, it is possible that some 'legacy' fossil fuel infrastructure will have to be preserved in the decades to come for the maintenance of military logistics.

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# 5. Conclusion and recommendations

This paper argues that a well-functioning fuel supply, distribution and storage system is indispensable for the safety and security of Europe. With full-scale conflict in Europe no longer unthinkable—due to aggression in Ukraine, a strained relationship with the United States, and rising tensions in the European neighbourhood it is crucial to critically evaluate the challenges and begin identifying solutions through a multi-stakeholder approach.

The current fuel system in Europe faces five bottlenecks in supporting military fuel security:

1. **Crude oil import dependence**: European NATO members are vulnerable to supply shocks due to their large imports of crude oil from unfriendly states. Allies' domestic supply capacity, particularly in Norway, the diversified supply base and the liquidity of the global market make it unlikely that a complete halt in supplies would occur. Still, the external positioning and domestic stability of key suppliers, along with potential maritime chokepoints on critical supply routes, pose strategic vulnerabilities for European Allies. In combination, they can trigger cascading effects.

2. **An unequally distributed and shrinking refining capacity**: The refining capacity of European Allies is highly concentrated in Germany, Italy, the Netherlands and France, while countries on the Eastern Flank have very limited capabilities within their borders. At the same time, refining capacity is being scaled down across Europe, driven by the lack of competitiveness in the global market and the anticipated decline in demand from the commercial sector due to the energy transition.

3. **Inadequate distribution lines**: The military fuel pipeline systems across European Allied countries lack in geographical scope, especially towards the Eastern Flank. This is particularly problematic given that these countries lack diversified energy supplies and sufficient domestic refining and storage capacity to sustain their militaries in the event of a full-scale war.

4. **Insufficient storage**: Fuel storage capacity is limited on the Eastern Flank. Moreover, there are no clear and coordinated non-military/military fuel policies in place across the different countries to apportion fuel supplies to the military in times of conflict.

5. **Challenges to maintaining two energy systems:** Fossil fuel capacity will remain important for military operations in the upcoming decades, even though fossil fuel systems are being phased out. It is essential to effectively manage the transition without restraining NATO military readiness.

In order to increase Europe's military readiness and ensure military fuel supplies, a few key actions should be taken to mitigate the current situation:

1. **Coordinate a comprehensive assessment of military needs and potential bottlenecks at the European level** to gain a granular understanding of challenges and develop tailored solutions.

2. **Acknowledge the centrality of the collaboration between the military and civilian fuel logistics sectors considering current geopolitical and security challenges, and enter into dialogue** to discuss potential solutions for the various bottlenecks in securing military fuel supply.

3. **Develop and coordinate clear policies between Allies regarding the use of strategic stocks in wartime** to enhance readiness and speed of action in case of a full-scale war.

4. **In the short term (1-5 years):**
   - **Monitor strategic vulnerabilities along critical oil supply routes and develop contingency plans** to ensure supplies during a full-scale war.
   - **European NATO members should ensure that oil terminals and refineries maintain sufficient capacity** to support military logistics.
   - **Additional fuel storage capacity on the Eastern Flank is key** to help provide the needed supply at a short notice in the event of military conflict.

5. **In the medium term (5-10 years):**
   - **Develop an effective military fuel distribution system connecting the Eastern Flank with the other European Allies** to strengthen military logistics and increase readiness.
   - **Investigate and identify ways to ensure military supply security whilst transitioning away from fossil fuels** to maintain readiness and contribute to climate goals.

In the short term, there is little prospect for large military platforms such as tanks, jets, and armoured personnel carriers using non-fossil fuels.

# Appendix A: **Conversion Table**

- 1 barrel of crude oil can create 0.170344 $m^3$ of refined petroleum.[100]
- 1 tonne of crude oil contains 7.33 barrels, so 1 tonne refined petroleum= 1.2486 $m^3$ of refined petroleum.
- 1 barrel of crude = 0.159 $m^3$
- 1 tonne of crude = 1.16547 $m^3$
- 1kg = 0.0012486 $m^3$ refined petroleum
- 1kg = 0.00116547 $m^3$ crude oil

[100] Muenster, Matt. 'What's In a Crude Oil Barrel? A Breakdown of Crude Oil Refined Products'. Breakthrough Fuel, November 2024. https://www.breakthroughfuel.com/.

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for Strategic Studies

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