European Warfighting Resilience and NATO Race of Logistics

Ensuring That Europe Has the Fuel It Needs to Fight the Next War

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The North Atlantic Treaty Organization’s (NATO) initial response to Russia’s brutal war against Ukraine signaled a commitment to strengthening deterrence and defense posture. Yet, the conflict highlighted capability gaps, readiness shortfalls and problem points across the alliance, including ever more contested logistics, vulnerable transport infrastructure, and growing energy insecurity. The need to meet these looming and often-overlooked challenges is acute. Left unchecked, they could weaken the alliance’s collective resilience and undercut efforts to provide continuous military support to Ukraine, stopping the military momentum on the ground from shifting decisively in its favor.

One fundamental component of warfighting capability underpinning all others is operational energy broadly and fuel specifically, both in peacetime and wartime. Efforts to increase the readiness and enablement of NATO forces should therefore explicitly take into consideration the logistics implications and the compounding effects of rising logistics requirements, including fuel. Enhanced ability to operate in contested environments as well as maintaining forward defense on NATO’s eastern flank will result in higher fuel consumption and, in turn, will require a larger logistics footprint. Thus, increasing operational energy capabilities, including storage and distribution, and reducing risks associated with the lack of or dependence on vulnerable supply lines are critical supporting capabilities for the future fight.

SUSTAINING UKRAINE’S NEW SYSTEMS

“Fuel can be a war stopper. A force can move and attack only as long as vehicles and weapon systems receive fuel, oils, and lubricants. Ultimate success may depend on having enough fuel to support the mobility requirements of air and ground weapon systems.”

—“Chapter 8: Fueling the Force,” Army Field Manual 54-30

The insights from 1993 Army Field Manual referenced above still hold true today. As the war continues into its second year, it has become increasingly clear that conventional heavy force, capabilities, and fires—as well as a constant and continued supply of Western weapons systems—are key to defeating Russia.

The equipment provided to Ukraine—including air defense, self-propelled howitzers, infantry fighting vehicles, main battle tanks, Soviet-era fighter jets from Poland and Slovakia, and most recently the promise of F-16 fighter jets from U.S. allies—will need to be sustained and fueled, and some of this support requires a significant logistics footprint. All of the advanced Western systems now in Ukraine’s possession will do little to shift the balance in the country’s favor if they are stuck behind the lines waiting for parts and fuel or are left without qualified specialists to maintain them.
Growing maintenance and support challenges, including the lack of spare parts and fuel, will impact timelines for further deliveries of advanced Western military equipment. Although training Ukrainian soldiers to use Leopards, Challengers, or Abrams is essential, equally important is training the maintenance and sustainment personnel necessary to keep those tanks running. Similar considerations will challenge the readiness of the F-16. The challenge of logistics for Ukraine is real and immediate. Any effect on the battlefield from these systems will depend on the availability of parts, ammunition, and fuel. Plans to supply these systems to Ukraine will need to account for the challenge of getting them where they need to be, when they need to be there.

**NATO’S RACE OF LOGISTICS**

For the alliance, sustaining large-scale operations in a high-intensity conflict requires sufficient initial weapons stocks for warfighting, but also robust logistical support networks—including maintenance, refueling, and medical support. Identifying and developing solutions to logistical challenges is thus a pressing issue for NATO and allies.

As NATO secretary general Jens Stoltenberg observed, “We are in a race of logistics.” In an increasingly contested security environment, resilient and more interoperable logistics are critical enablers to support ongoing deployments and effectively respond to emergent threats. The volatility of supply chains during the Covid-19 pandemic, along with disruptions caused by the Colonial Pipeline ransomware attack and the Suez Canal blockage, laid bare vulnerabilities that would be catastrophic in wartime. Adversaries can intentionally disrupt logistic networks and pursue regional gains through anti-access/area denial strategies in all-domain warfare.

Without improved capacity and infrastructure, NATO forces may face the prospect of “fighting to get to the fight,” unable to surge combat-credible forces and provide timely reinforcement of allies in a crisis or military conflict.

To convincingly meet the demands of the alliance, NATO members also need access to large amounts of fuel. For a high-end conflict, fuel capabilities will require a robust stockpile of fuel, including prepositioned fuel storage capacity, and the capability to move fuel to enable military movement. Fuel stockpiles and a multimodal network of fuel distribution can ensure redundancy and strengthen resilience. Of course, ensuring an adequate supply of fuel is an issue that goes beyond tanks to other weapons and capabilities; as such, it is particularly important to NATO airpower. The U.S. Air Force’s recent decision to move its refueling mission from Germany to Poland further demonstrates the role that strategic assets play in enhancing readiness and responding to any potential challenge in the region.

**EUROPE’S FUEL VULNERABILITIES**

Sufficient fuel—encompassing acquisition and contracting, transportation, storage, and distribution—is a necessary foundation for sustaining a combat-credible force. Enhanced ability to operate in contested environments as well as maintaining forward defense on NATO’s eastern flank will result in higher fuel consumption and, in turn, will require a larger logistics footprint. Thus, increasing future operational energy capabilities, including storage and distribution, and reducing risks associated with the lack of or dependence on vulnerable supply lines is essential.

During the Cold War, the development and maintenance of robust and credible military movement infrastructure and enabling elements across Western Europe was one of NATO’s top priorities. NATO understood that war might begin and end with logistics. Therefore, logistics considerations were at the heart of NATO’s deterrence posture and firmly embedded in its defense plans. These plans were underpinned by relevant logistics infrastructure, including fuel depots and pipelines.

In fact, NATO started to work on a dedicated military pipeline system back in the 1950s. From the beginning, allies agreed that the pipeline networks must be capable of meeting military requirements at all times. In 1956, the NATO Pipeline Committee was established and tasked with acting on all matters pertaining to the supervision, operation, and maintenance of the pipeline infrastructure. In 1958, NATO created and funded the Central Europe Pipeline System to satisfy operational requirements during peace, crisis, and war for the transport, storage, and delivery of fuel in the central European region covering Belgium, France, Germany, Luxemburg, and the Netherlands. Over time, the NATO
Pipeline System (NPS) evolved and encompassed eight additional pipelines, one each in Greece, Iceland, Italy, Norway, Denmark, and Portugal, and two in Turkey.

### NATO Pipeline System (NPS) Highlights

- The NPS consists of 10 distinct storage and distribution systems for fuels and lubricants.
- In total, it is approximately 6,200 miles (10,000 kilometers) long, runs through 12 NATO countries, and has a storage capacity of 4.1 million cubic meters.
- The NPS links storage depots, military air bases, civil airports, pumping stations, truck and rail loading stations, refineries, and entry/discharge points.
- Bulk distribution is carried out using facilities from the common-funded NATO Security Investment Program.
- The networks are controlled by national organizations, except for the Central Europe Pipeline System (CEPS), which is a multinational system managed by the CEPS Program Office under the aegis of the NATO Support and Procurement Agency.

Additionally, NATO regularly exercised logistics for large-scale collective defense operations, including during the annual REFORGER drills—annual military exercises conducted from the late 1960s to early 1990s to validate the ability of NATO allies to rapidly deploy forces to Europe and reinforce NATO positions on the continent, as well as demonstrate Western commitment to defend against Soviet aggression.

However, this robust structure for collective defense eroded following the collapse of the Soviet Union. As NATO shifted its focus from collective territorial defense to out-of-area contingency operations, Western European allies stopped modernizing the infrastructure necessary to underpin large-scale reinforcements to the east, and new Eastern and Central European members did not embark on developing standardized infrastructure in the absence of uniform NATO guidelines and other competing commitments. In leveraging the peace dividend, allies also started to divest from military logistics capabilities as they downsized their forces, instead developing plans to reach out to the private sector in case of contingencies.

“NATO has for decades ‘neglected the larger-scale logistics that is connected to collective defense’ because it was planning for operations out of its operational area.”

— Royal Netherlands Navy Admiral Rob Bauer, Chair of NATO’s Military Committee

As a result, the existing fuel storage capacity and capabilities required to move fuel across all of Europe are limited, and logistical challenges persist. This is especially notable in the Baltic Sea and Black Sea regions, where refining capacity, storage, transportation, and distribution might not be sufficient to support an increase in fuel demand over a longer period of time. In a potential conflict scenario, this would be further affected by Russia’s hostile economic and military actions. Shortfalls exist in military storage and distribution capacity on NATO’s eastern flank, including aviation fuel (F-34/F-35) and naval fuels (F-75/F-76). Civilian storage capacity might partly mitigate the shortfall. However, it would require much deeper civilian-military cooperation and integration, ensuring that civilian storage increases its readiness and is available on short notice in a contingency—which is possible but comes at a cost.

Transportation of large amounts of fuel to storage facilities across the Supreme Allied Commander Europe (SACEUR) area of responsibility faces similar challenges. Due to the limited number of military pipelines on NATO’s eastern flank, this is primarily done via rail and road. Since military fuel transportation assets are limited, the armed forces—including in a crisis—tend to rely on commercial capabilities.

Finally, the acquisition of fuel is an underestimated factor in assessing logistical challenges. The existing acquisition arrangements were designed for peacetime. Scaling up the acquisition of fuel without advanced planning would require concluding new contracts, which can be time-consuming and might not entirely meet the increased consumption volumes.
There is also no clear mechanism to prevent contractor fratricide or deconflict requirements more rapidly. This is an even bigger challenge if one assumes that the acquisition of fuel will generally only be possible at very high prices in a conflict scenario. All of those factors can have a direct impact on the operational efficiency of allied forces. This, in turn, could negatively affect NATO’s deterrence and defense posture, including the readiness of forces, their responsiveness, and their ability to reinforce.
EFFORTS TO IMPROVE MILITARY MOBILITY AND OPERATIONAL ENERGY SECURITY

Europe has undertaken initial steps to address the energy security of military operations since Russia’s illegal annexation of Crimea in 2014. In 2018, the European Union launched an Action Plan on Military Mobility to ensure “swift and seamless movement of military personnel, materiel and assets,” including with short notice and at large scale. In an attempt to tackle the impact of the deteriorating security environment following Russia’s renewed aggression against Ukraine and to improve military mobility beyond EU borders, the European Commission adopted a revised version in November 2022. It calls for identifying possible gaps in the infrastructure, which would inform future improvements and help integrate fuel supply chain requirements, including meeting the demands to support short-notice, large-scale movements of allied military forces. The European Union also committed to invest €1.69 billion ($1.82 billion) over the next five years to revamp civilian and military dual-use transportation infrastructure across Europe.

Other EU-led supporting initiatives include the Permanent Structured Cooperation Military Mobility project, the Logistic Hubs project, and the European Defence Agency’s Optimising Cross-Border Movement Permission Procedures in Europe program. Despite these efforts, developing European military mobility capabilities able to “reach in strength” to the very eastern frontiers of both NATO and the European Union remains a strategic challenge, according to the Center for European Policy Analysis.

In parallel, NATO allies have been talking to improve mobility and operational energy security. In 2018, NATO established the Joint Support and Enabling Command (JSEC), which is responsible for the alliance’s rear-area operations. JSEC’s enablement mission is to create conditions that allow for the movement of forces across SACEUR’s area of responsibility, though its role does not currently include fuel oversight. Allies continue to discuss the potential enhancement and extension of the NPS to the eastern flank. As agreed at NATO’s 2021 Brussels summit, the alliance will continue to prioritize improving its ability to support the deployment and sustainment of allied forces into, across, and from the entire alliance territory. These efforts include the development of fuel supply chain arrangements.

FUEL LOGISTICS ON NATO’S EASTERN FLANK

With the center of gravity shifting to the east, Eastern European allies have been playing an instrumental role in providing support to Ukraine while shoring up their own defenses against the Russian threat. Poland, in particular, has made significant investments in its military capabilities and critical infrastructure, becoming a “linchpin of Eastern Flank security” and a pivotal U.S. ally. The country has been providing substantial host nation support for over 10,000 U.S. troops stationed in different locations in Poland, as well as for over 1,000 soldiers contributing to the NATO Enhanced Forward Presence Battlegroup in Orzysz. It has also been the primary channel through which the West has been delivering vital

Civilian Fuel Infrastructure in Poland, PERN Gdańsk Base

Photo: PERN
military assistance to Ukraine. A de facto logistics hub for the alliance’s forward defense, Poland has been able to find practical solutions to logistical challenges and enhance infrastructure to support resupply and reinforcement. On the civilian side, PERN—the leading Polish company in oil and fuel logistics—has invested in its fuel storage and transportation capacity. Since 2019, the company has built 20 new fuel storage locations throughout Poland, with a total additional capacity of 574,000 cubic meters. In February 2023, PERN and Orlen—the largest Polish energy company—opened a new pipeline that enhances energy security in the southern part of Poland. The pipeline replaces rail transport, carrying an amount equivalent to that of 25,500 tankers annually. Both companies are also working on building a second pipeline to link the oil terminal in the port of Gdańsk with the refinery in Płock, the largest in Poland.

Additionally, the Polish government has been heavily investing in military infrastructure and in 2020 offered to fund infrastructure and logistical support for U.S. forces in Poland. The Poland Provided Infrastructure (PPI) and Poland Provided Logistical Support (PPLS) programs, as part of the 2020 Enhanced Defense Cooperation Agreement between Poland and the United States, will further support long-term sustainability. Under the PPI, Poland agreed to invest in a large bulk fuel storage and distribution facility and rotary wing aviation fuel point in Powidz Air Base, as well as a large bulk fuel storage in Żagań Training Area and the Toruń and Skwierzyna military complexes. Some of the PPI projects will be funded jointly by the NATO Security Investment Program, Poland, and the United States. Under the PPLS, Poland covers 75 percent of the cost of fuel for U.S. forces in agreed locations, including aviation fuels and ground transportation fuels, and 50 percent of the cost of fuels beyond the agreed volume. These initiatives provide considerable support for U.S. force posture and enhanced prepositioning, as well as modernized infrastructure on the eastern flank.
THE WAY FORWARD: DEVELOPING A ROBUST OPERATIONAL ENERGY AND FUEL STRATEGY FOR NATO

Russia’s full-scale invasion and war of aggression against Ukraine has accentuated the challenges facing NATO’s efforts to secure sufficient supply and access to fuel. These challenges will require sufficient attention from policymakers and military leadership, as well as decisive action to develop collective solutions on multiple levels—from NATO, national governments, and the fuel and infrastructure industries. Adapting the current fuel strategy requires reframing critical enablers and supporting resources within a broader NATO deterrence and defense policy, as well as resilience efforts. The new approach should account for policies and investments—in both the short and long term—necessary to ensure full fuel resilience and operational energy security. Although a comprehensive, sustained, and coordinated effort is needed, focusing on urgent actions to address immediate challenges will be essential for supporting Ukraine in its fight and ensuring that the alliance is ready to face the current threats while preparing for the future contingencies. Fortunately, the upcoming NATO Vilnius summit offers an opportunity for allies to plan for decisive action, including toward the following steps:

Providing Ukraine with the vital operational energy and logistical support required to continue the fight. Logistics remain central to Ukraine’s success on the battlefield. The war reveals crucial lessons for the alliance. The importance of logistics suggests that allies should find ways to expeditiously ensure that systems and capabilities provided to Ukraine receive the necessary operational energy support and are accompanied by fuel tankers to sustain battlefield fuel resupply. Moreover, the capacity of maintenance hubs should be further expanded in the vicinity of the border with Ukraine, including by employing Ukrainian mechanics. Poland’s recent initiative to set up a maintenance hub for Ukraine’s Leopards and Rheinmetall’s maintenance center in Romania are good examples of supporting operational readiness closer to the front lines and should be further leveraged.

Identifying strategic vulnerabilities in fuel supply across the alliance and taking urgent action to mitigate critical shortfalls. The enablement of SACEUR’s area of responsibility and NATO’s ability to rapidly move forces and their equipment depends on fuel availability. This puts into sharp focus the need to develop an alliance-wide robust action plan to identify strategic vulnerabilities in fuel supply, secure adequate funding for new infrastructure, and take immediate action to mitigate any gaps. The upcoming NATO summit offers an opportunity for discussion to move this forward. Furthermore, the recently launched EU-NATO taskforce on resilience and critical infrastructure offers a starting point that could be leveraged. The taskforce could be provided with a clear mandate to improve fuel resilience as a matter of priority.

Optimizing joint logistics on the eastern flank and fortifying frontline states. Given the importance of the military presence in the eastern part of the alliance in building NATO’s credible deterrence and defense posture, developing a robust logistic capacity on the eastern flank is crucial. The alliance can focus on joint logistics on the entire eastern flank and effectively support deployment, operational-level sustainment, and redeployment. The Vilnius summit offers allies the opportunity to consider options to include establishing a new NATO Joint Logistics Support Group (JLSG) in Poland or moving one from Western Europe—perhaps the Allied Joint Force Command in Brunssum, the Netherlands—to Poland in order to collocate it with the Multinational Corps Northeast in Szczecin. In addition, building a forward-deployed strategic fuel storage facility in Poland for the northeastern part of the eastern flank will further enable logistics support for any potential allied reinforcement through the Suwałki Corridor. Interlinking the strategic fuel storage with a network of smaller and dispersed fuel depots in Poland and the Baltic States will mitigate potential vulnerabilities. Updating the NATO Support and Procurement Agency’s toolbox offers another opportunity, including improving its current funding model and establishing a system to better track fuel needs, that will also facilitate the rapid acquisition of fuel. Finally, including fuel logistics in the Three Seas Initiative’s priority projects will better link NATO’s entire eastern flank and enhance regional civilian-military cooperation. As this list shows, there are multiple potential approaches to strengthening joint logistics.

Developing a resilient and adaptable NATO fuel infrastructure. Deploying NATO forces relies on
resilient and adaptable infrastructure, including fuel infrastructure with adequate storage and ability to facilitate movement. NATO committees responsible for fuel policies (the Logistics Committee and Petroleum Committee) could convene to plan for the next step, which is to develop a road map for bolstering fuel resilience and enabling energy transition with clear deliverables. There are several opportunities here. First, NATO could prioritize expanding the NPS to Eastern Europe to strengthen supply, which will also involve taking additional steps to revise military fuel supply chains. Creation of the Eastern European Pipeline System would be key to the operational effectiveness, combat power, and agility of NATO forces and would considerably support U.S. permanent and rotational presence on the eastern flank. The extension of the NPS would also play a crucial economic role and help enhance civilian-military logistics cooperation and integration.

**Establishing a reliable, resilient, and adaptive logistics system in Europe.** A system of interoperable logistics hubs—especially in potential theaters of operations—connected in a network across Europe would further strengthen the development of agile, scalable, and resilient operational support systems to maintain projection and sustainment superiority, as well as enable enhanced operational agility and resilience. Given Poland’s emergence as a strategic focal point and “a critical Ally in deterring and responding to Russian aggression,” it could serve as a central hub for the alliance’s logistics efforts.

**Enhancing intermediate-level operational logistics.** Additional efforts would strengthen the response to the logistics challenges on NATO’s eastern flank. The JLSGs are a deployable capability that provides command and control of assigned logistical forces from the theater to tactical levels in support of a joint task force. The JLSGs responsible for coordinating reception, staging, and onward movement, as well as pushing forward supplies from the rear to the corps level, remain underinvested in and are remote and detached from the eastern flank. The JLSGs can implement insights from the current conflict, with increased staffing levels and equipped with various logistics-enabling units that train together.

**Prioritizing fuel support requirements and operational energy needs.** The use of analytic tools, such as modeling and simulation, can help prioritize and better estimate fuel support requirements and operational energy needs. For example, a 2015 RAND report developed a methodology that could serve as a model for NATO. The report highlighted the impact of operational energy on combat effectiveness and the importance of stewarding limited resources more strategically. Furthermore, NATO should leverage its Defense Innovation Accelerator for the Northern Atlantic and the NATO Innovation Fund to identify and drive innovative, dual-use technological solutions, including artificial intelligence, to better determine how much, when, and where fuel is needed to sustain NATO’s missions and operations, as well as future solutions for generating energy on the battlefield.

**Exploring alternative operational energy solutions.** Another opportunity for the alliance is the exploration of alternative operational energy solutions—including cutting-edge technologies and processes, as well as alternative fuels—that can be integrated into civilian and military energy supply chains. This will require some additional resources, but because the investment will benefit the civilian sector as well, this could help support energy innovation and green energy solutions. The NATO Operational Energy Concept could include language on alternative solutions, with guidance for the future design of NATO energy standards.

**Integrating collective and national energy resilience requirements.** Lastly, NATO and EU states have different energy needs and will be making different investments to support their own economies and militaries. Adequate energy is both a foundation of warfighting effectiveness and an aspect of national resilience. If NATO as a whole has insight into where these operational energy capabilities exist, it can see where countries would have the assets to contribute in case of a war and note where gaps still exist. With such an approach, the whole can be greater than the sum of its parts.

**CONCLUSIONS**

Russia’s unprovoked and illegal invasion of Ukraine, resulting in the largest war in Europe since World War II, is a grinding war of attrition and a battle of logistics. The
conflict magnified the necessity to address often overlooked enablers to operational capabilities vital to the execution and sustainment of military missions and operations. Enhancing the ability to rapidly increase the readiness and enablement of NATO forces and improve combat capability is essential to ensuring that they are prepared and ready to face current and future threats. To help Ukraine win the war now, and prepare to win the next war, Europe needs prepositioned war reserve stocks, a robust and resilient fuel supply, operational readiness of fuels, and reliable infrastructure.

“The force structure requirement is not just tanks and ships and fighter planes. A large part of it is the required enablement, the required logistics, equipment, systems units, and so forth.”

—U.S. Army General Christopher G. Cavoli, Commander of United States European Command and Supreme Allied Commander Europe

This war demonstrates that meeting wartime demands in a large-scale conflict benefits from prior peacetime investments and clearly defined targets, as well as from better integration of logistics into strategic planning. Military planning for NATO collective defense can take insights from the current conflict and ensure that these considerations are part of the implementation for the deter and defense strategy and the decisions to conduct geographically specific regional plans, as well as functional strategic subordinate plans (SSPs)—in particular, the SSP for enablement. The urgency to solve real problems at scale through adapting and improving fuel supply logistics is not only fundamental to building capacity along Europe’s eastern flank to address Russia’s military threat but also to an expanded U.S. force posture that requires sustained access. Effective logistics across national borders will depend on the integrated effect of every ally. The Vilnius summit offers the alliance leaders the opportunity to collaborate on an approach to identify challenges and to resolve logistics burden-sharing. A comprehensive approach including a NATO Resilience Planning Process and adequate investments would bolster collective resilience in Europe. Ensuring that Europe has the fuel it needs to fight the next war could usefully be the first application of this approach.

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