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**Energy, Security, and Civil-Military Cooperation**


# *Energy, Security, and Civil-Military Cooperation*

## *Abstract:*

*Energy is not only an essential resource for sustaining our way of life and economic activity; it is also a key enabler of military operations. Today, a large share of mobile military equipment depends on fossil-based liquid fuels. In addition, electricity and natural gas serve as critical energy vectors, mainly for fixed facilities such as military bases. Due to the nature of military activity, energy supply is dominated by civilian actors —primarily private companies in countries like ours, though in other regions it may be controlled by major state-owned entities. In the current context, marked by profound transformation across many sectors, strengthening liaison activities in the field of civil-military cooperation related to energy supply is more necessary than ever. A better understanding of the armed forces' energy needs by the civilian sector—and, conversely, a deeper understanding among military actors of how civilian operators view the evolution of the energy sector—will enable us to maintain and enhance our defense capabilities.*

## *Keywords:*

*Energy, security, civil-military cooperation, NECP (PNIEC), total defence.*

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***NOTE:** The ideas contained in the Opinion Papers shall be responsibility of their authors, without necessarily reflecting the thinking of the IEEE or the Ministry of Defense.

On 10 December 2025, an important meeting[1] took place at the headquarters of the North Atlantic Treaty Organization (NATO) in Brussels. Among the attendees were the Secretary General of the organization, Mark Rutte; the Executive Director of the International Energy Agency (IEA), Fatih Birol; the European Commissioner for Energy, Dan Jørgensen; and the Acting Deputy Assistant Secretary for International Affairs at the U.S. Department of Energy, Tommy Joyce.

The conclusions of the meeting were unambiguous: energy is vital—now and in the future—for the security and defense of NATO member states. The Allies must have adequate energy supplies—particularly fuel for their armed forces—robust energy infrastructures, and reliable supply chains for energy-related technologies and critical raw materials. Achieving this requires close cooperation between defense and energy authorities, as well as the integration of security and defense considerations into energy policies across the Euro-Atlantic area.

Naturally, this was not the first time the Allies had reached similar conclusions. The war in Ukraine—where Russia has deliberately targeted critical energy assets and weaponized energy supplies as part of its military strategy—has once again underscored, in dramatic fashion, the central importance of energy to collective security.

## Energy and Military Operations

Energy, in addition to being an indispensable resource for sustaining our way of life and economic activity, is a key enabler of military operations. Many conflicts have originated from competition over energy sources. As the 23rd Secretary of the U.S. Air Force, Deborah Lee James, emphasized, “We cannot fly, fight or win without reliable energy.”

Today, a large portion of mobile military equipment depends on fossil-derived liquid fuels[2] with specific technical requirements[3]—such as gasoline, diesel, and military-grade

[1] «The NATO North Atlantic Council discusses Energy Security», NATO. 10 December 2025. Available at: https://www.nato.int/en/news-and-events/articles/news/2025/12/10/the-nato-north-atlantic-council-discusses-energy-security?selectedLocale=en (accessed on 13 February 2026).

[2] Ellermann-Kingombe, Jean-Charles. «Reliable defence requires reliable energy», Energy Highlights No 20. NATO Energy Security Centre of Excellence, 2025, p. 5.

[3] With additives and other tailored specifications for reasons of safety, performance, reliability, or operability

kerosene. Alongside liquid fuels, electricity is also a critical energy vector for numerous military applications, both in fixed infrastructures and in certain battlefield systems. Many essential facilities—such as bases, command centers, communication systems, radars, unmanned aerial vehicles (drones), hybrid tactical vehicles[4], and advanced weapon systems—require stable and reliable electrical supply. Natural gas is also used, mainly in fixed installations such as military bases.

In a modern armed force with global reach, such as that of the United States[5], roughly two-thirds of total energy consumption is associated with "operational" activities: training, mobility, sustainment of military forces, and energy used by ships, aircraft, and ground combat vehicles during operations. This consumption is almost entirely based on liquid fuels (amounting to around 70 million barrels per year in the U.S. military[6]). The remaining third corresponds to energy required to support fixed military infrastructures, permanent bases, and non-tactical vehicles. The consumption pattern in fixed installations is similar to the civilian sector, with electricity and natural gas playing a central role. One aspect gaining importance is the integration of renewable technologies and local microgrids capable of operating independently from national grids, enhancing the resilience and energy autonomy of critical installations.

In the United States, more than half of operational energy consumption corresponds to the Air Force, followed by the Navy[7] and the Army. For fixed installations, the largest consumer is the Army (around 40%), followed by the Air Force and the Navy (approximately 30% each).

Although operational consumption (based on liquid fuels) and stationary consumption (electricity and natural gas) can be described separately, the two are closely interconnected. Mobile operational platforms depend on a wide variety of fixed infrastructures for logistics and fuel distribution. In the future, as armed forces adopt more electrified systems, the practical distinction between energy used in fixed installations and

under extreme conditions.

[4] Which use fossil fuels and electricity, and offer valuable capabilities in certain contexts due to their silent operation and lack of a thermal signature.

[5] Annual Energy Performance, Resilience, and Readiness Report," United States Department of Defense, Fiscal Year 2023.

[6] Naturally, highly dependent on the volume and type of operations to be carried out.

[7] US Navy y US Marine Corps (USMC).

energy used in mobile operations will become even less defined[8].

Other relevant military-energy applications include nuclear propulsion for certain assets such as aircraft carriers and submarines, given the near-unlimited autonomy it provides. The study of energy use in military space operations is also gaining importance.

Because military platforms have long service lives, it is reasonable to expect that these energy solutions—fossil fuels, electricity, and nuclear propulsion—will remain in place for many years. At the same time, new and more experimental technologies are emerging[9], such as hydrogen-powered drones[10], redox-flow batteries[11] for specific applications, or high-intensity directed-energy weapons[12]. As a complement to these innovations, some governments are developing solutions such as Small Modular Reactors (SMRs) or mobile micro-reactors to supply energy to critical military installations, particularly in isolated settings or where vulnerabilities in national power grids may exist.

Military operations require significant energy supplies, which increases vulnerability and forces the diversion of combat units to protect supply lines. In this context, improving energy efficiency in military uses becomes essential—not only to reduce costs and enhance autonomy, but also to improve security, especially in combat zones where supply convoys can become vulnerable targets[13].

The energy transition places us in a context of major transformation in the energy sector. Given the enabling role of energy in military operations, civil-military collaboration must be strengthened, especially as strategic competitors and adversaries expand their capabilities. Public-private cooperation and innovation must continue—and must do so rapidly and effectively. It is essential that energy companies understand the future needs of the military domain and are properly incentivized to ensure that those needs can be met when required.

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[8] «Operational Energy Strategy, », United States Department of Defense, May 2023.
[9] TRAKIMAVIČIUS, Lukas. «Maintaining the Edge: 3 Energy Innovations Strengthening Defense», NATO Energy Security Centre of Excellence, 2025.
[10] Which can provide longer operational ranges (in distance, payload, or duration) and better performance in extreme cold environments than other types of batteries.
[11] Offering better safety and lifespan characteristics than conventional lithium batteries.
[12] Such as electromagnetic railguns or high-powered laser systems.
[13] According to the Army Environmental Policy Institute's report "Sustain the Mission Project: Casualty Factors for Fuel and Water Resupply Convoys. Final Technical Report," in Afghanistan there was, on average, one casualty for every 24 fuel-resupply convoys due to enemy attacks.

Going forward, energy will remain a decisive factor. The recent U.S. national security strategy[14], for example, identifies energy as an essential element for preserving and strengthening military technological advantage.

## The Energy Security Dimension in Spain's National Energy and Climate Plan (PNIEC)

In Spain, the National Integrated Energy and Climate Plan (PNIEC[15]) is the Government's strategic framework that integrates energy and climate policy with a 2030 horizon. The Plan establishes general and specific goals grouped into five dimensions: (i) decarbonization, (ii) energy efficiency, (iii) energy security, (iv) research, innovation and competitiveness, and (v) the internal energy market.

Regarding energy security, the PNIEC adopts the objectives set out in the 2015 National Energy Security Strategy. In simplified terms, the aim is to ensure national energy security by diversifying energy sources, guaranteeing secure transport and supply, and promoting energy sustainability. According to the PNIEC, this requires:

- diversifying the national energy mix, ensuring the presence of different alternatives.
- guaranteeing secure supply, so that essential resources are always available.
- promoting the use of domestic energy sources.

To achieve these objectives, the PNIEC identifies several challenges: reducing external energy dependence by lowering fossil fuel imports; diversifying energy sources and supply routes; strengthening response capacity in the event of limitations or disruptions; improving flexibility in the national energy system; and promoting the development of new energy sources.

The PNIEC proposes nine lines of action:

[14] «National Security Strategy of the United States of America», Office of the President of the United States, November 2025. The document states: "The United States must at the same time invest in research to preserve and advance our advantage in cutting-edge military and dual-use technology, with emphasis on the domains where U.S. advantages are strongest. These include undersea, space, and nuclear, as well as others that will decide the future of military power, such as AI, quantum computing, and autonomous systems, plus the energy necessary to fuel these domains".

[15] A general overview of the PNIEC can be found in: ÁLVAREZ ALONSO, Oliverio. "El PNIEC v2.0… Ya tenemos la nueva versión." Cuadernos de Energía, No. 78. Spanish Energy Club (Enerclub), November 2024.

1. Implementation of the "Plan + Seguridad Energética"[16] ("+Energy Security Plan"), including 73 measures focused on energy savings and efficiency, acceleration of the transition to renewable fuels, and reinforcement of energy autonomy.
2. Maintenance of minimum-security stocks of petroleum products and natural gas.
3. Reduction of energy dependence in island territories.
4. Deployment of charging infrastructure and alternative-fuel systems.
5. Reinforcement of regional cooperation.
6. Expansion of contingency planning.
7. System planning to ensure secure operation of a decarbonized energy system.
8. Support for strategic raw materials required for energy transition.
9. Enhancement of cybersecurity in the energy sector.

Although this Plan is a high-level strategic document and does not detail the role of the Armed Forces in ensuring energy security, it does underscore the importance of public-private collaboration.

## International Energy Cooperation within the European Union and NATO

Ensuring an adequate energy supply is essential for strengthening strategic autonomy and increasing resilience against external threats. In Spain, and generally across Europe, energy assets are owned by private companies. The security of these assets is primarily a national responsibility, although international institutions such as the European Union and NATO also play a significant role.

The European Commission has recently released an assessment document[17] on energy-security regulations in the natural gas[18] and electricity[19] sectors. This assessment precedes the adoption of a new regulatory framework. The document concludes that although existing rules have contributed positively to maintaining stable, secure and

[16] A general overview of the "+Energy Security Plan" can be found in: GONZÁLEZ-SALAS, Alberto and ÁLVAREZ ALONSO, Oliverio. "Los fondos europeos nos dan más seguridad energética… o no." Cuadernos de Energía, No. 70. Spanish Energy Club (Enerclub), October 2022.

[17] «EU energy security - evaluating the EU's security of electricity and gas supply framework», European Commission. 22 December 2025. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52025SC0435&qid=1767610011921 (accessed on 13 February 2026)

[18] Regulation (EU) 2017/1938.

[19] Regulation (EU) 2019/941.

uninterrupted supply during recent energy crises, they were not designed to withstand shocks of the magnitude seen following Russia's aggression against Ukraine. As a result, emergency measures had to be introduced. The assessment identifies several new challenges that require a strengthened regulatory architecture:

- Interdependencies between systems, particularly between gas and electricity networks.
- Vulnerabilities of energy infrastructures to physical and cyber threats.
- Greater exposure to extreme climate events and natural disasters.
- Increasing risks linked to a shifting geopolitical landscape.

To respond to these challenges, a new regulatory framework is expected to be adopted in 2026.

NATO, for its part, is fully aware of the critical importance of energy supply for ensuring security and has developed various initiatives to deepen its understanding of energy dynamics, enhance its ability to support the protection of critical energy infrastructure (with particular focus on subsea assets), and guarantee reliable energy supplies for military forces. NATO's role in energy security was first defined at the 2008 Bucharest Summit and has been reinforced since then. The establishment of the Energy Security Centre of Excellence in Vilnius (Lithuania) in 2012 provides ongoing support for the Alliance's efforts in this field.

Subsequent developments, especially at the Madrid Summit in 2022 and the Vilnius Summit in 2023, have further elevated the issue. In Madrid, NATO adopted a new Strategic Concept[20] acknowledging the growing complexity of the strategic environment, in which certain authoritarian actors may employ hybrid tactics, manipulate energy supplies, or resort to economic coercion. In Vilnius, Allies agreed to strengthen NATO's capacity to support national authorities in protecting critical energy infrastructure[21].

These recent developments—both within the EU and NATO—illustrate the growing relevance of energy and show that guaranteeing secure supply increasingly requires

[20] Accessible at: https://www.defensa.gob.es/Galerias/main/nuevo_concepto_estrat_gico_de_la_otan.pdf (accessed on 13 February 2026).

[21] A growing threat to critical undersea infrastructure was also identified, and it was agreed to establish the Maritime Centre for the Security of Critical Undersea Infrastructure within NATO's Maritime Command (MARCOM), as well as a network connecting NATO, the Allies, the private sector, and other relevant actors.

robust international cooperation with our allies.

## Civil-Military Cooperation (CIMIC) in the Energy Domain

Civil-military cooperation (CIMIC) can be defined as the set of activities aimed at securing support for military operations through cooperation and coordination with civilian actors in the surrounding environment. These civilian actors may be companies, authorities, organizations or the general population. Typically, the concept encompasses three core components:

- Liaison activities between military units and civilian stakeholders.
- Support provided by the military to the civilian environment.
- Support provided by civilian stakeholders to the military force.


Figure 1: Domains of Civil–Military Cooperation

Due to the nature of the activity, energy supply is dominated by civilian actors—mainly private companies in countries like ours (whether domestically or foreign-owned), but also by major state-controlled entities in other parts of the world, such as the so-called National Oil Companies (NOCs) in the Middle East and China. Moreover, this is happening during a period of profound transformation, marked by rising geopolitical tensions and significant changes in how energy is produced, distributed, and consumed. All these developments are generating growing concern about ensuring a reliable energy supply for both military and civilian uses.

Armed forces must have access to sufficient energy supplies, particularly high-energy-density liquid fuels. One area attracting special attention is how the energy transition—and particularly the shift toward electric mobility in the civilian sector—may affect the logistical availability of liquid fuels for military applications.

According to the International Energy Agency (IEA)[22], global electric-vehicle sales in 2025 will exceed 20 million and account for more than one quarter of all cars sold worldwide. In the heavy-duty vehicle segment, the IEA reports an 80% increase in electric-truck sales in 2024, reaching 2% of global truck sales. In terms of vehicle manufacturing, China is responsible for more than 70% of global electric-vehicle production. In some regions, such as Norway—where electric-vehicle penetration is already extremely high—significant reductions[23] in road-fuel consumption are occurring, which could, in the medium term, undermine the profitability of fuel-supply infrastructures. Complementing these trends, the European refining sector is also expected to undergo major restructuring: projections indicate that Europe will lose between 1 and 1.5 million barrels per day of refining capacity before 2030, and capacity could decline by up to 30% in the following decade.

Although, for now, the defense-related risks associated with rising prices or shortages of combustion-engine technologies and fuels remain limited, this issue is receiving increasing attention—especially given the growing role of NOCs and the significant influence of countries such as China in sectors like electric mobility, battery technology, and renewable-energy manufacturing. The risk is that, without new technological alternatives, a decline in fossil-fuel supply and infrastructure in Europe could increase dependence on fuels from other regions, with longer and more vulnerable supply chains, and limited ability to ramp up production during crises.

Introducing new energy technologies (such as batteries or hydrogen) into the military domain is not straightforward. Beyond the long service life of many military assets—and their associated energy requirements—there are challenges related to the large-scale operational performance and availability of these emerging technologies, which are largely driven by civilian actors, as well as budgetary constraints.

[22] «Global EV Outlook 2025. Expanding sales in diverse market», International Energy Agency, July 2025.
[23] In 2024, a 12% decrease in consumption was recorded compared to 2021.

In the current context —marked by deep transformations across many sectors— strengthening liaison activities in civil-military cooperation related to energy supply is more necessary than ever. A clearer understanding of the armed forces' energy needs by the civilian sector, along with a deeper knowledge among military actors of how private operators view the evolution of the energy sector, will help preserve and enhance national defense capabilities.

Another key area of civil-military cooperation involves mutual support between civilian actors and the armed forces in protecting dual-use critical energy infrastructure—both physically and in the cyber domain. The main energy infrastructures in countries like ours—electric-power plants, transmission and distribution networks, oil pipelines, gas pipelines, underground gas storage facilities, refineries, and others— are privately owned. The functioning of these infrastructures is essential not only for maintaining our way of life, but also for supplying the energy needed by the armed forces.

In addition, other elements included in Spain's national energy-security strategy[24] require effective civil-military collaboration, particularly those related to the stability of regions that produce energy resources (such as oil and natural gas) and the security of the routes through which these resources enter the country. Protecting these routes requires action in both their physical dimension and the informational one, by minimizing risk and uncertainty—or at least improving situational awareness—regarding the geographic regions through which our supply chains pass or where the energy we consume is produced. Attacks on complex energy infrastructures by hostile states, terrorists, or other malicious actors can have consequences across entire regions. This is another area where information sharing, strategic dialogue, and even joint exercises and simulations between civilian and military stakeholders are extremely valuable.

Civil-military cooperation is always beneficial, but in increasingly complex environments and in rapidly evolving critical sectors such as energy, it becomes indispensable.

[24] The official version, as of the date of this article, dates from 2015. The document is available at https://www.lamoncloa.gob.es/serviciosdeprensa/notasprensa/Documents/ESTRATEGIA%20DE%20SEGURIDAD%20ENERG%C3%89TICA%20NACIONAL%20(WEB).pdf (accessed on 13 February 2026). This document is currently being updated. The power-supply incident of 28 April 2025 has accelerated the need to proceed with its revision.

## An Expanded Form of Cooperation: The Concept of "Total Defence"

Beyond this collaboration between civilian and military actors, cooperation can be taken further. The concept of "total defence"[25] is a strategic doctrine in which society as a whole—not just the armed forces—prepares to defend the country against external or internal threats. Its implementation requires the coordinated mobilization of all necessary public and private resources in the event of serious conflict. This concept is frequently cited as a key component of the military and security strategies of Nordic countries (such as Sweden and Finland) and the Baltic states.

In practice, this doctrine requires action across multiple domains: military, civilian, economic, industrial, psychological, and digital. Military defence requires armed forces properly structured and equipped to respond to the risks they may face. Civil defence requires well-resourced emergency and civil-protection services, as well as a population that is prepared and resilient. Economic defence requires securing basic supplies—water, energy, food—along with logistical autonomy and strategic industrial capabilities. Psychological defence involves a combination of measures spanning education, communication, and information, aimed at maintaining social cohesion and countering disinformation used by adversaries as a weapon. Finally, digital defence—an increasingly critical dimension—requires strong cybersecurity capabilities.


Figure 2: Areas of 'Total Defence'

In short, the aim is to make modern societies understand that, beyond being aware of threats, it is essential to be prepared to defend our way of life — and that such defense may entail significant sacrifices[26].

[25] We may also refer to the concept as a 'Comprehensive Security Concept'.

[26] In some cases, cooperation from the civilian sector can enhance our ability to confront threats, but such involvement blurs the line between the civilian and military spheres and increases risks. It is also important to remember that when one seeks to protect something, one must be prepared to defend it.

**We need to deepen our understanding of the interrelationships between energy and security**

As discussed throughout this article, energy is a key factor in both the civilian and military domains. Numerous interactions exist between energy systems, national security, and the public and private sectors, and these interrelationships are becoming increasingly complex.

Addressing an international environment that is growing more challenging requires strengthening cooperation with our allies across many areas—including energy—both within the European Union and NATO.

Moreover, given that energy supply is predominantly managed by private companies, continuous and substantive dialogue between civilian and military stakeholders is indispensable. In Spain, several valuable initiatives already exist in this regard, such as periodic joint analyses on the links between national security, geopolitics, and the global energy landscape carried out by the Center for Higher National Defense Studies (CESEDEN), the Spanish Institute for Strategic Studies (IEEE), the Spanish Energy Club (Enerclub[27]) , and the Spanish Committee of the World Energy Council (CECME). These initiatives are essential for engaging society as a whole in this strategic conversation.

Civil–military cooperation is always valuable, but in increasingly complex environments and in critical sectors undergoing rapid transformation—such as the energy sector—it becomes indispensable. Every effort to reinforce this dialogue and cooperation will be highly beneficial for society.

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[27] An association founded in 1985 that brings together more than 150 companies and institutions, as well as more than 170 individual members, all linked to the energy sector, including the main energy operators in Spain.