EURODEFENSE Working Group

EWG26B

Energy, Climate, Security and Defence

RECOMMENDATIONS ON EU ENERGY (SECURITY AND DEFENCE)

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Introductory Summary

This paper is a working document of the EURODEFENSE Working Group 26B.The objective of the EWG26B is to focus on the realignment of Security and Defence in Europe in the face of the challenges of ongoing climate change and the consequent energy transition, in particular by taking into account the structural developments arising from the European Green Deal, the EU Strategic Compass, the Climate Change and Defence Roadmap and the European Commission's recent "defence package".

The EWG26B should provide an overview of the Security and Defence of new energy policies and energy transition posture. The main goal is to create policy recommendations and energy strategies informed by case studies, analysis, consultations and documentation review.

Security and Defence is a strategic sector with an impact on the land, sea, air and cyberspacedomains. It is, therefore, a global model that implies shared planning and programming with othersectors of civil society, and it is with this level of ambition that it must be articulated. EWG26B has developed work in three different areas, which will seek to cover a relevant part of the general theme proposed: geopolitical perspective, energy policies and models and technological perspective.

This document only takes into account **the main conclusions and recommendations/proposals** of each working subgroup in its specific area of study and research. All additional work and references are attached to this document.

PART A: GEOPOLITICAL PERSPECTIVE

Generic Considerations

For the first time since the end of the Cold War, there is a real strategic rivalry among the world's great powers. EU and specifically the German policy trust in Russian energy dependency has been a big mistake as well as the German reduction of defence spending and Ukraine renunciation of nuclear weapons. All these facts were causes that favoured the Russian invasion in Ukraine. Because of the presence of the Russia and China alliance and the US withdrawal from world leadership, at the moment we live in a very fragmented world and Europe is trying to avoid remaining isolated in between Asia and the US. The economy has changed on very few occasions: WWI, WWII, or the Yom Kippur war and the oil crisis. We are now in one of these inflexion points.The energy world also is changing with renewable energy and global problems like climate change challenging the role of *status quo* fuels. Regarding Climate Change, a new report concludes that the world cannot avoid some devastating impacts of climate change, but that there is still a narrow window to keep the devastation from getting even worse. However, highlighting a few of the extreme weather events the world witnessed in the last years, there is a contradiction between the growing awareness of the urgency to act against climate change and rising emission levels at the same time. For all these reasons energy will play an important role in this new disorder as well as being affected by these changes.

Main Conclusions

The new energy geography

The world that will emerge from this energy transition will be very different from the one built on the base of fossil fuels. Power will become more decentralised and diffused, and states that rely heavily on fossil fuel exports and do not adapt to the energy transition will face risks and lose influence. The supply of energy will no longer be the domain of a small number of states, since the majority of countries will have the potential to achieve energy independence, enhancing their development and security.

Climate change and defence nexus

Climate is a security issue, but there is no security solution to the problem, an integrated approach of government and of society is needed. Challenges posed by the sea-level rise in many parts of the world are affecting water and food security, energy security and to a loss of habitat. It constitutes an existential threat to mankind which will destabilise regional and international security. In sum, climate change effects need to be integrated into military strategic planning and can affect the traditional work of military personnel in several ways:

- The nature of the work might change (i.e. response to natural disasters, protection of critical infrastructure such as water and food supplies, etc.);
- The circumstances of the work might change (i.e. extreme heat, wider spreading of diseases, etc.);
- The nature of conflicts might change (i.e. more globalised, impact of human displacement and migration flows, conflict over land, water, and other resources, etc.);
- The equipment of soldiers might change (i.e. wearable devices producing and requiring energy, etc.).

Recommendations/Proposals

1. Security of supply.

a) The European energy policy must strengthen its unity and coordination or each country may be a particular case.

b) Dependence on specific third countries or geographical areas for primary energy supplies should be avoid to improve diversification in order to guarantee supply.

2. Reasonable costs and compatible with economic development

a) It is recommended to establish an European fuel purchasing centre, improving purchasing power and sharing among member states.

b) It would be convenient to decide if the primary energy mix be established at European level, or the mix of final energies, or the mix of electricity generation, and others.

c) It is important to decide how to establish equity and fair economic and industrial competition between countries with different degrees of economic development, with different environmental requirements and with different social costs.

d) European countries must rebalance the different productive sectors: industrial, food, services, etc. in the share of its GDP.

3. Minimal environmental impact

a) The closure programs of nuclear power plants that do not emit CO_2 should be reviewed, as well as if it is necessary to promote the use of nuclear energy in new generation reactors.

b) It is important to analyse if the development of renewable energies, with the economic crisis, can maintain the planned rate of investment and if the renewable energy program should go hand in hand with the development of energy storage facilities, as well as to study what could be the role of intermittent renewable energy backup power generation systems.

c) It is important to facilitate fast-track permitting for wind and solar projects.

d) The ongoing decarbonization policy also requires the promotion of CO_2 capture and storage plants.

e) Acceleration of industrial electrification should mean the substitution of fossil fuels for clean electricity, with opportunities ranging from the implementation of commercially available solutions to experimenting with emerging technologies.

4. Security and defence in the Energy area and environmental and Climate change

a) In the area of logistics, the Single Fuel Policy promotes the use of standardised fuels for all the services. From a technical point of view however there is a need for flexibility to make the energy transition work (see ANNEX C for more details).

b) The Common Security and Defence Policy (CSDP) will be involved in addressing maritime pollution, waste management, energy efficiency and power generation. It also will include recommendations similar as included in the NATO Smart Defence

c) CSDP should include those Military Principles and Policies for Environmental Protection, during the preparation and execution of military activities, as NATO already does.

d) Climate change effects need to be integrated into military strategic planning and can affect the nature of the work, the circumstances, the nature of the conflicts, (more globalised, migration flows), and the equipment of soldiers, as well as the working conditions of the five military domains.

PART B: ENERGY POLICIES AND MODELS

Main Conclusions

Many initiatives have already been launched to achieve the goals mentioned here above:

To support General Policies:

- At the EU general level

The *Climate Change and Defence Roadmap* -The European External Action Service (EEAS) and the European Commission (EC) "defence package" with the European Defence Fund (and its *cluster "Energy resilience and environmental transition"* with a total allocation of €133M to support R&D projects);

And The European Defence Agency (EDA) *CapTech on Energy and Environment (EnE)* which intends to foster R&D cooperation among Member States, Industry and Research Centers.

- At the NATO level

The *Climate Change and Security Agenda* endorsed in March 2021 and its related Action Plan adopted in June 2021, both being references within NATO, especially for the definition of standards and a common methodology to measure Greenhouse Gas Emissions (GHG) from military activities and installations.

To enhance cooperation through EDA- EC- NATO – Industry with the:

- *EDA's Energy and Environment Working Group* (formed in 2014 with Member States support), facilitating exchange of knowledge, best practices and proposing solutions for green, resilient and sustainable energy models, and encouraging cooperative projects;

- *Consultation Forum for Sustainable Energy in the Defence and Security Sector* (CF SEDSS), with its phase III (2019-2023) objectives;

- EDA's *Energy & Environment CapTech*;

- The *Incubation Forum on Circular Economy in European Defence* (IF CEED) launched in 2021 to help applying the EU Green Deal's Circular Economy approach to the European defence sector (MoDs, Defence Industry, RTOs, financial institutions and academia);

- EDA's Consultation forum to explore hydrogen technologies for green Defence;

- And the EDA *REACH Task Force.*

Recommendations/Proposals

Brussels based Institutions should identify, monitor and assess what is already in place in Europe to pave the way for additional actions at national and international (EU and NATO levels).

This would mean, the identification, adoption and implementation by the relevant EU stakeholders of a specific EU roadmap aiming to:

a) Follow and identify further development of already launched collaborative projects like Smart Energy Camps (EDA) or Smart Energy initiative (NATO);

b) Monitor, all the EU initiatives listed here above to enhance cooperation in the Defence sector and avoid misleading fragmentation which could lead to counter productive effects;

c) Use existing and identify potential news mechanisms with the aim to take into account the Defence Specificities;

d) At the operational level use, when possible, all military exercises to test the viability of existing and potentially mature operational and technical solutions;

e) It is important that the defence sector (EDA, DEFIS, NATO, etc.) monitor technological developments relevant to energy transition outside their own domain. Breakthroughs often happen sooner and faster elsewhere. Only in specific areas where this does not happen the defence related parties (i.e. NATO, EDA, etc.) should take the lead.

It is clear that the defence specificities and especially the protection of confidentiality, the security of supply and the compliance with the import/export rules will remain in force wherever the potential "non initial design for defence" technology will appear.

To conclude, although there are still many challenges to overcome (level of awareness, funding mechanisms, legislative barriers, operational requirements and defence specificities), all the numerous existing EU initiatives aiming to design sustainable energy models in Defence would ensure the near future resilience and energy autonomy of European armed forces.

A combination of national efforts, multinational cooperation (EU/NATO level) and Defence Industry's inputs will be the key to respond to these challenges.

PART C: TECHNOLOGICAL PERSPECTIVE

Generic Considerations

The energy transition for defence needs to progress in several areas. Energy sources, energy carriers (i.e. fuels/storage), energy efficiency/savings, and smart energy applications and design. Naturally all of this must be clean and sustainable, or at least better than the ones they replace. The most effective climate impact policy by far is innovation and hence should be invested in the most. In particular when required the operational solutions are not available in the commercial market.

While maintaining the required operational effectiveness, a successful energy transition for defence needs to:

- ◊ take into account short and long term solutions (i.e. 2030, 2050 and beyond)
- ◊ invest in innovation because this offers the best return by far (up to 11 times better when compared to other climate policies)
- ◊ drive technological downstream developments (improve efficiency, discover new methods)
- ◊ promote fundamental and abundant energy availability (i.e. energy security)

◊ Develop non fossil powered weapon systems keeping energy autonomy,logistic compatibility and quick deployability in mind.

We investigated along the following lines:

◊ efficiency and energy conservation

◊ role of hydrogen and synthetic e-fuels

◊ application of small and medium scale nuclear energy technology

◊ smart defence application, integration and design

Main Conclusions

Comparing climate impact policies, innovation offers by far the biggest return and hence should attract most investment and effort.

Small unmanned systems like UAVs, need less armour or space and life-support for crewmembers and thus less energy. These could complement or perhaps even replace larger traditional manned systems. Energy storage, either electrical in batteries, e-fuels, hydrogen tanks or another medium such as iron powder, needs to be made efficient, rugged, safe and reliable for military use. Modular design of flexible energy systems will enable swapping in/out new/old tech as it becomes available thus making it future proof.

Existing fossil technology needs to be improved through cleaner combustion technology (DFI[1]) and cleaner fuels (DWE[2], OME[3]). Retrofitting existing systems makes quick results possible. A hybrid combination of a methanol fuel-cell, a battery, and a methanol engine or generator, can result in an electric vehicle that has endurance and can be quickly charged or refilled. All the technology needed already exists but needs to be integrated. Ammonia can be a viable energy carrier for maritime application but some development is still needed.

- The ultimate source of clean, reliable and dispatchable heat and electricity is nuclear. For military applications the development of freight-container sized micro-reactors is of critical importance. The US is pursuing this and so should the EU.

- Synthetic fuels can be produced by pairing nuclear reactors with chemical installations. Nuclear can deliver the heat and electricity for the process itself but also to produce the feedstock needed. This needs to happen on both a small scale and large scale.

- For many industrial processes high temperature heat is required which enables different processes and improves efficiency considerably. Therefore the development of high temperature molten salt or gas cooled nuclear reactors is essential in the long term. This technology has already been demonstrated in the 50’s in Germany and more recently in China on a substantial scale.

Recommendations/Proposals

Below are some potential projects that should be supported by the European Commission. Additionally some recommendations are listed which will also support the energy transition for defence.

[1] Ducted Fuel Injection
[2] Diesel Water Emulsion
[3] Polyoxymethylene dimethyl ether

1. Proposed projects:

a) **Energy storage*)** be it through storage of electricity in batteries or hydrogen in tanks (or another medium) needs to be made rugged, safe and reliable for military use;

b) **Improving current fossil based systems*)** reducing emission and improving efficiency, could be achieved by ducted fuel injections (DFI) and diesel/water-emulsion (DWE) technology. These could potentially be retrofitted on existing engines and thus have an immediate effect in the short term. Specially engineered oxymethylene ethers (OME) based fuels offer an extremely clean burning alternative to diesel, especially when these can be produced using clean and sustainable sources and feed-stocks;

c) **Hybrid technology*)** such as a combination of a methanol fuel cell, battery, and a methanol engine, could result in an electric vehicle that can be charged using clean sustainable electricity but also has endurance due to the methanol fuel cell and combustion engine;

d) **Methanol and ammonia**)** are potentially clean fuels if produced sustainably. The use of ammonia is especially suited for maritime applications but needs to be developed further (i.e. technology and supply chain);

e) **Micro nuclear reactors**)** will be a reliable source of clean sustainable power that can supply heat and electricity independently and for prolonged periods when other sources cannot fill the gap. Europe will need its own micro reactor specifically designed for military use, i.e rugged, trans-portable, low maintenance, etc;

f) **Sustainable synthetic fuels[4]**)** are intended to replace traditional fossil fuels as a drop in replacement. These need to be produced at a substantial scale using sustainable energy sources and feed-stocks. Efficient large scale production can best be achieved using a small modular nuclear reactor (SMR) paired with industrial scale chemical plants. Small scale containerised versions of these power-liquid installations, paired with micro nuclear power plants (XSMR), could provide an independent onsite fuel supply during operations;

g) **Advanced high temperature reactors,***)** be it molten salt or gas cooled, will enable a substantial jump in efficiency and unlock processes that rely on, or profit from, high temperatures (e.g. hydrogen production). These designs are also interesting from a safety perspective due to low pressure operation.

2. In addition to the topics mentioned above, improvements on current technology are possible and will make short and intermediate term gains attainable.

a) Apply modularity in design especially so that energy related platform elements can be replaced when better/cleaner alternatives become available (specially true for ships).

b) Expand and complement use of UAVs to complement regular (traditional) platforms. Many tasks could potentially be assisted by (or even taken over by) UAVs or comparable technology.

c) Complement and extend use of smaller, lighter and more agile unmanned systems that need not be heavily armoured as this saves fuel/energy.

[4] Including e-fuels

d) High energy laser systems and rail-guns are essential to counter future (or even present) threats. Where they will save on regular ammunition and related logistics, suitable power sources for these systems need to be developed.

e) Invest in digitisation of general replacement parts such that they can be 3D printed on demand instead of stored and shipped, thus relieving logistical pressure and energy use.

f) Build small modular nuclear reactors (≈300 MWe) to supply electricity and heat to large military bases. These could be built on or near the bases and paired with industrial chemical plants producing fuels from sustainable feed-stock and supplying heat to the communities in the neighbourhood.

*****) = long term, 10-20 year, **) = medium term, 5-10 years, *)= short term, 0-5 years.(All the references in the annexes)**

List of Participants of EURODEFENSE Working Group 26B

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ANNEXES

Annex A Energy geopolitics and spheres of influence **(Subgroup A — ED-SP)**

Annex B "Framing of new energy policies and models arising from the ongoing Programmes, Activities and Studies" (**Subgroup B — ED-FR**)

Annex C Energy transition for defence-Eurodefense/EDTA working group 26B/Subgroup C – technological perspective (**Subgroup C — ETDA (NL)**

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