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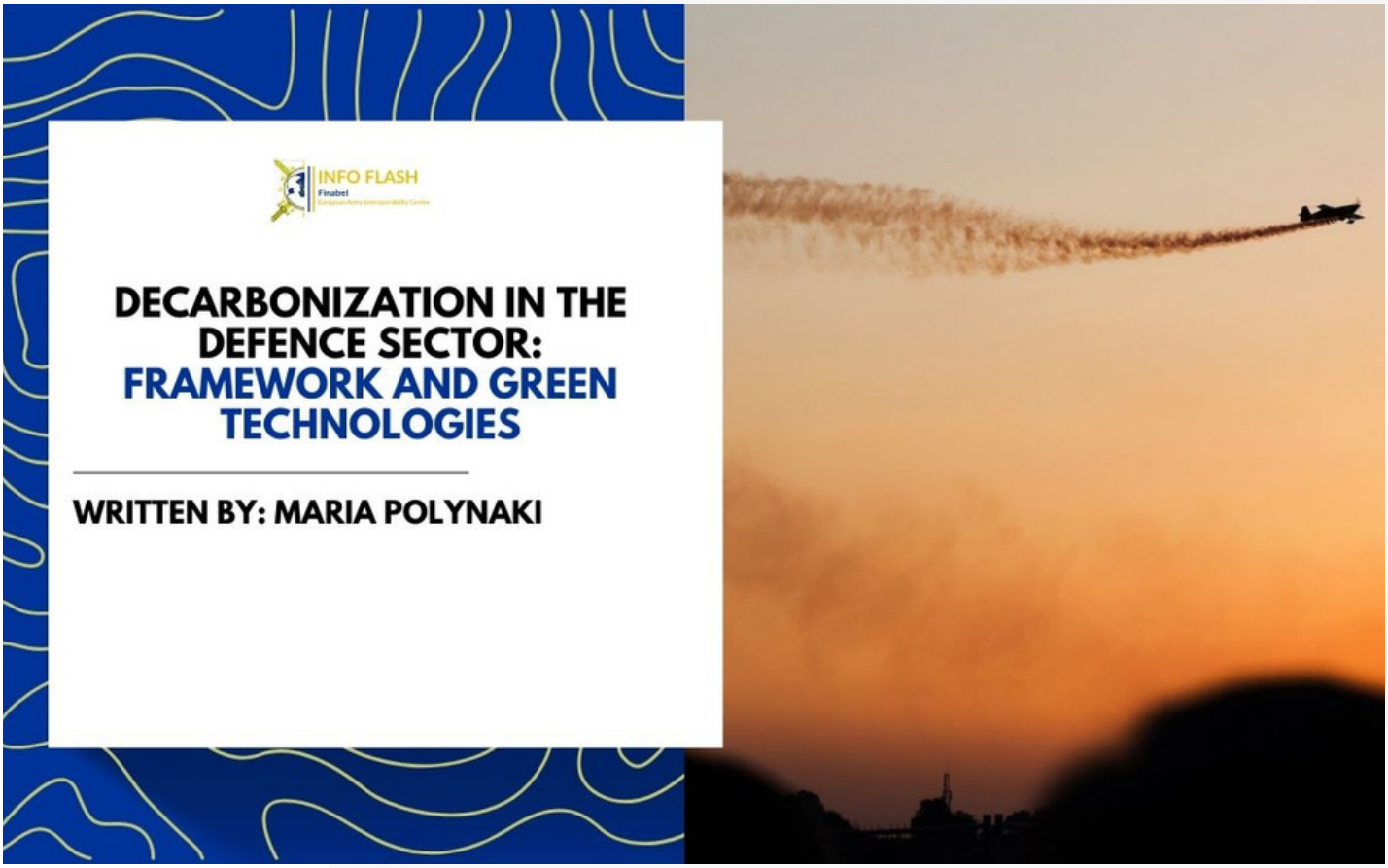
DECARBONIZATION IN THE DEFENCE SECTOR: FRAMEWORK AND GREEN TECHNOLOGIES



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Introduction

Environmental concerns have climbed to the top of the international agenda. Concerns about the environment, particularly on how to handle climate change, seem to underpin most state actions and societal actors these days (Duncan, 2023). The armed forces and the defence sector as a whole are not exempt from this trend. Moreover, the defence sector's environmental footprint is massive, making it all the more necessary for the armed services to devise new policies and activities targeted at minimizing this footprint. These changes represent both a threat to military institutions and an opportunity to implement new technologies that can improve operational and military capabilities (Duncan, 2023). Understanding the effects of climate change, thus, is critical for gaining a knowledge advantage. The military has to understand how climate change and shifting climatic conditions affect strategy and operational conduct. Extreme weather events, for example, may have an impact not only on the operability of military capabilities, but also on their efficiency and military installations as a whole. In the future, we are also expected to witness more conflicts caused by climate change, for which security agencies will need to prepare (Wigell & Hakala, 2022).

Historical Background on Green Defence

The climate emergency is widely understood to have repercussions for national and international security (Duncan, 2023). However, among Western allies, these concerns have mostly been expressed via the lens of 'climate security' or the belief that climate change would cause and worsen existing levels of instability, insecurity and violent conflict around the world (Busby, 2022). Such thinking is consistent with prior initiatives, dating back to the 1960s and 1970s, to reframe environmental degradation as a security issue (Duncan, 2023). Though it has only been since the 2000s that there has been increased attention in the impact of climate change on military operational conditions, as well as the resulting need for militaries modify their operations (Duncan, 2023).

Notably, the issue of military emissions was raised during the 1997 Kyoto Protocol negotiations (Michaelowa & Koch, 2001, pp. 383-94). Although the US did not obtain a blanket exemption for all military emissions, emissions from UN-authorized multilateral operations, international aviation or the use of marine bunker fuels were excluded from national emissions inventories (Duncan, 2023). Nonetheless, western defence ministries came under increased pressure in the 2000s to reduce emissions, particularly from domestic facilities and non-tactical vehicle fleets (Duncan, 2023).

The Paris Agreement, signed by 195 nations on 12 December 2015, marked a shift in the development of military operations and low-carbon warfare. To summarize, the agreement committed signatories to pursuing efforts to limit the average rise in global temperature to 1.5°C above pre-industrial levels, and it required all countries for the first time to set ambitious emissions-reduction pledges that would be strengthened over time (Duncan, 2023). Military emissions, for example, were no longer automatically exempt, though reporting would be voluntary (Duncan, 2023). In short, a commitment to limit average global warming to 1.5°C, which the international community reaffirmed in Glasgow in 2021, also meant committing to a low-carbon future (UNFCCC, 2021).

Currently, western defence leaders appear to be most concerned about whether their forces can afford to fall behind if the rest of the world continues to decarbonize (Duncan, 2023). There are two issues that stand out: one is economic/technological, and the other is societal/political. To begin with the economic/technological, the worldwide transition to net zero is expected to reduce demand for fossil-fuelled technologies, increased investment in research and development, improve the availability of supporting infrastructure and an increased accompanying skill base (Duncan, 2023). This means that, as the defence industrial base decarbonizes, carbon-burning technology may become more difficult to build, more expensive to fuel and more difficult to crew. Simply put, a military based mostly on fossil-fuelled forces will be far more expensive to operate in a net-zero society, necessitating a greater percentage of state resources (Duncan, 2023).

International Organization’s Initiatives

Among international organizations, the North Atlantic Treaty Organization (NATO) has been at the forefront in defining an eco-friendlier framework for its activities (Wigell & Hakala, 2022). In 2014, NATO approved the “Green Defense Framework”, a key document suggesting a way forward for the

Alliance and its member states in this regard (Wigell & Hakala, 2022). At the 2021 NATO Summit, Allied Heads of State and Government endorsed NATO's Climate Change and Security Action Plan, based on awareness, adaptation, mitigation and outreach. Moreover, NATO's efforts are echoed by the European Union (EU).

Later, the Strategic Compass, published in March 2022 to enhance the EU's security and defence policy, climate change is emphasized as an emerging threat but also from the point of view of cutting the emissions from activities associated with the Common Security and Defense Policy (CSDP) (Wigell & Hakala, 2022). In particular, a focus will be on limiting the environmental footprint of CSDP missions around the world (Wigell & Hakala, 2022). Furthermore, the EU Commission's contribution to European defence emphasizes the need to decrease emissions from the defence industry as an 'integral aspect' of the EU's efforts to achieve climate neutrality by 2050 (Wigell & Hakala, 2022). These goals are expanded upon in the EU's climate change and defence strategy, which requires for increased energy efficiency as well as the development and use of innovative technologies and practices to minimize defence-related emissions (Wigell & Hakala, 2022).

Various national governments have also highlighted the importance of integrating climate change issues into defence policy (Wigell & Hakala, 2022). The United Kingdom Ministry of Defence, for example, has developed a Strategic Approach to Climate Change and Sustainability that acknowledges the defence sector's role in reducing emissions. The UK defence actors have been recognized as being at the forefront of the greener military agenda, employing innovative technology such as new vehicles, fuel standards and energy storage (Wigell & Hakala, 2022). Meanwhile, the US Department of Defense has been working for some time to address the issues that climate change poses to its international security environment. This work has mostly focused on the military's and other security actors' ability to adapt to environmental risks and operate in changing scenarios, but it also includes mitigation and emission reductions. The US Army, for example, seeks to reduce emissions and achieve net-zero Greenhouse Gas (GHG) emissions by 2050 through initiatives that considerably expand the share of non-carbon energy sources and electric vehicles within its vehicle fleet (Wigell & Hakala 2022).

Furthermore, the International Institute of Strategic Studies (IISS) reports that the following countries have a Green Defense Strategy: France, the Netherlands, Slovenia, Spain, the United Kingdom, the United States and Canada (Massa, 2022). While initiatives for developing a greener defence sector at the national level are primarily intended to help governments reach their climate neutrality commitments, they are also justified by their potential to increase defence capacity. Energy efficiency and innovative technologies are thought to improve the ability of defence forces to adapt to changing climate circumstances and while also handling future security issues. For example, in the United States, climate change mitigation is regarded as both a necessity and a competitive advantage that will boost military resilience and capabilities (Massa, 2022).

Challenges and Policy Recommendations

The political project to create a greener and more sustainable military will not succeed if the systems and technologies that are necessary to enable such transition are not developed. The defence

industry thus, has that certain duty and mission (Massa, 2022). Thus, according to Massa (2022), it is quite clear that the contribution of the defence industrial sector will be crucial in order to achieve the ambitious goal of a decarbonized military.

In the short term, it is most effective to focus on the decarbonization of the military industrial sector due to it being the greatest emitter of GHG emissions (Massa, 2022). To begin, three types of GHG emissions can be distinguished. First, the emissions directly resulting from defence firms' industrial production. Second, emissions resulting from the supply chain, with emissions resulting from both component production and component transportation and, finally, emissions resulting from the final customer or user of defence industry products, namely the armed forces. Thus, three distinct solutions must be employed to address the reduction of the aforementioned emissions (Massa, 2022).

To begin with, for the reduction of the emissions originating from the supply chain, it will be fundamental that the suppliers of components for the defence industry meet precise standards of emissions in the production and shipment of such components. There is not much the industry can do in this sense, except for taking the decision to only work with suppliers that incorporate and implement green and sustainable policies, standards and procedures in their strategies (Massa, 2022). On the other hand, far more needs to be done to reduce emissions for which the defence industry is directly responsible, particularly those associated with the manufacturing process (Massa, 2022). In this regard, it will be critical for the defence sector to develop a decarbonization plan in its manufacturing process, as well as a plan for more efficient energy consumption management (Massa, 2022).

Finally, armed forces' GHG emissions need to be reduced due to them accounting for the majority of total emissions (Massa, 2022). As a result, the majority of decarbonization efforts should be focused on this category of emissions. The reduction of greenhouse gas emissions should be the top priority, the defence sector can support the armed forces' green transition primarily through the development of new systems and technology that will enable such a shift (Massa, 2022).

Green Technologies in the Defence Sector

To begin with, one of the most interesting and promising green technologies for the air domain is the development of solar-powered unmanned aerial vehicles (UAVs). In theory, such devices can have an endless flight time thanks to solar energy (Massa, 2022). The SKYDWELLER is an unmanned aerial system powered by photovoltaic cells put on the plane's wings which allows it to fly indefinitely (Massa, 2022). This technology can be utilized to reduce GHG emissions by carrying out intelligence, surveillance and reconnaissance missions with a solar-powered drone instead of with a more expensive and polluting fossil-fuel-powered aircraft (Massa, 2022).

In the maritime domain, unmanned ships powered by hydrogen are a great example of green technology developed by the defence industry (Massa, 2022). These systems can carry out missions similar to those described above for solar-powered UAVs. For the land domain, on the other hand, continued development of man-portable solar or wind energy generation devices can be expanded to

civic tasks and non-military activities (Massa, 2022). Additionally, the defence industry is already working on the development of electric-powered vehicles (Massa, 2022). Electric vehicles are not a new concept, nor a technology developed entirely by the defence industry; nonetheless, the defence industry's dedication to the development and manufacturing of such vehicles, as well as batteries and power units, may make a significant contribution to the entire sector. For example, in this regard, the US Army has also requested that the defence sector create a vehicle that can serve as an autonomous mini-grid, decreasing fossil fuel usage, while also developing a system that might be used for non-military purposes in the future (Massa, 2022).

Emissions, particularly carbon emissions, are another important aspect of the green transition (Massa, 2022). In this field, the defence industry can directly reduce its own emissions, in addition to producing new technologies that reduce emissions (Massa, 2022). Instead, the main effort should be dedicated to the development of energy-efficient systems and models of production, as well as the creation of production facilities. Those facilities should take into account the emissions and pollution caused by the production process, in order to reduce greenhouse gas emissions directly from the industrial production processes of the defence industry.

Another crucial aspect of the green transition is energy consumption, specifically in energy consumed and the efficiency of the energy systems. More specifically, there is a trend where green and sustainable fuels (such as biofuels and non-fossil fuels) are already in part used on both aerial and naval platforms. Some examples for the maritime domain are the Italian Navy “Flotta Verde” project or the US Navy “Green Fleet” initiative,; while in the air domain, there is the “Operational Energy” project of the US Air Force, which aims to develop a system that can convert the CO2 emissions of the jet engines into sustainable fuel usable by the jet itself (Massa, 2022, p.92). According to Massa (2022), with regards to energy efficiency, there are several measures that can be implemented such as, the use of more efficient engines and power units or the development of more aerodynamics and hydrodynamics designs when manufacturing aircraft or ships (Massa, 2022).

Finally, the defence sector will be a crucial enabler of the armed forces' green transformation, providing them with the essential technology and systems to decrease their carbon footprint without jeopardizing mission-critical capabilities. The defence sector, as the principal contractor for the armed forces, will play a critical role in enabling the military's green transition (Massa, 2022). Furthermore, such a contribution is tied to a political component, specifically the political establishment's readiness and willingness to adequately address such transformation, both in terms of allocating resources and building an effective normative framework (Massa, 2022). As a result, establishing a direct channel of communication and cooperation between the defence industry, the armed forces, and political institutions will be critical in order to accomplish the ambition of having a decarbonized military instrument.

Conclusion

Even if the military's role in facilitating the renewable energy transition is still being examined in depth, the defence industry must undoubtedly contribute to the green transition. In the short term, the key contribution of the military should be a reduction in emissions and increased usage of renewable energy sources (Massa, 2022). While in the long-term, contributions may be greater, particularly in terms of developing new systems and new technologies that enable the shift to a greener and more sustainable military instrument without risking the armed forces' capabilities (Massa, 2022). As previously stated, military capabilities are critical in maintaining a peaceful and safe environment, which serves as the foundation for any sort of growth, including their green transition. Some of the technologies discussed in the article are already in use, while others are under construction or under development. However, in order to maintain the green transition, significant resources must be allocated to the development of new systems and technologies that will shape the future and lead to a more sustainable society.

References

Busby, J. W. (2022). States and Nature: The Effects of Climate Change on Security. Cambridge University Press. https://doi.org/10.1017/9781108957922.

Depledge, D. (2023). Low-carbon warfare: climate change, net zero and military operations, International Affairs, Volume 99, Issue 2, pp. 667–685. https://doi.org/10.1093/ia/iiad001.

Gavenčiaková, L. (2023). Emerging Technologies and "Green-Friendly" Military Conflict? In Berghofer, J., Futter, A., Häusler, C., Hoell, M., Nosál, J. (Eds.), The Implications of Emerging Technologies in the Euro-Atlantic Space. Palgrave Macmillan, Cham. https://doi.org/10.1007/978-3-031-24673-9_7.

Massa, T. (2022). The Possible Contribution of the Defence Industry to the Green Transition. In G. Iacovino & M. Wigell (Eds.), Innovative Technologies and Renewed Policies for Achieving a Greener Defence (pp. 85–94). Springer Netherlands. https://doi.org/10.1007/978-94-024-2186-6_7.

Michaelowa, A., & Koch, T. (2001). Military Emissions, Armed Conflicts, Border Changes and the Kyoto Protocol. Climatic Change, 50(4), 383–394. https://doi.org/10.1023/a:1010695312025.

United Nations Framework Convention on Climate Change (2021, November 13): Glasgow Climate Pact [Draft decision -/CMA.3] [Advance Document FCCC/PA/CMA/2021/L.16]. United Nations Framework Convention on Climate Change. https://unfccc.int/sites/default/files/resource cop26_auv_2f_cover_decision.pdf.

Wigell, M., & Hakala, E. (2022). Towards a Greener Defence: An Introduction. In G. Iacovino & M. Wigell (Eds.), Innovative Technologies and Renewed Policies for Achieving a Greener Defence (pp. 1–6). Springer Netherlands. https://doi.org/10.1007/978-94-024-2186-6_1.