The Military Emissions Gap: Analysing the Implications of Militarization for the EU Green Deal

H.S.B. Huibregtsen

Faculty of Humanities, Leiden University

MA Thesis International Relations: Global Political Economy

Supervisor: Dr. S. Yang

Second Reader: Dr. M. Skalamera

June 6, 2025

Word Count: 14845

Abstract

As Europe navigates simultaneous climate and security crises, a critical policy blind spot has emerged: the climate cost of militarization. This thesis examines to what extent military emissions and reporting practices among EU-NATO Member States challenge the net-zero target of the European Union's Green Deal. The analysis reveals a military emissions reporting gap of at least 77% within Member States' National Inventory Reports. This omission is not simply technical; it is rooted in institutional inertia and political dynamics that prioritize short-term over long-term security. Additionally, using NATO defence expenditure data and the Transnational Institute's emissions methodology, the study estimates that under ReArm Europe, EU-NATO military emissions will reach 95.06 $MtCO_2e$ annually by 2025, surpassing those of several medium-sized Member States. These findings suggest that there is a critical blind spot in current EU Green Deal emission reduction targets, as they structurally neglect a large part of military emissions. This research concludes that mandating transparent military emissions reporting is essential, not only for reaching net-zero, but also for ensuring the EU's long-term strategic and environmental security.

Keywords: Military Emissions, EU Green Deal, ReArm Europe, Climate Accountability

‘’You can’t manage what you don’t measure’’

- *Ellie Kinney (personal communication, April 4, 2025)*

Acknowledgements

I would like to express my sincere gratitude to all the people that supported me throughout this research. In particular, I would like to extend my gratitude to *Lennard de Klerk,* lead author of the Initiative on Greenhouse Gas accounting of war, for his continued guidance and feedback throughout the research process. *Shiming Yang* for her invaluable aid in structuring my paper as my thesis supervisor. *Ellie Kinney (Conflict and Environment Observatory)* and *Stuart Parkinson (Scientists for Global Responsibility)* for answering key questions and providing me with relevant information for understanding the military emissions gap. Furthermore, I would like to thank all researchers taking part in the monthly military emissions gap meetings, organised by the Conflict and Environment Observatory, for their valuable insights.

Finally, I would like to thank my parents and my sisters for their unwavering support throughout my academic journey.

Note on Positionality

As a student researcher, I have participated in monthly Military Emissions Gap (MEG) meetings and had access to informal conversations with experts and advocates in this field. While these engagements enriched my understanding of the topic, they may also influence the framing of this thesis. Therefore, while I aimed to maintain analytical rigor and critical distance throughout, I acknowledge the potential impact of this proximity on the interpretation of findings.

Table of Contents

List of Acronyms and Abbreviations

AMECO- Annual macro-economic database of the European Commission's Directorate General for Economic Affairs

CEOBS - The Conflict and Environment Observatory

CCPI - Climate Change Performance Index

CO_2 - Carbon Dioxide Emissions

ECB - European Central Bank

EEAS- The European External Action Service

EDA- The European Defence Agency

EU- European Union

GDP- Gross Domestic Product

GHG - Greenhouse Gas Emissions

IISS - International Institute for Strategic Studies

IPCC - Intergovernmental Panel on Climate Change

IMCCS - International Military Council on Climate and Security

$KtCO_2e$ - Kilo-Tons of Carbon Dioxide Equivalent

MS - Member State

$MtCO_2e$ - Mega-Tons of Carbon Dioxide Equivalent

NATO - North Atlantic Treaty Organization

NDC - Nationally Determined Contribution

NIR - National Inventory Reports

SAFE – Security Action for Europe

SGR - Scientists for Global Responsibility

SIPRI - Stockholm International Peace Research Institute

TNI - Transnational Institute

UN - United Nations

UNFCCC - United Nations Framework Convention on Climate Change

1. Introduction

As the planet heats up, so does Europe's political climate. In 2024, global temperatures surpassed 1.5°C above pre-industrial levels for the first time, an alarming milestone that underscores the urgency of decisive climate action. At the same time, the war in Ukraine has redefined European security priorities, sparking an unprecedented defence buildup and recalibrating the strategic focus of the transatlantic alliance.

This evolving geopolitical context is particularly visible among the twenty-three EU-NATO Member States**,** which are situated at the crossroads of ambitious climate policy and rising defence imperatives. On the one hand, the European Union (EU) has long positioned itself as a normative power in global environmental governance, committing to climate neutrality by 2050 through the European Green Deal. On the other hand, mounting security concerns have reignited defence spending across the continent. This trend has been further intensified by U.S. political pressure, with President Trump calling on NATO allies to raise their military spending to at least 5% of GDP, while also raising doubts about the continued U.S. commitment to the alliance, whose contributions currently account for a significant share of NATO's overall capabilities (Hendrix, 2025). In response, the EU has launched the *ReArm Europe* initiative, a strategic plan that envisions €800 billion in additional defence spending between 2025 and 2028**,** amounting to a major increase of over 50% annually compared to 2024 spendings. While this surge in military expenditure is considered essential for safeguarding European sovereignty and collective defence, its climate implications have been largely downplayed both in public discourse and policymaking.

Research by the Conflict and Environment Observatory (CEOBS) and Scientists for Global Responsibility (SGR) in 2022, however, estimated that the global military sector is responsible for approximately 5.5% of total greenhouse gas (GHG) emissions. If this were attributed to a single country, it would rank as the fourth-largest emitter worldwide (Parkinson & Cottrell, 2021). Nevertheless, due to the longstanding exclusion of military emissions from international climate agreements, this substantial source of emissions has remained a persistent blind spot within global climate governance frameworks. This raises a fundamental question: How can the EU reconcile its climate ambitions with its rapidly expanding defence posture?

This thesis seeks to address this question by examining the extent to which increased military expenditure among EU-NATO Member States undermines the objectives of the European Green Deal. The central research question posed is: *To what extent do military* *emissions and reporting practices in EU-NATO Member States challenge the achievement of the EU Green Deal's net-zero target?*

To answer this research question, the thesis is guided by two sub questions:

1. To what extent is there a military emissions reporting gap amongst EU-NATO Member States?
2. How do institutional structures and political dynamics contribute to this reporting gap?

These questions, on the extent and drivers of the military emissions gap will guide this thesis to answer the central research question, on the implications of military emissions for the EU Green Deal. To do so, the paper proceeds as follows: Chapter 2 sets out the literature review and theoretical framework, identifying a critical gap in research on the contribution of military emissions to climate change. Furthermore, it discusses theories on priorities of short-term security over long-term security. Chapter 3 sets out the policy context necessary to understand both how EU-NATO MS currently need to report military emissions and what geopolitical factors contribute to increase military spendings. Chapter 4 explains the methodology, a mixed-methods approach combining qualitative policy analysis with quantitative emissions estimation. The qualitative component involves an analysis of international climate agreements and EU-NATO reporting frameworks. The quantitative component draws on NATO defence expenditure data and a military emissions estimation framework developed by researchers from the Transnational Institute (TNI) to calculate emissions from military activities for 2019-2024 and estimate those under ReArm Europe. The calculations include supply chain, mobile and stationary, scope 1, 2 and 3, emissions. Chapter 5 reveals the findings on military expenditure and emissions for 2019-2025. Chapter 6 will analyse these findings, answering both sub questions and the overall research question and Chapter 7 will end with concluding remarks.

The findings project that military emissions will amount to at least 95.06 $MtCO_2e$ by 2025 under ReArm Europe.[1] This volume surpasses the annual emissions of individual countries such as Portugal or Croatia, placing the military activities of the EU-NATO bloc among the top 50 global emitters if treated as a single country. The study therefore reaches

[1] This paper's calculations have taken the average proportion spent on equipment for 2024 similar for 2025, also it has taken an increase in military personnel of merely 2%, but there are strong indications that these numbers are to increase with a significant amount more, which would result in an even larger increase in emissions.

three core conclusions. First, there exists a substantial military emissions reporting gap of at least 77% under the UNFCCC's designated reporting categories. Second, this reporting gap is rooted in institutional inertia and the dominance of short-term security over long-term security, reflecting how institutions and governments treat climate change as a long-term threat. Third, the persistent exclusion of military emissions from national climate inventories poses a direct challenge to the European Green Deal's net-zero target. Therefore, the EU is now facing a security paradox: in attempting to strengthen security through militarization, EU Member States are simultaneously exacerbating one of the greatest long-term threats to global security, climate change.

By calculating and analysing military emissions, this paper contributes to the severely limited academic knowledge on the military's contributions to climate change and urges EU-NATO MS to acknowledge the importance of military emissions reporting, both for climate integrity and long-term security.

2. Literature Review and Theoretical framework

This literature review critically engages with academic research on the relationship between military activity and climate change, with specific attention to the structural omission of military GHG emissions in climate governance. It finds that while a significant body of literature has examined the ways in which climate change exacerbates conflict, there has been comparatively limited scholarly focus on the reverse: the contribution of militarization to climate change and environmental degradation.

The review starts with contextualizing the dominant climate–conflict literature, before turning to empirical studies of military emissions, their reporting gaps, and the underlying political economy of their invisibility. Additionally, it draws on critical security theories of the Giddens' paradox, the security paradox and institutional path dependency which will be used as guiding theories in this paper. This review finds a fundamental gap in the literature that systematically ignores the impact of the military sector on climate change.

2.1. Climate Change and Conflict: an established research field

The dominant climate–conflict literature frames climate change as a security threat. This literature has expanded considerably over the past two decades. Foundational contributions by Homer-Dixon (1994), and later by Klare (2007) and Mach et al. (2019), have demonstrated how environmental stress, through mechanisms such as drought, crop failure, and resource scarcity, can act as a threat multiplier in fragile sociopolitical contexts. Climate variability can even function as a breeding ground for extremist recruitment, as terrorist organisations such as Al Queda and ISIS use communal conflict created through scarcity to recruit new members (Middendorp, 2022).

However, as Selby and Hoffmann (2014) observe, much of the climate–security literature is written by actors within military institutions and international NGOs, who are often engaged in promoting securitized and market-based responses to anticipated climate-induced instability. This creates an "analytical asymmetry": while extensive attention has been paid to the risks climate change poses to international security, far less focus has been placed on how security policies, institutions, and military practices themselves contribute to environmental degradation. In other words, the securitization of climate change legitimizes militarized responses while obscuring their environmental costs (Selby & Hoffmann, 2014). This thesis builds on this emerging literature by examining the structural neglect of military emissions in climate governance and highlighting the need to reassess how security is conceptualized in light of environmental sustainability.

2.2. The contribution of the Military to global GHG Emissions

There is a limited number of studies examining and quantifying the climate impact of military activity. However, those that do so point to a substantial and systemic carbon footprint. Crawford (2019) quantifies the U.S. Department of Defence as one of the world's largest institutional fossil fuel consumers, emitting more GHGs annually than many industrialized countries. Belcher et al. (2020) extend this analysis to emphasize the diffuse and often invisible carbon costs of the "everywhere war," including emissions embedded in global logistics, supply chains, and infrastructure maintenance.

Furthermore, estimates from CEOBS and the SGR (2022) suggest that when indirect emissions are accounted for, everyday military activities are responsible for as much as 5.5% of global GHG emissions.

While these figures are among the most comprehensive currently available, they vary significantly and remain approximations due to the limited data disclosed by national governments. Nonetheless, these estimates show that military emissions exceed those of entire sectors, such as commercial aviation. The literature thus makes evident that military emissions are not peripheral but constitute a significant and inadequately addressed component of global GHG emissions.

2.3. Theoretical explanations for the military emissions gap: Giddens' paradox and Institutional inertia

Despite an increased number of evidence of the military sector's significant climate impact, military emissions remain largely underreported and invisible in securitization debates. From the start of the first internationally adopted climate protocol, the Kyoto Protocol, military emissions have been structurally exempted from climate agreements. During the negotiations of this protocol, the primary concern of the U.S. in particular, was that including military emissions would significantly threaten national security, create a conflict between the collective ability to preserve peace and reduce GHG emissions and lastly, it would discourage countries from deploying military forces outside of their national borders (U.S. Department of State, 1997). This rhetoric is still used amongst ministries of defence. The German defence ministry's environmental protection unit for example argues that ''We would not want to let everybody know how much fuel we use in these missions, how far we fly, how far we drive, and what our exercise patterns are'' (McFarlane & Volcovici, 2023). Beyond security concerns, politicians argue that including militaries in the reporting obligations would be too technically difficult, due to the long-term and dynamic processes of the military.

Several scholars offer explanations for this prioritization of 'national security' over climate change. A central insight comes from Giddens (2009), who explains through the Giddens' paradox that climate impacts are not immediate or visible during day-to-day life. Due to this relative invisibility, many people do not see its threats and will do nothing about it. Yet, when climate change becomes visible, society will be too late to act. In his book, the Politics of Climate Change, Giddens explains how people vote for immediate solutions to short-term issues and how the short-term electoral horizons create a loop where politicians need to prioritize this. These short-term electoral horizons and human priorities of short-term security, deprioritize long-term environmental concerns in favour of more immediate policy objectives (Giddens, 2009; Jordan & Matt, 2014).

In the case of defence policy, this dynamic is especially pronounced. Defence policy is typically driven by short-term operational imperatives, with planning cycles oriented around immediate strategic readiness rather than sustainability (Stevenson, 2021). These short horizons in turn reenforce institutional path dependency. This is what Pierson (2000) calls institutional inertia; large institutions develop self-reinforcing structures that resist adaptation, especially in complex policy domains like climate change. This inertia is compounded by the short-term political cycles that characterize both national ministries of defence and international institutions, where leadership often changes every four to five years. Such frequent turnover incentivizes policy continuity over reform, as political actors prefer the convenience and safety of the status quo (Pierson, 2000). Government institutions, particularly defence, are characterized by well-protected hierarchies and internal logics that are resistant to external pressures for transparency or reform.

Lastly, ministries of defence, arms manufacturers, and related bureaucracies benefit from the lack of public scrutiny and regulatory interference. State and corporate actors often co-produce these climate governance structures that exclude or marginalize politically sensitive sectors (Newell & Paterson, 2010). During the Kyoto Protocol's negotiations implicitly large countries with a "maritime empire" such as the US, France and the United Kingdom, as well as those operating military globally benefitted from this provision (Michaelowa, et al., 2022; Crawford, 2019; CEOBS, 2023).

2.4. Dependence on fossil fuels

Lastly, the militaries benefit from this status quo as it provides them with structures that allow them to respond to emergent threats quickly. Scholars such as Floyd (2008) and Deudney (1990) therefore caution that overextending environmental regulation into the military sphere may compromise this capacity to respond to emergent threats, particularly in periods of geopolitical volatility. The NATO is relying on a single fuel policy, which is almost entirely reliant on fossil fuels. Changing this status quo would thus significantly hamper strategic readiness. In line with this argument, the Dutch government is for example working on a law to exempts the defence of climate regulations, as quickly building and re-enforcing the military is of 'more societal importance than climate agreements' (van der Meijden, 2025).

However, according to the Dutch general Tom Middendorp, this argument structurally neglects a different vulnerability: dependence. As armed forces remain heavily reliant on fossil fuels, resources that are both increasingly scarce and geopolitically sensitive, they risk undermining their own strategic autonomy through exposure to fragile external supply chains. From this view, diversifying energy sources and investing in green alternatives is not only environmentally prudent but also a matter of operational resilience and long-term security planning (Middendorp, 2023).

Thus, while the tension between operational security and environmental responsibility is real, the literature increasingly suggests that excluding military emissions from climate action is neither sustainable nor strategically sound.

2.5.The Security Paradox: Militarization as a Driver of Insecurity

To conclude, there is an increasing debate amongst scholars who argue that exemptions of the military in climate agreements rest on a narrow and outdated conception of security. This emerging body of critical scholarship reframes this institutional exemption as a paradox of security itself. They argue that the systemic risks posed by climate change, ranging from mass displacement to economic destabilization, are likely to exceed those posed by conventional security threats in both scope and intensity (Belcher et al., 2020). Dalby (2022), for instance, argues that contemporary security practices, particularly those centred on militarized deterrence, border control, and force projection, are actively exacerbating the very conditions they purport to contain. Militaries contribute directly to climate change through emissions and indirectly through environmental degradation and resource consumption.

Belcher et al. (2020) similarly note that short-term securitization strategies, focused on immediate geopolitical threats, fail to account for the long-term consequences of ecological destabilization. By externalizing the environmental costs of military activities, states not only hinder decarbonization efforts but also heighten their exposure to climate-related insecurity: including mass displacement, over 1.2 billion climate refugees by 2050, critical infrastructure failure, and cross-border conflict (Institute for Economics and Peace, 2020).

This literature invites a reconceptualization of military emissions not merely as an environmental oversight, but as a critical failure of security governance, one that undermines states' long-term resilience and sustainability.

2.6.Concluding remarks

The literature reviewed here establishes three principal insights:

First, military activity is a significant source of GHG emissions, far exceeding what is typically acknowledged in public discourse. Second, these emissions are systematically excluded or underreported in climate governance due to institutional inertia and the Giddens' paradox. Third, the short-term security logics that justify carbon-intensive military expansion are increasingly at odds with the long-term environmental threats posed by climate change and the subsequent necessity of military resilience.

Despite these insights, very few empirical studies have quantified the extent of the military emissions accountability gaps across multiple states, nor are there reports on the link between the implications of this gap to the achievement of collective climate targets such as those defined by the European Union.

This thesis seeks to address that gap by quantifying the real and reported military emissions of EU-NATO Member States and assessing their compatibility with the EU's climate commitments. In doing so, it contributes to a growing academic and policy debate on the need to acknowledge military emissions and aims to fill the immense knowledge gap on military emissions.

3. Policy Context: Climate Agreements versus Security Demands

This chapter explains the institutional and political foundations of the military emissions gap. It shows how key international climate agreements, including the UNFCCC, Kyoto Protocol, and Paris Agreement, have excluded military emissions from binding reporting obligations. It also examines current geopolitical developments, that drive rapid increases in military spending across EU and NATO Member states. Together, these factors form the policy context in which military emissions are both produced and largely ignored, a context that is essential to understanding why the military emissions gap exists, and why it is growing.

3.1. International climate agreements and reporting obligations

The first international treaty created to combat climate change, the UN Framework Convention on Climate Change (UNFCCC), was adopted by 160 nations in 1992. This treaty sets out the basic legal framework and principles for international climate change cooperation with the aim of stabilizing atmospheric concentrations of GHGs to avoid "dangerous anthropogenic interference with the climate system (International Institute for Sustainable Development, 2025).''

3.1.1. The Kyoto Protocol of 1997

Under the UNFCCC, the parties to the treaty adopted the Kyoto Protocol in 1997. The first legally binding document with quantifiable targets for developed countries, the Annex I,[2]countries (Bassetti, 2022). To ensure that countries reduce their emissions, the Kyoto Protocol required industrialised countries to report their anthropogenic[3] emissions and removals in the so-called National Inventory Reports (NIR) under guidelines from the Intergovernmental Panel on Climate Change (IPCC), a scientific body established in 1988 that provides guidelines designed to provide a standardized framework for the complete, consistent, and transparent reporting of GHG emissions.

During negotiations of the Kyoto Protocol, as mentioned in the literature review, the U.S. delegation in particular, lobbied for an inclusion of a national security or national

[2] The Kyoto protocol only binds developed countries, with the argument that these countries were largely responsible for the high levels of greenhouse gas emissions (United Nations, 2022). To create this distinction of climate reporting obligations, Decision 24/CP.19 (UNFCCC, 2013) distinguishes between two types of countries, Annex I or non-Annex I countries. Annex I countries are classified as industrialised countries and economies in transition and are required to submit an annual national inventory report. These countries are typically also parties to the Organisation for Economic Co-operation and Development (OECD). Non-Annex I, typically lower-income countries, are under the Kyoto Protocol not legally obliged to report their emissions.

[3] Anthropogenic = caused by human activity.

emergency provision, which excluded military emissions from the Kyoto Protocol and its reporting requirements (IMCCS, 2022).

After long negotiations, the final text of the Kyoto Protocol, under decision 18/CP.8, contained no exemption for the Armed Forces to report their GHG emissions in NIRs. However, a short addendum (FCCC/CP/1997/7/Add.1) stipulated that international bunker fuels (including war ships and war planes) and multilateral operations pursuant to the Charter of the United Nations (i.e. military intervention) were not included in national totals and thus excluded from reduction targets (IMCCS, 2022).

3.1.2. The Paris Agreement of 2015

The Paris Agreement superseded the Kyoto protocol under the UNFCCC in 2015 and is currently the principal regulatory instrument governing climate change. In contrast to the Kyoto protocol, the Paris Agreement requires all parties to the UNFCCC, Annex 1 (industrialised) and non-Annex 1, to collectively tackle climate change. Annex I parties are however under stricter regulations and required to submit GHG inventories more often than non-Annex I countries. Countries must submit a biennial transparency report every two years, including a NIR of emissions by sources and removals by sinks of GHG emissions. Under the UNFCCC, each party is required to use the IPCC 2006 GHG reporting guidelines or the IPCC 2019 refinement to the 2006 IPCC GHG reporting guidelines which categorize emissions by sector, including energy industries, manufacturing industries and construction, agriculture, land use, land-use change and forestry (LULUCF), waste, and the 'Other' category.

Under the Paris Agreement, reporting military emissions is voluntary. Countries that choose to do so may report their military emissions under the IPCC's 1.A.5 'Other, not specified elsewhere' category. Within this category, they can report stationary emissions (1.A.5.a), for fuel use in military buildings, and mobile emissions (1.A.5.b), for fuel use in vehicles such as ships, aircraft and road vehicles. If a MS wants to detail even further its mobile emissions, it would be possible to distinguish these emissions by type of equipment, such as aviation (1.A.5.b.i) or vessels (1.A.5.b.i.i) (IMCCS, 2022). The emissions in 1.A.5, however, are not allocated to the military alone but include all remaining fuel combustion emissions that are not specified elsewhere (IPCC, 2019).

The IPCC guidelines also permit emissions from international military water-borne navigation to be included under category 1.A.3.d.i, if countries define and distinguish their international civil water-borne navigation with their international military water-borne navigation (European Environment Agency, 2023).

Emissions from multinational operations under the charter of the UN are not included in 1.A.5. or 1.a.3.d.i totals (Parkinson & Cottrell, 2021; IPCC, 2006).

3.1.3. The European Green Deal

The European Green Deal is the EU's strategy to fulfil its commitments under the Paris agreement. In short, the deal is a domestic implementation and enhancement of the Paris Agreement goals, but with its own legal framework and enforcement mechanisms.

The vision of the European Green Deal is to create a roadmap for EU countries to become the first climate-neutral area in the world by 2050, to cut pollution and restore a healthy balance in nature and ecosystems (European Commission, 2025c). All twenty-seven Member States of the EU are part of the Green Deal and aim for climate neutrality in 2050 by drastically reducing GHG emissions in all areas (European Commission, 2025c).[4] As core of this deal, the European Climate law of 2021 creates a legally binding target to reduce net GHG emissions to zero by 2050 and the intermediate 'fit for 55-package' target of reducing net GHG emissions by at least 55% by 2030 compared to 1990 levels.

The EU Green Deal does not create separate or additional emissions reporting requirements beyond the existing UNFCCC system, rather it builds on and reinforces existing climate reporting obligations, by mandating alignment with the Paris Agreement and using UNFCCC reporting frameworks. Since under the Green Deal countries are still required to report their emissions under the UNFCCC reporting framework, it does not provide an additional obligation for Member States to report their military emissions other than voluntarily reporting them under 1.A.5 or 1.a.3.d.i.

3.2. Military build-up amid threat perceptions: NATO demands and ReArm Europe

Understanding the current surge in European military emissions requires a clear view of the broader geopolitical and institutional pressures driving increased defence spending. This context is essential to this thesis, as it explains not only *how* military emissions are rising, but *why* governments across Europe are politically compelled to rearm, often without environmental safeguards. This chapter will dive into these rising threats to create an understanding of the current geopolitical landscape shapes demands for increasing military investments.

Long before the outbreak of full-scale war in Ukraine, NATO had repeatedly called on its members to meet the alliance's defence spending benchmark of 2% of GDP, a goal set in

[4] Climate neutrality refers to the idea of achieving net-zero greenhouse gas emissions by balancing those emissions, so they are equal to, or less than, the emissions removed, as well as accounting for regional or local bio geophysical effects of human activities, such as changes in surface albedo or local climate (UNFCCC, 2025)

2006 and reaffirmed at subsequent summits (NATO, 2024b). For years, many European countries, particularly in Western Europe, fell short of this target, prompting growing criticism from the United States. Under Donald Trump's first presidency, that criticism intensified into open threats of withdrawal from NATO. Upon his re-election in 2025, Trump raised the stakes by demanding that European allies increase defence spending to at least 5% of GDP, framing NATO as a transactional arrangement and linking protection directly to financial contributions (Kayali et al., 2025).

While Trump's position has sharpened transatlantic tensions, his demands fall into a broader context of geopolitical instability that has already pushed European governments to boost defence budgets. The Russian invasion of Ukraine in 2022 fundamentally altered the European threat perception, especially in countries along NATO's eastern flank. The scale and strategic unpredictability of the war forced a rapid reassessment of defence readiness and deterrence across the continent (Genini, 2025). At the same time, an increase in cyberattacks, hybrid threats, and regional instability in areas like the Middle East has reinforced the sense that Europe must strengthen its military posture in response to a diverse and evolving threat environment (NATO, 2024b).

In response to these pressures, the European Commission launched ReArm Europe, a large-scale defence investment initiative aimed at raising collective European military spending by over €800 billion between 2025 and 2028. The plan combines national-level commitments with €150 billion in EU-backed loans under the SAFE instrument (Security Action for Europe) and is designed to ensure both operational military readiness and political credibility in the face of external threats (European Commission, 2025).

3.3. Concluding remarks

In conclusion, the EU faces a complex climate-security nexus. While it aspires to become the first climate neutral continent by 2050 and on the other hand, they are rapidly increasing their defence investments to ensure operational military readiness and political credibility in the face of external threats. Despite this increase in defence investments, military emissions reporting remains voluntary in its core climate frameworks, including the European Green Deal and Climate Law. The next chapters will use this necessary information to analyse how military emissions are reported under the UNFCCC, what institutional and political factors drive the military emissions reporting and to what extent this will impact the goal of the EU Green Deal, to achieve climate neutrality by 2050.

4. Methodology

This chapter outlines the methodological approach used to answer the research question: *To what extent do military emissions and reporting practices in EU-NATO Member States challenge the achievement the European Union's Green Deal?* The research draws on a three-step empirical research design to investigate the scale and visibility of military emissions within EU-NATO countries and assess how the ReArm Europe initiative may impact future emission levels. Each step is designed to address a specific gap in current climate governance and build toward answering the central research question.

First, it conducts a data analysis of the National Inventory Reports (NIRs) submitted by 23 EU-NATO Member States under the UNFCCC. This step identifies which countries currently report military emissions under categories 1.A.5.a, 1.A.5.b and 1.a.3.d.i, in order to assess the transparency and consistency of military emission reporting.

Second, it estimates the actual military emissions of these countries for the period 2019–2024 using a modified version of the Transnational Institute's military emissions calculation method. This method quantifies stationary, mobile, and supply-chain emissions by combining military expenditure, personnel data, and emissions conversion factors. Adjustments are made for inflation and currency conversion to ensure year-to-year comparability.

Third, it projects potential military emissions for the year 2025 under the European Commission's ReArm Europe initiative. As official 2025 data is not yet available, this step applies conservative assumptions regarding equipment spending and personnel increases to estimate the emissions impact of the projected €650 billion rise in military expenditure.

Together, these three steps allow this thesis to expose the gap between reported and actual military emissions, and to critically assess the climate implications of Europe's current security trajectory.

4.1. Case study: EU-NATO Member States

This research will focus on the 23 Member States countries of both the EU and NATO. These states have been chosen for several reasons. First this research aims to analyse the effect of military expenditure on EU-climate agreements. Second, the EU is mostly affected by the Russia-Ukraine war, and as previously found in a study by Cottarelli & Virgadamo (2024), military expenditure ratios are inversely proportional to the of a country's border to Russia. Lastly, NATO mandates states to spend at least 2% of their GDP in the military and due to the increased pressure for NATO states to increase their defence expenditure to 5% of GDP, as mentioned in chapter 3, EU-NATO Member States have a contradicting interest of both decreasing GHG emissions and increasing military expenditure. Therefore, this study uses these 23 Member States as a case study for analysing how short-term securitisation might impact long-term securitization.

The four European Union countries which are not in the NATO and therefore not included in this research are Austria, Cyprus, Malta and Ireland. Finland and Sweden, two countries that have joined the NATO in 2022 and 2024 respectively, are included in the research for ease of comparison.

4.2. Analysing EU-NATO Military Emissions Reporting Practices

To assess the transparency and consistency of military emissions reporting within the European Union and NATO, this thesis conducted a structured data analysis of GHG inventory data submitted to the UNFCCC by the 23 EU-NATO Member States, drawing on the UNFCCC's detailed Data by Party portal. This GHG inventory data forms the foundation of national climate reporting and is expected to capture emissions across all sectors, including those related to military activities (UNFCCC, 2025).

The analysis focused specifically on sector 1.A.5 and 1.a.3.d.i to assess whether military-related subsectors were reported explicitly, and if so, whether corresponding emission values were disclosed. Cases in which the subsector appeared without data (marked as "not estimated" or left blank) were recorded as non-reporting.

A comparative table was created to display which countries reported under each category and to what extent. This data was then used to identify patterns of reporting, gaps in coverage, and possible inconsistencies across the EU-NATO space. This step provides the baseline for understanding the scale of underreporting and supports the broader argument that military emissions remain insufficiently integrated into national and international climate governance frameworks.

4.3. Calculating Real EU-NATO Military Emissions 2019-2024

To estimate military emissions for 23 EU-NATO Member States between 2019 and 2024, the Nato Defence Dataset and a modified version of TNI's military emission methodology was applied, allowing for improved comparability across years by adjusting for inflation.

4.3.1. Base year and Measurement Unit

This study uses 2019 as the base year for comparison, as it precedes the onset of the COVID-19 crisis. The pandemic significantly affected the defence sector, rendering comparisons of military expenditure between 2020 and 2024 less reliable (Parkinson, personal communication, Feb 2025).

All emission values are expressed in carbon dioxide equivalents (CO_2e)**,** a standardised unit that reflects various greenhouse gases' (CH_4, N_2O, etc.) global warming potential relative to CO_2. This allows for consistent measurement of the total climate impact of military-related activities.

4.3.2. Types of military emissions: Stationary, Mobile and Supply-chain

There are generally three types of emissions related to military action: stationary, mobile and supply-chain emissions. First, stationary emissions are the emissions resulting from energy use in military bases and military buildings. These emissions fall under scope 1, direct emissions and scope 2, emissions from purchased electricity and heating/cooling. Second, mobile emissions arise from the use of military equipment, such as the use of aircrafts, marine vessels and land vehicles. These emissions are the operational emissions and fall under scope 1, direct emissions. Finally, the supply-chain emissions are the emissions of the arms industry itself and the companies which supply the military, these fall under scope 3, indirect emissions resulting from activities not owned or controlled by the organization. To be able to calculate military emission all three scopes must fully be considered (Parkinson & Cottrell, 2022).

4.3.3. The TNI formula and this research' adjustment for inflation

The calculation method used in this thesis is based on the formula developed by researchers from the TNI in its 2023 *Climate Crossfire* report (Lin et al., 2023). This is one of the few methodologies produced that includes both scope 1, 2 and 3 emissions.

Their model calculates total military emissions as follows:

Carbon footprint of military and the associated military technology industry = (military expenditure) x (proportion spent on equipment) x (spend–emission conversion factor) + (number of military personnel) x (average stationary emission per military head).

The first term captures the mobile and supply-chain emissions using a spend–emission conversion derived from reported emissions and military equipment sales two of the biggest military equipment manufacturers, Thales and Airbus (see Appendix A for more details). The second term captures the stationary emissions using the average stationary emissions per head of 5 tCO_2e, as calculated by the SGR and CEOBS in 2022 (Parkinson & Cottrell, 2022).

One limitation of this TNI approach, however, is that it does not consider changes in purchasing power over the years. As this paper compares emissions over multiple years, this change could have significant impact on the calculations, since it might be the case that over the course of these years, military equipment has become more expensive, making the spend-emission factor which is based on 2021-2022 prices and exchange rates unfit for application to 2019 and 2024 prices. Therefore, this paper modifies the TNI approach to adjust the calculations to changes in purchasing power.

The calculations subsequently use the formula:
Carbon footprint of military and the associated military technology industry = (military expenditure, 2015 prices) x (proportion spent on equipment) x (spend–emission conversion factor, adjusted to 2015 prices) + (number of military personnel) x (average stationary emission per military head) (see Appendix A for more details).

Important to note is that this paper's calculations do not include emissions related to warfare, these emissions are estimated to also have significant impact but fall out of scope for this research (De Klerk et al., 2025).

4.3.4. Data sources and selection rationale

To calculate emissions, this paper has chosen to use the NATO Defence expenditure dataset, as this set provides the most aggregate data necessary for calculating military emissions.

There are three primary institutions that report on EU-NATO countries' military data, Stockholm International Peace Research Institute (SIPRI), the European Defence Agency (EDA) and NATO. SIPRI provides data on military expenditure and is generally acknowledged as providing more independent data than the NATO (Parkinson, personal communication, Feb 2025). However, the dataset has two shortfalls, it only reports data until 2023 and it does not provide specific data on military personnel and the proportion which Member States spent on their equipment. As these are necessary components for the calculations, this dataset cannot be used as a primary data source for this research.

Second, the EDA, created to promote defence collaboration amongst European Union Member States in 2004, has been collecting defence data on an annual basis from 2006 onwards. However, similar to the SIPRI database, this dataset does not contain numbers on the number of military personnel or proportions spent on equipment per EU-NATO Member State and is therefore also unfit for this paper's calculations.

Lastly, the NATO Defence expenditure dataset. This dataset includes data from 2014 to 2022 and estimates for 2023 and 2024 estimates based on their predictions of increased government spending for military purpose and the expectation that Allies are to meet or exceed the 2% GDP investment (NATO, 2024b). Important to note, however, is that the

NATO defines defence expenditure as: ‘’payments made by a national government (excluding regional, local and municipal authorities) specifically to meet the needs of its armed forces, those of Allies or of the Alliance (NATO, 2024a).’’ This defence data can therefore include retirement pensions made directly by the government to retired employees of military departments.[5] However, since this dataset provides data equipment shares and military personnel, two variables necessary for the military emissions formula, this dataset will be used for estimating military emissions.

4.4. Projecting military emission under ReArm Europe 2025

To calculate the emissions resulting from the ReArm Europe plan for the twenty-three EU-NATO countries, the aforementioned modified TNI method for military emissions method will be used. However, since there is no country-by-country NATO data yet available for 2025, these calculations rest on several assumptions. This section will first explain the method used to calculate EU-NATO defence expenditure for 2025 and after that will explain the method for calculating military emissions under ReArm Europe in 2025.

4.4.1. EU-NATO military expenditure under ReArm Europe

First this paper uses the €650 billion projected increase in defence expenditure by EU Member States as the basis for calculating military emissions under the ReArm Europe plan and excludes the extra 150 billion which the EU aims to raise.

This approach has been chosen since the 650 billion reflect the national-level spending commitments encouraged by the European Commission and will be mobilized and allocated by individual Member States through their national defence budgets.

By contrast, the additional €150 billion to be raised by the European Commission through the SAFE instrument represents EU-backed loans, which are centrally managed and can be used for individual or common procurement. While this amount is part of the broader €800 billion ReArm Europe ambition, it falls under a different financial mechanism and may not directly correspond national defence budgets, which is the data pilar that is used in this paper’s formula. Furthermore, detailed data on how and when these loans will be disbursed

[5] In contrast to the UNFCCC, which reports emissions based on territorial fuel use and excludes certain categories such as multilateral operations and international military transport, NATO’s definition includes a broader scope of military-related financial flows. These include not only spending on national armed forces, but also payments to support Allied and NATO operations, as well as pensions and equipment procurement, provided they are financed at the national level. As such, while NATO data offers the most comprehensive account of defence spending, it does not correspond to how or where emissions are produced and reported under international climate frameworks.

remains limited, making it difficult to estimate their emissions impact on 2025 emissions with accuracy or consistency.

Second, the average Military expenditure share of the 4 non-NATO EU Member States is calculated. This share should be deducted from the original 650 billion euro's amount, is assumed to remain similar to their average share in 2021-2023. The data the average share of the 4 non-NATO EU MS has been retrieved from the European Defence Agency's dataset (see Appendix C).

Third, when subtracting this percentage from the initial 650 billion euro's, this paper adjusts this amount to 2015 prices and exchange rates, using the GDP deflator forecast of the of the annual macro-economic database of the European Commission. Finally, this number in Euros will be converted to dollars using the average EU-USD exchange rates for 2025 retrieved from data of the European Central Bank.

Resulting from this logic, this paper's formula for annual EU-NATO military expenditure under ReArm Europe is;

EU-NATO Defence Expenditure$_{(2025)}$ (in 2015 prices) = ((Base Expenditure$_{(2024)}$ + (650 billion × Proportion$_{(EU\text{-}NATO)}$ × EU/USD Exchange Rate) ÷ 4) ÷ GDP Deflator$_{(2025)}$) × 100.

4.4.2. EU-NATO military emissions under ReArm Europe

The spend-emission conversion factor and average emissions per head of military personnel will be kept similar to previous EU-NATO 2019-2024 calculations. However, since there is no country-by-country NATO data yet available for 2025, military emission calculations for ReArm Europe rest on two assumptions.

First, to calculate the mobile- and supply chain emissions, this paper assumes that the average EU-NATO proportion spent on equipment, as calculated from the NATO defence expenditure Database of 2024 stays constant for 2025, which is 32.3%. This is since the ReArm Europe plan does not provide specific guidelines on proportion to be spent on equipment. Experts however, project that this proportion is likely to increase in the upcoming years (de Klerk, 2025). However, to ensure that these findings do not overstate total military emissions, this paper will use the same proportion spent on equipment for 2025 as for 2024.

Second, to calculate the stationary emissions, this paper uses the average increase in military personnel from 2019-2024 derived from the NATO defence expenditure database of 2%. However, there are strong indications that this number will increase a significant amount more. According to Burilkov and Wolf (2025), in their report on 'defending Europe without the US', Europe would need to either increase troop numbers significantly by more than 300,000 to make up for the fragmented nature of national militaries or find ways to rapidly enhance military coordination (Burilkov & Wolf, 2025). Some countries, such as the Netherlands have pledged to more than double their personnel, which would result in much higher emissions than this paper estimates (Müller, 2025).

These two assumptions are grounded in a deliberate effort to maintain methodological conservatism and avoid overstating the emissions impact of ReArm Europe. Given the lack of precise, disaggregated budget data for 2025 and the absence of specific EU guidelines on equipment spending or personnel targets, this thesis adopts a baseline scenario that reflects continuity with recent trends rather than speculative escalation. While expert projections indicate that both equipment expenditure and troop numbers are likely to increase significantly (de Klerk, 2025; Burilkov & Wolf, 2025), the decision to hold these variables constant, at 2024 levels for equipment proportion and a 2% annual increase for personnel, ensures that the resulting emissions estimates are moderate and defensible. This conservative approach strengthens the robustness of the findings by demonstrating that even under minimal growth assumptions, the climate impact of military expansion remains substantial.

4.4.3. Formula

Based on these assumptions, this paper uses the following formula to calculate military emissions under ReArm Europe:

*Total EU-NATO Military Emissions under ReArm Europe = (Annual defence expenditure$_{2025}$ x average proportion spent on equipment x adjusted spend-emission conversion factor) + (Total EU-NATO military personnel 2024 * average annual increase in military personnel * average stationary emission per military head).*

4.5. Limitations

While this thesis offers a novel and policy-relevant estimation of EU-NATO military emissions, several methodological and data limitations should be acknowledged.

First, the emissions estimates rely on proxy calculations using defence expenditure and spend–emission conversion factors, rather than direct measurements. This approach, while necessary due to data scarcity, assumes average emissions per dollar spent and may not reflect real variations in procurement practices, energy efficiency, or operational emissions across Member States.

Second, there is a definitional mismatch between the datasets used. The UNFCCC's 1.A.5 category, which includes "Other: not specified elsewhere" emissions, is not strictly aligned with NATO's definition of defence expenditure. UNFCCC data may include non-military government emissions (e.g. emergency services or civilian administration), while

NATO's defence expenditure includes pensions, administrative costs, and non-combat spending. This mismatch complicates direct comparison and may partially inflate or deflate either dataset when used for emissions accounting.

Third**,** the spend–emission conversion factor is derived from corporate emissions data provided by two major European arms manufacturers (Thales and Airbus). These firms may not be representative of all defence contractors, particularly non-EU suppliers or heavy land-based platforms, potentially skewing emission intensity estimates.

Fourth**,** the analysis excludes emissions related to active combat, military construction, large-scale training operations, and foreign deployments, activities that can carry significant but highly variable climate impacts. This results in a conservative estimate focused on institutional and procurement-related emissions.

Finally**,** all expenditure data were adjusted to constant 2015 prices using GDP deflators and exchange rate corrections to ensure comparability. While necessary for accuracy, these adjustments depend on macroeconomic indicators that may not fully capture sector-specific inflation or purchasing power fluctuations within the defence sector.

Despite these constraints, the findings presented in Chapter 5 provide a strong empirical basis for further research and policy interventions aimed at addressing the military emissions gap in EU climate governance.

5. Results

5.1. Military Emissions Reporting

To be able to answer this research' first sub-question; *To what extent is there a military emissions reporting gap amongst EU-NATO Member States?* this section reveals the results of the data-analysis on the reported military emissions under the UNFCCC.

The table below reflects the latest inventory year of 2021 for which data has been submitted in 2023 (due to the time-sensitive nature of calculating and reporting emissions there is a two-year time lag in reporting). Since some MS have not yet filed their 2024 NIR reflecting 2022 emissions and the UNFCCC data by party portal only provides data on the 2023 reports, this table reflects the inventory year of 2021. For the year 2021, EU-NATO Member States collectively reported a total of 6.9 $MtCO_2e$ under category 1.A.5. Furthermore, no reported data on 1.A.3.d.i emissions from international military waterborne navigation was found.

Table 1

Reported EU-NATO Military Emissions for 2021 (KtCO$_2$e)

	Reported Military emissions in NIRs under IPCC 2019 guidelines, 1.A.5 other (Not specified elsewhere) KtCO$_2$e, 2021	**1.A.3.d.i**
Belgium	Total: 105.5 - 1.A.5.a- 105.5. 1.A.5.b - Not Reported	Not reported
Bulgaria	Total: 0.93 - 1.A.5.a- Not Reported. 1.A.5.b - 0.93	Not reported
Croatia	Not reported	Not reported
Czechia	Total: 318.83 - 1.A.5.a- Not Reported. 1.A.5.b - 318.83	Not reported
Denmark	Total: 226.02 - 1.A.5.a- Not Reported. 1.A.5.b - 226.02	Not reported
Estonia	Not reported	Not reported
Finland	Total: 799.25 - 1.A.5.a- 799.25. 1.A.5.b - Not Reported	Not reported
France	Total: 2,144.81 - 1.A.5.a- 2,144.81. 1.A.5.b - Not reported.	Not reported
Germany	Total: 986.27 - 1.A.5.a- 466.94, 1.A.5.b - 519.34.	Not reported
Greece	Total: 35.94 - 1.A.5.a- Not reported. 1.A.5.b - 35.94	Not reported
Hungary	Total: 106.12 - 1.A.5.a- 49.03, 1.A.5.b - 57.09	Not reported
Italy	Total: 307.07 - 1.A.5.a- Not reported. 1.A.5.b - 307.07	Not reported
Latvia	Total: 24.13 - 1.A.5.a- Not reported. 1.A.5.b.- 24,13	Not reported
Lithuania	Total: 27.37 - 1.A.5.a- Not reported. 1.A.5.b - 27.37	Not reported
Luxembourg	Total: 0.11 - 1.A.5.a- Not reported. 1.A.5.b - 0.11	Not reported
Netherlands	Total: 167.27 - 1.A.5.a- Not reported. 1.A.5.b - 167.27	Not reported
Poland	Total: Not reported	Not reported
Portugal	Total: 73.46 - 1.A.5.a- Not reported. 1.A.5.b - 73.46	Not reported
Romania	Total: 1103.15 - 1.A.5.a- 1103.15. 1.A.5.b - Not reported	Not reported
Slovakia	Total: 64.06 - 1.A.5.a- 52.87. 1.A.5.b - 11.19	Not reported
Slovenia	Total: 4.59 - 1.A.5.a- Not reported. 1.A.5.b - 4.59	Not reported
Spain	Total: 400.19 - 1.A.5.a- Not reported. 1.A.5.b - 400.19	Not reported
Sweden	Total: Not reported.	Not reported
Total EU-NATO	6895.07 KtCo2e	

Note: Data from UNFCCC National inventory reports, 2023

5.2. Estimates of real Military Emissions

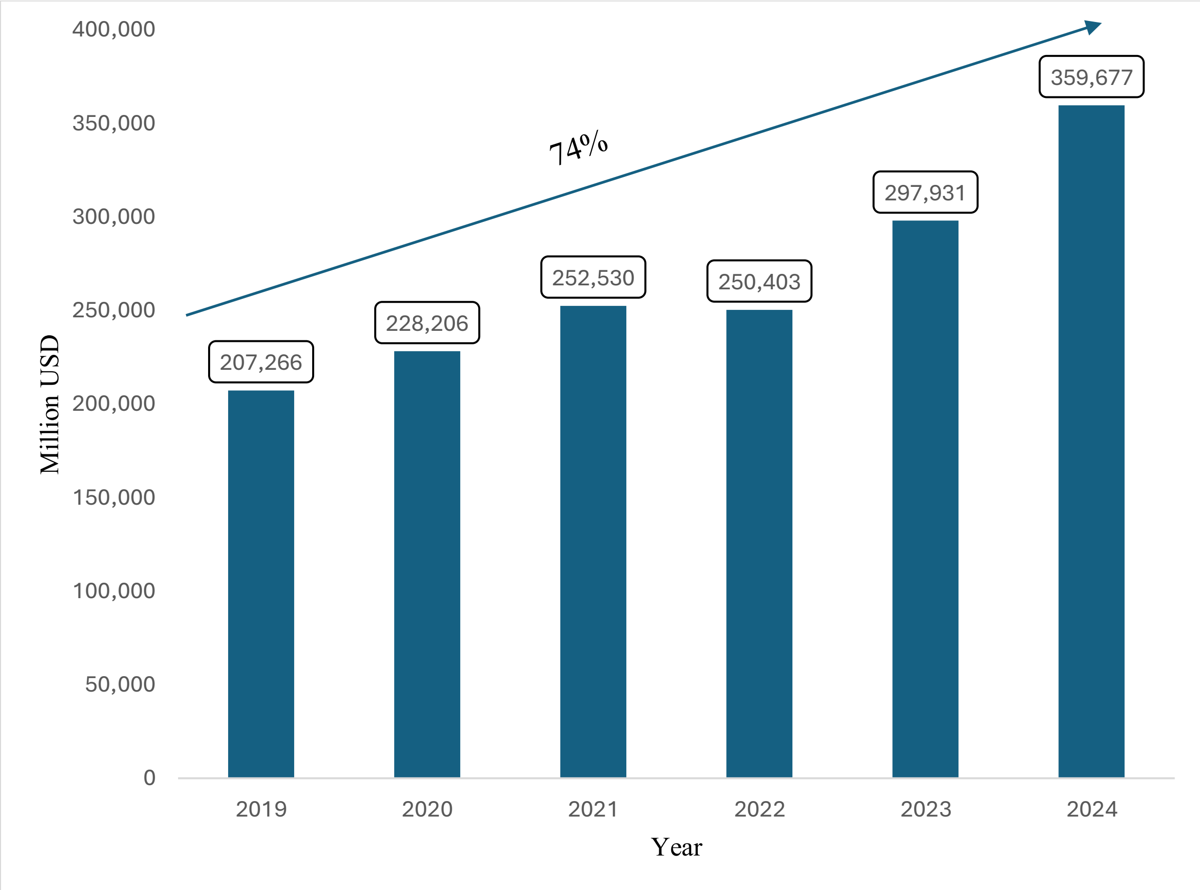
5.2.1. EU-NATO Defence Expenditure 2019-2024

From a data-analysis of the NATO defence expenditure dataset[6], it can be concluded that EU-NATO MS' increase in military expenditure, at current prices and exchange rates, amounted to 74%.

[6] Note: *Defence expenditure*; 'Payments made by a national government (excluding regional, local and municipal authorities) specifically to meet the needs of its armed forces, those of Allies or of the Alliance'

Figure 1

Increase EU-NATO defence expenditure 2019-2024 (current prices and exchange rates)[7]

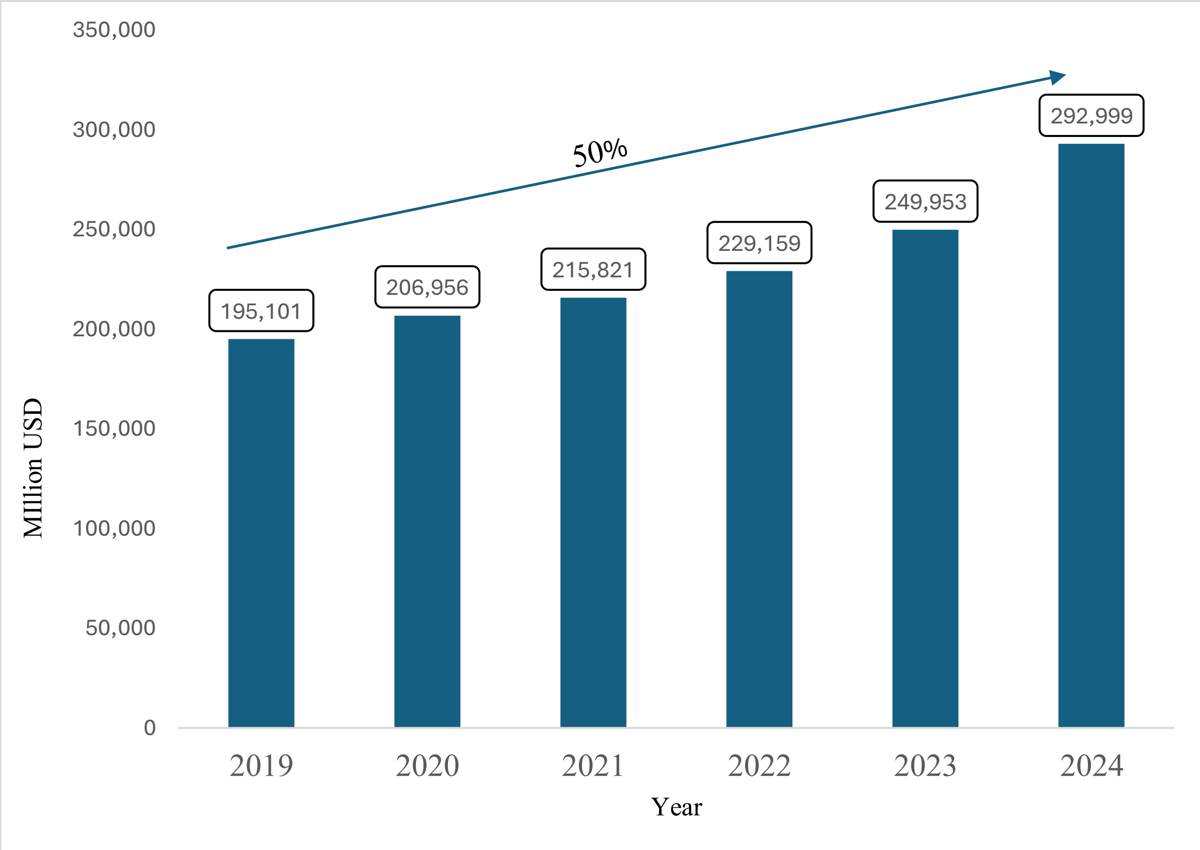


When adjusted for inflation, based on 2015 prices and exchange rates, the real military expenditure increases from 2019 to 2024 is 50% (figure 2).

[7] Figures for 2023 and 2024 are NATO estimates.

Figure 2

Real increase EU-NATO Defence Expenditure 2019-2024



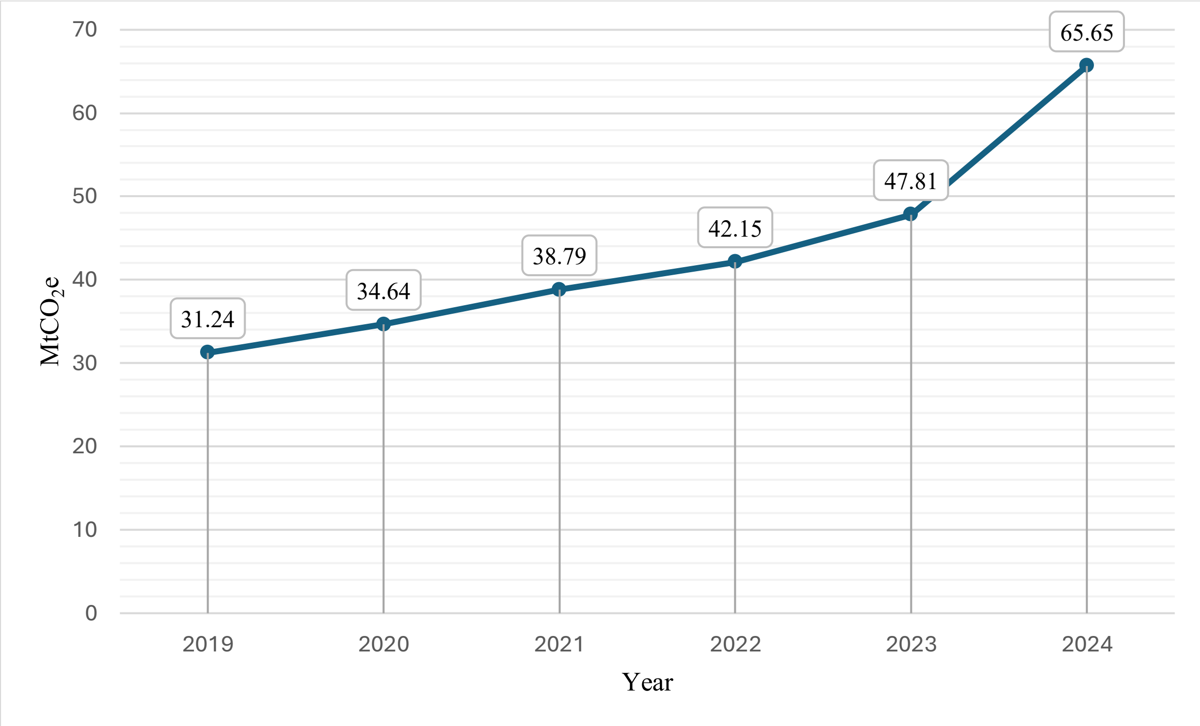
Note: figures are based on 2015 prices and exchange rates

5.2.2 Total EU-NATO Military emissions 2019-2024

When applying the TNI methodology to the NATO Defence expenditure dataset, adjusting for 2015 prices and exchange rates, this paper finds that the total military emissions of the twenty-three EU-NATO Member States for 2019 were 31.24 $MtCO_2e$. This number has increased in 2024 to 65.65 $MtCO_2e$, an increase in military emissions of 110% from 2019-2024 (Figure 3).

Figure 3

Total EU-NATO Military Emissions 2019-2024

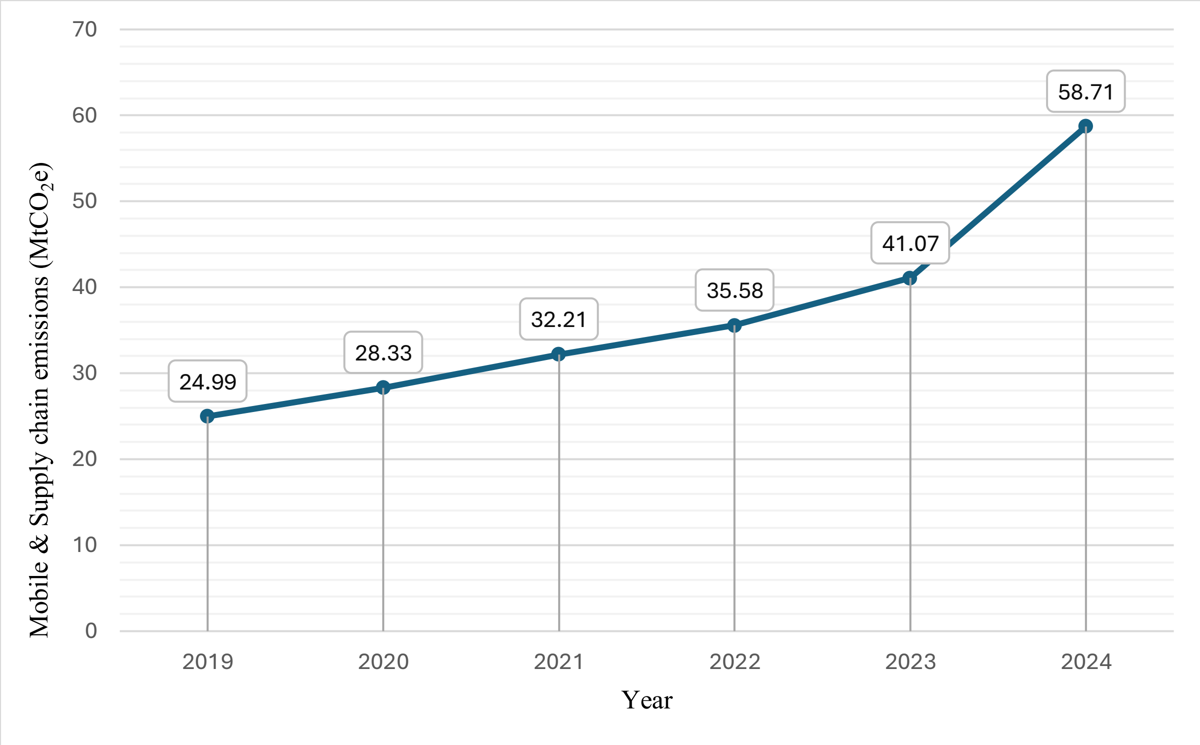


5.2.3. Total mobile and supply-chain emissions 2019-2024

In particular, spending on equipment has increased more than other areas of defence, reaching an average proportion of 32.3% of total defence expenditure per EU-NATO MS in 2024 compared to 23.3% in 2019. This has resulted in an overall increase of scope 1 and 3 (mobile- and supply-chain) emissions by an estimated 135% from 2019 to 2024 (see figure 4).

Figure 4

Total EU-NATO Mobile and Supply-chain emissions 2019-2024

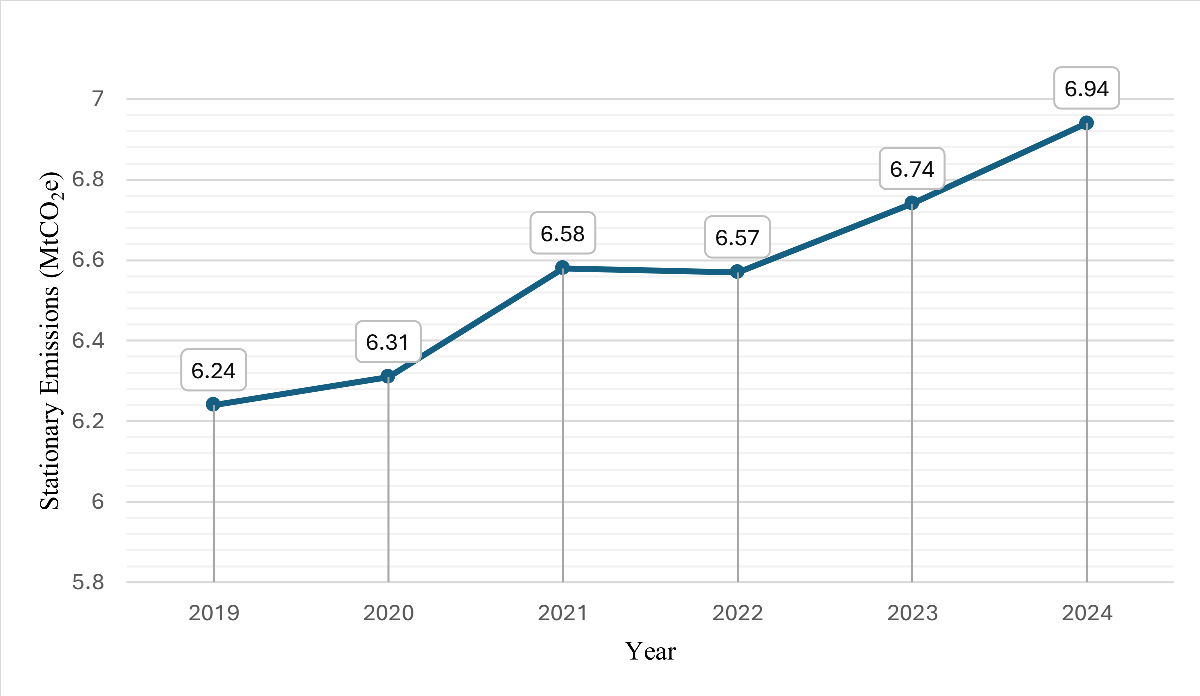


5.2.4. Total Stationary emissions 2019-2024

In contrast, stationary emissions have increased with 11% between 2019 and 2024. This indicates that Scope 1 and Scope 2 emissions from energy use in military bases and military buildings have remained comparatively limited, in contrast to the significant expansion in mobile- and supply-chain emissions (see Figure 5).

Figure 5

Total EU-NATO Stationary Emissions 2019-2024

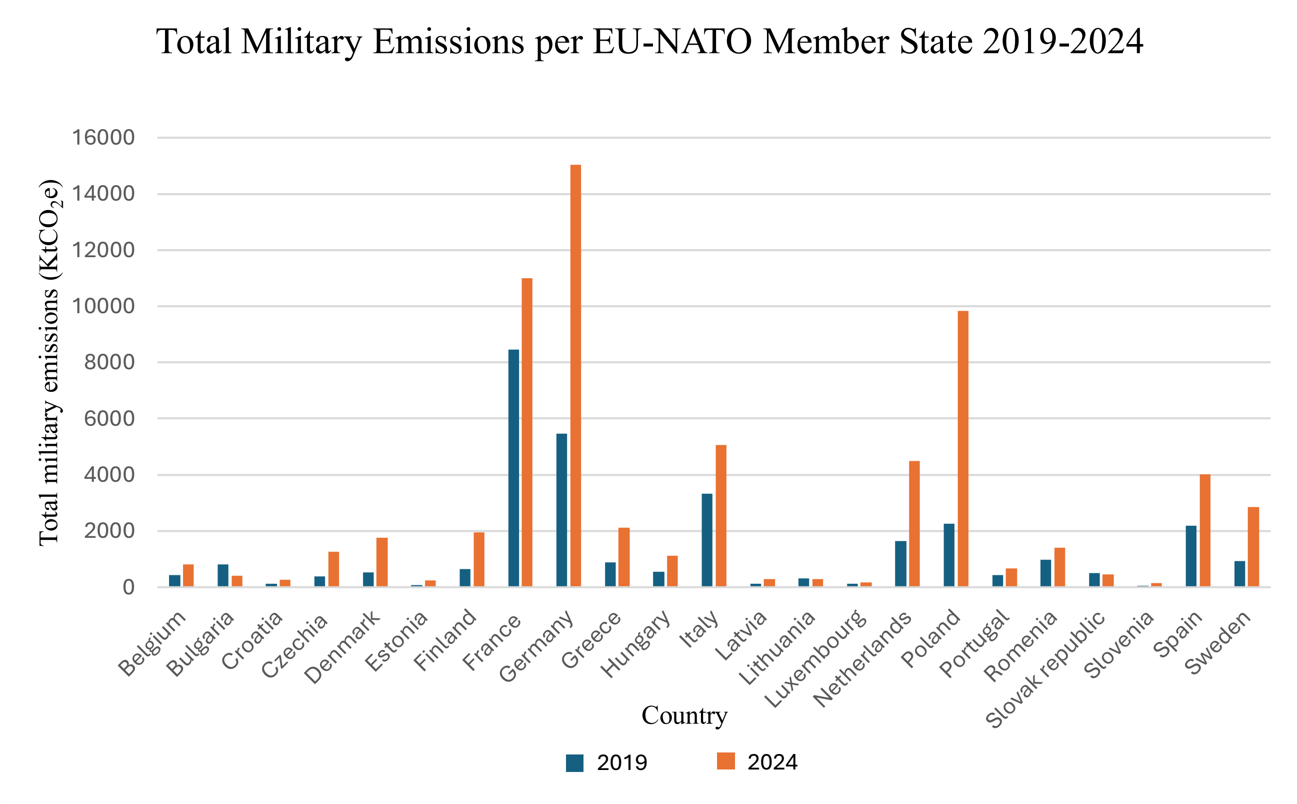


5.2.5. Total increase in military emissions 2019-2024 per EU-NATO Member State.

The military emissions increase per EU-NATO MS varies. Countries that have the largest increase in military emissions for 2019-2024 include Germany, Poland, France and the Netherlands (see figure 6).

Figure 6

Total Military Emissions increase per EU-NATO Member State 2019-2024



Note: for a full break-down of military emissions per state, see Appendix D.

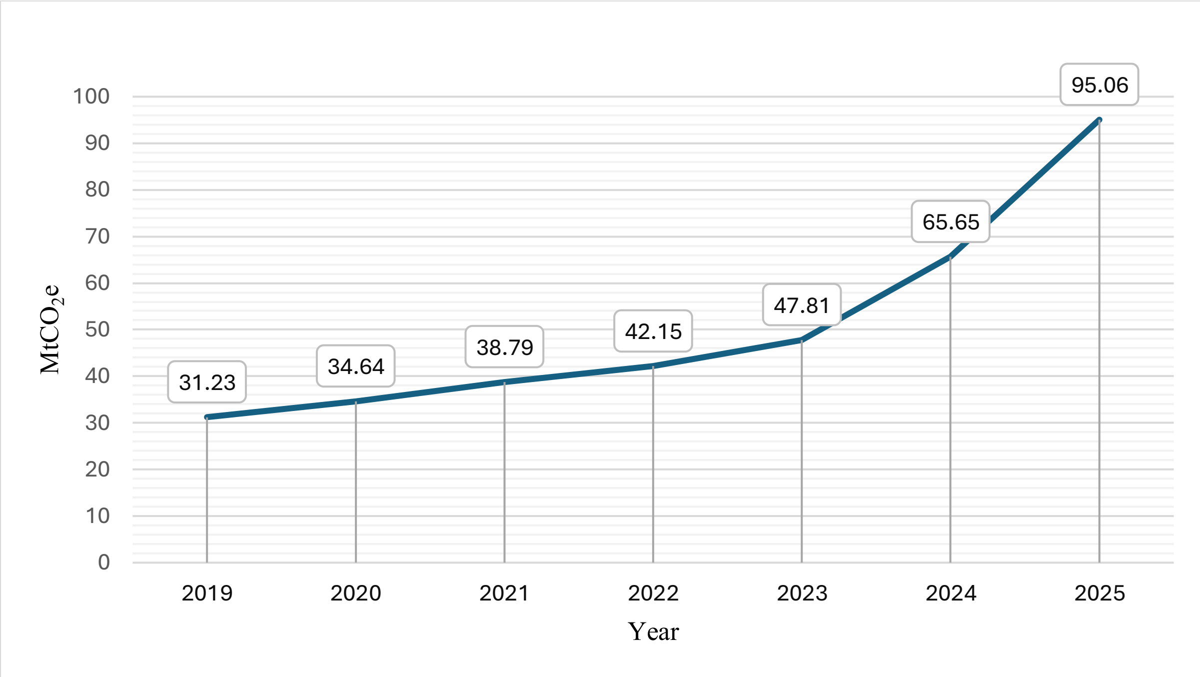
5.3. Projections military emissions under ReArm Europe 2025

5.3.1. Total EU-NATO military emissions ReArm Europe

For 2024, total EU-NATO Member States expenditure amounted to approximately 360 billion USD, resulting in an estimated 65.65 $MtCO_2e$ in emissions. Based on this papers' calculations, the projected implementation of the ReArm Europe plan is expected to increase military emissions by at least 44% compared to 2024 levels, and 252% relative to 2019 (see figure 7).

Figure 7

Estimated total EU-NATO Military Emissions under ReArm Europe

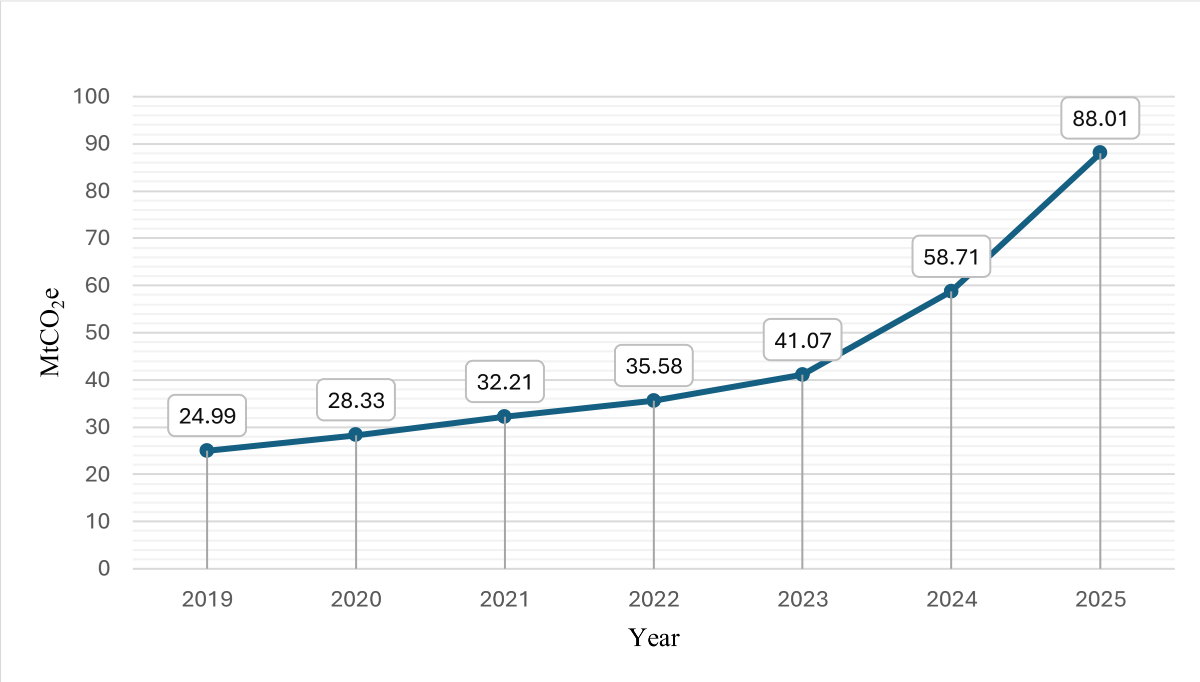


5.3.2. Total EU-NATO Mobile and Supply chain emissions ReArm Europe

The proportion spent on equipment is likely to increase, however, if this proportion remains the 2024 average of 32.3%, the mobile and supply chain emissions, in case of no structural changes in the spend-emission conversion factor, would amount to a total mobile-and-supply chain emissions of 88.01 $MtCO_2e$. An increase of over 49.9%, compared with 2024 mobile and supply-chain emissions (see figure 8).

Figure 8

Total EU-NATO Mobile and Supply-chain emissions under ReArm Europe

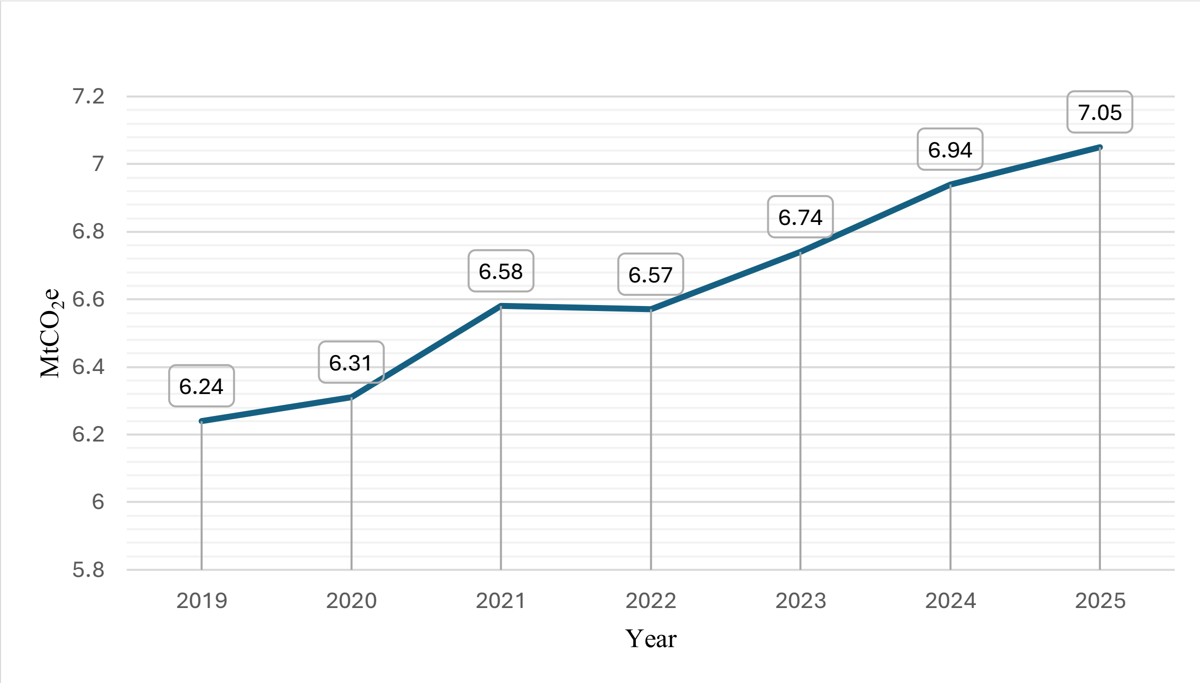


5.3.3. Total EU-NATO Stationary Emissions under ReArm Europe

The stationary emissions, on the other hand, will not increase drastically, since this calculation assumes the average military personnel increase of 2019-2024. As mentioned however, these figures are somewhat conservative, since there are strong indications that military personnel will increase more (see figure 9).

Figure 9

Total EU-NATO Stationary Emissions under ReArm Europe



Note: this figure takes the average increase of military personnel from 2019-2024 of 2%.

In summary, the results presented in this chapter reveal the limited reporting of military emissions by EU and NATO countries. Emissions estimates for ReArm Europe further underscore the substantial climate impact of anticipated defence expansions. These findings raise critical questions not only about the scale of military emissions, but also about the institutional, procedural, and political factors shaping their visibility.

6. Analysis

This chapter analyses both the emissions data and relevant literature to answer, to what extent there is a military emissions reporting gap, why this is the case and what implications it will have for the EU Green Deal. It starts with a comparison of military emissions with other industries, highlighting their significance within the broader context of global GHG emissions. Furthermore, the chapter proceeds with answering sub question one by quantifying the gap between reported and estimated military EU-NATO emissions. After doing so, it proceeds to answer sub question two, exploring the political and institutional factors contributing to this reporting gap, drawing on theories mentioned in the literature review. Finally, the chapter evaluates the implications of this emissions gap for achieving the EU's net-zero target. This analysis shows that military emissions significantly threaten the achievement of the EU Green Deal, as reduction targets are based on incomplete data. Therefore, to ensure long-term planetary security, this paper urges the EU to create mandatory reporting obligations for military emissions.

6.1. Contextualizing Military Emissions

As shown in the results, there is a stark increase in EU-NATO military expenditure between 2019-2024 of 77%. Notably, countries including Sweden, Germany and the Netherlands have found the largest increase in their military spendings. This increase in expenditure has resulted in an increase of military emissions of over 110% and a projection of a 225% rise under ReArm Europe.

6.1.1. Military Emissions in context: volume and sectoral comparison

To put these figures into perspective, the emissions from the EU-NATO military sector under ReArm Europe 2025 are equivalent to the emissions produced by over 59.6 million diesel cars driving average annual distances. Given that a typical European diesel car emits about 1.6 tCO_2e annually (ACEA, 2022; European Environment Agency, 2020).

Comparisons with the aviation sector further emphasize the large scale. In 2023, around 6.7 million flights departed from European airports, producing a total of 164.85 $MtCO_2e$ (Transport & Environment, 2023). In that year, military emissions already equalled approximately one third of the total European aviation emissions. In 2024, the aviation sector's emissions are expected to have declined slightly to 143 $MtCO_2e$ (Transport & Environment, 2024), while military emissions reached 65.65 $MtCO_2e$, equivalent to 46% of total EU aviation emissions.

Moreover, when emissions reach the calculated annual 95.06 $MtCO_2e$ emissions, they would equal over half of the total EU aviation sector and would exceed the total annual emissions of several medium-sized EU countries including Belgium (90,4 $MtCO_2e$), Greece (56,7 $MtCO_2e$), Portugal (41 $MtCO_2e$), Denmark (29 $MtCO_2e$) and Slovenia (13 $MtCO_2e$), and rival those of major civilian sectors like agriculture or industry in smaller states (International Energy Agency, 2025; Worldometers, 2025). This places the EU-NATO bloc amongst the top 45 global emitters if they were treated as a unified country (Worldometers, 2025).

6.2.The military emissions reporting gap

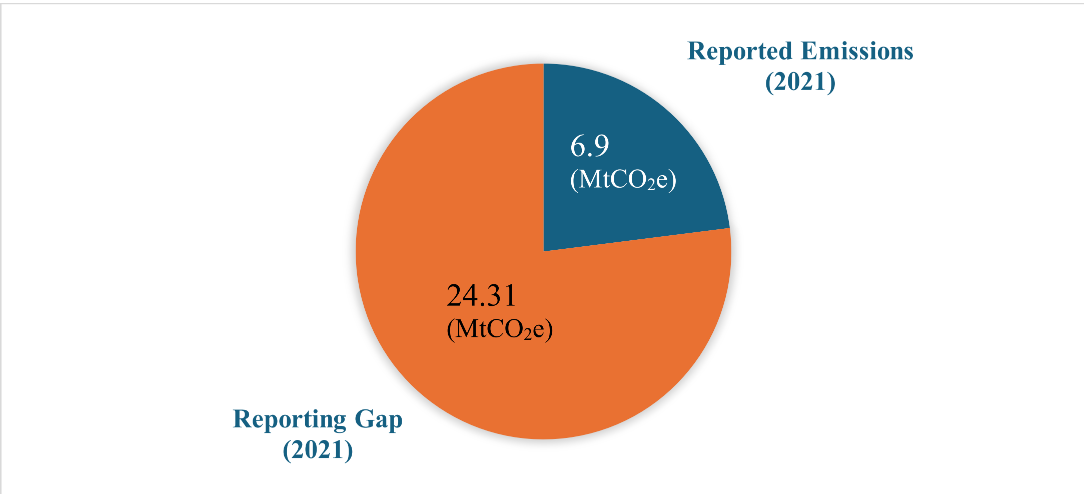
To answer this paper's first sub question*: To what extent is there a military emissions reporting gap in EU-NATO Member States National Inventory Reports?* This section will compare Table 1 (EU-NATO reported military emissions), with this paper's estimated real military emissions.

6.2.1. Comparison of reported versus actual emissions

As can be seen in Table 1, the 23 EU-NATO MS reported a total of 6.90 $MtCO_2e$ in the 1.A.5, Other not-specified elsewhere, category for 2021. Furthermore, this paper did not find any separately reported EU-NATO emissions under 1.a.3.d.i. Based on the estimated real emissions (figure 3), military emissions across these states totalled approximately 31.21 $MtCO_2e$ in 2021. This entails that more than 77% of real military emissions are missing from 1.A.5. or 1.a.3.d.i UNFCCC reporting, highlighting a substantial emission accounting gap.

Figure 10

Reported emissions as a percentage of total estimated emissions



6.2.2. Structural flaws in current reporting frameworks

As demonstrated in Table 1 and supported by the institutional review, several structural issues undermine the transparency and consistency of military emissions reporting within the EU-NATO framework. First, the voluntary nature of military emissions reporting under the UNFCCC**,** creates a significant lack of complete or disaggregated military data submissions in NIRs. Second, there is no standardized framework guiding how military emissions should be calculated or categorized, resulting in substantial variation across countries in what is reported, under which categories and how. Countries can report emissions under 1.A.5, 1.a.3.d.i, or include them in entirely different categories such as general energy use or transport. Even within the 'required' reporting categories, 1.A.5.a and 1.A.5.b. data can include both military and non-military sources of emissions, making it impossible to fully isolate and attribute reported figures specifically to military activities.

Third, the categories currently used for military emissions reporting, 1.A.5 and 1.A.3.d.i. only focus on scope 1, direct emissions from fuel combustion. However, this excludes indirect emissions such as Scope 2 (from purchased electricity) and Scope 3 (from supply chains, equipment manufacturing, and upstream fuel production), which represents a significant share of the military's overall climate impact.[8]

This fragmented approach means that military emissions fall into a regulatory grey zone, shaped by each Member State's discretion. For example, some countries, such as Croatia, Estonia, Poland, and Sweden, report no emissions at all under the military subcategories, despite maintaining active defence sectors. Others, including Italy and the Netherlands, submit partial figures without clarity on coverage or methodology. Only a few Member States, such as France, Germany, and Romania, provide relatively complete submissions under both 1.A.5.a and 1.A.5.b. Germany, for example does use the 1.a.5.b.i and 1.a.5.b.i.i. categories in its NIR to specifically report on military emissions. However, those from France and Romania cannot be reliably assumed to reflect actual military activity, as they may include emissions from police forces, emergency services, or other civilian agencies.

In sum, this UNFCCC reporting analysis illustrates how military emissions remain systematically under-accounted for across international climate agreements and regional

[8] It is important to note that official inventories generally emit scope 3 emissions entirely, while this broader accounting approach is justified for assessing the full footprint of military activity, it may partially explain the size of the estimated gap (77%).

frameworks. The current reporting system lacks the precision, clarity, and obligation necessary to ensure full and transparent disclosure of military emissions. The combination of optional disaggregation, varying interpretations of reporting categories, and the inclusion of non-military activities in reporting categories means that official NIR fall far short of reflecting actual military climate impacts. While sectors such as energy, industry, transport, and agriculture are governed by binding EU-level targets and regulations, defence remains exempt. As such, the exclusion of mandatory military emission reporting from climate governance continues to represent a structural blind spot in efforts to achieve climate neutrality, particularly within the EU context.

6.3. Institutional and political drivers of the military emissions reporting gap

To answer sub question two: *How do institutional structures and political dynamics contribute to this reporting gap?* this section will explain *why* military emissions are exempt from international reporting obligations. The main argument made here is that the omission of military emissions is not simply a technical oversight. Rather, it is a structural feature of the human tendency to prioritize immediate short-term security over long-term security. The framing of the military as an exceptional industry which should be exempt from climate governance frameworks, stemming from Kyoto negotiations, has created a structural neglect for its contributions to long-term security threats of climate change. This creates a durable accountability gap, one in which military emissions remain underreported, underregulated, and underdiscussed, despite their growing contribution to the EU-NATO carbon footprint amidst changing geopolitical threats.

6.3.1 Historical omission, institution inertia and technical difficulties.

Military emissions have been structurally excluded from climate governance from the outset. Under the Kyoto Protocol, military emissions from international operations were explicitly exempt from reduction targets and national totals, justified on national security grounds. Although the Paris Agreement technically removed this exemption, it failed to introduce a binding alternative, nor did the EU mandate additional reporting obligations for military emissions.

As Pierson (2000) argues, once institutional arrangements are established, they exhibit strong path dependency: early policy decisions structure subsequent choices and tend to become self-reinforcing over time. In this case, the precedent set by Kyoto has shaped subsequent norms, expectations, and technical guidelines, sustaining the invisibility of military emissions within climate governance frameworks. This is what Pierson (2000) calls institutional inertia; large institutions develop self-reinforcing structures that resist adaptation, especially in complex policy domains like climate change. This inertia is compounded by the short-term political cycles that characterize both national ministries of defence and EU institutions, where leadership often changes every four to five years. In the EU, this inertia is reinforced by consensus-based decision-making, which slows progress and makes bold shifts, like mandating military emissions reporting, politically difficult to achieve.

For example, in 2022, some institutional momentum emerged, the EU adopted the *Climate Change and Defence Roadmap*, which includes provisions for improved data collection and in 2023, the European Parliament even passed a resolution urging transparent military emissions accounting (Kinney, 2023). Yet despite these signals, no binding obligations have been implemented. This exemplifies how within the EU it is extremely difficult to change the status quo, particularly now times of geopolitical unrest. In short, institutional inertia inhibits adaptation, even in the face of clear evidence that military emissions constitute a significant and growing share of global GHG outputs (Wilson, et al., 2024).

6.3.2. The Giddens' paradox: priorities of short-termism over long termism

This institutional inertia, reinforced by short-term political cycles, contributes to the prioritization of immediate, visible threats over long-term, abstract risks. As Giddens (2009) argues, climate threats are often perceived as distant and abstract, making them less politically actionable than conventional security challenges. This dynamic helps explain why militarized responses gain traction while climate policies struggle for attention. As a result, military emissions remain excluded from climate governance, reinforcing a structural misalignment between short-term political imperatives and the long-term demands of climate security. A striking example of this paradox is the ReArm Europe plan. While the EU spent years negotiating and mobilizing €28.6 billion in climate finance by 2023, ReArm Europe, launched in response to immediate threats of for example Russia's invasion of Ukraine, is expected to raise 650 billion in four years (European Council, 2024). Several analysts warn that this military build-up also diverts resources away from climate finance (TNI, 2022). This stark funding imbalance reflects how immediate security threats are prioritized, while long-term climate risks require prolonged advocacy to receive even modest support.

6.3.3. The security paradox

While EU-NATO Member States expand their defence capabilities in response to short-term security threats, they simultaneously undermine the long-term stability they aim to protect. As previously discussed in Chapter 2, this creates a securitization paradox: militarization is justified in the name of security, yet it diverts attention away from and exacerbates climate change, one of the greatest threats to global and human society.

As explained in the literature review, climate change is a key driver of instability, increasing the risk of resource conflict, critical infrastructure disruption, and forced migration. Scientists project that climate-related displacement could affect over 1.2 billion people by 2050 (Institute for Economics and Peace, 2020). Moreover, climate-induced scarcity has been linked to the rise of extremist groups and regional insecurity (Middendorp, 2022). Yet rather than addressing this through emissions reduction in the defence sector, EU policy continues to hinder meaningful integration of military emissions in EU climate governance.

Together, these political dynamics create a closed loop: emissions are not reported because Member States aim to protect national security, however by doing so they inherently contribute to the security the military aims to ensure.

In sum, the omission of military emissions is not an oversight but a feature of the current climate governance architecture. It is enabled by historical policies, institutional inertia and the human tendency to prioritize immediate, short-term security over long-term sustainability. Until these barriers are addressed, the military sector will remain outside the scope of meaningful climate accountability, even as its emissions rise.

6.4. From findings to climate implications: Military Emissions and the Green Deal

The preceding chapters have explained how and why military emissions remain exempt from reporting obligations. This chapter, however, will answer this paper's research question, on the implications of these military emissions and reporting practices for the EU's ability to meet its Green Deal targets.

The European Union has legally committed to reducing net GHG emissions by at least 55% by 2030 and reaching climate neutrality by 2050. Current projections indicate that, as of 2023, the EU is generally on track to meet the required linear reduction pathway for the 2030 target. However, the EU notes that pace of reductions must accelerate: between 2023 and 2030, emissions need to decline by an average of 134 $MtCO_2e$ per year, up from 120 $MtCO_2e$ per year in the 2017–2023 period (European Commission, 2024).

Yet this trajectory is based on a key blind spot: this policy is based on incomplete data. As shown in this thesis, real military emissions are estimated at 65.65 $MtCO_2e$ for 2024, and projected to rise to 95.06 $MtCO_2e$ annually under ReArm Europe. These emissions are neither systematically reported nor accounted for under the Green Deal framework, despite representing a larger footprint than some EU Member States.

If these military emissions remain unaddressed, they will significantly alter the EU's climate equation. Based on the estimated 77% underreporting gap identified in Chapter 6.2, the effective emissions total could be understated by at least 73.2 $MtCO_2e$ annually. Including these emissions in climate accounting would raise the EU's annual reduction requirement from 134 $MtCO_2e$ to over 207 $MtCO_2e$. This would necessitate far deeper cuts in already strained civilian sectors such as transport, industry, and agriculture. Without politically challenging adjustments, this added burden risks undermining the EU's ability to meet its climate targets under the Green Deal.

6.4.1. Green Alternatives for Military Equipment and Fuel Use

As demonstrated in this thesis's emissions breakdown, the bulk of military emissions (90%) comes from the use and manufacturing of equipment, such as jet, tanks and ships, which is almost exclusively rely on fossil fuels. With long procurement cycles, complex supply chains, and limited green alternatives for equipment, decarbonisation in militaries is logistically and culturally difficult. However, there are significant steps being made for green procurement initiatives, particularly in greener fuels (biomass, renewable energy and solar fuels) (Council on strategic risk, 2024; Körts, 2022). Not only to reduce the military's carbon footprint but also to increase military resilience amidst resource scarcity (Körts, 2022). By developing more fuel-efficient military vehicles and assets that use renewable sources, the costs from overexposure to fossil fuel prices and supply volatility would reduce since it is expected that renewable energy price points will continue to be cheaper than fossil fuels (Van Schaik & Ramnath, 2022).

However, the operational use of these fuels is still in its development stage. To reach decarbonisation efforts, military emissions should first be acknowledged and transparently reported: since you cannot manage what you don't measure.

6.4.2. Technical difficulties of reporting military emissions

Since militaries operate in operational secrecy, have dispersed supply chains, complex fuel usage and mission-specific variability, there lies a complexity in reporting military emissions, one of the arguments often used by ministries of defence to exempt the military for emission reporting. However, recent developments are showing how defence contractors, and even some individual states, do find ways to report their military emission.

For instance, defence contractors Thales and Airbus are reporting their emissions, including scope 1 (direct), scope 2 (energy-related), and in some cases, scope 3 (supply chain), as part of their corporate sustainability disclosures, these figures and corporate reporting frameworks can be used by nations to address military emissions. Moreover, the UK Ministry of Defence has published detailed military emissions data since 2012, including disaggregated figures for estate, vehicle, and aviation fuel use (U.K. Government, 2024).

Additionally, efforts to standardise military GHG accounting have advanced in recent years. NATO (2023) has developed a dedicated GHG emission mapping methodology, while CEOBS (2022) has proposed comprehensive reporting frameworks tailored to the military sector. Despite the availability of standardised frameworks for military emissions reporting, their institutionalisation across EU and NATO member states remains extremely limited.

6.4.3. Policy proposal: Mandatory military emission reporting in EU climate law

To tackle this military emissions gap, therefore, the EU should step away from the idea that the military sector is a 'special case' and acknowledge how exempting the military from accountability measures will significantly hamper the net-zero target and consequently threaten our future security. Like Giddens' argues, there should be a new policy paradigm where people, including politicians, view climate accountability in defence not as a constraint on security, but as a precondition for long-term resilience and strategic autonomy. As energy supply chains become more volatile and fossil fuel infrastructure more vulnerable, the dependence of military operations on fossil energy becomes a strategic liability. Climate governance that excludes the defence sector is not only incomplete, it is strategically self-defeating.

To close the military emissions gap, the European Commission should mandate the inclusion of military GHG emissions in NIRs as part of its climate governance framework. Specifically, this obligation should be embedded within the EU Climate Law of 2021, ensuring that defence-related emissions are treated with the same transparency and accountability as other high-emitting sectors, such as energy, transport, and agriculture.

7. Conclusion

This thesis contributes to the growing field of climate-security research by reversing the dominant lens: instead of focusing solely on how climate change threatens security, it examines how militarization contributes to climate change and remains excluded from climate governance. While some existing literature has highlighted the scale of global military emissions, few studies have systematically quantified the reporting gap or assessed its implications for binding policy frameworks like the European Green Deal. This thesis provides a novel empirical analysis of military emissions in 23 EU-NATO Member States, using a modified methodology based on the Transnational Institute’s model, and applies it to estimate both actual and reported emissions. In doing so, connected a critical blind spot, military emissions, to broader institutional dynamics and climate policy targets, contributing a unique perspective to debates on environmental accountability and EU climate integrity.

This thesis reaches three core findings. First, it identifies that reported military emissions under the UNFCCC amount to only 6.9 $MtCO_2e$, whereas actual emissions in 2021 are estimated at 31.2 $MtCO_2e$, resulting in a 77% underreporting gap. This underreporting persists despite available reporting categories and emerging methodologies. Second, the thesis demonstrates that this gap is not merely a technical oversight but is embedded in institutional and political structures. It is rooted in path dependency from the Kyoto Protocol, sustained by voluntary reporting norms under the Paris Agreement, and reinforced by institutional inertia, short-term political cycles, and prevailing notions of national security exceptionalism. Third, it finds that these hidden emissions significantly affect the EU’s climate targets. Under the ReArm Europe initiative, emissions are projected to rise to 95.06 $MtCO_2e$ annually, equivalent to half the total emissions of the EU aviation sector, raising the EU’s annual reduction targets from 134 $MtCO_2e$ to over 207 $MtCO_2e$. This severely challenges the feasibility of the Green Deal’s pathway to achieve net-zero by 2050.

The implications of these findings are both urgent and far-reaching. Climate policy that excludes military emissions is structurally incomplete. The failure to integrate defence-related emissions into EU and UNFCCC frameworks undermines transparency, misrepresents national totals, and ultimately weakens global and regional efforts to mitigate climate change. As militarization accelerates in response to geopolitical threats, its climate impact is poised to grow, potentially at odds with long-term planetary security. This is not merely an environmental problem but also a strategic one. As global energy systems become more volatile and fossil fuel supply chains more vulnerable, continued ignorance of decarbonisation in militaries and reliance on carbon-intensive systems poses a risk to operational readiness and military autonomy.

Therefore, this thesis recommends a key policy shift. The EU should create mandatory reporting requirements for military emissions under its climate law, aligning defence transparency with other sectors. Doing so would not only reduce emissions but enhance operational resilience and strategic autonomy in a world of rising energy insecurity.

In sum, if the EU is to meet its climate goals and uphold its claim to climate leadership, it must stop treating the military as an exception. Climate governance must reflect the full scope of emissions, because what is not measured, cannot be managed.

8. References

ACEA (2022). *Report Vehicles on European Roads*. https://www.acea.auto/files/ACEA-Report-Vehicles-on-European-roads-.pdf

AMECO (2025). *AMECO Database*. Macro-economic database of the European Commission's Directorate General for Economic and Financial Affairs. https://economy-finance.ec.europa.eu/economic-research-and-databases/economic-databases/ameco-database_en#forecasts.

Bassetti, F. (2022). *Success or failure? The Kyoto Protocol's troubled legacy.* Foresight, the CMCC observatory on climate policies and futures. https://www.climateforesight.eu/articles/success-or-failure-the-kyoto-protocols-troubled-legacy/

Belcher, O., Bigger, P., Neimark, B., & Kennelly, C. (2020). The hidden carbon costs of the "everywhere war": Logistics, geopolitical ecology, and the carbon boot-print of the US military. *Transactions of the Institute of British Geographers*, 45(1)*,* 65–80. https://doi.org/10.1111/tran.12319

Burilkov, A. & Wolff, G. (2025). *Defending Europe without the US: first estimates of what is needed.* Bruegel. https://www.bruegel.org/analysis/defending-europe-without-us-first-estimates-what-needed

Conflict and Environment Observatory (2022). *A framework for military greenhouse gas emissions reporting*. [Report]. https://ceobs.org/report-a-framework-for-military-greenhouse-gas-emissions-reporting/

Conflict and Environment Observatory (2023a). *Military emissions gap: addressing the blind spot in national climate strategies*. [Report]. https://ceobs.org/projects/military-emissions/

Conflict and Environment Observatory (2023b). *EU military greening policies: A review of transparency and implementation.* [Report]. https://ceobs.org/report-eu-military-greening-policies-a-review-of-transparency-and-implementation/

Council on Strategic Risk (2024). *World Climate and Security Report 2024.* Expert Group of the International Military Council on Climate and Security. https://councilonstrategicrisks.org/2024/07/10/world-climate-and-security-report-2024/

Cottarelli, C., & Virgadamo, L. (2024). *Defence expenditure in EU countries*. (Policy

Brief). Osservatorio Conti Pubblici Italiani (OCPI), Università Cattolica del Sacro Cuore. https://osservatoriocpi.unicatt.it/ocpi-Defence%20expenditure%20in%20EU%20countries.pdf

Crawford, N. C. (2019). *Pentagon fuel use, climate change, and the costs of war*. Costs of War Project, Brown University. https://watson.brown.edu/costsofwar/files/cow/imce/papers/2021/Pentagon%20Fuel%20Use%20and%20Climate%20Change%20-%20Neta%20Crawford%20-%20November%202019%20final.pdf

Dalby, S. (2022). Anthropocene geopolitics: Globalization, security, sustainability. *University of Ottawa Pre*ss. https://doi.org/10.2307/j.ctvx5w8dk

De Klerk, L., Krakovska, S., Kryshtop, L., Myroniuk, V., Shlapak, M., Soshenskyi, O., Zibstev, S. (2025). *Climate damage caused by Russia's war in Ukraine*. Preliminary assessment. Ecoaction. https://en.ecoaction.org.ua/wp-content/uploads/2025/02/20250224_ClimateDamageWarUkraine36monthsENprelim-1.pdf

Deudney, D. (1990). The case against linking environmental degradation and national security. *Millennium: Journal of International Studies, 19*(3), 461–476. https://doi.org/10.1177/03058298900190031001

European Environment Agency (2023). EMEP/EEA air pollutant emission inventory guidebook 2023. https://www.eea.europa.eu/en/analysis/publications/emep-eea-guidebook-2023

European Central Bank (2025). Euro-US dollar exchange rate data. https://www.ecb.europa.eu/stats/policy_and_exchange_rates/euro_reference_exchange_rates/html/eurofxref-graph-usd.nl.html

European Central Bank (2025). *Macroeconomic projections*. Overview. https://www.ecb.europa.eu/press/projections/html/ecb.projections202503_ecbstaff~106050a4fa.en.html

European Commission (2025a). *European Economic Forecast: Winter 2024.* https://economy-finance.ec.europa.eu/economic-forecast-and-surveys/economic-forecasts/winter-2024-economic-forecast-delayed-rebound-growth-amid-faster-easing-inflation_en#documents

European Commission (2025b). *Commission unveils the White Paper for European Defence and the ReArm Europe Plan/Readiness 2030*. https://ec.europa.eu/commission/presscorner/detail/en/ip_25_793

European Commission (2025c). *Climate Action and the European Green Deal.* https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal/climate-action-and-green-deal_en

European Council (2024, November 5). *Council publishes 2023 international climate finance figures*. https://www.consilium.europa.eu/en/press/press-releases/2024/11/05/council-publishes-2023-international-climate-finance

European Defence Agency (2024). *EDA Defence data 2019-2023*. Accessed from: https://eda.europa.eu/publications-and-data/defence-data

European Environment Agency (2020). Average CO2 emissions from new cars and new vans increased again in 2019. https://www.eea.europa.eu/highlights/average-co2-emissions-from-new-cars-vans-2019

Eurostat (2025). Data browser. Air emissions accounts for greenhouse gases by NACE Rev. 2 activity - quarterly data. https://ec.europa.eu/eurostat/databrowser/view/ENV_AC_AIGG_Q__custom_16289243/default/table?lang=en

Floyd, R. (2008). The environmental security debate and its significance for climate change. *The International Spectator, 43*(3), 51–65. https://doi.org/10.1080/03932720802280565

Genini, D. (2025) How the war in Ukraine has transformed the EU's Common Foreign and Security Policy, *Yearbook of European Law*, yeaf003, https://doi.org/10.1093/yel/yeaf003

Giddens, A. (2009). *The politics of climate change*. Polity Press.

Hendrix, C. S. (2025). Trump's Five Percent Doctrine and NATO defense Spending. *Pieterson Institute for International Economics*. https://www.piie.com/blogs/realtime-economics/2025/trumps-five-percent-doctrine-and-nato-defense-spending

Homer-Dixon, T. (1994). Environmental scarcities and violent conflict: Evidence from cases. *International Security, 19*(1), 5–40. https://doi.org/10.2307/2539147

International Energy Agency (2025). Summit of the Future of Energy Security. Countries and regions data. https://www.iea.org/countries

Institute for Economics and Peace (2020). *Over one billion people at threat of being displaced by 2050 due to environmental change, conflict and civil unrest.* Press Release. https://www.economicsandpeace.org/wp-content/uploads/2020/09/Ecological-Threat-Register-Press-Release-27.08-FINAL.pdf

International Military Council on Climate and Security (2022). *Decarbonized defense: The* *need for clean military power in the age of climate change*. IMCCS Expert Group. https://imccs.org/wp-content/uploads/2022/06/Decarbonized-Defense-World-Climate-and-Security-Report-2022-Vol.-I.pdf

IPCC (2019). Chapter 8. Reporting Guidance and Tables. *2019 Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories*. https://www.ipcc-nggip.iges.or.jp/public/2019rf/pdf/1_Volume1/19R_V1_Ch08_Reporting_Guidance.pdf

International Institute for Sustainable Development (2025). UN Framework Convention on Climate Change, UNFCCC. IISD Earth Negotiations Bulletin. https://enb.iisd.org/negotiations/un-framework-convention-climate-change-unfccc

Jordan, A., & Matt, E. (2014). Designing policies that intentionally stick: Policy feedback in a changing climate. *Policy Sciences, 47*(3), 227–247. https://doi.org/10.1007/s11077-014-9201-2

Jun, P., Gillenwater, M. and Barbour, W. (2024). CO_2, CH4, and N2o emissions from transportation-water-borne navigation. Good practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories. IPCC Task Force on National Greenhouse Gas Inventories. https://www.ipcc-nggip.iges.or.jp/public/gp/bgp/2_4_Water-borne_Navigation.pdf

Kayali, L., Barigazzi, J., Detsch, J. & Posaner, J. (2025). *Trump's uphill battle to make NATO allies hit his mega defense spending target*. POLITICO. https://www.politico.eu/article/donald-trump-nato-allies-defense-spending/

Kinney, E. (2023). *European Parliament calls for closure of military emissions gap.* CEOBS Blog. https://ceobs.org/european-parliament-calls-for-closure-of-military-emissions-gap/?utm_source=chatgpt.com

Klare, M. (2007). Global Warming Battlefields: How Climate Change Threatens Security. Current History (2007) 106 (703): 355-361. https://doi.org/10.1525/curh.2007.106.703.355

Körts, M. (2022). *Climate Change Mitigation in the Armed Forces – greenhouse gas emission reduction challenges and opportunities for Green Defense*. NATO OTAN COE. https://www.enseccoe.org/wp-content/uploads/2023/12/Climate-change-mitigation-in-the-Armed-Forces.pdf

Lin, H., Buxton, N., Akkerman, M., Burton, D., & De Vries, W. (2023). Climate crossfire. How NATO's 2% military spending targets contribute to climate breakdown. Transnational Institute, Stop Wapenhandel, Tipping Point North South.

https://centredelas.org/wp-content/uploads/2023/10/Informe_NATOsClimateCrossfire_TNI_StopWapenhandel_TippingPoint_CentreDelas_ENG.pdf

Mach, K. J., Kraan, C. M., Adger, W. N., Buhaug, H., Burke, M., Fearon, J. D., ... & von Uexkull, N. (2019). Climate as a risk factor for armed conflict. *Nature, 571*(7764), 193–197. https://doi.org/10.1038/s41586-019-1300-6

McFarlane, S. & Volcovici, V. (2023*). Insight: World's war on greenhouse gas emissions has a military blind spot.* Reuters. https://www.reuters.com/business/environment/worlds-war-greenhouse-gas-emissions-has-military-blind-spot-2023-07-10/

Michaelowa, A., Koch, T., Charro, D., & Gameros, C. (2022). Military and conflict-related emissions: Kyoto to Glasgow and Beyond. *Perspectives Climate Group*. https://doi.org/10.5167/uzh-230045

Middendorp, T. (2022). Klimaatgeneraal*, Bouwen aan weerbaarheid*. Book.

Müller, R. (2025, March 21). *Dutch Army must be much larger: defence wants to grow to 200.000 employees.* NOS. https://nos.nl/artikel/2560532-nederlands-leger-moet-veel-groter-defensie-wil-groeien-naar-200-000-medewerkers

NATO (2024a). *Defence expenditure dataset of NATO countries 2014-2024.* https://www.nato.int/cps/en/natohq/topics_49198.htm

NATO (2024b). *Defence expenditures and NATO's 2% guideline.* https://www.nato.int/cps/en/natohq/topics_49198.htm

NATO (2023). *The NATO Greenhouse Gases Emission Mapping and Analytical Methodology*. https://www.nato.int/nato_static_fl2014/assets/pdf/2023/7/pdf/230710-NATO-GHG-Methodology.pdf

Newell, P., & Paterson, M. (2010). *Climate capitalism: Global warming and the transformation of the global economy*. Cambridge University Press. 2010:1-10.

Parkinson, S., & Cottrell, L. (2021). *Under the radar: The carbon footprint of Europe's military sectors*. Conflict and Environment Observatory & Scientists for Global Responsibility. https://ceobs.org/under-the-radar-the-carbon-footprint-of-europes-military-sectors/

Parkinson, S., & Cottrell, L. (2022). Estimating the Military's Global Greenhouse Gas Emissions. Scientists for Global Responsibility & Conflict and Environment Observatory. https://ceobs.org/wp-content/uploads/2022/11/SGR-CEOBS_Estimating_Global_MIlitary_GHG_Emissions.pdf

Pierson, P. (2000). Increasing returns, path dependence, and the study of politics. *American* *political science review*, 94(2), 251-267.

Selby, J., & Hoffmann, C. (2014). Rethinking climate change, conflict and security. *Geopolitics, 19*(4), 747–756. https://doi.org/10.1080/14650045.2014.964866

Stockholm International Peace Research Institute (2024). SIPRI Military Expenditure Database. https://doi.org/10.55163/CQGC9685.

Stevenson, H. (2021). Climate security and the politics of long-term threat. *Global Environmental Politics, 21*(3), 79–100. https://doi.org/10.1162/glep_a_00596

Tavares, D., Krausmann, E., & Hadjisavvas, C (2023). Impacts of climate change on defence-related critical energy infrastructure. *Publications Office of the European Union.* https://doi:10.2760/03454

Transnational Institute (2022). *Climate Collateral: How military spending accelerates climate breakdown*. Tipping Point South North, Stop Wapenhandel, Transnational Institute. https://www.tni.org/files/2022-11/Climate%20Collateral%20-%20ExecSumm%20-%20english.pdf

Transport & Environment (2023). *Above the clouds: European aviation emissions in 2023. Briefing.* https://www.transportenvironment.org/uploads/files/Europe_Aviation_2023_file.pdf

Transport & Environment (2024). *State of European Transport 2025: Aviation*. https://www.transportenvironment.org/state-of-european-transport/state-of-transport-2025/aviation

U.K. Government (2024, January). Climate change and defence: a Dstl biscuit book. *Defence Science and Technology Laboratory*. January 2024. https://www.gov.uk/guidance/climate/reduce-impact-of-defence-on-climate-change

UNFCCC (2025). National Inventories Annex I and Annex II parties to the UNFCCC data-Sets. https://di.unfccc.int/ghg_profile_annex1

U.S. Department of State (1997). Action message Melinda Kimble to Mark Hembly and all Nato: National Security Exemption on Climate Change (Case No. F-2010-06143 Doc No. C17528069). *National Security Archive.* https://nsarchive.gwu.edu/document/27354-document-1-cable-state-department-state-202013-us-del-mark-hambley-and-all-nato-post

Van der Meijden, M. (2025, March 31). *Defense wants exception to environmental rules to grow 'for the fatherland'*. NOS. https://nos.nl/artikel/2561838-defensie-wil-uitzondering-op-milieuregels-om-te-groeien-voor-het-vaderland

Van Schaik, L. & Ramnath, A. (2022). *A European Green Deal Policy Brief for militaries to* *strengthen Europe's Defence.* April 2022. Planetary Security Initiative and Clingendael Policy Brief. https://www.clingendael.org/sites/default/files/2022-04/PB%20A%20European%20Green%20Deal.pdf

Wilson, A., Connor, P., & Hardy, J. (2024). Fighting the past to win the future: Regulatory roulette, institutional inertia and the challenge of enabling military energy security. *Energy Research & Social Science*, 114, 103584. https://doi.org/10.1016/j.erss.2024.103584

World Bank (2025). *World Development indicators: GDP deflation factors.*https://databank.worldbank.org/reports.aspx?source=2&series=NY.GDP.DEFL.ZS&country=

Worldometers (2025). *CO2 emissions by country*. https://www.worldometers.info/co2-emissions/co2-emissions-by-country/

9. Appendices

Appendix A - Elaboration on spend-emission conversion factor

The approach used in the TNI paper to calculate military emissions uses a spend-emission conversion factor, derived from emission reports of two of the largest European Military equipment manufacturing companies, Thales and Airbus.

Both have reported their annual emissions in their corporate responsibility reports. The TNI report uses the average of both the Thales and Airbus's reported emissions, 0.000587 tCO_2e (see below).

Thales	2020	2021	2022	Average
Revenue, €mn	15,400	16,200	17,600	
Total Scope 1/2/3 emissions, including 'use of sold products and services', $KtCO_2e$	9,533	9,538	9,746	
Conversion factor, tCO_2e/€	0.000619	0.000589	0.000554	0.000587

Airbus	2021	2022	Average
Revenue (military-related), €mn	16,695	18,307	
Total Scope 1/2/3 emissions, including 'use of sold military products and services', $KtCO_2e$	9,601	10,939	
Conversion factor, tCO_2e/€	0.000575	0.000598	0.000587

(Lin et al., 2023).

This average spend-emission conversion factor is reported in euros and should therefore multiplied by the EU-USD average exchange rate of 2021 and 2022, 0.91. This results in a spend-emission conversion factor out of 0.000534 tCO_2e per dollar.

The average emissions per dollar spent on equipment are expected to not significantly change in the upcoming years since there are no signs of significant portfolio changes in equipment produced and the energy consumed within the military industry in the near future (Parkinson, personal communication, Feb 2025). Therefore, these emissions per dollar can be assumed to remain relatively stable.

Adjusted spend-emissions conversion factor for 2015 constant prices and exchange rates:

To make sure that the spend-emissions conversion factor reflects 2015 constant prices and exchange rates the average GDP deflator from the World Bank data is used. This is necessary as the current spend-emission conversion factor, 0.000534 tCO_2e/$, as calculated by the TNI, reflects the average emission per dollar spent in 2021 and 2022. Since in these calculations prices are adjusted to 2015 prices and exchange rates, this spend-emission conversion factor should in a similar fashion be adjusted.

To ensure consistency in comparing emissions data over time, the spend-emission conversion factor must be adjusted to reflect constant 2015 prices and exchange rates. The currently used factor, 0.000534 tCO_2e/USD, as calculated by the SGR, reflects nominal

2021–2022 expenditures. However, this does not align with other data in this study, which are expressed in 2015 constant prices.

Importantly, the emissions reported by these defence companies are based on actual fuel use and operational activities and therefore represent physical quantities that remain constant regardless of inflation or changes in purchasing power. It is therefore appropriate to hold total emissions constant, and only adjust the monetary component (i.e., spending) to 2015 price levels.

To make this adjustment, the original factor is corrected using the average GDP deflator for EU-NATO countries for 2021–2022, obtained from data of the World Bank. The average EU deflator for 2021-2022, with 2015 as the base year, is 119.9399 (The World Bank, 2023). This implies that a Euro in 2021–2022 had approximately 83.4% of the purchasing power it had in 2015.

Thus, the original factor of 0.000587 tCO_2e per euro is converted to 2015 constant euros as follows: $0.000587 \times 1.199399 = 0.000704$ tCO_2e/2015-euro
This value is then converted to US dollars using the average EUR-USD exchange rate for 2021–2022, 0.91 (Lin, et al., 2023).
This results in an adjusted spend-emission conversion factor of; 0.000704*0.91 =0.000638 tCO_2e/2015-USD.

This paper uses this approach to ensure consistency in application of the spend-emission conversion factor for the years 2019-2025. It ensures comparability across time, aligns with the physical nature of emissions data, and applies a consistent correction based on widely available deflator data.

Appendix B - Elaboration on average stationary emissions per head of military personnel

Similar to the spend-emission conversion factor, this paper uses the average stationary emissions per head as calculated by the SGR and CEOBS in their report 'Estimating the Military's Global Greenhouse Gas Emissions' (2022). In this report the researchers find the average stationary emissions per military personnel to be tCO_2e 5 annually. The TNI also adopts this number for their military emissions calculations in their 'Climate Crossfire' report of 2023.

In consultation with a military emissions expert, Stuart Parkinson, one of the lead authors of this report, the number 5, for average stationary emissions in tCO_2e per stationary head is expected to hold for all years 2019-2024 since there are no structural changes in military stations and its emissions.

Appendix C - Elaboration on Calculations ReArm Europe military emissions

Table 2

Average Military expenditure share of 4 non-NATO EU MS (EDA Datasets 2019-2023).

	2021	**2022**	**2023**
Total Military expenditure 27 EU Member States	€ 214,309 Mln	€ 239,750 Mln	€ 278,573 Mln
Total Military expenditure 4 non-NATO EU MS	€ 4,864 Mln	€ 5,129 Mln	€ 5,884 Mln
Proportion of defence expenditure of 4 non-NATO EU-MS	2.3%	2.1%	3.2%
Average proportion defence expenditure non-NATO MS of total EU defence	2.5%		

This table shows the average military expenditure share of the four EU MS not part of NATO (Austria, Cyprus, Ireland and Malta) of the total EU military expenditure for 2021-2023. These figures are used to calculate the total military expenditure of the 23 EU-NATO Member States.

Calculations:

The total EU-NATO Member States would be spending; Total EU-NATO defence expenditure 2025: 359 677 million USD + (650 Billion euros*0.975(minus non-NATO countries)*1.1 (EU/Dollar exchange rate))/4 = 533 958 Million USD in 2025-2029 annually.

However, the second term needs to be adjusted to 2015 prices and exchange rates. Taking an average EU GDP deflator forecast, using 2015 as a base year, of 130, as estimated by the AMECO database for 2025, this results in an annual defence expenditure of 427.062 Million US dollars (based on 2015 prices and exchange rates).

Based on the average equipment spending share of 32.3% and an average annual military personnel increase of 2%, this results in a total EU-NATO Military Emissions of:

(427.062 Million USD * 0.323* 0.000638) + (1410.8 (Military personnel in thousands) * 5) = 95.06 $MtCO_2e$.

Appendix D – Detailed breakdown military emissions per EU-NATO Member State 2019-2024

Table 3

Detailed breakdown military emissions per member state ($KtCO_2e$)

Detailed Breakdown military emissions per EU-NATO MS ($KtCO_2e$)	2019	2020	2021	2022	2023	2024
Belgium	427.1849204	534.7864521	757.0255106	899.863845	923.7996913	801.1494835
Bulgaria	808.6458003	172.2916334	192.1966135	226.4588286	349.9994744	418.3897461
Croatia	112.5209177	124.9918771	297.2495692	298.202289	244.4647206	257.8279686
Czechia	393.5613939	423.5079255	514.907396	588.6454054	570.9249526	1250.57345
Denmark	526.9121467	587.5808689	579.1855801	665.479821	674.5717388	1763.254241
Estonia	85.855953	123.3961526	119.2734908	117.2967155	125.7230893	240.3688064
Finland	654.4509551	681.7734061	608.916662	1081.896291	1607.897963	1954.832196
France	8468.132609	9195.965928	9761.123999	10628.83037	10703.56587	11008.6243
Germany	5472.849294	6735.69945	6428.459598	6920.021398	7749.846405	15039.96657
Greece	879.5974425	901.4926465	2305.895788	2760.408681	1529.252148	2117.110295
Hungary	552.4500681	819.1242793	563.496736	978.4976186	902.835565	1130.84486
Italy	3319.250301	4148.558868	5159.999613	5203.079443	5030.997177	5059.547834
Latvia	114.0452099	114.4387121	123.7271786	138.7558092	218.2574988	282.9339083
Lithuania	304.928357	289.7600021	218.5997505	378.2386518	355.4830779	297.441861
Luxembourg	120.1363806	126.4772861	88.73164974	120.8068374	195.390804	178.7617927
Netherlands	1642.246736	1807.511639	1979.565662	1416.832503	2476.259749	4482.688735
Poland	2254.217897	2913.021943	3695.815235	3791.703325	6921.155579	9834.967971
Portugal	442.7651798	441.7133344	387.8275309	443.6058303	543.6626767	659.4202369
Romenia	975.8575946	954.4250368	908.9969949	986.0074779	843.3653123	1413.679772
Slovak Republic	497.1081709	441.1311539	427.4431004	498.6833522	384.3438298	446.1675971
Slovenia	53.97984656	48.30544933	89.64782255	128.0659215	139.986193	154.5546348
Spain	2193.54796	2057.920831	2434.983634	2632.074387	3412.048832	4009.902608
Sweden	934.42437	993.5405291	1149.50143	1250.672892	1907.498078	2850.406558
TOTAL 23 MS Military emissions ($KtCO_2e$)	31234.6695	34637.4154	38792.57055	42154.12769	47811.33042	65653.41542