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Interplay between low-carbon energy transitions and national security: An analysis of policy integration and coherence in Estonia, Finland and Scotland

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ABSTRACT

Sustainable Development Goals aim for a better future, but gains are threatened by conflict and governance failures, exacerbated by climate change. While research on energy security is well-established, conceptual-analytical research on sustainability transitions has paid little attention to security threats as factors influencing transitions or security policy as part of policy mixes. This paper combines policy coherence and integration analysis of energy and security strategy documents with sustainability transitions' research, considering how landscape pressures and energy niches are presented in documents pertaining to Estonia, Finland and Scotland during 2006–2020. The findings show that security and energy policies present a functional overlap. Yet, policy integration and coherence are insufficiently addressed, conflicts created by coexisting low-carbon and hydrocarbon-based security considerations. An increasingly multifaceted landscape creates a complicated policy environment where pursuing policy coherence becomes harder. Despite the accelerating energy transition, the security implications of energy niches have received too little attention.

1. Introduction

When opening the annual General Assembly of the United Nations in 2016, Secretary-General Ban Ki-moon stated that, while the Sustainable Development Goals offer a manifesto for a better future, gains are threatened by conflict and failures of governance [1]. This is a particular challenge for sustainable energy transitions due to the significant geopolitical and economic importance of energy [2], and the emergence of "a new era in which energy security and climate change mitigation are both fundamental objectives", requiring more complex forms of policy coordination [3]. While the energy sector has been the key focus of academic research on sustainability transitions [4,5], this literature has paid scant attention to security threats as factors influencing transitions. The environmental sustainability debate often ignores security questions, although the attempts to accelerate sustainability transitions are likely to face barriers from manifestations of national security. Research on policy mixes in transitions [6] has not addressed security or defence policies. To address this research gap, we pay attention to national security and defence policy in connection to low-carbon energy transitions from the perspective of policy coherence and integration.

In this article, we analyse whether sufficient policy coherence and integration exists between security and defence policies and low-carbon energy policies. Coherence is important to overall policymaking to reduce and manage cross-domain policy conflicts and make the use of public funds more efficient. Such conflicts may, for example, hinder or reduce the effects of climate policies and, thus, stagnate the energy transition in practice. Policy coherence is of interest in different policy settings. For example, the UN Sustainable Development Goal 17 'means of implementation' includes a specific target to 'enhance policy coherence for sustainable development' and the European Union (EU) has pursued coherent policy making regarding security [7], development [8], and environment [9].

In the security context, however, pursuits towards policy coherence and integration also contain an inherent risk – a securitisation of low-carbon energy transitions. Securitisation is defined as a process where an "issue is presented as an existential threat, requiring emergency measures and justifying actions outside the normal bounds of political procedure" [10]. It can be rhetorically powerful to draw attention to

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issues, such as the environment, that may otherwise be left unprotected, but the use of the concept of security has consequences on governing that are important to notice [11].

No single definition of security exists; the concept has evolved over time. In its simplest, security has been described as "the absence of threats to acquired values" [12]. It is a derivative concept, meaning that different worldviews create dissimilar conceptions of security [11] and, thus, a diversity of meaning. Military security, the once dominating conceptualisation of national security [11], is defined as the ability of governments to maintain themselves against internal and external military threats and the use of military power [10]. However, national security is an increasingly broad concept that includes the protection of state and other actors with extensions to environmental, health and technology related threats [11]. This has given rise to further conceptualisations of economic, political, environmental and human security [10,11]. Our empirical analysis is open to multiple conceptualisations of security that emerge from the data.

Perceptions of security are often connected to geopolitics, which is a similarly nuanced concept. Classical geopolitics regards it as the influence of geographical factors (e.g. a country's size, position or resources) on international relations and the power of states [13,14]. However, critical geopolitics questions the pregiven role of geographical factors in international relations and wishes to expose how geographical assumptions are used in world politics [15], problematising existing structures of power and knowledge [16]. What is interesting from the perspective of energy policy is that geopolitical assumptions may play both explicit and hidden roles in policy decisions [14,17], even in countries that have adopted more market-based approaches to energy policy [18].

The geopolitical approach is often connected to pursuits towards energy security [19]. Energy security means low vulnerability of vital energy systems [20] referring to the absence of threats to system operations and the capabilities of states to respond to these threats [21]. This means, for example, the security of supply of the needed fuels, minerals and technical components (often dependent on international markets and trade), security of production (against technical faults or environmental disruptions), diversification of sources, harnessing of domestic energy, and stockpiles [22]. However, there is variety in how both academic literature and the EU member states express energy security, creating a fragmented policy setting and contextualised discussions of its different dimensions [23,24]. In short, energy security is a context-specific political phenomenon [25,26]. Given energy security has become a standard sub-topic of both energy and security policy, our analysis focuses on how policy goes beyond this by referring to such issues as national security, defence or cyber security in connection to energy.

We examine the interplay between national security and (low-carbon) energy policies by conducting a differentiating comparative analysis [27] of policy documents pertaining to three small European nations – Estonia (ES), Finland (FI) and Scotland (SC) - in how policy integration and coherence demonstrate in energy and security policies since 2006. Public policy is of interest due to its influence on the acceleration or deceleration of sustainability transitions [28]. Policy strategy documents present formalised policy goals and instrument mixes that have been recognised by the political parties in power. The nations share a small population number and an EU member state status (during the analytical period) but were purposefully selected to present differing energy resource profiles (ES 72% of energy from domestically produced oil shale; FI domestic bioenergy, nuclear and imported fossil fuels; SC a significant share of electricity from wind energy but fossil fuels in heat and transport), relationship to Russia, and governance status (FI independent since 1917, ES independent since 1991, and SC a nation within the United Kingdom with a devolved government). We regard the relationship to Russia important, because the Russian government has used its energy resources as a political instrument towards Europe since the late-1990s through price hikes and supply cut-offs [29,30]. It is also a major energy exporter and strategic trading partner for the EU [31]. Industrial production is most important for Estonia, circa 29% of GDP, but has been shifting to service and commercial sectors [32]; followed by Finland, 24% of GDP, which has a large energy-intensive industry contributing to high carbon-intensity [33]; and Scotland, 18% of GDP, with the least energy-intensive industry.

Building on this background, the organisation of the article is the following. Section 2 briefly reviews literature on security in sustainability transitions concerning energy. Section 3 introduces the concepts policy coherence and integration, followed by the analytical framework and methods in Section 4. Section 5 presents the findings regarding policy integration, policy coherence, and landscape and niche elements in energy and security policy documents. Section 6 discusses and concludes.

2. Security in sustainability transitions

Security and securitisation of fossil fuels has been studied extensively [e.g. [2,29,34]]. Increasing attention has also been paid to security in the context of transitions towards renewable energy -based systems and phasing out fossil fuels. This research points out the changing security aspects of energy demand and supply, such as new products and routes for trade [35] and yet unknown scale and scope of security challenges for critical metal and mineral supply [36]. Research appears divided on the opportunities for peace and consensus building versus risk of conflict via renewable energy [17], its effects on land use [37], and climate mitigation more broadly [38]. Many studies show how right-wing populism and hostility towards climate and renewable energy policy are connected with risk of conflicts [39,40]. The possibility of global unrest due to conflicts caused by climate change has been widely addressed [41–43]. Some point towards the reduced political and economic leverage of oil producing states [44]. Recent studies also argue that the risk of geopolitical conflict over critical materials for renewable energy is limited, while the cyber security implications are unclear [14]. Moreover, while the low-carbon energy transition is likely to improve climate security [38] globally, petroleum production in certain states is likely to continue [14,45]. Many security implications of energy transitions continue to unfold.

Despite the expansion of the above literature, the concept of security has not played a significant role in the specific field of sustainability transitions research that addresses the transformation of socio-technical systems towards environmental sustainability based on particular conceptual-analytical frameworks [5]. One of the most used frameworks in sustainability transitions studies is the multi-level perspective (MLP) [e.g. [46,47]]. It portrays change in socio-technical systems around societal service provision (e.g. energy, food, mobility) as alignments of processes within and between three analytical levels. *Niches* are protected spaces, such as specific markets or application domains, where potentially disruptive niche innovations develop via processes of learning and social networking but are safeguarded from the selection pressures of the dominating regime [46,48]. *Socio-technical regimes* are the deep structure of socio-technical systems involving alignment of technologies, infrastructures, markets, public policies, practices and behavioural patterns [47]. They may be destabilised and de-aligned via landscape-level influences, creating windows of opportunity for niches to mainstream [46]. The *landscape* characterises long-term gradual developments, such as climate change and demographic trends, and rapid abrupt events, such as natural disasters and wars that create pressures for regimes to change [49]. For example, Russian politics can be regarded as a significant landscape pressure influencing low-carbon energy transitions with possible implications on the interplay of energy and defence policy regimes in smaller European countries. Here, the MLP serves as a broad basis for examining how energy niches or landscape factors show in connection to security.

Johnstone and colleagues were the first to pay explicit attention to security in sustainability transitions [50,51]. They argued that the

military establishment is missing from the theorisation of transitions and describe militaries as means by which states occasionally pursue their energy-focused foreign policies [51]. Johnstone et al. associated terms such as the 'military-industrial complex' and the 'national security state' to the concept of deep incumbency [50]. This means that incumbent actors who have vested interests in the established socio-technical regime may try to impede niche innovations via different strategies. Two strategies are linked to the question of security: *securitisation*, recasting policy goals in terms of national security, and *masking*, for example, incorporating nuclear submarine construction costs into civil nuclear programmes.

Other sustainability transition studies have addressed security only in passing. In discussing pathways for transitions in the electricity sector, Verbong and Geels [52] made a reference to geopolitical security and energy security as major landscape threats. Similarly, Geels [53] has considered the military dimension being a part of fossil fuel alliances of policymakers and incumbent firms. Most recent research has acknowledged the military and geopolitical considerations as the context for the technological innovation system of large commercial nuclear reactors [54]. Here, we bring national security to sustainability transitions studies, by examining its connections via policymaking to low-carbon energy transitions.

3. Coherence and integration as concepts of policy interplay

3.1. Policy coherence

The concept 'policy coherence' originates from European foreign and security policy [55] and development policy [56]. In the foreign policy context, policy coherence has been described as common framework policies for the EU, free of contradictions and reduced distinctions between foreign and domestic policies of member states [55,57,58], while this aim has not realised in practice. This stream of literature does not provide a more generic framework for policy coherence. In the development policy context, Carbone [56] has identified different forms of policy coherence: (1) horizontal coherence between policy sub-systems, (2) vertical coherence between the EU and member states, (3) internal coherence, i.e. consistency of objectives within a policy sub-system, and (4) multilateral coherence, i.e. interaction between international organisations.

Climate and environmental policy studies have addressed policy coherence and integration extensively. We follow the definition of policy coherence presented in this literature "as an attribute of policy that systematically reduces conflicts and promotes synergies between and within different policy areas to achieve the outcomes associated with jointly agreed policy objectives" [59], where, the policy outputs of different policy sub-systems should be harmonious, without giving priority to a specific objective [60]. However, there is no agreement on the exact meaning of the term, and the literature includes an excess of definitions [61]. For example, Rogge and Reichardt [62] have used coherence to refer to the quality of policy processes [also [63]].

We focus on horizontal coherence of policy processes and outputs (i.e. objectives and instruments) between two policy sub-systems. The process dimension denotes mechanisms designed to advance coherence [56], such as political leadership, parliamentary committees or executive agencies [64], or shared visions between policy sub-systems, implemented by statements and actions [65]. The policy outputs dimension may include comprehensive frameworks combining the objectives of different policy sub-systems [7], and recognised synergies or absences of contradictions between policy objectives, design, instruments and implementation arrangements [57,59,66].

Often the realisation of policy coherence is far from ideal. Divergent ideals, interests, and perceptions in different policy sub-systems [56] complicate the achievement of collective action from policymakers [7]. Furthermore, policy mutates when it is reinterpreted by public officials who implement it to practice [67]. Conflicts unseen or concealed at the higher level of policy formulation are detected when different policies are implemented [59]. This also links to the issue of coherence for whom; whose perspective is taken influences whether policies are seen to cohere [56].

3.2. Policy integration

Policy integration is an attribute of policy that can advance policy coherence. The difference between the terms is that 'policy integration', i.e. the integration of a specific policy objective into another policy sub-system, such as the integration of national security objectives into energy policy, can occur independently of horizontal coherence and aim for principled priority.

The concept emerged in the 1990s within European environmental policy, following the 1987 Brundtland report. Environmental policy integration (EPI) received much interest in academic literature in the early 2000s [68–70], containing different perceptions of policy integration. Russel et al. [71] have categorised these as normative approaches that emphasise the principled priority of environmental issues and the need of political commitment [e.g. [69]]; organisational and procedural approaches such as departmental responsibilities, administrative integration of instruments and mandates [e.g. [9]]; output-based assessments of integration, whether policy outputs and outcomes generate environmental improvements [72], and reframing approaches, focused on learning between policy actors [e.g. [68]]. Kivimaa and Mickwitz [72] evaluated EPI in a policy sub-system based on whether environmental objectives are included, their consistency with other objectives, their emphasis, and specifications to evaluate and report on EPI. Runhaar et al. [73] argue that a distinction can be made between weak EPI in the form of procedural input and strong EPI mirrored in policy outputs.

Recent work on policy (dis)integration analyses political processes behind policy (dis)integration and coherence [66]. It examines the extent to which a cross-cutting policy problem is recognised to require holistic governance; actors and institutions involved and density of interactions between sub-systems; the range of policies and subsequent coherence; and the extent to which policies contain instruments to address the problem, and the coherence of the instrument mix [66,74].

Policy integration faces challenges as environmental policy objectives have failed to fully integrate into other policy subsystems [73]. First, policy integration may improve policy coherence, but it can also remain an isolated functional exercise without generating interaction between actors across policy sub-systems. Second, policy integration has a fluctuating quality. It can first increase but then decrease again [74]. This may result, for example, from conflicting interests or lack of access to knowledge and advice [73]. Third, cultural and cognitive frames behind policymaking affect the degree to which policy integration occurs [75]. Lack of sufficient integration can show in policy documents as conflicting statements and the absence of discussion on potentially conflicting objectives [73].

Policy integration has been noted as a specific challenge for energy policy that faces two fundamental objectives, climate change mitigation and energy security, while energy efficiency that would benefit both has shown poor progress [3]. Lack of policy coordination creates higher costs for obtaining both policy objectives, resulting in sub-optimal solutions, calling for a two-way integration process to maximise synergies [76].

4. Research approach and method

In this article, we conducted comparative case study research by means of policy document analysis concerning three countries during 2006–2020. We were interested in policy strategy documents, because they produce tangible outputs, such as context-setting, objectives, and proposed policy instrument packages, as well as contain promises from policymakers to stakeholders, influencing what stakeholders expect

from future policy development and their choices of action. Policy documents include a certain interpretation of context and statements that have been designed to speak to different audiences.

The countries analysed - Estonia, Finland and Scotland – have populations of less than 6 million, giving a small-country perspective and, thus, complementing previous studies on energy and security focused on large countries [e.g. [77,78]]. The selection aimed at variety in terms of country profiles regarding domestic fossil energy reserves, renewable energy production, role in the EU and the North Atlantic Treaty Organization (NATO), and relationship to Russia as a major energy power (Table 1). The countries' takes on fossil fuel phase out, import dependency and geopolitical positioning differ.

Key energy/climate and security/defence strategy documents (see Appendix A) were identified for each country, by searching the websites of the Parliaments and the Scottish Government, Prime Minister's Offices, Ministries for Defence, Foreign Affairs, Energy, and Economic Affairs; contacting personnel; conducting background reading on the case countries; and by references made in other strategy documents. Typically, defence policy is a narrower sub-system than a more cross-cutting security policy; we focused on both. In addition, we examined climate policy to the extent it related to energy policy. We wanted to focus on the official policy agenda presented via strategy documents of relevant ministries and the government. We, thus, excluded reports and assessments produced by consultants or working groups. The large number of documents also required some boundaries to be drawn. Broader national strategies, programmes and visions were excluded. While they may give some insights on policy coherence, they would not give information on policy integration in energy and security policy sub-systems. We used English versions whenever available; otherwise, the original ones. We analysed in total 72 documents: 18 for Estonia, 21 for Finland, and 33 for Scotland (Table 2). The materials were divided into three periods (2006–2010, 2011–2015, 2016–2020) to compare development over time. Our starting point was the year 2006, when energy security reached the top of the EU's political agenda following the first Russian-Ukrainian natural gas dispute [79]. The second period presents time after the EU Energy 2020 Strategy for competitive, secure and sustainable energy in November 2010 [80] and the third period after the EU Energy Union Framework Strategy for a Resilient Energy Union with a Forward-Looking Climate Change Policy in February 2015 [81] and the Paris Agreement on Climate Change.

The security/defence strategy documents were searched for occurrences of energy-related words: "energy", "electric*", "heat", "nuclear power", "fuel", "oil", "gas", "peat", "renewable", "wind" and "solar". The paragraphs in which at least one of these words were used were inserted into Excel, to its own row for coding. The energy/climate strategy documents were searched for the occurrences of words "security", "defence/defense", "geopolitic*" and "threat". The word "risk" was omitted from the analysis as it is used in many different contexts as a general word. For Scotland, paragraphs from the broader UK strategies were excluded if they only concerned England and Wales. We searched for the selected words, and coded text paragraphs around them. We also conducted broader reading of the documents to note if relevant parts were missing with some paragraphs added.

Table 1
Case country population, energy profiles and geopolitical positions.

Country	Population	Energy profile (2018)	Connections to NATO, EU and Russia
Estonia	1.3 million	Oil shale important; 30% of total energy from RES	Former part of Soviet Union (independence in 1991). NATO member and EU member since 2004.
Finland	5.5 million	No domestic oil/gas reserves; 41% RES. Diverse energy mix.	Neighbouring country to Russia, independence from Russian Empire in 1917. EU member since 1995.
Scotland (part of UK)	5.5 million	Significant oil reserves; 21% of energy from RES, 77% for electricity from RES	Partially autonomous region and constituent nation of the United Kingdom. In NATO since 1952, EU since 1973. Links to Russia as a net energy importer.

Sources: Eurostat [83], Scottish Energy Statistics Hub [84]

Table 2
Analysed policy document material.

Period/sub-system	Estonia	Finland	Scotland
2006–2010 energy & climate policy	4 documents, 243 pages, 75 coded paragraphs	2 documents, 314 pages, 22 coded paragraphs	6 documents; 917 pages, 270 coded paragraphs
2006–2010 security & defence policy	3 documents, 68 pages, 17 coded paragraphs	3 documents, 313 pages, 104 coded paragraphs	3 documents, 219 pages, 94 coded paragraphs
2011–2015 energy & climate policy	1 document, 75 pages, 11 coded paragraphs	3 documents, 320 pages, 33 coded paragraphs	5 documents, 477 pages, 70 coded paragraphs
2011–2015 security & defence policy	3 documents, 54 pages, 2 coded paragraphs	4 documents, 263 pages, 78coded paragraphs	7 documents, 372 pages, 50 coded paragraphs
2016–2020 energy & climate policy	3 documents, 325 pages, 118 coded paragraphs	3 documents, 472 pages, 67 coded paragraphs	6 documents, 346 pages, 58 coded paragraphs
2016–2020 security & defence policy	4 documents, 145 pages, 13 coded paragraphs	6 documents, 241 pages, 51 coded paragraphs	6 documents, 290 pages, 15 coded paragraphs
Total	18 documents, 910 pages, 236 coded paragraphs	21 documents, 1923 pages, 355 coded paragraphs	33 documents, 2621 pages, 557 coded paragraphs

In the analysis, we combined a focus on policy integration and coherence with the MLP (Fig. 1). First, we analysed the degree to which security policy has been integrated into energy policy, and energy policy has been integrated into security and defence policy (Step 1), and the existence of mechanisms improving coherence as framings presented in the documents (Step 2). These framings may concern the description of the issue in general, or outline specific objectives and measures, or resources concerning that issue. For example, we examined whether broader mechanisms are introduced for reducing conflicts and improving synergies between the policy sub-systems, such as overarching visions, committees or agencies, and whether the documents show synergies or conflicts between the policy areas. Second, applying the MLP, we made an assessment whether and how the coded paragraphs focused on the energy or security regime, energy niches, and/or broader landscape factors (Steps 3 and 4).

The selected paragraphs were analysed by two researchers in Excel, following Meyer and Avery [82], using codes for the MLP-level, policy coherence and policy integration. The codes had 3–8 sub-codes each identified based on the literature review on the concepts (Table 3). We aimed for intercoder reliability, i.e. that "a single knowledgeable coder may be reasonably confident that his or her coding would be reproducible by other equally knowledgeable coders" [83]. While we examined the frequency of mentions of different issues, our analysis was principally oriented to what was described and how. As energy security is increasingly a standard sub-topic of energy and security policies, our analysis specifically focused on how the documents refer to national security, defence or cyber security. For example, we assessed the integration of security policy to be 'low' when energy policy documents did not go beyond typical energy security remarks.

5. Findings

5.1. Introduction to energy and security policy in the case countries

Estonian energy policy is based on energy independence from Russia,

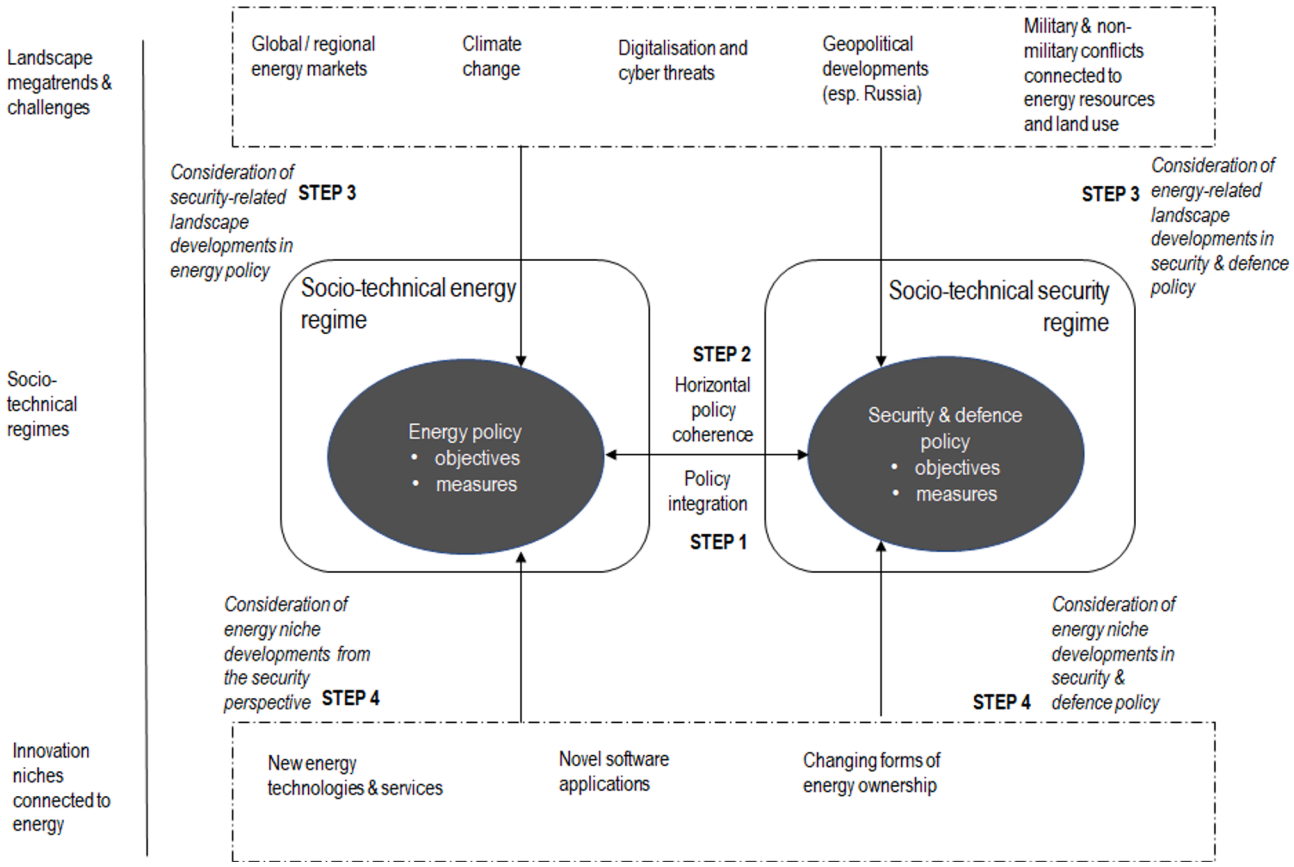

Fig. 1. Analytical focus on policy integration and coherence in the context of the multi-level perspective, and research steps taken.

the country having the lowest import dependence in the EU. Security of supply, competitive energy prices and the oil shale industry play an important role [84], causing Estonia's ecological footprint to be among the highest in Europe [85]. However, the energy transition is changing Estonia's traditional stance on energy. Estonia is part of the NordPool, the Nordic power market, with gas connection plans to North and South via the Balticconnector. Estonia's security policy is based on a broad security concept, referring to the state's capability to defend its values and objectives from military and non-military risks. Security policy aims to guarantee independence, sovereignty, survival and the constitutional order [86]. Cyber security is of specific interest as Estonia is among the most digitalised societies, Tallinn hosting the NATO Cooperative Cyber Defence Centre of Excellence [87].

Finland's energy policy has for long been based on security of supply via multiple energy sources, domestic production based on bioenergy and peat, and the needs of the energy intensive industry. Some biofuels are imported [88], record amount in 2019 from Russia and the Baltic states [89]. Energy policy is characterised by dependence on imports of oil, gas and electricity from Russia [90] and operation in the NordPool. Climate change concerns became to the policy agenda in the 1990s [91], yet phasing out peat has been politically difficult. Defence and security policy are focused on the operation of the Defence Forces and a comprehensive concept of security to maintain independence and territorial sovereignty and promote the population's wellbeing. "The primary aim of Finland's foreign and security policy is to avoid becoming a party to a military conflict" [92]. The threat posed by its neighbouring country Russia has played a role in defence policy planning, traditionally being too sensitive to openly discuss [93] but becoming more open since the Russia-Ukraine war in 2014 [94].

Energy policy in Scotland, and the UK, is based on a long-history of domestic fossil fuels, while renewable energy and nuclear power are seen as increasingly important due to diminishing domestic hydrocarbon production (coal production ended in 2005) [95]. A low-carbon transition has been pursued since early 2000s, with the Climate Change Act 2008 as an important cross-sectoral policy. For Scotland, the responsibility for security and energy policy lies with the UK government. Scotland's devolved administration has duties related to climate change mitigation, economic development and energy efficiency [95], with more ambitious plans than the UK. Scotland is part of interconnected power networks with France, Ireland and the Netherlands with plans to connect with Norway and Denmark [96]. Despite efforts by the Scottish government to be more involved in security, Scotland still depends on the UK government agencies, for instance, regarding cyber security, even with its notable IT-sector [97]. Yet, the Scottish Government has its distinctive way of doing things in certain aspects of security governance, including policing and resilience planning [97]. UK defence policy aims to protect its people and prospects, to prevent conflicts and to prepare for possible battle [98].

Fig. 2 shows an overview of selected events providing context to our analysis.

5.2. *Integration of energy and decarbonisation into security and defence policies*

This section summarises our analysis of how energy policy has been integrated into the case countries' national security and defence policies. The analysis focused on examining the appearance in texts of (1) procedural and learning processes for integrating energy into security policy; (2) evidence of integrating energy into security policy objectives and (3) measures, and; (4) principled priority of energy.

Across the countries, energy issues were not very visible in defence policy. Energy policy appears, however, functionally integrated with security policy via the concepts of 'energy security' and 'critical infrastructure' and the use of a comprehensive concept of national security.

Table 3
The main codes and sub-codes used in the analysis.

Main code	Sub-codes
MLP in context	1. Niche 2. Regime 3. Landscape [46]
Policy integration – integration of energy into security/defence policy	1. Procedural and learning processes for integrating energy into security/defence policy (e.g. plans, programmes, task forces, reporting requirements) [9] 2. Evidence of integrating energy into security/defence objectives [72] 3. Evidence of integrating energy into security/defence policy measures/ instruments [72] 4. Principled priority of (low-carbon) energy in security/defence policy [69]
Policy integration – integration of security into energy policy	1. Procedural and learning processes for integrating security into energy policy (e.g. plans, programmes, task forces, reporting requirements) [9] 2. Evidence of integrating security into energy/climate objectives [72] 3. Evidence of integrating security/defence into energy policy measures/instruments [72] 4. Principled priority of security in energy policy [69]
Policy coherence	1. Coherent vision for decarbonised energy and security/defence [65] 2. Overarching framework/strategy for energy and security/defence [7] 3. Coherence of objectives between energy and security/defence [59] 4. Joint instruments for energy and security/ defence [64] 5. Coherence of instruments between energy and security/defence [59] 6. Mechanisms/processes to improve coherence between energy security/ defence [64] 7. High level support for coherence [64] 8. Synergy or conflict [59]

Albeit not reaching to the kind of functional overlap, where policy instruments perform overlapping functions [99], the concepts and associated measures show energy security in the strategy-level of both policy sub-systems. Yet, the degree to which this integration shows, and the issues raised in the documents vary between the countries and periods (Table 4).

Energy issues are acknowledged in Estonian security policy but with a low degree of integration compared to Finland and Scotland. During 2006–2010, in Estonia, energy security (security of supply and infrastructure) as a policy *objective* was intertwined with aims to deepen cooperation with the EU, the Baltic states and the US. The energy security objective contained the 'rational' use of oil shale and introduction of renewable energy technologies, creating a conflict between decarbonisation and the continuation of fossil fuel production. The only *measure* relating to energy policy was the early warning system for nuclear radiation. During 2011–2015, energy was addressed much less, in only two paragraphs. During 2015–2020, energy policy integration was similarly low as during the first period. The extensions to *objectives* included energy efficiency, peat, and reducing natural gas use.

Finland's security/defence policy documents have more extensively integrated energy than those in Estonia, showing in the amount and nature of content. During 2006–2010, energy policy integration was visible as *objectives* for energy security and to mitigate climate change and avoid one-sided energy dependencies internationally. The policy documents referred to the Energy and Climate Strategy. Evidence of energy policy integration in *measures* show as stockpiling hydrocarbons, developing renewable energy, arrangements for Nordic collaboration, and nuclear safety. Energy efficiency of repairs in defence policy is

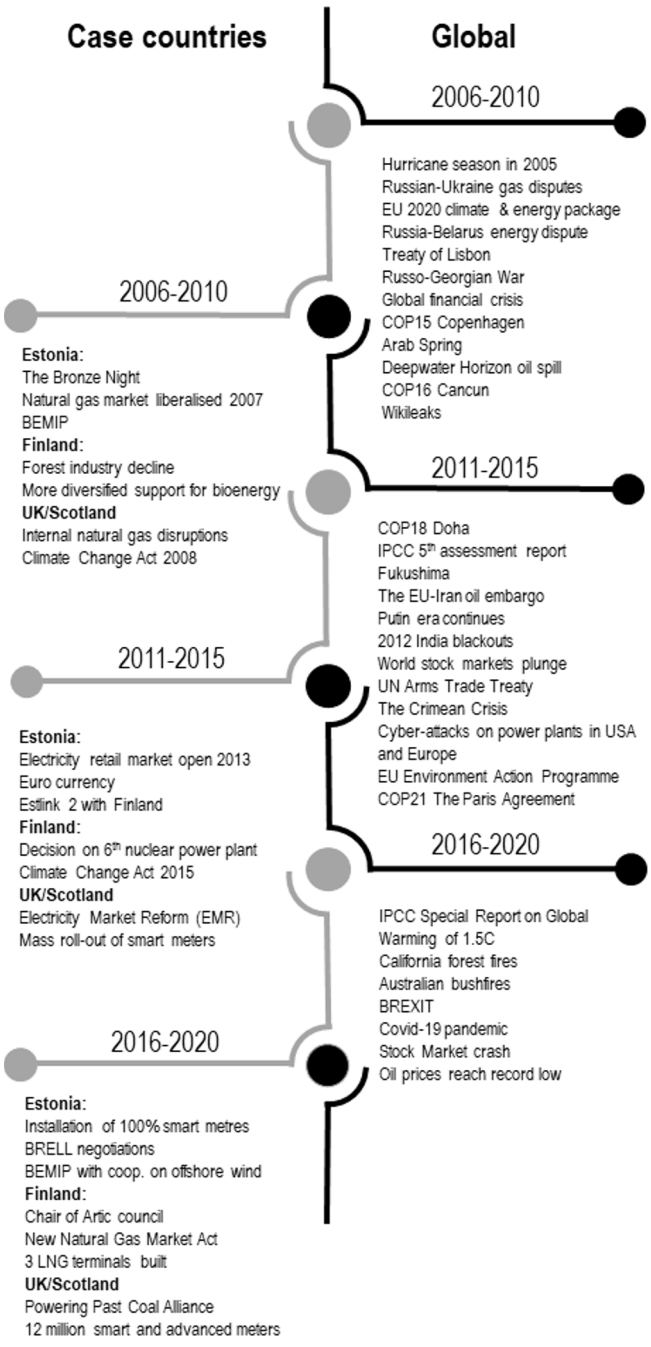

Fig. 2. Selected major events and developments related to energy during 2006–2020.

mentioned. During 2011–2015, energy policy integration deepened, showing not only as evidence in objectives and measures, but also as selected *procedures* to improve integration. The Defence Administration's Strategy on Society and Environment stated that the defence forces will draft a climate and energy programme. Improving energy efficiency of the Defence Forces' infrastructure was coupled with user practices, education, monitoring and reporting. Policy integration was visible in defence policy, where the documents state a vision considering environmental policy for defence capability and meeting the government's climate and energy policy requirements in developing defence infrastructure, including guidance for energy efficiency in military areas. Energy considerations highlighted different *objectives* and *measures* than before, including collaboration with Norway, Russia and China in energy expertise and preparing for cross-border threats in

Table 4
Summary of energy policy integration in security and defence policy documents.

	Estonia	Finland	Scotland
2006–2010	**Evidence in objectives** Low integration in terms of energy security, critical infrastructure, and ambitions to deepen international collaboration on national security and energy	**Evidence in objectives** Moderate integration in terms of energy security, references to *National Energy and Climate Strategy*, and climate change	**Evidence in objectives** High integration in terms of energy security, low-carbon transition, references to *National Climate and Energy Strategy,* climate change, open global energy markets, security and stability in international relations
	Evidence of EPI in measures Low integration; a warning system for nuclear radiation mentioned	**Evidence of EPI in measures** Moderate integration in terms of stockpiling fossil fuels, RES development, energy efficiency of repairs in defence, arrangements for securing electricity transmission under Nordic cooperation, and measures for nuclear safety	**Evidence of EPI in measures** High-to-moderate integration in terms of diversifying fuel sources, energy efficiency, low-carbon technologies, defensive measures for climate change, security enhancements at critical energy sites, international energy cooperation, Royal Navy ships protecting oil platforms
	Procedures & learning processes No observations	**Procedures & learning processes** No observations	**Procedures & learning processes** No observations
	Principled priority of EPI No observations	**Principled priority of EPI** No observations	**Principled priority of EPI** No observations
2011–2015	**Evidence of EPI in objectives** Low integration, energy issues mentioned only twice	**Evidence of EPI in objectives** High-to-moderate integration in terms of a vision for societal and environmental policy preconditions for credible defence capability, references to government's climate and energy policy decisions, energy efficient military areas, Arctic energy expertise and international collaboration, improving oil recovery capabilities, improving information regarding nuclear risks	**Evidence of EPI in objectives** Moderate integration in terms of energy security and critical infrastructure, resilience to flooding, security of maritime energy trade and offshore energy installations, managing risks posed by regional instability, climate change, natural events and rising global energy demand
	Evidence of EPI in measures No observations	**Evidence of EPI in measures** Moderate integration in terms of guidance for energy efficiency in military areas and defence force premises, international cooperation to prepare for cross-border threats in climate and energy policy	**Evidence of EPI in measures** High integration in terms of assessing security implications of offshore energy and national energy infrastructure, Royal Navy maintains movement of world energy supply, investments in innovative technologies, intensifying international cooperation on energy security, implementing global standards for nuclear safety, climate finance for developing countries
	Procedures & learning processes No observations	**Procedures & learning processes** Moderate integration in terms of climate and energy programme for defence forces, and education and monitoring to improve energy efficiency of defence forces' infrastructure	**Procedures & learning processes** Moderate integration via Secretary of State for Energy and Climate Change a permanent member of National Security Council
	Principled priority of EPI No observations	**Principled priority of EPI** No observations	**Principled priority of EPI** No observations
2016–2020	**Evidence of EPI in objectives** Low integration in terms of energy security, energy efficiency, deepening international cooperation	**Evidence of EPI in objectives** High integration in terms of energy security, security policy stability in the Arctic, coordinating security and energy policy, intensifying international energy and climate cooperation, promoting carbon–neutral transition	**Evidence of EPI in objectives** Low integration in terms of energy security and critical infrastructure, mitigation of threats from climate and energy policy
	Evidence of EPI in measures Low integration, a warning system for nuclear radiation mentioned	**Evidence of EPI in measures** Low-to-moderate integration in terms of stockpiling, power preparedness measures, international collaboration to improve links between climate change mitigation, energy and security	**Evidence of EPI in measures** Moderate integration in terms of legislation for security of oil and gas exploration and production, energy task force for nationwide power failure, finance for clean energy infrastructure in India, cyber security advice and apprenticeships
	Procedures & learning processes for EPI No observations	**Procedures & learning processes for EPI** No observations	**Procedures & learning processes for EPI** No observations
	Principled priority of EPI No observations	**Principled priority of EPI** No observations	**Principled priority of EPI** No observations

climate and energy policy. During 2016–2020, energy policy integration was no longer explicit in procedures. Yet, new issues were raised as evidence of integration in *objectives*, including a need to coordinate security and energy policy, and intensifying energy and security cooperation with the US, EU, Russia and China. Carbon-neutral transition and climate resilience were mentioned. Energy policy integration showed

widening content but less depth.

Energy policy integration in documents concerning Scotland showed as a larger number of *objectives* during 2006–2010 and of *measures* during all periods compared to Estonia and Finland. Securing global energy supply was addressed, an aspect missing from other countries' documents, possibly explained by Britain's colonial past. Britain's early leadership in climate change is evidenced as frequent mentions of the low-carbon transition and connections between climate change and international stability during 2006–2010. Same as in Finland, the policy documents referred to national climate and energy strategy. Akin to Estonia, there were conflicting objectives and measures between integrating traditional energy policy versus low-carbon energy policy. During 2011–2015, less evidence exists of integration in *objectives*, while new issues included the security of maritime energy trade and offshore installations. A new *measure* was finance for developing countries to increase energy access. The National Security Council included the Secretary of State for Climate and Energy, i.e. a procedure for integration. During 2016–2020, energy policy integration weakened, containing earlier *objectives* to protect infrastructure and work internationally to ensure energy security. *Measures* included improving cyber security advice and skills in the energy sector.

None of the countries stated a principal priority for energy over security. Yet, clearly, energy policy is functionally integrated into national security. Explicit mentions of procedures of integration are rare, appearing only during 2011–2015. Selected examples contain energy-policy representation in national security committees, a climate and energy programme for defence forces, and monitoring and reporting on energy efficiency implementation. The analysis also shows conflicts between fossil fuels and low-carbon transition objectives, international cooperation as a popular strategy for energy security, and global climate security aspects being partially visible. Fig. 3 is our interpretation of how the policy documents show evidence of energy policy integration using the four analytical categories ranging from low (dotted line) to high (thick line) integration. It differentiates between traditional energy policy connected to fossil fuels, and new, low-carbon energy policy linked to climate change concerns and renewable energy. While the second period has a somewhat stronger emphasis of the latter, both co-exist in all periods.

5.3. Integration of security policy into energy policy documents

Here, we summarise our analysis of security policy integration into energy policy. The analysis focused on examining the appearance of (1) procedural and learning processes for integrating security into energy policy; (2) evidence of integrating security into energy policy objectives and (3) measures, and; (4) principled priority of security (Table 5). We view integration of security "low" when the documents do not go beyond energy security. Across countries, references were made to broader security, such as cyber security and including defence in planning energy policy. These connections were least frequent during 2010–2015 but increasing in 2016–2020, especially in Estonia.

During 2006–2010 in Estonian documents, security was moderately visible in *objectives* as references to energy security and the Security Strategy. The *measures* implied moderate integration, for example, energy market cooperation and diversification of energy supply to reduce dependence from Russia and considering the security of offshore wind planning. During 2011–2015, integration was low. During 2016–2020, security policy integration increased significantly. More security-related *objects* were mentioned, such as the National Security Concept and national defence considerations in energy policy. *Measures* included investments into additional pre-warning systems for defence to enable offshore wind development, Baltic interconnector and energy synchronisation projects, and Cyber Security Strategy. Processes for integration included the Ministers of Defence and of Foreign affairs as members in the Government Climate and Energy Committee, and "readiness of war" as an important principle for energy systems development. The principled priority of national security was not explicitly stated but becomes obvious through the integration of objectives and measures and processes for integration.

Finland's documents show a similar level of security policy integration as in Estonia and Scotland, apart from Estonia during 2016–2020. During 2006–2010, *objectives* referred to energy security and the Government Report on Security and Defence. *Measures* mentioned diplomatic relations via climate policy. During 2011–2015, the documents showed moderate integration in *objectives,* with Defence Forces' needs to be considered in offshore wind development. *Measures* merely addressed energy security. A priority of security over low-carbon energy was detected with a statement as to the extent of energy system

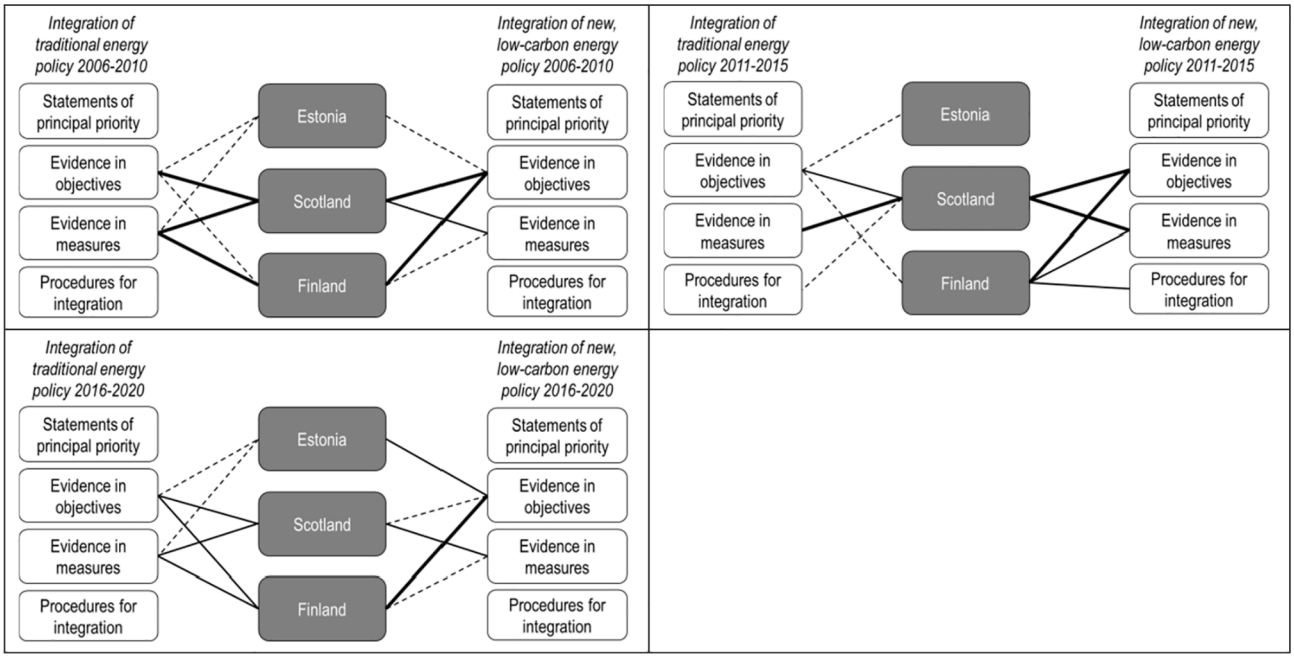

Fig. 3. Changing quality and extent of energy policy integration in security policy documents.

Table 5
Summary of security policy integration in energy and climate policy documents.

	Estonia	Finland	Scotland
2006–2010	**Evidence in objectives** Moderate integration in terms of energy efficiency and security of gas supply, oil shale production to be continued in interest of energy security, a reference to security policy strategy, energy market planning to take "all aspects of security" into account, and operational security and immunity of the power system	**Evidence of SPI in objectives** Moderate integration in terms of increasing energy security via climate policy and a reference to Government Report on Security and Defence Policy and its attention to climate change	**Evidence of SPI in objectives** Moderate integration in terms of energy security pertaining to international cooperation and diversity of and domestic renewables supply, securing the transmission system, stability in source/transit regions, and Scotland-specifically nuclear safety (via no use)
	Evidence of SPI in measures Moderate-to-high integration in terms of energy security (market cooperation, regulating oil shale, diversification of supply); including Ministry of Defence to knowledge/ legislation creation for nuclear power programme, cooperation with MoD in offshore wind planning, national defence and security with energy in Estonian R&D and Innovation Strategy	**Evidence of SPI in measures** Low integration via mentions of security of supply via national emergency supply operations, e.g. stockpiling of fuels; including climate diplomacy in foreign relations	**Evidence of SPI in measures** Moderate integration in terms of energy security (energy efficiency/saving, reforming international/ local markets, international cooperation, diversification, R&D), regulating offshore transmission system security, and Scotland-specifically legislation to oppose nuclear power
	Procedures & learning processes for SPI No *observations*	**Procedures & learning processes for SPI** *No observations*	**Procedures & learning processes for SPI** *No observations*
	Principled priority of SPI *No observations*	**Principled priority of SPI** *No observations*	**Principled priority of SPI** Moderate integration in Scotland: opposition of nuclear power for reasons of nuclear safety (radiation, risk of terrorist attacks)
2011–2015	**Evidence of SPI in objectives** Low integration in terms of oil shale development to ensure security of supply but mitigating impacts on the environment and capacity development for gradual decarbonisation of the energy sector	**Evidence of SPI in objectives** Moderate integration in terms of ensuring security of supply under all circumstances, energy efficiency, diversifying energy sources, securing oil transports; mentioning the needs of the Finnish Defence Forces when planning offshore wind	**Evidence of SPI in objectives** Low-to-moderate integration in terms of energy security (low-carbon economy based on renewables, energy efficiency, diversification, systems resilience, security of gas/oil supply, investments in new generation capacity)
	Evidence of SPI in measures *No observations*	**Evidence of SPI in measures** Low integration in terms of security of supply via national emergency supply agency, energy efficiency and legislation to ensure network operation even in exceptional circumstances	**Evidence of SPI in measures** Low-to-moderate integration in terms of energy security (low-carbon economy/transition, electricity system reform, planning of Electricity Market, reports and regulations), statutory security of supply report and electricity capacity assessment
	Procedures & learning processes for SPI *No observations*	**Procedures & learning processes for SPI** *No observations*	**Procedures & learning processes for SPI** *No observations*
	Principled priority of SPI *No observations*	**Principled priority of SPI** High integration: "Because of security of supply, energy system cannot be reformed to such an extent that supply of energy is compromised when shifting toward a low-carbon energy system" [100]	**Principled priority of SPI** *No observations*
2016–2020	**Evidence of SPI in objectives** High integration in terms of energy security (oil shale extraction, energy independency, EU/domestic primary energy sources, capacity development); re-defining security of supply for operational continuity even when transmission capacity between Member States is lost; specifying the use of the National Security Concept and restrictions from national defence considerations when planning energy generation; considering the impact of the geopolitical situation; reference to Cyber Security Strategy, National Security Concept and National Defence Development Plan	**Evidence of SPI in objectives** Moderate integration in terms of security of supply in international electricity and gas networks and cyber security	**Evidence of SPI in objectives** Moderate integration in terms of energy security, smarter, flexible network, reducing fossil fuel consumption, decarbonising while securing security of supply; resilience of the energy system and cyber security as a new specialism in the Scottish vision
	Evidence of SPI in measures High integration via Baltic energy market interconnection and energy synchronisation project, implementation of EU cybersecurity readiness measures, investments in additional pre-warning systems for defence and relaxing national altitude constraints via compensatory measures for defence to enable offshore-wind development; Cyber Security Council.	**Evidence of SPI in measures** Moderate integration in terms of energy efficiency and security of energy supply, climate change adaptation plan including critical infrastructure and energy security, a mention of Ministry of Defence Energy and Climate strategy, national emergency supply agency's cyber security operation, Nordic electricity market cooperation	**Evidence of SPI in measures** Moderate integration in terms of international energy cooperation, market and legislation improvement; Scotland-specifically Cyber Resilience Strategy, cooperation of grid operators and generators, and efficient transmission networks
	Procedures & learning processes for SPI High integration in terms of Ministers of Defence and of Foreign affairs members in Government Climate and Energy Committee; "readiness of war" as an important principle for the development of energy systems and implementing the energy strategy; ministry of Defence taking over energy security during emergency	**Procedures & learning processes for SPI** *No observations*	**Procedures & learning processes for SPI** Moderate integration: Scottish expertise and skills in subsea engineering also used in defence sector
	Principled priority of SPI *No observations*	**Principled priority of SPI** *No observations*	**Principled priority of SPI** *No observations*

reform being conditioned by security of supply. During 2016–2020, cyber security added a new dimension to *objectives* and *measures*. Measures also included the Ministry of Defence's Energy and Climate Strategy.

Security policy integration in energy policy concerning Scotland stayed similar throughout: Many *objectives* and *measures* existed but mostly on energy and not on broader security. During 2006–2010, security *objectives* included a mention of the economic and political stability of energy source and transit countries. The UK energy policy diverged from the Scottish one by Scotland's strong opposition of nuclear power demonstrated in *objectives* and *measures*; Scotland provides legislation for the no-nuclear scenario. It is a principled priority where the risk of radiation or terrorist attacks is seen larger than energy gains. During 2010–2016, *objectives* and *measures* showed less evidence of security policy integration. During 2016–2020, cyber security in the Scottish vision was stated as an *objective*. Using Scottish know-how in subsea engineering in the defence sector was a moderate form of integration via processes. The documents expressed a strong international market-orientated approach to energy security with 'low-carbon global economy' as an *objective*.

Fig. 4 is our interpretation of how the documents show evidence of security policy integration using the four analytical categories ranging from low (dotted line) to high (thickest line) integration. In Estonia and Scotland, the integration first decreased and then increased in 2016–2020. Our analysis shows that, in Estonia, national security is more deeply integrated into energy policy than in Finland and Scotland, including security and defence policy in energy policy planning extensively. This can be explained by Estonia's history with Russia, with only 30 years of full independence and precaution in critical infrastructure development. The Finnish policy documents' approach' is quite different despite the long border and history with Russia. Scottish documents show a degree of independence from the UK, visible especially in the later periods around the independence referendum in 2014; some documents showcase the capacity and policy of an independent Scotland.

5.4. Policy coherence

Policy coherence was little addressed in any country and period. One document noted the policy coherence problem, while otherwise coherence between low-carbon energy and national security was not acknowledged. Small examples of synergies, conflicts or measures were found (Table 6).

Estonian documents did not mention pursuits to coherence between low-carbon energy and national security policy, assess the consistency of objectives and measures, nor were they explicit about the prioritisation between energy and security objectives. Yet, the documents stated that national interest is best served with oil shale, supporting the incumbent hydrocarbon-based system. The National Security Concept includes energy security and highlights the 'rational use of oil shale'. Coherence may be somewhat advanced during 2016–2020 by including the Defence Ministry into the Climate and Energy Committee. Increasing energy efficiency and deployment of renewable energy in security policy shows a synergy between low-carbon energy and security policy. A potential conflict is created with solar energy creating new risks in terms of cyber security. The defence forces saw a conflict between national defence and wind power, due to disturbed pre-warning systems. Conflicts also exists between low-carbon energy pursuits and using oil shale to improve national security.

During 2006–2020 in **Finland**, no objectives or measures addressed coherence between security and low-carbon energy. One document recognised the policy coherence problem: how different policies can remain unconnected or work against each other. Climate policy mainstreaming was seen as a tool to overcome this challenge from the decarbonisation perspective. During 2011–2015, the concept of comprehensive security considered energy issues, but gave priority to security. The Energy and Climate Strategy referred to coherence in terms a coherent future vision for energy security and emissions control. A conflict existed in wind power locations and operations by the Defence Forces. During 2016–2020, evidence of policy coherence somewhat increased but was insufficient. The Government Report on Foreign and Security Policy [92] stated: "*In order to realise the strategic goals in an environment in flux, coordination in other policy sectors associated with foreign and security policy such as internal security and energy policy, is also needed.*" The Energy and Climate Strategy again mentioned the need for a coherent vision. It included measures such as adaptation programmes in different policy sub-systems, mentioning the Defence Ministry's climate strategy.

In **Scotland** during 2006–2010, no objectives or measures addressed coherence. One document referred to international energy security, connecting to geopolitics but not decarbonisation. An integrated strategy for security and energy supply to reduce vulnerability to security shocks was mentioned. Measures to protect oil platforms in Iraq for Iran's long-term stability constituted a conflict with decarbonisation. During 2011–2015, policy coherence was somewhat addressed by establishing the National Security Council including the Minister for Energy, and integrating the work of the foreign, defence, home, energy and international development departments. It promoted coherence from the perspective of national security. Some energy policy measures were outlined, such as increasing investment in renewable energy to improve national security. The declining domestic hydrocarbon production was framed as a security risk, conflicting with low-carbon energy policy. Attempts to maintain stability in the Persian Gulf and to protect oil production were also in conflict with decarbonisation. During 2015–2020, one issue linked to policy coherence: how the Cabinet Office deals with cross-sector mitigation and response related to energy and security. Cyber security was considered to improve the security of new smart systems, bringing security and decarbonisation closer.

5.5. Landscape and niche factors in energy and security policy documents

This section summarises our findings regarding how landscape pressures and energy niches were presented in the energy-security nexus of the documents. We do not address the regime-level here, considering that was covered via policy integration and coherence analysis in Sections 5.2-5.4.

5.5.1. Landscape pressures

A variety of economic, geopolitical and environmental landscape pressures were depicted in the documents of all countries, forming a setting for the policy objectives and measures proposed. Some documents go into the detail about the dynamics by which these pressures may evolve in the future. Contrarily, the security implications of new energy niches were addressed very little in security policy documents, and energy policy documents mostly addressed renewable energy niches as an element increasing security of supply.

In Estonia, during 2006–2010, Russia was portrayed as a major landscape pressure, a global power prepared to use military force and using energy as political and economic means in international relations. Other landscape pressures included, for example, the globally increasing competition over energy coupled with risks of cyber-attacks, climate change and conflicts over distribution of land (see Appendix B). During 2011–2015, fewer landscape factors were outlined due to shortage of material. During 2016–2020, many landscape pressures resembled the first period. However, Russia was addressed less, and new issues included the instability of the global economy, international finance and energy economy developments, and the possibility of military attacks on energy infrastructure.

In Finland, during 2006–2010, many same landscape pressures existed as in Estonia, including international competition for energy, climate change and marine disasters. Russia was described as the EU's most important trading partner, with interdependence in energy trade a

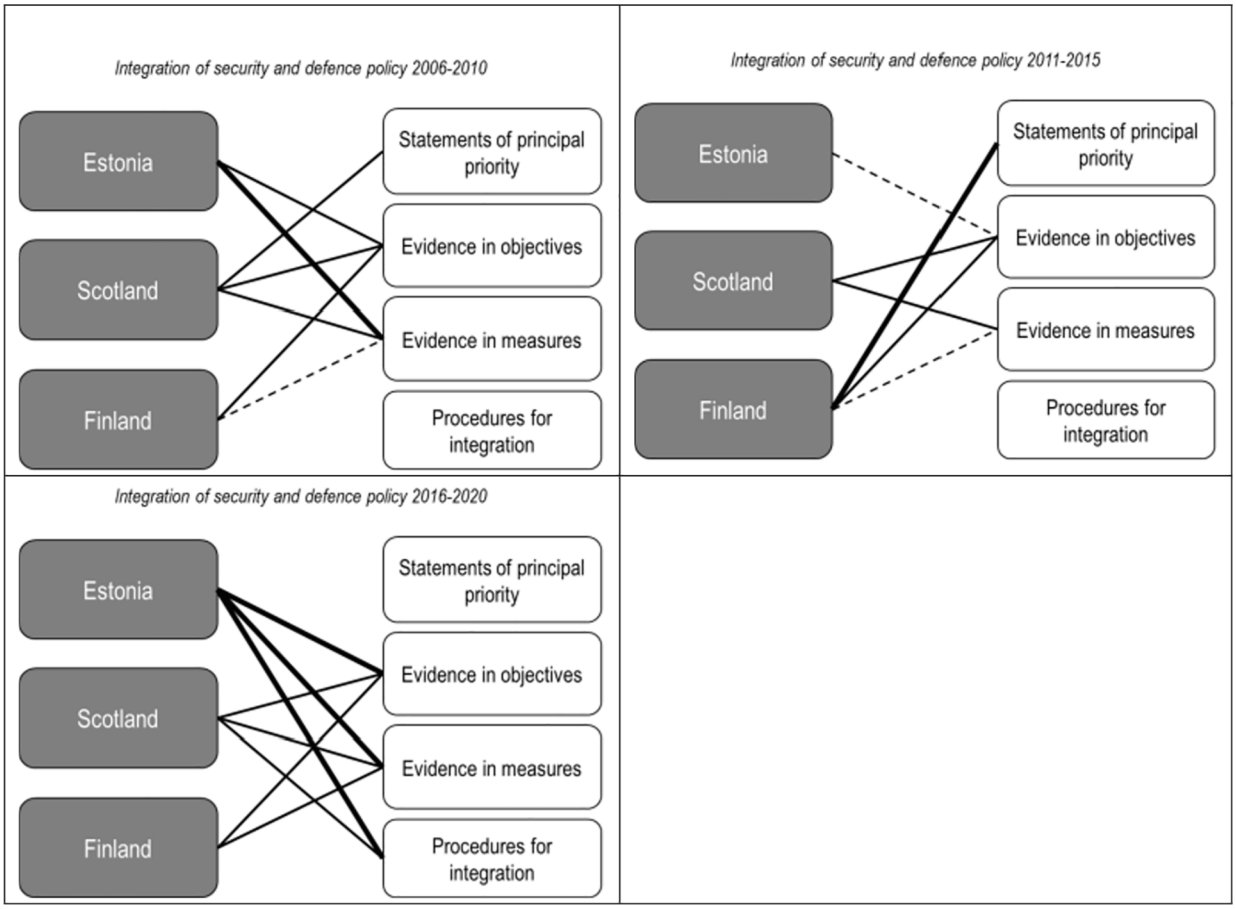

Fig. 4. Changing quality and extent of security and defence policy integration in energy and climate policy documents.

security risk as it uses energy as political leverage. Also, different issues were outlined: nuclear safety, Arctic energy resources and their security implications, China's high demand for energy and organised military operations on energy infrastructure. During 2011–2015, the documents were more elaborate about Russian issues, Arctic developments and climate change as sources of potential security conflicts. Cross-border threats, such as disruptions in energy supply, were seen to expand. During 2016–2020, Russia was viewed to aim for a superpower status, willing to employ military force and challenging the EU security system. Akin to Estonia, the documents mentioned economic and political instability due to decreased demand for fossil fuels.

Documents concerning Scotland, during 2006–2010, highlighted similar issues as above. Global state-led competition for energy was seen to involve security implications via producing states using energy as a 'hostile policy tool', and the exploitation of resources becoming a source of regional instability. Globally, inequality, social unrest and corruption were seen to increase supply disruptions. The Russia-EU gas dispute was mentioned, where Russia is using energy as a political lever causing supply disruptions. Nuclear safety was an issue for Scotland. Issues not acknowledged in other countries included crime in marine areas, and a breakdown of the rules-based international system. During 2010–2015, developments in the Arctic region, emerging markets and nuclear proliferation came up. The landscape pressures facing maritime energy supply included thefts of supplies and the crowding of sea space with transport and offshore energy installations. The period 2015–2020 mentioned fewer landscape pressures: cyber-attacks, climate change, global pandemics and nuclear and chemical weapons were mentioned.

5.5.2. Security considerations of energy niches

When energy niches gradually become part of socio-technical energy regimes, they change system security considerations. Yet, these considerations were little addressed compared to the number issues identified in our literature review (Section 2.1). The documents did not mention security of supply for new energy technologies, critical minerals and metals, nor the opportunities/risks for consensus building and conflicts from expanding renewable energy.

During 2006–2015, Estonian documents did not note energy niches. They merely implied that local wood fuels might improve energy security. During 2016–2020, security became more visible in the energy policy documents with statements that local offshore wind, hydro and biomass can increase energy security. A connection was made to defence policy restrictions set for wind-energy development that may be exempted with a scheme of additional pre-warning radars. Security documents note that increasing ability to harness solar energy will be accompanied by threats and risks, requiring work to ensure smart and preventive defence against them.

Similarly, in Finland, energy niches were rarely addressed in security policy documents. During 2010–2015, wind power was identified as an area of Arctic energy expertise for Finnish-Russian cooperation. A small note was made in energy policy documents that in planning offshore wind farms, needs of the defence forces must be considered. During 2011–2020, renewable energy was seen to increase security of supply.

Security policy documents concerning Scotland did not address energy niches. Energy policy documents mentioned some developments. During 2006–2010, renewable energy was seen by Scotland as "far more

Table 6
Summary of policy coherence.

	Estonia	Finland	Scotland
2006–2010	- Policy coherence not explicit - Conflict between oil shale objectives for national security and low-carbon energy transition	- Policy coherence not addressed in energy-security context - Coherence problem recognised in general; climate mainstreaming as a means	- Integrated strategy to security and energy supply to reduce vulnerability to security shocks, but not linked to low-carbon - Conflict between climate change mitigation and UK's action to protect oil platform in Iraq for geopolitical stability
2011–2015	- Policy coherence not explicit - National Security Concept includes energy security, but not low-carbon objectives	- Concept of Comprehensive security includes energy - Energy and Climate Strategy mentions a coherent vision for energy security and emissions control - Conflict regarding wind power and defence operations	- National Security Council including energy and defence and the Energy Minister - Renewable energy pursuits in coherence with national security
2016–2020	- Policy coherence not explicit - Defence Ministry part of Climate and Energy Committee - Synergy via RES and energy efficiency - Potential conflicts via cyber security risk of solar, influence on defence pre-warning systems of wind power, and plans for oil shale and peat	- Foreign and Security Policy Report states that coordination with energy policy is needed - Energy and Climate Strategy mentions a coherent vision for all sectors and mentions Defence Ministry's climate strategy - No explicit measures proposed for policy coherence	- Policy coherence not explicit in the security documents - Cabinet Office deals with cross-sector mitigation and response related to energy and security - Energy documents refer often to international security to secure energy security

robust" for energy security than a fossil fuel -based system, while also carbon capture and storage was remarked to allow fossil fuels to contribute to energy security. These views were also stated in during 2011–2015, with an added remark that electric vehicles have implications on energy security posing increased demands on the grid but also giving opportunities to balance electricity demand variation. 2016–2020 saw different passing references to security from niches, including cyber security associated with new energy technologies.

Table 7 illustrates how security of supply is the most frequently mentioned security consideration of accelerating energy niches. It also shows that Finland has not addressed security risks arising from energy niches, while in Estonia and Scotland it is a recent development. Defence and radar systems are an issue for Finland and Estonia, but less visible in the Finnish documents.

Table 7
Illustration of the focus given to security considerations of energy niches.

	2006–2010	2011–2015	2016–2020
Renewable energy increasing security of supply			
Estonia	+		++
Finland		++	++
Scotland	+++	++	+
New security risks arising from renewable energy/electric vehicles			
Estonia			++
Finland			
Scotland		++	++
Conflicts (and solutions) between defence radar systems and wind power			
Estonia			+++
Finland		+	
Scotland			

6. Discussion and conclusions

Policy coherence is pursued as part of UN sustainable development goals to reduce conflicts and promote synergies between different policy areas. A connected concept, policy integration, has a long history in the EU, particularly in promoting cross-sectoral environmental protection. Here, we combined the analysis of policy coherence and integration with sustainability transitions' research, examining policy interplay between energy and security policy and how landscape pressures and energy niches are presented at this interface in policy strategy documents. We analysed in total 72 documents concerning three European nations. Of the case nations, Scotland is not independent, with security and energy policy administered by the UK government. Yet, its independence efforts brought an interesting angle to the analysis, as Scottish policy documents were used as means to display Scotland's somewhat differing political aims.

Security and energy policy strategies present a degree of functional overlap [cf. 99], because both cover energy security. Energy security has been a core goal of energy policy from the early 1970s, while climate change has become an additional goal since the 1990s, increasing in importance. To security and foreign policy, energy has been a new area since the early 2000s. Our analysis shows that the integration of energy into security policy has been highest in Scotland during 2006–2010 and in Finland during 2011–2015, while in Estonia, low. The integration of hydrocarbon-based energy policy and low-carbon energy policy co-exist, the latter becoming stronger during 2011–2015 (e.g. objectives and processes for making defence forces infrastructure more energy efficient) but showing some disintegration during 2016–2020. Overall, energy policy is less integrated into security policy documents than vice versa. In energy policy documents, energy security is very visible, while broader security concerns (e.g. national defence or cyber security) are moderately addressed. We observe some disintegration during 2011–2015, while integration strengthens during 2016–2020 with new mentions of cyber security and the need to consider national defence issues in energy system planning; integration being the highest in Estonia. Overall, insufficient policy integration is demonstrated by conflicting statements pertaining to fossil fuels, renewable energy, energy security and carbon emissions, and the absence of discussion in the documents on potentially conflicting objectives [cf. 73]. We can observe a principled priority given to national security, evident in the concepts and committees supporting this. No explicit measures for resources or evaluation mechanisms to improve policy integration are outlined.

Policy coherence is also inadequately addressed in all countries' policy documents. Some processes or measures exist, but they do not take a harmonious approach to coherence [cf. [60]]. Rather, they prioritise national security (e.g. Comprehensive Concept of National Security or National Security Council). Mechanisms for a balanced

consideration of low-carbon energy transitions and national security are missing. Attempts towards policy coherence may still be present in practical policy making but the documents reveal it is not something that is important to publicly disclose, indicating a lack of coherence at least on the level of public objective-setting and reporting on policy. While this means that energy policy is not highly securitised, it also shows that traditional energy security thinking dominates, and a reframing of security based on energy transitions is lacking.

The document analysis showed an increasingly complex and multi-faceted landscape, where many pressures have intensified and expanded over time (see Fig. 5 illustrating the findings). They have created a complicated policy environment, where it may be increasingly difficult to pursue coherence between energy and security policy. The past hydrocarbon-based energy policy was perhaps easier to integrate with national security than the new low-carbon energy policy combined with cascading pressures from climate change, domestic and international conflicts, and increasing global instability and demand for energy. Yet, this changing landscape calls for more careful assessments of the opportunities for and means of increasing coherence to advance an environmentally and socially sustainable and secure energy transition.

In turn, despite the accelerating energy transition, the security implications of energy niches were little and rather superficially mentioned. Renewable energy was seen to increase security of supply and security risks were generally noted. Offshore wind had impacts on defence forces' pre-warning systems. However, security issues noted in literature, such as critical materials for renewable energy and supply routes [35,36] and potential impacts on peace and conflict [17] were absent. A partial explanation may be that the energy transition has progressed more rapidly than initially thought and, therefore, issues identified in academic literature have yet not become policy considerations. There may also be political sensitivity to identify issues such as reactions of the far-right on renewable energy [39] as national security concerns. Recent developments in just transitions policy, for example in the European Commission, point that social issues and the alleviation of potential conflicts is receiving rapidly increasing attention from policymakers, which would not have shown yet in our analysis.

The risk of energy-rich countries using energy as a geopolitical weapon and the increasing risk of conflicts from globally rising energy demand are well recognised, creating likely struggles with advancing the low-carbon energy transition globally, but may also support the progress of decentralised renewable energy systems. Thus, we argue that it is vital for policymakers to pay more explicit attention in their official strategies to the security implications of new low-carbon technologies and smart energy systems. In addition to questions of 'minerals security' [19], the risk of increasing 'securitisation' of natural resources can lead to diminishing domestic or regional security and patterns of violence and conflict [101,102]. The security implications of climate change more broadly, such as environmental disasters and global stability, were noted in documents concerning Finland and Scotland but not Estonia. While 'climate security' [38] has entered the security debate, it needs to become a more explicit part of national and international energy and climate policymaking.

We conclude that the established framing of national security, prioritising hydrocarbons, demonstrated in official policy documents, may

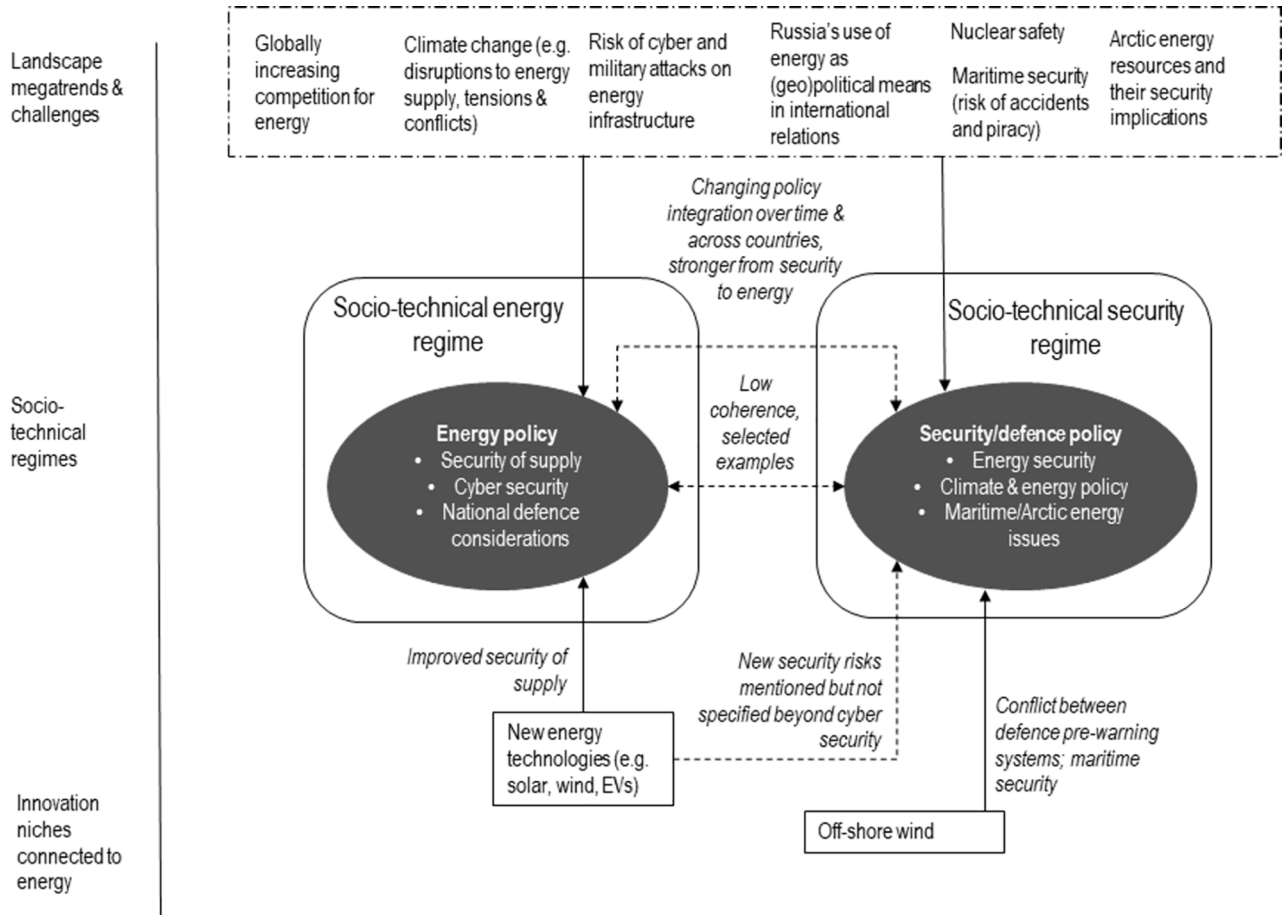

Fig. 5. Illustration of policy coherence, integration, landscape pressures and energy niches at the interface of energy and security policies (a dotted line indicates insufficient attention).

delay the much-needed energy transition due to policy incoherence and conflicting signals to stakeholders. Thus, we argue that achieving improved policy coherence and integration between energy and security, new ways of thinking about energy in national security policy, and about security in energy policy are urgently needed. Yet, increasing renewable energy is not a simplistic synergy with security of supply due the technologies' dependencies on critical materials and supply routes. Moreover, the security risks are not similar across different energy niches and in different countries and, thus, require more specific analysis. The energy and security policy nexus should also consider the changing security implications of the low-carbon energy transition globally, such as effects on changing international relations, regional conflicts and their resolutions, trade of technology and critical materials, and the vulnerability of energy systems to disruptive weather events and other abrupt landscape changes, such as pandemics. Further research is needed to deepen the understanding of this policy interplay at the changing security and energy context, for instance, by analysing contemporary stakeholder perceptions of future developments during the transition, or by developing specific processes for policy integration and coherence.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Policy documents selected for the analysis

		2006–2010	2011–2015	2016–2020
Finland	Energy/ Climate 8 documents	Long-term Climate and Energy Strategy (2008) Government Foresight Report on Climate and Energy (2009)	National Energy and Climate Strategy (2013) Background Report for the National Energy and Climate Strategy (2013) Energy and Climate Roadmap (2014)	National Energy and Climate Strategy (2017) Background Report for the National Energy and Climate Strategy (2017) Finland's Integrated Climate and Energy Plan to EU (2019)
	Security/ Defence 13 documents	Strategy for Safeguarding Vital Societal Functions (2006) Government Report on Finland's Defence and Security Policy (2009) Security Strategy for Society (2010)	Government Report on Finland's Security and Defence Policy (2012) Finland's Cyber Security Strategy (2013) Finland's Strategy for the Arctic Region (2013) Ministry of Defence Strategy on Society and Environment (2011)	Government Report on Finnish Foreign and Security Policy (2016) Update to Finland's Arctic Strategy (2016) Society's Security Strategy (2017) Government Report on Defence (2017) Finland's Cyber Security Strategy (2019) Government Report on Finnish Foreign and Security Policy (2020)
Estonia	Energy/ Climate 7 documents	Development Plan of the Energy Sector until 2020 (2009) National Development Plan for the Utilization of Oil Shale 2008–2015 (2008) Development Plan of the Estonian Electricity Sector until 2018 (2009) National Renewable Energy Action Plan 2020 (2009)	National Development Plan for the Use of Oil Shale 2016–2030 (2015)	National Development Plan for the Energy Sector until 2030 (2017) General Principles of Climate Policy until 2050 (2017) Estonian National Energy and Climate Plan 2030 (NECP 2030) (2018)
	Security/ Defence 11 documents	Cyber Security Strategy (2008) National Security Concept of Estonia (2010) Estonian Long-Term Defence Development Plan 2009 – 2018 (2009)	National Defence Strategy (2011) Estonian National Cyber Security Strategy (2014) National Defence Development Plan 2013 – 2022 (2013)	National Defence Development Plan 2017–2026 (2017) National Security Concept of Estonia (2017) Digital Agenda 2020 for Estonia (2018) Cyber Security Strategy (2019)
Scotland	Energy/ Climate 17 documents	The Energy Challenge (2006) The Scottish Government Response (2007) UK White Paper on Energy (2007) Scottish Government overview on Energy (2008) UK Low Carbon Transition Plan (2009) Scotland's Offshore Wind Route Map (2010)	The Carbon Plan: Delivering Our Low Carbon Future (2011) Security of Energy Supply Scotland (2014) UK Energy Efficiency Action Plan (2014) Decarbonising heat: A policy statement of the Scottish government (2015) Scottish Government Energy Security Report (2015)	Scottish Energy Strategy (2017) Energy Efficiency Scotland Route Map (2018) Renewables obligation: Scotland's Response (2018) Energy Consumer Action Plan (2019) Scotland's electricity and gas networks (2019) UK's Integrated Climate and Energy Plan to EU (2019)
	Security/ Defence 16 documents	National Security Strategy (2008) National Security Strategy (update, 2009) National Security Strategy (2010)	The Strategy for Defence (2011) The Digital Strategy of the Ministry of Defence (2012) Scotland analysis: Security (2013) Scotland Analysis: Defence (2013) The UK National Strategy for Maritime Security (2014) National Security Strategy and Strategic Defence and Security Review (2015) Cyber resilience strategy for Scotland (2015)	National Cyber Security Strategy (2016) Industry for Defence and a Prosperous Britain: Refreshing Defence Industrial Policy (2017) National Security Capability Review (2018) Cyber Resilience Strategy for Scotland: Economic Actions (2018) Cyber Resilience Strategy for Scotland: Learning and Skills Plan (2018) Cyber Resilience Strategy for Scotland: Third Sector Action Plan (2018)

Appendix B. Identified landscape pressures and niche security consideration at the energy-security nexus of the policy documents

	2006–2010	2011–2015	2016–2020
Estonia	**Landscape pressures:** - Russia as a major global power prepared to use military force, using energy as political/economic means in international relations - Energy import dependency on Russia - Cyber-attacks with physical damage - Conflicts over distribution of land - Climate change - Natural disasters - Infectious diseases - Nuclear accidents - Increased ship-traffic, marine disasters - Global energy market developments - Rapid development of RES	**Landscape pressures:** - Attacks against energy and ICT systems - Uncertainties in global energy markets - Environmental pressures	**Landscape pressures:** - Changes in energy supply structure between Russia and EU - Risk of cyber-attacks - Globally increasing demand for energy, leading to global instability - Climate change and following tensions and conflicts - Nuclear accidents - Instability of global economy - International finance and energy economy developments - Possibility of military attacks on energy infra
	Niches: - No attention to energy niches in security documents - More extensive use of local fuel (wood) to improve energy security	**Niches:** - No attention to energy niches in security documents - No attention to security implications of niches in energy documents	**Niches:** - Security documents note that increasing ability to harness solar energy will be accompanied by threats and risks, requiring work to ensure smart and preventive defence against them. - Intention to increase energy security through establishment of local off-shore wind, hydro and biomass generation - The completion of more than 4GW of planned wind farms depends on the mitigation of defence restrictions - Supporting wind energy development by additional pre-warning radars to achieve exemptions to altitude restrictions set by defence policy
Finland	**Landscape:** - Russia as EU's most important trading partner, with interdependence in energy trade a security risk as it uses energy as political leverage - Risks from Russia's obsolescent nuclear plants - Organised military operations on energy infra - Arctic energy resources and their security implications - Nuclear safety - Increasing international competition for energy - Climate change - China's high demand for energy and raw materials - Increased ship-traffic, marine disasters - Terrorism	**Landscape:** - Russia as largest trading partner to EU and Finland; with an aim to preserve its great power status built on abundant energy reserve, but facing internal challenges - Increasing demand for energy globally - Risk of nuclear accidents - Conflicting developments in the Arctic: climate change opening transport route and increasing exploitation of energy - Climate change effects on critical infrastructure and conflicts over resources - Cyber attacks - Terrorism - Infectious diseases - China as major importer of raw materials and energy	**Landscape:** - Russia described as aiming for superpower status, with will to employ military force, challenging EU security system - Broad energy cooperation between EU and Russia - Nuclear accidents - Pandemics - Cyber threats - Development of the Arctic region - Climate change – global commitments but limits of international institutions - Economic and political instability due to decreased demand of fossil fuels
	Niches: - Note on the increasing role of renewable energy in global energy policy but security not discussed beyond power plants fulfilling regular safety and security requirements	**Niches:** - Increasing renewable energy will increase security of supply - Wind power as an area of Arctic energy expertise but security not discussed - In planning offshore wind farms, needs of the Defence Forces need to be considered	**Niches:** - No attention on energy niches in security documents - Increasing renewable energy will increase security of supply, especially when using demand flexibility and power-to-x
Scotland	Landscape: - Russia-UK gas dispute, using energy as a political lever; stable EU-Russia energy relations, but risk of supply disruptions; Russia raising energy as a foreign policy priority - Nuclear safety (only for Scotland) - Stability of energy source and transit countries - Climate change - Increasing global demand for energy influenced by population growth and urbanisation - Breakdown of the rules-based international system - China as growing world power - Economic crisis - Crime in Marine areas/piracy - Cyber security - Disruptions to oil and gas supplies	**Landscape pressures:** - Russia's actions on Europe's Eastern neighbourhood and the EU's energy dependence on Russia - Increasing global demand for energy globally, with volatile prices - regional disputes, instability, terrorism - Technological development - Globalisation, resource competition, population growth - Climate change - Increasing global use of seas and crime in marine areas (e.g. piracy) - Developments in the Arctic region Nuclear proliferation - Emerging markets - Disruption to oil and gas supplies	**Landscape pressures:** - Cyber attacks - Climate change - Global pandemics and antimicrobial resistance - Nuclear & chemical weapons - *(Rather little attention to landscape pressures in connection to energy in security policy documents)*

(*continued on next page*)

(*continued*)

2006–2010	2011–2015	2016–2020
Niches:	**Niches:**	**Niches:**
- No attention on energy niches in security documents - Renewable energy "far more robust" for energy security - Also, carbon capture and storage (CCS) seen to improve energy security	- No attention on energy niches in security documents - Electric vehicles have implications on energy security, e.g. increased demand on the grid and opportunities to balance variations in electricity demand. - Scotland's contribution to UK's renewable generation provide greater energy diversity to meet the challenges of energy security - CCS will allow fossil fuels to contribute security of supply	- No attention on energy niches in security documents - New technologies (e.g. electric vehicles, heat pumps, and new generation) are part of the Scottish vision which includes cyber security as a new specialism - Offshore wind generation and grid infrastructure projects may have cross-border effects on security of supply in the North Sea area

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