KOVIS:
Towards a Triple Benefit

Public Investment for Comprehensive Security, Competitiveness and the Green Transition in Finland

A strategic pre-study

The Solutions Group (*Ratkaisuryhmä*)

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Abstract

This strategic pre-study asks which Finnish security-of-supply vulnerabilities can be reduced through defence and security-of-supply procurement while also strengthening industrial competitiveness and advancing the green transition in 2026–2035. It assesses domestic capabilities in energy, chemicals, materials and digital, treating import dependence as a capability gap only where a critical function remains materially exposed once stocks, substitution and diversification are taken into account. The assessment indicates that the green transition changes Finland's dependency profile: reduced reliance on imported fossil fuels can be accompanied by greater dependence on equipment, specialised materials and processing capability, in which Finland has existing strengths to build on. Six cross-sector investment areas are assessed through two lenses, strategic investment potential and the case for public intervention. Four representative case studies examine different capability problems and intervention pathways, including an exploratory circular-material case. The assessment identifies mechanisms through which the three objectives could reinforce one another. For the interventions examined, opportunities appear most readily actionable in security-of-supply procurement under general rules and selected dual-use applications. It identifies two spearheads that can be prepared now, a shared hydrogen and captured-carbon feedstock platform and reserve and surge capacity for critical electricity equipment, with secondary aluminium as a promising candidate. Across these pathways, matching the instrument to the barrier that constrains the capability could enable the same public intervention to advance security, competitiveness and the green transition together.

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Summary

Finland faces three connected challenges during 2026–2035: strengthening defence and security of supply, renewing industrial competitiveness, and advancing the green transition towards carbon neutrality by 2035. These draw on overlapping capabilities, infrastructure and investment resources. This study examines where procurement and other public instruments could reduce specific security-of-supply vulnerabilities while strengthening competitiveness and supporting the transition.

The study assesses energy, chemicals, materials and digital. Food and water, health, finance and payments, and transport and logistics are outside its scope, not judged less vulnerable. Import dependence constitutes a capability gap only where a critical function remains materially exposed under disruption after existing mitigation. Capability concerns inform six investment areas, assessed through two separate lenses; four case studies examine intervention pathways. The scoring is qualitative and not yet calibrated.

Key findings

- **Combined benefits depend on reinforcing mechanisms.** Securing grid equipment can strengthen electricity-system resilience while enabling electrification. Domestic hydrogen and captured carbon could substitute selected imported fossil feedstocks while supporting industrial renewal.
- **The green transition changes Finland's dependency profile.** Reduced reliance on imported fossil fuels can be accompanied by greater dependence on grid equipment, specialised materials, processing capability and semiconductors.
- **Budget size alone does not determine combined benefits.** For the interventions examined, opportunities appear most readily actionable in security-of-supply procurement under general rules and selected dual-use applications. This does not establish a general ranking of civilian and military procurement.
- **The instrument follows the barrier, not the sector.** Bankable offtake, unremunerated reserve capacity and material-loop coordination call for different instruments. Accessing European and allied financing also requires dedicated preparation and coordination capacity.

Where to focus

- **Domestic molecules:** A shared hydrogen and captured-carbon feedstock platform could substitute selected imported fossil feedstocks. Working objectives for preparation are 50–100 kt H_2/year of committed anchor demand and approximately 0.1 Mt CO_2/year of qualified captured-carbon supply by 2035. These are initial scales, not validated investment thresholds or estimates of critical demand.
- **Critical electricity equipment:** Reserves and contracted repair, procurement and production capacity would allow Finland to restore a defined share of its critical grid infrastructure within an agreed period while grid expansion continues. This is also the clearest dual-use case.
- **Secondary aluminium:** Domestic recovery capacity could supply a defined share of strategically relevant aluminium demand. It is a promising candidate, but the evidence does not yet support treating it as a spearhead.

What to do first

1. Establish which procurement regime applies to each spearhead, and who the buyer is.
2. Commission a restoration-capability assessment for critical electricity equipment.
3. Test bankable demand for the hydrogen and captured-carbon platform with identified anchor buyers.
4. Designate responsibility for preparing European and allied co-financing.

Mechanisms and further preparation

Preparation should match instruments to barriers and contracts to market conditions, coordinate civil and defence demand where appropriate, develop European funding pathways early, and tie environmental criteria to lifecycle performance and certification. Before deployment, the priorities require calibration, critical uses and residual disruption exposure must be established, and case-specific uncertainties resolved. Further work should also assess the defence sector's own transition-driven dependencies.

Chapter 1

Introduction

Finland is entering a period in which three strategic pressures converge: the need to strengthen defence and security of supply, renew industrial competitiveness, and advance the green transition. These pressures are distinct, but they act on overlapping industrial, technological and infrastructural capabilities.

The first pressure concerns security. Finland's defence-spending trajectory and wider preparedness obligations create sustained requirements for military capability, critical infrastructure and continuity of essential production. The agreed trajectory towards NATO's 5% of Gross Domestic Product (GDP) defence-spending target implies sustained growth in defence- and security-related expenditure. The target comprises 3.5% on core defence and a 1.5% component covering broader security-related spending. In May 2026, the Ministerial Committee on Economic Policy outlined that the latter was already estimated at 2.4% of GDP in 2026 in Finland [1], alongside the preparedness obligations that underpin Finland's security of supply [2].

The second concerns competitiveness: industrial renewal requires investment in productivity, innovation and capabilities that can sustain internationally competitive economic activity [3]. The third concerns the green transition. Meeting Finland's 2035 carbon-neutrality objective requires continued development of the electricity system and conversion of industrial processes, feedstocks and transport [4].

The question is therefore not only how Finland should respond to each pressure separately, but where particular investments can advance these objectives together, and where trade-offs remain.

Appendix C provides an overview of the scale, composition and recent development of Finland's defence spending. It distinguishes state-budget appropriations from SIPRI's military expenditure series. Neither measure identifies the total expenditure relevant to comprehensive security or the value of procurement governed by the defence and security procurement act.

The convergence of multiple simultaneous pressures has produced a new policy expectation: that increased security-related investment can simultaneously strengthen industrial competitiveness and support decarbonisation, and that public spending driven by one objective can be directed so as to serve the others. The expectation is visible in Finnish industrial argument [5], in the parliamentary assessment of defence resource needs in the 2030s [6], and at European level in instruments that explicitly join competitiveness and decarbonisation to security of

supply [7]. It is a plausible expectation but not an automatic one. Investment that serves one objective may be neutral towards the others, or may advance one at the expense of another, and an expectation asserted at the level of national strategy says little about which specific investments would realise it.

Therefore, this study asks which Finnish security-of-supply vulnerabilities can be most effectively reduced through defence and security-of-supply procurement while simultaneously strengthening competitiveness and supporting the green transition. The question is deliberately narrower than a general case for domestic capacity. It asks where the three objectives genuinely reinforce one another — where progress towards one enables progress towards another rather than merely accompanying it — and which public instruments could realistically act on those opportunities during the period 2026–2035.

This study takes as its starting point the Confederation of Finnish Industries (EK) and Teknologiateollisuus report *Kasvua kriisinkestävyydestä* [5], which argues that crisis resilience can be a source of economic growth and identifies logistics, energy, materials and critical value chains as holding significant investment and competitiveness opportunities. Much of the sector-level evidence assembled there informs Chapter 4, where it is examined through the capability-based framework developed in this study.

That argument raises the conversion question, which this study sets out to answer: in which categories of defence and security-of-supply procurement those opportunities can be turned into actual procurement demand, and on what terms green-transition objectives can be reconciled with capability and security requirements.

This study complements it in four respects. It confines the scope specifically to defence and security-of-supply procurement rather than to resilience-related investment in general. It treats environmental sustainability as more than a competitiveness factor, since the transition also changes which capabilities become critical. It identifies the mechanisms through which public demand can be converted into a market-steering signal, and the conditions under which it cannot. Furthermore, it examines how security requirements, restricted procurement procedures and European and allied funding pathways affect feasibility.

Recent work by the Finnish Institute of International Affairs and the National Emergency Supply Agency examines how climate change, the energy transition and geopolitical disruption interact to affect Finland's security of supply. It highlights cascading risks and transition-related dependencies, including those involving critical raw materials [8]. KOVIS addresses a complementary question: under what conditions can procurement and public investment strengthen the capabilities needed to manage such vulnerabilities while also supporting competitiveness and the green transition?

The study covers four sectors: energy, chemicals, materials and digital. Food and water, health, finance and payments, and transport and logistics are outside its scope. Dependencies running through them appear only where they bear on the four sectors assessed, and their exclusion reflects the scope set for this study, not a judgement that their vulnerabilities are less severe.

Answering this question required three analytical decisions that shape the report. The first decision concerns what counts as a problem. Import dependence is not treated as a capability gap in itself: a gap requires a critical societal function, a relevant domestic capability, and a material deficiency under disruption

once stocks, substitution, diversified supply and other mitigating arrangements are taken into account. Finland's economic openness makes diversification and integration with trusted partners a complement to domestic capacity rather than a substitute for it [9], and the analysis proceeds accordingly. The second decision concerns the direction of the analysis. Within the four selected sectors, the study begins from evidence about domestic capabilities rather than from predefined technologies or policy instruments. It identifies capability concerns, assesses whether they constitute material gaps, synthesises recurring patterns across sectors, and only then considers investment areas and instruments. Finally, the third decision concerns how strategic value and public intervention are assessed. These are evaluated through two separate lenses — the strategic investment case, and the case for public intervention specifically — which are deliberately not combined, since an area may be strategically valuable without public intervention adding anything, and may warrant intervention without ranking highest overall. Figure 1.1 outlines the system studied.

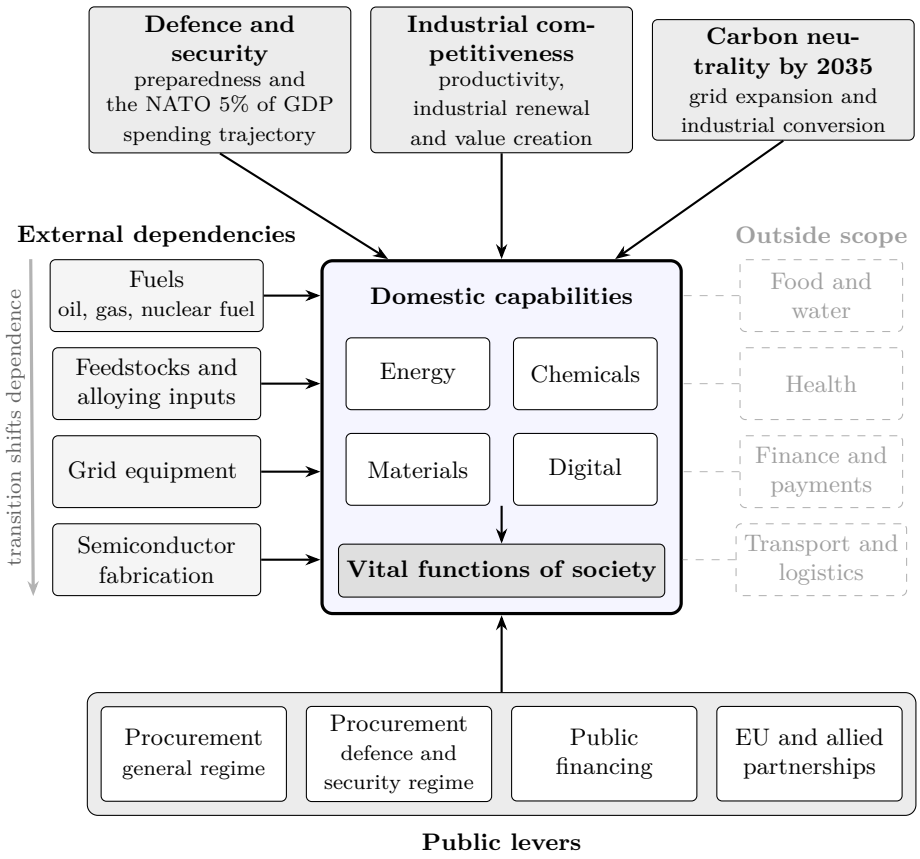


Figure 1.1: Domestic capabilities, external dependencies and public policy levers. The diagram defines the system studied: domestic capabilities in energy, chemicals, materials and digital technologies support the vital functions of society. It shows the external dependencies of these capabilities, the three strategic pressures acting on them and the public levers available. Sectors outside the study's scope are shown to indicate their connections to the assessed system.

The study does not appraise individual technologies or projects; its case studies illustrate plausible implementation pathways rather than provide investment-grade assessments. It does not rank sectors against one another, nor does it propose that Finland pursue self-sufficiency in any of the areas examined. It quantifies neither emissions effects nor fiscal costs. And its prioritisation is qualitative and semi-quantitative: the scoring supports judgement traceable to the underlying evidence rather than replacing it. The study was commissioned by the Solutions Group (*Ratkaisuryhmä*), a cross-sectoral and multidisciplinary group convened by Aalto University and the University of Helsinki, bringing together researchers, cities, companies, startups, ministries, foundations and funders. The research was carried out by Aalto University and the University of Helsinki. The study was funded by the National Emergency Supply Agency. The analysis and conclusions are those of the authors and do not necessarily represent the views of the funder or of the organisations participating in the Solutions Group. The analysis presented here rests on documentary evidence: national and European policy documents, sectoral and security-of-supply assessments, statistical and market data, and academic literature. In parallel with this study, Demos Helsinki has conducted and analysed 10 expert interviews. The policy recommendations developed separately from this report draw on its findings, these interviews and the policy authors' analysis. The interviews do not form part of the evidence base assessed in this report.

The report proceeds as follows. Chapter 2 sets out the policy and regulatory framework within which Finnish investment decisions in this area are taken. Chapter 3 describes the analytical framework, including the capability-gap logic and the two assessment lenses. Chapter 4 assesses domestic capabilities and identifies capability gaps across energy, chemicals, materials and digital, and synthesises the patterns recurring between them. Chapter 5 clusters those patterns into cross-sector investment areas and prioritises them. Chapter 6 examines how procurement, financing and strategic partnerships act on capability development, and matches instruments to the barriers they address. Chapter 7 develops four case studies that translate the assessment into concrete intervention pathways. Chapter 8 sets out recommendations, and Chapter 9 sums up the main conclusion of this study.

Chapter 2

Policy and regulatory framework

The assessment of strategically important investment areas is grounded in Finland's existing policy and regulatory framework. National strategies, parliamentary reports and legislative developments increasingly connect national security and resilience, economic competitiveness, technological capability and the green transition, providing a basis for evaluating investments by their contribution to national resilience and strategic capabilities as well as by their direct economic or environmental effects.

Two frameworks anchor this perspective. The Security Strategy for Society defines the vital functions of society and treats the continuity of economic activity, critical infrastructure, services and production capabilities as integral to comprehensive security [10]. The security-of-supply framework sharpens this into an economic and industrial lens: security of supply depends on functioning markets, diversified production and supply chains, critical infrastructure and the ability of Finnish society to withstand disruptions [2]. Together, these establish domestic capabilities, infrastructure and supply chains as elements of both economic activity and national resilience, and raise the question of how strategically important domestic capabilities carry societal value exceeding what individual firms can capture.

The institutional and statutory basis is provided by the Act on Safeguarding Security of Supply and on the National Emergency Supply Agency (107/2026), which entered into force on 1 April 2026. The Act assigns security-of-supply responsibility to each ministry within its remit and coordination to the Ministry of Economic Affairs and Employment. It defines the tasks of the National Emergency Supply Agency, including safeguarding critical infrastructure and essential supplies. Section 13 authorises production-reservation and performance-capacity reservation contracts, although the reserved arrangements may be activated only during serious disruptions in normal conditions or emergency conditions. Sections 14 and 18 govern the financing role of the security-of-supply fund and the conditions for support. These provisions offer existing routes for examining the interventions proposed here; they do not establish eligibility or funding for a particular project [11].

The defence-policy framework complements this view. The parliamentary working group's report on *Development and Resource Needs of National Defence in the 2030s* emphasises the long-term development of Finland's defence capabilities, highlighting technological development, industrial capacity and infrastructure, par-

ticularly where civilian and defence-related capabilities overlap [6]. At the level of materiel policy, the Ministry of Defence identifies the ability to integrate, maintain and repair critical systems domestically as a core objective of military security of supply, to be achieved partly through partnerships with domestic industry [12] — an objective that concerns industrial and maintenance capability rather than the acquisition of equipment alone. This overlap between civilian and defence capability is shaped further by Finland's export control regime for dual-use items — goods, software and technologies serving both civilian and military applications — governed jointly by EU Regulation 2021/821 and national export-authorisation procedures administered by the Ministry for Foreign Affairs [13]. Because the same underlying technologies increasingly serve civilian and defence markets simultaneously, this regime is directly relevant to investment areas that build dual-use capabilities.

This framework is now underpinned by concrete spending commitments. At the 2025 NATO Summit in The Hague, Allies agreed to raise defence-related spending to 5 % of GDP annually by 2035, comprising at least 3.5% on core defence requirements and up to 1.5% on broader defence- and security-related spending. For Finland, the Ministerial Committee on Economic Policy already estimated the 1.5% component at 2.4% of GDP in 2026, exceeding the target nearly a decade ahead of schedule [1]. The parliamentary working group calls for stronger investment in defence technology, research, development and innovation [6]. These commitments strengthen the policy context for long-term capability development, particularly where civilian and defence capabilities overlap. Whether they generate additional demand for the investment areas assessed here depends on identified buyers, funded requirements and procurement arrangements.

This picture is shaped further by Finland's economic openness, which brings efficiency and growth benefits but also creates exposure to disruptions in cross-border flows, supply chains and strategic technologies. Kristeri et al. emphasise that the appropriate response is not comprehensive self-sufficiency but a combination of capacity building, diversification, friend-shoring and stronger integration with trusted economic partners [9, pp. 4–8, 17–18]. This framing runs through the study's later analytical approach: the relevant question is not whether an investment increases domestic production as such, but whether strengthening Finnish, European or allied capabilities can simultaneously generate economic value and reduce strategically significant vulnerabilities.

The industrial, research and innovation, and energy and climate frameworks add the economic and environmental dimensions. Industrial policy emphasises productivity, investment and internationally competitive industrial ecosystems [3], while Finnish RDI policy seeks to strengthen knowledge, skills and productivity through increased research and development investment, with national research and development (R&D) expenditure targeted at 4% of GDP by 2030 [14]. The green transition constitutes the third of these policy strands. With Finnish electricity generation already largely free of fossil fuels [15], advancing towards the 2035 carbon-neutrality objective [4] requires the conversion of remaining fossil-based end uses alongside sufficient low-carbon generation, network capacity and flexibility to serve a growing electrified load. That conversion is uneven — district heating is well advanced [16], while industrial process heat, chemical and metallurgical feedstocks, and heavy road, maritime and air transport are not. The investment requirement is therefore concentrated in the same infrastructure and industrial capabilities that

the security-of-supply and competitiveness objectives concern. This is what makes the three strands analytically connected rather than merely concurrent: decarbonisation changes which capabilities a resilient system requires, and the capabilities it requires are largely those that also determine industrial capacity.

The same convergence is visible at European level, where the policy environment is shifting towards competitiveness and security alongside decarbonisation rather than away from it [17, pp. 7–9]. The Green Deal Industrial Plan addresses the scaling of net-zero manufacturing capacity within the Union together with access to finance, skills and raw materials [18], and the Clean Industrial Deal is framed explicitly as a joint roadmap for competitiveness and decarbonisation, covering energy costs, lead markets for low-carbon products, circularity and access to critical materials [7]. In parallel, the European Defence Industrial Strategy [19] and the White Paper for European Defence — Readiness 2030 [20] address defence-industrial capacity, joint procurement and security of supply for defence. Taken together, these instruments treat industrial capability as the common object of decarbonisation, competitiveness and security policy, and they define the European funding and regulatory environment within which Finnish investment decisions will be made.

Finally, the public procurement framework offers a direct mechanism through which public authorities can shape the development and availability of strategically important capabilities. Procurement decisions can create demand for innovative solutions and incorporate security-of-supply and security considerations alongside economic, environmental and social objectives [21]. Procurement in the fields of defence and security is nonetheless governed by a separate regime, established by Directive 2009/81/EC and transposed in Finland by the Act on Public Procurement in the Fields of Defence and Security [22, 23]. That regime contains specific provisions on security of information and security of supply. Its implications for contract design and the visibility of public demand are examined in Chapter 6 on procurement and financing.

These frameworks establish four considerations for assessing investment areas: **security and resilience; economic competitiveness and industrial capability; the green transition; and the potential role of public intervention.** They need not be pursued independently — in some investment areas, strengthening a single capability can simultaneously reduce strategic dependencies, strengthen Finnish industrial competitiveness and accelerate the green transition. Identifying such synergies, and where public intervention can add value, forms the basis of the analytical framework set out in Chapter 3.

Chapter 3

Methodology

3.1 Research approach

This study adopts an evidence-based approach to identify opportunities for strengthening Finland's security of supply through investments in domestic capabilities. Rather than beginning from predefined technologies or policy instruments, the analysis starts by examining the current structure of selected sectors and identifying capability gaps that may reduce the resilience of essential societal functions.

Security of supply is interpreted as the ability of society to maintain the continuous availability of critical goods and services despite external disruptions. The assessment therefore focuses on the domestic capabilities that support this objective, rather than on individual technologies or commodities.

The methodology follows a bottom-up analytical process: evidence is collected from authoritative sources and translated into capability assessments; these are used to identify capability gaps, which are synthesised across sectors to reveal recurring patterns; only then are investment areas and procurement opportunities considered. This sequence keeps recommendations traceable to the underlying evidence and avoids introducing solutions before capability needs have been established.

The sectoral assessment draws substantially on the EK and Teknologiateollisuus report [5], complemented by the sources recorded in Appendix B. The inventory organises this evidence around domestic capabilities, external dependencies and critical functions. Its coverage defines the basis for identifying investment areas and preparation priorities; it does not provide a comprehensive ranking of national security-of-supply vulnerabilities.

3.2 Analytical framework

The analytical framework distinguishes between evidence, capability assessment and capability gaps. The overall analytical sequence is presented in Figure 3.1.

Evidence consists of factual observations describing each sector's characteristics, including domestic production, infrastructure, strategic reserves, and import/export relationships. Based on this evidence, the domestic **capabilities** supporting security of supply are assessed – understood as the ability to provide, operate, maintain or restore functions essential for the continuous availability of critical

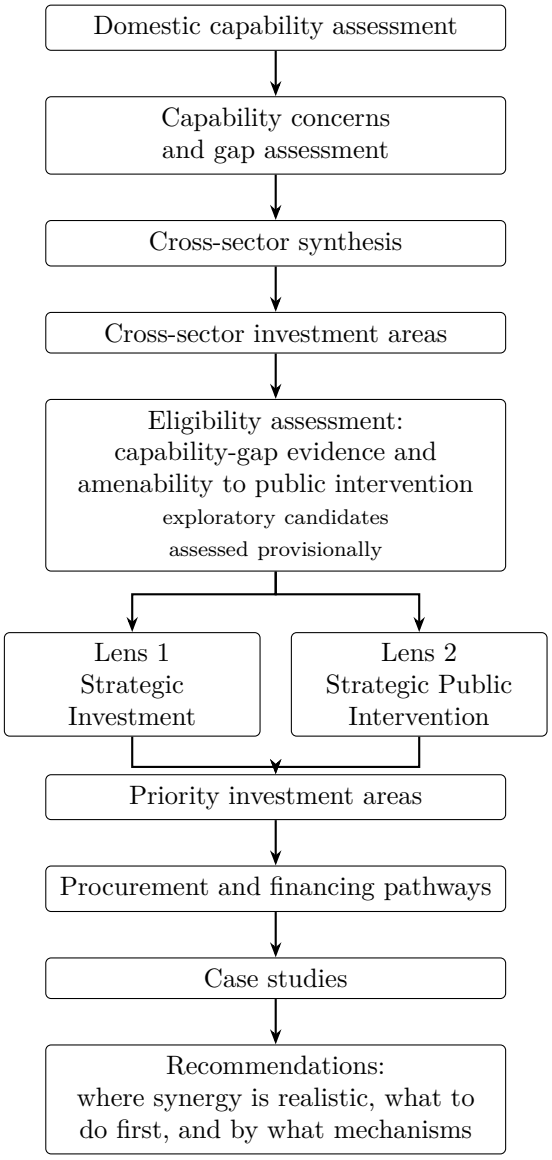


Figure 3.1: Analytical framework for identifying and prioritising investment areas for strengthening Finland's security of supply. The two lenses inform the prioritisation but are not combined into a single score.

goods or services.

Capability gaps are not directly observed in the evidence; they are analytical conclusions derived from the capability assessment. For example, complete dependence on imported raw materials indicates limited domestic production capability, while reliance on a single critical facility indicates concentration. Whether either constitutes a capability gap depends on the critical function supported and the residual exposure after existing mitigation. Maintaining this distinction between evidence and conclusion improves the transparency and reproducibility of the assessment.

The green transition enters the analysis in two distinct ways, which are kept separate throughout. First, it acts as a driver that changes capability requirements over time: decarbonisation alters which functions are critical, which inputs they depend on and which dependencies grow in significance, and this is assessed as part of the capability analysis in Chapter 4. Second, it is an outcome dimension within the Strategic Investment Lens, where investment areas are assessed for their contribution to the transition. The first is evidence about capability requirements; the second is a judgement about strategic value. Keeping them distinct avoids an assessment in which an area scores highly on the green dimension because the transition was used to establish the capability gap in the first place.

3.3 Capability assessment process

The capability assessment is performed separately for each sector using a common analytical structure, collecting information on:

- domestic production and industrial capability;
- import and export dependencies;
- critical infrastructure;
- storage and strategic reserves;
- supporting logistics and supply chains; and
- critical societal functions.

Particular attention is given to external dependencies – foreign suppliers, cross-border infrastructure, imported industrial components and international transport routes – since these may affect continuity of supply during external disruptions. The resulting assessment identifies domestic capabilities that are well established, those that are limited, and those that represent significant capability gaps.

For digital capabilities, assessing residual exposure requires attention to service continuity as well as access to physical equipment. Relevant considerations include jurisdiction, supplier remote access, software updates and licensing, portability, and the ability to operate, maintain or restore systems without the original supplier. These dimensions are not assessed systematically in the present inventory, whose digital evidence concerns selected semiconductor value-chain stages. The findings therefore do not constitute a comprehensive assessment of digital security of supply.

3.4 Cross-sector analysis

Each sector is assessed independently using the same methodology, ensuring consistency across the assessments and supporting the identification of recurring capability gaps that are not visible when sectors are analysed in isolation. The purpose

is not to compare sectors directly but to identify common structural weaknesses affecting Finland's security of supply – capability themes that may be addressed through investments strengthening multiple sectors simultaneously.

3.5 From capability gaps to procurement opportunities

Recurring capability concerns and identified gaps are synthesised into investment areas: domestic capability domains through which specific security-of-supply vulnerabilities could be addressed. Investment areas therefore correspond not to individual technologies or sectors, but to broader strategic capability-building priorities derived from recurring evidence across sectors.

The assessment then proceeds through two analytical lenses: the **Strategic Investment Lens** (Lens 1), assessing the overall strategic potential of each investment area, and the **Strategic Public Intervention Lens** (Lens 2), assessing whether and how public intervention could generate additional value. The two lenses are applied in parallel to the same investment areas rather than in sequence – Lens 2 does not build on or depend on a prior Lens 1 result, and the two are never combined into a single score. Table 3.1 summarises these criteria and how each is applied in the assessment that follows.

Table 3.1: Overview of the two-lens analytical framework

Lens 1 – Strategic Investment Opportunities *Where are the strongest strategic investment opportunities?*	**Lens 2 – Strategic Public Intervention Opportunities** *Where and how could public intervention generate additional value?*
Economic and Industrial Potential	Strategic Synergy
System Transformation Potential	EU Strategic Opportunity
Green Transition Contribution	Public Intervention Additionality
Strategic Domestic Capability Development	Instrument Suitability

3.5.1 Lens 1: Strategic Investment Opportunities

Security-of-supply relevance and amenability to public intervention guide eligibility. Exploratory candidates may also be scored provisionally, as identified in Chapter 5, but their scores neither validate a capability gap nor establish a case for intervention. The Strategic Investment Lens assesses four dimensions:

Economic and Industrial Potential the extent to which an investment area can generate economic growth, strengthen value chains and support the competitiveness of Finnish firms and markets.

System Transformation Potential whether an investment area enables structural change extending beyond individual firms or technologies to affect multiple critical systems.

Green Transition Contribution the extent to which an investment area contributes to decarbonisation, resource efficiency and Finland's broader energy and climate transition objectives.

Strategic Domestic Capability Development whether an investment area builds or strengthens a nationally significant domestic capability base with lasting strategic value.

Each dimension is assessed on a five-point scale (Table A.1, Appendix A), with higher scores indicating greater expected strategic benefit; the assessment concerns the investment area as a capability domain rather than individual technologies or projects. Unlike the Lens 2 dimensions, which are kept separate to preserve distinct intervention logics, the Lens 1 dimensions are combined into a total score, reflecting the assumption that strong performance across economic, systemic, environmental and capability dimensions jointly indicates greater overall strategic investment potential.

3.5.2 Lens 2: Strategic Public Intervention Opportunities

The second lens assesses, independently of Lens 1, whether an investment area's strategic potential is matched by a distinctive opportunity for public intervention. The four dimensions below (Table A.2, Appendix A) use qualitative five-point scales and are *not* combined into an aggregate score, since each captures a different intervention logic:

Strategic Synergy whether security, competitiveness and green-transition objectives reinforce one another – not merely whether benefits are present in several dimensions, but whether progress in one enables progress in another.

EU Strategic Opportunity whether European cooperation, strategic partnerships, joint investment or procurement, value-chain integration or EU-level financing can materially increase the strategic or economic value of an investment for Finland.

Public Intervention Additionality whether market forces alone are likely to provide the capability at the socially desirable level. Strategic importance alone is not sufficient: a credible rationale is required for why private incentives or existing market structures may be insufficient. Research on New Deal programmes similarly finds substantial variation in the effects of different forms of spending, lending and relief, supporting an assessment against the counterfactual market outcome rather than strategic importance alone [24, 25].

Instrument Suitability whether public procurement or public investment are appropriate responses to the identified barrier – a strong case for intervention does not automatically imply that procurement is the right instrument. Instrument suitability is assessed here against the barrier rather than against the legal framework governing a particular procurement. Where a capability falls within the defence and security procurement regime, that framework

determines how a suitable instrument must be structured and how far its market effects extend; this is examined in Chapter 6 on procurement and financing.

Strategic partnerships are treated as a cross-cutting mechanism rather than a separate scoring dimension, relevant where cooperation with European or other trusted partners can provide scale, technology, infrastructure, financing, market access or complementary capabilities that would be difficult or inefficient to develop nationally.

This structure separates the strategic value of an investment area from the case for public intervention in it: a high Lens 1 score does not automatically imply a high Lens 2 score, and an area with more moderate overall investment potential may still warrant targeted intervention where market failures, security externalities or coordination problems are significant. The full qualitative scoring criteria for both lenses are reproduced in Appendix A (Tables A.1 and A.2).

3.6 Representative case studies

Representative case studies examine selected capability concerns and intervention pathways, including an exploratory circular-material case. Their selection reflects both the strategic assessment and the opportunity to examine different capability problems and public instruments; it does not determine or revise the prioritisation outcome. Each case starts from a capability concern and examines whether and how a specific intervention could strengthen the relevant capability.

The analysis considers the scale of the intervention, the capabilities and infrastructure required, the relevant demand or market conditions, and the constraints that currently prevent the capability from developing autonomously. Where relevant, it distinguishes between the scale required for an individual project to become viable, the scale required to support shared infrastructure or a wider market, and the point at which subsequent investment could proceed increasingly on commercial terms.

The objective is to identify a concrete and measurable intervention proposition: the minimum or sufficient combination of capacity, infrastructure and committed demand that public action could help establish in order to trigger further capability development. The resulting pathway is assessed according to its contribution to security of supply, economic value and the green transition. Procurement, financing and other public instruments are then considered in relation to the specific bottleneck identified by the case.

The case studies are not intended to constitute project-level feasibility studies. Where the available evidence does not support a precise threshold, they explore plausible intervention ranges rather than establish validated investment thresholds.

Chapter 4

Domestic capability assessment

This chapter assesses Finland's domestic capabilities relevant to security of supply and identifies material capability gaps that may constrain critical functions under disruption. It draws on the detailed capability inventory in Appendix B, which maps the available evidence to domestic capabilities, external dependencies, critical functions and capability gaps; this chapter presents the principal findings emerging from it.

The inventory distinguishes evidence about domestic capabilities and external dependencies from conclusions about material capability gaps. Findings differ in evidential maturity: some identify specific capability deficiencies, while others establish dependencies whose residual exposure under disruption requires further assessment. A validated capability gap requires a critical function, a relevant domestic capability and a material deficiency after stocks, substitution, diversification and other mitigating arrangements are considered. The sector sections present these findings and their qualifications; the cross-sector synthesis identifies recurring structures informing the investment areas in Chapter 5. Four sectors are covered: Energy, Chemicals, Materials and Digital.

4.1 Energy

Finland has substantial domestic capabilities across the energy system — electricity generation and system operation, nuclear power, oil refining, district heating and energy infrastructure development — but these do not extend across all stages of the supply chains on which they depend. The relevant vulnerabilities concern specific external dependencies and the ability of the domestic system to maintain critical functions when access to inputs, infrastructure or equipment is constrained.

A first vulnerability concerns externally supplied energy inputs. Finland has no domestic crude oil, natural gas or coal production, and nuclear electricity generation relies on internationally supplied fuel assemblies [26, 27, 28, 29]. The significance of these dependencies differs by function: oil remains particularly important for transport and logistics, natural gas is used more selectively in industry and energy production, and nuclear fuel represents a different type of dependency in which a large domestic generation capability relies on an externally supplied input. Strategic

stocks, fuel inventories, domestic refining and generation capabilities and alternative energy sources partly mitigate these dependencies. The capability concern therefore arises where a critical domestic function remains materially dependent on continued access to an external supply chain, not from import dependence as such.

A second vulnerability concerns cross-border electricity infrastructure. Interconnections with neighbouring countries form an established part of normal system operation and provide important supply and balancing capacity [26]. Hourly exchange data for 2024 and 2025 indicate that Finland's annual net import position does not fully capture their importance: although annual net imports represent a relatively limited share of total consumption, imports can account for a substantially larger share of demand during individual periods [15]. The capability issue is therefore not electricity imports as such, but the resilience of the domestic system if cross-border capacity becomes constrained during periods when it contributes significantly to adequacy and balancing.

A third capability gap concerns the equipment required to maintain and expand electricity infrastructure. Finland has established capabilities in electricity-system engineering, infrastructure development and system operation, but the electricity transition is increasing the requirement for transmission and other critical grid equipment. Transformers, switchgear and transmission equipment are identified as particularly important components whose availability is relevant to security of supply [5]. The concern is not whether individual components are imported under normal market conditions, but whether sufficient access can be maintained when supply chains are disrupted or when infrastructure investment requirements increase rapidly.

These changes are driven substantially by decarbonisation. Finland's carbon-neutrality objective for 2035 [4] implies continued electrification of transport, heating and industrial processes together with the renewable generation capacity required to supply it, increasing the importance of generation, transmission, distribution, flexibility and storage capabilities. The capability consequence is a shift in the composition of energy-related dependencies: reduced reliance on imported fossil fuels is accompanied by increased reliance on the equipment, components and system capabilities required to build and maintain an expanded electricity system. This does not imply that all emerging flexibility or storage requirements constitute existing capability gaps; rather, the relevant question over the period considered here is whether the capability to expand and maintain electricity infrastructure keeps pace with the rate at which electrification transfers critical functions onto it.

4.2 Chemicals

Finland has established capabilities across parts of the chemical sector, including chemical manufacturing, petrochemical processing and the production of selected industrial inputs, but not across all chemical products and upstream inputs required by the value chains that depend on them.

A first capability concern relates to limited domestic production and substantial import dependence for selected chemical products. Methanol is not produced domestically and approximately 70 kt is imported annually; aromatic compounds are likewise not produced locally, with approximately 130 kt imported from Central Europe; and caustic soda shows substantial net imports against very limited domestic production [5]. Domestic chemical-sector capability is therefore uneven

across the value chain: Finland has established chemical manufacturing capabilities but not domestic production capability for all chemical inputs required by industrial activities. The concern is the ability to maintain supply of selected products when external supply is disrupted, rather than a general lack of domestic chemical production. The reviewed evidence establishes these production and import dependencies more directly than their residual exposure after stocks, substitution and diversified sourcing. Their material security-of-supply significance therefore requires input-specific assessment.

A second capability concern relates to the dependence of domestic petrochemical processing on imported upstream feedstocks. Finland has established petrochemical processing capabilities, particularly at Kilpilahti, but the value chain depends on imported chemicals and feedstocks [5]. Here domestic processing capability exists while its continued operation depends on externally supplied inputs. The significance extends downstream: petrochemical products and intermediates are used in plastics and other products required for food packaging, equipment, vehicles and construction, including pipes and cables [5]. The concern is therefore not the continuity of petrochemical production as an industrial activity, but the ability to maintain downstream material supply when access to upstream feedstocks is constrained. Here too, the material exposure of particular downstream functions requires assessment against existing stocks, substitution options and diversified supply.

4.3 Materials

Finland has substantial domestic capabilities across several parts of the materials and metals value chains, including mining, ferrochrome production, steelmaking, zinc processing and metal recycling, but not across all stages of the value chains on which those activities depend. The relevant vulnerabilities concern selected externally supplied inputs and missing stages of strategically relevant value chains.

A first capability gap concerns the dependence of domestic metals production on selected externally supplied alloying and specialty inputs. Finland has substantial steel-production capability, including conventional and specialty steel products, but selected alloying materials and intermediate inputs required for particular grades remain externally dependent [5]. Domestic downstream capability exists, while its ability to produce selected materials may depend on continued access to specific upstream inputs. Where those inputs are difficult to substitute and are required for strategically relevant grades or applications, disruption of external supply could constrain otherwise established production capabilities. The concern relates to the resilience of the domestic production chain rather than to import dependence for metals in general.

A further capability concern relates to the limited domestic coverage of the aluminium value chain. Finland has domestic aluminium recycling and downstream processing capabilities, while primary production and parts of the higher-value product chain depend on external supply [5]. This does not by itself establish a material security-of-supply gap. Its significance depends on which products support critical functions, the consequences of disrupted supply, and the availability of stocks, substitutes and diversified sources. The secondary aluminium case therefore examines whether a circular pathway could address a strategically relevant exposure.

4.4 Digital

Finland has substantial capabilities across several parts of the digital and ICT ecosystem, including telecommunications, digital infrastructure, semiconductor design and research, silicon-wafer production and pilot-scale semiconductor manufacturing. The assessment focuses on the depth and resilience of the semiconductor value chain, rather than on digital capability as a whole.

The capability concern relates to access to commercial-scale semiconductor fabrication and downstream processing. Finland has established capabilities in design and research, silicon-wafer production and pilot-line manufacturing, but high-volume device fabrication and downstream packaging, assembly and testing are not established at significant domestic scale [5]. Given the role of semiconductors as enabling inputs across telecommunications, industrial electronics and other advanced technologies, disruption to external fabrication or downstream processing could constrain the ability to scale strategically important technologies. The absence of domestic high-volume manufacturing is not itself the gap — Finland need not reproduce the entire global value chain domestically, and European and international supply arrangements provide important mitigation — the concern is the resilience of the pathway from domestic design and pilot capability to scalable manufacturing when external supply chains are disrupted.

The digital assessment connects to the energy transition less directly than the other sectors. Semiconductors and power electronics are enabling inputs for the conversion, control and monitoring equipment on which electrified energy systems, industrial processes and transport depend, so the depth of the value chain affects the capability to build and maintain those systems as well as the digital sector itself. This broadens the range of critical functions potentially exposed, but does not establish the materiality of that exposure under disruption.

4.5 Cross-sector synthesis

The sector-level assessment identifies several recurring patterns of capability dependence that extend beyond individual sectors. These matter because security-of-supply vulnerabilities do not necessarily arise from a lack of capability within a single sector: in several cases Finland has substantial capabilities in downstream production, system operation or technology development while remaining dependent on external inputs, equipment or processing stages necessary for those capabilities to function.

A first pattern concerns the dependence of established domestic capabilities on externally supplied upstream inputs, visible in the energy, chemicals and materials assessments, where domestic generation, processing and manufacturing rely on imported fuels, feedstocks, concentrates or intermediate inputs. The gap is not import dependence itself but the inability to fully exercise an otherwise established capability if access to a critical external input is disrupted, and its significance varies with the function supported and the mitigation available.

A second pattern concerns critical equipment required to maintain, replace and expand domestic infrastructure. The energy assessment illustrates it clearly: Finland has substantial capabilities in electricity-system operation, engineering and infrastructure development, but relies on externally supplied equipment and components for parts of the physical infrastructure on which those capabilities depend.

This indicates a distinction between the capability to operate a critical system and the capability to maintain access to the equipment required to sustain it over time.

A third pattern concerns incomplete value chains. Finland possesses capabilities at selected stages of a production or technology chain while depending on external actors for others — evident in Chemicals, where domestic processing depends on imported upstream feedstocks, and in Digital, where design, materials and pilot-production capabilities do not extend to commercial fabrication and downstream processing. The resulting vulnerability concerns the resilience of the overall capability chain rather than the absence of any single domestic activity.

A fourth pattern concerns the effect of the energy transition on the composition of Finland's dependencies: it relocates external dependence rather than removing it, lowering exposure to fuel supply chains while raising the importance of access to equipment, specialised materials and processing capability. In Energy, the declining significance of fuel imports is accompanied by a growing requirement for transmission and other critical grid equipment. In Chemicals, the low-carbon pathways under development for methanol and aromatic compounds would substitute imported fossil feedstocks with domestic electricity, hydrogen and captured carbon, together with the conversion capability required to use them — the capability at issue being not the product but the pathway supplying it, which extends into the energy system. In Materials, decarbonisation raises demand for the alloying and specialty inputs required by electrification technologies and raises the value of material already circulating in the Finnish economy, whose recovery is substantially less energy-intensive than primary production. In Digital, the semiconductor and power-electronics value chain supports the control and conversion equipment on which electrified systems depend. The transition therefore changes which capabilities matter rather than being favourable or unfavourable for resilience: requirements adequate for the present energy system may not be adequate for the system decarbonisation implies, and assessments based only on current dependency profiles will understate what becomes critical over the period considered here.

These changing dependencies should also be considered in combination rather than only within individual supply chains. Recent Finnish security-of-supply research highlights the significance of cascading and interacting climate-related risks [8]. For the present assessment, this means that strengthening a domestic production capability is not sufficient if its operation remains exposed to disruption in electricity, logistics or critical upstream inputs. The relevant unit of assessment is therefore the capability chain and the critical function it supports, rather than the individual facility alone.

Beyond these four patterns, the assessment indicates the potential importance of domestic repair, recovery and circular capabilities as additional resilience mechanisms. These can reduce the consequences of external supply disruptions by extending the life of existing equipment, recovering materials or providing alternative sources of critical inputs, and they relate closely to the fourth pattern, since the relocation of dependencies towards equipment and materials increases the value of being able to maintain and recover both. The evidence supporting them is less uniform across sectors than that supporting the external-input and critical-equipment dependencies. They are therefore treated as areas for further assessment rather than as established cross-sector capability gaps in their own right.

Taken together, the findings indicate that Finland's security of supply depends not only on the presence of domestic production and infrastructure capabilities

but on the depth and resilience of the wider capability chains supporting them. The following chapter clusters these recurring concerns into cross-sector investment areas addressing common underlying capability requirements.

Chapter 5

Cross-sector investment areas and prioritisation

The sector-level assessment in Chapter 4 identifies recurring capability concerns across sectors: dependence on externally supplied inputs, limited access to critical equipment, missing stages in otherwise established value chains, and potential limitations in resilience and recovery capacity. These concerns differ in their evidential maturity. Some are supported by specific capability findings, while others remain candidates requiring further assessment.

This chapter clusters these concerns into six cross-sector investment areas and applies the two-lens framework to assess their strategic potential and the case for public intervention. The assessment identifies promising directions for further preparation rather than investment-ready projects. It also explains the selection of representative cases through which different capability problems and intervention mechanisms are examined.

5.1 From capability gaps to investment areas

Investment areas represent broader capability-building directions through which related security-of-supply vulnerabilities could be addressed. They do not correspond to individual technologies or sectors, nor are they intended to rank sectors against one another. An investment area may combine findings from several sectors where the underlying capability requirement is similar, while a single sector may contribute to more than one investment area.

The clustering identifies a working set of six investment areas. Their inclusion does not imply equivalent evidence that a material security-of-supply capability gap has been established in each case.

Critical Energy Equipment (CEE) The capability to secure access to, supply, maintain and replace essential equipment for electricity-system expansion and resilience. This area is supported primarily by the Energy assessment's grid-equipment findings, with interfaces to Materials and Digital. Electrification increases the significance of equipment availability as more critical functions depend on the electricity system. The evidence identifies relevant equipment categories and supply concerns; the scale of any additional reserve,

repair or production requirement must be established through more detailed assessment.

Critical Materials and Feedstocks (CMF) Strategically important industrial inputs and upstream value-chain stages, drawing on the Chemicals and Materials assessments with interfaces to Energy. The recurring concern is that established domestic processing, manufacturing or system capabilities depend on externally supplied materials, feedstocks or intermediate processing. The significance of the dependency varies by input, application and available mitigation. The investment area therefore does not establish a general case for domestic substitution: the critical function and the material consequences of disruption must be specified for each proposed intervention.

Strategic Repair and Recovery (SRR) The capability to repair, replace and restore critical systems following disruption. Repair and recovery are plausible resilience mechanisms, but the evidence assembled in this study does not establish a distinct cross-sector capability gap to the same standard as the strongest sectoral findings. SRR is therefore retained as an exploratory candidate.

Energy Infrastructure Resilience and Flexibility (EIR) The capability of the electricity system to maintain reliable operation as production and consumption patterns change. This area builds on the Energy findings concerning cross-border infrastructure and the changing requirements associated with electrification, flexibility, storage and balancing. It concerns capabilities relevant both to electricity-system resilience and to the pace of the energy transition. Its breadth requires caution: growing system requirements do not by themselves demonstrate a current shortfall in every component of flexibility or resilience. The shorter term *Energy Infrastructure Resilience* is used elsewhere in the report for this investment area.

Digital Critical Infrastructure (DCI) Capabilities supporting critical digital, information and operational-technology systems. The evidence assembled here concerns primarily the semiconductor value chain, with interfaces to Energy and other sectors that depend on digital control and conversion equipment. This is a narrower evidential basis than the investment area's title suggests. The extent to which external fabrication and downstream processing leave critical functions materially exposed requires further assessment, including consideration of European and allied supply arrangements.

Circular Materials and Resource Recovery (CM) Recovery, recycling and reuse capabilities that could provide an alternative resilience mechanism where primary supply is externally dependent. This area remains an exploratory candidate rather than an established cross-sector capability gap. Its strategic value depends on recoverable volumes, processing capability, product qualification and access to suitable material streams. Environmental benefits must be assessed against the relevant alternative pathway.

Two eligibility conditions guide progression from a capability concern to a proposed intervention: a material security-of-supply capability gap affecting a critical societal function, and a plausible role for public intervention. External dependence alone is insufficient; stocks, substitution, diversified supply and other mitigating arrangements must be considered.

SRR and CM are retained as exploratory candidates. Their provisional scores do not establish that the eligibility conditions have been met. The other areas also retain input- and function-specific uncertainties, particularly concerning the materiality of digital dependencies.

The clustering reflects how the green transition changes capability requirements. As critical functions become more electrified, access to equipment, specialised materials and processing capability becomes increasingly important. This changing requirement helps identify concerns for assessment, but does not itself establish a capability gap or the appropriate public response.

5.2 Assessment approach

The six areas are assessed using the two-lens framework in Chapter 3, with SRR and CM included on an explicitly exploratory basis. The five-point scales are reproduced in Appendix A.

The Strategic Investment Lens (Lens 1) assesses economic and industrial potential, system transformation, green-transition contribution and domestic capability development. Its total uses an equal-weight scoring convention to support indicative comparison, not precise measurement of investment value.

The Strategic Public Intervention Lens (Lens 2) separately assesses strategic synergy, EU opportunity, additionality and instrument suitability. These dimensions are not aggregated, since a strong result on one does not establish a strong result on another.

The lenses are not combined. Evidence confidence is also kept separate from strategic potential: a high score cannot compensate for insufficient evidence that a critical function is materially exposed under disruption.

5.2.1 Lens 1: Strategic Investment results

Table 5.1 presents the indicative assessment under Lens 1. Scores for exploratory candidates describe potential conditional on further validation.

CMF and EIR receive the highest indicative totals under the current scoring convention. This supports closer examination of selected interventions, not a conclusion that every intervention in these areas is justified.

The ordering must be read alongside evidence status. CM's relatively high score does not resolve uncertainty about whether a circular pathway addresses a material capability gap. Similarly, a lower score does not imply that the security function concerned is less important.

Green Transition Contribution reflects the assessed connection between capability development and the transition. EIR and CEE support electricity-system adaptation; CMF includes potential substitutes for selected fossil feedstocks; and CM includes recovery pathways that may reduce primary-material requirements. DCI contributes through control and conversion technologies, while SRR is assessed primarily through maintaining existing assets. These judgements do not quantify emissions reductions or establish equal confidence in the underlying gaps.

Table 5.1: Indicative strategic assessment of investment areas

Criterion	CEE	CMF[‡]	SRR[*]	EIR	DCI[†]	CM[*]
Economic and Industrial Potential	3	5	2	4	4	4
System Transformation Potential	4	5	2	5	4	4
Green Transition Contribution	4	4	2	5	3	5
Strategic Domestic Capability Development	5	5	4	5	4	4
Indicative total	16	19	10	19	15	17

CEE = Critical Energy Equipment; CMF = Critical Materials and Feedstocks; SRR = Strategic Repair and Recovery; EIR = Energy Infrastructure Resilience and Flexibility; DCI = Digital Critical Infrastructure; CM = Circular Materials and Resource Recovery.

[*] SRR and CM are exploratory candidates: eligibility is not fully demonstrated and their scores are provisional.

[†] DCI: evidence concerns primarily the semiconductor value chain; its material security-of-supply significance and the wider scope of the investment area require further assessment.

[‡] CMF: the chemical findings establish production and upstream-feedstock dependencies; their material security-of-supply significance requires input- and function-specific assessment after existing mitigation.

5.2.2 Lens 2: Strategic Public Intervention results

Table 5.2 presents the indicative assessment under Lens 2. It separates the interaction between objectives, opportunities for European cooperation, the rationale for intervention and instrument suitability. The same evidence qualifications apply as under Lens 1.

Table 5.2: Indicative public intervention assessment of investment areas

Criterion	CEE	CMF[‡]	SRR[*]	EIR	DCI[†]	CM[*]
Strategic Synergy	5	5	3	5	3	5
EU Strategic Opportunity	5	5	3	5	4	5
Public Intervention Additionality	4	4	3	5	4	4
Instrument Suitability	5	4	5	5	5	4

Abbreviations and evidence-status markers follow Table 5.1. Scores use the five-point criteria in Appendix A and are not aggregated. They do not establish legal eligibility for a particular instrument or funding programme.

EIR receives the maximum score on each dimension. This reflects distinct judgements about the potential interaction between resilience and electrification, European cooperation, preparedness benefits not fully captured commercially, and suitable public instruments. Each judgement requires testing at the intervention level. In particular, additionality depends on what operators, suppliers and existing policy arrangements would provide without the proposed intervention.

Strategic Synergy concerns mechanisms through which objectives reinforce one another, not simply the presence of several benefits. For CEE and EIR, equipment and infrastructure availability can support restoration and continued electrification. Selected CMF and CM pathways could reduce supply exposure while supporting industrial renewal and lower-resource production. The maximum scores describe this potential, not demonstrated outcomes.

The lower synergy scores for SRR and DCI reflect the less direct transition mechanisms examined here, rather than a general judgement about their security or environmental importance.

EU Strategic Opportunity indicates potential value from cooperation or value-chain integration, not confirmed funding eligibility. Instrument Suitability concerns whether a public instrument could address the barrier; it does not determine the applicable procurement regime or establish legal feasibility.

Taken together, the lenses support further examination of CMF and EIR, alongside specific equipment and circular-material pathways. They provide a basis for preparation rather than a final allocation of investment priorities.

5.3 Candidate areas for case studies

Case selection is purposive rather than determined solely by score. The four cases examine different capability problems and intervention mechanisms, including one exploratory circular pathway. Table 5.3 summarises the selection logic.

Table 5.3: Selection of representative cases

Case	Main connection	Reason for inclusion
Green hydrogen	CMF; energy-system interfaces	Examines committed demand and shared infrastructure for selected domestic feedstock applications.
Captured carbon	CMF; complementary to hydrogen	Examines coordination of qualified carbon supply, hydrogen and downstream demand, subject to lifecycle performance.
Critical electricity equipment	CEE and EIR	Examines equipment access, restoration capability and reserve or surge capacity.
Secondary aluminium	CM; Materials assessment	Tests whether qualified secondary supply could address strategically relevant exposure. Exploratory pending evidence on material flows, product requirements and security-of-supply significance.

The cases do not retrospectively validate the scores. They examine whether capability concerns can be translated into specific intervention propositions with identifiable demand, capacity, infrastructure or coordination requirements. The

aluminium case additionally tests whether the evidence supports progression from a value-chain concern to a material security-of-supply gap.

Quantitative analysis is introduced where supported, but the cases are not investment appraisals. Buyers, responsible authorities, procurement rules and the choice between procurement, financing, regulation or other instruments must be established separately.

5.3.1 Interpretation and caveats

The assessment compares capability-building directions, not individual technologies, whole sectors or security risks. It does not establish a case for self-sufficiency. Strengthening capability may involve domestic repair, assured access or cooperation with trusted suppliers rather than domestic manufacture of every input.

The numerical ordering remains indicative. It depends on qualitative judgements, equal weighting under Lens 1 and evidence of varying maturity. Calibration and sensitivity analysis are needed before treating that ordering as settled. Case-study selection does not substitute for validation of the underlying gap.

Green-transition scores are not estimates of emissions reductions. Economic and capability scores likewise do not measure returns, fiscal costs or reductions in disruption risk. Each intervention requires assessment against the relevant counterfactual and the dependencies introduced by any replacement pathway.

The chapter therefore supports decisions about further preparation, not immediate deployment. Subsequent work must specify the critical function and disruption exposure, the required capability, responsible buyers or authorities, additionality, costs and legal arrangements. The following chapters examine the procurement, financing and implementation pathways within these limits.

Chapter 6

Capability-based procurement and financing pathways

Public procurement provides a direct link between identified capability needs and market demand. Beyond the conventional acquisition of goods and services, procurement can influence supplier incentives, technological development, production capacity and resilience – though its relevance varies: the Instrument suitability dimension distinguishes cases where procurement is the appropriate response from those better addressed by R&D funding, guarantees or regulation. Public *funding* follows the same logic on the investment side, with financing needs varying by capability maturity, technological and commercial uncertainty, and the extent to which benefits extend beyond the individual investor. Funding and procurement are therefore complementary mechanisms operating at different stages of capability development, not substitutes for one another.

6.1 Procurement as a capability-building instrument

Procurement shapes capability development through its effect on supplier incentives and demand: where public authorities represent a significant share of potential demand, procurement decisions affect whether firms invest in technologies, facilities and supporting capabilities – particularly where capabilities are costly to maintain but difficult to recreate once production capacity, skills or supplier networks have disappeared. The relevant object of analysis is therefore not only the product acquired but the underlying industrial, technological and infrastructural capacity behind it, particularly where civilian and defence requirements overlap, as the parliamentary working group on defence resource needs in the 2030s emphasises [6].

The scale and composition of the defence administration budget are illustrated in Appendix C. The aggregate budget should not, however, be interpreted as procurement demand available to the investment areas examined here. The relevant demand depends on the expenditure category, the contracting authority, the applicable procurement regime and the capability being acquired.

The defence-spending trajectory provides a stronger strategic rationale for long-term capability development. The extent to which it generates additional procurement demand in the areas examined here must nevertheless be established through identified buyers, funded requirements and contract design. A spending target, or the classification of existing expenditure as security-related, does not by itself establish additional demand for a particular capability.

The working group's emphasis on technology, research, development and innovation (TRDI) further strengthens the rationale for long-term capability development [6]. The role of public funding in capability development has empirical support: analysis of defence research and development across OECD economies finds that public defence R&D crowds in private research investment rather than displacing it, with measurable productivity effects and international spillovers [30].

Establishing what those conditions are is the subject of a substantial innovation-policy literature. Rather than treating procurement only as a corrective for market failure in markets that already exist, recent work reframes it as an instrument through which public demand and finance actively create and shape markets for strategically important technologies [31, 32, 33, 34]. Where technologies are not yet mature enough for full market exposure, the Strategic Niche Management literature describes how markets are incubated within publicly shielded niches in which performance and demand can develop before competitive conditions fully apply [35]. Ruttan's economic history of security- and defence-driven market creation similarly shows that public demand has repeatedly formed markets on which later commercial activity depended [36].

The effect procurement has depends on the state of the market it acts upon. Recent work distinguishes three modes: accelerating adoption in a market that already functions, building a market that does not yet exist at commercial scale, and transforming the system within which a market operates [37]. The distinction matters for this study because the capability problems it identifies are not all of the same kind. Where domestic suppliers exist and the constraint is the predictability of demand, procurement accelerates: acting as an anchor customer or reference market reduces uncertainty sufficiently for suppliers to invest in commercial-scale production. Where no market exists at the required scale, procurement must build one, and committed offtake, shared infrastructure and early certification requirements operate together rather than separately. Where the constraint is the organisation of a wider system – material flows, recovery capacity, downstream qualification – procurement alone is unlikely to be sufficient. Identifying which mode applies is therefore prior to selecting an instrument.

This mechanism has limits in all three modes. Procurement cannot substitute for technological feasibility or viable long-term demand, nor does public demand necessarily build Finnish production capacity where the relevant value chain sits elsewhere. Its effectiveness depends on market structure and on the relationship between procurement requirements, supplier incentives and wider value chains.

The models through which these effects are pursued differ in what they commit the buyer to and in the conditions under which they change supplier behaviour (Table 6.1). One of these, the contract for difference, pays a producer the gap between an agreed strike price and the market price when the market price is lower, and recovers the gap when it is higher; it stabilises the producer's revenue without the public party buying the product itself.

No model generates impact on its own: each depends on a condition that the ca-

Table 6.1: Procurement models and the conditions under which they shape capability

Model	**What it commits**	**Conditions for impact**
Framework agreement with reserved capacity	Access to supply or manufacturing capacity without committing volumes in advance	The constraint is availability under stress rather than price or innovation; suppliers exist but hold no spare capacity
Anchor or offtake contract; price-support arrangement such as a contract for difference	A revenue stream sufficient to make first-of-a-kind production bankable	Technology is proven but demand certainty is absent; the commitment is visible to firms that are not yet suppliers
Preparedness and security-of-supply contract	Continuity obligations — stocks, maintenance, crisis delivery — not remunerated in normal supply	Societal value exceeds commercial value; expressly available under the defence and security regime
Pre-commercial procurement and innovation partnership	Development and testing ahead of or alongside deployment, sharing technological risk	The barrier is technological uncertainty rather than demand; of limited relevance where technologies are already mature
Aggregated or joint procurement	Demand combined across buyers, sectors or states	Minimum efficient scale exceeds what a single buyer sustains; requires coordination across procurement frameworks
Award criteria and contract conditions	What is supplied, rather than whether it is supplied	Requirements deliver verifiable lifecycle, environmental or operational performance

pability assessment, not the procurement function, establishes [37]. The fourth row is included partly to mark a boundary. Pre-commercial procurement and innovation partnerships are the standard instruments where the constraint is technological uncertainty, and they are of limited relevance to the priority areas identified in this study, where the technologies are largely mature and the binding constraints are demand certainty, capacity and coordination.

6.2 The defence and security procurement regime

The mechanisms described above assume that public demand can be made visible, committed and contractible. Where an acquisition falls under the defence and security procurement regime, each of those assumptions is qualified, and the feasibility of the instruments considered in this study depends on how far those qualifications extend.

Procurement in this field is governed principally by Directive 2009/81/EC on the award of works, supply and service contracts in the fields of defence and security [22], transposed in Finland by the Act on Public Procurement in the Fields of Defence and Security [23]. Beyond that regime, Article 346(1)(b) of the Treaty on the Functioning of the European Union permits measures necessary to protect a Member State's essential security interests connected with the production of or trade in arms, munitions and war material. This derogation does not exempt defence procurement generally: its application requires case-specific justification and must not adversely affect competition in the internal market for products not intended for specifically military purposes [38].

The relevant legal routes include general procurement law, governed by Directive 2014/24/EU [39] and Finland's Act on Public Procurement and Concession Contracts [21]; utilities procurement; the defence and security procurement regime; and contracts placed under a justified Treaty derogation. The applicable route affects how each instrument can be structured.

Utilities procurement is governed by Directive 2014/25/EU [40] and Finland's Act on public contracts and concessions of entities operating in the water, energy, transport and postal services sectors (1398/2016) [41]. Acquisitions by covered entities for covered activities may fall under this framework rather than the general procurement act, subject to applicable exclusions and exemptions. This distinction is particularly relevant to electricity-network equipment and must be resolved for each proposed acquisition.

The defence and security regime differs from general procurement law in ways that matter for capability development. For procurements governed by the EU-threshold provisions of the Act on Public Procurement in the Fields of Defence and Security (1531/2011), the principal routes are the restricted procedure and the negotiated procedure with prior publication; an open procedure is not provided for [23]. The negotiated procedure allows discussion of requirements and delivery arrangements within the applicable procedural rules. The regime expressly allows contracting authorities to impose requirements concerning the security of classified information and the security of supply, including commitments on delivery continuity, maintenance capacity and the treatment of the contract in crisis conditions, and it regulates subcontracting more closely than the civil regime. In several respects it is therefore better suited to long-horizon capability building than general procurement law: it accommodates extended supplier relationships, lifecycle sup-

port obligations and continuity requirements that would be difficult to specify in a conventional open tender.

The constraint falls elsewhere — on visibility. Market building depends on demand being not only committed but legible to firms that are not yet suppliers: an anchor customer shapes investment across a market only if the market can see the commitment. Classification, restricted procedures and security of information requirements attach precisely to that visibility. A procurement may create genuine, durable demand for an incumbent supplier while transmitting little signal to the wider supply base, and the effect on capability formation beyond the contracted firm is correspondingly weaker. Restricted procedures should not, however, be equated with classification or an absence of public information. The extent of the visibility constraint depends on the particular procurement, the information withheld and the opportunities available for market engagement. Limited market visibility is therefore treated here as a condition to be assessed, rather than an automatic consequence of using the defence and security procurement regime. This does not argue against using defence procurement for capability development, but it does mean the market-shaping effect cannot be inferred from contract value alone. Where market formation is the objective, the civil or dual-use side of a capability will often carry the signal more effectively than the classified side — a pattern consistent with wider analysis of how defence mobilisation translates into civilian innovation across the Euro-Atlantic area [42].

Two consequences follow. The instruments best matched to this regime are those that do not depend on public signalling: strategic reserves, framework agreements, capacity-retainer arrangements and pre-arranged repair and surge capacity operate through contractual commitment to identified suppliers rather than through market-wide demand formation, and the regime's security-of-supply provisions support them directly. And environmental and lifecycle criteria remain available but are applied within capability and security requirements rather than alongside them, while classification limits the extent to which lifecycle data can be published or independently verified.

For the interventions examined in this study, opportunities to combine the three objectives appear most readily actionable in security-of-supply procurement under general rules and selected dual-use applications. In these settings, environmental and lifecycle requirements can potentially support continuity of operation, resource efficiency and capability development together. The defence estate is a further setting for examination, but is not directly assessed in the case studies. This is not a general ranking of the strategic value of civilian and military procurement: the feasibility of combined benefits must be assessed against the requirements and market conditions of each acquisition.

6.3 Procurement, security of supply and the green transition

Within these limits, procurement requirements can carry two kinds of objective beyond the immediate acquisition. The first concerns supply-chain organisation. Resilience does not require domestic self-sufficiency: Finland's economic openness makes diversification and integration with trusted European and international partners an important complement to domestic capacity-building [9, pp. 4–8, 17–18].

Requirements on supplier diversification, lifecycle support, repair and maintenance, interoperability, strategic stocks and alternative sources strengthen the ability to maintain essential functions when individual suppliers or supply routes are disrupted — particularly relevant for Digital Critical Infrastructure and Strategic Repair and Recovery, where resilience depends as much on operating and restoring systems as on equipment availability.

The second concerns environmental performance. Environmental and lifecycle criteria can shape demand for energy-efficient technologies, low-carbon materials and circular solutions, and where such technologies also reduce strategically significant dependencies or strengthen Finnish or European industrial capabilities, environmental and security objectives reinforce one another — the procurement-level application of Strategic Synergy. An environmental benefit alone does not establish triple-benefit synergy: the relevant question is how security, competitiveness and green-transition benefits reinforce one another through the same intervention. This is the procurement-level expression of a more general argument that industrial policy directed at decarbonisation must be justified by the same tests applied to industrial policy generally [43].

How criteria are specified determines whether they are compatible with operational and cost requirements. Requirements concerning energy consumption, maintainability, service life and material recoverability can connect environmental performance with operational sustainability and long-term cost. Their value depends on demonstrable performance rather than on whether they are framed as lifecycle or product requirements. The Act on Public Procurement and Concession Contracts permits environmental considerations to be applied through award criteria and contract conditions [21], and lifecycle costing is the mechanism through which such considerations connect to procurement decisions that would be justified on operational grounds in any case. Trade-offs nonetheless remain: environmental requirements may raise costs, narrow supplier choice or conflict with operational needs.

The security dimension of green procurement is also more ambiguous than it may appear. Decarbonisation relocates dependencies rather than removing them, and environmental criteria can therefore either reduce or increase security-of-supply exposure depending on where the substituted value chain sits. Requirements that shift demand towards technologies whose production is concentrated outside Europe may improve environmental performance while creating a new external dependency for a critical function. The strategic assessment of green procurement consequently requires the same question applied elsewhere in this study: whether the resulting dependency profile is one that can be maintained under disruption.

The Commission's proposed Industrial Accelerator Act would introduce targeted Union-origin and low-carbon requirements for specified products in public procurement and public-support schemes, alongside measures to accelerate permitting and conditions on certain large foreign investments. If adopted, it would extend the role of origin requirements in covered procurement, subject to the final legislation and applicable international commitments [44].

6.4 Matching financing to the underlying barrier

Different financing mechanisms correspond to different constraints (Table 6.2). These pathways are not mutually exclusive — an investment area may face tech-

nological uncertainty at one stage, financing constraints at another, and demand uncertainty during scale-up — so each financing implication should be read as an intervention pathway rather than a single instrument.

Table 6.2: Financing pathways and their primary barriers

Financing pathway	**Primary barrier / rationale**	**Relevant instruments**
Knowledge and technology	Knowledge spillovers and technological uncertainty	R&D grants; public research funding; research infrastructure; R&D tax incentives
Commercialisation and scale-up	Financing constraints, production risk and high upfront investment	Development loans; guarantees; co-investment; targeted public investment
Strategic capability and infrastructure	Security or societal value not fully captured commercially	Security-of-supply funding; strategic reserves; infrastructure investment
Demand creation	Insufficient or uncertain demand	Public procurement; anchor contracts; preparedness contracts
European and allied leverage	Benefits or investment requirements extending beyond national capacity	EU co-financing; EU defence and industrial instruments; NATO common funding

Financing needs shift as capabilities move from research towards commercial deployment and long-term maintenance: R&D support suits early technological uncertainty, loans and co-investment suit commercialisation and scale-up, procurement addresses demand uncertainty, and infrastructure or strategic funding applies where a capability's security or resilience value is not reflected in private returns. This is particularly relevant to the defence technological and industrial base, where the parliamentary working group highlights strategic funding through Tesi, Business Finland and Finnvera alongside strengthened production capacity and access to critical technologies [6]. The same logic extends beyond defence: financing for Critical Materials and Feedstocks may target processing, refining or recycling rather than extraction, while Energy Infrastructure Resilience's public-good characteristics make public investment and European co-financing more relevant than firm-level financing alone. This underscores the National Audit Office of Finland's finding that the security-of-supply funding base needs clearer alignment between instruments and capability needs [45].

Finland's security-of-supply fund provides a national financing route to examine alongside these pathways. Under Section 14 of Act 107/2026, the fund finances material-preparedness procurement and investment and may also finance specified programme measures, other investments necessary for security of supply and crisis-response costs. Where intervention takes the form of support granted under Section 18, the statutory conditions include addressing market failures, an incentive effect, time-limited support and compliance with competition and EU State aid requirements. Support may be granted only where supporting the measure is not another authority's statutory responsibility. These conditions require intervention-specific assessment; neither strategic importance nor a high additionality score establishes entitlement to funding [11].

6.5 Strategic partnerships, dual-use capabilities and European and allied financing

Strategic partnerships provide a complementary mechanism where technological complexity, investment scale or value-chain structure makes national self-sufficiency inefficient or undesirable, combining Finnish capabilities with European or allied technology, finance, infrastructure, production capacity and demand. A particular form of such partnership concerns the deliberate development of dual-use products and technologies — goods, software or systems capable of serving both civilian and military applications with limited or no adaptation.

The literature on dual-use technology transfer emphasises that the relationship between civilian and military innovation is neither automatic nor unidirectional: spillovers depend on the specific technology, the institutional arrangements governing its development, and the incentives facing the firms and public bodies involved [46]. Dual-use potential is therefore better understood as a strategic choice about how civilian and military development paths are organised — through joint development programmes, licensing arrangements or the deliberate maintenance of separate but interoperable capabilities [47] — and successful civilian-military co-operation depends less on the technology itself than on how cooperation is structured between developers, procurers and end users from an early stage [48].

Where a capability has genuine dual-use potential, coordinated civilian and defence procurement can create a larger and more resilient demand base than either sector could sustain alone, while reducing the risk that investment in a narrowly defined military capability collapses if defence demand alone proves insufficient. As noted in Chapter 2 on policy and regulatory framework, the materiel policy strategy makes domestic integration, maintenance and repair a core objective of military security of supply [12], which is what makes dual-use development an instrument of that objective rather than an industrial preference; the export control regime described there sets the limits within which such products can be developed and traded [13]. Coordination of this kind is an institutional task: the applicable procurement regime must be established for each acquisition, so aggregating civil and defence demand requires coordination across frameworks with different procedures and supplier-qualification rules.

The sector-level evidence gives this logic concrete grounding. The Energy assessment's critical-equipment gap — transformers, switchgear and transmission equipment — is a direct dual-use candidate, since the same grid infrastructure underpinning civilian electricity resilience also carries growing military mobility requirements. The Digital assessment's semiconductor value-chain concern is similarly relevant, since the fabrication and processing capacity that would need strengthening also underpins the communications, sensor and data infrastructure shared by civilian and defence users. Synthetic fuels are a third candidate: aviation, maritime and heavy road transport fuels serve civilian logistics and military mobility alike, and domestic production from hydrogen and captured carbon would reduce the dependence on imported oil identified in the Energy assessment for both.

European and allied financing is the second component of this mechanism. The Connecting Europe Facility supports infrastructure relevant to security of supply and military mobility [49]; NATO common funding offers a channel for capabilities contributing to collective defence; and critical materials illustrate how European

cooperation can combine diversification, value-chain development, recycling and international partnerships [50, pp. 6–7]. For capabilities with a defence or dual-use dimension, the European Defence Fund supports collaborative research and development [51], while the European Defence Industry Programme addresses defence-industrial capacity and joint procurement [52]. SAFE provides loans to Member States for eligible defence-related procurement, normally through common procurement [53]. The Strategic Technologies for Europe Platform directs existing Union funding towards critical technologies [54], and InvestEU mobilises private investment through budgetary guarantees [55]. Eligibility, scope and combination rules differ between these instruments and change over time, so the relevant question at the preparation stage is which instrument matches a given capability's barrier rather than which is largest.

For civil industrial capabilities, the Critical Raw Materials Act sets Union-level benchmarks for the extraction, processing and recycling of strategic raw materials and provides for strategic project designation [56], and the Net-Zero Industry Act establishes Union manufacturing-capacity benchmarks and sustainability and resilience requirements for covered public procurement involving specified net-zero technologies, including electricity-grid technologies, subject to the applicable scope, implementing rules and exemptions [57].

Access nevertheless depends on institutional capacity. EU and NATO programmes require project preparation, specialised expertise, coordination and compliance with relevant conditions, and the National Audit Office of Finland has identified exactly this kind of personnel and institutional capacity gap in pursuing NATO common funding [58] — meaning the ability to access external financing is itself part of the capability underpinning security of supply.

6.6 Financing implications for the priority investment areas

Table 6.3 summarises indicative intervention pathways for each investment area, drawing on the underlying capability concerns, investment barriers and the Public Intervention Additionality and Instrument Suitability assessments. The resulting patterns are differentiated: CEE centres on securing reserve, repair and surge capacity, with targeted financing where additional capacity is needed; CMF requires attention to specific value-chain and scale-up constraints; SRR is more closely associated with preparedness and public infrastructure; EIR combines infrastructure investment, procurement and European financing; DCI emphasises resilience-oriented procurement and standards; and CM connects green procurement with investment support and European financing.

This chapter therefore distinguishes two complementary forms of intervention: procurement, operating through demand — adoption, market formation, capability maintenance — and funding, operating through investment conditions — technological uncertainty, financing constraints, production capacity and strategic infrastructure. Strategic partnerships connect the two, particularly where capability development depends on European or allied cooperation, and the procurement regime determines which combinations are usable in practice. This provides an analytical bridge to the case studies that test whether these intervention pathways translate into credible implementation arrangements.

Table 6.3: Preliminary financing implications for the priority investment areas

Investment area	**Preliminary financing implication**
CEE – Critical Energy Equipment	Reserved-capacity and preparedness contracts; strategic reserves; targeted scale-up finance and EU co-financing where relevant
CMF – Critical Materials and Feedstocks	Investment/guarantees + EU finance + R&D; target specific value-chain gaps
SRR – Strategic Repair and Recovery	Preparedness contracts + strategic procurement + public infrastructure
EIR – Energy Infrastructure Resilience and Flexibility	Public infrastructure investment + procurement + EU financing
DCI – Digital Critical Infrastructure	Security/resilience procurement + standards + targeted investment
CM – Circular Materials	Green procurement + investment support + EU financing

Chapter 7

Case studies

This chapter develops representative case studies. Their purpose is not to re-run the prioritisation but to illustrate plausible implementation pathways through procurement, financing or strategic partnership. Each case begins from a capability concern rather than from an investment-area score and examines a specific pathway for addressing it.

Four cases are developed. Green hydrogen and captured CO_2 examine complementary feedstock pathways within Critical Materials and Feedstocks, with interfaces to the energy system. Hydrogen converts domestic renewable electricity into an industrial molecule, while captured carbon provides the carbon input required to convert part of that hydrogen into methanol and other carbon-containing products. Critical electricity infrastructure and equipment addresses the critical-equipment gap identified in the Energy assessment, expressed in the working set as Critical Energy Equipment with a direct interface to Energy Infrastructure Resilience. Secondary aluminium addresses the aluminium value-chain concern identified in the Materials assessment, examined through the circular pathway represented by Circular Materials and Resource Recovery.

The critical electricity equipment and secondary aluminium cases are included to examine different capability problems, rather than selected solely by score. The former develops the Energy assessment's equipment-access concern; the latter tests whether qualified secondary supply could address a material security-of-supply exposure. The aluminium case is exploratory: incomplete domestic value-chain coverage does not itself establish a capability gap, consistent with Chapter 5.

The cases also differ in the kind of threshold they identify, which is itself a result: a committed-demand scale for hydrogen and captured CO_2, a restoration-capability threshold with a separate surge requirement for critical electricity equipment, and a share of strategically relevant domestic demand for secondary aluminium. None is intended as a project-level feasibility study; where the evidence does not support a precise threshold, the case identifies and tests a plausible intervention range.

7.1 Green hydrogen as a cross-cutting capability

Green hydrogen is produced through the electrolysis of water using renewable electricity, supplied directly from renewable generation or through the grid provided it meets the applicable EU requirements for renewable hydrogen: Delegated Reg-

ulation (EU) 2023/1184 specifies when the electricity used may be counted as fully renewable [59], while Delegated Regulation (EU) 2023/1185 establishes the methodology for calculating greenhouse-gas emissions savings [60]. Directive (EU) 2023/2413 requires Member States to ensure minimum shares of renewable fuels of non-biological origin in industrial hydrogen use, subject to specified exclusions and conditional reductions [61]. Finland's low-carbon electricity system and growing renewable generation provide favourable conditions for domestic electrolytic production [26].

Hydrogen converts domestically generated electricity into a molecule that can be stored, transported and used as an industrial feedstock or energy carrier, extending electrification into applications where the direct use of electricity is technically difficult or economically unattractive. This is particularly relevant to the chemical and feedstock dependencies identified in the capability assessment: increasing renewable generation reduces dependence on imported fossil energy, but a highly electrified industrial system still requires molecules and feedstocks that electricity cannot directly replace. In practical terms hydrogen is primarily an industrial input — used to produce ammonia, methanol together with a carbon source, and direct reduced iron for steelmaking, and convertible with captured CO_2 into synthetic fuels. These applications provide the principal potential demand anchors, and they are not hypothetical: global hydrogen demand reached almost 100 Mt in 2024, used mainly in oil refining and in industry for ammonia, methanol and direct reduced iron, and low-emissions production still accounted for less than 1% of global production [62].

The Government's hydrogen resolution states that Finland has the capacity to produce at least 10% of the EU's emissions-free hydrogen in 2030 [63]. Against the REPowerEU ambition of 10 Mt by 2030, this corresponds to an indicative scale of approximately 1 Mt per year, not a binding national production target [62]. The relevant investment question is not whether public intervention should deliver that full scale, but what combination of production, infrastructure and committed demand is sufficient to establish a commercially self-sustaining domestic market capable of attracting further private investment and of scaling towards it.

Developing such a market requires more than electrolyser capacity: renewable electricity, hydrogen production, storage and transmission must develop alongside downstream demand. That infrastructure is moving from concept to planning — Gasgrid's preliminary national hydrogen-backbone plans aim to enable an open hydrogen market by the early 2030s, initially on coastal routes and subsequently extending towards other production and demand regions [64].

The market is itself being formed largely through public intervention, which bears on what public action should aim to establish. At EU level, four hydrogen Important Projects of Common European Interest — Hy2Tech, Hy2Use, Hy2Infra and Hy2Move — have been approved since 2022, combining approximately €18.9 billion of public funding across value-chain stages from generation to end use [65], while the European Hydrogen Bank has begun running price-based auctions and signalled openness to contracts for difference and carbon contracts for difference, which apply the same logic to the carbon price, as demand-side instruments [66]. Finland is already positioned within this development: it participates in Hy2Tech; P2X Solutions' Harjavalta plant became Finland's first industrial-scale green hydrogen production facility in 2025, with an initial 20 MW electrolysis capacity [67]; Hycamite operates a lower-energy methane-splitting process at Kokkola Industrial

Park [68]; and Gasgrid Finland and Nordion Energi have secured €29.4 million under the Connecting Europe Facility for feasibility studies and basic design of the Nordic Hydrogen Route pipeline [69]. The relevant question is how Finnish participation can build on these developments and under what conditions a commercially sustainable domestic market can emerge.

The central challenge is one of scale and coordination. Stable and predictable offtake is necessary to support investment, and shared industrial hubs can aggregate demand and reduce infrastructure and offtake risk, but scale alone does not guarantee competitiveness: electricity costs, capital costs and the price gap with incumbent fossil-based production remain decisive [62]. The objective is therefore not to maximise hydrogen production but to establish sufficient anchor demand and shared infrastructure for subsequent users to enter at progressively lower risk. A further possibility, not assessed in this study, is that production capacity exceeding normal domestic demand could also carry security value. Capacity serving export markets in peacetime might be redirected to domestic and defence needs under disruption, so that export demand would help sustain surge capacity that domestic demand alone could not. Whether this is feasible depends on contractual and infrastructure arrangements for redirection in a crisis, and it does not change the objective set out above, which is to establish anchor demand rather than to maximise production.

An illustrative preparation scale is 50–100 kt H_2/year, equivalent to 5–10% of the indicative 1 Mt ambition. The objective would be a shared production and infrastructure platform anchored by applications such as e-methanol, hydrogen-based steelmaking or synthetic fuels and designed for subsequent expansion, rather than an isolated plant.

Preparation should distinguish three questions: the scale at which a producer and offtaker can support a viable project; the scale at which shared infrastructure can serve several users; and the delivered cost at which further demand becomes commercially viable. The 50–100 kt H_2/year range provides a working scenario for the second question, not a validated market-formation threshold. Producing methanol equivalent to Finland's approximately 70 kt/year import flow would require roughly 13 kt H_2/year, around a quarter of a 50 kt market. This provides a possible anchor application whose critical demand and security-of-supply significance require separate assessment; the larger working range assumes additional demand from steel, synthetic fuels or other industrial applications. The methanol import volume is used here as a scale reference, not as an estimate of critical demand or a recommendation to replace all imports domestically. For comparison, the 1 Mt reference ambition would require approximately 55 TWh/year of electricity and around 11 GW of electrolysis at roughly 5,000 full-load hours annually — a system-scale ambition rather than the scale an initial public intervention would need to deliver [62, 70].

Such an intervention could generate the triple benefit:

- **Security of supply** would be strengthened where domestic hydrogen and its derivatives substitute strategically relevant imported fossil fuels or feedstocks.
- **Economic value** would arise from establishing domestic production, infrastructure and downstream industrial activity, and a platform for further private investment.
- **Green-transition benefits** would result from converting low-carbon do-

mestic electricity into feedstocks and fuels capable of replacing fossil-based production in sectors difficult to electrify directly.

The concrete policy question is not how to finance Finland's full hydrogen ambition, but how to bring the first industrial-scale, infrastructure-sharing hydrogen market to bankability. A measurable intervention objective could consequently be formulated around establishing **50–100 kt/year of committed anchor demand together with shared and expandable hydrogen infrastructure by 2035**. Once that market is established, further production should increasingly be driven by commercial demand and private investment rather than continued public support.

The instruments follow the pathways in Section 6.4 (Matching Financing to the Underlying Barrier) and Table 6.3 rather than requiring a separate mechanism. Where demand uncertainty is confirmed as a binding constraint, offtake commitments or appropriately designed price-support arrangements could address it alongside infrastructure and coordination requirements. Applications serving both civilian and defence needs, such as synthetic fuels for military mobility, could also be examined for relevant European and allied financing, subject to programme eligibility. Scale-up finance may also support electrolyser and balance-of-plant component manufacturing where specific equipment-supply or financing constraints are established, complementing demand and infrastructure measures for hydrogen production. Purchasing commitments by potential energy and industrial anchor buyers, including state-owned companies where relevant, could create early demand for hydrogen certified under EU renewable hydrogen rules, reducing offtake risk ahead of full market maturity — the anchor-customer mechanism.

7.2 Captured CO_2 as a cross-cutting carbon-feedstock capability

Captured CO_2, particularly from biogenic sources, can provide a domestic source of carbon for chemicals and synthetic fuels when combined with renewable hydrogen. Whereas green hydrogen converts domestic renewable electricity into an industrial molecule, captured CO_2 provides the carbon input required to convert part of that hydrogen into carbon-containing products such as methanol and synthetic hydrocarbons. The two capabilities are complementary rather than substitutes.

This connects directly to the chemical-production and upstream-feedstock dependencies identified in Section 4.2. Finland has no domestic methanol production identified in the reviewed evidence and imports approximately 70 kt/year, while domestic petrochemical capability depends more broadly on imported upstream chemicals and fossil feedstocks [5]. Captured domestic CO_2 does not by itself remove those dependencies but can provide an alternative carbon source for selected products. The capability problem is therefore not the absence of CO_2 itself, but the absence of a reliable pathway for converting domestic carbon streams into an accessible industrial feedstock.

Developing that capability requires more than capture equipment. Suitable CO_2 streams must be captured, purified to downstream users' specifications, conditioned for transport or storage, aggregated where necessary and connected to sufficiently stable demand, and for utilisation pathways these requirements must develop alongside hydrogen production and conversion capacity. The strategic value of

shared infrastructure consequently depends on whether it can serve several sources or users rather than remaining tied to a single captive project.

For synthetic-fuel applications, qualification must cover both technical purity and the carbon source's treatment under EU fuel-emissions accounting. Regulation (EU) 2023/1185 specifies the conditions for crediting captured CO_2 as avoided emissions, including relevant biomass sustainability requirements and safeguards against double counting [60].

Methanol provides the clearest quantified example of the relationship with the emerging hydrogen economy. The methanol reaction implies a theoretical requirement of approximately 1.38 tonnes of CO_2 and 0.19 tonnes of H_2 per tonne of methanol, so producing an amount equivalent to the approximately 70 kt/year currently imported would require roughly 0.10 Mt CO_2/year and 13 kt H_2/year. The same calculation shows why the relevant intervention may need to extend beyond a single methanol project: the 50–100 kt H_2/year working range in the hydrogen case is substantially larger than that, and directing it largely towards methanol would imply on the order of 0.4–0.7 Mt CO_2/year. The question is therefore whether an initial CO_2 capability should be designed around one identified demand source or as an expandable platform capable of supporting additional hydrogen-derived products.

The central challenge is consequently one of coordination and bankable demand rather than CO_2 availability. Capture investments require confidence that the resulting CO_2 will have an economically viable destination, while downstream synthetic-fuel and chemical projects require confidence that reliable CO_2 and hydrogen supplies will be available. There are also potential integration benefits: techno-economic studies of Finnish industrial and energy-system configurations have examined the integration of water electrolysis with oxy-fuel combustion, including the productive use of electrolytic oxygen, heat integration and the simultaneous production of hydrogen and concentrated CO_2 streams [71, 72, 73].

An illustrative initial scale is approximately 0.1 Mt of qualified captured CO_2 per year, corresponding to the carbon requirement for methanol production equivalent to the import flow identified in the reviewed evidence [5]. The objective should not, however, be limited to reproducing that flow: capture, conditioning and aggregation assets should be designed so that additional CO_2 sources and industrial users can be connected if demand from e-methanol, synthetic fuels or other Power-to-X applications becomes bankable.

Such an intervention could generate the triple benefit:

- **Security of supply** would be strengthened where domestic captured carbon and renewable hydrogen substitute strategically relevant imported methanol or other fossil-based industrial feedstocks.
- **Economic value** would arise from enabling downstream production of hydrogen-derived chemicals and fuels and widening the range of industrial applications that can build on Finland's renewable-electricity and hydrogen capabilities.
- **Green-transition benefits** could arise where captured CO_2 replaces fossil carbon in chemicals and fuels, provided lifecycle emissions are lower than those of the incumbent pathway. The climate effect depends on the CO_2 source, electricity and hydrogen inputs, and the product's subsequent use and end of life. Using biogenic carbon can defossilise these products, but does

not constitute permanent carbon removal where the carbon is subsequently released.

Preparation should assess how the proposed shared pathway would complement existing and planned projects, address an unmet capability requirement and avoid duplicating commercially committed capacity. The concrete policy question is not how much CO_2 Finland should capture in aggregate, but how to establish a reliable and expandable shared domestic carbon-feedstock pathway connecting Finnish CO_2 sources with hydrogen-derived industrial demand. A measurable initial objective could be formulated around establishing **approximately 0.1 Mt CO_2/year of bankable, qualified captured-carbon supply by 2035, anchored by domestic methanol or equivalent industrial demand and supported by conditioning and logistics infrastructure designed for subsequent expansion**.

The intervention addresses a coordination problem: capture investments require confidence in downstream demand, while conversion projects require confidence in qualified CO_2 and hydrogen supply. Where this mutual dependence constrains investment, offtake or price-support arrangements for qualified captured carbon could be combined with public investment in shared conditioning, aggregation and logistics infrastructure.

7.3 Critical electricity infrastructure and equipment as a resilience capability

Electrification is increasing the importance of the electricity system across the Finnish economy. Industrial processes, transport and heating are becoming increasingly dependent on electricity, while renewable generation, hydrogen production and other electricity-intensive investments require continued expansion of transmission and distribution infrastructure. The transition reduces dependence on imported fossil energy but concentrates a growing share of critical economic activity on the availability and resilience of the electricity system.

Finland possesses substantial domestic capabilities in electricity generation, transmission, system operation, engineering and infrastructure development, so the capability gap is not an absence of electricity-system capability. Rather, increasing electrification raises the strategic importance of maintaining access to the equipment required to repair and expand the grid. Transformers, switchgear and transmission equipment are the components the Energy assessment identifies as critical on this test. Under normal conditions these can be procured through established international supply chains; the concern arises when equipment must be replaced rapidly during a disruption, or when accelerating grid investment creates demand exceeding normal supply capacity.

The strategic problem is therefore different from simply increasing domestic manufacturing. A resilient electricity system requires the ability to replace damaged or unavailable equipment quickly enough to restore critical functions while continuing the expansion electrification requires. Depending on the component, that capability can be provided through strategic equipment reserves, repair and refurbishment capability, diversified procurement, framework agreements and reserved manufacturing or delivery capacity. Domestic production can strengthen it where economically and technically justified, but complete national self-sufficiency in grid equipment is neither necessary nor realistic.

The increasing scale of electrification makes this progressively more important. As transport, heating and industrial processes shift towards electricity, failures in electricity infrastructure affect a wider range of essential functions, while new renewable generation, industrial electrification and hydrogen production require substantial additions to transmission and connection capacity. Equipment shortages can therefore create two simultaneous risks: delayed restoration following a disruption, and delayed expansion during the energy transition. That competition is intensified where new connection and transmission requirements arise on shorter timescales than equipment lead times, since the same equipment categories serve emergency replacement, planned reinforcement and new connections alike. The resilience objective is to ensure that emergency replacement requirements do not compete entirely with normal grid-development needs for the same constrained supply.

The intervention should therefore distinguish immediate replacement capability from sustained surge capability. A strategic reserve can provide selected equipment required during the first phase of a disruption, while pre-arranged repair, procurement and production capacity can support larger or longer-lasting requirements. Standardisation and interchangeability can further increase the value of reserve equipment where technically feasible. The appropriate combination depends on the criticality, replacement lead time, technical specificity and failure consequences of each equipment category.

Unlike the hydrogen case, the relevant scale is not primarily a production-volume threshold. It is a *restoration-capability threshold*: the amount of critical electricity infrastructure Finland should be able to restore within a defined period without relying solely on normal international procurement conditions. This can be assessed by identifying credible disruption scenarios, determining the equipment required to restore the affected system functions, and comparing those requirements with existing reserves, repair capacity and assured supplier availability. A second threshold concerns surge capacity: whether additional equipment can be mobilised while planned grid expansion continues rather than being postponed to meet emergency replacement needs.

Public intervention may be justified because the value of reserve and surge capacity is not fully reflected in normal equipment procurement. Grid operators and suppliers have incentives to meet expected investment and maintenance requirements, whereas maintaining spare equipment or unused production capacity for low-frequency but high-impact disruptions imposes costs even when unused. The fact that the value is not commercially remunerated does not by itself select procurement over regulation: an obligation on network operators to hold defined reserves would place the same capability on the same parties at tariff rather than budgetary cost. The choice between regulatory obligations on operators, operator-led contracting and direct public procurement requires further assessment. Relevant considerations include the ability to aggregate requirements across operators, secure supplier-held repair and surge capacity, allocate costs and avoid duplication of existing preparedness arrangements. Capacity-retainer or framework contracts could secure selected capabilities without requiring public ownership of the supply chain.

An existing statutory route to examine is the National Emergency Supply Agency's authority under Section 13 of Act 107/2026 to enter production-reservation and performance-capacity reservation contracts [11]. Preparation

should assess whether this mechanism could secure the supplier-held repair or surge capacity identified by the restoration assessment. The reserved arrangements may be activated only during serious disruptions in normal conditions or emergency conditions. They should therefore be distinguished from ordinary commercial supply supporting planned grid expansion.

Such an intervention could generate the triple benefit:

- **Security of supply** would be strengthened by reducing the time required to restore critical electricity infrastructure after major equipment failures or supply-chain disruption, and by reducing dependence on normal international delivery conditions during a crisis.
- **Economic value** would arise from reducing the consequences of prolonged electricity-system disruption, supporting domestic engineering, repair and selected manufacturing capabilities, and preventing equipment bottlenecks from delaying industrial and grid investment.
- **Green-transition benefits** would result from maintaining the infrastructure required for electrification, renewable-energy integration and electricity-intensive industrial investment. The relevant indicator is not the emissions effect of the equipment itself, but the extent to which equipment availability prevents grid constraints from delaying the transition. In peacetime, secure access to grid equipment would also help keep grid reinforcement on schedule, on which the integration of variable renewable generation depends.

The concrete policy question is not how to manufacture all critical electricity equipment domestically, but how much replacement and surge capability Finland should secure in advance. A measurable intervention objective could be formulated around establishing, by 2035, **sufficient strategic reserves and contracted repair, procurement and production capacity to restore a defined share of critical grid infrastructure within an agreed recovery period while maintaining essential grid-expansion activity**. The appropriate equipment categories, restoration target and recovery period should be determined from asset criticality, existing replacement lead times and credible disruption scenarios rather than from a predetermined stockpile size.

The relevant financing pathway is strategic capability and infrastructure rather than demand creation: the barrier is that the value of reserve and surge capacity is not reflected in commercial procurement, which is an additionality question. Procurement remains relevant as a contracting mechanism — capacity-retainer or framework arrangements, consistent with the supplier-diversification and continuity requirements that procurement can carry — rather than as a means of forming a market that does not otherwise exist. Instruments of this kind are also least affected by the constraints of the defence and security procurement regime, since they operate through contractual commitment to identified suppliers rather than market-wide demand formation. This case also provides the concrete instance of the dual-use logic: the transformers, switchgear and transmission equipment at issue serve civilian electricity resilience and military mobility requirements alike, and coordinated civil and defence demand could sustain reserve and surge capacity that neither would support on its own.

7.4 Secondary aluminium as a circular security-of-supply capability

The EK report identifies external dependence in Finland's aluminium supply chain and proposes additional domestic production capacity as one way to strengthen security of supply [5]. The present assessment treats this as a capability concern whose material security-of-supply significance remains to be established, rather than as a validated capability gap. Primary production could reduce dependence on imported aluminium metal, but where upstream mineral feedstocks cannot be sourced domestically it would not eliminate the underlying external dependency.

An alternative or complementary pathway is to treat aluminium already circulating in the Finnish economy as a secondary domestic resource. This requires more than collection: scrap must be sorted, processed and remelted into material meeting the technical requirements of domestic users. Secondary aluminium cannot fully replace primary production, since material losses, alloy composition and quality requirements limit substitution in some applications. The strategic objective is therefore not aluminium self-sufficiency but reducing the share of strategically relevant demand exposed to external supply.

The relevant scale is consequently not a recycling rate or the capacity of a single plant, but the share of Finnish industrial demand that can be supplied from qualified domestic secondary aluminium — which requires matching recoverable scrap volumes with sorting and remelting capacity and downstream demand.

Access to recovered material is also shaped by waste-shipment rules. Regulation (EU) 2024/1157 introduces tighter controls on waste exports, with most new export provisions applying from 21 May 2027. Intra-EU shipments of scrap classified as waste remain subject to applicable information or notification and consent requirements [74]. These rules do not reserve material for Finnish users, so arrangements securing access to suitable scrap streams remain important.

The planned EU Circular Economy Act aims to strengthen the single market for secondary raw materials and stimulate supply and demand for recycled materials [75]. It would support the Clean Industrial Deal's objective of increasing the EU circular material use rate to 24% by 2030 [7]. These initiatives indicate the direction of policy rather than establish conditions on which the proposed intervention can already rely.

Such an intervention could generate the triple benefit:

- **Security of supply** would be strengthened where assured access to suitable scrap streams and qualified domestic processing capacity provide a recurring source of aluminium for strategically relevant uses, reducing exposure to disrupted external supply.
- **Economic value** would arise from retaining more of the aluminium value chain domestically through processing, remelting and industrial reuse.
- **Green-transition benefits** would arise where secondary aluminium displaces more energy- and resource-intensive primary production, subject to lifecycle performance.

The concrete policy question is how much of Finland's external aluminium dependency can be converted into a recoverable domestic material capability. A measurable intervention objective could be formulated around establishing, by 2035,

collection, sorting and secondary-production capacity sufficient to supply a defined share of strategically relevant Finnish aluminium demand from domestically recovered material. The precise target should be derived from recoverable scrap volumes, processing capacity and downstream material requirements.

Two financing pathways apply in combination: commercialisation and scale-up financing for missing sorting and remelting capacity, and demand creation through procurement or offtake arrangements for qualified secondary aluminium. Because the strategic value lies in the closed loop rather than in any single facility, arrangements securing predictable access to suitable scrap streams matter as much as processing capacity itself, consistent with the supplier-diversification and lifecycle requirements that procurement can carry.

Taken together, the four cases illustrate different pathways from Table 6.2 rather than repeating one intervention logic. Green hydrogen and captured CO_2 are demand-creation and shared-infrastructure problems in which bankable offtake and coordinated infrastructure development are central constraints; critical electricity equipment is a strategic-capability problem in which reserve and surge capacity is not fully commercially remunerated; secondary aluminium combines scale-up financing with demand creation for qualified material. The cases also illustrate different market conditions: hydrogen and captured carbon require market building, secondary aluminium requires coordination across a material loop, and electricity equipment requires preparedness capacity within an existing market. The appropriate instrument therefore follows from the barrier rather than from the sector or technology.

Chapter 8

Recommendations

This chapter answers the three questions the study was set: in which categories a synergy between green-transition objectives and defence and security-of-supply procurement is realistic, what should be done first, and through which mechanisms. The recommendations are addressed to the organisations that make comprehensive-security procurements and to the ministries that steer and finance them. One qualification applies throughout: the case studies illustrate plausible implementation pathways rather than constitute project-level appraisals. The recommendations translate the four cases into two proposed spearheads for further preparation: a shared hydrogen and captured-carbon feedstock platform, and critical electricity equipment resilience. Secondary aluminium is retained as an exploratory candidate.

8.1 Where synergy is realistic

This section identifies the categories of procurement in which the three objectives can reinforce one another, and names the capabilities that warrant preparation.

For the interventions examined in this study, opportunities to combine security, competitiveness and green-transition objectives appear most readily actionable in security-of-supply procurement under general rules and selected dual-use applications. The defence estate is a further setting for examination, rather than a finding established by the case studies. The relevant mechanisms include visible demand commitments, supply-continuity requirements and lifecycle performance. Their suitability depends on the capability, market conditions and applicable procurement arrangements.

This finding does not establish a general ranking of civilian and military procurement. Classification may constrain wider market signalling, but restricted procedures do not automatically imply limited visibility, and core defence procurement may support capability development through long-term supplier commitments, maintenance and continuity requirements. Budget size alone therefore does not determine the potential for combined benefits.

Within the opportunities examined, the study identifies two proposed spearheads for further preparation and a third area retained as an exploratory candidate.

Domestic molecules: hydrogen and captured carbon as an industrial feedstock platform. Green hydrogen and captured CO_2 are complementary rather than alternative — the second supplies the carbon input required to convert part of the first into industrial products — and both address the same capability pattern of established downstream capability dependent on externally supplied upstream inputs. Treated as one spearhead, the objective is a first shared production and infrastructure platform, not an isolated plant: 50–100 kt H_2/year of committed anchor demand together with expandable infrastructure, and approximately 0.1 Mt CO_2/year of bankable, qualified captured-carbon supply, both by 2035. The two targets represent different initial scales: the captured-carbon target is sized against the methanol example in Section 7.2, which would require approximately 13 kt of hydrogen per year, whereas the larger hydrogen target assumes additional industrial demand.

Critical electricity equipment and infrastructure resilience. Access to transformers, switchgear and transmission equipment determines both the resilience of the electricity system and the pace at which electrification can proceed, which makes this a particularly clear case in which the security and green-transition objectives depend on the same enabling capability. The objective is sufficient strategic reserves and contracted repair, procurement and production capacity to restore a defined share of critical grid infrastructure within an agreed recovery period, while sustaining essential grid-expansion activity. This is also the spearhead with the strongest dual-use character, since the same infrastructure carries growing military mobility requirements.

Circular materials: secondary aluminium, as a candidate. Qualified secondary production could reduce exposure to external primary supply and displace more energy- and resource-intensive primary production, subject to material suitability and lifecycle performance. It is presented as a candidate rather than a spearhead because its material security-of-supply significance and the scale that would matter — the share of strategically relevant Finnish demand suppliable from recovered material — have not been established.

8.2 What to do first

This section sets out four preparatory actions that need not await full calibration of the prioritisation or resolution of all outstanding questions. Initiating these actions does not in itself constitute a commitment to fund deployment of the proposed interventions.

Establishing which procurement regime applies to each spearhead, and who the buyer is. Instrument design must take account of the applicable legal framework: general procurement law, utilities procurement, the defence and security procurement regime, or a justified Treaty derogation. Identifying the buyer and determining which rules govern the proposed acquisition are therefore prerequisites for contract design. Utilities procurement is particularly relevant to electricity-network equipment. The buyer need not be the state, and state ownership alone does not determine the applicable procurement rules.

Commissioning a restoration-capability assessment for critical electricity equipment. The assessment should establish how much critical grid infrastructure Finland should be able to restore, within what period, without relying on normal international procurement conditions. It should test credible disrup-

tion scenarios against equipment lead times, existing reserves and the availability of protection, automation and supplier-support systems, including under cyber-related disruption. The result should identify any additional capability required and assess how best to secure it through reserves, regulatory obligations, operator arrangements or supplier contracts.

Testing bankable demand for the molecules platform with identified anchor buyers. Preparation should test whether committed offtake is the binding constraint, alongside the infrastructure and coordination requirements identified in the case studies. Engagement with potential anchor buyers, including state-owned energy and industrial companies and buyers serving defence-adjacent logistics, should establish whether early certified demand is achievable at the 50–100 kt H_2/year scale, and on what terms. Preparation should also identify the critical uses concerned and establish their residual disruption exposure after existing mitigation, since aggregate import volumes do not measure critical demand.

Designating responsibility for preparing European and allied co-financing. The National Audit Office has identified a personnel and coordination gap in preparing and managing co-financed projects [58], and has separately found that the security-of-supply funding base needs clearer alignment between instruments and capability needs [45]. Access to external financing is itself a capability and should be resourced alongside technical and commercial preparation.

8.3 By what mechanisms

This section sets out how each spearhead would be pursued once the buyer and the regime are established.

Selecting the instrument according to the barrier, not the sector or the technology. Demand instruments apply where demand certainty is absent, loans and guarantees where scale-up capital is lacking, public investment where security value is not commercially remunerated, and research support where technological uncertainty dominates. Where the barrier concerns obligations or market rules, regulation may be more appropriate than procurement or financing. The choice should consider effectiveness, cost allocation and existing responsibilities; this study focuses on procurement and financing pathways. Applying the wrong instrument does not merely underperform; it creates the appearance of public commitment without changing the investment conditions that govern whether a capability develops.

Matching the contract model to the state of the market, not to the size of the budget. Where technology is proven and demand certainty is the binding constraint, anchor and offtake contracts or appropriately designed price-support arrangements can make first-of-a-kind production bankable — the mechanism relevant to the molecules spearhead. Where the market functions but preparedness capacity is insufficient, reserved-capacity and preparedness contracts are options to assess alongside regulatory obligations and operator-led arrangements. Pre-commercial procurement and innovation partnerships address technological uncertainty and are of limited relevance to either spearhead, where the technologies are mature.

Coordinating civil and defence demand where a capability serves both. Critical grid equipment provides a concrete starting point. Semiconductor applications in communications, sensors and control systems offer a further area for examining shared requirements and opportunities to coordinate demand. Coordination of this kind requires institutional arrangements: the applicable procurement regime must be established for each acquisition, and aggregating demand requires cooperation across frameworks with different procedures and supplier-qualification requirements. Applicable export-control requirements must also be taken into account [13].

Building the European funding pathway for each spearhead deliberately and early. Funding preparation should match instruments to investment needs and eligibility: the European Defence Fund supports collaborative defence R&D, not general deployment [51], while InvestEU supports eligible investment [55]. Selection should consider the barrier addressed and the rules on combining support, not the instrument's size.

Making environmental criteria operational rather than declaratory. This means tying environmental criteria to lifecycle performance and, where applicable, recognised certification: EU renewable hydrogen rules for hydrogen offtake, lifecycle emissions relative to the incumbent pathway for captured carbon, and lifecycle performance alongside technical qualification for secondary aluminium. Their cost and supplier-choice implications should be stated explicitly rather than assuming compatibility with operational requirements.

8.4 What requires further preparation

This section identifies what remains to be settled: the ordering of the priorities, the scale at which each intervention should be set, and how far dual-use coordination can be relied on.

Calibrating the prioritisation before the ranking is treated as settled. The scoring criteria and aggregation approach should be calibrated so that the numerical result remains traceable to the capability assessment rather than becoming an independent ranking exercise. The two proposed spearheads warrant further preparation on the basis of the qualitative assessment and case-study analysis. Their relative priority, and the status of secondary aluminium, remain subject to calibration and further evidence.

Resolving the questions the case studies could not. For secondary aluminium, recoverable scrap volumes and qualified downstream demand; for captured carbon, the lifecycle conditions under which utilisation delivers a climate benefit; for critical electricity equipment, the equipment categories for which domestic repair or production capacity is economically justified as against contracted access. Each is a bounded study, and each determines the scale at which the corresponding intervention should be set.

Extending the capability assessment to the defence sector itself. The finding that the energy transition relocates external dependence towards equipment, specialised materials and processing capability has not been applied systematically to defence assets and supply chains, whose lifecycles extend beyond the period considered here. That assessment is a precondition for treating dual-use coordination as more than an aggregation of demand.

Chapter 9

Conclusions

This study asked which Finnish security-of-supply vulnerabilities can be reduced through defence and security-of-supply procurement while simultaneously strengthening competitiveness and supporting the green transition. Such opportunities exist, but they are more specific and conditional than a general case for domestic capacity would suggest. Identifying them depends on a distinction applied throughout the analysis: import dependence is not by itself a capability gap. Applying this test narrowed the assessment from general import dependence to specific capability concerns, while identifying where further evidence is needed to establish material exposure under disruption. This provides a more focused basis for examining where procurement and public investment can plausibly act.

The capability assessment identified three related structural patterns and a cross-cutting change in capability requirements. First, established domestic production can depend on externally supplied upstream inputs, as illustrated by petrochemical feedstocks and selected alloying materials for specialty steel. Second, the ability to operate critical infrastructure does not by itself ensure access to the equipment needed to maintain, restore and expand it, as illustrated by transformers and switchgear in the electricity system. Third, domestic strengths at selected stages of a value chain can coexist with reliance on external processing or manufacturing at others, as illustrated by semiconductor design and pilot capabilities linked to external commercial-scale fabrication and downstream processing. These patterns overlap, and their security-of-supply significance depends on the critical function concerned and the mitigation available. Across them, the energy transition changes capability requirements: reduced reliance on imported fossil fuels can be accompanied by greater dependence on equipment, specialised materials and processing capability. Assessments to 2035 must therefore consider the changing dependency profile rather than current requirements alone. Repair and recovery capability remains an exploratory concern, supported by weaker and less uniform evidence.

A second result concerns the conditions under which procurement can support combined benefits. For the interventions examined, opportunities appear most readily actionable in security-of-supply procurement under general rules and selected dual-use applications. Wider market formation depends partly on demand being visible beyond existing suppliers, while classification may constrain that visibility. Restricted procedures do not, however, automatically imply limited market signalling, and capability development may also proceed through contractual commitments to identified suppliers. The finding is therefore conditional rather than

a general ranking of procurement categories: budget size alone does not determine the potential for combined benefits.

The indicative assessment highlighted Critical Materials and Feedstocks and Energy Infrastructure Resilience as promising investment areas. The case studies developed two proposed spearheads for further preparation: a shared hydrogen and captured-carbon feedstock platform, and reserve and surge capacity for critical electricity equipment. Secondary aluminium remains an exploratory candidate. Across the four cases, different binding constraints — bankable offtake, uncompensated reserve capacity and the organisation of a material loop — call for different instruments and targets: a demand volume, a recovery time or a share of domestic demand. The form of the intervention therefore follows from the barrier, not the sector or technology.

It follows that the triple benefit is not a property that investment areas possess, but a condition that particular interventions may or may not satisfy. Where the three objectives genuinely reinforce one another, they do so through a specific mechanism: the same capability, asset or demand commitment advances more than one objective because progress towards one enables progress towards another. Where that mechanism is absent, the objectives may each be worth pursuing, but they do not constitute a combined case for public intervention, and treating them as one risks justifying investment on the accumulation of benefits rather than on their interaction.

The limits should be read alongside these conclusions. The four sectors assessed are energy, chemicals, materials and digital; vulnerabilities running through food, water, health, finance or transport lie outside the study's scope rather than having been judged less severe. The scoring is qualitative and uncalibrated. The two proposed spearheads warrant further preparation, but their relative priority remains subject to calibration and further evidence. The evidence behind Strategic Repair and Recovery and Circular Materials is less uniform than that supporting the strongest sectoral findings. The green-transition dimension establishes the direction in which decarbonisation changes capability requirements but not its magnitude, and no emissions effects are quantified. The case studies illustrate plausible pathways rather than constitute project-level appraisals, and the scales they identify are order-of-magnitude working ranges intended to indicate the scale of an initial intervention, not validated investment thresholds.

What follows is a decision about preparation, not deployment: which spearheads to carry forward, which procurement levers to test first, and for which a credible European or allied funding pathway can be built. Two things coincide in the period to 2035. The trajectory of Finnish security-related expenditure creates opportunities for longer-term capability development, but additional demand for particular capabilities must be established through identified buyers, funded requirements and contract design. The same period carries the investment requirements implied by the carbon-neutrality objective [4]. Whether that coincidence produces combined value or merely parallel spending turns on two questions: whether each instrument is matched to the barrier that actually constrains the capability, and whether the procurement regime governing that capability lets the instrument work as intended.

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Appendix A

Scoring frameworks

Tables A.1 and A.2 reproduce the qualitative five-point scoring frameworks used in the Lens 1 and Lens 2 assessment described in §3.5.

Table A.1: Qualitative scoring framework used to evaluate Lens 1: Strategic Investment Opportunities

Score	**Economic and Industrial Potential**	**System Transformation Potential**	**Green Transition Contribution**	**Strategic Domestic Capability Development**
1	Limited niche economic activity with little wider industrial impact.	Benefits a single technology or application with negligible wider system effects.	Negligible contribution to decarbonisation or resource efficiency.	Limited opportunity to establish or strengthen enduring domestic capability.
2	Supports a specialised industrial capability with modest value-chain effects.	Improves one sector but produces limited wider structural change.	Limited indirect contribution to one transition objective.	Incrementally strengthens an existing capability.
3	Strengthens an existing industrial sector and creates moderate value-chain opportunities.	Enables improvements across several related sectors.	Moderate contribution through one or more transition pathways.	Develops important national competence in a specialised field.
4	Creates significant industrial growth and strengthens multiple firms and markets.	Enables major structural changes affecting several critical systems.	Significant contribution to multiple green-transition objectives.	Builds a substantial domestic industrial ecosystem with broader spillovers.
5	Has the potential to establish or transform nationally significant industrial value chains.	Represents a foundational capability for long-term national system transformation.	Fundamental enabler of Finland's long-term decarbonisation and resource-efficiency objectives.	Creates or fundamentally strengthens a nationally strategic capability base.

Table A.2: Qualitative scoring framework used to evaluate Lens 2: Strategic Public Intervention Opportunities

Score	Strategic Synergy	EU Strategic Opportunity	Public Intervention Additionality	Instrument Suitability
1	Primarily advances one objective; limited benefits for the other two.	Limited EU relevance and little opportunity for cooperation, markets or financing.	Limited barriers to private investment; public intervention largely unnecessary.	Limited relevance of procurement or public investment to the identified barrier.
2	Meaningful reinforcing effects between two objectives; limited contribution to, or interaction with, the third.	Clear EU alignment, but limited additional value from European cooperation or support.	Some market or coordination barriers, but private actors could plausibly overcome them.	Some relevance, but other instruments may be more appropriate.
3	Meaningful contribution to all three objectives, with some reinforcing effects.	Strong EU relevance with identifiable opportunities for cooperation, value-chain integration or EU financing.	Significant market, coordination, technology or demand barriers; targeted intervention could improve outcomes.	Procurement or public investment provides a credible means of addressing the barrier.
4	Strong benefits across all three objectives, with clear reinforcing effects.	Strong EU alignment with substantial opportunities for cooperation, joint action, value-chain integration or EU financing.	Strong market or coordination failures constrain a strategically important capability; intervention likely necessary.	Procurement or public investment is particularly well suited to address the barrier.
5	Strong and structural interdependence between security, competitiveness and the green transition.	Significant European strategic capability or dependency; European action can substantially amplify Finland's strategic or economic value.	Severe and persistent market or coordination failure; public intervention necessary to deliver the capability at the socially desirable level.	Procurement or public investment is clearly among the most effective and proportionate instruments available.

Appendix B

Capability inventory

B.1 Overview

This appendix reproduces the capability-gap inventory on which the domestic capability assessment in Chapter 4 is based. The inventory is an evidence-linked record of domestic capabilities, external dependencies, critical functions and capability gaps relevant to security of supply. Only evidence supported by a cited source is included.

Each row is an evidence item, identified by a sector letter and a number (for example, E-001). It records the domestic capability the evidence indicates, the external dependency and the critical function involved, and whether a capability gap follows. Identifiers are retained from the study's working inventory and have not been renumbered; rows that do not meet the inclusion criterion above are omitted, so the numbering within each sector is not consecutive. Findings are identified by CORE followed by a sector letter and a number (for example, CORE-E-01). These identifiers link the evidence items to the cross-sector synthesis in Section 4.5. CORE-M-02 is retained for tracking an unresolved aluminium value-chain concern and does not denote a validated capability gap. Following the approach set out in Chapter 3, import dependence is not treated as a capability gap in itself: a gap requires a critical function, a relevant domestic capability and a material deficiency under disruption once stocks, substitution, diversification and other mitigating arrangements are taken into account.

The appendix is organised in four parts: this overview; the inventory itself (Section B.2); the classification applied to each row (Section B.3); and the findings the inventory supports (Section B.4).

B.2 Capability inventory

Table B.1 lists the inventory by sector. The Ref. column gives the source of each evidence item, and the final column gives its evidence status, its relevance and the finding it is linked to; the categories are defined in Section B.3.

Table B.1: Capability inventory

ID / system	Evidence	Ref.	Domestic capability	External dependency	Critical function	Capability gap	Status / relevance / finding
Energy							
E-001 Oil	No domestic crude oil production; oil remains an important energy source and is concentrated particularly in transport.	[27, 26, 76]	No domestic primary production; downstream refining and strategic storage capability is established.	Imported crude oil; maritime transport; concentrated refining route.	Transport, industry, backup heat	Dependence on externally supplied crude oil for important domestic functions, mitigated by strategic stocks, diversified sourcing and domestic refining.	Validated *Core* CORE-E-01
E-002 Oil	Porvoo is Finland's only crude-oil refinery; imported crude is processed domestically.	[26, 76]	Strong domestic refining capability with geographic concentration.	Imported crude supply.	Fuel production	Geographic concentration of refining creates a potential resilience vulnerability, while the upstream crude dependency remains external.	Validated *Supporting* CORE-E-01
E-003 Oil	Finland maintains strategic oil stocks; 2021 reserves corresponded to approximately 259 days of net imports.	[26]	Strong strategic storage capability.	Stock replenishment depends on imported crude/ products.	Emergency fuel supply	No major current storage capability gap identified.	Validated *Supporting* CORE-E-01
E-004 Natural gas	Finland has no domestic natural gas production and is entirely dependent on imports.	[27, 77]	No domestic primary production.	LNG imports; foreign suppliers; regional gas infrastructure.	Industrial processes	External supply dependency for selected industrial and energy uses.	Validated *Core* CORE-E-01
E-005 Natural gas	Supply shifted towards LNG imports and the Balticconnector connection; Finland has LNG import terminals in Inkoo and Hamina.	[26, 77]	Strong import infrastructure capability with diversified routes compared with previous pipeline dependence.	LNG supply chains and cross-border Balticconnector infrastructure.	Industrial energy supply	Dependence on external supply and cross-border infrastructure remains, despite diversification.	Validated *Supporting* CORE-E-01

ID / system	Evidence	Ref.	Domestic capability	External dependency	Critical function	Capability gap	Status / relevance / finding
E-006 Natural gas	Emergency natural gas reserves are maintained in underground storage facilities in Latvia.	[26]	Limited domestic storage; emergency reserve arrangement exists outside Finland.	External storage location and regional infrastructure.	Supply continuity	External location of emergency reserves creates a residual dependency in gas supply continuity.	Validated *Supporting* CORE-E-01
E-007 Coal	Finland has no domestic coal production and is entirely dependent on imports; coal use is concentrated primarily in steel industry.	[27, 26, 78]	No domestic primary production; coal-fired electricity production effectively ceased in 2025, apart from reserve capacity.	International coal suppliers; maritime transport.	Steel industry	External dependency for remaining coal-using industrial functions, with declining overall role and policy phase-out.	Validated *Supporting* CORE-E-01
E-008 Peat	Peat is domestically available and remains an emergency fuel resource, although production has declined substantially.	[79]	Strong domestic production capability, but long-term production capability is declining.	Mainly domestic supply.	Emergency heat	Potential long-term erosion of a domestic fuel-security capability.	Validated *Supporting* E-CONTEXT-01
E-009 Peat	Peat is maintained as an emergency fuel reserve equivalent to approximately six months of consumption for heat and power generation.	[79]	Strong strategic reserve capability.	Domestic production required for future replenishment.	Heating security	No immediate storage gap identified; long-term production decline may affect replenishment capability.	Validated *Supporting* E-CONTEXT-01
E-010 Nuclear	Nuclear energy accounts for approximately 39% of Finnish electricity generation and provides stable baseload generation.	[27]	Strong domestic nuclear generation and operational capability.	International nuclear fuel supply chain.	Baseload electricity	Domestic generation capability is strong but depends on external fuel supply.	Validated *Core* CORE-E-01

ID / system	Evidence	Ref.	Domestic capability	External dependency	Critical function	Capability gap	Status / relevance / finding
E-011 Nuclear	Fuel assemblies for Finnish reactors are imported from Germany, the US, Spain and Sweden; on-site inventories are sufficient for two years of operation.	[28, 29, 26]	Domestic reactor operation; no domestic fuel fabrication capability identified in the inventory.	Foreign fuel suppliers/ fabrication facilities; international transport.	Reactor operation	Dependence on international fuel-fabrication supply chain, mitigated by on-site inventories.	Validated *Core* CORE-E-01
E-012 Electricity	Electricity generation is diversified, dominated by nuclear, wind, hydropower and biofuels.	[27]	Strong/diversified domestic generation capability.	Cross-border electricity system provides balancing and additional supply.	Economy-wide electricity	Seasonal or temporal supply deficits remain despite strong domestic generation.	Validated *Core* CORE-E-02
E-013 Electricity	Finland's transmission system is operated by Fingrid and is interconnected with Sweden, Estonia and Norway; cross-border exchanges support balancing.	[26, 15]	Strong domestic transmission and system-operation capability.	Nordic/Baltic cross-border interconnections.	Power-system stability and supply adequacy	Dependence on cross-border electricity infrastructure for balancing and supply during periods of higher import reliance.	Validated *Core* CORE-E-02

ID / system	Evidence	Ref.	Domestic capability	External dependency	Critical function	Capability gap	Status / relevance / finding
E-014 Electricity	Transformers, switchgear and transmission equipment are identified as essential components; the report identifies import dependence and/or limited domestic manufacturing capability for several of these equipment categories, while noting that demand is expected to increase with electrification and other electricity-system expansion.	[5]	Domestic capability exists in parts of the power-grid equipment value chain, but important equipment categories rely on imports or have limited domestic manufacturing capacity.	Foreign manufacturers and suppliers of transformers, switchgear and selected grid components/ materials.	Electricity transmission, distribution, grid expansion, maintenance and restoration.	Insufficient domestic manufacturing capacity and/or supply resilience for selected critical power-grid equipment creates external dependency for maintaining and expanding the electricity system.	Validated *Core* CORE-E-03
E-015 Power transformers	The report identifies transformer availability as import-dependent and highlights increasing demand associated with electrification and data-centre construction.	[5]	Limited domestic manufacturing capability relative to system requirements; supply depends substantially on external manufacturers.	Foreign transformer manufacturers and associated components/ materials.	Electricity transmission, distribution and grid expansion.	External dependence for critical transformer supply creates a vulnerability for electricity-system expansion, replacement and resilience.	Validated *Core* CORE-E-03
E-016 Grid switchgear	The report identifies no Finnish manufacturing of high-voltage switchgear and insufficient domestic capacity for projected low- and medium-voltage switchgear demand.	[5]	Domestic capability is insufficient in key switchgear categories relative to projected system requirements.	Foreign switchgear manufacturers and suppliers.	Grid operation, protection, transmission/ distribution and expansion.	Limited domestic switchgear manufacturing capacity creates external dependency for critical grid infrastructure and may constrain resilient system expansion and replacement.	Validated *Core* CORE-E-03

ID / system	Evidence	Ref.	Domestic capability	External dependency	Critical function	Capability gap	Status / relevance / finding
E-017 Power electronics	Current evidence indicates selected domestic capability but significant external supply integration; the available evidence in *Kasvua kriisinkestävyydestä* does not by itself establish a distinct Finnish power-electronics manufacturing capability gap.	[5]	Selected domestic capability may exist, but the extent and resilience of domestic manufacturing capability are not sufficiently established.	International suppliers of power-electronic equipment and components.	Grid, generation, industry and transport electrification.	Potential dependence on imported power-electronic equipment and components, but a distinct capability gap requires further evidence.	Partially supported *Supporting* —
E-020 Heat	Heat production is diversified; district heating is dominant in urban areas and uses biomass, waste, electricity, recovered heat and smaller fossil-fuel shares.	[16]	Diversified heat-production capability.	Electricity, biomass and selected fuels; increasing electricity dependence.	Space heating	No general heat-production capability gap established; system transformation changes dependency profile.	Validated *Supporting* E-CONTEXT-01
E-021 Heat	Electric boilers and thermal storage are increasing; thermal storage enables shifting heat production and provides flexibility to the electricity system.	[16]	Growing domestic capability.	Equipment, electricity-market integration and technology.	District-heating resilience	Storage/flexibility capacity remains developing.	Partially supported *Supporting* E-CONTEXT-01
E-025 Steel pylons / transmission towers	The report identifies steel pylons as imported despite the existence of a domestic steel and related value-chain capability.	[5]	Domestic upstream capability exists, but finished transmission structures are externally supplied.	Imported steel pylons and external suppliers.	Electricity transmission infrastructure.	Dependence on imported finished transmission structures creates an external supply dependency for critical grid infrastructure.	Validated *Supporting* CORE-E-03

ID / system	Evidence	Ref.	Domestic capability	External dependency	Critical function	Capability gap	Status / relevance / finding
E-026 Grid insulators	The report identifies scarce production of grid insulators and proposes stockpiling as a resilience measure.	[5]	Limited/scarce domestic production capability.	External suppliers for critical grid insulators.	Electricity transmission and distribution.	Limited domestic availability of critical grid insulators creates a supply vulnerability that may require external sourcing and/or strategic stockpiling.	Validated *Supporting* CORE-E-03
E-027 Electrical steel and critical equipment components	The report identifies dependence on imported electrical steel and other components used in transformers and switchgear, while noting limited European production capacity for electrical steel.	[5]	Domestic capability is limited for selected specialised materials/ components required for critical grid equipment.	Foreign suppliers of electrical steel and specialised equipment components.	Manufacture, maintenance and replacement of critical power-grid equipment.	External dependence on specialised materials and components can constrain domestic production and timely replacement of critical grid equipment.	Validated *Supporting* CORE-E-03
Chemicals							
C-004 Petrochemicals	The EK report describes Finnish petrochemical value chains as dependent on imported chemicals or imported feedstocks and links petrochemical products to downstream plastics and industrial applications.	[5]	Established domestic petrochemical processing capability, but the upstream value chain remains dependent on imported chemicals/ feedstocks.	Imported chemicals and fossil feedstocks; international supply chains.	Petrochemical production; downstream plastics and industrial products	External feedstock dependence may expose domestic petrochemical production and downstream material supply to disruption; its material significance requires assessment against stocks, substitution and diversified sourcing.	Requires additional evidence *Core* CORE-C-02

ID / system	Evidence	Ref.	Domestic capability	External dependency	Critical function	Capability gap	Status / relevance / finding
C-006 Methanol	The EK report identifies approximately 70 kt of methanol imports and states that there is no domestic production.	[5]	No domestic methanol production capability identified in the cited source.	Imported methanol; external suppliers.	Chemical industry; industrial value chains	External supply dependence is established, but the residual exposure of critical uses after stocks, substitution and diversified sourcing requires assessment.	Requires additional evidence *Core* CORE-C-01
C-007 Caustic soda and sulfur	The EK report identifies approximately 0.7 Mt of caustic soda net imports, very limited domestic production, and significant sulfur imports; it links these chemicals to forest-industry and battery value chains and discusses potential domestic recovery from sulfate streams.	[5]	Limited domestic production/recovery capability; potential domestic recovery route identified.	Imported caustic soda and sulfur.	Forest industry; battery value chains; industrial processes	Significant import dependence and limited domestic production/ recovery capability are established; their material security-of-supply significance requires input-specific assessment against existing mitigation.	Requires additional evidence *Core* CORE-C-01
C-008 Aromatic compounds	The EK report states that approximately 130 kt of aromatic compounds are imported annually from Central Europe because Finland has no local production.	[5]	No local production capability identified in the cited source.	Imports from Central Europe.	Chemical industry; downstream industrial products	External supply dependence is established, but the residual exposure of critical uses after stocks, substitution and diversified sourcing requires assessment.	Requires additional evidence *Core* CORE-C-01

ID / system	Evidence	Ref.	Domestic capability	External dependency	Critical function	Capability gap	Status / relevance / finding
C-009 Petrochemical feedstocks / olefins	The EK report states that the Finnish petrochemical value chain is dependent on imported chemicals or feedstocks and describes dependence on imported fossil feedstocks for petrochemical production.	[5]	Established domestic petrochemical processing capability without independence from imported upstream feedstocks.	Imported fossil feedstocks and chemicals.	Petrochemical production; downstream plastics, packaging, equipment, vehicles, pipes and cables	External feedstock dependence may expose downstream material supply to disruption; the residual exposure of particular functions requires assessment against stocks, substitution and diversified sourcing.	Requires additional evidence *Core* CORE-C-02
Materials							
M-009 Steel	Domestic steel production is strong, with selected dependencies on imported raw materials, ferroalloys and alloying materials.	[5]	Strong domestic steel-production capability with selected external input dependencies.	Iron, ferroalloys and alloying materials.	Infrastructure; machinery; defence	Domestic steel capability depends on selected externally supplied inputs; the materiality of these dependencies requires product-specific assessment.	Requires additional evidence *Supporting* CORE-M-01
M-010 Specialty steel inputs	Specialty steel production depends on selected imported alloying inputs, including ferroniobium and other specialised materials.	[5]	Partial domestic capability in selected alloying/ intermediate inputs; domestic steelmaking cannot be fully supplied from domestic specialty inputs.	Imported ferroniobium and other alloying materials.	Specialty / HSLA steel; infrastructure; machinery	Dependence on selected imported alloying inputs can constrain domestic capability to produce certain specialty steel grades if external supply is disrupted.	Validated *Core* CORE-M-01

ID / system	Evidence	Ref.	Domestic capability	External dependency	Critical function	Capability gap	Status / relevance / finding
M-017 Aluminium	The EK report identifies limited vulnerability in aluminium volumes but a significant opportunity to strengthen Finland's metals and equipment value chain through a major aluminium project. The inventory indicates domestic capability is concentrated in downstream/recycled aluminium rather than a complete value chain of primary-to-high-value.	[5]	Domestic aluminium capability exists in recycling/ downstream stages, while primary/ high-value stages are not fully represented domestically in the reviewed evidence.	Imported primary aluminium and higher-value aluminium products; upstream bauxite/alumina would also be externally sourced for any new primary project.	Metals and equipment manufacturing; selected industrial applications	Potential missing stages in the domestic aluminium value chain may create external dependence for selected products, but the security-of-supply significance and critical functions require targeted assessment.	Requires additional evidence *Unresolved* CORE-M-02
M-018 Long steel products	The EK report states that Finland relies mainly on imports of long steel products, approximately 0.4 Mt, and that domestic production would face competitiveness/ overcapacity constraints.	[5]	Domestic production is limited relative to current long-steel demand; imports are the main supply route.	Imported long steel products; supply chains through Norway and Central Europe.	Construction; infrastructure; machinery	Import dependence exists, but the current evidence does not demonstrate that it constitutes a security-of-supply capability gap rather than an economically efficient supply arrangement.	Validated *Supporting* —

ID / system	Evidence	Ref.	Domestic capability	External dependency	Critical function	Capability gap	Status / relevance / finding
M-019 Defence-industry steel	The EK report states that most domestic plate-steel demand of approximately 1.1 Mt can be met by domestic production, but there is no production approved for defence-industry use.	[5]	Substantial domestic plate-steel production exists; defence-use approval/ qualification is not established in the cited source.	Potential reliance on externally approved/suitable steel supply.	Defence-industry material supply	The absence of approved domestic production is an identified condition, but the current evidence does not establish whether the underlying issue is technical capability, qualification, regulation, procurement or another constraint; a capability gap is therefore not demonstrated.	Validated *Unresolved* —
Digital							
D-004 Semiconductors	Commercial high-volume semiconductor fabrication is not established at significant domestic scale.	[5]	Commercial-scale domestic fabrication capability not established in the reviewed evidence.	Foreign foundries and equipment.	Electronics, ICT and industrial systems.	Dependence on external fabrication constrains the ability to scale selected semiconductor technologies domestically.	Requires additional evidence *Core* CORE-D-01
D-005 Semiconductors	Commercial packaging, assembly and testing capability is not established at significant domestic scale.	[5]	Commercial national capability not established in the reviewed evidence.	Foreign packaging/testing capacity and equipment.	Electronics, ICT and industrial systems.	External dependence remains at downstream stages between device fabrication and usable semiconductor products.	Requires additional evidence *Core* CORE-D-01

B.3 Classification

Each row is classified by evidence status and by its relevance to the findings (Table B.2).

Table B.2: Evidence status and relevance

Evidence status	
Validated	Evidence is sufficient for the claim made in the row.
Partially supported	Some support exists, but a specific element of the row needs further evidence or qualification.
Requires additional evidence	The claim is supported by a cited source, but its significance for security of supply needs further assessment.
Relevance	
Core	Directly supports a finding.
Supporting	Strengthens, qualifies or contextualises a finding.
Unresolved	Potentially important but not yet sufficiently established.

B.4 Findings

Table B.3 links the findings presented in Chapter 4 to the evidence items supporting them. Core rows provide the direct evidence for a finding; supporting rows strengthen, qualify or contextualise it. These relevance labels do not by themselves establish that a material security-of-supply capability gap has been validated; the evidence status and table notes qualify how each finding should be interpreted.

Table B.3: Findings and the evidence items supporting them

ID	Finding	Core rows	Supporting rows
CORE-E-01	External dependence in selected critical energy supply chains	E-001, E-004, E-010, E-011	E-002, E-003, E-005–E-007
CORE-E-02	Dependence on cross-border electricity infrastructure	E-012, E-013	–
CORE-E-03	Critical power-grid equipment for electricity-system expansion, maintenance and resilience	E-014–E-016	E-025–E-027
E-CONTEXT-01	Increasing electrification as a structural driver (context)	–	E-008, E-009, E-020, E-021
CORE-C-01*	Selected chemical-production and import dependencies: security-of-supply significance requires further assessment	C-006–C-008	–
CORE-C-02*	Domestic petrochemical capability depends on imported upstream feedstocks: residual disruption exposure requires further assessment	C-004, C-009	–
CORE-M-01	Selected critical alloying and specialty inputs constrain otherwise strong domestic steel production	M-010	M-009
CORE-M-02	Aluminium value-chain concern: security-of-supply significance unresolved	–	M-017†
CORE-D-01‡	Limited domestic semiconductor manufacturing and downstream processing capability	D-004, D-005	–

*For CORE-C-01 and CORE-C-02, dependencies are established; material exposure requires input- and function-specific assessment after stocks, substitution and diversified sourcing.

†M-017 is classified as Unresolved (Table B.1) and is listed under supporting rows for tracking only. CORE-M-02 tracks an unresolved aluminium value-chain concern, not a validated security-of-supply capability gap.

‡For CORE-D-01, domestic value-chain limitations are identified; material exposure requires further assessment, including European and allied supply arrangements.

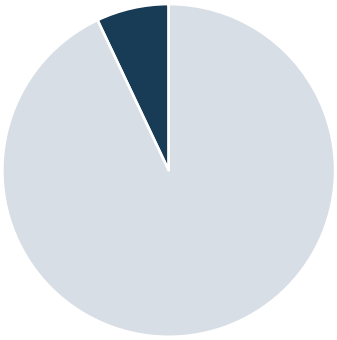
Appendix C

Finland's defence spending: scale, composition and trends

This appendix illustrates the scale of Finland's defence spending, its allocation across expenditure categories and its development over time. The figures distinguish state-budget appropriations from SIPRI's military expenditure series; neither measures total comprehensive-security expenditure or procurement under the defence and security procurement act.

SIPRI's series indicates that Finland's military expenditure increased by approximately 87% in real terms between 2016 and 2025, while its share of GDP rose from approximately 1.43% to 2.57%. The increase was concentrated in the later years of the period [82].

Finland's state budget, 2026
Total appropriations: EUR 90.830 billion

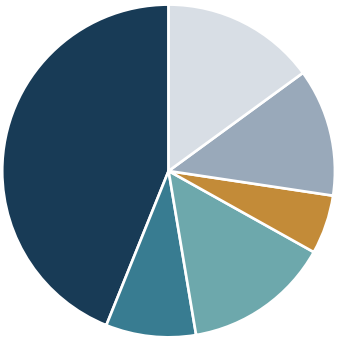


Category	EUR billion	Share
Defence administration	6.397	7.0%
Other state-budget expenditure	84.433	93.0%

Figure C.1: Defence administration within Finland's original 2026 state budget. Total appropriations are EUR 90.830 billion. The Ministry of Defence's published breakdown totals approximately EUR 6.397 billion, including VAT. The figure excludes subsequent supplementary budgets and does not represent total general-government expenditure. Sources: [80, 81]; authors' calculations.

Finland's defence administration budget, 2026

Total: EUR 6.397 billion



Category	EUR million	Share
Materiel procurement	2,808	43.9%
Materiel maintenance, excluding salaries	560	8.8%
Defence Forces payroll	911	14.2%
Defence Forces real estate	367	5.7%
Other military operating expenditure	794	12.4%
Crisis management, VAT and other administration	957	15.0%
Total	6,397	100.0%

Figure C.2: Composition of Finland's defence administration budget, 2026, in current prices, including VAT. Materiel procurement combines other materiel (EUR 1,240 million), the F-35 programme (EUR 1,355 million) and Squadron 2020 (EUR 213 million). Other military operating expenditure combines conscript upkeep and other military expenditure. The final category combines military crisis management, VAT and other administration. Figures are budget allocations, not realised expenditure or multi-year procurement authorisations. Source: [81]; authors' grouping and calculations.

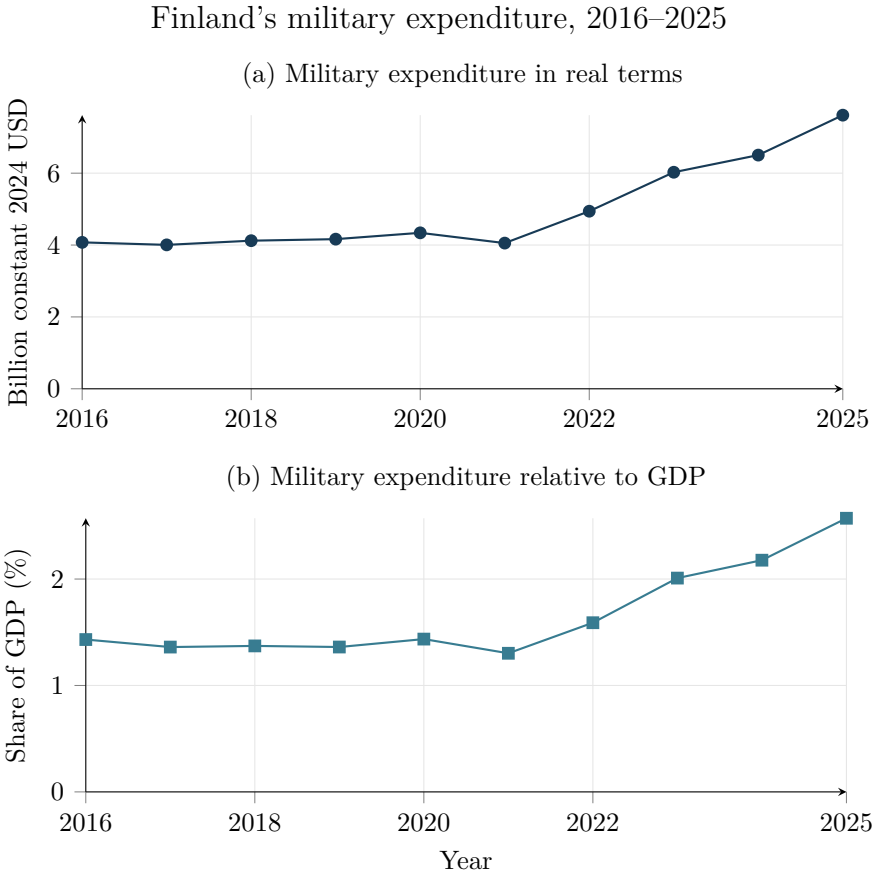


Figure C.3: Finland's military expenditure, 2016–2025. Panel (a) shows expenditure at constant 2024 prices and exchange rates, in billion US dollars; panel (b) shows military expenditure as a percentage of GDP. The Finland series includes pensions and paramilitary forces. SIPRI military expenditure differs in scope from the defence administration budget shown in Figures C.1 and C.2. Source: [82], 1949–2025 workbook, version 1.2; authors' unit conversions.