High-Level SRIA

EERA tJP Energy Security and Resilience (tJP-ESR)

Executive summary

Contents

1. Context and Rationale

Strategic landscape: Europe faces complex, interconnected risks especially related to climate, security, and competitiveness. Energy system resilience sits at the intersection of these challenges, with low-carbon energy R&I playing a central role in strengthening energy system security and resilience.

Opportunities: Strong political alignment on this theme creates an opportunity to steer strategic low-carbon energy R&I investments towards competitiveness, security, climate objectives, and social readiness, and the overall system resilience through the upcoming FP10. It also offers a chance to position EERA as a more explicit actor on this pressing issue, strengthening the role and impact of both EERA and its participating organisations while providing research-based input to support European policymaking.

EERA's role: Building on the 2025 Working Group on Energy Resilience and Preparedness and the position paper issued at the end of 2025 and informed by discussions at the 21–22 January 2026 Presidency Strategy retreat, a transversal JP is proposed to embed energy security and resilience across the EERA research ecosystem.

2. Motivation and background (why)

Continuity of energy supply, and the related security and resilience of energy systems have always been essential for well-functioning societies. Until recently, European policy efforts largely prioritised building an efficient and integrated energy system, often under the assumption of a relatively stable geopolitical environment.

Recent developments — particularly Russia's war against Ukraine, growing uncertainty in transatlantic relations, global market tensions, strategic dependencies in clean energy supply chains (notably on China), and renewed instability in the Middle East — have exposed the limits of this approach and revealed structural vulnerabilities. Together, these developments signal a shift from isolated disruptions to a more persistent and systemic form of risk. In this context, energy is increasingly used as a geopolitical tool, while critical infrastructure faces growing threats, including deliberate hostile physical-, cyber- and hybrid attacks.

At the same time, the growing electrification of modern economies is increasing society's dependence on reliable energy supply. Citizens, businesses, public services, and critical infrastructure now rely more than ever on uninterrupted energy, meaning that disruptions can have immediate and far-reaching consequences. Climate change and related risks will increase going forward. Sector coupling, coordination between energy carriers, and digitalization creates new interdependencies and complexity in the system, with the potential of failures propagating between infrastructures, and new interfaces where the system is exposed to threats.

To respond effectively, we must adapt how we plan, design, and operate energy systems, recognising these new threats and vulnerabilities.

In 2025, EERA addressed these challenges by forming a transversal team across several Joint Programmes to develop a position paper. The paper was presented and discussed at multiple events that year, including as a top priority at the EERA High-Level Policy Conference on 3 December 2025.

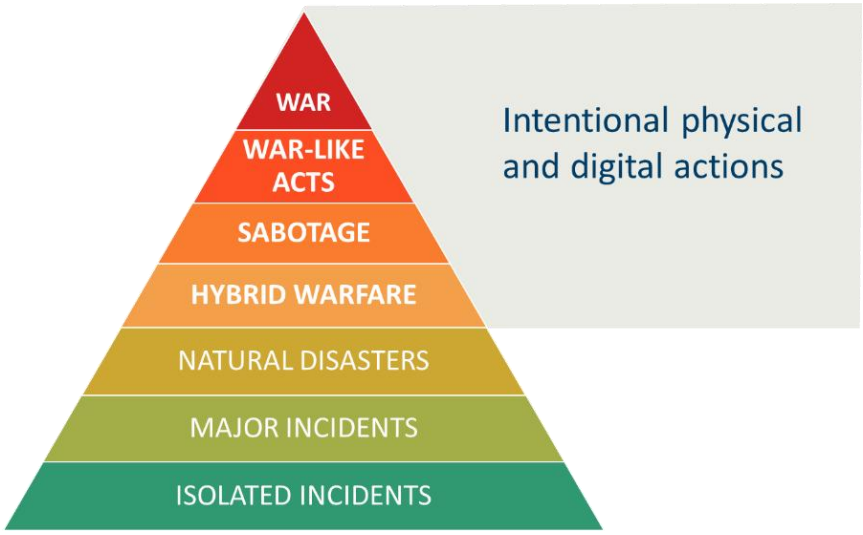
The initiative and position paper were well received, gaining momentum in addressing this critical issue. In the SET-Plan Steering Group there are currently ongoing discussions on how to mobilise a stronger and more explicit effort on energy security and resilience. Current discussions aim to establish a SET-Plan task force.

The findings from EERA's 2025 Working Group on Energy Resilience and Preparedness work form a shared foundation for the SRIA. This draft SRIA is intended only to organise, not pre-decide, the future priorities of the Joint Programmes. It serves as a starting point — an invitation for all participating EERA JPs and member organisations to contribute, challenge, and refine these priorities.

3. Important findings from the development of EERAs position paper

Some important findings from EERA's work on the development of the position paper "Resilience and preparedness in Europe's energy transition: the role of low-carbon energy R&I" are as follows:

The most significant threat at present is that our energy systems have, over the past decades, been built under the assumption of a prolonged period of peace. This assumption no longer holds. We must now fully address the risks posed by intentional physical, digital, and hybrid actions - that is, the top layers of the risk pyramid (see figure below).



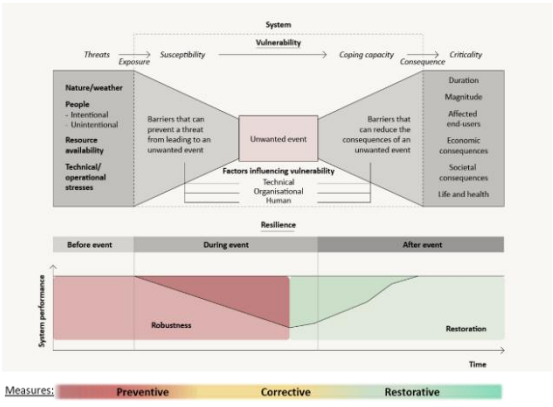
Source: "The risk pyramid". Source: SINTEF/NTNU report – Towards an Energy-Secure and Resilient Society

The present geopolitical situation has shed light on the mutual dependencies between energy supply and defence capabilities. In NATO's Article 3, "Resilient energy supplies" is listed as number two among the requirements for civil preparedness. It is evident that insufficient attention to intentional threats to energy security has led to significant shortcomings in our overall defence capacity.

EERA has demonstrated the capacity to bring together world-leading scientific expertise in this domain, providing a strong foundation on which to build. However, we need to approach the issue from a new perspective and, among other things, strengthen our capabilities to address deliberate hostile interventions - physical, cyber, and hybrid. Below are two excerpts from the current knowledge base.

FIGURE 1:
Source: Vaasa University

Source: Vaasa University



Bow tie model for risk, vulnerability and resilience, and related concepts.
Source: SINTEF/NTNU report – Towards an Energy-Secure and Resilient Society

It is clear, however, that without a strategic, targeted, and sustained ramp-up in RD&I capacity for energy security and resilience, Europe risks undermining both its energy security and its strategic autonomy. The establishment of an EERA tJP on Energy Security and Resilience would play a vital role in this regard, serving both as a European collective knowledge resource and as a strategic actor providing the best possible research-based, independent advice to policymakers and industry.

4. Why now?

The resilience and preparedness of energy systems face new threats, while at the same time becoming increasingly essential for Europe. Massive investments in energy systems lie ahead across Europe. It is therefore crucial that these investment decisions are informed by research and innovation, helping to accelerate innovation and ensure that the right choices are made. At the same time, the next European Framework Programme is currently being shaped, making this a critical moment to develop a shared and robust European strategic research agenda for energy system resilience and preparedness for the coming decade.

5. Scope and mission (what)

This initiative is well anchored in EERAs mission statement:

"Research and innovation at the heart of a sustainable and resilient European energy system"

The EERA Joint Programme on Energy Security and Resilience constitutes a permanent, pan-European research platform that helps Europe anticipate, withstand, and recover from energy system disruptions, while also deepening understanding of the evolving geopolitics of energy — from the traditional dynamics surrounding fossil fuels to the emerging geopolitics of low-carbon electricity. Increasing interdependencies and complexity is considered, i.e. interdependencies between and within critical infrastructures, energy vectors, digitalization, sector coupling. The EERA Joint Programme on Energy Security and Resilience constitutes a permanent, pan-European research platform that helps Europe anticipate, withstand, and recover from energy system disruptions. To fulfil our ambitions, we need to address the following:

- Components, systems, and manufacturing processes must be resilient by design.
- Analysis capabilities must consider all potential threats.
- Mutual dependencies within the energy system and with other critical infrastructure must be fully understood.
- Mutual dependencies between energy security, system resilience, and defence needs must be fully understood.
- Resilience, and associated robustness repair and improvisation capabilities, stockpiles, and simplified production methods for critical components must be strengthened.

Tangible objectives

The EERA transversal Joint Programme on Energy Security and Resilience will, among others:

- Develop a shared European R&I agenda on energy security and resilience, aligned with the SET-Plan and focused on real physical, cyber and hybrid threats.
- Provide clear, research-based input to EU and SET-Plan processes, drawing on EERA's combined expertise.
- Build resilience and preparedness into energy technologies, infrastructure and value chains from early research to deployment.
- Improve understanding of interdependencies between energy systems, digital systems and other critical infrastructure, including links to civil preparedness and defence.

- Strengthen analysis and modelling of major disruptions and deliberate attacks, covering prevention, response and recovery.
- Bring together expertise across EERA Joint Programmes to enable practical cross-disciplinary collaboration.

6. Overview (how)

The transversal Joint Programme should be organised to ensure strategic focus, cross-disciplinary integration and strong policy relevance, while remaining lightweight and action-oriented.

Steering Group

A small Steering Group with representatives from key EERA Joint Programmes and EERA leadership, responsible for strategic direction, prioritisation, and alignment with the SET-Plan, FP10 and other relevant EU processes.

Ukraine and conflict-informed expertise

The organisation should aim to explicitly include experts with first-hand knowledge of developments in Ukraine, ensuring that lessons from real-world attacks on energy infrastructure, system operation under stress, and rapid adaptation are systematically translated into European research priorities and innovation needs. At the same time, it should bring together a broader range of expertise relevant to energy system resilience, including geopolitics, large-scale electricity disruptions such as the Iberian blackout, and cyber security, among others.

Strong interface to policy and stakeholders

Structured dialogue with SET-Plan governance, EU institutions, Member States and organisations like E.DSO, ENTSO-E, Eurelectric and other relevant system actors to ensure that research results are translated into actionable guidance for planning, investment and preparedness, included, to support the value chain from early research to deployment. Such dialogue could take the form of an external advisory board.

7. Proposed High-Level Research Agenda

Guiding principles: Leverage low-carbon energy R&I to strengthen systemic, multi-dimensional energy security and resilience, emphasising its role in reinforcing overall energy system robustness and the risks posed to the energy system security and resilience.

Key dimensions:

- **Geopolitical & governance challenges:** Supply chain risks, dependencies, cross-border coordination
- **Physical & digital infrastructure vulnerabilities:** Grid resilience, cyber resilience, multi-vector integration, infrastructure interdependencies, increasing system complexity
- **Societal and climate dynamics:** Demand-side vulnerabilities, social responsiveness and climate-driven stressors

Example low-carbon energy R&I focus areas (aligned with the 2025 position paper):

1. **Supply chain resilience:** Domestic manufacturing, material substitution, adaptive system designs

2. **Governance & coordination:** Living labs, cross-border simulations, institutional stress-testing and policy and regulatory response frameworks
3. **System modelling & digitalisation:** Integrated system models, digital twins, predictive analytics, resilience modelling
4. **Infrastructure resilience:** Component and system resilience-by-design, HVDC controls, multi-vector integration, predictive maintenance
5. **Cyber & hybrid threats:** AI-enabled detection, layered cybersecurity, secure communications
6. **Climate adaptation:** Extreme weather modelling, energy storage flexibility, nature-based solutions
7. **Societal readiness:** Demand-side management, participatory solutions, public trust and misinformation mitigation

8. Draft Structure of tJP-ESR

Following the model of the already existing EERA Transversal Joint Programme Digital for Energy, the EERA Transversal Joint Programme Energy Security and Resilience will be organised through a set of subprogrammes that are inherent to the Joint Programme, together with transversal subprogrammes to be defined in coordination with the other 18 EERA Joint Programmes at a later stage. As an illustration of this approach, the following outline, with suggested themes for dedicated subprogrammes, has been identified:

Proposed sub-programmes based on EERA report

Sub-Programme A: Geopolitical dependencies vulnerabilities and risks
Challenge #1, #4, #7

Objective:
Strengthen the resilience and preparedness of Europe's energy system against shocks and attacks by improving the ability to prevent, absorb and recover from disruptions affecting supply chains and infrastructure. + geopolitical analysis

R&I priorities:

- Foresight and monitoring on geopolitical+ climate, environment and tech threats
- Resilient supply chain modelling and strategy
- System repair capabilities

Sub-Programme B: Cascading effects and interdependencies
Challenge #3

Objective:
Identify cross-sectoral interdependencies and improve Europe's ability to anticipate, withstand and recover from cascading disruptions in the integrated energy system.

R&I priorities:

- Integrated system modelling
- Risk and vulnerability analyses
- Interoperability standards

Sub-Programme C: Physical, hybrid and cyber risks
Challenge #5, #6

Objective:
Enhance the security and resilience of the European energy system by addressing emerging physical, hybrid and cyber threat detection across interconnected digital and physical infrastructure.

R&I priorities:

- Physical, hybrid and cyber resilience
- System-wide simulation methodologies
- Integration of monitoring systems

Transversal Sub-Programmes
Challenge #1-8

Transversal sub-programmes for R&I priorities that have a strong connection to existing JPs

9. Implementation Timeline