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Nature, environmentally and socially friendly energy transition



Theme D – Excerpt of the CASRI Strategic Research & Innovation Agenda (SRIA)

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Nature, Environmentally and Socially Friendly Energy Transition – *Theme D*

Abstract

A nature-, environmentally- and socially friendly energy transition must reconcile climate neutrality, biodiversity protection, energy security, competitiveness, and social justice. Renewable energy deployment and industrial decarbonisation offer significant opportunities but also create challenges related to land use, ecosystem integrity, affordability, and public acceptance. Addressing these requires coherent multi-level governance, stakeholder participation, cross-border cooperation, and evidence-based assessment of alternative transition pathways to identify synergies and manage trade-offs. Research and innovation can support inclusive decision-making, strengthen environmental monitoring, and improve coordination between policy, science, and practice. A just and nature-compatible transition can contribute to climate mitigation, biodiversity conservation, industrial resilience, energy sovereignty, and social inclusion, supporting key European policy priorities and SDGs 7, 9, 10, 11, 13, 15, 16, and 17.

Keywords

Renewable Energy Deployment; Biodiversity Safeguards; Citizen Participation; Social Acceptance; Transition Scenarios; Trade-Off Assessment

Expected Impacts

Governance of Nature-, Environmentally and Socially Friendly Energy Transition (Topic D1)

Improve policy coherence, accelerate implementation, reduce administrative barriers and strengthen public trust in the energy transition — by developing governance systems capable of balancing different policy frameworks, societal interests and stakeholders, thereby increasing implementation efficiency and reducing delays caused by fragmented responsibilities and conflicting objectives.

Societal Engagement (Topic D2)

Strengthen public participation, social acceptance and societal ownership of the energy transition — making it not only technically feasible but broadly supported by society, thereby improving implementation, reducing conflicts, increasing trust in institutions and supporting more inclusive and resilient energy systems.

Comparing Scenarios (Topic D3)

Support evidence-based decision-making in a nature-, environmentally- and socially friendly energy transition by enabling decision-makers to identify synergies, understand trade-offs, and evaluate the consequences of action, delayed action and non-action — through comparing alternative development pathways that assess environmental, social, economic and technological impacts simultaneously.

Further Information

For topic-related information on Background & Rationale, Significance and CASRI added values, expected outputs of the research questions and synergies with other relevant R&I initiatives, please refer to the full SRIA (Dictor et al., 2026).

Topic D1 - Governance of Nature-, Environmentally and Socially Friendly Energy Transition

Frameworks, policies, and collaborative mechanisms needed to coordinate stakeholders, create effective regulatory and incentive systems and ensure transparency & participation.

***Keywords**: energy-transition governance; renewable deployment; biodiversity safeguards; policy coherence*

Description*:* Governance of nature-, environmentally and socially friendly energy transition refers to the frameworks, policies, and collaborative mechanisms needed to steer the transition towards sustainable, competitive, resilient and socially just energy systems. It includes regulatory and incentive systems, stakeholder participation, territorial planning, cross-border cooperation and multi-level governance arrangements that ensure transparent and democratic decision-making, balancing ecological, social, economic and political dimensions in guiding the energy transition.

Impacts*:* Effective governance is essential to the energy transition, as successful deployment of renewable energy and energy-efficiency solutions depends on governance systems capable of balancing different policy frameworks, societal interests and stakeholders. Strengthening cross-border cooperation among public authorities, regulators, funding bodies, EPAs, businesses, and civil society can accelerate implementation and policy coherence, reduce administrative barriers and delays, and build public trust, reflecting priorities highlighted in recent EU initiatives.

Contribution to Environmental and Sustainability Challenges*:* Governance of nature-, environmentally, and socially friendly energy transition contributes to addressing challenges by providing transparent and inclusive frameworks that balance ecological protection, social justice, and economic resilience. It supports the integration of renewable systems, fosters cross-border cooperation, and ensures that the transition is both just and sustainable for present and future generations.

Transnational Societal and Policy Relevance*:* The topic is highly relevant across Europe because energy systems, infrastructure networks, environmental impacts and security-of-supply challenges increasingly transcend national borders. By providing effective regulatory frameworks and coordinated policies, governance of nature-, environmentally, and socially friendly energy transition enables a fair distribution of benefits and burdens, addresses energy poverty, and aligns national and regional strategies with broader sustainability goals. It thus strengthens democratic legitimacy, public trust, policy coherence and implementation capacity, while supporting European priorities related to competitiveness, industrial decarbonisation, resilience, preparedness and strategic autonomy.

Systemic Knowledge Needs*:* How can objectives related to climate neutrality, energy transition and biodiversity protection be reconciled with societal aspects?

Transversal Knowledge Needs*:* How can European policy frameworks, funding instruments and regulations be effectively connected to national authorities, EPAs, municipalities, businesses, energy communities and citizens through multi-level governance arrangements?

Actionable Knowledge Needs*:* Pathways for combining social aspects and targeted support for implementation at the local level, including regulatory simplification, incentive structures, stakeholder engagement mechanisms and territorial planning approaches.

Topic D2 - Societal Engagement

Active involvement of citizens, communities, and stakeholders in shaping the energy transition process.

Keywords: *citizen participation; social acceptance; energy communities; behavioural change*

Description*:* Societal engagement refers to the active involvement of citizens, communities, and stakeholders in shaping the energy transition process. It encompasses fostering public awareness, encouraging behavioural change, and creating inclusive spaces for dialogue and co-design. By strengthening participation and democratic practices, societal engagement helps to build trust, ensure social acceptance, and promote equitable and sustainable energy solutions. Examples such as renewable energy communities demonstrate how collective action can strengthen local participation, as energy communities go beyond electricity sharing by promoting democratic participation, social inclusion, and environmental responsibility.

Impacts*:* Societal engagement is essential to a successful and just energy transition, strengthening public participation, social acceptance, and ownership while addressing challenges related to energy sufficiency, behavioural change, land use, biodiversity, and the fair distribution of costs and benefits. Research can support participatory governance, energy communities, and citizen science, helping bridge the knowledge-action gap, reduce conflicts, build institutional trust, and advance inclusive, nature-positive, and resilient energy pathways in line with key EU initiatives.

Contribution to Environmental and Sustainability Challenges*:* Key challenges include public disengagement, disinformation, insufficient public involvement in the energy transition and conflicts associated with renewable energy deployment, biodiversity conservation and land use. Strengthening societal engagement can help address these challenges by supporting social acceptance, social and procedural justice, and nature-positive transition pathways.

Transnational Societal and Policy Relevance*:* Understanding the drivers and political implications of social acceptance and behavioural change is highly relevant across Europe. Equally important is understanding how public support and participation can contribute to more sustainable energy systems and exploring ways to foster new eco-social energy solutions, thereby strengthening the overall energy transition.

Systemic Knowledge Needs*:* How can energy transition, climate neutrality, biodiversity protection, climate adaptation, circular economy objectives and social justice be addressed simultaneously through societal engagement? This requires attention to systemic factors shaping engagement, including societal structures, dynamics, and barriers that influence participation across regions.

Transversal Knowledge Needs*:* How can EU policy, national agencies (e.g. EPAs), regions, cities and municipalities be engaged in ways that strengthen societal participation and mutual learning on how social engagement contributes to energy, climate and environmental objectives?

Actionable Knowledge Needs*:* Practical knowledge is needed at all levels of governance, including roadmaps, participation frameworks, citizen engagement tools, educational approaches, policy guidelines, territorial planning models and community-based solutions that strengthen participation, support behavioural change and contribute to socially accepted energy transitions.

Topic D3 - Comparing scenarios

Identification of key levers for change in the energy transition. It explores how scenario analysis can inform strategic decisions by highlighting ecological risks, trade-offs, and long-term sustainability pathways beyond 2030.

***Keywords**: transition scenarios; foresight; trade-off assessment; decision support*

Description*:* Scenario comparison identifies key levers for change in the energy transition by assessing ecological risks, trade-offs, and long-term sustainability pathways beyond 2030. Robust methodologies are needed to evaluate the environmental and social impacts of different options, compare action and inaction, and guide policy and investment decisions towards an ecologically resilient energy future.

Impacts*:* Scenario analysis supports evidence-based decision-making by comparing alternative energy transition pathways and assessing their long-term environmental, social, economic, and technological impacts under uncertainty. It helps identify synergies and trade-offs across climate objectives, biodiversity, competitiveness, resilience, and energy security, while strengthening stakeholder dialogue and informing robust policy and investment decisions in line with key European initiatives.

Contribution to Environmental and Sustainability Challenges*:* Scenario comparison enables policymakers and stakeholders to anticipate risks, identify synergies, assess ecological and social trade-offs, and evaluate alternative transition pathways. It supports informed decisions that balance environmental integrity, social acceptance, and long-term resilience of the energy infrastructure beyond 2030.

Transnational Societal and Policy Relevance*:* Comparing scenarios enhances transparency in decision-making, builds public trust, and helps to navigate conflicting interests in the energy transition. By providing evidence-based insights into future risks, opportunities, and trade-offs, it enables policymakers to design strategies that ensure cross-border energy security and are both socially and ecologically acceptable.

Systemic Knowledge Needs*:* Integrated methodologies should combine environmental, social, economic, technological, and governance dimensions through interdisciplinary foresight, risk assessment, and policy analysis to identify key leverage points for sustainable change. Understanding how transition scenarios interact across local, regional, and global scales is essential to strengthen the long-term resilience, stability, and coherence of renewable energy strategies.

Transversal Knowledge Needs: How can collaboration across disciplines, sectors, and governance levels help scenario comparisons in capturing the full complexity of the energy transition? This includes fostering data sharing and harmonised methodologies across countries, integrating social and environmental dimensions into scenario models, and linking foresight exercises to democratic participation and stakeholder engagement.

Actionable Knowledge Needs*:* Practical outputs should include transition pathways that balance sustainability, competitiveness, resilience, and energy security, alongside tools and guidelines that translate scenario findings into accessible policy options. Decision-support systems, monitoring frameworks, and pilot projects are needed to demonstrate how scenario comparisons can inform governance, investment decisions, and societal engagement in the energy transition.

Background on CASRI SRIA

SRIA Objectives, Positioning And Targeted End-Users. Europe is facing interlinked environmental, economic, technological and geopolitical pressures. Sustainability transformation therefore remains essential to Europe's long-term resilience, competitiveness and security. Sustained access to resources, resilient production systems and supply chains, climate-resilient infrastructure, healthy populations, functioning ecosystems, effective regulation and the societal capacity to manage transformation all depend on robust and actionable knowledge. Against this background, European Environmental Protection Agencies (EPAs) and EPA-like sustainability expert organisations have worked with actors across Europe through the project CASRI – Collaborative Action coordinating and enhancing systemic, actionable and transversal Sustainability Research and Innovation – to co-create this Strategic Research and Innovation Agenda (SRIA), which have been developed in close connection with the EPA Network Interest Group on Sustainability Research and Solutions (IG EPAS)**.** The CASRI SRIA consolidates transnational knowledge needs identified and further developed through the CASRI co-design process, providing a basis for further prioritisation, programming, collaboration and implementation. It is not a fixed research programme or a formally agreed policy position of European EPAs. Its topics and priority levels reflect the evidence, participants and timeframe of the CASRI process and are intended to be further developed with funders, policymakers, researchers and implementation actors. The SRIA addresses European and national funders, programme owners and partnerships seeking opportunities for coordinated programming and investment, as well as research organisations, businesses, public authorities, cities, regions, civil society and EPAs developing collaborative R&I and implementation activities. Through the SRIA, CASRI invites these actors to jointly develop and apply systemic, transversal and actionable knowledge for a sustainable, competitive, democratic, resilient and liveable Europe.

SRIA Content and Topic Prioritisation. The CASRI SRIA comprises 8 interconnected themes and 20 transnational Research and Innovation topics. For each topic, it describes expected impacts, background and rationale, the systemic, transversal and actionable knowledge needs, and the significance and added value of further Research and Innovation, including links and gaps in relation to existing initiatives. The topics were developed to different levels of detail according to the interest and evidence emerging through the co-design process.

CASRI SRIA Co-design Process. The SRIA was developed through a bottom-up co-design process involving EPAs and EPA-like organisations as National Contacts who invited National Key Stakeholders and European experts with backgrounds in knowledge production, funding, implementation, politics and use. Around 600 national knowledge needs were identified, clustered and consolidated into 20 transnational Research and Innovation topics, which were subsequently discussed, prioritised and further elaborated through surveys, online exchanges and workshops. The resulting agenda therefore combines national implementation experience with transnational analysis and European dialogue.

CASRI Added Value and Next Steps. The SRIA provides two mutually reinforcing contributions. First, it offers an evidence-based agenda of shared R&I needs, showing where systemic, transversal and actionable knowledge can support sustainability transformation. Second, it provides a basis for collaboration with EPAs and between those who identify knowledge needs, fund research, generate knowledge and innovation, and implement, regulate or scale solutions. EPAs can make a distinctive contribution to this collaboration because they operate between environmental science, monitoring, policy advice, regulation and implementation. Their data, institutional knowledge, stakeholder relations and experience with implementation barriers can help connect research agendas and innovation with real-world needs and support continuous learning between research, policy and practice. Implementation is understood as an iterative process rather than a final stage following research. CASRI will therefore explore how the SRIA can inform agenda-setting, funding and programming, collaborative Research and Innovation, practical implementation and learning, while developing structures for continued cooperation beyond the project.

Further information

Within the EPA Network, the Interest Group on Sustainability Research and Solutions (EPAS) serves as a collaborative platform to support the implementation of the SRIA and advance this thematic priority through knowledge exchange, cooperation and joint action. In case of interest, please contact **Camilo Molina - Umweltbundesamt Gesellschaft mit beschränkter Haftung (UBA GmbH) (Camilo.Molina@umweltbundesamt.at)**.

Visit the CASRI website at CASRI.eu for more information.

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