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FINEX

Stimulating and Connecting the FINEST Experimentation Practices and Spaces

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Disclaimer

Executive Summary

FINEX is a 2-year Horizon Europe project aimed at strengthening and connecting six cleantech innovation ecosystems - Finland, Estonia, Latvia, Lithuania, Bulgaria, and Cyprus. Among the project's key activities is the identifying of challenges that can be addressed through cleantech solutions; strengthening the ecosystems' connectivity, capacity, and resources to more effectively engage, develop, and promote cleantech; and enhancing the potential of experimentation spaces to test and implement innovative cleantech solutions.

This deliverable D3.1 focuses on identifying priority Cleantech priority domains to be targeted with experimentation pilots. The deliverable showcases the collaborative effort to jointly agree on specific Cleantech domains to be targeted through these pilots, highlighting Cleantech use cases that leverage the strengths and potential of project partners. The interactive process behind this document involved desk reviews, workshops and the engagement of all penta-helix stakeholders from each region, working closely with FINEX, national, regional and EU experts and networks to ensure inclusive and multidisciplinary participation throughout the project.

The deliverable report is organized around the four interconnected tasks of WP3, which are described in the four sections, each bringing complementary output and enriching context around Cleantech priority areas selection and validation.

Section 2.1 on identification of Cleantech challenges and needs, presents a coordinated effort involving a wide range of external stakeholders from the pentahelix, government, academia, industry, civil society, and finance. Through this collaboration, 33 key challenges and innovation needs were identified across the FINEX domains.

Section 2.2 explores the barriers and drivers behind the identified challenges using Climate-KIC's challenge-led systems mapping methodology. Through workshops across six innovation ecosystems, stakeholders identified the most pressing challenges and shared policy priorities themes in clean energy, sustainable transport, resilient infrastructure, and inclusive, data-driven governance. These insights will guide future pilot experiments.

Section 2.3 on policy levers for experimentation reviews EU and Member States policies supporting cleantech experimentation, drawing on FINEX IEs and four thematic policy labs. Policy labs with stakeholders from 6 FINEX IEs lead to recommendations calling for a more proactive regulatory approach using tools like sandboxes, sectoral guidelines, and cross-sector collaboration. They emphasize the need for dedicated funding, coordinated infrastructure, and regulatory flexibility to align cleantech innovation with EU climate and competitiveness goals.

Section 3.4 on Cleantech use cases showcases how the identified challenges can be addressed through concrete cleantech solutions. Each initiative tackles key issues in sectors that emerged as top priorities during the challenge mapping and validation process: energy, mobility, the built environment, or governance and data. These use cases offer a solid foundation for experimentation pilots and support the development of scalable models to accelerate cleantech deployment across Europe.

Finally, the conclusion brings together all key outcomes of this work, highlighting the most urgent challenges, shared policy priorities, and thematic areas identified across the six FINEX innovation ecosystems, including cleantech use cases and policy recommendations derived from policy labs. It underscores the need to translate these insights into action by moving from policy diagnosis to prototyping and actively engaging in EU-level policy processes to ensure cleantech experimentation becomes a core component of Europe’s broader strategies for innovation, sustainability, and green transition.

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Table 1. Definitions

Abbreviation	Definition
BSR	Baltic Sea Region
CDE	Communications, Dissemination and Exploitation
Cleantech	“Cleantech refers to new technology and related business models offering competitive returns for investors and customers while providing solutions to global challenges. (…It] embraces a diverse range of products, services, and processes across industry verticals that are inherently designed to: Provide superior performance at lower costs; Greatly reduce or eliminate negative ecological impact. Improve the productive and responsible use of natural resources.”[1]
Deep tech	“Deep tech is technology that is based on cutting-edge scientific advances and discoveries and is characterised by the need to stay at the technological forefront by constant interaction with new ideas and results from the lab. Deep tech is distinct from ‘high tech’ which tends to refer only to Research & Development intensity.” - EISME standard definition
EC	European Commission
EU	European Union
IE	Innovation Ecosystem[2]
LC&D.IE	‘Less connected and developing innovation ecosystems’ - i.e. 'IE' categorised as ‘Emerging innovator’ or ‘Moderate innovator’ by the RIS and/or EIS
Policy Lab	“A Policy Lab is a space designed to foster creativity and engagement, and to develop interactions, processes, and tools able to encourage innovation for better policymaking. The work proceeds based on four complementary dimensions: Foresight, Modelling, Behavioural Insights and Design for Policy. In policy labs […], the emphasis is placed on co-designing, experimenting and usefulness for policy, by using tailored made frameworks with a strong visual focus. Labs can be thought of as both physical and conceptual spaces to open up the conversation and facilitate collaboration between policymakers and

[1] https://www.cleantechforeurope.com/explainers/what-is-cleantech

[2] https://eismea.ec.europa.eu/programmes/european-innovation-ecosystems_en#european-innovation-ecosystems

	stakeholders." (Matti, et al. 2022).
S&IL	Innovation ecosystems categorised as 'Strong innovators' or 'Innovation leaders'
R&D	Research and Development

1. Introduction

This report presents an aggregated analysis based on WP3 activities and related policy work. WP3 commenced the work by engaging all innovation ecosystem stakeholders to identify key Cleantech areas and representative use cases. The work was structured into four interconnected tasks focused on: identifying major challenges and opportunities for coordinated action between innovators and regulators; analysing legal, regulatory, fiscal, technical, and operational drivers and barriers; organizing policy labs and workshops to enable cross-sector dialogue and develop actionable policy guidance; and finally, selecting the most representative Cleantech use cases.

The core approach of this work is based on desk research, (virtual) workshops, and strong multi-stakeholder engagement, involving key actors from the Cleantech innovation ecosystem across all FINEX regions. These include higher education institutions, research and technology organizations, companies, venture capitalists, financial intermediaries, investors, and policymakers, as well as individual innovators and organizations. Engaging this broad range of innovation ecosystem stakeholders helps ensure a strong alignment between real-world needs, societal challenges, and the identified priority areas, including specific use cases designed to directly address issues particularly relevant to the participating regions and countries.

1.1 Scope and objectives

This report presents the analysis and outcomes of the joint work on key Cleantech challenges and needs, regulatory barriers and enablers, cross-sector policy dialogue, and the identification of the most representative Cleantech use cases, building on the strengths of the participating IEs. Its primary goal is to establish a shared agreement on priority Cleantech domains and specific use cases for developing experimentation pilots. Additionally, it aims to provide a foundation for other work packages, foster interregional consensus, and promote cross-border collaboration. highlighting individual strengths and complementarities within the participating IEs.

Key Sections Covered:

- Section 2: Cleantech priority areas selection. This section is divided into four subsections, each corresponding to one of the four Tasks in WP3. It begins with the identification of Cleantech challenges and needs, based on regional analyses and stakeholder input. The second subsection explores the main barriers to Cleantech adoption, as well as the levers that can drive progress. Subsection 2.3 focuses on policy levers that enable experimentation and support the development of Cleantech solutions. Finally, subsection 2.4 presents the Cleantech use cases selected by FINEX partners, building on their strengths, and aligned with regional

priorities, with validation from external stakeholders. Each subsection outlines the methodological steps taken and presents the key outcomes.
- Annexes: Supporting Information. The annexes provide additional details regarding challenges identified, the Cleantech use case template and concrete use cases descriptions. These annexes support the main content and offer a comprehensive view of the project's structure and timeline.

1.2 Relation to WPs, tasks and other deliverables

The present deliverable is directly related to the work that is performed under WP3 in Tasks:

- Task 3.1 Identify areas where the multi-sectoral and/or emerging nature of some innovations requires coordinated action by innovators and regulators
- Task 3.2: Identify legal, regulatory, fiscal, technical, and operational pre-drivers and barriers for different use-cases which enable or hamper the development of innovation
- Task 3.3: FINEX Policy Lab: identifying regulatory and legal levers for experimentation in testbeds
- Task 3.4: Select most representative Cleantech use-cases building on the partners strengths, complementarities and potential

The outcomes described in this deliverable also will be used in other WPs and Tasks in particular:

- WP4: Task 4.2: Identify and formulate experimentation and support tools & services best practices
- WP6: Task 6.3: Deploying the FINEX Action Plan - support the running of the experimentation activities
- WP7: Task 7.2: Project implementation monitoring, results analysis & policy formulation

2. Cleantech priority areas selection

2.1 Identification of Cleantech challenges and needs

This section provides an overview of Task 3.1 work, where six innovation ecosystems collaborated to identify the most urgent challenges faced by public authorities, cities, and other potential end-users. The focus was on the predefined Cleantech domains of the FINEX project: **Mobility, Energy, Built Environment, Data & Analytics, Smart Governance**, as well as additional relevant areas.

2.1.1 Methodology

The methodological foundation of this work is based on the Rapid Evidence Assessment (REA) approach[3]. REA is a streamlined form of systematic review designed to provide a robust and timely synthesis of existing evidence and is well-suited for informing policy and practice in dynamic fields such as Cleantech innovation, where rapid insights are needed to support decision-making.

The primary research questions were:

1. *What are the most relevant and pressing challenges of each IE for public authorities, cities, and other potential end-users in the predefined Cleantech areas (Mobility, Energy, Built Environment, Data & Analytics, Smart Governance)?*
2. *What could be the innovative solutions, technologies to tackle these challenges?*

These research questions were addressed through REA methodology, which provided a structured and efficient approach to synthesizing existing knowledge in these competence domains.

Our work followed a mixed-methods approach, integrating:

- **Desk research:** A comprehensive literature analysing local reports, surveys, studies, policy documents and completed or ongoing projects' results
- **Stakeholder consultation:** experts, stakeholders' engagement through workshops, meetings, and interviews to validate findings and ensure completeness. Through direct contact or events, meetings around 50 stakeholders were involved.
- **Challenge mapping:** categorisation of relevant challenges and potential solutions according to FINEX domains, enabling a structured overview of barriers and innovation opportunities across Cleantech domains.

[3] More information can be found here

- **Qualitative analysis:** evaluation of identified challenges by project partners to identify common gaps and needs for action.

The documents consulted for this research are listed in the Reference List, as provided by partner countries (IEs).

2.1.2 Common Challenges Across Innovation Ecosystems and Innovative Solutions[4]

The challenge mapping exercise resulted in **33 challenges** to be addressed with Cleantech innovation across the six ecosystems (LT, EE, LV, FI, BG, CY) summarised in Table 1. The most recurring themes emerge in three FINEX predefined sectors of **Energy, Mobility, and Built Environment**. The majority of challenges were identified in the Energy sector (11), followed by Mobility (9) and the Built Environment (7). Smart Governance and Data Analytics were highlighted by four innovation ecosystems. Additionally, Estonia introduced two unique focus areas: Waste Management and Cleantech for Defense. Cleantech for defense relates to other areas, in particular energy and mobility.

The most challenges (12) were presented by Estonian IE. Five of them are coming from FinEst Centre Smart City Challenge Program and already have concrete solutions providers. The complete list of all the challenges presented by 6 IEs can be found in Annex I.

Table 2. Common challenges in IEs

Sector	No. of Challenges	Innovation Ecosystems	Key Themes
Energy	11	LT, EE, LV, BG, CY, FI	Energy independence, efficiency, renewables, energy storage
Mobility	9	LT, EE, LV, BG, FI	Traffic congestion, inefficient transport management, reliance on private vehicles, need for public transport improvements
Built Environment	7	LT, EE, CY	Energy-efficient buildings, circular construction, water management
Data & Analytics	3	EE, FI, BG	Lack of data, AI solutions, public engagement
Smart Governance	2	EE, BG	Smart communities, policy barriers, stakeholder coordination

[4] FINEX Project Report (2025, February). WP3 – Cleantech priority areas selection and validation: T3.1 Identify areas where the multi-sectoral and/or emerging nature of some innovations require coordinated action by innovators and regulators, link

Waste Management	1	EE	Circular economy, maximizing resource value
Cleantech for Defense	1	EE	Cleantech for critical infrastructure resilience

Energy Independence & Energy Efficiency & Sustainability challenges occur in 5 ecosystems. LT, LV, EE, BG, CY, FI with focus on energy independence outlining importance of national security and economic stability factors, transitioning to renewable energy sources, energy storage, reducing reliance on energy imports and inefficient usage. Finland also relies heavily on imported energy production and fuel sources, where the main challenge is achieving greater energy independence and further strengthening the Finnish-Baltic energy cooperation. Additionally, energy challenges are closely related to broader sustainability goals, such EU climate neutrality goals, as low-emission energy production. For example, Finland has committed to comply to EU policies to reduce transport-related emissions by at least 55% by 2030.

Potential solutions suggested:

- Expansion of renewable energy (solar, wind, biomass)
- Smart grid integration, energy storage, and grid balancing
- Industrial and building efficiency upgrades, real-time energy monitoring
- Use of AI for energy optimization

Inefficient Mobility & Traffic Congestion challenges were identified in LT, EE, LV, BG, FI. Challenges include inefficient transport management, reliance on private vehicles, and congestion in urban/tourist areas. Estonia addresses specific water mobility challenge with smart solutions. Finland addresses the limitations in insufficient electric vehicle charging network, being a large country with majority of inhabitants in the Southern capital area, along with challenges of public transport in urban areas transitioning further to shared mobility.

Potential solutions suggested:

- Intelligent Transport Management Systems (ITMS)
- EV charging networks and smart energy management
- Multimodal, low-emission transport infrastructure
- Policy support for transport electrification and integration

Energy Inefficient Buildings are an important challenge for LT, EE, CY. Countries highlight the need for energy-efficient buildings, integration of renewables and circularity in construction. Limited reuse of construction materials and the lack of reliable data to support AI-driven solutions were mentioned. EE and CY also introduced challenges regarding urban water and wastewater infrastructure.

Potential solutions suggested:

- Smart building technologies, insulation, EMS, and BIPV
- Modular construction, recycled materials, 3D printing

- Digital platforms for circular construction and material tracking

Data & Analytics Deficiency challenges are pointed out by EE, FI, BG, highlighting that the lack of comprehensive data hampers smart governance and slows Cleantech adoption.

Potential solutions suggested:

- Open data platforms, AI, IoT, and drones for real-time analytics
- Digital twins for simulation (e.g., tree roots, water infrastructure)
- Cross-platform data integration, citizen engagement

Smart Governance Barriers identified by EE and BG. These include regulatory complexity, limited coordination, and low levels of public awareness and involvement. In Bulgaria noting stakeholder fragmentation and limited engagement as key issues. In Estonia specifically, insufficient preparedness for climate-related disasters such as floodings

Potential solutions suggested:

- Smart community toolkits for resilience and crisis response
- Real-time monitoring of environmental systems
- Innovation hubs, inclusive governance models, and legal frameworks

Some additional, unique challenges identified in Estonia. These include weak circular economy practices in the waste management sector. Addressing these requires dedicated circular economy platforms, waste prevention strategies, and stronger cross-sector collaboration. Estonia also highlighted the strategic need for resilient energy and transport systems capable of functioning during conflict or crisis scenarios. This underscores the importance of developing Cleantech solutions tailored for national security and critical infrastructure resilience.

The most recurring topics among IEs highlight opportunities for shared innovation roadmaps and joint pilots. Addressing these challenges through targeted policies and collaborative efforts would enhance innovation ecosystems, promote sustainability, and strengthen economic resilience across the countries involved.

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2.2 Cleantech barriers and levers

This section focuses on the work carried out in Task 3.2, building on the outcomes of Task 3.1, where partners identified a list of potential challenges that could be addressed through clean technologies. The objective of this work was to further develop this initial list by identifying the legal, regulatory, fiscal, technical, and operational drivers and barriers that either enable or hinder innovation and technology experimentation in response to these challenges. Applying Climate-KIC's challenge-led system mapping methodology and involving quadruple helix stakeholders, the task also served to validate and refine the predefined Cleantech focus areas.

2.2.1 Methodology

For this work FINEX partners led by Climate KIC used the Challenge-led System Mapping approach, which is a participatory, knowledge-management methodology developed by EIT Climate-KIC[5]. It's designed to help practitioners, including public authorities, businesses, and civil society collaboratively understand complex socio-technical systems surrounding a specific challenge and thereby support system-level transformation

Key features include:

- **Participatory Co-creation** – Stakeholders from across sectors are invited into workshops to visually map system components, relationships, barriers, and leverage points. This shared process co-produces actionable knowledge.
- **Visual and Iterative Process** – through step-by-step facilitated tools, participants build a systems map that iteratively refines understanding of how socio-technical elements interact within the challenge context
- **Knowledge Mobilisation** – the method emphasizes capturing participants' insights as structured system intelligence, making them accessible and reusable for strategic planning and innovation design
- **Flexible and Adaptable** – is a modular guide that adapts to diverse regional or thematic contexts

Using this methodology six workshops were organised by Climate KIC & Cleantech Group in each IEs involving 46 stakeholders. These workshops employed two complementary system mapping methodologies developed by Climate-KIC to identify and analyse innovation drivers and barriers in Cleantech ecosystems. The first methodology, Context Mapping, helping participants understand their ecosystem's dynamics by examining key drivers across legal, regulatory, fiscal, technical, and operational dimensions. This is followed by the Fishing for Barriers exercise, which uses a visual metaphor to help participants identify, break down, and prioritize key barriers preventing innovation

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[5] More information link

uptake. Together, these tools enable participants to both understand their ecosystem's broader context and pinpoint specific obstacles that need addressing, creating a foundation for future experimentation pilots.

2.2.2 Cleantech Challenges and Barriers Overview Across FINEX IEs[6]

Estonia

Table 3. Challenges validated with stakeholders - Estonia

No.	Challenge	Focus Area
1.	Need for technologies that keep the lights on and transport going in the most severe conditions	Defence/Energy
2	Low-emission energy production and efficient energy use	Energy
3	Reusing old buildings	Built Environment

Addressing the challenges of defence, energy production, and sustainable construction requires a strategic and collaborative approach. Ensuring resilience in defence technologies demands proactive risk management, stronger government coordination, and targeted investment in infrastructure protection. The geopolitical landscape, particularly in regions like the Baltics, underscores the urgency of reducing energy dependency on external sources and fortifying critical infrastructure.

In the energy sector, the transition to low-emission production faces regulatory, financial, and technical hurdles. Market conditions, slow permitting processes, and investment limitations hinder progress, while mismatches between energy production and consumption exacerbate inefficiencies. Strengthening financial support, fostering collaboration between public and private sectors, and accelerating the development of off-grid solutions will be key to achieving long-term energy security and sustainability.

Similarly, the reuse of old buildings presents economic, logistical, and regulatory challenges. A shift in business models, improved certification processes, and innovative market solutions can help scale up the reuse of materials. Cultural attitudes toward sustainable housing must also evolve to align with emerging demographic and environmental priorities.

Ultimately, overcoming these challenges requires policy reforms, investment in technological innovation, and a shift in societal perspectives. By fostering international cooperation, advancing research, and streamlining regulations, a more resilient, efficient, and sustainable future can be achieved across defence, energy, and construction sectors.

Lithuania

Table 4. Challenges validated with stakeholders - Lithuania

[6] FINEX Project Report (2025, April). WP3 – T3.2 Workshops report: Cleantech priority areas – Selection and validation, link

No.	Challenge	Focus Area
1.	Achieving energy independence, upscaling integration of renewables	Energy
2	Sustainable mobility infrastructure is not sufficiently developed	Mobility
3	Energy inefficient buildings	Built Environment

Addressing the challenges of energy independence, sustainable mobility, and energy-efficient buildings in Lithuania requires a systemic approach that combines political commitment, financial investment, regulatory reform, and education. The transition to renewable energy infrastructure is hindered by grid limitations, reliance on foreign materials, and public resistance to new technologies like hydrogen. Overcoming these barriers necessitates strategic investment in storage solutions, local manufacturing, and public engagement.

Similarly, sustainable mobility infrastructure remains underdeveloped due to political reluctance, regulatory delays, and cultural preferences for personal vehicles. Increased investment in public transport, EV charging infrastructure, and awareness campaigns can help shift mindsets and promote sustainable practices.

Energy efficiency in buildings faces financial and regulatory hurdles, with outdated infrastructure lacking the necessary support for renovation. Strengthening leadership, improving access to climate funding, and fostering a skilled workforce will be essential to ensuring long-term improvements.

Ultimately, achieving these goals requires a coordinated effort between governments, businesses, and society. By leveraging EU funding, advancing education and skills development, and implementing targeted regulatory changes, sustainable development can become a reality, leading to a resilient and energy-independent future.

Latvia

Table 5. Challenges validated with stakeholders - Latvia

No.	Challenge	Focus Area
1.	Energy independence and security	Energy
2	Enhancing public transport systems	Mobility
3	Missing regulation/overregulation for flexible public transport	Mobility

Achieving energy independence and enhancing public transport systems require addressing significant regulatory, technical, and societal challenges. The slow development of wind energy infrastructure, combined with political lobbying and public resistance, highlights the need for stronger national and EU-level collaboration. Innovations in energy storage and education will be key to overcoming technical limitations, particularly in emerging areas like hydrogen.

In the mobility sector, overcoming stigma and behavioural barriers is essential for the adoption of clean transportation solutions. Expanding charging infrastructure, integrating shared mobility platforms, and promoting systemic change in how society perceives mobility will contribute to more sustainable urban transport. However, heavy regulation and missing legal frameworks hinder flexible mobility solutions, requiring more agile policymaking and proactive strategies.

Investment in infrastructure, funding for public transport decarbonization, and data-driven decision-making are crucial to creating an efficient and sustainable transportation network. By fostering innovation, simplifying regulations, and prioritizing education, both the energy and mobility sectors can move towards a more secure and environmentally responsible future.

Finland

Table 6. Challenges validated with stakeholders - Finland

No.	Challenge	Focus Areas
1.	Ensure grid stability with renewable energy, limited storage, and reliance on imported materials.	Energy
2	Limited EV charging network/cold climate impact/public sector green transportation initiatives	Mobility
3	Need for transparency and public engagement in Cleantech initiatives and adoption	Smart Governance

Transitioning to a sustainable and energy-efficient future requires overcoming significant challenges related to grid stability, resource dependence, regulatory complexity, and public engagement. The intermittent nature of renewable energy highlights the urgent need for large-scale energy storage solutions to ensure grid reliability. Additionally, reliance on imported raw materials and a lack of prioritization in energy usage create vulnerabilities that must be addressed through strategic investments and regulatory reforms.

The expansion of electric vehicle (EV) infrastructure presents both opportunities and hurdles. While government incentives and taxation policies support EV adoption, an insufficient charging network—especially in older urban areas—and the cold climate's impact on battery performance remain barriers. Public sector initiatives, such as Helsinki's electric bus fleet, demonstrate the potential for green transportation but require sustained funding and policy support to scale effectively.

Public engagement and regulatory complexity further complicate Cleantech adoption. Organizations face challenges navigating intricate EU regulations, while concerns over data sharing hinder collaboration. Addressing these issues will require innovations in regulatory technology (RegTech), improved sustainability tools, and greater public awareness to drive meaningful participation in clean energy solutions.

Ultimately, achieving a cleaner and more resilient energy future will depend on fostering innovation, enhancing collaboration between stakeholders, and implementing forward-thinking policies. By investing in infrastructure, supporting local energy communities, and leveraging emerging technologies, society can move toward a more sustainable and self-sufficient energy landscape.

Bulgaria

Table 7. Challenges validated with stakeholders -Bulgaria

No.	Challenge	Focus Area
1.	Limited stakeholder coordination and involvement in Cleantech initiatives	Smart Governance
2	Lack of data	Data & Analytics
3	Energy efficiency	Energy

The transition to a more sustainable and efficient energy sector is hindered by fragmented stakeholder coordination, outdated policies, and a lack of reliable data. National policies remain misaligned with EU legislation, and political resistance further complicates efforts to implement cohesive regulatory frameworks. Energy pricing mechanisms and subsidies, while intended to support consumers, inadvertently discourage investment in green solutions and energy efficiency improvements.

Infrastructure and workforce limitations present additional barriers, with outdated grid systems, a shortage of skilled professionals, and insufficient vocational training preventing the adoption of nearly zero-energy buildings and other sustainability initiatives. The overuse of natural resources, particularly water, highlights the need for better resource management to balance green energy expansion with environmental preservation.

A critical challenge remains the lack of reliable data. Many government projects still rely on outdated mapping resources, while essential hydrographic and energy consumption data remain inaccessible or incomplete. This lack of transparency and data-driven decision-making hinders progress in energy efficiency and infrastructure planning.

Public scepticism towards legislative processes further complicates renewable energy adoption. While solar projects face fewer barriers, wind energy remains met with resistance due to misinformation and past political failures. A lack of proper communication and stakeholder engagement contributes to disbelief in the regulatory system, leading to legal disputes that delay critical projects.

To overcome these challenges, stronger collaboration at national and EU levels is essential. Improving access to reliable data, investing in workforce development, and modernizing grid infrastructure are necessary steps toward a resilient and sustainable energy future. Additionally, fostering public trust through transparent communication and stakeholder engagement can help build long-term support for energy efficiency initiatives and renewable energy projects.

Cyprus

Table 8. Challenges validated with stakeholders - Cyprus

No.	Challenge	Focus Area
1.	High dependence on imported fossil fuels, need for renewable storage solutions, and grid balancing	Energy
2	Inefficient traffic management and public transport	Mobility
3	Energy inefficient buildings, limited integration of renewables	Built Environment
4	Need for urban water management, ensure quality, safety, dependability, wastewater management	Built Environment

Cyprus faces significant challenges in energy, mobility, the built environment, and water management. While the country has vast solar energy utilisation potential, its heavy reliance on fossil fuels, insufficient storage solutions and poor integration of variable renewable energy sources in the distribution grid hinder renewable energy integration. Similarly, limited availability of public transport and the lack of widespread infrastructure supporting the adoption of electric vehicles, are both exacerbating traffic congestion and the environmental impact respectively. Regarding the built environment, older buildings fail to meet environmental efficiency standards, particularly lacking in energy efficiency, air quality and automation. Moreover, better management, control, monitoring and fault diagnosis of the aging water infrastructure and to mitigate resources scarcity and are needed.

Overcoming these issues requires a combination of policy support, financial incentives, technological advancements, and public engagement. By addressing these challenges through smart infrastructure, governance reforms, and innovative solutions, Cyprus can enhance sustainability, improve quality of life, and align with broader EU environmental and economic goals.

2.2.3 Common Cleantech priority areas

Stakeholder discussions across all participating countries highlighted energy-related challenges as a top priority, with a strong focus on energy security, independence, renewable integration, and the need for storage and grid balancing solutions. Sustainable mobility and the built environment were also identified as key areas of concern.

In mobility, the main issues include heavy car dependence, limited EV infrastructure and incentives, policy and regulatory barriers, funding constraints, and public resistance to behavioural change. In the built environment, challenges centre around energy-inefficient buildings, insufficient financial support for renovations, limited adoption of sustainable materials, and slow progress in urban climate adaptation.

Governance and data-related issues were also frequently raised, either as standalone challenges or as cross-cutting themes impacting multiple sectors.

Based on the prioritized challenges by the six ecosystems, **four overarching policy themes** (Table 8) were identified for experimentation pilots and to be further addressed in the policy sessions.

Table 9. Common Cleantech Priority Areas

1. Energy Security and Renewable Integration
Key Challenges: • Heavy reliance on imported fossil fuels (Cyprus, Bulgaria) • Grid limitations and outdated infrastructure (Finland, Bulgaria, Lithuania, Estonia, Cyprus) • Need for large-scale energy storage solutions (Cyprus, Finland, Latvia) • Slow permitting processes and regulatory hurdles (Lithuania, Estonia, Bulgaria) • Public scepticism and political resistance to renewable energy (Bulgaria, Latvia) • Need for financial incentives for renewable energy projects (Lithuania, Estonia, Cyprus)
2. Sustainable Mobility and Transport Transformation
Key Challenges: • Heavy reliance on private vehicles and inefficient public transport (Cyprus, Latvia, Lithuania) • Limited incentives and infrastructure for electric vehicles (Finland, Cyprus, Lithuania, Latvia) • Regulatory and political barriers to sustainable transport solutions (Lithuania, Latvia) • Low adoption of shared mobility solutions due to behavioural resistance (Cyprus, Latvia, Lithuania) • High costs and lack of funding for public transport decarbonization (Finland, Lithuania, Latvia)
3. Built Environment and Infrastructure Resilience
Key Challenges: • Energy-inefficient buildings and outdated infrastructure (Cyprus, Lithuania, Estonia, Bulgaria) • Lack of financial support for building renovations (Lithuania, Bulgaria) • Barriers to adopting sustainable construction materials and circular economy practices (Estonia) • Climate adaptation challenges in urban areas (Cyprus, Finland)
4. Governance, Data, and Public Engagement for Sustainability
Key Challenges: • Lack of reliable data for decision-making in energy and infrastructure (Bulgaria, Cyprus, Finland) • Regulatory complexity and misalignment with EU policies (Bulgaria, Lithuania, Estonia, Finland) • Limited public trust and engagement in sustainability policies (Bulgaria, Cyprus, Latvia) • Need for targeted financial incentives and stakeholder coordination (Lithuania, Bulgaria, Estonia, Cyprus)

2.3 Policy levers for experimentation in Cleantech domains

This section presents the main results of Task 3.3 that explored policy (regulatory and legal) levers where Europe can foster experimentation and testing testbeds for cleantech. This activity was supported by a review of existing EU and MS policies, incorporating findings from previous tasks T3.1 and T3.2. It also comprised the design and implementation of four policy labs focusing on the areas previously identified in section 2.2. The results derived from initial guidance about possible texting areas (beyond FINEX) and specific draft policy recommendations to support EU cleantech policy.

2.3.1 Methodology

The methodology employed in this task was embedded into both traditional and novel co-creation methods in sustainability transitions and transformative innovation policy[7].

Firstly, for the design and delivery of each **policy lab**, a participatory foresight methodology was applied across the four areas of enquiry. Each of them incorporated scenario-based discussions, stakeholder engagement, systems thinking, and back casting. This approach enabled a deep exploration of structural and systemic challenges while co-developing forward-looking policy options. The overall planning and knowledge extraction process was informed by the methodological framework outlined in the "*Challenge-Led System Mapping: a knowledge management approach"* method [8]. Each Policy Lab consisted of a guided virtual workshop of 2 hours of duration, using the Zoom platform and a Miro board. Each lab followed a structured journey combining systemic foresight and participatory tools. It began with a “context mapping” to understand the forces shaping each theme. Then, participants worked on turning barriers into levers for systemic change, identifying key patterns from the context to reframe as opportunities. This set the stage for “scenario explorations”. Using the tools of “triangle of the future” and “future radars” and concluded with the identification of policy levers and roadmap creation aligned with desired future pathways. Using this framework, all workshop’s data were captured in real time through structured conversations documented on the collaborative, online Miro platform. These written records served as the raw material for a subsequent process of data curation, categorization, and synthesis—leading to the identification of contextual dynamics, systemic barriers, and high-potential policy levers presented throughout this report.

Secondly, the review of scientific and grey literature aimed at conducting a comparative mapping of EU and member state level policies and support measures that contribute to cleantech ecosystem development in **Estonia, Latvia, Lithuania, Finland, Cyprus, Bulgaria, UK, Germany, France** (the latter three countries as strong innovators and as a way to compare other ecosystems). The aim of this review was to identify and organize key public initiatives that promote clean technology innovation, commercialization, and ecosystem support.

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[7] More information: link

[8] More information: link

The mapping is based on **desk research**, drawing primarily from official government and ministry websites, EU-level sources (European Commission documents/website), reports from the relevant institutions/organizations (OECD, think tanks), and select academic and policy publications (using databases such as ScienceDirect). The review focused on publicly available materials in English or official translation, covering active policies. The selection criteria included policy measures with an explicit support to cleantech, green innovation/transition, or climate-related technologies. In addition, it was considered for review those policies that are implemented or coordinated at the EU and/or national level and that are publicly documented and currently active or recently completed or updated. EU-level initiatives without country-specific implementation detail and regional/local programs without national coordination were excluded from this analysis. Keywords used in the search criteria included: “EU policies”, “[country’s name] cleantech policies”, “cleantech”, “innovation”, “climate”, “ecosystem”, “green tech”, “support measures”, “programmes”, ‘regulatory sandboxes”, “experimentation”, “testbeds”, “hubs”. The actual **mapping process** focused on documenting information about main policies and measures using a standard format capturing:

- Name and brief description
- Type of support (e.g. funding, regulation, strategic framework)
- Target group(s)
- Timeline/status
- Available information on outcomes or uptake.

2.3.2 FINEX Policy Labs

This section provides a synthesis of the **key insights and outcomes from the four Policy Labs** conducted under Work Package 3. A full report of this activity is included in Annex IV.

The FINEX Policy Labs explored critical enablers and barriers across four strategic domains for climate transition: Energy Security and Renewable Integration, Sustainable Mobility and Transport Transformation, Built Environment and Infrastructure Resilience, and Governance, Data and Public Engagement. These were designed as **structured spaces for collective sense-making**, the labs generated rich qualitative insights through facilitated dialogue among consortium partners. While rooted in a systematic methodology, **the core value of these sessions** lies in their ability to surface lived barriers, articulate shared goals, and co-design actionable policy levers that respond to specific system’s dynamics in each domain.

The four main components of each of the workshop in each policy lab were:

1. **Context Mapping**, to surface critical dynamics, stakeholders and tensions in the current system;
2. **Barrier Identification and Lever Framing**, to transform key obstacles into opportunities for change;

3. **Visioning and Scenario Exploration**, to co-create desirable futures and map enabling conditions; and
4. **Roadmapping**, to define concrete steps and policy levers to navigate the transition toward systemic transformation.

Across the four labs, **participants identified a diverse set of policy levers**—ranging from regulatory reforms and investment incentives to digital infrastructure upgrades and new governance models. When analysed comparatively, **clear cross-cutting themes emerged**. Nearly all domains underscored the urgency of workforce upskilling, the need for more agile and interoperable digital systems, and the role of public procurement and experimentation (e.g., regulatory sandboxes) as enablers of systemic change. Weak coordination between governance levels, regulatory misalignments with EU frameworks, and the lack of clear incentives for market creation were **recurrent obstacles**. The comparative lens also revealed domain-specific gaps—such as the underdevelopment of stakeholder engagement models in energy or the regulatory fragmentation in the water-data nexus—pointing to where targeted interventions are most needed.

Two main operational elements were captured in the policy lab implementation:

2.3.2.1 Use of real, cleantech solutions Use cases in the Policy Labs

The use cases selected for the FINEX Policy Labs served as practical illustrations of cleantech experimentation within four key thematic areas: energy, mobility, the built environment, and governance. These real-life examples, grounded in the experiences of stakeholders from different regions, enabled a concrete and contextualised exploration of regulatory and policy barriers. By anchoring the policy dialogues in specific local initiatives, the use cases provided a valuable basis to identify systemic challenges and inform relevant policy pathways for sustainable transformation.

2.3.2.2 Cross-Cutting Insights

Throughout the four FINEX Policy Labs, several systemic patterns emerged that transcend sectoral boundaries. Despite the distinct technical languages and policy landscapes of each thematic area, participants converged around a shared set of underlying challenges and enabling conditions for transformative action.

Despite thematic differences, **several transversal insights emerged**:

- Fragmentation in governance structures inhibits systemic innovation.
- Regulatory environments are often rigid, slowing cleantech deployment.
- Public-private collaboration is essential but underdeveloped.
- Digital infrastructure remains uneven and underleveraged.
- Capacity building needs are pervasive, especially at local levels.

These insights reflect recurring bottlenecks—such as fragmentation, capacity gaps, and misaligned incentives—as well as critical levers for progress, including data governance, regulatory coherence, and inclusive engagement mechanisms. Rather than offering ready-made solutions, this helps distil the collective intelligence generated during the participatory foresight process. It aims to illuminate cross-cutting dynamics that can inform more integrated policy responses and strategic experimentation across Europe's diverse territories and sectors.

The different policy levers identified across the labs are included in section 2.3.4. A detailed overview of the implementation process, key insights and findings of each of the policy labs is included in the Annex 4.

2.3.3 Review of EU and MS level policies supporting cleantech/ deeptech experimentation

2.3.3.1 EU Level policies, programmes and measures

EU Policies and Programmes for Cleantech Innovation Ecosystems

The European Green Deal is the EU's flagship strategy to achieve climate neutrality by 2050, transforming the EU economy toward sustainability. It encompasses a broad array of policies across energy, climate, transport, industry, and finance, all aimed at reducing emissions (at least 55% by 2030) while fostering green growth. Notably, roughly one-third of the EU's €1.8 trillion budget for 2021-2027 (including the NextGenerationEU recovery fund) is earmarked for Green Deal objectives, underscoring the central role of cleantech in Europe's recovery and future competitiveness.[9]

Sustainable Products Initiative and Ecodesign Revision: A key Green Deal component is the push to make sustainable products "the norm" in the EU. In March 2022, the European Commission proposed a new Sustainable Products Policy framework to broaden Ecodesign requirements beyond energy-related products. This culminated in the Ecodesign for Sustainable Products Regulation (ESPR), which entered into force on 18 July 2024. The ESPR replaces the 2009 Ecodesign Directive and significantly expands its scope. Now, virtually all physical goods (not just appliances) can be subject to eco-design criteria, with standards for durability, repairability, recyclability, energy efficiency and other sustainability factors. For example, under the ESPR manufacturers will need to meet requirements on product lifespan, recycled content, and carbon footprint, and provide information via Digital Product Passports. This overhaul of the sustainable product policy framework is designed to drive innovation in circular design and ensure European products lead in environmental performance, supporting Green Deal goals of lower resource use and waste.[10]

"No Green Deal without Cleantech Manufacturing": The Green Deal Industrial Plan

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[9] Find out more here.

[10] Further information is available here.

Recognizing that clean innovation must be backed by industrial capacity, the EU in early 2023 launched the Green Deal Industrial Plan, a strategy to bolster EU cleantech manufacturing and innovation ecosystems. As noted by Commission President Ursula von der Leyen, Europe is determined to "lead the clean tech revolution," turning "innovation into mass production" with a supportive policy framework. This initiative was encapsulated by the mantra "no Green Deal without strong European cleantech manufacturing," underlining that climate targets require a robust home-grown clean technology industry. The Green Deal Industrial Plan comprises four pillars aimed at creating a more favourable environment for cleantech scale-up in Europe:

- **Simplified, Predictable Regulation:** The plan calls for streamlined regulatory processes for net-zero industries. This includes faster permitting and clear targets through measures like the proposed Net-Zero Industry Act and Critical Raw Materials Act. The goal is to remove red tape and accelerate the deployment of key technologies (e.g., renewables, batteries) by providing a "simpler and faster framework" for investors.
- **Faster Access to Funding:** EU State Aid rules are being loosened and existing funds redirected to provide easier financing for clean tech projects. For instance, the Commission has encouraged use of the Innovation Fund and Recovery Fund (see NextGenerationEU below) to subsidize cleantech and allowed greater national aid for strategic sectors (as seen in temporary crisis frameworks).
- **Enhancing Skills:** Recognizing a skilled workforce is critical, the plan includes initiatives to boost green skills and training, so that labour shortages don't hinder cleantech deployment.
- **Open Trade and Resilient Supply Chains:** The EU aims to secure supply of critical inputs (through trade agreements and stockpiling) so that cleantech industries have the necessary raw materials and components (e.g., lithium, rare earths, etc.), reducing dependency on imports.

This industrial push was in part a response to global competition (such as the U.S. Inflation Reduction Act) and seeks to keep Europe an attractive base for cleantech investment. In practical terms, it led to new legislative proposals (like the Net-Zero Industry Act[11] discussed below, as well as the Critical Raw Materials Act[12] and Reform of Electricity Market Design[13]).[14]

The Net-Zero Industry Act

As a centrepiece of the industrial plan, the European Commission proposed the Net-Zero Industry Act (NZIA) in March 2023[15]. This proposed regulation creates a legal framework to boost production of critical net-zero technologies in the EU. Its headline objective is that by 2030 the EU's domestic

[11] More about the Net-Zero Industry Act.

[12] Find out more about the Critical Raw Materials Act here.

[13] Additional information is available here.

[14] Further information is available here.

[15] Further information is available here .

manufacturing capacity for strategic clean technologies should approach or reach at least 40% of the EU's annual deployment needs. In other words, Europe aims to manufacture at least 40% of its own required solar panels, wind turbines, batteries, heat pumps, electrolysers, carbon capture equipment, etc., by 2030, to reduce reliance on imports and secure its clean energy supply chain[16].

Key provisions of the NZIA include:

- **Streamlined Permitting:** Creating "enabling conditions" for cleantech investments by simplifying and speeding up permitting processes for new production facilities. Certain strategic projects (e.g., gigafactories or large renewable plants deemed of EU interest) would be designated as "Net-Zero Strategic Projects" and benefit from faster permit timelines and single contact points.
- **Attracting Investment:** Through net Zero Europe Platform and European Hydrogen Bank
- **Carbon Capture Targets:** Introducing a Union-wide goal to develop 50 Mt per year of CO2 storage capacity by 2030. Oil and gas producers would contribute to this CO2 storage objective, removing a major barrier to scaling carbon capture utilization and storage (CCUS) solutions for hard-to-abate sectors.
- **Public Procurement and Market Access:** Encouraging public authorities to consider sustainability and resilience criteria when tendering for net-zero tech, to help innovative clean solutions gain market traction.
- **Skills and Academies:** Establishing Net-Zero Industry Academies to train workers in the skills needed for these sectors, addressing the human capital side of the scale-up.
- **Innovation/Regulatory Sandboxes:** Notably, the Act explicitly enables Member States to set up regulatory sandboxes for innovative net-zero technologies. These sandboxes allow companies to test new clean innovations under real-world conditions with temporary regulatory exemptions - a mechanism to spur innovation that we will see examples of in the final section.
- **Net-Zero Europe Platform:** Creating a coordination platform for the Commission and Member States to monitor progress, identify bottlenecks, and facilitate financing for the net-zero industrial goals. This platform will also promote Industrial Alliances (like those for batteries and hydrogen) and coordinate investment needs across Europe.

NextGenerationEU and Recovery Funding for Cleantech

NextGenerationEU is the EU's €600+ billion temporary recovery instrument launched in 2021 to help rebuild after the COVID-19 pandemic.[17]

The key policy instrument of the NextGenerationEU is the Recovery and Resilience Facility (RRF), which provides grants and loans to EU countries for implementing national Recovery and Resilience

[16] More information is here.

[17] Additional details can be found here.

Plans. Each national plan must devote at least 37% of its budget to climate-related measures, a target which all countries exceeded (the average is ~42% green spending per plan as of 2024). In total, about €275 billion of RRF funding is going toward climate objectives EU-wide, with over €180 billion specifically supporting energy-related projects (renewables, efficiency, grids, etc.).[18]

Concrete cleantech-focused elements of NextGeneration EU include:

- **Massive Renewable Energy Investments:** Many countries are using RRF funds to build out solar and wind capacity, invest in energy storage, and modernize electricity grids (often under the Commission's REPowerEU plan). By late 2024, RRF projects had already enabled over 100 GW of new renewable generation capacity in the EU.
- **Energy Efficiency and Building Renovations:** Over half of energy-related RRF funds (~€106 billion) are allocated to energy efficiency, such as retrofitting buildings with insulation, efficient heating, and smart controls. This not only cuts emissions but also stimulates cleantech in construction (e.g., smart HVAC systems). By end of 2023, RRF measures had saved an estimated 34 million MWh per year through efficiency - more than Denmark's annual energy consumption.
- **Green Innovation and Industrial Projects:** Some countries channel RRF grants into hydrogen production facilities (13.6 billion), or decarbonization of industry. For example, state aid for innovative hydrogen and low-carbon steel projects has been approved with RRF support in countries like Slovakia[19].

By tying recovery money to climate goals, NextGenerationEU has effectively become a huge stimulus for cleantech deployment and innovation in Europe. It ensures that post-pandemic rebuilding also strengthens green industries and infrastructure. The NextGenerationEU funding is temporary (most projects to be completed by 2026), but its impact from modernized grids to new renewable capacity and EV networks - is set to transform Europe's energy landscape and provide a fertile environment for cleantech companies.

The Clean Industrial Deal State Aid Framework (CISAF)

Adopted by the European Commission on 25 June 2025, it enables EU Member States to support clean energy, industrial decarbonisation, and cleantech manufacturing until 2030. CISAF replaces the Temporary Crisis and Transition Framework and simplifies State aid rules in five main areas:

- the roll-out of renewable energy and low-carbon fuels;
- temporary electricity price relief for energy-intensive users to ensure the transition to low-cost clean electricity;
- decarbonisation of existing production facilities;

[18] Find out more here.

[19] Further information is accessible here.

- the development of clean tech manufacturing capacity in the EU, and;
- the de-risking of investments in clean energy, decarbonisation, clean tech, energy infrastructure projects and projects supporting the circular economy.

It permits financing through stock, loans, guarantees (including for PPAs), and blended finance instruments. Aid limits are now applied at the project level, allowing numerous initiatives per company, and support is extended to projects backed by the Innovation Fund or near-miss projects. The framework's goal is to promote cleantech adoption and boost Europe's clean industrial ecosystem.[20]

2.3.3.2 EU Research & Innovation Programmes Supporting Cleantech

In addition to regulatory and financing policies, the EU has strong research, innovation and ecosystem-building programmes to drive cleantech development and scale-up. Key initiatives include:

- **Horizon Europe (2021-2027):** This is the EU's main R&I framework programme. Horizon Europe devotes a substantial portion of funding to climate and energy innovation - over 35% of the total programme spending is targeted at climate-related objectives[21]. Within Horizon Europe, Cluster 5: Climate, Energy and Mobility supports research projects in areas such as renewable energy technologies, energy storage, smart grids, sustainable transport, and climate adaptation[22]. Additionally, Horizon Europe introduced missions (like the Climate-Neutral Cities mission) to foster systemic innovation for climate-neutral solutions by 2030.[23] The programme also includes the European Innovation Council (EIC), which provides grants and equity funding to high-risk, high-impact startups (many in climate tech) to help them scale up.[24] In summary, Horizon Europe is a powerful engine for cleantech R&D - funding everything from basic research in green tech to demonstration projects and by doing so, it underpins the pipeline of innovation for Europe's Green Deal.
- **European Institute of Innovation and Technology (EIT) - InnoEnergy and Climate-KIC:** The EIT supports thematic innovation communities known as KICs (Knowledge and Innovation Communities) that integrate education, business incubation and R&D in strategic areas. EIT InnoEnergy (established 2010) focuses on sustainable energy and is often cited as one of Europe's most active cleantech accelerators. Backed by EU funding, EIT InnoEnergy invests in start-ups and scale-ups across the energy value chain from renewable generation and energy storage to energy efficiency and mobility solutions and has supported over 500 companies since 2010.[25] It has built

[20] Find out more here.

[21] Additional information is available here.

[22] Further details can be found here.

[23] More information is available here.

[24] Additional information is available here.

[25] Further information is available here.

a network of over 1,400 partners (industry, universities, investors). EIT InnoEnergy's portfolio companies had attracted over 9.4 billion in investment by 2024, highlighting its pivotal role in accelerating Europe's net-zero economy. Similarly, EIT Climate-KIC is the KIC focused on climate innovation more broadly (clean tech, climate services, etc.).[26] It runs the Climate-KIC Accelerator, the EU's largest cleantech start-up accelerator program which supports over 150 early-stage startups in Europe each year. This accelerator provides funding, coaching, and access to networks in three stages, helping climate entrepreneurs validate and grow their businesses. Such EU-supported incubator programs have produced numerous cleantech SMEs working on solutions ranging from carbon capture to agritech.

- **Clusters, Incubators and Alliances:** The EU also facilitates cleantech innovation through support for regional clusters and incubators. For example, the European Cluster Collaboration Platform[27] connects hundreds of green industry clusters across Member States, fostering knowledge exchange and partnerships. The EU's regional funds and programmes like Interreg[28] has a budget of 394 million euros from the European Regional Development Fund (ERDF) and includes Greener Europe as a key focus area; these projects bring together a fixed number of partners from different regions who exchange and transfer experience on a shared regional development issue. Furthermore, the Innovation Fund[29] (funded by EU carbon emission permit revenues) is providing direct support to first-of-a-kind commercial projects in renewable energy, hydrogen, energy storage, carbon capture, etc. with 40 billion euros of grant money available from 2020 – 2030. Together, these initiatives create a supportive ecosystem from lab to market: research funding (Horizon Europe) generates new ideas; accelerators and incubators (EIT KICs, etc.) help startups develop and commercialize those ideas; and alliances and funds ensure the most promising technologies find pathways to deployment in Europe.[30]

2.3.3.3 Examples of Cleantech Testbeds and Sandboxes in Europe

Innovative cleantech solutions often need real-world experimentation spaces such as regulatory sandboxes, living labs, or test beds to refine technologies and business models before full scale deployment. Below are a few concrete examples (at national or regional level) where such experimental environments have been created in Europe to accelerate clean technology innovation:

- EIT Community Testbeds[31]: The **EIT Community Testbeds** initiative has established a network of controlled environments across Europe for deploying and testing emerging technologies. While

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[26] Find out more here.

[27] See here to know more.

[28] Additional details can be found here.

[29] Find out more about the Innovation Fund.

[30] Other sources from Cleantech for Europe can be found here.

[31] Find out more about the EIT Community Testbeds.

many of these testbeds focus on sectors beyond cleantech, it remains useful to monitor the program for relevant infrastructure or pilot opportunities. Most testbeds target food and safety innovation, with a few notable exceptions.

Testbed Locations & Focus Areas

- **Porto, Portugal – iFishCan**
  Focus: Intelligent monitoring of food loss and waste in the **fish canning industry**.
  Sector: Foodtech / Waste reduction.
- **Murcia, Spain – SAIFE**
  Focus: Safety enhancement through AI vision systems in **food production**.
  Sector: Food safety / AI.
  Note: This testbed also appears in Twente (Netherlands), Wolfsburg (Germany), and Senieji Trakai (Lithuania), indicating broad replication.
- **Italy – EMOTOR-VTB**
  Focus: Development and testing of **electric motors using recycled materials**.
  Sector: **Mobility / Circular Economy**.
  *Note: **This is the most relevant testbed for FINEX** due to its alignment with sustainable mobility.*
- **Patras, Greece – Teaching Factory for the Food Industry**
  Focus: Digital tools and simulations for **food sector workforce training**.
  Sector: Food industry education / digital transformation.
- **Twente, Netherlands – SAIFE (duplicate)**
- **Wolfsburg, Germany – SAIFE (duplicate)**
- **Senieji Trakai, Lithuania – SAIFE (duplicate)**

2.3.3.4 Examples of successful policy support mechanisms throughout Europe

- The **EMOTOR-VTB testbed in Italy** stands out as the only one directly relevant to FINEX's mobility objectives, especially in the context of sustainable manufacturing and recycling. While the other sites demonstrate EIT's broader food safety and AI focus, they are less aligned with FINEX's core themes but may offer transferable tech validation methods or cross-sector insights.
- **Germany - "Reallabore der Energiewende" (Energy Transition Living Labs):** Germany's Federal Ministry for Economic Affairs and Energy launched the Regulatory Sandboxes for the Energy Transition program in 2019 to test innovative energy technologies in real-life conditions. These "real-world laboratories" allow consortia of companies and researchers to trial cleantech solutions within a limited geographic area, often with temporary regulatory waivers. For example, the Westküste 100 project in Schleswig-Holstein is a sandbox aimed at creating a regional green

hydrogen economy: it links offshore wind power to hydrogen production, storage, and usage in refineries and aviation fuels, all tested on an industrial scale in a coordinated cluster.[32] By operating under real conditions (with citizens, grids, markets) and identifying regulatory obstacles, the Reallabore provide crucial insights before scaling these solutions nationwide.

- **France - Energy Regulation Sandbox (CRE):** In France, the 2019 Energy-Climate Law established a regulatory sandbox regime for the energy sector, run by the national energy regulator CRE. This framework empowers the regulator to grant time-limited exemptions from certain energy market rules for experimental projects that support the energy transition (e.g., smart grids, demand response, local energy communities). Innovators can apply to test new services or technologies such as peer-to-peer energy trading platforms, innovative energy storage integrations, or Vehicle-to-Grid schemes without having to fully comply with all existing network or market regulations during the trial. The CRE evaluates each project's potential benefits and monitors the results, with an eye to informing permanent regulatory adaptations if the experiment proves successful.[33]
- **United Kingdom – Catapults and Ofgem:** The UK (though not part of the EU) supports cleantech scale-up through both physical test facilities and sandboxed regulation. The Catapult Centres[34] – government-backed innovation hubs – provide open-access testbeds for startups and SMEs. There are 9 catapult centres, of which at least 3 are relevant for cleantech: High Value Manufacturing Catapult; Offshore Renewable Energy Catapult, and Energy Systems Catapult. For example, the Offshore Renewable Energy Catapult operates a 7 MW Levenmouth offshore wind demonstration turbine that has hosted technology trials for over *120* SMEs[35]. Likewise, the Energy Systems Catapult runs a Home Energy Living Lab (a network of real homes) for testing smart heating, IoT, and energy-flexibility products with users.[36] In the regulatory realm, Ofgem's Energy Regulation Sandbox (launched 2017) lets innovators trial new energy products, services or business models *without some of the usual rules applying.*[37] Both the Catapult testbeds and the Ofgem sandbox are active and have a cross-sector focus (energy systems, mobility, smart cities), explicitly targeting startups/SMEs to de-risk innovation and speed up market entry for clean technologies.
- **Sweden – Stockholm:** Stockholm host several testbeds. These include "Reality Lab" – test beds for developing care of the elderly (out of scope); Innovation zone Hornsgatan – a testbed used for innovative projects related to traffic control, emissions level, and mobility; and The StockholdRoyal

[32] Further information is available here.

[33] Find out more here.

[34] Find out more about the Catapult Centres.

[35] Additional details can be found here.

[36] Find out more here.

[37] More information here.

Seaport, a large brownfield redevelopment project in Sweden's capital, has been turned into a living laboratory for climate-smart urban solutions.[38]

Sweden also has a well-developed network of testbeds and living labs open to external innovators. The national RISE research institute alone offers 100+ test and demonstration environments accessible to companies, allowing them to “test and evaluate ideas at an early stage” in areas ranging from smart grids, battery, agriculture, carbon capture, pyrolysis, textiles, stormwater systems, and many more[39]. [40]

Each of these examples - from regulatory sandboxes to living labs - play a critical role in strengthening cleantech innovation ecosystems. They reduce time-to-market for new technologies by providing "safe spaces" for trial and error, help identify needed regulatory adjustments and build local know-how and public acceptance. Going forward, the EU (through the Net-Zero Industry Act and other initiatives) is encouraging more such experimentation environments across Member States, recognizing that accelerating cleantech also means innovating in policy and deployment, not just in the lab. For practitioners and policymakers, these testbeds and sandboxes are invaluable for sharing best practices on governing innovation ultimately helping Europe turn its bold climate targets into on-the-ground reality.

2.3.3.5 Policy and Support measures for cleantech innovation in FINEX Regions

Out of the 6 FINEX regions, only Lithuania has established regulatory experimentation (for the energy sector). Latvia and Finland have it under development or consideration, while Estonia, Cyprus, and Bulgaria have no regulatory experimentation under consideration.[41]

Cyprus

Cyprus shows strong political support for innovation and especially for renewable energy innovation through a dedicated **Deputy Ministry, a Chief Scientist for Research, Innovation and Technology and key institutions like the Cyprus Research and Innovation Foundation (RIF) and the Cyprus Energy Agency.** Its legal framework ensuring high IP protection, support to SMEs and startups, initiatives to upgrade critical infrastructures, availability of cutting-edge laboratory facilities and state-backed testbeds are conducive to fostering CleanTech innovation.

Cyprus’s **Research and Innovation Strategy Framework 2024–2026 (built on strategy** 2019–2023), outlines national priorities to strengthen the innovation ecosystem, support technological development, and align with the country’s green and digital transitions. The **R&I Strategy 2024–2026** reaffirms Cyprus’s commitment to research and innovation as drivers of sustainable development, economic competitiveness, and international investment appeal. It builds on national progress by prioritizing infrastructure use, outward collaboration, and stronger links between research, industry, and the labour

[38] Find out more here.

[39] Additional information can be found here.

[40] A website that shows a list of living labs and test beds around Europe can be found here.

[41] Further details are available here.

market. While distinct, it complements the **National Energy and Climate Plan (NECP) 2021–2030** by promoting research and innovation in clean energy, climate technologies, and sustainable infrastructure.[42]

The **Smart Specialisation Strategy for Cyprus (S3CY) 2023–2030** was formally approved by the **Council of Ministers** following a proposal by the **Deputy Ministry of Research, Innovation and Digital Policy**. It sets national research and innovation (R&I) priorities across four categories: **Technological Priorities** (e.g. Digital Technologies, Advanced Materials), **Ecosystems** (e.g. Agrifood, Renewable Energy, Maritime and Shipping), **Emerging Ecosystems** (e.g. Space Technologies), and **Enablers** (e.g. Health and Environment).

As a strategic policy framework, S3CY 2023–2030 guides Cyprus's R&I funding landscape by prioritizing key sectors such as renewable energy, environment, and digital technologies, thereby supporting cleantech innovation and sustainable economic growth.[43]

One of the key R&I funding instruments aligned with Cyprus's smart specialisation objectives was the **RESTART 2016–2020 Programme**, implemented under the previous **S3CY 2014–2020 cycle**. With a total budget of approximately **€215.5 million**, co-funded by national and EU sources, RESTART supported a broad range of activities including collaborative research, SME innovation, infrastructure development, and international partnerships. As of **March 2023**, new funding calls and future R&I programmes are being designed in line with the priorities of the **S3CY 2023–2030**, which was developed through a **Technopolis Group study** and extensive stakeholder consultations. These programmes now reflect the updated strategic focus across the four categories: **Technological Priorities**, **Ecosystems**, **Emerging Ecosystems**, and **Enablers.**[44]

Cyprus's **Green Recovery and Climate Action Initiatives (2023)**, in alignment with and backed by EU Recovery and Resilience Plan (~€1.2 billion funds), dedicate over 40% of resources to 29[45] green projects to achieve sustainable mobility, cities, and increased and cleaner energy supply, for example, via the EuroAsia Interconnector[46] project. The RRP also includes 34[47] reforms addressing skill mismatch (skilling, reskilling and upskilling) and innovation funding programmes for start-ups, innovative companies and SMEs have been planned (not yet fully assessed).[48]

[42] Further details can be found here.

[43] Further information is available here.

[44] Further details can be found here.

[45] Further information can be found here.

[46] Further details are available here.

[47] Further details can be found here.

[48] Further information is available here.

Approved by the Council of Ministers, the **Business Support Center (BSC)**[49] serves as a point of contact for foreign and Cypriot investors looking to grow their operations or conduct business in Cyprus. BSC accompanies startups and SMEs on different stages of development: planning, starting, running/growing, funding, including cleantech ones.

Cyprus's **National Action Plan for the Circular Economy 2021-2027**, adopted by the Council of Ministers in June 2021, is coordinated across the **Ministry of Agriculture, Rural Development and Environment**, the **Deputy Ministry for Research, Innovation and Digital Policy**, and the **Ministry of Energy, Commerce and Industry**. With a budget of €90 million, it includes measures to foster circular practices among businesses and citizens, incentivize green investments, and improve waste management. Key actions target waste declassification, infrastructure development, and separate collection systems like "Pay as You Throw." The plan creates a supportive policy environment to scale circular economy innovation and efficiency across sectors.[50]

Baltics[51]

The policy and regulatory environment in the Baltic region has seen significant advancements, driven by both global trends and initiatives like the **European Green Deal**. Support measures include sustainable business incentives, as well as **local and EU-level grants** and **subsidies** targeting biofuels, electric vehicles, green energy, and urban mobility. **National programs** such as those led by the **Investment and Development Agency of Latvia, Accelerate Estonia, and Tallinn Science Park Tehnopol** play key roles in fostering cleantech innovation.

Regional initiatives are also established. **Interreg Baltic Sea Region co-funded by the EU** supports 115 cooperation cleantech, green transition, and resilience projects, with €225.7 million committed as of July 2025. Partners include public, private, education and research, as well as non-governmental organizations helping transfer solutions in sustainable mobility, energy efficiency, water management, and coastal protection across the region[52]. **Interreg Central Baltic Program** (2021–2027) is an EU-funded cross-border cooperation initiative supporting projects in Finland (incl. Åland), Estonia, Latvia, and Sweden with €152 million from the **European Regional Development Fund**. It funds projects involving partners from at least two countries that address shared challenges through one of seven thematic objectives. The programme supports public bodies, NGOs, and private actors, aiming for sustainable results and long-term regional cohesion.[53]

Estonia

[49] See further information here.

[50] Additional information can be found here.

[51] See also the CleanTech for Baltics Report 2022

[52] Further information is available here.

[53] Additional details are available here.

Estonia has built a robust and well-structured framework to accelerate cleantech innovation, supported by aligned policy, regulation, and targeted funding. The country's **ENMAK 2030**[54] and **Transport and Mobility Plan 2021–2035**[55] aim to modernize energy and transport systems by promoting renewable energy, energy efficiency, and low-carbon mobility. Together, they support cleantech through market-based reforms, €200M in sustainable transport investments, and systemic alignment with EU climate goals. The **Climate Resilient Economy Act** reinforces Estonia's green objectives through legal commitments to promote renewable electricity, innovation in clean technologies, and preferential treatment for sustainable solutions in public procurement. As part of this effort, the government allocated **€100 million from the Recovery and Resilience Facility (RRF)**[56] to the **SmartCap Green Fund**[57], aimed at increasing venture capital availability for cleantech companies. Estonia's **Hydrogen Roadmap** outlines strategic plans to scale up hydrogen production, use, and infrastructure, positioning the country for regional leadership in renewable hydrogen exports. To support this, **€50 million** has been allocated specifically for hydrogen technology development, including R&D and pilot projects.[58] Estonia has allocated €53 million for **resource-efficient cleantech applications**, €20 million supports **security of supply**, and another €20 million is directed to **biogas and biomethane** projects. Additionally, €8 million is provided for **development services** to support cleantech startups.

Complementing these strategies, recent **amendments to the Building Code** have streamlined the permitting process for renewable energy projects by consolidating requirements into a single process. This reform is crucial for accelerating project deployment across all clean technologies funded under the green transition.[59]

Lastly, Estonia's **Just Transition Fund** plays a key role in ensuring a fair and inclusive energy shift, especially in fossil fuel-dependent regions like Ida-Virumaa. The fund supports modernization of **district heating systems** with cleaner, low-carbon alternatives, further embedding cleantech into Estonia's infrastructure transformation. The plan envisions the restoration of abandoned and polluted areas and investments in solar, wind and hydrogen power. There are also plans to develop a business environment based on the circular economy.[60]

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[54] More about ENMAK 2030 here.

[55] Further information is available here.

[56] More about the Estonian RRF here.

[57] Further information can be found here.

[58] Read more here.

[59] Further details are accessible here.

[60] Further information is available here.

Governmental initiatives like **Accelerate Estonia**[61] **-** an innovation lab that identifies and removes regulatory barriers for emerging cleantech firms - brings together public and private stakeholders to ease market entry and promote impactful, legal clean technology solutions.

Some other support measures are **Startup Estonia**[62] and **Invest in Estonia**[63]**,** working closely with Estonian ministries and stakeholders to connect different sectors with the startup community, building a startup ecosystem which also enables cleantech and deep tech. The **Estonian Business and Innovation Agency**[64] supports development projects of companies by providing financial resources, tools, and with knowledge/technology transfers, while allowing them to cooperate with universities and development partners, and find and implement innovative technologies.

Tehnopol Science and Business Park[65] is the largest tech park in Estonia (and the Baltics), supporting over 200 companies and 35+ startups. It provides business development, mentoring, and test environments. Through its **GreenTech Cluster**, Tehnopol fosters cleantech innovation by linking startups with funding, international markets, and R&D support, helping accelerate the growth and commercialization of sustainable technologies.

Lithuania

Lithuania is advancing its cleantech transition through a structured mix of national, sectoral, and local policies supported by substantial public investment. The country's **National Energy Vision (2024-2050)**[66] outlines long-term goals to position it as a hub for next-generation industry with strategies enabling cleantech production and dissemination fostering collaboration between local authorities, private businesses, and international partners. This is complemented by the **Roadmap for Lithuania's Transition to a Circular Economy by 2035 (**2019[67]**)**, the **National Hydrogen Development Vision**[68], and the **Green Finance Action Plan (**2023–2026[69]**)**, setting strategic directions for circular growth and transition while also highlighting the role that public authorities play in facilitating the transition. Measures have been established for different sectors, such as, a **legislative framework for transport decarbonization** through energy efficiency requirements for public vehicle procurement and **net billing** to support solar and wind park development. Lithuania has also changed its **permitting processes**,

[61] Further details can be found here.

[62] Further details can be found here.

[63] Additional information is available here.

[64] Additional details can be found here.

[65] Find more here.

[66] More about the Energy Vision here.

[67] Further information is available here.

[68] More about the hydrogen development vision here.

[69] Additional information is available here.

simplified regulation and reduced administrative burdens to accelerate the development of renewable energy and to deliver on the key objectives of the European Green Deal.[70]

In 2022, the Ministry of Economy and Innovation established a single **innovation agency to act as a business one-stop shop** centralising national assistance for exports, entrepreneurship, and innovation. It provides specialised assistance to companies at every level and oversees more than €500 million in funding. By 2030, goals include doubling high value-added exports and tripling private R&D investment in an effort to increase competitiveness and streamline assistance.[71] Furthermore, to support green transformation in March 2024 **the GreenTech Hub**[72] was established by the Innovation Agency of Lithuania. It functions as a one-stop competence centre, offering tailored consulting on green technologies, funding opportunities, and regulatory compliance. The Hub also facilitates international cooperation, helps businesses access EU and national financial instruments, and implement major projects like the €27 million **European Circular Innovation Valley** initiative[73]

Some other examples of financial support measures include €50 million for green hydrogen from the Modernization Fund[74], €100 million for circular economy initiatives, over €30 million for biogas and biomethane, €40 million for solar in residential buildings, €32 million for household investment in solar parks, and €19 million for EV charging stations. Cohesion policy grants of €6.3M and €3.8B from the **Recovery and Resilience Facility (RRF)** support these efforts (37% dedicated to climate objectives).[75]

Between 2021 and 2024, Lithuania's cleantech sector received **€376 million funding**, with the largest share directed toward photovoltaic technologies (36.26%) and alternative fuels (23.08%). Other key areas of investment included electricity grid technologies (5.03%), advanced materials production (4.48%), sustainable biogas/biomethane (3.72%), and battery storage solutions (1.77%)[76].

In 2025, the Lithuanian Ministry of Economy and Innovation launched a €42 million funding package to help industrial companies accelerate climate-neutral projects and modernize their equipment. The program specifically targets technologies that contribute to decarbonization and energy efficiency, aiming to save approximately 2,607 GWh of energy and reduce greenhouse gas emissions by about 489,000 tonnes by 2035.[77]

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[70] Further information is accessible here.

[71] Additional information can be found here.

[72] More information here

[73] More information here

[74] Find out more in Modernisation Fund. (2024). *Lithuania: Annual report* here.

[75] More about the Lithuanian RRF here.

[76] More information in Sunrise Tech Park. (2024, November). FINEX Workshop Report: link

[77] Additional information is available here.

Focusing on **regulatory experimentation**, Lithuania established a **Regulatory sandbox for energy innovations** enabled by amendments[78] to the Energy Law in 2020 supporting innovation and providing a legal basis for the enactment of regulatory. The sandbox allows **live testing of innovative energy technologies** under the supervision of the **National Energy Regulatory Council**. The sandbox simplifies the permitting process and helps identify regulatory barriers. This initiative aims to **accelerate clean energy innovation and policy improvement**.[79]

Latvia

Latvia has implemented financial, strategic, and institutional initiatives to fortify its cleantech innovation environment. To centralise and streamline climate and energy governance, the government created the **Ministry of Climate and Energy in 2023**. This ministry took over duties from other ministries to better coordinate the green transition.[80] Latvia's **National Energy and Climate Plan (NECP) 2021-2030**, a key strategic document, sets enforceable goals such as reducing greenhouse gas emissions by 65% from 1990 levels and reaching 50–57% of final consumption from renewable energy by 2030. The NECP is in line with **EU guidelines** and advocates for policies including transportation decarbonisation, electrification, and the growth of renewable energy sources.[81]. With an **emphasis on smart energy and mobility**, Latvia also takes part in the **EU's Smart Specialisation Strategy (RIS3),** which allocates **public R&I funds to clean transportation innovations, energy efficiency, and smart grids**. More than €34 million was allocated to this particular area between 2014 and 2018.

Through **ALTUM, the state development finance organisation**, which works with the **EU's ERDF** and **EIF** funding, Latvia provides **financial support for cleantech initiatives**. More than 300 businesses benefited from ALTUM's €101 million in support of 16 venture capital funds by 2024, which also helped with job development and the energy transition.[82]

The **Investment and Development Agency of Latvia (LIAA)[83]** supports cleantech innovation by enhancing export capacity, attracting foreign investment, and offering business incubation services. It runs programs such as the **Venture Catalysts**[84] training initiative to help researchers and entrepreneurs commercialize their ideas. Latvia is also implementing **reforms to enable the green transition of Riga's transport system**, to promote **energy efficiency in buildings**, and **accelerate renewable energy** deployment as well as to **improve regulatory framework** facilitating deployment of onshore wind energy and reduce legal uncertainty of investments in wind power. These efforts are backed by

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[78] Further information can be found here.

[79] Access additional information here.

[80] Further details are available here.

[81] Find out more here.

[82] Additional information is available here.

[83] Additional information can be found here.

[84] Find out more about the Venture Catalysts.

€1.97 billion in Recovery and Resilience Facility (RRF)[85] funding and **€4.4 billion in cohesion policy funds**.[86]

Bulgaria

Bulgaria is gradually stepping up its support for cleantech innovation through a mix of national policies, EU funding, and dedicated programs.

The **Ministry of Energy** leads on policy implementation, working alongside the **Ministry of Environment and Water** and the **Innovation and Growth Ministry**. The country's Integrated **National Energy and Climate Plan (2021-2030)** sets targets for over 34% renewable energy use and a coal phase-out by 2038.[87]

A key funding initiative is the €602 million **RESTORE program**, managed under the **Recovery and Resilience Facility**[88] (2021–2026; ~57% funds for green transition)**,** which supports battery energy storage projects with up to 50% co-financing. It has approved €587 million in grants for 82 standalone battery storage projects, enhancing grid stability and renewable integration.[89]

The **Energy from Renewable Sources Act** eases for small-scale renewable projects to launch, offering feed-in tariffs and incentives specifically targeting small-scale solar and biomass deployments, driving growth in decentralized renewables.

Local organizations like **Cleantech Bulgaria**[90], a nationally backed clean-tech network, supports startups and SMEs with incubation, acceleration, pilot testing in municipalities, and access to EU innovation platforms like EIT Climate-KIC and EIT Manufacturing. Additional backing comes from EU cohesion funds and Interreg projects, which channel resources into circular economy and cleantech SME development. Together, these efforts mark a steady shift toward a more sustainable and innovative energy system.

Finland

Finland's cleantech innovation drive is supported by the legally enforceable objective of becoming carbon neutral by 2035, which is outlined in the **2022 Climate Change Act**. The **National Climate and Energy Strategy (NCES),** which describes measures to decarbonise energy, industry, transportation, and buildings through efficiency, renewable technology, and electrification, is at the heart of this. Finland, which ranks fourth among IEA countries by GDP share, supports innovation through **targeted finance and robust public R&D investment.** Other important stakeholders include **Business Finland**

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[85] Know more about the Latvian RRF here.

[86] Additional information can be found here.

[87] Find out more here.

[88] Further details are available here.

[89] Additional information is available here.

[90] More about Cleantech Bulgaria.

and **EU funding authorities**. In order to increase Finland's worldwide "carbon footprint," the government actively **encourages the commercialisation of technology for exports** and industries that are difficult to mitigate. Fossil fuels make only a small portion of the energy mix; nuclear power already accounts for over 40% of electricity, and wind, hydro, and biomass are also expanding. Using heat pumps, district heating, and thermal storage, heat decarbonisation is progressing. Significant savings are fuelled by industry-wide energy efficiency agreements. Building on its strengths in recycling and minerals, Finland's **National Battery Strategy 2025** seeks to establish the country as a global leader in batteries. By 2045, fossil fuel-free transportation is supported by EV incentives and strict biofuel requirements (34% by 2030).[91]

Finland also promotes cleantech experimentation, through initiatives like **Smart Otaniemi**, a living energy lab in the Helsinki capital region. Smart Otaniemi (active since 2019) is an innovation ecosystem led by VTT that connects energy companies, startups, and city authorities to pilot integrated smart energy solutions in a real district. It functions as a *"showroom and pilot platform for new smart energy solutions"*, combining pilots in smart grids, buildings, mobility and communication.[92]

All things considered, cleantech policy strengthens Finland's position as a leader in clean innovation, promotes energy resilience, and lessens reliance on Russian imports.

2.3.4 Policy levers for cleantech experimentation and testing

Across the four labs, participants identified a diverse set of policy levers—ranging from regulatory reforms and investment incentives to digital infrastructure upgrades and new governance models. When analysed comparatively, clear cross-cutting themes emerged. Nearly all domains underscored the urgency of workforce upskilling, the need for more agile and interoperable digital systems, and the role of public procurement and experimentation (e.g., regulatory sandboxes) as enablers of systemic change. Weak coordination between governance levels, regulatory misalignments with EU frameworks, and the lack of clear incentives for market creation were recurrent obstacles. The comparative lens also revealed domain-specific gaps—such as the underdevelopment of stakeholder engagement models in energy or the regulatory fragmentation in the water-data nexus—pointing to where targeted interventions are most needed.

A comparative synthesis of the key policy levers identified across the four Policy Labs is presented in Annex IV.

The table below consolidates the most relevant policy levers identified across the four Policy Labs. Each lever is defined and linked to its primary thematic relevance:

Table 10 Most relevant policy levers identified across the four Policy Labs of the FINEX project.

Policy Lever	Description	Thematic Relevance

[91] Further information is accessible here.

[92] See more here.

Governance & Institutional Alignment	Strengthening coordination mechanisms across levels and institutions to overcome fragmentation and enable coherent policy delivery.	All four areas
Regulatory Flexibility	Creating adaptive, clear, and harmonised regulatory frameworks that allow for innovation testing, rapid deployment, and systemic coherence.	All areas, especially Energy and Data
Public-Private Collaboration	Fostering joint efforts between governments and private actors to enable innovation, scale solutions, and de-risk investments.	All areas
Data & Digital Infrastructure	Investing in open, interoperable, and ethical digital systems that support decision-making, integration, and innovation.	All areas, especially Data & Energy
Capacity Building & Learning Ecosystems	Developing inclusive learning systems and targeted training to close skill gaps, empower local actors, and sustain innovation uptake.	All areas, especially Built Environment
Finance & Market Creation	Mobilising blended finance, public investment, and fiscal tools to scale green markets and support early-stage innovation.	All areas, especially Energy and Mobility
Technology Enablement & Innovation Ecosystems	Enabling experimentation and uptake of cleantech solutions through supportive environments, standards, and sandboxes.	All areas
Monitoring, Metrics, and Impact Assessment	Implementing robust systems and indicators to evaluate transition progress, behavioural impacts, and systemic outcomes.	All areas
Equity, Inclusivity and Access	Embedding fairness, diversity, and accessibility across transition policies, particularly for underserved communities.	All areas, especially Data & Governance

The policy levers extracted from these four policy labs reflect a **shared ambition to transform Europe's energy, mobility, built, and data systems in line with climate and resilience goals**. Yet the pathways diverge depending on sectoral specificities, technical maturity, and institutional readiness. Regulatory innovation, capacity building, data governance, and stakeholder collaboration emerge as indispensable threads across all domains.

Strategic integration across these pillars could significantly enhance the systemic impact of interventions, while targeted efforts are still needed to close gaps—especially in governance coherence, inclusive policy making, and investment coordination. A cross-cutting strategy that aligns regulation, digital tools, and community engagement will be key to enabling a just, scalable, and resilient transition.

2.3.5 Policy recommendations, limitations and future directions

This policy task of the FINEX project has brought important lessons about the role that public policies and regulations are expected to play to create positive conditions to support a wider set of experimentation approaches in European Cleantech. Each thematic lab produced a rich set of recommendations tailored to their specific context:

- **Energy**: Regulatory stability, cleantech procurement, and public-private R&D partnerships.

- **Mobility & Transportation system**: Governance reform, smart taxation, business model innovation.
- **Built Environment**: Retrofitting incentives, digital construction tools, circularity.
- **Data & Governance**: AI policy, open data hubs, inclusive participation models.

The policy-related analysis in this task also derived into a series of strategic recommendations for European policy makers to further support cleantech experimentation in testbeds (and other systemic instruments and platforms, such as living labs and demonstrators). The findings suggest that systemic alignment across sectors and governance levels is crucial. At the higher level, prioritized recommendations include:

- Establish multi-level coordination bodies.
- Embed adaptive regulation mechanisms.
- Create cleantech investment platforms.
- Expand reskilling and vocational training linked to green jobs.
- Integrate digital tools for real-time governance and citizen engagement.

Below, ten specific policy recommendations for EU legislators are provided:

1. Expand the Anticipatory Regulation Toolkit

A broader mix of proactive regulatory tools is needed to keep pace with rapid cleantech innovation. This includes:

- Technology-specific reviews to assess emerging developments.
- Sectoral guidelines for underregulated or fast-evolving areas.
- Cross-sector dialogues to foster collaboration and coherence.
- Capacity-building through education and expert networks focused on cleantech legislation.

2. Strengthen and Scale Regulatory Experimentation Spaces

The EU should:

- Raise awareness among Member States of the benefits and potential of cleantech regulatory sandboxes.
- Develop cross-border frameworks to harmonise national sandbox initiatives.
- Create an EU-level platform to coordinate experimentation, share best practices, and host regular workshops.
- Integrate regulatory learning into real-world testbeds and living labs.
- Connect sandboxes with public procurement and innovation funding to facilitate market entry and de-risk scale-up.

3. Align Regulatory Experimentation with EU 2024–2029 Strategic Priorities

Support the Commission's competitiveness agenda by:

- Embedding experimentation into broader strategies for frontier science, innovation, and cleantech.
- Promoting agile frameworks for cleantech startups and scaleups, in line with the Commissioner for Startups, Research and Innovation's mandate.
- Empowering EU and Member State regulators to adapt quickly to new technologies and reduce the regulatory lag.

4. Dedicate NextGenerationEU Funds for Cleantech Sandboxes and Testbeds

- Advise Member States to allocate Recovery and Resilience Facility (RRF) funding to establish and expand cleantech regulatory sandboxes, living labs, and pilot zones for technologies like hydrogen, storage, carbon capture, and circular economy, sustainable mobility and building.

5. Establish an EU Cleantech Experimentation Coordination Facility

Create a central coordination facility (modelled on the EIC, ERA, FinTech, or digitalisation hubs) to:

- Support legal, technical, and regulatory needs of local authorities.
- Facilitate collaboration across Member States.
- Aggregate learnings to inform EU-level policy and scaling pathways.

6. Incentivise Regional and Cross-Border Cleantech Sandboxes

- Support transnational experimentation zones in areas with shared infrastructure (e.g., Baltic hydrogen corridors or Alpine battery testbeds) through co-financing from Horizon Europe and the RRF, reducing investment risks for cross-border innovation.

7. Embed Experimentation into Green Transition Missions and Procurement

- Allow regulatory sandboxes to work in alignment with innovation partnerships and pre-commercial procurement, enabling public buyers to test cleantech solutions in live settings.
- Prioritise sandbox integration in EU missions on climate-neutral cities and climate adaptation.
- Conditions for procurement tenders should include both sustainability criteria and the assessment of clean technologies, promoting innovative and sustainable solutions.

8. Create Flexible Regulatory Frameworks for Experimentation

- Encourage Member States to revise laws (e.g., permitting, product standards, grid access, building code) after dialogue with stakeholders, to enable legal flexibility through derogations or time-bound exceptions for cleantech pilots.

- Ensure all experimentation spaces include evaluation tools so that learnings contribute to longer-term regulatory reform.

9. Build Local Capacity to Host and Operate Experimentation Spaces

Use the Technical Support Instrument (TSI) to fund training for regional authorities and regulators, equipping them to:

- Design and manage regulatory sandboxes.

- Handle legal risk, data governance, and stakeholder engagement.
- Partner effectively with cleantech startups and scaleups.

10. Prioritise End-User Involvement to Build Trust and Inclusivity

Ensure experimentation spaces engage citizens and end-users, the future adopters of cleantech to enhances public trust, facilitate uptake, and ensure innovations serve diverse societal needs. This can be done through:

- Co-design processes and participatory pilots.
- Transparent communication of risks, benefits, and trade-offs.
- Evaluation criteria that include social acceptance and user experience.

This set of policy recommendations underscores the urgent need for coherent, inclusive, and digitally enabled policy and governance strategies for cleantech experimentation in testbeds They require the development of systemic policy frameworks to accelerate Europe's transition towards climate resilience and innovation.

It is relevant to mention two salient limitations of the approach followed by this Task. A first limitation is derived from a participant selection bias. Whereas the policy review has been focused on experimentation and policy labs were designed and implemented as a co-creation and participatory process, participation in the labs, while not extensive, provided a valuable first layer of ecosystem intelligence. Nonetheless, the relatively low number and diversity of stakeholders—particularly the limited presence of policymakers and funders—highlighted both a challenge and an opportunity. To fully realise the potential of the insights gathered, it is necessary to conduct follow-up interviews and deep-dives with key actors across sectors. Despite participation constraints, the process succeeded in establishing a foundation of shared understanding and setting strategic directions. The combined output of the four labs and the comparative analysis offers a navigable map of leverage points, ready to inform national dialogues, regional pilots, and future experimentation within and beyond the FINEX consortium.

A second limitation is related to the real-life applicability of policies to support experimentation in testbeds. This is mostly related to the state of development of the use cases (cleantech solutions) across the FINEX regions and the actual degree of support from policy instruments in their respective countries of origin. The experience in the use of virtual policy labs suggested that while technical solutions abound, they are rarely implemented within a coherent and enabling governance framework, FINEX can play a catalytic role in changing this. By treating the current analysis as a prototype and scaling it through deeper partner engagement and real-world testing, the project can evolve from an information exercise into a transformative platform. Future research, therefore, should not aim merely to validate the results, but to activate them: in public policy, in administrative reform, and in citizen engagement. This is where the true value of systemic thinking will be realized—not in abstract coherence, but in grounded transformation.

2.4 Cleantech use-cases building on FINEX partners' strengths and potential

This work focus on Task 3.4: Select most representative Cleantech use-cases building on the partners strengths, complementarities and potential, and builds on previous efforts carried out under Tasks 3.1 and 3.2, which involved in-depth partner analysis and engagement with stakeholders to identify the most pressing Cleantech challenges within the FINEX domains.

Aligned with the Cleantech priority themes verified by stakeholders, FINEX partners were invited to identify the most relevant Cleantech use-cases. These selections were based on each partner's specific expertise and strengths.

2.4.1 Methodology

The methodology for developing Cleantech use cases within the FINEX project followed a structured, template-based approach designed to ensure consistency, clarity, and strategic alignment across IEs. This approach is grounded in established best practices for innovation case design and technology pilot preparation. Partners provided detailed description of the Cleantech use cases based on the agreed template (Annex II). The template includes these main components:

- **Use Case Name** – A clear and descriptive title for the innovation project.
- **Objective** – The specific goals, outcomes to be achieved with the use case
- **Problem Statement** – A summary of the challenge, the problem addressed, who is affected, and why solving the issue is a priority.
- **Potential Solution** – A detailed description of the proposed solution, its key features, technologies involved, and how it addresses the identified problem.
- **Innovation and Piloting of the Solution** – Explanation of what makes the solution innovative, how it builds on or improves existing approaches, and potential plans for piloting and scaling.
- **Expected Outcomes and Impact** – The projected environmental, social, and economic benefits of the solution, supported by measurable indicators where possible.

When selecting Cleantech use cases, in addition to relevance to national and regional priorities and alignment with partners' expertise and strengths, several key aspects were considered:

- **Challenge alignment:** The use case must directly address one or more joint Cleantech challenges areas identified by IEs.
- **Environmental & social impact:** It should demonstrate the potential to reduce environmental harm and improve resource efficiency and offer social value
- **Feasibility and viability:** It must be based on technologically feasible solutions with a viable economic model.

- **Innovation potential:** The use case should introduce innovative approaches and offering novel technologies, processes, or models that can effectively address the identified challenge and adapt to future needs.
- **Piloting and scalability:** It must be suitable for piloting and capable of being scaled or replicated in other regions or contexts.

A key step in the use case selection process was validation with external stakeholders. The FINEX Multidisciplinary Expert Advisory Board (MEAB), composed of Cleantech experts from research institutions, policy bodies, accelerators, and innovative companies across all six IEs, served as a valuable forum for feedback and guidance on the proposed use cases. Its broad and diverse composition ensured well-informed and strategic input. The meeting held on May 15, 2025, marked an important milestone for WP3, concluding the selection and validation of Cleantech use cases from the FINEX IEs.

2.4.2 Cleantech use cases selected

Through this process, the partners ultimately selected seven Cleantech use cases to present to the MEAB members (Table 11). Seven innovative Cleantech use cases across EE, LT, LV, CY, BG address pressing environmental challenges covering all identified FINEX domains. During the MEAB meeting, experts were introduced to the use cases and invited to provide feedback and suggest additional important cases for potential piloting. The list of Cleantech use cases remains open to include additional relevant solutions that may emerge during project implementation.

Table 11. Cleantech Use Cases presented to MEAB

No.	Cleantech Use Cases	Focus Areas	Country
1.	Smart Flood Resilience Toolkit	Governance/ Data/Stakeholders	Estonia
2	Reusing Old Buildings for Circular Construction	Built Environment	Estonia
3	Smart Renewable Energy Systems with AI-Driven Optimization and Integrated Storage Solutions	Energy	Lithuania
4	LAT-MaaS +: An Integrated, Zero-Emission Mobility-as-a-Service Platform for Latvia’s Public Transport Network	Mobility	Latvia
5	Enhancing Grid stability and Renewable integration	Energy	Cyprus
6	Smart Safe Water: Pathogen contamination detection	Built Environment/ Infrastructure	Cyprus
7.	Smart Energy Retrofit Kits for Residential and Industrial Buildings	Energy	Bulgaria

Detailed descriptions of these Cleantech use cases are provided in the Annex III. Below is a summary of the potential solutions presented in each use case.

The Smart Flood Resilience Toolkit from Estonia proposes a decentralized system that integrates municipalities, citizens, emergency services, and private companies to improve urban flood preparedness. It enhances early warning capabilities through real-time data, predictive analytics, and multi-channel communication, ensuring timely alerts and coordinated action. By bridging centralized warning systems with local responses, it fosters a holistic, stakeholder-driven approach to flood risk reduction.

Use case of **Reusing Old Buildings for Circular Construction** initiative aims to create a structured process for repurposing components from existing buildings in new construction projects. It includes assessing building adaptability, conducting audits, setting safety standards, and developing both technical deconstruction methods and material tracking systems. Digital tools like auditing platforms, digital twins, and material databases support transparency, efficiency, and coordination. This approach reduces material demand, construction waste, and environmental impact while fostering new circular economy business models.

In Lithuania, **Smart Renewable Energy Systems** integrates AI-driven energy management, smart EV charging, optimized solar infrastructure, and advanced storage technologies to enhance the efficiency and sustainability of energy systems. It leverages real-time monitoring, predictive battery management, and grid-responsive tools to balance supply and demand while maximizing renewable energy use. By combining technologies from multiple providers based on the strength of ecosystem, it enables scalable, localized clean energy generation and optimized grid interaction.

Latvia's **LAT-MaaS+** project proposes a nationwide, zero-emission Mobility-as-a-Service platform that integrates all public transport modes in Latvia into a single, user-friendly app with contactless payment and real-time trip planning. It simplifies travel by unifying fare systems, reducing wait times through AI-driven scheduling, and enhancing accessibility across urban and rural areas. The solution also includes a major fleet upgrade with 400 electric buses, 30 hydrogen coaches, and demand-responsive electric minibuses, all powered by Latvia's renewable energy. Key technologies include AI for route optimization, cloud-based back-end systems, IoT-enabled maintenance, and V2G-capable charging infrastructure.

Cyprus, efforts to **Enhance Grid Stability and Renewable Integration** involves using digital twin technology to simulate and monitor the power grid in real time. These virtual models help operators forecast demand-supply fluctuations, prevent blackouts, and optimize load distribution by analysing system-wide data. Key features include advanced control algorithms, integration of energy storage, inverter-less PV connections, and cybersecurity tools to support a resilient and renewable-powered smart grid.

Cleantech use case on **Smart Safe Water** solutions in Cyprus uses a virtual water network to simulate contamination events and test emergency response workflows without risking real-world infrastructure. This innovative approach enables safe evaluation of leak detection, pathogen monitoring, cyber resilience, and control strategies under realistic conditions. By piloting these technologies in collaboration with utilities and validating their effectiveness, the solution ensures readiness for real-world deployment while minimizing operational risk.

Smart Energy Retrofit Kits use case from Bulgaria aim to accelerate energy efficiency in residential and industrial buildings through modular, prefabricated solutions that are quick to install and minimally disruptive. These kits combine insulation panels, smart thermostats, efficient lighting, and IoT sensors for real-time monitoring, all tailored to be cost-effective and scalable across diverse building types. Paired with mobile apps and user education, the solution empowers occupants to monitor and manage energy use effectively.

These Cleantech solutions leverage advanced technologies like AI, IoT, and digital twins to improve disaster resilience, resource efficiency, energy independence and infrastructure management. They promote circular economy practices to reduce waste and optimize material reuse in construction and manufacturing. Energy and mobility systems are enhanced through smart integration of renewables and zero-emission technologies, reducing emissions and improving accessibility. Additionally, real-time monitoring and virtual testing strengthen water safety and public health, contributing to more sustainable and resilient communities.

All these Cleantech use cases demonstrate strong scalability potential and offer promising opportunities for piloting within the partner ecosystem. They provide valuable foundations for developing experimentation pilots that can test and refine innovative solutions in real-world settings. Together, these initiatives have the potential capacity to drive meaningful environmental improvements, enhance resource efficiency, and strengthen community resilience by enabling cleaner energy, safer infrastructure, and smarter urban systems.

3. Conclusions

The selection and validation of Cleantech priority areas began with a comprehensive challenge mapping exercise, which identified 33 key challenges across the FINEX innovation ecosystems. These challenges were primarily concentrated in the three predefined FINEX sectors: Energy, Mobility, and the Built Environment. In addition, Governance and Data Analytics were emphasised by several ecosystems, either as cross-cutting issues or as standalone priorities. Stakeholder discussions held across all participating countries confirmed strong alignment with these findings, clearly reinforcing energy as the top priority, followed by growing concern for sustainable mobility, resilient buildings, and improved, data-driven governance.

This analysis confirms that energy stands out as the leading Cleantech priority across all FINEX ecosystems driven by pressing needs for energy security, independence, and renewable integration. While Mobility and the Built Environment also present substantial challenges, particularly related to infrastructure, funding, and behavioural barriers, the rising emphasis on governance and data reflects a broader shift toward integrated, system-level solutions.

Based on the prioritised challenges across the six ecosystems, four overarching policy themes have been identified to guide experimentation pilots:

- **Energy Security and Renewable Integration**
- **Sustainable Mobility and Transport Transformation**
- **Built Environment and Infrastructure Resilience**
- **Governance, Data, and Public Engagement for Sustainability**

These recurring themes across the innovation ecosystems highlight opportunities for shared innovation roadmaps and collaborative pilot projects. Addressing these challenges through coordinated policy actions and joint efforts will not only accelerate sustainable innovation but also strengthen the resilience and competitiveness of regional economies.

The FINEX **Policy Labs** identified key 'cleantech' **policy levers** identified across the four thematic 'challenge' areas listed above. These include the eight dimensions depicted in the figure below. The policy levers extracted from these four policy labs reflect a shared ambition to transform Europe's energy, mobility, built, and data systems in line with climate and resilience goals. Yet the pathways diverge depending on sectoral specificities, technical maturity, and institutional readiness. Regulatory innovation, capacity building, data governance, and stakeholder collaboration emerge as indispensable threads across all domains.

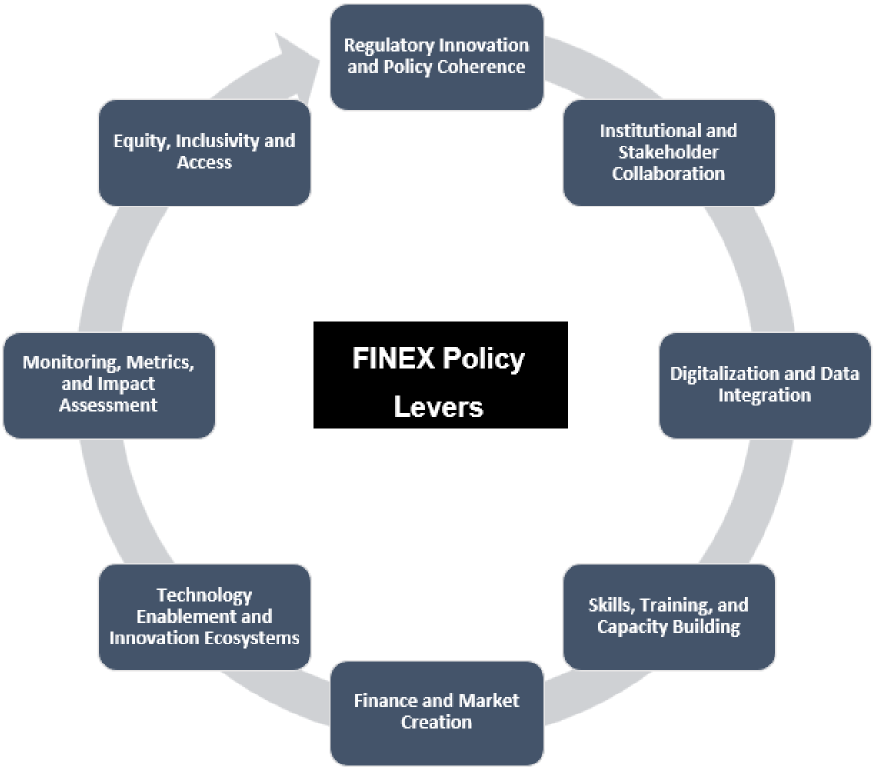

Figure 1 FINEX policy levers for wider cleantech experimentation in testbeds

The initial **policy recommendations** presented in section 2.3.5 seem to underscore the urgent need for coherent, inclusive, and digitally enabled policy and governance strategies for cleantech experimentation in testbeds. They require the development of systemic policy frameworks to accelerate Europe's transition towards climate resilience and innovation. The policy recommendations in this document clearly call for a refocus of EU policies to mainstream an experimentation-focused policy towards cleantech. While innovation hubs for fintech and digitalisation receive significant attention, cleantech experimentation remains underrepresented. As a result, the EU should support Member States in rebalancing priorities to ensure that cleantech sandboxes and testbeds are integrated across innovation and green transition strategies.

Moreover, from the discussions held in each of the labs, experts pointed out the potential of the FINEX project to contribute meaningfully to the European Cleantech policies (including the European Green Deal, the Digital Decade strategy, and cohesion policy objectives) — particularly in terms of smart specialization and territorial transitions. To fulfil this potential, however, it must pivot from policy-based diagnosis to policy prototyping and multi-level advocacy. To achieve this aspirational ambition, some initial policy-influence activities could include:

- Engage actively with EU-level policy fora (such as the Mission Boards, the Covenant of Mayors, and CEMR) to present findings and co-shape future funding mechanisms.
- Align FINEX outputs with upcoming EU regulatory cycles, such as the revision of the Energy Efficiency Directive, the Urban Mobility Framework, and the Data Act implementation.

- Contribute to capacity-building programs (e.g., under the Just Transition Mechanism or Digital Europe) with tailored modules based on the project's thematic insights.

The Cleantech use cases presented by IEs are closely aligned with the priority areas identified through stakeholder engagement. Each initiative addresses core challenges in energy, mobility, and the built environment or governance & data sectors that emerged as top priorities during the challenge mapping and validation process. From enhancing grid stability and renewable integration to transforming mobility systems and promoting circular construction, these solutions directly respond to stakeholder-identified needs such as energy security, decarbonization of transport, infrastructure resilience, and sustainable resource use. Cross-cutting issues like governance, data analytics, and stakeholder engagement are embedded within these use cases through the integration of digital technologies, AI-driven decision-making, and participatory approaches. Together, these solutions exemplify how Cleantech innovation can be tailored to regional strengths while contributing to shared goals of sustainability, resilience, and economic transformation. They provide a strong foundation for experimentation pilots, supporting the development of scalable models that can accelerate Cleantech deployment across Europe.

In line with the European Commission's call to accelerate research and innovation for climate neutrality by 2050[93], the FINEX initiative aims to translate these strategic objectives into actionable pathways through sector-focused experimentation pilots. By prioritising energy security, sustainable mobility, resilient built environments, and governance and data-driven solutions, FINEX supports the EU's ambition to foster systemic, cross-sectoral cleantech innovation.

[93] More information: link

4. References

1. Cleantech for Europe. (n.d.). *What is cleantech?* Retrieved from https://www.cleantechforeurope.com/explainers/what-is-cleantech

2. European Innovation Council and SMEs Executive Agency (EISMEA). (n.d.). *European Innovation Ecosystems.* Retrieved from https://eismea.ec.europa.eu/programmes/european-innovation-ecosystems_en

3. Barends, E., Rousseau, D. M., & Briner, R. B. (n.d.). CEBMa *Guideline for Rapid Evidence Assessments in Management and Organizations.* Retrieved from https://cebma.org/resources/frequently-asked-questions/what-is-a-rapid-evidence-assessment-rea/

4. FINEX Project Report (2025, February). WP3 – Cleantech priority areas selection and validation: *T3.1 Identify areas where the multi-sectoral and/or emerging nature of some innovations require coordinated action by innovators and regulators*, link

5. Matti, C. (2020). Handbook: *Challenge-led system mapping – A knowledge management approach.* EIT Climate-KIC. https://transitionshub.climate-kic.org/publications/challenge-led-system-mapping-a-knowledge-management-approach/

6. FINEX Project Report (2025, April). WP3 – T3.2 Workshops report: *Cleantech priority areas – Selection and validation*, link

7. Escola d'Administració Pública de Catalunya. (n.d.). *Foresight as a catalyst for systemic change and co-creation in public policy.* EPuM no. 24. Retrieved from https://www.gencat.cat/eapc/epum/N24/index.html

8. Matti, C., Martín Corvillo, J. M., Vivas Lalinde, I., Juan Agulló, B., Stamate, E., Avella, G., & Bauer, A. (2020). Challenge-led system mapping: A knowledge management approach (Transitions Hub series). EIT Climate-KIC.

9. European Commission. (n.d.). *The European Green Deal.* Retrrieved from https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal_en

10. European Commission. (n.d.). *Ecodesign for Sustainable Products Regulation – Standards, tools and labels in the field of environment. European Commission.* Retrieved from https://commission.europa.eu/energy-climate-change-environment/standards-tools-and-labels/products-labelling-rules-and-requirements/ecodesignsustainableproductsregulation_en

11. European Commission. (n.d.). *Net-Zero Industry Act.* Retrieved from https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal/green-deal-industrial-plan/net-zero-industry-act_en

12. European Commission. (n.d.). *European Critical Raw Materials Act.* Retrieved from https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal/green-deal-industrial-plan/european-critical-raw-materials-act_en

13. European Commission. (n.d.). *Electricity market design.* Retrieved from https://energy.ec.europa.eu/topics/markets-and-consumers/electricity-market-design_en

14. European Commission. (n.d.). *Green Deal Industrial Plan*. Retrieved from https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal/green-deal-industrial-plan_en#:~:text=Leading%20the%20clean%20tech%20revolution

15. European Commission, Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs. (2023, March 16). The Net-Zero Industry Act: Making the EU the home of clean technologies manufacturing and green jobs. Retrieved from https://single-market-economy.ec.europa.eu/industry/sustainability/net-zero-industry-act_en

16. European Commission, Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs. (n.d.). Net-Zero Industry Act. Retrieved from: https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal/green-deal-industrial-plan/net-zero-industry-act_en

17. European Commission. (n.d.). NextGenerationEU: For a stronger, more resilient Europe. Retrieved from https://next-generation-eu.europa.eu/index_en

18. European Commission. (n.d.). Recovery and Resilience Facility for clean energy. Retrieved from https://energy.ec.europa.eu/topics/funding-and-financing/recovery-and-resilience-facility-clean-energy_en#:~:text=overall

19. European Commission. (n.d.). EU Monitor: Industry. Retrieved July 29, 2025, from https://eumonitor.vlaio.be/keywords/25#:~:text=09%20Oct

20. European Commission, Directorate-General for Competition. (2025, June 25). Clean Industrial Deal State Aid Framework (CISAF). Retrieved from https://competition-policy.ec.europa.eu/about/contribution-clean-just-and-competitive-transition/clean-industrial-deal-state-aid-framework-cisaf_en

21. European Commission, Directorate-General for Research and Innovation. (n.d.). Research and innovation for the European Green Deal. Retrieved from https://research-and-innovation.ec.europa.eu/strategy/strategy-research-and-innovation/environment-and-climate/european-green-deal_en

22. European Commission, Directorate-General for Research and Innovation. (2025, May 14). *Horizon Europe Work Programme 2025 – Cluster 5: Climate, Energy and Mobility*. Retrieved from https://research-and-innovation.ec.europa.eu/funding/funding-opportunities/funding-programmes-and-open-calls/horizon-europe/cluster-5-climate-energy-and-mobility_en

23. European Commission, Directorate-General for Research and Innovation. (n.d.). *EU Missions in Horizon Europe.* Retrieved from https://research-and-innovation.ec.europa.eu/funding/funding-opportunities/funding-programmes-and-open-calls/horizon-europe/eu-missions-horizon-europe_en

24. European Commission, Directorate-General for Research and Innovation. (n.d.). EIC funding opportunities. Retrieved from https://eic.ec.europa.eu/eic-funding-opportunities_en

25. InnoEnergy. (n.d.). *InnoEnergy: Industrialising clean tech innovation for a net-zero economy*. Retrieved from https://innoenergy.com/

26. Climate-KIC. (n.d.). Climate entrepreneurship. Retrieved from https://www.climate-kic.org/programmes/climate-entrepreneurship/

27. European Commission. (n.d.). *European Cluster Collaboration Platform*. Retrieved from https://www.clustercollaboration.eu/

28. Interreg Europe. (n.d.). What is Interreg Europe. Interreg Europe. https://www.interregeurope.eu/what-is-interreg-europe

29. European Commission. (n.d.). *Innovation Fund*. https://climate.ec.europa.eu/eu-action/funding-climate-action/innovation-fund_en

30. Cleantech for Europe. (n.d.). *Cleantech for Europe*. https://www.cleantechforeurope.com/

31. European Institute of Innovation and Technology. (n.d.). *EIT Community Testbeds*. https://eit.europa.eu/our-activities/opportunities/eit-community-testbeds

32. Erneuerbare Energien Hamburg. (n.d.). *Sandboxes of the energy transition*. Erneuerbare Energien Hamburg. https://www.erneuerbare-energien-hamburg.de/en/projects/sandboxes-of-the-energy-transition.html

33. Commission de Régulation de l'Énergie. (n.d.). *Regulatory sandbox*. CRE. https://www.cre.fr/en/electricity/electricity-networks/regulatory-sandbox.html

34. UK Research and Innovation. (n.d.). *Catapult Centres*. https://www.ukri.org/about-us/infrastructure/catapult-centres/

35. UK Research and Innovation. (n.d.). *The wind turbine demonstrator powering green growth*. UKRI. https://www.discover.ukri.org/the-wind-turbine-demonstrator-powering-green-growth/index.html

36. Energy Systems Catapult. (n.d.). *Living lab.* https://es.catapult.org.uk/tools-and-labs/living-lab/

37. Ofgem. (n.d.). *Energy regulation sandbox*. https://www.ofgem.gov.uk/energy-regulation-sandbox

38. City of Stockholm. (n.d.). *Testbeds – Innovation and Development.* Start Stockholm. Retrieved from https://start.stockholm/en/about-the-city-of-stockholm/stockholmers-focus/innovation-and-development/testbeds/

39. RI – Research Institutes of Sweden. (n.d.). *Expertise areas: Test & Demo.* RI Sweden. Retrieved from https://www.ri.se/en/expertise-areas/test-demo?&page=1

40. Eranet Smart Energy Systems. (n.d.). *Living Labs: Smart Otaniemi* [Web page]. Retrieved from https://www.eranet-

smartenergysystems.eu/Partners/Living_Labs#:~:text=Smart%20Otaniemi%20is%20an%20innovation,living%20lab%20with%20real%20customers

41. European Commission. (2023, August 29). Commission staff working document: *Regulatory learning in the EU – Guidance on regulatory sandboxes, testbeds, and living labs in the EU, with a focus section on energy* (SWD(2023) 277/2 final) [Corrigendum]. Research and Innovation – European Commission. https://research-and-innovation.ec.europa.eu/document/download/fc6f35cd-a8d6-4770-aefe-c09ca85cff8c_en

42. Research and Innovation Foundation. (n.d.). *R&I Strategy 2024–2026* [National Strategy]. Research and Innovation Foundation (Cyprus). Retrieved July 29, 2025, from https://www.research.org.cy/en/strategic-planning/national-strategy/

43. Research and Innovation Foundation. (n.d.). *National Strategy*. https://www.research.org.cy/en/strategic-planning/national-strategy/#toggle-id-2

44. Research and Innovation Foundation. (n.d.). *Smart Specialization Strategy* [Στρατηγική έξυπνης εξειδίκευσης]. https://www.research.org.cy/en/strategic-planning/national-strategy/#stratigiki_exipnis_exidikeusis

45. Start Stockholm. (n.d.). Testbeds. https://start.stockholm/en/about-the-city-of-stockholm/stockholmers-focus/innovation-and-development/testbeds/

46. European Commission. (n.d.). *Ending energy isolation – Project of Common Interest "EuroAsia Interconnector"*. European Commission. Retrieved from https://commission.europa.eu/projects/endingenergyisolationprojectcommoninteresteuroasiainterconnector_en European Commission

47. Delivorias, A. (2024, March). *Cyprus's national recovery and resilience plan: Latest state of play* (EPRS Briefing No. PE 698.885). European Parliamentary Research Service. https://www.europarl.europa.eu/RegData/etudes/BRIE/2022/698885/EPRS_BRI(2022)698885_EN.pdf

48. European Commission. (n.d.). *Cyprus Recovery and Resilience Plan – Recovery and Resilience Facility.* Country page for Cyprus. European Commission. Retrieved from https://commission.europa.eu/businesseconomyeuro/economicrecovery/recoveryandresiliencefacility/countrypages/cyprusrecoveryandresilienceplan_en

49. Business in Cyprus. (n.d.). *Business support center.* Government of Cyprus. Retrieved July 29, 2025, from https://www.businessincyprus.gov.cy/business-support-center/#:~:text=General%20Information,and%20growth%20of%20the%20economy

50. Cyprus Circular Economy Platform. (2021, July 27). C*yprus action plan for circular economy.* https://cypruscircular.org.cy/cyprus-action-plan-circular-economy/#:~:text=On%2027%20July%202021%2C%20the%20Ministers%20of%20Energy%2C,has%20been%20approved%20by%20the%20Council%20of%20Ministers

51. Central Baltic Programme. (n.d.). *About the programme.* https://centralbaltic.eu/programme/about-the-programme/]

52. Interreg Baltic Sea Region. (2025, July). *Programme factsheet.* https://interreg-baltic.eu/wp-content/uploads/2025/07/2025.07_IBSR_Programme-Factsheet.pdf

53. Central Baltic Programme. (n.d.). *About the programme.* Retrieved from https://centralbaltic.eu/programme/about-the-programme/

54. Ministry of Economic Affairs and Communications. (n.d.). *Energy Sector Development Plan.* Retrieved July 29, 2025, from https://mkm.ee/en/energy-sector-and-mineral-resources/energy-economy/energy-sector-development-plan

55. EIT Community. (n.d.). Testbeds. Retrieved from https://testbeds.eitcommunity.eu/

56. European Commission. (n.d.). Estonia's Recovery and Resilience Plan – Recovery and Resilience Facility, country page for Estonia. Retrieved from https://commission.europa.eu/business-economy-euro/economic-recovery/recovery-and-resilience-facility/country-pages/estonias-recovery-and-resilience-plan_en#whats-in-the-plan

57. SmartCap Estonia. (n.d.). *SmartCap.* Retrieved from https://smartcap.ee/#:~:text=This%20fund%20operates%20both%20as%20a%20fund-of-funds%20and,early-stage%20Estonian%20Greentech%20innovators%20with%20high%20growth%20potential.

58. International Energy Agency. (2025, March 26). *2021–27 Strategic Plan: Estonian Hydrogen Roadmap*. Retrieved from https://www.iea.org/policies/13931-2021-27-strategic-plan-estonian-hydrogen-roadmap

59. Ministry of Climate. (2024, May 29). T*he Riigikogu passed the Act accelerating the establishment of offshore wind farms and solar farms*. Retrieved July 29, 2025, from https://kliimaministeerium.ee/en/uudised/the-riigikogu-passed-the-act-accelerating-the-establishment-of-offshore-wind-farms-and-solar-farms

60. ERR News. (2022, October 10). *Ida-Viru County to receive €354 million for green transition, EU confirms*. ERR News. https://news.err.ee/1608745423/ida-viru-county-to-receive-354-million-for-green-transition-eu-confirms

61. Accelerate Estonia. (n.d.). Accelerate Estonia. Retrieved from https://accelerate.ee/

62. Startup Estonia. (n.d.). *Our story*. Retrieved from https://startupestonia.ee/about-us/our-story/

63. Invest in Estonia. (n.d.). *Energy*. Retrieved , from https://investinestonia.com/business-opportunities/energy/

64. Enterprise Estonia. (n.d.). *Tootearendus ja innovatsioon.* Retrieved from https://eis.ee/tootearendus-ja-innovatsioon/

65. Tehnopol Science and Business Park. (n.d.). *About us.* Retrieved from https://www.tehnopol.ee/en/about/

66. Seimas of the Republic of Lithuania. (2024, June 27). *National Energy Independence Strategy (NENS) 2024–2050.* https://enmin.lrv.lt/public/canonical/1740735085/5963/NENS%202024-2.12_EN.pdf

67. European Environment Agency. (2024, December 3). *Lithuania 2024 circular economy country profile*. European Environment Agency. Retrieved from https://www.eea.europa.eu/.../lithuania_2024-ce-country-profile_final.pdf

68. Ministry of Energy of the Republic of Lithuania. (2025, April 26). Order of the Minister No 1-81 .D*ėl Vandenilio plėtros Lietuvoje 2024–2050 m. gairių patvirtinimo.* Retrieved from https://e-seimas.lrs.lt/portal/legalAct/lt/TAD/10783411040711ef8e4be9fad87afa59

69. Ministry of Finance of the Republic of Lithuania. (2023, January 17). *New plan for development of green finance in Lithuania: Public consultations begin*. Retrieved July 29, 2025, from https://finmin.lrv.lt/en/news/new-plan-for-development-of-green-finance-in-lithuania-public-consultations-begin/

70. CE Energy News. (2025, June 27). *New legislation to facilitate RES development in Lithuania*. https://ceenergynews.com/renewables/new-legislation-to-facilitate-res-development-in-lithuania/

71. Lithuania.lt. (2022, April 8). *The Innovation Agency Lithuania has been launched – a one-stop shop for business start, development and innovation*. https://lithuania.lt/news/the-innovation-agency-lithuania-has-been-launched-a-one-stop-shop-for-business-start-development-and-innovation/

72. Ministry of the Economy and Innovation of the Republic of Lithuania. (2024, March 20). *Lietuvoje veiklą pradeda „GreenTech Hub": sieks proveržio žaliųjų inovacijų srityje*. Retrieved from https://eimin.lrv.lt/lt/ziniasklaidai/naujienos/lietuvoje-veikla-pradeda-greentech-hub-sieks-proverzio-zaliuju-inovaciju-srityje/

73. Innovation Agency, Lithuania. (2024, September 10). Europe's largest circular economy initiative launches. Inovacijų agentūra. Retrieved from https://inovacijuagentura.lt/news/2024/09/europes-largest-circular-economy-initiative-launches.html?lang=en

74. Modernisation Fund. (2024). *Lithuania: Annual report 2023*. https://modernisationfund.eu/wp-content/uploads/2024/07/LT-MF-Annual-Report-2023.xlsx

75. European Commission. (2023, November 9). *Lithuania's recovery and resilience plan*. https://commission.europa.eu/business-economy-euro/economic-recovery/recovery-and-resilience-facility/country-pages/lithuanias-recovery-and-resilience-plan_en

76. Sunrise Tech Park. (2024, November). FINEX Workshop Report

77. Ministry of the Economy and Innovation of the Republic of Lithuania. (2024, July 31). *GreenTech Hub helps companies adapt to change*. Ministry of the Economy and Innovation of the Republic of Lithuania. Retrieved from https://eimin.lrv.lt/en/structure-and-contacts/news-1/eimin-greentech-hub-helps-companies-adapt-to-change/

78. Seimas of the Republic of Lithuania. (2024, April 26). *Amendment of Articles 2, 3, 8, 13¹, 19, 27 of the Energy Law No. IX-884 and Supplementation of Article 18¹ to the Law* [Legal act]. https://www.e-tar.lt/portal/lt/legalAct/33f49d908f5611ea9515f752ff221ec9

79. Ministry of Energy of the Republic of Lithuania. (2023, November 28). *Regulatory sandbox for the energy sector*. https://enmin.lrv.lt/en/sectoral-policy/research-and-innovation-in-the-energy-sector/regulatory-sandbox-for-the-energy-sector/

80. Ministry of Economics of the Republic of Latvia. (2023, January 13). *The Ministry of Climate and Energy takes over functions from MoE and MoEPRD*. Retrieved from https://www.em.gov.lv/en/article/ministry-climate-and-energy-takes-over-functions-moe-and-moeprd

81. EUCityCalc Consortium. (2024, May). *Report on NECP national roundtable in Latvia*. Retrieved from https://europeancitycalculator.eu/wp-content/uploads/2024/05/EUCityCalc_Riga_NECP_roundtable.pdf

82. International Energy Agency. (2024, May). *Latvia 2024: Executive summary*. Retrieved from https://www.iea.org/reports/latvia-2024/executive-summary

83. Investment and Development Agency of Latvia (LIAA). (n.d.). *About us*. Retrieved from https://www.liaa.gov.lv/en/about-us

84. Investment and Development Agency of Latvia (LIAA). (2024, September 11). *Venture Catalysts – A hands-on guide to starting a knowledge-intensive business.* Retrieved from https://www.liaa.gov.lv/en/event/venture-catalysts-hands-guide-starting-knowledge-intensive-business

85. European Commission. (2023, November 9). *Latvia's recovery and resilience plan.* Retrieved from https://commission.europa.eu/business-economy-euro/economic-recovery/recovery-and-resilience-facility/country-pages/latvias-recovery-and-resilience-plan_en

86. Ministry of Finance of the Republic of Latvia. *The Minister for Finance discusses the role of EU funds in stimulating the Latvian economy with the EU Commissioner for Cohesion and Reforms.* (2023, February 2). Retrieved from https://www.fm.gov.lv/en/article/ministerfinancediscussesroleeufundsstimulatinglatvianeconomyeucommissionercohesionandreforms

87. European Commission. (2025, January 15). Bulgaria – Final updated NECP 2021–2030 (submitted in 2025). Directorate-General for Communication. https://commission.europa.eu/publications/bulgaria-final-updated-necp-2021-2030-submitted-2025_en

88. European Parliament. (2022). Bulgaria's National Recovery and Resilience Plan. Retrieved from https://www.europarl.europa.eu/RegData/etudes/BRIE/2022/733662/EPRS_BRI(2022)733662_EN.pdf

89. Todorović, I. (2025, April 22). Bulgaria grants EUR 587 million to 82 battery storage projects. Balkan Green Energy News. https://balkangreenenergynews.com/bulgaria-grants-eur-587-million-to-82-battery-storage-projects/

90. Cleantech Bulgaria. (n.d.). Home. Retrieved from https://cleantech.bg/en/home/

91. International Energy Agency. (2023, May 5). *Finland 2023: Executive summary.* Retrieved from https://www.iea.org/reports/finland-2023/executive-summary

92. ERA-Net Smart Energy Systems. (n.d.). *Smart Otaniemi.* Retrieved from https://www.eranet-smartenergysystems.eu/ll/122/Smart-Otaniemi.html

93. European Commission. (2024). *Research and innovation for climate neutrality by 2050.* Publications Office of the European Union. https://op.europa.eu/en/publication-detail/-/publication/5dee91d3-d9e8-11ee-b9d9-01aa75ed71a1/language-en

Country specific references

Bulgaria

Bulgarian News Agency (BTA). (2024, March). Bulgaria's Electric Mobility Promotion Act (Draft) – Cluster Analysis Presentation. Retrieved from https://www.bta.bg/en/news/economy/637272-cluster-presents-analysis-on-electric-mobility-in-bulgaria-in-march-2024

Cleantech Bulgaria. (n.d.). Home. Retrieved July 16, 2025, from https://cleantech.bg/en/home/

European Commission. (2025, January 15). Bulgaria – Final updated NECP 2021–2030 (submitted in 2025). Directorate-General for Communication. https://commission.europa.eu/publications/bulgaria-final-updated-necp-2021-2030-submitted-2025_en

European Parliament. (2022). Bulgaria's National Recovery and Resilience Plan. Retrieved from https://www.europarl.europa.eu/RegData/etudes/BRIE/2022/733662/EPRS_BRI(2022)733662_EN.pdf

Ministry of Economy and Energy. (2011). Energy Strategy of the Republic of Bulgaria until 2020 for Reliable, Efficient and Cleaner Energy. Retrieved from https://climate-laws.org/document/energy-strategy-of-the-republic-of-bulgaria-until-2020-for-reliable-efficient-and-cleaner-energy_ac1d

Ministry of Energy, Republic of Bulgaria. (2020). Integrated Energy and Climate Plan of the Republic of Bulgaria. Retrieved from https://energy.ec.europa.eu/system/files/2020-06/bg_final_necp_main_en_0.pdf

SofiaPlan. (2019). Sustainable Urban Mobility Plan for Sofia Municipality (2019–2035). Retrieved from https://sofiaplan.bg/en/2019/08/13/sustainable-urban-mobility-plan/ and https://urban-mobility-observatory.transport.ec.europa.eu/resources/case-studies/sofias-sump-2019-2035-addressing-urban-mobility-challenges_en

Todorović, I. (2025, April 22). Bulgaria grants EUR 587 million to 82 battery storage projects. Balkan Green Energy News. https://balkangreenenergynews.com/bulgaria-grants-eur-587-million-to-82-battery-storage-projects/

Cyprus

Business in Cyprus. (n.d.). Business Support Center [Webpage]. Republic of Cyprus Government. https://www.businessincyprus.gov.cy/business-support-center/

Cyprus Circular Economy Network. (2021, July 27). Cyprus action plan for the transition to a circular economy 2021–2027. https://cypruscircular.org.cy/cyprus-action-plan-circular-economy/

Delivorias, A. (2024, March). Cyprus's national recovery and resilience plan: Latest state of play (EPRS Briefing No. PE 698.885). European Parliamentary Research Service. https://www.europarl.europa.eu/RegData/etudes/BRIE/2022/698885/EPRS_BRI(2022)698885_EN.pdf

Directorate General for Communication. (2023, December 8). Cyprus' recovery and resilience plan [Webpage]. European Commission. https://commission.europa.eu/business-economy-euro/economic-recovery/recovery-and-resilience-facility/country-pages/cyprus-recovery-and-resilience-plan

Directorate General for Communication. (2024, December 20). Cyprus – Final updated NECP 2021–2030 (submitted in 2024) [PDF]. European Commission. https://commission.europa.eu/publications/cyprus-final-updated-necp-2021-2030-submitted-2024_en

Directorate-General for Communication. (n.d.). Ending energy isolation – Project of Common Interest "EuroAsia Interconnector" [Webpage]. European Commission. https://commission.europa.eu/projects/ending-energy-isolation-project-common-interest-euroasia-interconnector_en

Directorate General for Economic and Financial Affairs. (n.d.). Recovery and Resilience Scoreboard: Country overview [Webpage]. European Commission. https://ec.europa.eu/economy_finance/recovery-and-resilience-scoreboard/country_overview.html

European Commission, LIFE Programme. (n.d.). LIFE10-ENV-CY-000723 – National Strategy for Adaptation to Climate Change. https://webgate.ec.europa.eu/life/publicWebsite/project/LIFE10-ENV-CY-000723/development-of-a-national-strategy-for-adaptation-to-climate-change-adverse-impacts-in-cyprus?utm_source

International Monetary Fund. (2024). Cyprus: Article on Economic Growth and Policy. World Economic Outlook. https://www.elibrary.imf.org/view/journals/002/2024/138/article-A003-en.xml

Lelantus Innovations. (n.d.). ANT's Project. https://lelantusinnovations.com/projects/ants/

Ministry of Energy, Commerce and Industry, Republic of Cyprus. (2023). RepowerEU – Cyprus Energy Transition Plan. https://www.energy.gov.cy/assets/modules/wnp/articles/202306/220/docs/repowereufinal.pdf

pv magazine. (2024, February 5). Cyprus set to curtail 28% of renewable electricity in 2024. https://www.pv-magazine.com/2024/02/05/cyprus-set-to-curtail-28-of-renewable-electricity-in-2024/

Research and Innovation Foundation. (n.d.). National strategy [Webpage]. https://www.research.org.cy/en/strategic-planning/national-strategy/

University of Cyprus. (n.d.). Low Voltage Experimental Microgrid Laboratory (UCY) [Webpage]. ERIGrid 2.0. https://erigrid2.eu/ucy/

Estonia

Accelerate Estonia. (n.d.). Accelerate Estonia. https://accelerate.ee/

Directorate General for Communication. (2023, June 16). Estonia's recovery and resilience plan [Webpage]. European Commission. https://commission.europa.eu/business-economy-euro/economic-recovery/recovery-and-resilience-facility/country-pages/estonias-recovery-and-resilience-plan_en#whats-in-the-plan

Enterprise Estonia. (n.d.). Product development and innovation. https://eis.ee/tootearendus-ja-innovatsioon/

International Energy Agency. (2025, March 26). 2021–27 Strategic Plan: Estonian Hydrogen Roadmap. https://www.iea.org/policies/13931-2021-27-strategic-plan-estonian-hydrogen-roadmap

Invest in Estonia. (n.d.). Energy. https://investinestonia.com/business-opportunities/energy/

Ministry of Climate. (2023, September). Transport and mobility development plan 2021–2035 [PDF]. Republic of Estonia. https://kliimaministeerium.ee/sites/default/files/documents/2023-09/Transpordi%20ja%20liikuvuse%20arengukava%202021-2035_EN%20%281%29.pdf

Ministry of Climate. (2024, May 29). The Riigikogu passed the Act accelerating the establishment of offshore wind farms and solar farms. Republic of Estonia. https://kliimaministeerium.ee/en/uudised/the-riigikogu-passed-the-act-accelerating-the-establishment-of-offshore-wind-farms-and-solar-farms

Ministry of Economic Affairs and Communications. (n.d.). Energy Sector Development Plan [Webpage]. Republic of Estonia. https://mkm.ee/en/energy-sector-and-mineral-resources/energy-economy/energy-sector-development-plan

Republic of Estonia Ministry of Climate. (2024, December 31). Kliimakindla majanduse seadus. https://kliimaministeerium.ee/eesti-kliimaseadus

Republic of Estonia Ministry of Climate. (2024, May 8). Kliimaseaduse kokkuvõte. https://kliimaministeerium.ee/kliimaseaduse-kokkuvote

Republic of Estonia Ministry of Climate. (2024, May 17). Töörühmad. https://kliimaministeerium.ee/tooruhmad

SmartCap. (n.d.). SmartCap Green Fund [Webpage]. https://smartcap.ee/

Startup Estonia. (n.d.). Our story. https://startupestonia.ee/about-us/our-story/

Tehnopol Science and Business Park. (n.d.). About us. https://www.tehnopol.ee/en/about/

Tärnov, K. (2025, July 1). Meet the six finalists of Smart City Challenge 2024. FinEst Centre for Smart Cities. https://finestcentre.eu/media-and-events/news/meet-the-six-finalists-of-smart-city-challenge-2024/

Wright, H. (2022, October 10). Ida-Viru County to receive €354 million for green transition, EU confirms. ERR News. https://news.err.ee/1608745423/ida-viru-county-to-receive-354-million-for-green-transition-eu-confirms

Finland

ERA-Net Smart Energy Systems. (n.d.). Smart Otaniemi. Retrieved July 16, 2025, from https://www.eranet-smartenergysystems.eu/ll/122/Smart-Otaniemi.html

EU Urban Mobility Observatory. (2023, June 29). Attitudes to Electric Cars on the Rise in Finland. Retrieved from https://urban-mobility-observatory.transport.ec.europa.eu/news-events/news/attitudes-electric-cars-rise-finland-2023-06-29_en

European Commission. (2022). 2022 European Semester Country Report – Finland. Retrieved from https://commission.europa.eu/system/files/2022-05/2022-european-semester-country-report-finland_en.pdf

European Parliament. (2024). Finland's Climate Action Strategy. Retrieved from https://www.europarl.europa.eu/RegData/etudes/BRIE/2024/767180/EPRS_BRI(2024)767180_EN.pdf

Finnish Ministry of Transport and Communications. (2023). Influence Development of the Electric Car Charging Network. Retrieved from https://valtioneuvosto.fi/en/-//1410829/influence-development-of-the-electric-car-charging-network-1680065

Friedrich-Ebert-Stiftung. (2024). Energy Without Russia – Country Report: Finland. Retrieved from https://library.fes.de/pdf-files/bueros/budapest/20613.pdf

International Energy Agency. (2023, May 5). Finland 2023: Executive summary. Retrieved from https://www.iea.org/reports/finland-2023/executive-summary

Tesi. (2024). Market Study: Cleantech in Finland. Retrieved from https://tesi.fi/wp-content/uploads/2024/06/Cleantech-in-Finland-2024-Market-Study-1.pdf

Latvia

EUCityCalc Consortium. (2024, May). Report on NECP national roundtable in Latvia [PDF]. Retrieved from https://europeancitycalculator.eu/wp-content/uploads/2024/05/EUCityCalc_Riga_NECP_roundtable.pdf

European Commission. (2023, November 9). Latvia's recovery and resilience plan. Retrieved from https://commission.europa.eu/business-economy-euro/economic-recovery/recovery-and-resilience-facility/country-pages/latvias-recovery-and-resilience-plan_en

International Energy Agency. (2024, May). Latvia 2024: Executive summary. Retrieved from https://www.iea.org/reports/latvia-2024/executive-summary

Investment and Development Agency of Latvia (LIAA). (2024, September 11). Venture Catalysts – A hands-on guide to starting a knowledge-intensive business. Retrieved from https://www.liaa.gov.lv/en/event/venture-catalysts-hands-guide-starting-knowledge-intensive-business

Investment and Development Agency of Latvia (LIAA). (n.d.). About us. Retrieved July 16, 2025, from https://www.liaa.gov.lv/en/about-us

Ministry of Economics of the Republic of Latvia. (2023, January 13). The Ministry of Climate and Energy takes over functions from MoE and MoEPRD. Retrieved from https://www.em.gov.lv/en/article/ministry-climate-and-energy-takes-over-functions-moe-and-moeprd

Ministry of Economics, Republic of Latvia. (2020). Latvia's National Energy and Climate Plan for 2021–2030. Retrieved from https://energy.ec.europa.eu/system/files/2020-04/lv_final_necp_main_en_0.pdf

Riga Energy Agency. (2024). The Riga State City Energy and Climate Action Plan for 2030. Retrieved from https://rea.riga.lv/wp-content/uploads/2024/12/JAUNS_energoneatkaRIGA_en_gb.pdf

Lithuania

CE Energy News. (2025, June 27). *New legislation to facilitate RES development in Lithuania*. https://ceenergynews.com/renewables/new-legislation-to-facilitate-res-development-in-lithuania/

European Commission. (2023, November 9). *Lithuania's recovery and resilience plan*. https://commission.europa.eu/business-economy-euro/economic-recovery/recovery-and-resilience-facility/country-pages/lithuanias-recovery-and-resilience-plan_en

Interreg Europe. (2024, March 5). *Improvements in Lithuanian strategic framework* [Webpage]. https://projects2014-2020.interregeurope.eu/circpro/news/news-article/8658/improvements-in-lithuanian-strategic-framework/

Lithuania.lt. (2022, April 8). *The Innovation Agency Lithuania has been launched – a one-stop shop for business start, development and innovation*. https://lithuania.lt/news/the-innovation-agency-lithuania-has-been-launched-a-one-stop-shop-for-business-start-development-and-innovation/

Lithuanian Ministry of Economy and Innovation. (2025, July 16). EIMIN pramonės modernizacijai paskirstys 42 mln. eurų [Press release]. Retrieved from https://eimin.lrv.lt/lt/ziniasklaidai/naujienos/eimin-pramones-modernizacijai-paskirstys-42-mln-euru/

Lithuanian Ministry of Energy. (2024). *National Energy and Climate Strategy (NENS) 2024-2.12_EN*. https://enmin.lrv.lt/public/canonical/1742986630/6022/NENS%202024-2.12_EN%20(1).pdf

Lithuanian Ministry of Environment. (2020). *Energy and Climate Action Plan for the Period 2021–2030 of the Republic of Lithuania*. Vilnius. https://am.lrv.lt/lt/veiklos-sritys-1/klimato-politika/klimato-kaita/nacionalinis-energetikos-ir-klimato-srities-veiksmu-planas-2021-2030-m/

Lithuanian Ministry of Environment. (2023). *National Action Plan for the Circular Economy (2023–2035)*. Vilnius. https://am.lrv.lt/uploads/am/documents/files/VPA20230621_2%2Bkl_%2Bpriedas(1)(1).pdf

Lithuanian Ministry of Transport and Communications. (2021). *National Transport Development Program 2022–2030 of the Republic of Lithuania*. Vilnius. https://sumin.lrv.lt/lt/administracine-informacija/planavimo-dokumentai/2022-2030-metu-susisiekimo-pletros-programa/

Ministry of Energy of the Republic of Lithuania. (2023, November 28). *Regulatory sandbox for the energy sector*. https://enmin.lrv.lt/en/sectoral-policy/research-and-innovation-in-the-energy-sector/regulatory-sandbox-for-the-energy-sector/

Ministry of Finance of the Republic of Lithuania. (2023, January 17). *New plan for development of green finance in Lithuania: Public consultations begin* [News release]. https://finmin.lrv.lt/en/news/new-plan-for-development-of-green-finance-in-lithuania-public-consultations-begin/

Modernisation Fund. (2024). *Lithuania: Annual report 2023*. https://modernisationfund.eu/wp-content/uploads/2024/07/LT-MF-Annual-Report-2023.xlsx

Seimas of the Republic of Lithuania. (2024, April 26). *Amendment of Articles 2, 3, 8, 13¹, 19, 27 of the Energy Law No. IX-884 and Supplementation of Article 18¹ to the Law* [Legal act]. https://www.e-tar.lt/portal/lt/legalAct/33f49d908f5611ea9515f752ff221ec9

Seimas of the Republic of Lithuania. (2024, April 26). *On the approval of the guidelines for the development of hydrogen in Lithuania for 2024–2050*. https://e-seimas.lrs.lt/portal/legalAct/lt/TAD/10783411040711ef8e4be9fad87afa59

Sunrise Tech Park. (2024, November). *FINEX Workshop Report*.

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5. Annex I Synopsis of challenges of six IEs

No	IE	Sector	Challenge	Challenge description	Potential solutions
1.	LT	Energy	Achieving energy independence	Scaling renewable energy deployment requires integrating high-output solar and wind power into existing grids efficiently while minimizing disruptions and costs.	Renewable energy deployment, energy grid integration, energy storage solutions, smart grid development, demand-response mechanisms, AI, machine learning, predictive analytics, energy optimization, supply fluctuations, cost reduction.
2.	LT	Energy	Low energy efficiency	Lithuania's high energy consumption intensity and low energy productivity undermine economic competitiveness, increase pollution, and hinder development, highlighting the need for improved industrial energy efficiency.	Industrial energy efficiency, process optimization, automation, artificial intelligence, energy waste reduction, operational efficiency, cogeneration systems, insulation, smart meters, real-time energy monitoring, demand adjustment, renewable energy integration.
3.	LT	Mobility	Inefficient transport management, traffic congestions, traffic flows inefficiencies in cities	Expanding cities and regions face growing traffic congestion, inefficient transport systems, and environmental impact, highlighting the need for improved mobility solutions that enhance efficiency, safety, and sustainability.	Smart traffic management systems; use AI and real-time data to optimize route recommendations to reduce congestion; systems allowing better integration of sustainable mobility options; smart parking solutions
4.	LT	Mobility	Sustainable mobility infrastructure is not sufficiently developed	The lack of sustainable transport infrastructure hinders the integration of innovative mobility technologies, requiring solutions that support low-emission transport and align with energy and climate goals.	Fast EV charging stations; energy balancing solutions allowing for convenient use of charging infrastructure; smart energy management solutions dynamically distribute energy; integration of renewable energy sources; solar-powered infrastructure on transport facilities like bus stops, stations, and parking lots.
5.	LT	Built Environment	Energy inefficient buildings	Aging, unrenovated buildings suffer from poor insulation and high energy consumption, requiring urgent energy efficiency upgrades and greater integration of renewable energy solutions.	Energy efficiency technologies, energy-efficient heating systems, smart building systems, energy management systems (EMS), smart thermostats, smart meters,

					and Building-Integrated Photovoltaics (BIPV).
6.	LT	Built Environment	Low circularity in construction sector	Construction sector struggles with low circularity, requiring solutions that promote resource efficiency through durable, recyclable materials and increased use of secondary raw materials.	Modular Construction BIM, 3D Printing, Recycled materials, Advanced recycling technologies, Circular Economy Software Solutions, LCA tools
7.	EE	Cleantech for defence	Need for clean technologies that keep the lights on and transport going in most severe conditions	Ensuring resilient, cleantech-based energy and transport solutions for national security in case of in case of military threat/invasion/war	
8.	EE	Energy	Efficient street lighting	Modern urban lighting must balance security, aesthetics, and efficiency while minimizing environmental impact, requiring smart grid solutions that integrate renewable energy, reduce light pollution, optimize energy use, and support additional services	**FinEst Centre** Smart City Challenge program: Lighting Nanogrids solution addresses the challenges of street lighting to transform its traditional on/off model into a highly versatile, flexible concept — a street lighting nanogrid
9.	EE	Mobility	Water traffic on the river	The growing water traffic on the Pärnu River, especially during the summer, increases safety risks due to a lack of real-time information for users, highlighting the need for a dynamic communication system to regulate traffic and ensure safe navigation.	**FinEst Centre** Smart City Challenge program: Smart Water Traffic System solution will utilize a network of buoys and digital panels powered by renewable energy sources, such as sonar and/or wind.
10.	EE	Smart Governance	Smart communities' toolkit for enhanced flood resilience	Porto Alegre's severe flooding highlights the need for smart community mechanisms to improve disaster preparedness, enhance data literacy, and strengthen resilience in the face of climate-related crises. Also Estonian towns, Kuressaare and Haapsalu have confirmed the same challenge.	**FinEst Centre** Smart City Challenge Program: Natural Hazard Resilience Toolkit for Cities will be collaboratively developed to support timely crisis management decision-making based on collective intelligence principles.
11.	EE	Built Environment	Reusing old buildings	The challenge is that the construction industry needs to adopt a circular economy by reusing materials from old buildings, but it is difficult due to a lack of knowledge about the contents and structure of these buildings, and decisions need to consider CO2 emissions, costs, and sustainability to make climate-friendly building processes possible.	**FinEst Centre** Smart City Challenge Program: The digital circular construction platform which will tackle and solve circular construction obstacles in terms of organisational (on private sector, city, as well as state levels) technical, legal, environmental and economic aspects,

					bearing in mind digitalisation of construction sector.
12.	EE	Built Environment	Urban underground infrastructure and tree root	Tallinn and Brussels have highlighted that urban trees play a vital role in enhancing the quality of life and health of city residents. The root system plays a vital role in a trees' survival, representing more than just an anchor in the soil but they do not have good enough tools. Since tree roots are not visible to both citizens and urban planners, the potential impact of infrastructure projects, such as excavations, on tree health is frequently overlooked, despite the risk of long-term damage or even tree death.	**FinEst Centre** Smart City Challenge Program: TreeCity solution will produce algorithmic 3D models of tree roots for urban digital twins, together with data collection and model updating procedures, root growth prediction models and solutions for city data formats and interoperability.
13.	EE	Data & Analytics	AI for detecting street markings	Local governments face growing challenges in monitoring activities with limited resources, highlighting the need for AI-driven automation, drone-based data collection, and integrated data management to enhance efficiency and support data-driven decision-making.	AI-Powered Roads Monitoring Solution is AI solution for automated street markings detection for the purpose of automated inventory of their state and scheduling of markings renewal.
14.	EE	Energy	Low-emission energy production and efficient energy use	The challenge includes Estonia's transitioning to 100% renewable electricity by 2030 and CO2-free energy production by 2040, ensuring energy security and attracting sustainable investments while supporting industrial growth aligned with climate goals.	
15.	EE	Energy	Low-emission and high-value-added industry	Estonia is looking forward to a new industry that will contribute to a climate-resilient economy and support transitioning from fossil fuel-based industries. The law will limit new oil shale mining permits to non-fuel uses and restrict existing permits to their expiration, creating an emission buffer for industry.	
16.	EE	Mobility	Environmentally friendly transport and better mobility	Estonia aims to transform its transport sector by achieving zero-emission public transport and domestic ferry shipping by 2040, and a greenhouse gas-free public sector fleet by	

				2035, while promoting sustainable, multi-modal transportation.	
17.	EE	Built Environment	Energy-efficient buildings and high-quality spatial design promote a circular economy	Estonia faces the challenge of reducing greenhouse gas emissions from the building sector with the long-term strategy aiming to cut emissions by 89% by 2050 through building reconstruction efforts.	
18.	EE	Waste Management	Maximize the value of what exists and promote a circular economy	The challenge includes implementing waste prevention and recycling measures, such as mandatory bio-waste collection, to reduce greenhouse gas emissions and promote sustainable waste management through the municipal waste reform.	
19.	LV	Energy	Energy independence and security	Achieving energy independence and security is a high-priority challenge for Latvia, driven by geopolitical tensions, historical energy dependencies, and the urgent need to diversify energy sources and increase renewable production to ensure stable prices and national security.	Potential solutions focus on renewable energy expansion (wind, solar, biomass), advanced energy storage technologies for grid stability, and future solutions emphasizing sustainability, resilience, and scalability to ensure energy security and meet growing demands.
20.	LV	Mobility	Enhancing public transportation systems	Enhancing public transportation in Latvia is a high-priority challenge focused on modernizing aging infrastructure, improving service efficiency through integrated systems and regular timetables, and shifting public perceptions to increase usage by 2027	Potential solutions focus on smart mobility solutions (intelligent transport systems for efficiency and user experience), sustainable transport modes (eco-friendly vehicles like electric buses), with key features including accessibility (inclusive for all populations), reliability (consistent, timely services), and integration (seamless connectivity across transport modes).
21.	BG	Mobility	Traffic congestions and inefficient traffic flows	Urban centers in Bulgaria, such as Sofia and Plovdiv, face severe congestion driven by rising private vehicle use, inadequate public transport capacity, outdated traffic management, and insufficient infrastructure to support sustainable mobility options like carpooling and cycling.	Solutions include expanding ITMS, promoting carpooling, investing in multimodal hubs, and raising private vehicle taxes, focusing on affordability, real-time adaptability, and transport integration.
22.	BG	Mobility	Lack of sustainable mobility infrastructure	Bulgaria faces slow progress in developing EV charging stations, cycling infrastructure, and	Solutions focus on expanding EV charging, safe cycling infrastructure, smart public

				underfunded public transport with poor urban-rural connectivity, requiring comprehensive planning and public-private partnerships for sustainable mobility.	transport systems, and reducing car speeds, with emphasis on sustainability, scalability, and in line with governmental support.
23.	BG	Energy	Low energy efficiency	Bulgaria, the EU's most energy-intensive economy, faces a high-priority challenge in improving energy efficiency, with outdated buildings, inefficient heating systems, and industrial processes, hindered by slow implementation of national programs due to administrative complexity and funding shortages.	Solutions include introducing funding mechanisms for energy-efficient renovations; smart energy monitoring in households and industries, and prefabricated insulation for faster retrofitting, with key features of cost-effectiveness, scalability across urban and rural areas, and user-friendly educational campaigns to encourage adoption.
24.	BG	Energy	Achieving energy independence	Bulgaria faces a high-priority challenge in achieving energy independence, as it relies on imported energy, with outdated infrastructure, limited financial incentives, regulatory delays, and low public approval for clean energy, hindering progress toward reducing fossil fuel dependency.	Expanding solar and wind farms, supported by advanced energy storage systems. Establishing LNG terminals to diversify natural gas supply sources. Increasing biogas and biomass production as transitional fuels.
25.	BG	Data & Analytics	Lack of data	Bulgarian cities struggle to create unified systems for data collection and analysis. disconnected systems and outdated IT infrastructure, hindering efficient resource use and urban planning. Limited data collection, due to low digitalization in urban sectors and public services, further compounds the issue.	Solutions include open data platforms and IoT for real-time analytics, along with public-private partnerships for data-sharing, focusing on interoperability, security and privacy compliance, and cost-efficiency and scalability.
26.	BG	Smart Governance	Limited stakeholder coordination and engagement	Stakeholders in Bulgaria often operate in silos, leading to inefficiencies in innovation and governance. Administrative hurdles, lack of stakeholders engagement limit public-private partnerships.	Solutions include innovation hubs and incubators for cross-sector collaboration, along with clear legal frameworks for partnerships, focusing on transparent and inclusive governance, metrics for evaluating outcomes, and flexibility to adapt to stakeholder needs.
27.	CY	Energy	High reliance on imported fossil fuels,	Cyprus is not energy self-sufficient, with underutilized high solar potential and a low EU ranking for renewable energy use, highlighting	1.Cyprus has reliable generator infrastructure in place. 3.Advanced smart girds that allow forcasting of energy consumption and weather allowing for RES

				the island-wide need for greater integration of solar and wind to meet EU climate targets.	integration. Project : Twin EU digital twin of EU energy system.
28.	CY	Energy	RE storage challenges. Critical for balancing supply and demand with intermittent RES. Aging electricity grid struggles to integrate fluctuating renewable sources. Lack of smart grid infrastructure to balance supply & demand. Peak electricity demand in summer (due to air conditioning) worsens grid instability.	Renewable energy (RE) storage challenges are an extremely high-priority issue in Cyprus, critical for balancing supply and demand with intermittent sources like solar and wind; Energy storage systems are required to facilitate storage of energy produced via renewables and PVs. Currently, when supply exceeds demand, renewable sources are shut down.	Intelligent platforms for planning and managing battery storage for renewable energy systems. (OptimRES project) Intelligent platforms for planning and managing battery storage for renewable energy systems.
29.	CY	Built Environment	Energy inefficient buildings. Limited integration of renewable energy resources. Buildings use up a third of the total energy usage.	Energy-inefficient buildings in Cyprus, with limited integration of renewable energy resources, account for a third of the country's total energy consumption. This challenge significantly impacts both residents and industries, as extreme hot weather conditions increase energy demand for cooling, posing risks to public health.	Energy-efficient building management systems, green infrastructure, IoT-enabled sensors, automated climate control, renewable energy integration, real-time energy optimization, self-learning intelligent control, energy storage, and HVAC management.
30.	CY	Built Environment	Need for urban Water Management - Ensure quality, Safety, Dependability. Wastewater management. Water scarcity (need for water security) in Cyprus is a critical issue, affecting drinking water, agriculture, energy production, and ecosystems.	Cyprus faces a critical challenge in urban water management. Water scarcity, driven by limited freshwater resources and rapid urbanization, is worsened by aging infrastructure that leads to leaks and inefficiencies. Effective wastewater management and upgraded systems are essential to meet growing demand, supporting both economic growth and societal well-being.	Development of smart water systems for real time monitoring and control. Creating digital twins for simulation and optimization. Enhancing cyber-physical security of water infrastructure.
31.	FI	Data & Analytics	Lack of transparency and public engagement in cleantech initiatives	Some Finnish cities have implemented open data portals to share environmental and energy data (e.g., Helsinki Region Infoshare). The present solutions are still insufficient due to data fragmentation (different platforms use different formats and standards, making it difficult to integrate data), limited accessibility (some datasets remain closed or restricted to government agencies), lack of real-time data	1. Smarter Urban Planning – data-driven insights enable better infrastructure investments, from public transport to energy grids -> engagement with decisions-makers 2. Easier access to cleantech data fostering innovation in AI, smart energy, and sustainable solutions for start-ups and accelerators

				(many existing systems rely on periodic reporting rather than continuous, real-time updates), insufficient public engagement (open data initiatives do not always reach or involve citizens effectively).	
32.	FI	Mobility	1. Limited EV charging network, as Finland has a growing but still insufficient network of fast-charging stations, especially in rural and remote areas. 2. Cold climate impact on EVs, as harsh winters reduce battery performance and increase energy consumption, requiring more frequent charging and improved battery technologies. 3. High upfront costs, as despite subsidies, EVs remain expensive compared to fossil-fuel cars, slowing mass adoption.	Urban areas like Helsinki, Tampere, and Turku face congestion, pollution, and rising demand for low-emission mobility. Citizens expect affordable, efficient transport and widespread EV charging. Despite progress in renewables, transport—especially in rural areas—remains fossil fuel–dependent due to limited EV infrastructure, climate challenges, and reliance on imported fuels. Finland must meet the EU goal to cut transport emissions by 55% by 2030	Potential solutions include Public Transport Operators like HSL (Helsinki Region Transport) transitioning further to electric and hydrogen-powered buses, rail, and shared mobility while maintaining affordability and efficiency. 2. Freight and logistics operators decarbonizing transport fleets, adopt electric and hydrogen trucks.
33.	FI	Energy	1. Integration of Renewable Energy Sources and managing fluctuations in wind and solar power generation while maintaining grid stability. 2. Limited large-scale energy storage solutions hinder renewable energy adoption. 3. Dependence on imported raw materials.	The clean energy transition is crucial for Finland's government, households, and regional partners. Achieving Finland's 2035 carbon neutrality goal requires rapid energy sector decarbonization, enhanced energy security, and reduced reliance on imported fossil fuels—particularly from Russia. For households, rising energy costs and climate concerns highlight the need for affordable, sustainable options for heating, transport, and electricity. As part of the Nordic electricity market, Finland must also coordinate regionally, relying on cross-border grid connections with Sweden, Norway, and Estonia to balance supply and demand.	Potential solutions include 1. Utilizing Finland's vast coastline to increase wind power capacity. 2. Converting surplus renewable energy into hydrogen, synthetic fuels or heat. 3. Cross-border energy cooperation – strengthening Nordic-Baltic electricity interconnections for a more stable energy market. 4. Finland has extensive forests, making sustainable biomass a key energy source, but balancing biomass use with biodiversity protection is a distinct challenge. Offshore wind expansion is gaining momentum.

6. Annex II Cleantech use case template

1. Use Case Name

- A concise title that describes the use case (e.g., *"Real-Time Energy Monitoring in Smart Grids"*)

2. Objective

- What is the goal of the use case? Define the goal or desired outcome of the use case.

3. Problem Statement

Briefly describe the problem or challenge this use case addresses:
- To whom is it important (e.g., people, specific group pf people, city, region, country)?
- Why this is priority to this target group?
- Is this a unique challenge/problem or applicable to other target groups (people, cities, regions, countries)?

3. Potential Solution

- What is the solution you are proposing for the challenge above?
- How does it solve the challenge?
- What are the main features, characteristics of the solution to be potentially best for that challenge or problem?
- List the main technologies or tools involved which could be used to implement the solution.

5. Innovation and piloting of the solution

- How will this solution be better when existing ones? What is the innovation in it?
- What is needed to pilot the proposed solution? How could the piloting work?

6. Expected outcomes and impact

- Highlight the benefits or results anticipated from implementing the use case.
- What is the potential impact for the target group, environment and sustainability?

7. Annex III Cleantech use cases selected

1. Smart Flood Resilience Toolkit – Estonia

Objective
The goal of this use case is to develop a decentralized flood resilience system that enhances coordination among municipalities, citizens, emergency services, and private companies to minimize casualties and damages from floods.
Problem Statement
Description: Cities face significant challenges in flood preparedness and response, leading to delayed evacuations, risky rescues, and substantial property damage. Current systems often lack effective coordination among stakeholders and fail to provide timely warnings to citizens. **Target Group**: This challenge is particularly critical for cities prone to flooding, such as Porto Alegre and Tartu. **Priority**: It is a priority due to the increasing frequency and severity of floods, which pose significant threats to lives, infrastructure, and the economy. **Applicability**: While the focus is on specific cities, the problem is applicable to any urban area vulnerable to flooding.
Potential Solution
Proposed solution – to develop a blueprint for a decentralized flood resilience system that integrates various stakeholders, including municipalities, citizens, emergency services, and private companies. The system aims to: •Investigate the current flood resilience situation in cities. •Formulate requirements for an improved, decentralized system. •Bridge interfaces between centralized governmental warning systems and decentralized municipal and neighbourhood resilience systems. •Inform potentially affected citizens through multiple communication channels. **How It Solves the Challenge:** By creating a systematic approach to early warnings and preparedness, the solution ensures that citizens are informed promptly and that all relevant stakeholders are coordinated effectively, reducing the risks associated with floods. **Main Features:** A holistic, stakeholder-inclusive system that leverages multiple communication channels for early warnings and emphasizes decentralized coordination. **Technologies/Tools:** The solution likely involves IoT sensors for real-time data collection, data analytics for flood prediction, communication platforms for disseminating warnings, and possibly AI for predictive modelling.
Innovation and piloting of the solution
Current Solutions vs. Proposed Innovation: Existing flood management solutions are often centralized and may not effectively coordinate multiple stakeholders or provide timely, localized warnings. The innovation in this solution lies in its decentralized approach, which tailors the system to the specific needs of the cities and integrates various actors for a more cohesive response. **Piloting Needs and Process**: **Needs**: Suitable test sites in the cities (e.g., flood-prone areas) and budget for demonstration projects. **Process**: Implement pilot projects in Porto Alegre and Tartu to test the system's effectiveness, refine the blueprint based on real-world feedback, and demonstrate its scalability to other cities.
Expected outcomes and impact
Benefits:

- Increased security for citizens regarding their health and property through timely evacuations and reduced exposure to flood risks.
- Improved governance in involved cities through better information flow, communication, and decision-making processes.

Impact:

- **Target Group (Cities and Citizens)**: Enhanced safety, reduced economic losses from flood damage, and a greater sense of community resilience.
- **Environment**: Potentially less environmental damage from floods through better management and quicker response times.
- **Sustainability**: A more resilient urban infrastructure capable of withstanding and recovering from flood events, contributing to long-term sustainability goals.

2. Reusing Old Buildings for Circular Construction – Estonia

Objective

The goal of this use case is to enable the reuse of building parts from existing structures in new constructions, thereby promoting a circular economy in the construction sector and reducing the environmental impact of building activities.

Problem Statement

Description: The construction industry significantly contributes to environmental degradation through the consumption of raw materials and the generation of construction and demolition waste (CDW). With upcoming EU regulations on the CO2 footprint of buildings and a growing need to conserve resources, there is an urgent need to find sustainable ways to manage aging building stock.

Target Group: This challenge is critical for cities, regions, and countries striving for climate resilience and sustainability.

Priority: It is a priority due to the necessity of reducing CO2 emissions, minimizing waste, and preserving natural resources.

Applicability: While particularly relevant to urban areas with older buildings, this problem is applicable globally wherever sustainable urban development is a goal.

Potential Solution

Proposed solution to develop a comprehensive process for reusing building parts from existing buildings in new constructions. This involves:

- Assessing the adaptability potential of existing buildings.
- Conducting pre-demolition audits to identify reusable components.
- Establishing safety and quality criteria for reused building parts, including laboratory testing.
- Developing technical solutions for deconstructing typical buildings.
- Initiating parallel design processes for new buildings using reused parts.
- Creating physical and digital material banks to manage and track reusable components.
- Utilizing digital tools for building auditing and creating digital twins.
- Developing a circularity process for reusing building parts, including flowchart, responsibilities, and verification.
- Exploring new business models for reusing building parts.

How It Solves the Challenge: This solution reduces the demand for new materials, minimizes waste generation, and lowers the overall environmental footprint of construction projects.

Main Features: A holistic approach integrating organizational, technical, legal, and economic aspects, supported by digitalization for efficiency and transparency.

Technologies/Tools: Digital auditing platforms, digital twin technology, and material database systems.
Innovation and piloting of the solution
Current Solutions vs. Proposed Innovation: While current practices often involve demolition and partial recycling of materials, the innovation here lies in the direct reuse of building parts, preserving their original functionality and structural integrity. This approach is more sustainable than recycling, as it avoids the energy and resources needed for processing materials. The holistic process connects existing knowledge and fills gaps to create a viable, scalable model for circular construction. **Piloting Needs and Process**: **Needs:** Pilot buildings for deconstruction and reconstruction (ideally provided by the city or private partners), legislative support from the city for updating construction and waste management regulations, collaboration with private companies, and organizational support for permits and tendering. **Process:** Select a building scheduled for demolition, conduct a pre-demolition audit to identify reusable parts, design a new building incorporating these parts, and execute the deconstruction and reconstruction processes to serve as a proof of concept.
Expected outcomes and impact
Benefits: • Reduced environmental impact through decreased use of new materials and lower waste generation. • Conservation of raw materials, contributing to resource sustainability. • Minimized transportation needs, reducing traffic congestion, noise, dust, and emissions in urban areas. • Potential cost reductions in construction due to the use of reused materials. • Less disturbance to urban environments and citizens compared to traditional demolition and construction methods. **Impact:** • Target Group (Cities and Construction Sector): A more sustainable approach to urban development and modernization, aligning with climate resilience goals. • Environment: Reduced CO_2 emissions, less mining of raw materials, and decreased waste. • Sustainability: Enhanced through a circular economy approach, ensuring resources are used efficiently and preserved for future generations.

3. Smart Renewable Energy Systems with AI-Driven Optimization and Integrated Storage Solutions – Lithuania

Objective
To enhance energy efficiency, grid stability, and sustainability by implementing AI-based energy management, intelligent battery storage, and smart EV charging solutions.
Problem Statement
Description: Modern electricity grids are facing rising challenges due to the integration of intermittent renewable energy sources, leading to inefficiencies, grid instability, and increased energy costs. **Target Group:** This is critical for utility companies, solar farm operators, municipalities, and countries transitioning to renewables.

Priority: The problem is urgent due to growing energy demand, renewable energy deployment and climate targets.
Applicability: It applies broadly across urban, regional, and national levels in countries adopting clean energy transitions.

Potential Solution

Potential solution providers:
- Inion Software’s AI-based energy management and battery optimization solutions.
- Inbalance Grid’s smart EV charging infrastructure that supports dynamic load balancing and grid integration.
- PVcase’s solar design software to optimize solar farm deployment and grid contribution.
- Solitek’s integrated solar panel manufacturing and smart energy storage solutions, supporting localized, sustainable energy generation.

Main features:
- Real-time performance monitoring of energy assets (Inion).
- Predictive battery charge/discharge management (Inion).
- Intelligent EV charging stations integrated with local grid conditions (Inbalance).
- Precision solar infrastructure planning with high-yield outcomes (PVcase).
- Integrated solar panels with battery systems for optimized rooftop and community-scale solar deployment (Solitek).

Technologies/Tools:
- AI & machine learning
- IoT sensors & cloud data logging (Solarone Logger)
- Web-based monitoring dashboards (Inview)
- Grid-responsive EV charging control
- CAD/BIM-based solar modeling (PVcase)
- Modular solar panel + storage systems for scalable deployment (Solitek)
- Inion Software’s AI-based energy management and battery optimization solutions.
- Inbalance Grid’s smart EV charging infrastructure that supports dynamic load balancing and grid integration.
- PVcase’s solar design software to optimize solar farm deployment and grid contribution.

Innovation and piloting of the solution

Innovative solutions:
- Inion’s platform includes AI-powered energy management using real-time market data and predictive algorithms.
- Inbalance Grid adds smart load balancing for EV charging—benefiting grid operators.
- PVcase enables automated solar farm layout optimized for both design and energy output.
- Solitek contributes vertical integration of solar panel and battery manufacturing—offering tailored and efficient renewable energy systems with reduced supply chain dependency.

Piloting opportunities:
- Deploy Inion’s solution in a municipal building with PV + battery system.
- Set up Inbalance chargers in city parking lots integrated with the grid.
- Use PVcase for a pilot solar plant design in a regional energy community
- Implement Solitek’s rooftop solar and battery solutions in public infrastructure or residential pilot projects to showcase end-to-end renewable integration.

Expected outcomes and impact

- 15–30% increase in energy efficiency.
- Reduced energy costs and managed peak loads.
- Improved stability of regional energy grids.
- Demonstrate scalable model for national clean energy transitions.

- Reduced carbon footprint via optimized renewable generation and storage.
- Supports SDGs: Affordable Clean Energy, Sustainable Cities, and Climate Action.

4. LAT-MaaS +: An Integrated, Zero-Emission Mobility-as-a-Service Platform for Latvia's Public Transport Network – Latvia

Objective
•Modernise Latvia's public-transport infrastructure and services by 2030. •Replace the aging diesel fleet with zero-emission vehicles and install renewable-powered charging/maintenance depots. •Create a single national digital platform that lets passengers plan, book and pay for seamless trips across buses, regional trains, trams, shared micro-mobility and demand-responsive shuttles. •Raise public-transport modal share (vs. private cars) from ~27 % to 40 % in urban areas and double service coverage in rural regions.
Problem Statement
Description: Latvia's public-transport system still relies heavily on 15- to 20-year-old diesel buses, paper tickets and uncoordinated timetables. Rural communities have infrequent service; urban commuters. **Targe group:** More than half of residents (especially students, low- income families, the elderly and rural dwellers) depend on affordable transport for work, healthcare and education. **Priority:** Road transport generates ~28 % of Latvia's GHG emissions; EU Fit-for-55 and national climate-law targets require a rapid shift to low-carbon mobility. **Uniqueness / transferability:** The pain points (aging fleet, fragmented ticketing, rural access) mirror challenges in many Central & Eastern European countries, making the solution replicable region wide.
Potential Solution
Core concept is to combine a nation-wide MaaS platform with a progressive fleet electrification & infrastructure upgrade. **How does it solve the challenge:** LAT-MaaS + fixes Latvia's transit woes by merging every bus, tram, train and rural shuttle into one "tap-anywhere" payment and real-time planning app, while replacing the dirtiest diesel vehicles with electric and hydrogen models powered by Latvia's renewables. That makes travel faster, simpler and cleaner—cutting wait times, erasing fare confusion, and slashing transport-sector CO_2 in just a few years. **Main features:** • Open-loop, contact-less fare payment (bank card/NFC) & single mobile app in Latvian, & English. • Real-time vehicle tracking, predictive arrival info and dynamic timetable optimisation via AI. • 400 battery-electric buses and 30 hydrogen fuel-cell coaches for long inter-city routes. • Demand-responsive electric minibuses for rural parishes, dispatched via the MaaS app or phone hot- line. • Accessible design: low-floor vehicles, audio-visual alerts, wheelchair spaces and tactile platform edges. **Technologies/tools:** Intelligent Transport Systems (ITS), GTFS-RT feeds, Cloud-based MaaS back end & public APIs , AI route- optimisation engine (e.g., reinforcement-learning scheduler), V2G-enabled chargers

using 100 % renewable power, Telematics & IoT sensors for maintenance-as-a-service, Cyber-secure open-loop EMV fare gates.
Innovation and piloting of the solution
Innovation: Current best-in-class Helsinki and Tallinn run MaaS apps (Whim, TLT) and electric fleets; Riga has begun limited e-bus trials. **Why this approach is better:** First to integrate nation-wide MaaS, covering urban + rural Latvia in one system. •Combines multiple zero-emission drivetrains (battery + hydrogen) with vehicle-to-grid services to stabilise Latvia's renewable-heavy grid. •Open data layer invites local start-ups to build value-added services (e.g., carbon-footprint tracking, tourism passes). **Piloting plan:** 1.Riga Metro-Area Sandbox (2025) – 80 e-buses, 1 depot, beta MaaS app for 250 k users. 2.Vidzeme Rural Cluster (2026) – 15 on-demand e-minibuses serving 35 villages; test dynamic routing & phone-booking UI. 3. National Roll-out (2027) – scale fleet conversion, connect rail operator "Pasažieru vilciens" to MaaS, launch loyalty incentives.
Expected outcomes and impact
• CO_2 reduction: -110 kt/yr by 2030 (≈6 % of transport sector emissions). • Air-quality gains: NO_x and $PM_{2.5}$ in Riga drop ≥25 % near bus corridors. • Social inclusion: Rural households gain at least 4 additional weekly round-trip options; mobility costs fall 15 % relative to private-car ownership. • Economic boost: Creates ~2 000 skilled jobs (charging-infrastructure build-out, software development, fleet maintenance). • Data-driven governance: Open analytics dashboard supports evidence-based route planning and climate reporting. • Replicability: Template can be exported to Lithuania, Estonia and other EU cohesion-policy regions, leveraging EU CEF & Cohesion Fund financing.

5. Enhancing Grid stability and Renewable integration – Cyprus

Objective
To facilitate the efficient and reliable integration of renewable energy sources, such as solar and wind, into the power grid. To strengthen the power system using innovative methods, enhancing stability, quality, reliability, and integrity without affecting system performance bridge the gap between theoretical research and practical deployment and meet the EU climate targets for renewable energy use by 2030.
Problem Statement
Description: Cyprus has a high reliance on imported fossil fuels and underutilized high solar potential. Modern power systems are increasingly complex, requiring advanced tools to manage the growing integration of renewable energy sources, the need for reliable grid stability, cybersecurity, and the coordination between power and telecommunication infrastructure. Testing new technologies in real environments is often costly, risky, or impractical. **Target group:** This challenge is critical for cities, countries and regions striving for renewable energy integration and sustainability to meet the EU goals. It is a global issue. **Priority:** Power networks are undergoing a transformation toward decentralization, digitalization, and electrification, increasing the complexity of managing and integrating new technologies and,

it is challenging to deploy new control schemes, validate emerging grid devices, or prepare for cybersecurity threats.
Potential Solution
•Maintaining a stable power grid is crucial in the energy sector. Digital twins of power grids are employed to monitor real time operations and predict the impact of fluctuations in demand and supply. •Virtual models simulate the entire grid infrastructure, including substations, transmission lines and distribution networks. •By analysing data from models, operators can forecast potential blackouts, optimize load distribution and quickly respond to faults. Ensuring more resilient and reliable power grid. •Utilizing real-time simulation tools to model the entire Cyprus power system and assess the interaction between renewable energy sources and smart grid controllers. **Key Features:** Digital twin models for Cyprus's HV transmission grid, real-time control algorithms for power electronic converters, advanced inverter-less photovoltaic connections, integration of energy storage systems, and cybersecurity measures for smart grids.
Innovation and piloting of the solution
Existing Solutions: Conventional power system testing often relies on offline simulations or lab-scale setups that lack real-time, hardware-integrated capabilities. **Innovation:** Combines digital twins with real-world hardware integration (power and control HIL). Supports future technologies like EV charging, HVDC systems, and smart building integration **Piloting needs and process:** •Identifying specific challenges in the energy grid, such as the variability of renewable sources or the need for enhanced grid stability. •Modelling and Simulation: Developing detailed models of the proposed solutions and simulating their performance under various scenarios to predict outcomes and identify potential issues. •Hardware-in-the-Loop (HIL) Testing: Integrating actual hardware components with simulation models to test the real-time performance and interactions of the system, ensuring that the solutions can operate effectively within the existing grid infrastructure. •Pilot Implementation: Deploying the validated solutions in a controlled, real-world environment to monitor performance, gather data, and make necessary adjustments. •Evaluation and Scaling: Analysing the results from the pilot to assess effectiveness, reliability, and scalability, with the aim of broader implementation across the energy grid.
Expected outcomes and impact
Anticipated Benefits: • This staged piloting approach would allow the testbed to serve as a critical pre-deployment environment for evaluating technologies in a safe, replicable, and measurable way before any real-world deployment. • Enhanced Grid Stability and Reliability: By developing advanced control algorithms and integrating energy storage systems aims to mitigate the variability of renewable energy sources, ensuring a stable and reliable power supply. • Reduction in Greenhouse Gas Emissions: Facilitating a higher penetration of renewable energy sources contributes to a decrease in reliance on fossil fuels, thereby reducing greenhouse gas emissions and supporting environmental sustainability goals. • Improved Power Quality and Efficiency: The integration of smart technologies and microgrid solutions enhances power quality by reducing transmission losses and optimizing load management, leading to more efficient energy distribution. • Increased Energy Resilience: The development of localized microgrids and energy storage solutions enhances the resilience of the power system, allowing for continued operation during disruptions and reducing dependency on centralized power sources.

- Economic Benefits: Optimizing the operation of renewable energy sources and storage systems can lead to cost savings for both utilities and consumers, as well as support the viability of green investments.

6. Smart Safe Water: Pathogen contamination detection – Cyprus

Objective
Deploy and validate a real-time contamination response system in a city water network by stimulating contamination events and testing responses: focusing on improving water quality monitoring, strengthening resilience of water utilities against contamination risks, improving operational efficiency, and cyber-physical resilience.
Problem Statement
Description: Cyprus faces a critical challenge in urban water management. Water scarcity driven by limited freshwater resources and rapid urbanization is worsening by aging infrastructures. Water systems face persistent issues like leakage, inefficiencies in operations, water quality concerns, and increasing vulnerability to cyber-physical threats. However, implementing and validating innovative technologies in live networks is difficult, risky, and often costly. **Target group:** Affects everyone living on the island and can be applicable globally. Public health can be endangered during delayed contamination detection. **Priority:** Water is a critical resource, and the ability to manage it smartly is essential for long-term sustainability. EU water safety planning guidelines push for smarter monitoring. Cybersecurity threats can cripple essential services. There is a growing need for safe, modular environments to test and validate innovations without disrupting real-world operations. **Wider Relevance:** Although this system is based in Cyprus, these challenges and solutions are relevant to many regions globally facing similar issues in water infrastructure modernization. These challenges affect not only local water boards but cities and countries globally facing climate change, urbanization, and increasing demand. Applicable to any mid-sized European city seeking to improve its emergency water response protocols.
Potential Solution
Proposed solution: Use real-time monitoring and a simulation-based decision support system to improve utility responses to contamination. **How It Solves the Challenge**: It provides training, forecasting, and real-time support for incident response, tested in a controlled environment. This minimizes risk, speeds up innovation, and ensures better performance, resilience, and sustainability in real-world applications. **Main Features:** Real-time data integration from SCADA and water quality sensors. Simulation engine for contamination spread and control. Operator decision-support interface Technologies: Platforms for real time data processing analytics, incident management and information visualization.
Innovation and piloting of the solution
Innovation: Existing water network systems often rely on isolated monitoring and control tools that are not integrated or tested in realistic conditions. The solution enables safe simulation of emergencies without affecting real-world systems. Strengthens operational readiness in a virtual environment first. It allows researchers to safely test leak detection, contaminations, smart metering, cyber-attack resilience, and control strategies in a controlled environment that behaves like a real water network. This approach makes it possible to evaluate solutions before applying them to actual city infrastructure.

Piloting Plan: Simulate contamination events and test operator response workflows. Validate effectiveness before considering real-world utility deployment. A specific pilot scenario (e.g. contamination detection. Collaboration with city water utilities or private partners. Legal and organizational backing for using data or interfacing with real systems. Run experiments to observe performance and impact under realistic scenarios. Use the results to refine the technology and prepare it for field deployment
Expected outcomes and impact
Benefits: • Reduced water losses through early detection of leaks/ contamination and better pressure control • More efficient use of water resources through smarter control **Impact:** • Improved reliability and efficiency of urban water systems • Less wasted water contributing to better resource conservation. Operational cost savings and improved service reliability. • Lower environmental impact due to optimized system operations: Lower resource waste and energy-efficient operations. • A practical tool to support long-term water security and innovation • Public health: Better detection and mitigation of water quality issues. • Sustainability: Enables digital transformation of water infrastructure, contributing to sustainable development goals.

7. Smart Energy Retrofit Kits for Residential and Industrial Buildings – Bulgaria

Objective
The goal is to accelerate affordable and scalable energy efficiency upgrades in buildings and industrial sites through modular, prefabricated retrofit kits.
Problem Statement
Description: Bulgaria, and many similar regions, face a major challenge with outdated, inefficient building stock and industrial infrastructure, resulting in high energy consumption and costs. **Target group:** This is a critical issue for property owners, businesses, and municipalities seeking to meet EU energy targets and reduce operational costs. **Applicability:** The problem is broadly applicable across Eastern Europe and many aging urban areas globally.
Potential Solution
Develop modular kits combining insulation panels, smart thermostats, efficient lighting, and energy sensors, designed for quick retrofitting with minimal disruption. The kits will be cost-effective, scalable across different building types, and paired with educational support for users. **Technologies/tools involved:** •IoT sensors for real-time monitoring •Prefabricated energy-efficient insulation •Smart thermostats and energy controllers •Mobile apps for guidance and monitoring
Innovation and piloting of the solution

Innovation: Existing retrofitting solutions are expensive and slow, often requiring complex permits. Innovation here lies in modularity, standardization, and integration of smart monitoring into the retrofit. **Piloting** could involve partnerships with property owners (e.g., residential blocks or small factories) installing kits in selected pilot buildings, with energy savings tracked over 12 months.
Expected outcomes and impact
• Expected outcomes include a 20–30% reduction in energy consumption, lower heating/cooling bills, and improved living/working comfort. • Environmental impact includes reduced CO_2 emissions and greater awareness of sustainable practices among citizens.

8. Annex IV Cleantech Policy Labs: detailed report [94]

In coordination with Task 3.4 and 4.2, a series (virtual) policy dialogues were organised with 10 stakeholders of each of the use cases in the project (2h of duration each). These dialogues served as basis for a hybrid (or virtual) policy workshop engaging and discussing with the EU-level and FINEX IE regional/national supervisory authorities, presenting the FINEX project objectives, targeted Cleantech domains and preliminary list of experimentation spaces and potential pilots in order to identify the most desirable and high-impact use-cases for testing and improving the experimentation spaces from a regulatory standpoint. Thematically, the lab results derived in the formulation of a policy vision and possible policy pathways as an input to Task 7.2.2, offering policy guidance on how to turn Europe into the world's cleantech powerhouse, as it is envisioned in the NextGenerationEU. The results of this task will be included in a report summarising the main findings of the policy lab (part of D.3.1)

8.1 OVERVIEW OF USE CASES

The use cases selected for the FINEX Policy Labs served as practical illustrations of cleantech experimentation within four key thematic areas: energy, mobility, the built environment, and governance. These real-life examples, **grounded in the experiences of stakeholders from different regions**, enabled a concrete and contextualised exploration of regulatory and policy barriers. By anchoring the policy dialogues in specific local initiatives, the use cases provided a valuable basis to identify systemic challenges and inform relevant policy pathways for sustainable transformation.

Below is a summary of the use cases shared by participating stakeholders. Each case

provides practical insights that will inform the discussions during the FINEX Policy Labs.

Case Title	Country	Thematic Area / WS	Key Challenge	Lead Actor	Notes
Grid Digital Twins	Cyprus	Energy / WS1	Grid instability, lack of real time testing for renewables	KIOS CoE	Hardware in the loop for power systems
Smart RE Systems (AI + Storage)	Lithuania	Energy / WS1	Intermittent renewables, grid inefficiency	Cleantech Startups	AI-based grid management + EVs
LAT-MaaS+	Latvia	Mobility/ WS2	Outdated diesel fleet, poor rural access,	Public Transport Authority / Gov	Scalable MaaS platform; strong rural inclusion

[94] The FINEX project team would like to acknowledge the expert inputs of Ana Torralba Barallat and Jose Manuel Martin Corvillo for the facilitation of the FINEX policy labs and the codification of information that led to the identification of policy levers.

			fragmented ticketing		
Smart Energy Retrofit Kits	Bulgaria	Built Environment / WS3	Inefficient Buildings, retrofit cost, slow uptake	Tech providers / Property Owners	Modular retrofitting with smart sensors
Circular Building Reuse	Estonia	Built Environment / WS3	High CDW, lack of reuse protocols	Urban planners / Builders	Material banks and digital twins
Urban Digital Twin	Bulgaria	Governance & Data / WS4	Lack of integrated urban data for planning	City Governments	Interactive 3D planning tools with IoT
Water Contamination Simulation	Cyprus	Governance & Data / WS4	Aging infrastructure, cyber-physical threats	KIOS CoE	Safe innovation testing in water networks
Open Data Innovation Hubs	Bulgaria	Governance & Data / WS4	Data silos between public and private sectors	Innovation Hubs / Public-Private	Enabling local collaboration via shared data
Smart Flood Resilience Toolkit	Estonia	Governance & Data / WS4	Lack of early warning, poor coordination	City Resilience teams	Decentralized response platforms

8.2. POLICY LAB RESULTS - THEMATIC INSIGHTS

8.2.1 POLICY LAB 1: ENERGY SECURITY AND RENEWABLE INTEGRATION

Step 1. ANALYSIS

Context Analysis

This section captures the initial mapping exercise conducted with stakeholders to identify key contextual factors shaping the innovation landscape. It reflects the systemic forces, barriers, and enablers influencing each thematic area across region

The outputs of the Context mapping highlighted a complex landscape for energy security and renewable integration across several European regions, shaped by a diversity of institutional, infrastructural, and market dynamics. Despite the participation of academics, private sector actors, and policymakers, the grid infrastructure in many countries remains outdated, rigid, and unprepared for the rapid deployment of renewables and storage technologies. **Specific challenges include** long and complicated permitting procedures (especially in Bulgaria and Cyprus), poor integration between storage, EVs, and renewables (Lithuania), and a lack of real-time data and smart metering capabilities.

Market signals are not always aligned with the needs of transition: private capital is scarce, start-ups struggle with product-market fit, and public investment in modernization is insufficient. National energy plans often lack ambition or fail to prioritize smart grid integration. Moreover, institutional fragmentation, public mistrust—particularly in Bulgaria—and low cross-sector collaboration exacerbate the challenges, limiting systemic progress and social engagement.

Raw inputs of the participants are now structured into clusters to provide a detailed insight to reader:

Stakeholders

- Academic and research experts
- Industry and private sector representatives
- Policymakers and regulators

Grid Challenges

- Lengthy and complex permitting slows deployment (Bulgaria & Cyprus)
- Lack of integrated planning between storage, EVs and RE (Lithuania)
- Grid lacks real-time data for decision-making (Cyprus)
- Renewables enter an outdated, inflexible grid (Lithuania)
- Lack of private capital, limited/underdeveloped VC ecosystem in the region
- Slow permitting and admin barriers
- Grid limitations outdated or rigid grid
- Outdated grid with low flexibility
- Limited smart metering

Innovations

- Nothing relevant

Market Barriers

- Ecodesign for sustainable Products Regulation Work Plan may not be including smart grid systems or electricity infrastructure (new work plan focuses on consumer goods
- Immature product/market fitting and business plan of startups offering the cleantech solutions
- Limited incentives for private investment in grid modernization (Cyprus, Lithuania)
- Skill gap for operators that will be using the new clean technology (e.g. national energy agency, local electricity company)
- Technology testing in real operational conditions may take longer than what adopters are willing to accept (time bound rationality of pilot testing)

- National energy and climate plans not sufficiently including/addressing smart grid integration technologies / renewables OR with different levels of ambitions (all countries in FINEX)

Energy Issues

- (Cyprus) Nationalised electricity companies (lack of free market competition >> stagnation and lack of incentives)
- Cyprus is experiencing steady economic growth with increased investment in green infrastructure, driven by EU targets, rising energy costs, and the strategic push to harness its high solar potential and reduce fossil fuel dependency.
- Rising energy demand due to electrification, digitalisation -> requires investments in grid transmission and distribution.
- Market volatility and competition for Power Purchase Agreements
- In Finland we have a relatively affordable electricity price (ca 5c/kWh) because the state wants to keep it low for the industries (wood, metal, paper etc.)
- Heavy reliance on fossil fuels due to country limitations (Cyprus is an island, cannot participate in cross-member state energy optimisation like other mainland European countries)

Institutional Trust

- Lack of trust in the public authorities, therefore, lack in trust in any reforms, transitions, policies. Strong believe in the power of nuclear power plant as one solution (Bulgaria)
- Smart RE Systems (AI+Storage) /Lithuania Energy/WS1
- Public resistance to green transition and energy reforms in coal regions (Bulgaria)
- Fragmented regulatory ecosystem - functions and incentives divided between ministries of Economy and Innovation and Energy (Lithuania)
- Fear or low awareness of new tech (Bulgaria)
- Limited citizen engagement in energy projects (Bulgaria)

Collaboration

- Low cross-sector collaboration culture — silos between academia, utilities and startups (generalized across countries)
- Interoperability between systems, cybersecurity, limited grid observability at low voltage levels. These are impacting real time monitoring and forecasting as well as the deployment of tools like digital twins
- Governance is fragmented: e.g. key institutions like ENTSO-E and ENTSO-G have limited mandates and depend on reliable data

Uncategorized

- Fear of technology
- Grid Digital Twins (Cyprus)
- Enhances grid resilience, reliability, and stability during high renewable penetration

Identified Barriers

Building on the insights generated through the context mapping, the second exercise focused on identifying the key barriers hindering progress within each thematic area. Participants distilled regulatory, financial, technological, and behavioural obstacles that emerged from the previous step, highlighting the main constraints to innovation and cleantech deployment across Europe

The key barriers to energy security and renewable integration identified in the workshop span behavioural, regulatory, financial, and technological dimensions. Culturally, mistrust in public authorities and resistance to reforms—especially in regions dependent on coal—undermine public support for the energy transition. A widespread fear or lack of awareness of new technologies, limited citizen engagement, and persistent skill gaps further hamper adoption.

From a market perspective, the lack of capital and incentives, along with pricing structures that do not reflect the true cost or value of clean technologies, reduce investor confidence. On the policy front, regulatory complexity, shifting legal frameworks, and bureaucratic delays create uncertainty and discourage long-term investment. Technologically, limited data integration and system interoperability, along with poor monitoring capacity, weaken the case for infrastructure upgrades and hinder the deployment of advanced tools like digital twins, which are crucial for grid resilience and renewable integration.

Raw inputs of the participants are now structured into clusters to provide a detailed insight to reader:

Behaviour and Culture

- Lack of trust in the public authorities, therefore, lack of trust in any reforms, transitions, policies. Strong believe in the power of nuclear power plant as one solution
- Fear or low awareness of new tech
- Limited citizen engagement in energy projects
- lack of skills and difficulty to spot people that already have them
- not addressing so much the social behavior
- client lack of knowledge and understanding

Market and Finance

- lack of capital (both private and public)
- Lack of incentives
- Macroeconomic regime, pricing infrastructure

Policy and Regulation

- Regulatory changes that bring uncertainty which makes investors more uncertainty
- changing directions/ norms, legal aspects
- Complex procedures and bureaucracy
- Constant Revisions and Integration

Technology and Infrastructure

- Fear or low awareness of new tech
- Limited citizen engagement in energy projects
- lack of consistent, integrated data to support/ show results that back up investments and allow to ask for more

Step 2. SHARED VISION OF DESIRED SCENARIO

The final part of the workshop invited participants to envision desirable futures and enabling conditions for systemic transformation. This exercise aimed to stretch thinking beyond current constraints and identify what capacities, collaborations, or shifts would be needed to unlock change at scale

The visioning exercise highlighted the relation between capacity development and improvement in the energy field. We can summary the visioning stage in these three topics:

Impacts

- Energy Independence: Lithuania aims to be completely energy independent by 2050, producing all electricity and heat from renewable sources, enhancing energy security and achieving climate targets.
- Skillset Evolution: National policies are needed to align private sector, citizens, and government officials with the fast-changing skill set requirements for the energy transition.

Innovations

- Cleantech Integration: Public-private partnerships and funding for cleantech testing and scaling are crucial for electricity and energy integration.
- Digitalization: Digitalizing regulations and integrating them into demo/pilot platforms can streamline processes and align with EU digitalization agendas.

Enablers

- Public Procurement: Targeted use of public procurement can drive cleantech adoption and energy integration across national and regional levels.
- Reskilling Programs: Tailored national programs for reskilling workers, particularly in state-owned or public energy companies, are essential for cleantech adoption.

Step 3. IMPLEMENTATION

Building on the shared vision of a desirable future, participants worked collectively to outline a **high-level roadmap for systemic change**. This final step aimed to translate aspirations into a structured pathway, identifying key milestones, enabling actions, and timeframes to guide the transition from current challenges toward the envisioned scenario.

According to the generated shared vision, participants briefly defined a three-window process to implement the changes and shifts needed to reach the desired scenario:

Timeline for Implementation

Now–2025

- **Quick Wins**: Automatic online permissions and digitalization of regulations can provide immediate benefits and regulatory nudges.
- **Pilot Projects**: Initiating pilot projects for cleantech testing and digitalization can set the foundation for future scaling.

2026–2030

- **Scaling**: Creation of public-private partnerships for large-scale adoption of cleantech and energy integration.
- **Institutional Shifts**: Implementing national programs for reskilling and updating skills in the workforce.

1. **2031–2035**

- **Systemic Transformations**: Establishing energy communities and mainstreaming public consultations to foster trust-based citizen engagement.

Strategic Clusters

Faster Permitting Pathways

- **Digitalization**: Streamlining regulations through digital platforms to reduce permit processing times.

Digital Grid Resilience

- **AI-based Platforms**: Investing in AI-based grid platforms to enhance real-time optimization and data accessibility.

Trust-based Citizen Engagement

- **Public Consultations**: Making public consultations a standard practice to improve integration and engagement with citizens.

Assessment and Prioritization

- **Feasibility**: The proposed strategies are feasible with existing technologies and frameworks.

- **Impact**: These strategies are expected to create systemic change by enhancing energy security, fostering innovation, and improving workforce skills.
  By focusing on these key insights and strategic opportunities, stakeholders can effectively navigate the transition towards a sustainable energy future.

8.2.2 POLICY LAB 2: MOBILITY AND TRANSPORTATION SYSTEM

Step 1. ANALYSIS

Context Analysis

The workshop revealed persistent structural and cultural obstacles hindering the shift towards sustainable mobility across European regions. Despite growing interest in electric vehicles (EVs) and the emergence of mobility-as-a-service (MaaS) models, uptake remains low due to inadequate infrastructure, limited investment, and entrenched car dependency—especially in rural areas and countries like Cyprus, where private car ownership is culturally embedded. Public transport systems are often underdeveloped, particularly in long-haul or maritime logistics, and where monopolistic operators dominate, innovation is stifled.

Conflicts between city, regional, and national planning authorities exacerbate fragmentation, and shared mobility services face safety concerns and social tensions, notably due to poor integration into public space. Data quality, interoperability, and the lack of real-time, user-centric journey planning tools also constrain systemic change. While EV adoption is growing, it is hindered by limited charging infrastructure, suboptimal incentives, and low awareness, especially among middle-income urban populations.

Politically, sustainable mobility reforms face resistance from both citizens and elected officials wary of disrupting comfort and voting patterns.

Raw inputs of the participants are now structured into clusters to provide a detailed insight to reader:

Resistance

- Citizens resist shared solutions due to trust or comfort habits (Latvia)
- Sustainable, shared and active mobility hits resistance among citizens who are also voters and politicians are moving slowly or even against reforms

Infrastructure challenges

- Low market uptake of mobility-as a service due to lack of infrastructure and users volume
- Insufficient investment for cleantech in sustainable mobility (outside components/technologies round EV, there is not a lot of activity in other sustainable transport modes)
- Insufficient development of EV charging infrastructure and e-sharing mobility schemes (e.g.bikes, cars, scooters)

- E-sharing schemes bikes/scooters causing social issues with pedestrians (due to lack of public lanes for safely use the road)
- Insufficient development of low carbon public transport (reduced or no fleet, very few developments in sea transport or long-haul logistics)
- Tensions between city, region and national urban and transport planning (competing priorities or conflicting objectives at different government levels)

Monopoly Issues

- A public PT operator has a monopoly - no incentive to innovate
- Monopoly PT operator reluctant to share the MaaS actorships
- Limited incentives for private investment

Car Dependency

- Car dependency is driven by insufficient public multimodal transport integration.
- Real-time origin-destination matrix and transport choice
- Multimodal journey planner
- Transport model with common data space

Data Quality

- LAT-MaaS+ Latvia Mobility
- Improve mobility data quality

EV Adoption

- Electric vehicle (EV) adoption is rising, supported by state incentives and growing charging networks but limited by lack of knowledge and initiative to change.
- Lack of EV charging infrastructure limits adoption
- Lack of more effective subsidies and incentives for EV (urban median income citizen perspective)

Uncategorized

- Rural areas: usually carrying stuff, so PT is not an option
- One of the major challenges in Cyprus is related to behavioural and cultural factors, particularly the strong car ownership culture. Cyprus has one of the highest car ownership rates in the EU, which leads to significant resistance to modal shift
- Renewable diesel never advertised properly

Identified Barriers

The barriers to advancing sustainable mobility are deeply rooted in mindset, infrastructure, regulation, and political will. Culturally, many citizens remain reluctant to embrace shared or low-carbon transport options due to comfort habits, lack of trust, and limited exposure to alternatives. In rural areas, public transport is often impractical, reinforcing car dependence.

Technologically, the lack of real-time multimodal transport planning tools and poor data interoperability hinders user uptake and system efficiency. In terms of EVs, adoption is constrained by insufficient incentives, lack of knowledge, and inadequate charging networks. On the public transport front, limited fleet development, particularly in underexplored areas such as sea or long-distance transport, is a major barrier. Monopolistic public operators resist sharing roles within MaaS ecosystems, reducing opportunities for private innovation. Politically, there is insufficient boldness to implement radical alternatives, while issues of personal safety, data sharing, and pricing continue to limit the perceived convenience and appeal of sustainable mobility systems.

Raw inputs of the participants are now structured into clusters to provide a detailed insight to read. Please note in this case data can be repeated, as barriers were also detected during the context map and later extrapolated to the barrier exercise:

Mindset

- General mindset

EV Adoption

- Electric vehicle (EV) adoption is rising, supported by state incentives and growing charging networks but limited by lack of knowledge and initiative to change.
- Lack of more effective subsidies and incentives for EV (urban median income citizen perspective)

Public Transport

- Insufficient development of low carbon public transport (reduced or no fleet, very few developments in sea transport or long-haul logistics)
- Citizens resist shared solutions due to trust or comfort habits
- Car dependency is driven by insufficient public multimodal transport integration.
- Rural areas: usually carrying stuff, so Public Transport is not an option
- data legal aspects (shared mobility
- Personal safety to use shared data

Political Resistance

- Political resistance- not enough radical alternatives
- Convenience- is it convenient enough to use it? the pricing, the infrastructure

Step 2. SHARED VISION OF DESIRED SCENARIO

The visioning exercise highlighted the relation between urban, inter-urban and rural space modification and the improvement of the mobility system, and the transformative potential in construction and urban development sectors once barriers are removed. By focusing on job creation, traffic reduction, transport connectivity, infrastructure improvement, health and well-being, social cohesion, and sustainable investment, we can envision a future that is economically vibrant, environmentally sustainable, and socially inclusive. These insights provide a roadmap for stakeholders to collaboratively work towards realizing this future. But, before that, let's summarize the visioning exercise.

Job Creation: The removal of barriers in construction and urban development is expected to lead to substantial job creation. New opportunities will arise in emerging sectors such as e-scooter companies, reflecting a shift towards sustainable and innovative transportation solutions. This expansion will not only increase the number of jobs but also diversify employment opportunities, contributing to economic growth and resilience.

Traffic Reduction: A future with reduced traffic congestion and accidents is envisioned, leading to more car-free public spaces and a decrease in CO2 emissions. These changes will enhance urban liveability and environmental quality, fostering healthier communities and promoting sustainable urban planning.

Transport Connectivity: Improved transport connectivity is anticipated through better business models enabled by data sharing and enhanced multimodal transport systems. Online applications will facilitate seamless connections between various modes of transport, improving efficiency and accessibility for urban dwellers.

Infrastructure Improvement: Investments in infrastructure are expected to significantly boost city economies, as seen in the example of bicycle infrastructure improving city economies by eightfold. Enhanced public transport services, improved air quality, and sustainable interconnections between urban and rural areas will attract more tourists and outdoor activities. Coordinated sustainable transport planning at city, regional, and national levels will ensure safer and more comprehensive Mobility as a Service (MaaS) systems, respecting data privacy concerns.

Health & Well-being: The envisioned future includes better health and well-being for urban populations, facilitated by faster permitting processes and improved urban environments. These improvements will contribute to the overall quality of life and foster healthier communities.

Social Cohesion: Social cohesion is a critical aspect of future urban development, with a focus on creating inclusive communities through initiatives like the "city consortium." This approach will promote collaboration and unity among diverse urban populations, enhancing social bonds and community resilience.

Sustainable Investments: Significant improvements in greenhouse gas emissions reduction, with a target of 40% reduction from transport sources, are expected. There will be a major shift from large transport corporations towards low-carbon transportation solutions, including sea and road logistics. Diversification of private investments, including venture capital, into sustainable mobility solutions beyond electric vehicles and charging infrastructure will drive innovation and sustainability in urban development.

Step 3. IMPLEMENTATION

The envisioned energy system of 2035 aims to create a sustainable and efficient future. The process involves mapping relevant levers and insights on a timeline to identify when and how they could unfold. The centre of the timeline cone serves as a compass, guiding actions that can create the most significant ripple effect. By focusing on these collective signals of change, stakeholders can ground their efforts in shared insights ready to spark action.

Key Insights and Timeline

Now–2025: Quick Wins and Pilots

- **Public Procurers and Private Providers**: Transition from a public monopoly to a collaborative model.
- **Common Mobility Data Space**: Establish a shared data environment to enhance mobility solutions.
- **Mandatory Green Public Procurement**: Implement targets and quotas to promote sustainable mobility solutions.
- **Infrastructure and Regional Connectivity**: Build infrastructure to manage demand flows effectively.
- **Fleet Modernisation**: Electrification and regulation of low-carbon zones to balance demand-supply sustainably.

2026–2030: Scaling and Institutional Shifts

- **Pedestrianised Urban Areas**: Transform key urban areas to prioritize pedestrian movement.
- **Dense Urban Areas with Amenities**: Develop urban spaces with sufficient amenities to support sustainable living.

2031–2035: Long-term Systemic Transformations

- **Improved Public Transport Supply**: Enhance transport schedules and flow to meet future demands.

2. **Strategic Opportunities and Policy Levers**

- **Trust-based Citizen Engagement**: Foster community involvement to drive systemic change.
- **Feasibility and Impact Assessment**: Evaluate clusters based on their potential for high impact and feasibility, prioritizing those that offer significant systemic change.

8.2.3 POLICY LAB 3: BUILT ENVIRONMENT

Step 1. ANALYSIS

Context Analysis

The Lab shed light on the multidimensional challenges hindering the transition to sustainable and circular construction practices in European regions. A major issue is the limited awareness and dissemination of information on building circularity, particularly in rural-urban transition areas where infrastructure struggles to meet population demands. Monitoring systems for evaluating the benefits of sustainable construction are either underdeveloped or poorly implemented, making it difficult to demonstrate impact and value. Despite the potential of digital tools like BIM (Building Information Modelling), adoption is slow due to technical limitations and user reluctance.

The uptake of circular construction practices is further obstructed by a lack of reuse protocols, disincentives for material recycling, and widespread knowledge gaps regarding alternative, eco-friendly materials. Regulatory frameworks, such as Extended Producer Responsibility (EPR), are unevenly implemented across member states, creating an unlevel playing field.

The construction sector remains highly fragmented, with small contractors and insufficient skills in key areas like eco-design, decarbonization, and climate adaptation. Combined with outdated building stock, low innovation capacity, and limited financial support—especially in countries like Lithuania, Bulgaria, and Cyprus—these factors create systemic inertia and constrain scalable progress.

Raw inputs of the participants are now structured into clusters to provide a detailed insight to reader:

Building Circularity Challenges

- Lack of information diffused around the topic of building circularity
- Poorly integrated development between rural/urban; lack of infrastructure while the population is increasing

Monitoring Issues

- Difficulty to monitor benefits
- Gaps in monitoring

Sustainable Construction Barriers

- Circular Building Reuse
- Barriers to adopting sustainable construction materials and circular economy practices

Circular Economy Incentives

- Insufficient use of market creation mechanisms from public and public-private actors.
- Not clear building owners and state of their buildings
- No mandatory practices to preserve or reuse materials on neither level (publicly owners and privately owned buildings)
- No incentives or disincentives to engage into circular activities for builders and investors

BIM Adoption Barriers

- BIM limits (hopefully will be overcome with AI)
- People are reluctant to adopt limits

Climate Adaptation

- Climate adaptation challenges in urban areas
- Old buildings cannot keep up with climate change. Too cold in winter too hot in summer so ac is overused etc.
- Optimization of buildings air monitoring and timed use of AC with temp sensors etc. (e.g. some work buildings are cooling rooms that are not even in use especially in hot summer months.
- Benchmark across Europe needs to be adapted to different contexts/climates

Reuse and Recycling Challenges

- Lack of reuse protocols
- Design limitations not allowing reuse
- No incentive to recycle
- Lack of knowledge or reluctance in using new material (may be more costly) so people struggle to see long term advantages.
- Lack of knowledge of alternative materials and environmental impact
- Not enough of awareness/interest of possibility to reuse materials already now

Extended producer responsibility (EPR) and Skills Gap

- New EPR requirements across Europe, with different transposition at MS levels (e.g. construction waste already implemented in France but not elsewhere), creating uneven playfield.
- Innovation in the building/construction sector is difficult to replicate from one project to another - multiple small contractors in a project makes it difficult to replicate in other projects.
- Serious skills gap in eco-design, decarbonisation, circularity, and climate adaptation and resilience at vocational and professional levels, creates shortages of qualified personnel for cleantech adoption in building and infrastructure projects.

Infrastructures and renovation

- Fragmentation of built environment specialists increase timelines and costs
- Lack of financial support for building renovations (Lithuania, Bulgaria)
- Energy-inefficient buildings and outdated infrastructure (Cyprus, Lithuania, Estonia, Bulgaria)
- Very old buildings

- Low Innovation from governments
- Difficult to scale innovations at similar costs to current materials

Uncategorized

- Smart Energy Retrofit Kits in Bulgaria
- Lack of methods to calculate financial benefits

Identified Barriers

The barriers identified in the workshop span issues of awareness, data, regulation, and capacity. There is a widespread lack of citizen and professional education regarding circular practices and sustainable materials, coupled with insufficient incentives to engage stakeholders across the value chain.

The data–decision gap remains wide: poor access to relevant, context-sensitive benchmarks and inadequate monitoring systems hinder evidence-based decision-making.

Technologically, adoption of tools like BIM is slowed by usability concerns, while innovation diffusion is constrained by fragmented project structures. Regulatory inconsistency—especially in how EPR is transposed across countries—and a perceived overregulation further reduce clarity and initiative.

The absence of clear financial benefits or return-on-investment pathways makes it difficult to attract investment into circular construction, and many stakeholders lack the capacity to calculate or demonstrate long-term value. Critically, the skills gap in climate-resilient building design and execution persists at all professional levels, posing one of the most significant roadblocks to the sector's transformation.

Raw inputs of the participants are now structured into clusters to provide a detailed insight to the reader. Please note in this case data can be repeated, as barriers were also detected during the context map and later extrapolated to the 'identifying barriers' exercise:

Awareness and education:

- Citizen's awareness & education
- People need education and incentives

Information and decisions

- Lack info/awareness (so to engage)
- Benchmark across Europe needs to be adapted to different contexts/climates
- Gap between data and informed decisions - so to take data informed decisions around built environment
- lack of knowledge of alternative materials and env impact

Skills and Technology

- Skilling

- Desynchronization in technology

Regulations and Support

- Uneven playfield- lack of clarity around regulations, standards....and little public support to adopt
- sense of over regulation
- Lack of guided procedures to follow

Sustainability barriers

- Barriers to adopting sustainable construction materials and circular economy practices (Estonia)
- No incentives or disincentives to engage into circular activities for builders and investors
- Very old buildings + low innovations from governments

Uncategorized

- No idea how to maximise return of investment
- Difficult to monitor benefits
- Serious skills gap in eco-design, decarbonisation, circularity, and climate adaptation and resilience at vocational and professional levels, creates shortages of qualified personnel for cleantech adoption in building and infrastructure projects.

Step 2. SHARED VISION OF DESIRED SCENARIO

This stage aims to envision the desired impacts in the construction and urban development sectors once the main barriers and obstacles identified in previous context mapping are removed.

<u>**Governmental Incentives and Social Equity**</u>

Green Building Incentives

- **Transition to Sustainable Practices**: Governmental incentives are proposed to support green building initiatives, effectively transitioning unsustainable construction businesses into sustainable ones. This shift is crucial for fostering environmentally friendly practices and reducing the ecological footprint of the construction industry.

Shelter as a Human Right

- **Universal Access to Modern Shelter**: The vision includes comfortable and modern shelter as a basic human right for all individuals, including residents, refugees, and immigrants. This approach emphasizes inclusivity and social equity in housing policies.

<u>**Indoor Comfort**</u>

Enhanced Living Conditions

- **Improved Insulation and Air Quality**: Better insulation, air quality, and temperature control are highlighted as key factors in enhancing occupant health and comfort. This leads to healthier, more comfortable homes with lower energy bills due to improved thermal efficiency.

Green Jobs and Circular Economy

Employment Opportunities

Creation of Green Jobs: The transition to sustainable practices is expected to create new employment opportunities in green jobs and circular economy sectors. This shift supports economic growth while promoting environmental sustainability.

Energy Efficiency

Economic and Environmental Benefits

- **Lower Energy Bills and Carbon Emissions**: Energy-efficient buildings contribute to reduced operational costs and lower greenhouse gas emissions, aligning with EU climate targets. These buildings also offer increased property value and resilience to climate change impacts, such as heatwaves.

Adaptability and Innovation

Embracing Change

- **Adaptability to Needs and Environment**: The construction industry is encouraged to adopt new approaches and ownership models, fostering adaptability to changing needs and environmental conditions. This includes exploring innovative solutions and promoting a sustainable lifestyle.

Climate Resilience

Preparedness and Risk Management

- **Climate-Ready Infrastructure**: Buildings and infrastructure are envisioned to be climate-proofed, anticipating and enduring climate risks. This includes reducing material use, extending the lifetime of structures, and enhancing the return on investment through circular and decarbonized solutions.

Urban Innovation

Biodiversity and Ecosystem Services

- **Urban Gardens and Green Spaces**: The creation of urban gardens, such as green roofs and facades, is proposed to increase biodiversity and ecosystem services in cities. This initiative supports urban sustainability and enhances the quality of life for city dwellers.

Collaboration and Information Sharing

Stakeholder Engagement

- **Increased Collaboration**: The activity emphasizes the importance of sharing information and best practices among stakeholders in public-private partnerships, industry forums, and non-profit organizations. This collaboration is crucial for aligning national and local policies and enhancing disaster preparedness and adaptive capacity.

Step 3. IMPLEMENTATION

The roadmap for sustainable development in the built environment outlines key actions and steps from 2025 to 2050, integrating insights from stakeholders present in this policy Lab. This document reflects the collective intelligence gathered from this workshop's exercises, emphasizing feasible and impactful changes. It aims to guide the transition towards a circular, decarbonized, and climate-resilient infrastructure

2025-2030: Quick Wins and Regulatory Nudges

Key Actions

- **Pilot Projects**: Initiate pilot projects to validate innovations in the built environment, showcasing successful cases to stimulate further developments.
- **Regulatory Frameworks**: Increase the use of regulations such as the Energy Efficiency Directive and Waste Directive to promote circular material use and extend the lifetime of buildings.
- **Incentives for Retrofitting**: Implement mechanisms to incentivize retrofitting with easy-to-assess improvements, encouraging investments in sustainable practices.
- **Insurance and Guarantees**: Develop insurance and guarantee schemes to support the adoption of climate-resilient solutions.
- **Training Programs**: Launch training programs to reduce skill gaps in cleantech and circular adoption, targeting in-company, vocational, and higher education sectors.

Stakeholder Perspectives

Participants emphasized the importance of regulatory nudges and pilot projects as quick wins to demonstrate the feasibility and benefits of sustainable practices. Stakeholders from the construction industry and educational sectors highlighted the need for training programs to build a qualified workforce.

2030-2035: Scaling and Institutional Shifts

Key Actions

- **Scaling Innovations**: Scale successful innovations and integrate them into existing industry software, such as AI tools for material selection.
- **Institutional Support**: Increase government support for disaster preparedness and adaptive capacity of public buildings and infrastructure.

- **Market Creation Mechanisms**: Utilize public procurement and performance targets to create markets for circular and climate-resilient solutions.
- **Educational Programs**: Develop new educational programs to engage citizens in sustainable practices and increase awareness of cleantech benefits.

Stakeholder Perspectives

Stakeholders from governmental and educational sectors stressed the need for institutional shifts to support scaling innovations. Collaboration across different fields was identified as crucial for optimizing methods and streamlining procedures.

2035-2050: Long-term Systemic Transformations

Key Actions

- **Systemic Transformations**: Implement long-term systemic transformations to ensure fully sustainable and climate-resilient infrastructure becomes the norm.
- **Standardization and Monitoring**: Establish standards, data, and monitoring systems for climate-ready buildings and infrastructure.
- **Secondary Materials Market**: Develop a well-functioning market for secondary materials to support circular economy practices.
- **Policy Development**: Elaborate policies to provide incentives for green building and transition unsustainable construction businesses into sustainable ones.

Stakeholder Perspectives

Participants highlighted the importance of systemic transformations and standardization to achieve long-term sustainability goals. Stakeholders from the construction industry and policy-making sectors emphasized the need for effective policies and market mechanisms to drive systemic change.

Conclusion

The roadmap from 2025 to 2050 outlines a strategic approach to achieving sustainable development in the built environment. By focusing on feasible and impactful actions, stakeholders can drive the transition towards a circular, decarbonized, and climate-resilient infrastructure. Collaboration, regulatory support, and educational initiatives are key enablers for this transformation, ensuring that sustainable practices become the norm across all sectors.

8.2.4 POLICY LAB 4: DATA AND GOVERNANCE

Step 1. ANALYSIS

Context Analysis

This exercise helped surface the deep-rooted governance and data fragmentation issues undermining sustainable transitions in various European contexts. A pervasive lack of trust—between public and private stakeholders, within government ministries, and among citizens—emerged as a central theme, obstructing cooperation and legitimacy.

The data landscape is marked by silos, insufficient integration across sectors and governance levels, and critical gaps in availability, quality, and granularity, especially at the local level. Local authorities often lack the agency, resources, or institutional backing to invest in data infrastructures or lead sustainability initiatives. Policy coordination between national and local levels remains weak, with unclear mandates and fragmented responsibilities. Digital cleantech solutions face limited support and low awareness, alongside unresolved challenges related to data ethics, interoperability, and sensing technologies.

Furthermore, the governance of shared resources such as water is complicated by geopolitical interdependencies and a systemic undervaluation of these goods.

Cross-sector coordination and platforms for dialogue are lacking, and slow permitting procedures, conflicting interests, and short-term political priorities continue to delay systemic action. Tools such as digital twins and smart resilience kits are being piloted, yet scale-up is hindered by disconnected policymaking and limited citizen engagement.

Raw inputs of the participants are now structured into clusters to provide a detailed insight to reader:

Trust Issues

- Lack of trust and alignment among public-private stakeholders
- Low public trust
- Data fragmentation between public agencies
- Partnership models between public, private, and community entities

Cleantech challenges

- Lack of public awareness about cleantech solutions and how to contribute to citizen-science data platforms
- Lack of technologies to sense contaminants
- Insufficient support for market creation of digital cleantech solutions (public good)
- Insufficient interoperability of standards (digital twin) and gaps in data sets (e.g. climate data)
- Insufficient data and studies about negative consequences and rebound effects (economy, society, environment) of digital / deeptech /cleantech solutions.

Policy Coordination

- Lack of policy coordination between national and local levels (e.g. for climate risks assessments or monitoring)
- Fragmented roles and unclear mandates between national/local governments.

Water Governance

- Water-diamond paradox
- Users not paying the real cost of the good (water, elect...)
- Water is often delegated to non-profits or governments (since it's a human right) which are typically slow
- Water is linked to geopolitics, it knows no boundaries, hence the effect in one country may originate from another one. Requires common goals/vision

Regulatory Fragmentation

- Weak cross-sector coordination.
- Multi-level governance & coordination

Funding and ownership

- Lack or limited funding for upscaling & replication
- Lack of centralized databases
- Lack of clear ownership and funding
- Lack of platforms for dialogue

Permitting and interests

- Slow permitting processes
- Conflicting interests
- Readiness

Privacy and ethics

- Privacy and Ethics concerns for data collection
- Elected members prioritise short term goals rather than long term such as sustainability related ones.
- Disconnected policymaking and regulations. Lack of inclusivity (gender, communities and income ranges

Sustainability barriers

- Regulatory complexity and misalignment with EU policies (Bulgaria, Lithuania, Estonia, Finland)
- Barriers to adopting sustainable construction materials and circular economy practices (Estonia)
- Limited public trust and engagement in sustainability policies (Bulgaria, Cyprus, Latvia)
- Lack of reliable data for decision-making in energy and infrastructure (Bulgaria, Cyprus, Finland)

- Need for targeted financial incentives and stakeholder coordination (Lithuania, Bulgaria, Estonia, Cyprus)
- Shifting priorities among funding agencies in light of emerging challenges, e.g., safety

Data Integration

- Need to demystify complexity and extract useful information from data
- Open data innovation hub
- Lack of integrated data (Bulgaria use case)
- Restricted data access
- Lack of national government support to local governments in terms of data collection or sustainability initiatives
- Local authorities' perspectives: difficult to keep up with the investing in data because they don't have the agency

Uncategorized

- Smart flood resilience toolkit
- Urban digital twins

Identified Barriers

Participants identified a constellation of barriers across institutional trust, data infrastructure, governance coordination, and policy alignment. Persistent silos within public institutions and between stakeholders limit transparency and collaborative problem-solving.

Governance structures remain highly fragmented, with overlapping roles and insufficient coordination between national and local authorities, weakening implementation capacity.

Local actors often struggle to maintain and interpret data due to restricted access, inadequate support, and privacy concerns, while also lacking platforms to voice inefficiencies or real challenges.

The misalignment of national regulatory frameworks with EU directives, alongside shifting priorities of funding bodies, creates uncertainty and policy discontinuity.

Additionally, economic signals are distorted by the failure to reflect the real cost of resources like water and electricity.

A critical gap persists in understanding the unintended consequences or rebound effects of digital and cleantech deployments, limiting responsible innovation.

These systemic constraints must be addressed in parallel if data-driven, equitable, and effective climate governance is to be realized.

Raw inputs of the participants are now structured into clusters to provide a detailed insight to the reader. Please note in this case data can be repeated, as barriers were also detected during the context map and later extrapolated to the barrier exercise:

Trust issues

- Silo's working in the ministry/public institutions
- Low public trust
- Lack of trust and alignment among public-private stakeholders.

Governance Coordination

- Lack of policy coordination between national and local levels (e.g. for climate risks assessments or monitoring)
- Fragmented roles and unclear mandates between national/local governments.
- Multi-level governance & coordination
- Weak cross-sector coordination

Data Challenges

- Local authorities' perspectives: difficult to keep up with the investing in data because they don't have the agency
- Fear of data privacy
- Access and quality of data
- Data gaps/level of granularity
- Lack of authenticity to share the real struggles/inefficiencies around their data

Policy Misalignment

- Shifting priorities among funding agencies in light of emerging challenges, e.g., safety
- Limited public trust and engagement in sustainability policies (Bulgaria, Cyprus, Latvia)
- Regulatory complexity and misalignment with EU policies (Bulgaria, Lithuania, Estonia, Finland)

Economic Impact

- Users not paying the real cost of the good (water, elect...)
- Insufficient data and studies about negative consequences and rebound effects (economy, society, environment) of digital / deeptech /cleantech solutions.

Uncategorized

- Slow permitting processes

Step 2. SHARED VISION OF DESIRED SCENARIO

The activity offered valuable insights into the envisioned future for cleantech solutions in the field of Data & Governance, highlighting the pivotal role of data accessibility, interoperability, and governance frameworks in enabling innovation and delivering societal value. By addressing existing barriers and fostering cross-sector collaboration, stakeholders can jointly shape a more sustainable and resilient future.

Envisioned Future for Cleantech Solutions

- **Market Stability and Climate Resilience**

Participants highlighted the importance of achieving market stability and climate resilience through better management of resources. This includes disaster preparedness and adaptive capacity, ensuring that communities are equipped to handle climate-related challenges effectively.

- **Data-Driven Innovation and Governance**

A comprehensive, interoperable data infrastructure is envisioned to support cleantech innovation. This includes standardized data formats, open access to public data, and enhanced data literacy among stakeholders. Better datasets and guidance documents about sustainability and GHG reduction benefits are crucial for informed decision-making.

- **Economic and Employment Opportunities**

The ideal future includes the creation of new green jobs and attracting foreign direct investment and talent through a predictable innovation environment. This economic growth is supported by efficient resource allocation in times of crisis and improved coordination among stakeholders.

- **Inclusive and Integrated Policymaking**

Participants emphasized the need for more inclusive planning and integrated policymaking across sectors. Institutions should shift toward foresight and agile responses, treating all water sources as interconnected and managed together for smoother policy implementation.

- **Trust and Public Engagement**

Building trust through data encryption and anonymity is essential to tackle data privacy concerns. Increased public perception and trust in digital/data-driven cleantech solutions are envisioned, with citizens actively participating in climate monitoring and cleantech platforms.

Changes in People’s Lives and Society

- **Improved Health and Safety**

The envisioned future includes improved health outcomes and safety in public spaces. Access to timely and accurate information will empower individuals and communities to make informed decisions about their environment and well-being.

- **Participatory Ecosystem**

A participatory ecosystem where government, industry, academia, and civil society co-create cleantech solutions is crucial. Efficient and transparent collaboration through public-private partnerships and large-scale demonstrators will showcase the benefits of data-driven solutions.

- **Enhanced Preparedness and Resilience**

Better preparedness to deal with climate risks and hazards is a key aspect of the envisioned future. Data-informed policies and consistent collaborative approaches will ensure that society is resilient and adaptable to changing environmental conditions.

Step 3. IMPLEMENTATION

This document outlines a strategic roadmap for transitioning towards a climate-resilient future through governance and data-driven cleantech solutions. It integrates insights from stakeholders to emphasize feasible and impactful changes categorized into short-term, mid-term, and long-term systemic transformations. The roadmap aims to guide actions from 2025 to 2050, focusing on sustainable transitions and cleantech innovations.

Short-term Actions (2025-2030)

Quick Wins and Pilot Projects

- **Regulatory Nudges**: Implement regulatory frameworks to support cleantech innovations and sustainable data practices.
- **Public Funding and Demonstration Projects**: Increase funding for citizen-led projects focusing on climate monitoring and cleantech solutions.
- **Data Literacy and Education**: Conduct data literacy training in schools and communities to enhance understanding and engagement with climate data.
- **Participatory Culture**: Build traditions of participatory governance across all sectors to foster collaboration and innovation.
- **Cleantech Regulatory Sandboxes**: Introduce environments for testing cleantech solutions under real-world conditions without regulatory constraints.

Enhancing Public Perception and Engagement

- **Transparency and Visibility**: Improve transparency in public works and data accounting to build trust and engagement.
- **Public Awareness Campaigns**: Launch campaigns to inform citizens about the benefits of open data and cleantech solutions.

Mid-term Actions (2030-2040)

Building Resilience and Capacity

- **Disaster Preparedness**: Enhance adaptive capacity and preparedness for climate-related disasters through data-driven strategies.

- **Resource Management**: Implement better management practices for natural resources to improve climate resilience.
- **New Green Jobs**: Foster the creation of green jobs to support the transition to a sustainable economy.

3. **Infrastructure and Policy Development**

- **Interoperable Data Infrastructure**: Develop comprehensive data systems to support cleantech innovation and cross-sector collaboration.
- **Standardized Data Formats**: Establish open access to public data with standardized formats to facilitate data sharing and analysis.
- **Integrated Policymaking**: Promote policies that integrate actions across sectors for a cohesive approach to sustainability.

<u>**Long-term Systemic Transformations (2040-2050)**</u>

Sustainable Ecosystems and Governance

- **Collaborative Ecosystems**: Cultivate ecosystems that support cross-sector collaboration, involving government, industry, academia, and civil society.
- **Networked Governance Models**: Develop governance models that engage diverse stakeholders in decision-making processes.
- **Anticipatory Governance**: Implement foresight and scenario planning tools to anticipate and respond to future challenges.

Technological and Data Innovations

- **AI and Data Ethics**: Establish guidelines for sustainable AI data processing and reinforce data privacy through encryption and anonymity.
- **Predictive Analysis**: Enhance predictive analysis capabilities for climate resilience and decision-making.
- **Space Technologies**: Utilize advanced technologies to monitor environmental changes, such as water levels, beyond current capabilities.

Conclusion

This roadmap provides a comprehensive guide for transitioning towards a climate-resilient future through governance and data-driven cleantech solutions. By implementing these strategic actions, stakeholders can collectively drive impactful changes that ensure sustainability and resilience in the face of climate challenges. The roadmap emphasizes the importance of collaboration, innovation, and data-informed decision-making to achieve these goals.

8.3 CROSS-TOPIC ANALYSIS

8.3.1 READING THE LANDSCAPE: A CROSS-SECTOR VIEW OF CONTEXTS FOR GREEN TRANSITION

Across the four thematic workshops—energy transition, sustainable mobility, circular construction, and data governance—**a shared pattern emerges: systemic inertia in the face of complex, multi-layered change**. While each domain reveals specific dynamics, all are entangled in tensions between innovation and institutional path dependency, social resistance, and fragmented political will.

In the energy transition field, **local resistance to renewable infrastructure coexists with policy fragmentation and limited redistributive mechanisms**. While technologies are available, the governance architecture lags behind: energy communities face regulatory bottlenecks, incentives do not target the most vulnerable, and municipalities lack the tools to steer transformative planning.

In sustainable mobility, car dependency is not only a result of personal habits but a consequence of structural deficits: weak multimodal integration, poor public transport in rural areas, and underdeveloped e-mobility infrastructure. Shared transport schemes encounter not just infrastructural barriers but social ones—comfort, trust, and perceived safety—all of which reduce uptake and weaken political support.

The construction sector suffers from a different kind of lock-in: a fragmented and traditionalist ecosystem, where small contractors dominate, public incentives are vague or absent, and sustainable materials remain marginal. Circular building practices remain aspirational, hindered by lack of reuse protocols, high perceived costs, and the absence of regulatory mandates. Meanwhile, climate adaptation challenges grow, especially in ageing building stock.

Data and governance issues cut across all sectors. Public institutions lack coordination, public-private partnerships are fragile, and local governments often feel disempowered in the digital transition. Trust is low—both in institutions and between actors—complicating everything from data sharing to co-creation efforts. Where data exists, it is fragmented, inaccessible, or not actionable.

A key systemic faultline lies in the vertical and horizontal misalignment between governance levels. Whether it's urban transport planning, climate risk assessment, or water governance, national and local actors often operate in silos or with conflicting mandates. This misalignment is further compounded by the lack of inclusive platforms for dialogue, vision building, and feedback.

In all four domains, there is a chronic mismatch between the ambition of green transition goals and the operational reality on the ground. The speed of digital and technological innovation is outpacing the ability of institutions, businesses, and civil society to adapt and absorb. Consequently, promising pilots often remain isolated successes, unable to scale or influence mainstream policy.

Ultimately, **what emerges is a landscape of opportunity constrained by disconnection**: between citizens and institutions, between policy and practice, and between long-term visions and short-term pressures. Any serious strategy for transition must work across these disjunctions—not just with more investment or better data, but with new forms of governance, trust-building, and cultural transformation.

8.3.2 THE HIDDEN ARCHITECTURE OF RESISTANCE: BARRIERS ACROSS THE GREEN TRANSITION

Despite their thematic differences, all four workshops exposed a set of recurrent barriers that go beyond technical capacity or regulatory gaps. These barriers form a kind of hidden architecture of resistance—rooted in culture, institutions, and the deep design of our systems—which must be addressed for transitions to take hold.

One of the most pervasive obstacles is **governance fragmentation**. Across sectors, there is a striking lack of coordination both within and across government levels. Whether it's fragmented mandates between national and local actors or weak cross-sector coordination, this misalignment leads to inefficiencies, contradictory strategies, and implementation paralysis.

Another common barrier is **the absence of enabling regulatory and financial frameworks**. In construction, circular practices are hindered by the lack of mandatory reuse protocols or fiscal incentives. In mobility, e-sharing schemes lack public investment and are undermined by regulatory ambiguity. In the energy domain, the absence of redistributive mechanisms limits social inclusion. And in data governance, regulation struggles to keep up with privacy and ethical challenges.

The **skills and capacity gap** is a transversal issue. From vocational training in circular construction to technical know-how in local administrations for data management or climate planning, there is a clear shortage of qualified professionals. The cleantech transition is constrained not only by lack of capital but by a lack of people ready to operationalise the change.

Cultural resistance appears in every workshop, albeit in different forms. Citizens resist shared transport options due to comfort or trust issues; builders hesitate to adopt alternative materials due to costs or uncertainty; and local leaders remain wary of participatory data platforms. These resistances are not irrational—they reflect perceived risks, lack of clarity, and insufficient engagement.

Trust, both horizontal (between actors) and vertical (toward institutions), is another silent barrier. Without it, coordination collapses, data sharing halts, and collective decision-making becomes nearly impossible. The lack of inclusive governance processes—especially involving marginalised groups—compounds this challenge, reinforcing perceptions of unfairness or exclusion.

Many barriers are further amplified by **technical limitations** in infrastructure, data availability, or digital interoperability. Without high-quality, integrated data, decision-making remains reactive. Without accessible platforms or common standards, replication and scalability suffer. These are not merely logistical issues—they determine the tempo and trajectory of change.

Finally, **economic and behavioural disincentives** remain deeply entrenched. Fossil-fuel-based habits are often more convenient and cheaper in the short term, while green solutions may require higher upfront costs, complex behavioural shifts, or systemic coordination. Without better incentives, these solutions struggle to compete.

To overcome these barriers, we need more than policy tweaks—we need to rethink how institutions learn, how they relate to people, and how they collaborate across boundaries. The real work of transition is not just technical or economic; it's institutional, cultural, and relational.

8.4 COMPARATIVE ANALYSIS OF POLICY LEVERS

This section presents a two-part exploration of the policy levers identified across the four FINEX Policy Labs—each focused on a critical domain of the green and digital transition: Energy Security and Renewable Integration, Mobility and Transportation, Built Environment, and Data and Governance. The first part outlines the specific policy levers that emerged from each thematic workshop, providing a detailed account of proposed interventions, enablers, and innovation opportunities. The second part offers a cross-cutting comparative analysis, synthesizing common threads, recurring patterns, and complementary approaches. This comparative lens helps to surface systemic insights and alignments that can inform integrated policy design across sectors.

8.4.1 POLICY LEVERS EXTRACTED THROUGH DATA CURATION FROM EACH POLICY LAB.

POLICY LAB 1: ENERGY SECURITY AND RENEWABLE INTEGRATION

Regulation and Policy Making Levers

- **Establish Public-Private Partnerships** to fund and scale cleantech initiatives, focusing on electricity and energy integration. This includes creating tailored programs for reskilling and new skills development, particularly for state-owned or public energy companies.
- **Leverage Public Procurement** strategically to adopt and improve cleantech solutions. Utilize pre-competitive procurement to test innovations and ensure growth in the sector, aligning with national and regional government priorities.
- Additional notes:
    - Use of pre-competitive public procurement of innovation to test/improve cleantech for electricity/energy integration (national government)
    - Improved knowledge exchange systems
    - Consistent, accessible, legible norms and rules to deploy and implement solutions

Education and Training Levers

- **Invest in Workforce Training** to update skills in renewables and digitalization. Develop national policies and programs to align private sector, citizens, and government officials with the fast-changing skillset requirements for the energy transition.
- **Promote Ecodesign and Circularity** for cleantech products, focusing on renewable electricity generation and energy integration. Implement voluntary requirements through information campaigns and technical assistance to avoid rebound effects.
- Additional Notes:

    - Awareness and citizenship education
    - Upskilling and training of workforce in renewables and digitalisation

Digitalization Lever

- **Enhance Digitalization** by integrating regulations into demo/pilot platforms and testing interoperability with existing national databases. This includes digitalizing active laws and running hybrid systems for validation.
- Additional Notes:
    - Digitalize few regulations and integrate into a demo/pilot platform (pilot projects Municipalities).
    - Learn from automatic BIM permit processes. Align with EU digitalization agendas.

Tech Lever

- **Stabilize regulatory frameworks** and grid capacity
- Additional Note:
    - Quick automatic online permissions

Financial Lever

- **Foster public and private investments** in different stages

POLICY LAB 2: MOBILITY AND TRANSPORTATION SYSTEM

Data access Lever

- **Enhancing mobility data quality** and infrastructure.
- Additional Note:
    - Suggestions include improving data quality, infrastructure conditions, and creating designated PT infrastructure for increased speed.

Behavioural change Lever

- **Public transport improvements through digital solutions** like live tracking and predictive analysis to optimize supply.
- **Fleet modernization**
- **Regional interconnectivity**

Institutional innovation Lever

- **Promotion of sustainable mobility** through various strategies: innovation procurement, eco-design requirements, and incentivizing green procurement.
- **Tax incentives** and infrastructure for mobility sharing schemes are also suggested

- Additional notes:
  - Longer term thinking, bold/ radical initiatives and rethinking of business models with different KPI (connected to the vision)

Strategic Lever

- **Multimodal journey planner** and a real-time origin-destination matrix to enhance transport choices.
- **Integration of the other transport modes** (maritime, ...) that are missing today in the political/solution's agenda of clean tech transportation

POLICY LAB 3: BUILT ENVIRONMENT

Regulatory Lever

- **Generation of incentives for sustainable construction**, with calls for governmental incentives and regulations to support green building practices. The goal is to transition unsustainable businesses into sustainable ones, with the help of digital dashboards for monitoring compliance.
- **Incentives for retrofitting** and widely known successful cases are stimulating further innovations.

Innovation Ecosystem Lever

- An **innovation ecosystem** is being developed to support advancements in the built environment.
- **Fostering cross-collaboration** across various sectors to optimize methods and streamline procedures. There's a noted increase in information sharing among stakeholders, which aligns national and local policies

Capacity building Lever

- **Fostering workforce training** to bridge the skill gap in cleantech and circular adoption.
- **Generation of training programs** span in-company, vocational, and higher education, with industry roadmaps outlined

Economy framework Lever

- **Regulatory improvement for the use of circular solutions t**o foster market creation mechanisms. Government support is increasing for disaster preparedness and energy efficiency at the household level.

Technological Lever

- **AI tools** are being introduced to enhance material selection and integration into existing industry software. Educational programs are also being developed to engage citizens

POLICY LAB 4: DATA AND GOVERNANCE

Regulatory Lever

- **Generation of regulatory sandboxes** with an emphasis on AI and Cleantech. This suggests a proactive approach to innovation within regulated environments.

Governance Lever

- **Clean energy governance** with proposals for a digital platform for permitting and a Cleantech Task Force.

Data Lever

- **Trust-building** through encryption, standardized policies, and public awareness campaigns. There's also a push for sustainable data practices, especially in AI.

Stakeholder Lever

- **Generation of framework of collaborative guidelines** to foster inclusive and cross-sector partnerships. The goal is to embed a culture of collaboration within the ecosystem.
- **Development of stakeholder models** is highlighted, with ideas like advisory councils and community ownership models to enhance engagement.

Funding lever

- In the realm of **climate services**, the team is advocating for **increased public funding** and robust datasets to support cleantech solutions and climate resilience.

8.4.2 TOWARDS SYSTEMIC COHERENCE: A THEMATIC COMPARISON OF POLICY LEVERS ACROSS FOUR CLIMATE TRANSITION DOMAINS

The four thematic workshops /Policy Labs—on energy, mobility, the built environment, and data/governance—highlight a range of policy levers to accelerate decarbonization, adaptation, and sustainability. Though each domain operates under distinct technical and institutional conditions, several cross-cutting issues emerge. Below is a comparative synthesis organized into eight thematic dimensions:

1. Regulatory Innovation and Policy Coherence

- **Energy**: Strong emphasis on stabilizing regulatory frameworks and enabling cleantech testing through pre-competitive procurement. Suggests digitizing regulations for better compliance and oversight.
- **Mobility**: Regulatory innovation appears in eco-design, procurement incentives, and modernization mandates (e.g., fleet updates), with additional attention to business model transformation.

- **Built Environment**: Encourages incentives and mandates for sustainable construction. Policy levers focus on retrofitting and regulatory dashboards to monitor impact.
- **Data & Governance**: Pushes regulatory sandboxes and simplified permitting. Stresses policy alignment between national and local levels and regulatory frameworks for AI.

→ *Convergence*: All sectors call for more adaptive, clear, and integrated regulation to de-risk innovation and enable scale.

→ *Divergence*: Energy and data sectors highlight digital regulatory environments; mobility and built sectors emphasize structural reforms and procurement as key levers.

2. Institutional and Stakeholder Collaboration

- **Energy**: Advocates public-private partnerships for innovation deployment, including skills programs.
- **Mobility**: Encourages institutional innovation to rethink KPIs, governance models, and intermodal planning, with emphasis on regional coordination.
- **Built Environment**: Suggests cross-sector innovation ecosystems and better horizontal alignment between government levels.
- **Data & Governance**: Introduces inclusive stakeholder models (e.g., advisory councils), cross-sector partnerships, and a Cleantech Task Force.

→ *Convergence*: All sectors acknowledge fragmented institutional arrangements and propose new governance formats to foster collaboration.

→ *Divergence*: Data & Governance has the most developed models for stakeholder diversity and equity; others focus more on inter-institutional coherence.

3. Digitalization and Data Integration

- **Energy**: Digitalization is treated as both a goal and a tool—embedding law compliance into platforms and improving grid/permitioning systems.
- **Mobility**: Proposes real-time tracking, predictive models, and a multimodal journey planner.
- **Built Environment**: Highlights BIM and AI use in retrofitting and materials selection. Suggests integrating with educational platforms.
- **Data & Governance**: Calls for open data hubs, digital permitting, secure data environments, and policies for AI ethics and privacy.

→ *Convergence*: Digital infrastructure is seen as a critical enabler for resilience and efficiency.

→ *Divergence*: Energy and data sectors invest in system-level integration, while mobility and building sectors focus more on operational applications.

4. Skills, Training, and Capacity Building

- **Energy**: Pushes for national reskilling programs aligned with private sector and citizen needs.

- **Mobility**: Less direct mention but implies workforce needs through fleet modernization and business model change.
- **Built Environment**: Strong focus on education—from vocational to in-company training in circular and cleantech practices.
- **Data & Governance**: Less formal mention but calls for capacity within public agencies and inclusion of community data agents.

→ *Convergence*: All recognize skill gaps as a barrier to innovation uptake.

→ *Divergence*: Built Environment is the most advanced in defining educational pathways and workforce strategies.

5. Finance and Market Creation

- **Energy**: Encourages private-public investment across development stages and targeted cleantech scaling.
- **Mobility**: Suggests tax incentives for green transport and shared mobility, including infrastructure modernization.
- **Built Environment**: Seeks market mechanisms for circular economy practices and energy-efficient retrofitting.
- **Data & Governance**: Advocates public funding for climate services, resilient infrastructure, and trust-enabling datasets.

→ *Convergence*: All sectors recognize finance as both enabler and constraint, calling for better targeted public funds and private leverage.

→ *Divergence*: Data sector focuses on non-market value and public goods; energy/mobility sectors prioritize returns and scale.

6. Technology Enablement and Innovation Ecosystems

- **Energy**: Focus on cleantech testing, rapid permitting, and digital grid stabilization.
- **Mobility**: Promotes technology for tracking, interoperability, and clean vehicle transitions.
- **Built Environment**: Supports AI-enhanced retrofitting, BIM integration, and systemic innovation across fragmented actors.
- **Data & Governance**: Frames innovation as a socio-technical system requiring ethical standards, sandboxes, and open platforms.

→ *Convergence*: All workshops view technology as both a solution and a disruptor requiring safeguards and enablement.

→ *Divergence*: Only Data/Governance systematically addresses ethical, geopolitical, and rebound effects of technology.

7. Monitoring, Metrics, and Impact Assessment

- **Energy**: Recommends improved systems for measuring impact of cleantech rollouts and procurement policies.
- **Mobility**: Suggests real-time OD matrices and behavioural impact tracking.
- **Built Environment**: Emphasizes dashboards to track regulatory compliance and material reuse.
- **Data & Governance**: Highlights data gaps and proposes harmonized metrics across levels of governance.

→ *Convergence*: All sectors are grappling with how to measure systemic transformation.

→ *Divergence*: Built and mobility sectors focus on operational indicators; data sector emphasizes meta-governance and knowledge systems.

8. Equity, Inclusivity and Access

- **Energy**: Inclusivity is addressed indirectly through support for state-owned companies and public workforce reskilling, aiming to avoid leaving behind traditional energy sector workers.
- **Mobility**: Acknowledges disparities in transport access, particularly in rural areas or among lower-income users. Emphasizes the need for intermodality and smart pricing to expand equitable access.
- **Built Environment**: Mentions the need for incentives that are geographically and socioeconomically accessible, though does not explicitly articulate inclusion frameworks.
- **Data & Governance**: Strongest focus on inclusivity, advocating for ethical standards in data collection, gender-sensitive policy making, community ownership models, and participation of underrepresented groups.

→ *Convergence*: All sectors recognize some form of equity challenge—whether in terms of access to infrastructure, services, or participation in the transition.
→ *Divergence*: Only the Data & Governance domain offers a structured and intersectional inclusion strategy. The others, while acknowledging access gaps, tend to frame equity more in economic or geographic terms rather than institutional or structural terms.