D4.1 Policy Recommendations for Regulatory Authorities & Market needs and technology trends for the Industry and SMEs

Delivery Date: April, 2026

Co-funded by the European Union

This project has received funding from the European Union's Horizon Europe research and innovation programme under the grant agreement № 101160145

Deliverable Title	D4.1 Policy Recommendations for Regulatory Authorities & Market needs and technology trends for the Industry and SMEs
Project acronym and N°	SynGRID - Grant Agreement №: 101160145
Contractual Delivery Date	April 2026 (M24 of the project)
Actual Delivery Date	April 2026 (M24 of the project)
Work package	WP4
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Dissemination level	R-PU
Abstract	This deliverable presents policy recommendations for regulatory authorities and actionable guidance for industry, SMEs and research institutions to support the uptake of innovative low-voltage grid and flexibility solutions across Widening countries and less R&I performing regions, with specific focus on Slovenia, Greece and Croatia. Building on a People-Centric Design methodology and stakeholder engagement, the analysis identifies non-technical barriers (regulatory, institutional, market-related) and proposes coordinated measures aligned with the EU regulatory window of 2026–2027.
Keywords	low-voltage grids; flexibility services; regulatory frameworks; Widening countries; SME participation

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Control Versions

Version	Date	Description	Author
V0.0	01.03.2026	ToC definition	Alexandros Chronis (ICCS)
V0.1	25.03.2026	Initial contributions	Alexandros Chronis (ICCS), Jan Jeriha (IRI), Tomislav Antic (FER), Danijel Topic (FERIT)
V0.2	24.04.2026	Final contributions	Alexandros Chronis (ICCS), Jan Jeriha (IRI), Tomislav Antić (FER), Hrvoje Pandžić (FER), Danijel Topic (FERIT), Goran Knezevic (FERIT), Karina Medved Bregar (PETROL), Tomi Medved (IRI), Edin Lakić (IRI)
V1.0	28.04.2026	Ready for review	Alexandros Chronis (ICCS)
V2.0	30.04.2026	Final version	Alexandros Chronis (ICCS), Jan Jeriha (IRI), Tomislav Antić (FER)

Executive Summary

This deliverable, prepared within the SynGRID project, presents a coherent set of policy recommendations for regulatory authorities and actionable guidance for industry, SMEs and research institutions, with the objective of supporting the uptake, deployment and scaling of innovative solutions in low-voltage electricity grids and flexibility services across Widening countries and less R&I performing regions. The analysis is geographically anchored in the three SynGRID target countries (Slovenia, Greece and Croatia) and addresses the structural, regulatory and market-related barriers that hinder the transition from validated research outcomes to real-world deployment.

The work is built on a People-Centric Design approach, adapted from the methodological precedent of the STREAM project to fit the objectives of a Coordination and Support Action. Insights have been gathered through semi-structured interviews, focus groups and workshops with regulatory authorities, distribution and transmission system operators, industry representatives, SMEs and research institutions in the three target countries, and have been cross-validated against partners' direct experience in EU-funded projects. This stakeholder-driven evidence base provides the foundation on which all recommendations rest.

The analysis confirms that the deployment and scaling of innovative low-voltage grid solutions is constrained primarily by non-technical instead of technical factors. Many tools developed in prior Horizon projects have already reached TRL 7–8 and have been validated in real-world pilots, yet their uptake remains limited because regulatory frameworks do not yet provide DSOs with explicit mandates to procure flexibility or with operational provisions for distribution-level flexibility markets, because regulatory authorities are seldom involved in R&I projects despite their pivotal role as decision-makers, because R&I outputs focused on TRLs remain misaligned with market needs centred on commercial readiness and scalability, and because SMEs and industry continue to face persistent participation barriers including administrative complexity, reimbursement-based funding, intellectual property uncertainty and unclear pathways from pilot to market.

On this basis, the deliverable proposes a coordinated set of country-specific measures aligned with the forthcoming EU Network Code on Demand Response and with the obligation for Member States to conduct national flexibility assessments by July 2026 and set indicative flexibility targets by January 2027. For Slovenia, the priority is to establish a clear legal mandate for DSO flexibility procurement, to integrate flexibility into network planning and tariff methodologies, and to create enabling conditions for participation by aggregators and energy communities. For Greece, the focus is on moving from a project-by-project approach to a structured distribution-level flexibility framework, on strengthening the regulatory basis for data access, smart metering and local flexibility participation, and on using the evolving energy communities framework as a strategic vehicle for technology uptake in less R&I performing regions. For Croatia, the deliverable highlights enabling measures around self-consumption, a gradual shift towards capacity-based network tariffs, and the systematic deployment of dynamic and time-of-use tariffs supported by smart metering and regulatory sandboxes. Across all three countries, the recommendations converge on a common need to reposition regulatory authorities as strategic partners in innovation through dedicated staff time, internal innovation units, the use of regulatory sandboxes, structured peer collaboration and the formal integration of project participation into strategic planning documents.

Complementary recommendations are addressed to industry, SMEs and research institutions. Industrial actors are encouraged to establish dedicated R&I units linked to business strategy, to adopt a more selective and impact-oriented approach to participation, and to engage earlier in consortium building and proposal design in order to bridge the gap between research outputs and industrial deployment. Research institutions, particularly those operating in less R&I performing regions, would benefit from stronger administrative and project management capacity, from measures to retain young researchers, and from deeper links with industry. SMEs are advised to prioritise opportunities with clear commercial pathways, to secure intellectual property arrangements before engaging in collaborative projects, to address cash-flow constraints through pre-financing or milestone-based payments, and to progressively build in-house capability to navigate funding programmes. The three Croatian initiatives examined in the document (Nuqleus, the Zagreb Innovation Centre and the European Digital Innovation Hub CROBOHUB++) are presented as concrete reference points for connecting science, industry and SMEs in less R&I performing regions and offer transferable models for similar initiatives elsewhere in Europe.

Taken together, these findings lead to a single overarching message. The transition to a flexibility-enabled, digitally-managed low-voltage grid in Widening countries does not require new technological breakthroughs, it

requires the alignment of regulatory frameworks, institutional capacities and market conditions with the validated solutions that already exist. A coordinated effort along these three dimensions, anchored in stakeholder engagement and timed to the EU regulatory window of 2026–2027, can substantially accelerate uptake while contributing to a more cohesive and inclusive European energy transition.

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1 Introduction

1.1 Purpose of the document

The purpose of this document is to provide a set of policy recommendations and actionable guidance to support the uptake, deployment, and scaling of innovative solutions in the energy sector, with a particular focus on low-voltage electricity grids and flexibility services in less R&I performing regions and Widening countries.

Within the framework of the SynGRID project, this deliverable addresses the systemic barriers that hinder technology uptake in these regions, including regulatory constraints, limited involvement of key actors such as regulatory authorities, and structural challenges affecting the participation of industry and SMEs in research and innovation (R&I) activities.

A central objective of this document is to support technology adoption and innovation diffusion in less R&I performing regions, where gaps in institutional capacity, regulatory readiness, and market alignment often slow down the transition from research outcomes to real-world implementation.

The document builds on insights gathered through stakeholder engagement activities, such as interviews, workshops, and exchanges with regulatory authorities, distribution system operators (DSOs), industry representatives, SMEs, and research institutions while ensuring that the recommendations reflect regional specificities and operational realities.

In this context, the document aims to:

- Identify regulatory and structural barriers limiting technology uptake, particularly in less R&I performing regions;
- Provide targeted policy recommendations to enhance regulatory frameworks and support innovation deployment;
- Address participation challenges of SMEs and industry, including misalignment between R&I funding mechanisms and market needs;
- Propose actionable measures to strengthen collaboration, capacity building, and cross-border knowledge transfer.

Ultimately, this deliverable contributes to the development of more inclusive, adaptive, and region-sensitive policy environments, enabling improved uptake of innovative energy solutions and supporting a balanced and cohesive energy transition across Europe.

1.2 Scope of the document

This document focuses on the formulation of policy recommendations and actionable guidance to support the uptake of innovative energy solutions, with particular emphasis on low-voltage electricity grids, flexibility services, and digitalisation of distribution networks within the context of the SynGRID project.

The scope of the document is geographically centred on Widening countries and less R&I performing regions, with specific reference to the pilot and target regions addressed in the project (e.g., Greece, Croatia, Slovenia). The analysis takes into account regional disparities in innovation capacity, regulatory maturity, and market conditions, which influence the adoption and scaling of new technologies.

The document covers the following key dimensions:

- Regulatory frameworks and policy conditions affecting the deployment of innovative solutions, including barriers related to testing, validation, and scaling (e.g., pilots and demonstrators);
- Technology uptake challenges, particularly in less R&I performing regions, including gaps in institutional capacity, limited involvement of regulatory authorities in innovation processes, and constraints in enabling experimentation environments;
- Stakeholder participation and ecosystem dynamics, with a focus on the roles and challenges of regulatory authorities, industry, SMEs, and research institutions in research and innovation activities;
- Structural misalignments between R&I funding mechanisms and market needs, including issues related to Technology Readiness Levels (TRLs), commercialisation pathways, and the limited market orientation of certain projects.

The document draws on stakeholder engagement activities conducted within SynGRID (interviews, workshops, and collaborative exchanges), as well as insights from related projects and regional experiences, to ensure that the analysis reflects practical, evidence-based perspectives.

The scope of this deliverable does not include detailed technical descriptions of specific SynGRID solutions or pilot implementations. Instead, it focuses on cross-cutting challenges and enabling conditions that influence the broader adoption of innovation in the energy sector.

1.3 Structure of the document

The document is structured to present, in a coherent and progressive manner, the methodological approach, analytical insights, and resulting recommendations developed within the SynGRID project. Following this introductory section, Section 2 outlines the methodology applied in the preparation of the deliverable, including the people-centric design approach, stakeholder engagement activities such as interviews and workshops, and the regional perspective adopted across the target countries.

Building on this foundation, Section 3 provides an overview of the key challenges and needs identified in the energy sector, with particular attention to factors affecting the uptake of innovative solutions, especially in less R&I performing regions, alongside a brief discussion of relevant technology trends. Section 4 constitutes the core of the document, presenting the main policy recommendations for regulatory authorities, with a focus on enabling technology uptake, improving regulatory frameworks for pilots and demonstrators, and reinforcing the role of regulators within the innovation ecosystem.

Subsequently, Section 5 offers actionable recommendations addressed to industry, SMEs, and research institutions, aiming to tackle participation barriers, enhance collaboration, and support the effective exploitation and scaling of results. The document concludes with Section 6, which summarises the main findings and key messages

2 Methodology

2.1 People-Centric Design Approach

The adopted methodology builds on the people-centric design (PCD) approach, a qualitative, stakeholder-driven framework that ensures policy recommendations and capacity-building activities are grounded in the actual needs, barriers, and priorities of the actors they target. Instead of deriving recommendations solely from desk-based analysis, PCD places stakeholders at the centre of the research process, using iterative engagement to validate assumptions and refine outputs.

The PCD approach applied in SynGRID draws on methodological experience from the STREAM project, where a structured user-centric service design methodology was developed and applied across four European pilot sites. In STREAM, the approach followed three interconnected phases: first, development of the user-centric methodology and identification of draft services, second, implementation of co-design activities in pilots through interviews, focus groups, and workshops, and third, analysis of research outcomes, testing, and final definition of consumer and technical services. This iterative structure ensured that service definitions evolved based on empirical stakeholder input rather than predefined technical specifications.

In SynGRID, the PCD approach has been adapted to fit the objectives of a coordination and support action (CSA). While STREAM applied PCD to design flexibility services and tools for energy communities and DSOs, SynGRID applies it to identify barriers to technology uptake, understand the needs of regulatory authorities and SMEs, and formulate policy recommendations that reflect regional specificities. Capacity-building activities within SynGRID are designed through this approach: feedback gained through interviews and focus groups informs how activities are customised for regulatory authorities and SMEs, with a focus on impacting decision-making processes and fostering future collaborations. The rationale for adopting PCD in this context is straightforward. Validated technical solutions for LV grid management, observability, and local flexibility markets already exist from projects as presented in [1]. Various tools have reached TRL 7-8 and have been tested in real-world pilot environments. However, the deployment and scaling of these solutions is constrained not by technical readiness but by regulatory barriers, limited institutional capacity, weak involvement of key decision-makers (particularly regulatory authorities), and misalignment between R&I project outputs and market needs [2]. PCD provides a systematic method for identifying these non-technical barriers through direct engagement with the stakeholders who experience them. A key distinction from purely desk-based policy analysis is that PCD allows the identification of barriers and needs that are not visible in published regulatory documents or project reports.

2.2 Stakeholder Engagement Methods

2.2.1 Overview and methods

The stakeholder engagement activities for this deliverable combine two complementary tracks. The first track draws on engagement already conducted during the landscape assessment phase (WP2) and early capacity-building activities, which provided initial empirical grounding for identifying key barriers and needs. The second track consists of targeted engagement activities carried out as part of the regional capacity-building programme (WP4), specifically designed to refine and validate the policy recommendations and market needs analysis presented in this deliverable.

Three qualitative methods are employed across both tracks:

- **Semi-structured interviews** are conducted individually or in small groups with stakeholders from each target country. Interview protocols cover the following thematic areas: (i) experience with regulatory frameworks affecting LV grid innovation, (ii) barriers to technology uptake in the respondent's operational context, (iii) experience with or perception of EU-funded R&I projects, and (iv) specific needs and expectations regarding policy support. The semi-structured format allows for consistent thematic coverage while enabling respondents to raise issues not anticipated in the protocol.
- **Focus groups** bring together stakeholders from complementary roles (e.g., DSO representatives with SMEs, or regulators with technology providers) to facilitate exchange on shared challenges. These are particularly effective for identifying systemic issues that individual actors cannot fully articulate in isolation, such as coordination gaps between regulatory processes and innovation timelines.

- **Workshops** are conducted as part of SynGRID's regional capacity-building activities (WP4) and showcase events (WP5). These serve as knowledge dissemination and structured feedback collection on policy needs and market conditions.

The choice of these methods is consistent with the PCD approach described in Section 2.1 and follows the methodological precedent set by the STREAM project, where a similar combination of interviews, focus groups, and co-creation workshops was used to define consumer and technical services across pilot sites [3].

All engagement activities follow established ethical procedures. Participation is voluntary, and informed consent is obtained in advance. Where needed, participants receive information sheets outlining research aims, methods, implications, and their right to refuse or withdraw. Where applicable, pseudonyms or codes are used to protect the identity of respondents, particularly when sensitive information about organisational practices or regulatory positions is shared.

2.2.2 Targeted stakeholder groups and strategies per country

The engagement targets the following groups, identified during the project design phase and refined during WP2 and WP5 activities. For each country, specific organisations have been identified as primary targets.

2.2.2.1 Regulatory authorities and public bodies

In **Slovenia**, the primary targets are the Energy Agency (Agencija za energijo), as the national regulatory authority (NRA) responsible for network tariffs and market oversight, and the Ministry of the Environment, Climate and Energy (MOPE), responsible for energy policy and legislation including the Energy Act (ZOEE). In **Croatia**, engagement targets the Croatian Energy Regulatory Agency (HERA) and the Ministry of Economy and Sustainable Development. In **Greece**, the Regulatory Authority for Energy, Waste and Water (RAAEW, formerly RAE) and the Ministry of Environment and Energy are the primary interlocutors. These actors are central to enabling or constraining the deployment of innovative energy solutions, particularly through regulatory frameworks, tariff methodologies, and licensing procedures. A recurrent finding from SynGRID's initial activities is that regulatory authorities are key decision-makers for technology deployment but are often not included as active participants in Horizon Europe or similar R&I projects [2].

2.2.2.2 Distribution System Operators (DSOs)

In Slovenia, the engagement targets SODO d.o.o. (the national DSO responsible for network operation) and the five regional distribution companies (Elektro Celje, Elektro Gorenjska, Elektro Ljubljana, Elektro Maribor, Elektro Primorska). In Croatia, HEP-ODS (the national distribution system operator) is the primary target. In Greece, DEDDIE/HEDNO (the Hellenic Electricity Distribution Network Operator) is the counterpart. DSOs are the primary operators of low-voltage networks where flexibility solutions, observability tools, and local market mechanisms are deployed. Their input is essential for understanding operational constraints, planning processes, and the practical feasibility of proposed policy measures.

2.2.2.3 Transmission System Operators (TSOs)

Where relevant, Transmission System Operators (TSOs) are engaged to address the coordination dimension between distribution-level flexibility and national-level balancing markets. In Slovenia, this concerns ELES d.o.o., in Croatia, HOPS and in Greece, IPTO/ADMIE. TSO-DSO coordination is a critical topic for local flexibility market design, and therefore activities engaging both DSOs and TSOs are targeted.

2.2.2.4 Industry and SMEs

In Slovenia, the engagement targets technology integrators with pilot experience (such as Petrol d.d., a SynGRID consortium partner with direct experience from COMPILE and X-FLEX pilot implementations) as well as broader SMEs in the energy technology sector. In Croatia, industrial engagement focuses on companies where innovation capacity is weaker and prior involvement in Horizon projects has been limited. In Greece, the focus is on technology providers and SMEs active in the Region of Attica (EL30). The engagement aims to understand barriers to participation in EU-funded projects, misalignment between TRL-focused project outputs and market needs, and the conditions required for effective technology uptake and scaling.

2.2.2.5 Research institutions

The SynGRID consortium itself includes key research partners: IRI UL (Slovenia), ICCS/NTUA (Greece), FER (Croatia), and FERIT (Croatia). As participants in multiple Horizon projects, these institutions provide both methodological input and insights into the challenges of translating research outcomes into policy-relevant recommendations and market-ready solutions. FERIT is of particular interest as it represents a research institution from a less R&I performing region (Slavonia) with no prior Horizon project involvement, offering a distinct perspective on the barriers faced by such institutions.

2.3 Data Collection and Analysis

The data collection process for this deliverable is based on a qualitative, stakeholder-driven approach, drawing on multiple sources of input to capture both practical experiences and systemic challenges related to the uptake of innovative energy solutions. Data has been collected through a combination of semi-structured interviews, workshops, focus groups, and continuous exchanges with project partners, complemented by insights derived from partners' prior experience in relevant EU-funded projects and national contexts.

Stakeholder engagement activities involved key actors across the energy innovation ecosystem, including regulatory authorities, distribution system operators (DSOs), industry representatives, SMEs, and research institutions. These interactions were designed to elicit perspectives on regulatory barriers, participation challenges, technology uptake constraints, and gaps between research outcomes and market deployment, with particular attention to the conditions prevailing in less R&I performing regions.

The collected data has been analysed using a thematic analysis approach, allowing for the systematic identification of recurring patterns, challenges, and enabling factors across different stakeholder groups and regional contexts. Inputs from various activities were consolidated and categorised into key thematic areas, such as regulatory frameworks, stakeholder participation, market alignment, and innovation deployment barriers.

To ensure robustness and consistency, findings were further validated through cross-comparison between stakeholder groups and SynGRID partners' experience and project-level observations. This process enabled the identification of both common challenges and context-specific issues, particularly those affecting Widening countries.

Based on this structured analysis, the identified themes were translated into actionable recommendations and policy suggestions. This translation process focused on linking observed challenges to concrete intervention points, ensuring that the recommendations are:

- evidence-based, reflecting stakeholder input;
- targeted, addressing specific barriers and actors;
- action-oriented, providing clear directions for regulatory authorities and other stakeholders.

Overall, this approach ensures that the recommendations presented in this deliverable are grounded in empirical insights and practical experience, while maintaining relevance to broader policy and regulatory discussions at European and national levels.

3 Policy Recommendations for Regulatory Authorities

3.1 Regulatory Frameworks

3.1.1 EU regulatory context

As the penetration of distributed generation, especially rooftop photovoltaic (PV), electric vehicles (EVs), heat pumps, and storage systems increases, the LV distribution grid faces growing congestion, voltage management challenges, and limited observability. These challenges are particularly acute in rural and semi-urban areas, where grid infrastructure is often weaker and upgrade cycles longer, and are especially pronounced in less R&I performing regions where institutional capacity to respond is more limited.

Despite the legal framework established by Directive (EU) 2019/944 [4], which requires DSOs to procure flexibility services through market-based mechanisms under Article 32, implementation across Member States remains uneven. The CEER report on NRA approaches [5] to Article 32 derogations (November 2025) confirms that many countries are still operating through pilots, not established frameworks. The SmartEN [6] Market Monitor (2025 edition) similarly confirms that DSO flexibility markets are in early stages across most of Europe, with a growing number of trials but limited commercial markets. A significant regulatory development is now approaching ACER submitted its proposal for an EU network code on demand response to the European Commission in March 2025. [7] Once adopted, this code will mandate market-based procurement of flexibility services by DSOs and TSOs, introduce harmonised prequalification procedures, and establish DSO-TSO coordination requirements. Member States are also required to conduct national flexibility assessments by July 2026 and set indicative flexibility targets by January 2027. This impending change makes it particularly timely for all three SynGRID target countries to begin developing their enabling frameworks proactively without waiting for mandatory transposition.

3.1.2 Common challenges across target countries

Against this evolving EU regulatory backdrop, the three SynGRID target countries (Slovenia, Greece and Croatia) exhibit a shared set of structural challenges, but each country is at a distinct stage of regulatory maturity. The following subsections examine the situation in each country in turn, identifying both the common patterns that justify a coordinated EU-level response and the country-specific gaps that require tailored national action.

Slovenia's electricity distribution system operates within a regulatory framework that was primarily designed for passive network operation and infrastructure-based solutions. The distribution network is operated by SODO d.o.o. as a public utility service, with five regional companies (Elektro Celje, Elektro Gorenjska, Elektro Ljubljana, Elektro Maribor, Elektro Primorska) maintaining the physical infrastructure. The Energy Agency (Agencija za energijo) serves as the national regulatory authority, responsible for setting network tariffs and overseeing market operation. The electricity market is organised by Borzen d.o.o., which manages the Slovenian Balance Scheme. Slovenia transposed key provisions of Directive (EU) 2019/944 [4] and Directive (EU) 2018/2001 [8] through the Act on Electricity Supply (ZOEE, 2021). These transpositions established a legal basis for energy communities, active customers, and collective self-consumption. However, the ZOEE and the associated grid codes and tariff methodologies do not currently provide DSOs with an explicit legal mandate to procure flexibility services or to engage in local flexibility markets as part of their operational toolkit [9]. As a result, flexibility remains an underutilised resource in Slovenia, even where it could offer cost-effective and faster alternatives to traditional grid reinforcement. The situation was identified as a key barrier in SynGRID's regulatory gap analysis [2], and stakeholder engagement activities confirmed that the lack of regulatory clarity around DSO flexibility use is the primary obstacle to deploying the tools and market mechanisms developed in prior projects.

A first recommendation for **Slovenia** is to **establish a legal mandate for flexibility procurement** and define the DSO's role as a neutral market facilitator. The ZOEE and/or secondary regulatory acts should be amended to explicitly permit DSOs to contract flexibility services from distributed generation, demand response, storage, and aggregators as an alternative to traditional grid reinforcement [9]. The framework should define the conditions under which flexibility may be used, establish DSOs as neutral procurers with functions focused on identifying system needs and ensuring fair access for third-party providers, and introduce legal safeguards for non-discriminatory market access and transparent publication of procurement criteria. This is consistent with the unbundling principles of Directive (EU) 2019/944 and with the position that DSOs should be able to select from multiple flexibility mechanisms depending on network context. **A second recommendation** is to **integrate**

flexibility into network planning and align tariff methodologies accordingly. DSOs should be required to assess flexibility as a genuine alternative during investment planning, including through non-wires alternatives analysis. Article 32(3) of Directive (EU) 2019/944 [4] already requires network development plans to consider alternatives to system expansion, with validated research outcomes already demonstrating how this can be operationalised for LV grid scenarios [1]. Tariff methodologies should also ensure that flexibility procurement costs are recognised as legitimate regulated expenditures, consistent with Article 32(2) of the Directive, which establishes that DSOs shall be adequately remunerated for such services. Extending the Energy Agency's current focus beyond capital expenditure to cover operational flexibility costs is necessary to remove the existing incentive asymmetry [9]. Local flexibility markets must additionally be coordinated with national balancing markets through updated grid codes establishing interoperability standards and coordination procedures between DSOs and ELES [9]. **The third recommendation** is to create **enabling conditions for market participants**, ensuring the framework is accessible to a broad range of actors including smaller and community-based ones. Regulation should establish transparent, technology-neutral participation criteria and introduce a national digital registry of flexibility assets to streamline pre-qualification, metering verification, and settlement, in line with the European registry concept proposed in the ACER network code. The aggregator role should be fully defined, enabling independent aggregators to operate without requiring supplier consent in line with Directive (EU) 2019/944, as implementation remains incomplete in Slovenia. Network tariff structures should not penalise flexibility activations: where participation delivers measurable system benefits, participants should be exempt from adverse tariff impacts or appropriately compensated. Finally, energy communities should be formally recognised as flexibility providers, with specific rules allowing them to aggregate members' assets and access local markets under simplified conditions. The COMPILE project's experience in Luče provides validated evidence that community-level aggregation is technically feasible and delivers measurable grid benefits.

While Slovenia's main challenge lies in transforming an existing legal foundation into operational mandates for flexibility procurement, Greece faces a comparable but distinct set of issues centred on the transition from project-based piloting to systematic deployment.

In the Greek context, a key policy priority is to create a more enabling framework for the uptake of innovative solutions at the low-voltage and distribution-grid level, where the practical impacts of decentralised renewable generation, electrification and flexible demand are increasingly concentrated. Greece already has important enabling elements in place: the distribution framework is anchored in Law 4001/2011[16], the reform of Law 4951/2022 simplified and digitalised parts of the grid-connection process and introduced a legislative framework for electricity storage, and Law 5037/2023 [10] transposed key provisions of Directive (EU) 2018/2001 [8] and Directive (EU) 2019/944 [4], including the updated framework for energy communities. However, for technologies such as local flexibility services, demand response, dynamic pricing, storage coupled with renewable energy sources (RES), and digital low-voltage grid management, the regulatory environment still needs to evolve from basic legal enablement to operational deployment at scale. This is particularly relevant in less R&I performing regions, where innovation capacity is weaker and distribution-grid constraints can more easily delay uptake.

A first recommendation is therefore to move from a project-by-project approach to a distribution-level flexibility framework that explicitly values services delivered close to the grid edge. Past and ongoing R&I projects have highlighted the added value that enabling frameworks could provide. For example, work in the RE-EMPOWERED project highlighted, in the Greek island context, the need for a framework supporting energy storage and demand-side response, the possibility to connect RES together with flexible assets in saturated areas, and the use of regulatory sandboxes to test innovative tariff designs and integration schemes before they are embedded in standard regulation. Those lessons are highly relevant for SynGRID as well, even beyond islands, because low-voltage congestion, voltage deviations and limited observability are increasingly common in mainland distribution networks with growing shares of rooftop PV, heat pumps, EV charging and active consumers. A practical policy direction for Greece would be to allow DSOs and the regulator to pilot non-wire alternatives (such as local storage, controllable demand, smart EV charging and flexibility aggregation) as regulated tools for resolving local constraints where conventional reinforcement is slower or more expensive.

A second recommendation is to strengthen the regulatory basis for data access, smart metering and local flexibility participation. At EU level, the electricity framework under Directive (EU) 2019/944 already recognises active customers and citizen energy communities, while the 2024 electricity market design reform further reinforces the role of flexibility and enables Member States to introduce flexible connection agreements for TSOs and DSOs. For Greece, this implies that technology uptake in low-voltage grids should not focus only on hardware

investments, but also on the regulatory conditions for data-sharing, customer participation and remunerated flexibility at distribution level. In practice, this could support a more structured pathway for local flexibility markets or flexibility procurement schemes led by the DSO in clearly defined congestion or voltage-management areas.

A third recommendation is to use Greece's evolving framework for energy communities more strategically as a vehicle for technology uptake in weaker innovation regions. Under Greek law, the newer framework established by Law 5037/2023[10] builds on the earlier Law 4513/2018[17] model and reflects the distinction between Renewable Energy Communities and Citizen Energy Communities under EU law. This creates an opportunity to move beyond communities as mainly self-consumption actors and to integrate them more systematically into local flexibility, storage and low-voltage optimisation schemes. At the same time, prior analysis for Greece has shown that bureaucracy, repeated legislative changes and limited support capacity can disadvantage smaller local actors. For SynGRID's purposes, this supports a broader recommendation: less R&I performing regions need not only funding opportunities, but also simplified procedures, technical assistance, and protected testing environments so that municipalities, SMEs and community-based actors can participate in pilots and early deployment without facing the same administrative burden as large market players.

In Croatia, the regulatory debate has reached a particularly timely juncture: the national regulator HERA has recently opened a structured public consultation on the development of self-consumption from renewable sources. The following analysis draws on the issues identified in that consultation, which align closely with the priorities of the SynGRID project.

In Croatia, The Republic of Croatia is actively advancing its energy transition, characterised by a continuous and significant increase in the share of renewable energy sources (RES) within its national energy mix. Historically, Croatia has maintained a robust foundation in renewable generation due to its high share of hydropower and has successfully managed the large-scale integration of wind energy over the past decade. Currently, PV represents the leading technology in the new investment cycle, with a rapid increase in installation connection requests at both the utility and prosumer levels.

The Croatian power system is fully unbundled, consisting of independent entities including the Transmission System Operator (HOPS), the Distribution System Operator (HEP ODS), as well as competitive producers and suppliers. Within this decentralised structure, the Croatian Energy Regulatory Agency (HERA) plays a pivotal role. HERA is responsible for defining and supervising the regulatory framework, ensuring that all methodologies, grid rules, and legislative acts are harmonised with both national objectives and EU directives. While this established framework provides a solid basis for market operations, the rapid integration of decentralised RES and the application of new concepts in distribution networks present evolving challenges that require continuous regulatory refinement and modernisation. In light of these evolving challenges, HERA has recently initiated a public consultation process for the document titled "Incentive framework for promoting and facilitating the development of self-consumption of energy from renewable sources". This comprehensive document provides a detailed overview of existing regulatory barriers and proposes strategic measures to streamline the integration of decentralised energy sources. Within this deliverable, we will highlight several key segments of this framework that are most relevant to the objectives and implementation of the SynGRID project.

Current levels of **self-consumption** of electricity from renewable energy sources remain constrained by a combination of structural, regulatory, and market-related barriers that jointly limit wider uptake and active participation of consumers. A key challenge lies in insufficient awareness and understanding among both citizens and market actors regarding the concept of self-consumption and its role within the broader energy transition. This often leads to suboptimal investment decisions, unrealistic expectations, and, ultimately, reduced trust in the system when anticipated benefits are not fully realised.

At the institutional level, the absence of a coherent strategic framework for the development of different self-consumption models results in fragmented implementation and limited coordination across stakeholders. This is further exacerbated by insufficient administrative capacity, lack of specialised expertise, and weak inter-institutional cooperation, which together reduce the ability of public bodies to effectively support and guide consumers.

The legal and regulatory framework represents another significant barrier. Existing provisions are often unclear, inconsistently applied, or insufficiently adapted to national circumstances, creating legal uncertainty and limiting practical implementation. Frequent changes, lack of detailed guidance, and misalignment between different legislative areas further complicate participation and discourage investment.

Administrative procedures also present a major obstacle, as they are frequently complex, time-consuming, and insufficiently transparent. The need to interact with multiple authorities, combined with a lack of clear guidance and standardised processes, increases both the administrative burden and associated costs for consumers.

Technical constraints additionally limit the expansion of self-consumption. These include insufficient grid capacity, limited deployment of advanced metering infrastructure, inadequate data availability, and the overall lack of readiness of system operators to support more complex and decentralised energy flows. Delays and inconsistencies in connection procedures further hinder new installations.

Finally, economic and financial barriers remain highly relevant. Access to support schemes is often complicated, while existing financial instruments are not sufficiently tailored to the needs of small-scale consumers. At the same time, regulatory uncertainty regarding tariffs, fees, and the valuation of surplus electricity reduces investment security. The absence of clear market-based signals and comprehensive impact assessments also raises concerns regarding fairness, cost allocation, and potential cross-subsidisation.

Taken together, these barriers highlight the need for a more coherent, transparent, and supportive framework that integrates regulatory clarity, institutional capacity, technical readiness, and appropriate economic incentives in order to unlock the full potential of self-consumption in the energy transition.

The current **tariff framework for electricity transmission and distribution** in Croatia is broadly aligned with European structures, however, several challenges limit its effectiveness in supporting the energy transition and the increasing role of distributed energy resources. Tariff systems are designed to ensure the sustainable operation of the power grid by balancing economic viability with technical stability, while distributing network costs among users.

A key structural issue lies in the misalignment between tariff design and actual cost drivers. Existing models rely heavily on volumetric components based on energy consumption, while network costs are largely driven by capacity requirements. This can lead to distortions in cost allocation and does not fully reflect the impact of different users on the system. In addition, certain tariff elements, although already provided for under existing methodologies, are not yet operationally implemented, such as charges for electricity injected into the grid.

Regulatory complexity further constrains the system. The allocation of tariff elements across different legal acts reduces transparency and limits flexibility in adapting the framework to decentralised and more dynamic energy systems. At the same time, legacy mechanisms such as net metering and implicit benefits for specific user groups may result in unequal cost distribution and potential cross-subsidisation, particularly as self-consumption increases.

Technical limitations also play a role. The insufficient deployment of advanced metering infrastructure restricts the implementation of more sophisticated tariff elements, such as peak-based or time-of-use pricing, while limited data availability constrains the development of dynamic and location-based signals.

To address these challenges, future tariff development should focus on a gradual shift toward capacity-based structures, full implementation of existing tariff elements, and simplification of the regulatory framework. In parallel, unjustified exemptions should be progressively phased out, while ensuring a predictable transition for existing users.

Finally, further development should be supported by a comprehensive cost-benefit analysis of distributed energy resources, ensuring that tariff systems remain fair, transparent, and aligned with long-term energy policy objectives.

The implementation of **dynamic pricing contracts and time-of-use (ToU) tariffs** offers significant potential for improving system flexibility and more efficient network use. However, their wider deployment faces several structural and regulatory barriers.

A key challenge is the lack of a clearly defined and harmonised methodology for determining the value of electricity (e.g., average unit prices for injected or withdrawn energy), which leads to non-transparent and inconsistent practices across suppliers. In addition, market concentration and the limited availability of dynamic contracts, particularly for household customers, further constrain uptake.

For ToU tariffs, main barriers include insufficient deployment of smart metering infrastructure, absence of systematic pilot testing through regulatory sandboxes, and the complexity of implementing dynamic tariff structures that require advanced forecasting, Information and Communication Technology (ICT) systems, and

timely access to consumption data. There is also a risk of uneven cost allocation, as customers unable to shift consumption patterns may be disproportionately affected.

Key enabling measures include clearer methodological rules for price calculation, stronger incentives for suppliers to offer dynamic contracts, accelerated rollout of smart meters, and the use of regulatory sandbox environments for controlled pilots. In the transition phase, a combination of static ToU tariffs and explicit flexibility procurement appears to be the most pragmatic and robust approach.

The country-level analyses above describe the regulatory environment as observed from a policy standpoint. To complement this view, the next subsection presents the perspective of market actors operating within these frameworks: actors whose investment decisions and operational choices ultimately determine whether the regulatory ambitions translate into deployed solutions.

3.1.3 Market players' perspective

From the perspective of electricity market participants, SynGRID's objectives are closely aligned with long-standing industry calls for a predictable, market-based and technology-neutral flexibility framework. At policy level, organisations such as EURELECTRIC, representing the European electricity industry, where Petrol is an active member with vice-presidency role in the national section at the Energy Chamber, consistently emphasise that demand response, storage and other flexibility providers must be able to participate in electricity markets on an equal footing with generation, without undue regulatory or administrative barriers. However, insights from project implementation confirm that these principles are not yet fully reflected in practice.

Market players highlight the importance of avoiding a purely reactive transposition of forthcoming EU rules on demand response and instead encourage Member States to proactively shape national frameworks adapted to local system needs. From an industry standpoint, the current timeline (national flexibility needs assessments by July 2026 and a binding Network Code on Demand Response around 2027) represents a critical window for testing and refining market arrangements.

Petrol's experience in Horizon projects such as COMPILE and X-FLEX supports this view. In these projects, pilot flexibility solutions were often developed faster than the surrounding regulatory frameworks, leading to uncertainty around roles, procurement models and long-term revenue streams. Early clarification of national rules, particularly regarding the interaction between TSOs, DSOs and aggregators, would significantly reduce implementation risk and improve the investment case for flexibility solutions once pilots transition towards deployment.

EURELECTRIC's strong preference for market-based procurement of flexibility is echoed by market participants involved in SynGRID. Experience from demonstrations shows that where flexibility is procured through transparent, competitive mechanisms, it is easier for both industrial consumers and solution providers to assess value, price risk and operational implications. Conversely, poorly designed rules-based schemes risk crowding out innovative solutions or creating uncertainty over remuneration.

This reinforces SynGRID's focus on evidence-based recommendations: lessons from pilots demonstrate that flexibility markets function best when price signals reflect actual system needs and when procurement mechanisms are stable enough to support business planning beyond the project lifetime.

A recurring concern raised by market players, including Petrol, is the need for technology neutrality, particularly in national implementations of EU-level rules. Market participants warn that narrowly defined eligibility criteria may unintentionally exclude batteries, hybrid assets or industrial demand-side solutions. From Petrol's operational perspective, flexibility often emerges from complex, integrated assets, not single-purpose technologies. In several project pilots, flexibility could only be delivered through hybrid configurations combining load control, storage and digital platforms. Regulatory frameworks that do not recognise such configurations risk limiting participation and undermining the scalability of solutions tested in several projects.

National flexibility assessments must go beyond a compliance exercise and be embedded in market design and network planning. Industry experience confirms that assessments only create value if they translate into concrete procurement signals and bankable revenue opportunities.

Projects involving Petrol have shown that uncertainty about whether identified flexibility needs will lead to actual procurement remains a major barrier to sustained industry engagement. National regulators and system

operators must be able to design, operate and supervise increasingly complex market arrangements. From a market perspective, the regional capacity-building activities envisaged under SynGRID are therefore not ancillary, but central to ensuring consistent and efficient implementation.

3.2 Incentives and Recommendations for Regulatory Authorities

Regulatory authorities are pivotal decision-makers within the innovation lifecycle, however, they are frequently underrepresented during the core stages of research and development (R&D) projects. This is particularly evident in complex domains such as smart grids and the green and digital energy transition, where regulatory alignment is essential for large-scale deployment.

Their limited involvement is often rooted in structural and institutional constraints. Routine administrative responsibilities are rarely reduced to accommodate research commitments, and as public sector entities, they operate within fixed budgetary and salary frameworks where traditional financial incentives have limited impact.

Furthermore, a persistent misalignment exists between the research community's focus on academic Key Performance Indicators (KPIs) and regulatory bodies' prioritization of legal certainty, system reliability, and implementability. From a regulatory perspective, many initiatives are perceived as technically advanced but insufficiently aligned with operational and legislative realities, which can reinforce institutional inertia and limit proactive engagement.

To address these challenges and position regulatory authorities as strategic partners in the green and digital transition, a targeted incentive and recommendation framework is required, aligning institutional mandates with project-driven innovation while ensuring tangible policy relevance.

1. **Institutional Advancement and Policy Influence**

   Participation in research initiatives provides regulators with early insight into emerging technologies such as smart grids, distributed energy resources, digital platforms, and data-driven energy systems. This enables authorities to anticipate regulatory needs and develop adaptive frameworks that support innovation while ensuring system stability and security.

   Active engagement in European projects also allows regulatory authorities to contribute to the development of harmonised standards and guidelines, ensuring that national regulatory approaches remain aligned with the evolving European energy landscape.

2. **Mitigation of Operational and Workload Barriers**

   Sustainable engagement requires explicit organisational measures that address workload limitations. Without such adjustments, participation in research projects remains an additional burden, not an integrated institutional activity.

   Dedicated allocation of staff time for project participation should be formally recognised within institutional planning and workload distribution frameworks. This includes ensuring that experts involved in projects are relieved from a clearly defined share of their routine responsibilities in order to contribute effectively and consistently.

   In parallel, the provision of resources for temporary staffing support or structured internal task redistribution is essential to maintain continuity of core regulatory functions while enabling meaningful engagement in project activities. Such measures reduce operational pressure and ensure that participation does not compromise institutional performance.

   The establishment of specialised coordination structures, including dedicated innovation or research units within regulatory bodies, further strengthens continuity, knowledge retention, and institutional learning. These structures can act as focal points for project participation, ensuring alignment with strategic priorities and facilitating engagement across multiple initiatives.

   In addition, the use of controlled pilot environments, such as regulatory sandboxes, enables authorities to test new regulatory approaches, digital solutions, and market models in a supervised and risk-managed setting. This supports iterative, evidence-based policy development and reduces uncertainty associated with implementation.

   Finally, structured collaboration with peer regulators and institutions across the European Union facilitates access to tested regulatory approaches and shared experiences. This exchange of best practices reduces

duplication of effort, accelerates learning, and supports the harmonised adoption of innovative solutions across jurisdictions.

3. Professional Development and Institutional Capacity Building

Non-financial incentives play a critical role in motivating public sector experts. Participation in international projects provides access to cutting-edge knowledge, interdisciplinary collaboration, and exposure to different regulatory and market models.

In the context of smart grids and digital energy systems, this includes strengthening expertise in areas such as data governance, interoperability standards, cybersecurity, and system integration.

Providing staff with opportunities to engage in complex and forward-looking topics enhances professional development, supports talent retention, and strengthens the overall institutional capacity to respond to emerging challenges.

4. Financial Alignment and Access to Knowledge

Favorable funding conditions for public institutions significantly reduce barriers to participation in European projects. External funding enables regulatory authorities to engage in analytical and strategic activities that would otherwise be difficult to prioritize within national budgets.

Equally important is access to shared knowledge, data, and technical expertise generated within projects. This supports more informed regulatory decision-making and reduces reliance on external or fragmented sources of information.

Participation in European partnerships and joint initiatives further enhances alignment between national priorities and broader European policy objectives in the energy transition.

5. Strengthening the Translation of Research into Regulation

To ensure relevance, research activities must be closely aligned with regulatory needs from the outset. Early and continuous involvement of regulatory authorities in project design is essential to ensure that outputs are applicable within real regulatory and market contexts.

Concrete mechanisms should be established to translate project results into regulatory practice. These include the development of implementation guidelines, testing of regulatory approaches through pilot environments such as sandboxes, and validation of solutions against existing legal frameworks.

Clear pathways for uptake should be defined to ensure that project outcomes contribute to regulatory updates, market design improvements, and system-level transformation.

6. Incentivizing Long-Term Engagement and Strategic Positioning

Sustained participation requires formal recognition at the institutional level. Engagement in research and innovation projects should be integrated into strategic planning documents and organisational objectives.

Defining measurable indicators, such as contributions to regulatory innovation, participation in European working groups, or implementation of project results, supports accountability and demonstrates institutional value.

Strengthening the visibility of regulatory contributions within projects also reinforces their role as key actors in enabling the green and digital transition, not solely as compliance authorities.

By reframing participation in smart grid and energy innovation projects as a strategic instrument for institutional strengthening, regulatory authorities can move from reactive oversight to proactive system shaping. This ensures that technological innovation is supported by adaptive, forward-looking regulation that safeguards reliability, sustainability, and public interest.

3.3 Recommendations for the RA from SMEs

Feedback from SMEs highlights several structural and procedural barriers that limit their ability to effectively participate in innovation ecosystems and EU-funded programmes.

A key recommendation relates to simplifying and clarifying funding mechanisms. Although SMEs are generally aware of available national and EU incentives, including instruments implemented through national bodies such as HAMAG-BICRO in Croatia, the application process is often perceived as overly complex, administratively

burdensome, and difficult to navigate without specialised support. This creates dependency on external consultants, introducing additional costs and risks for SMEs, as consultants are compensated regardless of project success. SMEs therefore recommend clearer guidelines, simplified procedures, and direct support from programme authorities to reduce reliance on intermediaries.

Another critical issue concerns the financial structure of incentives. The prevalent reimbursement-based funding model creates significant cash flow challenges, as SMEs must first finance activities upfront before receiving support. SMEs recommend introducing pre-financing mechanisms or milestone-based payments to improve liquidity and make participation more feasible.

SMEs also emphasise the need for improved communication and outreach. While funding opportunities exist, programmes such as Horizon Europe are often communicated in highly technical or institutional language that does not resonate with SMEs focused on short-term commercial outcomes. More targeted, plain-language communication is needed to clearly explain the benefits, expectations, and practical aspects of participation.

From a regulatory perspective, SMEs highlight the importance of aligning research funding with market realities. There is a perceived gap between research outputs and their commercial applicability, with projects sometimes focusing on theoretical frameworks that lack practical implementation pathways. Additionally, long project timelines and delays between call publication and project start reduce the relevance of outcomes in fast-moving sectors. SMEs recommend faster funding cycles and stronger emphasis on measurable commercial results.

Finally, SMEs stress the importance of clear intellectual property frameworks, well-defined roles within projects, and fair collaboration structures. Without clarity on IP ownership and tangible benefits, SMEs are reluctant to commit resources to collaborative projects.

4 Actionable Recommendations for Industry, SMEs and Research Institutions

Regulatory reform alone, however, is not sufficient to unlock technology uptake. Even the most enabling regulatory framework would fail to deliver impact if the actors expected to develop, deploy and scale innovations (industry, SMEs, and research institutions) face structural barriers to participation in research and innovation activities. Section 4 turns to this complementary dimension, presenting actionable recommendations addressed to these three groups, building directly on the engagement activities and stakeholder feedback gathered within the SynGRID project.

4.1 Recommendations for increasing the industry's participation in research projects

4.1.1 Challenges of Industry participation

Despite strong policy support for greater industry involvement in research and innovation, private-sector participation remains below its potential. Evidence from project implementation that emerged also through workshops and events organised within the SynGRID project suggests that three barriers are particularly persistent across sectors and countries, including Slovenia, Croatia and Greece. Petrol as a representative of the industry actors, participating in research projects, has exposed challenges they face with through the respective associations at national and the EU level in light of reflecting industry's views in preparing national/EU calls/tenders.

Firstly, administrative complexity remains a primary deterrent for industry participation. European research programmes are frequently characterised by extensive proposal preparation, detailed reporting requirements and strict compliance rules. For companies, these obligations entail non-negligible internal costs and divert key personnel away from core business activities, particularly where participation is not aligned with immediate business priorities.

Recent EU policy discussions linked to the next Multiannual Financial Framework and the proposed Competitiveness Fund explicitly acknowledge this challenge and commit to reducing administrative burden and

improving accessibility for industry participation in future framework programmes, what Petrol and other industry representatives see as an important incentive for industry involvement in future research programmes.

A second structural barrier is the persistent gap between research outputs and industrial deployment. Many collaborative projects deliver results at intermediate Technology Readiness Levels, leaving companies to carry the cost and risk of further development, system integration and commercial scaling. While research projects can generate valuable proofs of concept or pilot-scale solutions, internal decision-making typically requires clear evidence of operational robustness, integration with existing systems and regulatory acceptance. Where these elements fall outside the scope of the research project, continued industrial engagement becomes difficult to justify from a business perspective, even if the underlying innovation is promising.

Regulatory uncertainty significantly influences innovation decisions in infrastructure-intensive sectors. When future regulatory frameworks, technical standards or compliance requirements are unclear or evolving, industry is hesitant to invest resources in research activities whose outcomes depend on those frameworks. Policy uncertainty weakens the business case for sustained private-sector engagement in R&I. Closely linked to this is data governance. Industrial actors such as Petrol, that is also a critical infrastructure per national respective laws, operate under strict internal data-security and confidentiality rules. In collaborative research settings, concerns around data sharing, protection of commercially sensitive information and control over background knowledge remain a material constraint. Internal data-security and compliance functions play a decisive role in determining what operational or customer-related data can be shared within research consortia. Even where collaboration is strategically supported, data-sharing arrangements must be carefully assessed to avoid regulatory or commercial risk. This can limit the scope of experimentation or delay project execution unless clear governance frameworks are in place.

4.1.2 What is needed

To address the limited participation and often passive involvement of industrial actors in EU-funded research and innovation (R&I) projects, a set of organisational, strategic, and operational measures can be adopted by companies to better align project engagement with their core business objectives.

A first key recommendation is the establishment of dedicated R&I or EU projects units within industrial organisations. However, such units should not function solely as administrative support structures for proposal writing and project management. Instead, they should be strategically positioned to:

- identify project opportunities that are directly aligned with the company's business roadmap and market priorities;
- facilitate internal coordination between technical, commercial, and innovation teams;
- systematically monitor project outcomes and assess their potential for integration into products, services, or operational processes.

To be effective, these units should operate with clear performance indicators, such as contribution to new product development, access to new markets, or enhancement of technological capabilities, moving beyond participation rates or funding secured.

Beyond organisational structures, companies should adopt a more selective and impact-oriented approach to participation.

Industrial actors should prioritise initiatives where:

- the expected outcomes are closely linked to market needs;
- there is a credible pathway towards commercialisation or deployment;
- their role goes beyond demonstration and allows for active co-development and influence on project direction.

A further recommendation is to strengthen internal mechanisms for knowledge transfer and exploitation. One of the recurring challenges identified is that results from EU projects often remain isolated within project teams and are not effectively disseminated within the organisation. To address this, companies can:

- establish internal processes for capturing and evaluating project results;
- promote cross-departmental knowledge sharing;
- systematically review successful use cases and best practices emerging from EU projects and assess their applicability to core business activities.

In addition, industrial actors should seek to engage more actively in the early stages of project design, including consortium building and proposal development. Early involvement allows companies to:

- shape project objectives in line with real market demands;
- ensure that planned activities reflect practical implementation constraints;
- position themselves in roles that maximise strategic value, rather than purely technical or peripheral contributions.

Companies can also benefit from developing long-term partnerships and stable collaboration networks with research institutions, SMEs, and other industrial actors. Moving away from ad hoc participation towards more strategic alliances can improve efficiency, reduce entry barriers, and enhance the quality and relevance of project outcomes.

Finally, there is a need for companies to adopt a more market-oriented perspective within R&I projects, actively bridging the gap between Technology Readiness Levels (TRLs) and market readiness. This includes:

- allocating internal resources to support post-project exploitation and scaling;
- integrating pilot results into commercial development pipelines;
- evaluating participation not only in terms of innovation output, but also in terms of business impact and return on investment.

Overall, increasing industry participation in EU R&I projects requires a shift from a funding-driven approach to a strategy-driven engagement model, where participation is closely linked to business objectives, internal capabilities, and long-term innovation positioning.

In addition to the organisational and strategic measures outlined above, further actions can be considered to strengthen both the level and quality of industry participation in EU-funded R&I projects.

A key aspect is the adoption of more flexible and progressive participation models, allowing companies to engage with reduced initial commitment and scale their involvement as the value of the project becomes clearer. This can include participation in more focused roles (such as pilot validation, use-case provision, or advisory contributions) before committing significant internal resources. Such an approach can lower entry barriers, particularly for companies with limited prior experience in EU projects.

Moreover, companies are encouraged to adopt an investment-oriented perspective when engaging in R&I projects. Participation should be treated as a strategic innovation investment, assessed against internal criteria such as expected business impact, contribution to product development, and alignment with long-term market positioning. This shift can support more informed decision-making and ensure that participation generates tangible value.

To further enhance impact, companies should establish clearer internal pathways linking project outcomes to commercial exploitation. This includes identifying, at early stages, which project results have the potential to evolve into products or services, assigning internal ownership for their development, and allocating resources for post-project scaling activities. Without such mechanisms, there is a risk that valuable outcomes remain confined within project boundaries and are not translated into business applications.

Another important dimension is the use of EU projects as platforms for strategic market intelligence and positioning. Participation can provide access to emerging technological trends, evolving regulatory frameworks, and potential future partners. Companies can leverage this exposure to inform their strategic planning, explore new markets, and strengthen their position within the broader innovation ecosystem.

Furthermore, companies should define more clearly what constitutes active and meaningful participation within projects. This includes taking on roles that enable influence over project direction (such as leading use cases, contributing to system design, or actively shaping exploitation strategies) rather than limiting involvement to peripheral or administrative tasks.

Finally, industrial actors can benefit from aligning their participation in EU projects with broader market expansion and partnership strategies. By engaging in projects that involve target markets or strategic regions, companies can test solutions in different regulatory environments and build long-term collaborations. In this context, structured partnerships with SMEs can also play a valuable role, enabling access to specialised technologies and fostering more agile innovation processes.

4.2 Recommendations for increasing the Research Institutions participation in research projects

Research institutions are central actors in the European research and innovation ecosystem, both as generators of new knowledge and as partners that translate scientific results into solutions of practical relevance for industry, public authorities and society. In the energy sector specifically, universities and research centres play a particularly important role in developing and validating the digital, control and market-design tools needed for the transition to a flexibility-enabled, decentralised low-voltage grid. Their effective participation in EU-funded research and innovation programmes is therefore essential for ensuring that scientific advances reach the deployment stage and contribute to the goals of the European Green Deal and the energy transition.

Across Widening countries and less R&I performing regions, however, research institutions face structural conditions that limit the scale and competitiveness of their engagement in EU-funded calls. These conditions reflect a combination of institutional, national and individual factors, ranging from administrative capacity and human resources to the broader incentive structures that shape academic careers. The recommendations developed within SynGRID address these factors in a coordinated way, recognising that meaningful improvement requires action at all three levels.

The following section discusses these challenges in more detail and proposes targeted recommendations to strengthen the participation of research institutions in EU-funded programmes. The analysis combines general patterns observed across Widening countries with concrete evidence from the Croatian context, where the experience of the Faculty of Electrical Engineering, Computer Science and Information Technology Osijek (FERIT), engaged within SynGRID, provides a representative illustration of how these challenges manifest at the institutional level.

For example, one of the underlying factors reducing motivation among researchers in Croatian research institutions to actively pursue EU-funded projects is related to the structure of their remuneration and employment conditions. In many cases, researchers employed at public institutions receive stable salaries financed from the state budget, which are largely independent of their involvement in externally funded projects. Unlike in some other European systems, participation in EU projects does not significantly increase individual income, as financial incentives are limited or regulated. As a result, the additional effort required for preparing complex proposals, managing administrative obligations, and ensuring project delivery is not matched by corresponding personal benefits. This creates a misalignment between institutional expectations and individual motivation, where researchers may prioritize core teaching or research duties over engaging in demanding and highly competitive EU funding schemes. Consequently, without stronger performance-based incentives or more flexible remuneration frameworks, the willingness to invest time and effort into project applications may remain limited.

4.2.1 Challenges in Research Institutions

Research institutions across Widening countries and less R&I performing regions face a recurring set of structural challenges that limit their ability to participate competitively in EU-funded research and innovation programmes. Although the manifestation and intensity of these challenges vary by country, several patterns emerge consistently from stakeholder engagement carried out within SynGRID and from comparable evidence collected in prior Horizon projects.

A first general challenge concerns administrative and project-management capacity. Many research institutions in less R&I performing regions operate with project offices that are understaffed relative to the volume and complexity of EU-funded calls, particularly for large-scale Horizon Europe and infrastructure projects. The administrative burden associated with proposal preparation, consortium agreements, financial reporting and audit compliance often falls disproportionately on academic staff, who must combine these duties with teaching and research obligations.

A second challenge concerns human resources and talent retention. Attracting and retaining early-career researchers, particularly doctoral and postdoctoral candidates in technically intensive disciplines, is increasingly difficult, as short project durations and salaries that are not always competitive with industry reduce the attractiveness of academic careers. This is particularly acute in disciplines such as electrical engineering, ICT,

energy systems and computer science, where industry demand is high and where private-sector employers are able to offer guaranteed pathways from study to employment.

A third challenge concerns the alignment of incentives and remuneration. In many national systems, researchers' salaries are largely funded from the state budget and do not vary substantially with participation in externally funded projects. Consequently, the additional effort required by EU project participation is not consistently matched by individual financial or career-progression rewards, which weakens the underlying motivation to engage with demanding international funding schemes.

A fourth challenge concerns proposal preparation capacity and access to consortia. Institutions in less R&I performing regions frequently depend on limited internal funding to support networking, travel and proposal development, and they often join consortia in junior or partner roles rather than as coordinators. This limits both the volume and the strategic reach of their participation.

It is indicative to observe the performance of Croatian research institutions which is shaped by systemic constraints within the broader national innovation system, where fragmented governance, rigid implementation mechanisms, and gaps between research and market needs limit overall effectiveness. Although recent progress has been made, persistent structural weaknesses continue to hinder the transition towards a knowledge-based, innovation-driven economy. These challenges affect both the quality of research outputs and the ability of institutions to participate competitively in international research programmes.

A central issue is the inefficiency of research funding and output. Although R&D expenditure has increased over time, it remains below the EU average and does not result in a proportional scientific impact. Evidence shows that Croatia has one of the lowest ratios of citations relative to R&D spending in Europe, indicating limited investment effectiveness and insufficient incentives for high-quality research. Historically, funding allocation mechanisms based on past expenditures rather than performance have further weakened incentives for excellence and innovation.

Institutional fragmentation is another major constraint. The research system comprises numerous small public research organisations, many with limited staff and overlapping research areas. This fragmentation leads to inefficiencies in resource allocation, reduced critical mass, and weak internal collaboration, ultimately affecting the ability to compete in large-scale international projects. At the same time, limited international cooperation remains a significant weakness, with a large share of scientific publications produced without foreign collaboration, reducing visibility and integration into global research networks.

Human capital challenges further constrain institutional performance. Despite relatively strong participation in higher education, the system faces skill mismatches, brain drain, and insufficient alignment with labour market needs. Many researchers lack opportunities for professional development and exposure to international research environments, which limits their ability to engage in competitive and interdisciplinary projects.

Weak links between academia and industry significantly reduce the impact and relevance of research activities. Collaboration levels remain low, with limited business funding for research and insufficient incentives for commercialisation. Differences in priorities between academic institutions and firms, combined with underdeveloped technology transfer capacities, further hinder the translation of research into marketable innovations. Addressing these challenges requires coordinated reforms to strengthen governance, improve funding mechanisms, and foster stronger collaboration across the innovation ecosystem.

4.2.2 Actionable recommendations

Addressing these challenges requires a combination of institutional, national and EU-level measures. At the institutional level, expanding dedicated project-management staff at faculty and university level, investing in internal digital tools for proposal preparation, project monitoring and knowledge sharing, and providing structured training on EU funding instruments are concrete actions that can reduce the administrative load on researchers and improve proposal quality.

At the national level, strengthening the availability of junior research and development assistant positions, providing more flexible employment frameworks for early-career researchers, and ensuring that participation in EU projects is recognised in academic career-progression criteria can help retain talent and align incentives with international engagement. National funding schemes dedicated to proposal preparation (covering networking, travel, consultancy and pre-proposal feasibility work) also play an important role, particularly for large-scale and infrastructure projects.

At the EU level, the dedicated Widening instruments under Horizon Europe (including Teaming, Twinning, ERA Chairs and Hop-On) provide structured vehicles for capacity building when used strategically and integrated into institutional development plans not treated as one-off opportunities. Strengthening strategic partnerships with industry and with research institutions in EU14 Member States further improves proposal competitiveness, increases access to consortia, and enhances the long-term impact of research activities.

A practical implementation of the recommendations would be the strengthening the participation of research institutions such as FERIT in EU-funded projects, which requires targeted and practical measures addressing both administrative and human capacity constraints. A key priority is the expansion of institutional support structures through the recruitment and training of dedicated project management staff at both faculty and university levels. This should be complemented by continued development of internal digital tools for project monitoring and knowledge sharing, enabling more efficient coordination and reducing administrative burden on researchers.

In parallel, improving human resource capacity is essential. Introducing more flexible employment mechanisms for young researchers, along with increased availability of development assistant positions, would help retain talent within academia. Competitive incentives, including career development opportunities and stronger links between research and industry, should be further promoted to make academic careers more attractive.

Finally, targeted financial support for proposal preparation, particularly for large-scale and infrastructure projects and should be enhanced through national and institutional funding schemes. Strengthening strategic partnerships with industry and international partners can further improve proposal quality, increase access to consortia, and enhance the long-term impact of research activities.

4.2.2.1 FERIT's example

The Faculty of Electrical Engineering, Computer Science and Information Technology Osijek (FERIT) continues to face persistent challenges in strengthening its capacity for participation in EU-funded research projects, with many of the issues identified earlier, remaining largely unresolved. Administrative capacity represents a key constraint, as the Office for International Cooperation, Scientific and Research Projects currently operates with only two staff members, which is insufficient given the growing number of project proposals and ongoing projects. Although FERIT has attempted to mitigate this limitation through subcontracting external administrative services and developing internal digital tools for project monitoring, these measures are not sufficient to address the increasing complexity and scale of projects, particularly large infrastructure initiatives.

At the same time, human resource constraints significantly affect project implementation capacity. While academic staff are actively engaged in both ongoing and newly prepared projects, attracting and retaining young researchers, particularly doctoral and postdoctoral candidates, remains a major challenge. Short project durations and comparatively lower salaries make research positions less competitive than employment opportunities in industry, especially in high-demand fields such as electrical engineering, ICT, and computer science. This situation is further intensified by strong industry demand, where many top students receive company-sponsored scholarships with guaranteed employment, limiting the pool of candidates available for academic research roles.

The need to strengthen institutional capacity is therefore closely linked to broader structural issues in the national system, particularly the limited availability of development assistant positions funded by the Ministry of Science and Education. Expanding such positions would not only support research activities but also address teaching demands, especially in technically intensive programmes requiring extensive laboratory work. While FERIT provides limited internal funding to support proposal preparation (primarily for networking, travel, and consulting), its capacity to finance large-scale infrastructure project development remains highly constrained. Overall, enhancing both administrative and human resource capacities is essential for improving FERIT's competitiveness and sustainability in EU-funded research programmes

4.3 Building Cross-Border Partnerships

The challenges faced by industry and research institutions described above converge on a single practical question: how can stronger, more competitive consortia be assembled when preparing proposals to EU-funded

calls? The following section addresses this question directly, drawing both on the lessons learned within SynGRID and on examples of good practice from the wider innovation ecosystem.

Improving the quality and competitiveness of proposals requires a more strategic approach during the preparation phase, with particular emphasis on the formation of well-balanced and complementary partnerships. The composition and alignment of the consortium are critical factors influencing both the evaluation outcome and the long-term impact of the project.

A key success factor is the development of strategic partnerships that go beyond formal consortium requirements. Project consortia should be built around complementary roles, shared objectives, and clear value creation pathways. Strong partnerships typically include a balanced mix of research institutions, industrial actors, SMEs, and relevant stakeholders such as regulatory authorities or system operators, each with clearly defined contributions linked to the project's objectives.

Early engagement of partners is essential. Involving key stakeholders (including industry and end-users) at the concept development stage allows for better alignment of project objectives with real market needs and operational constraints. This contributes to more realistic work plans, stronger impact sections, and increased commitment from partners throughout the project lifecycle.

Cross-border collaboration can further enhance proposal competitiveness by enabling knowledge exchange between regions with different levels of innovation capacity. In particular, partnerships between more advanced regions and less R&I performing regions can facilitate capacity building, transfer of best practices, and more effective localisation of solutions, which is strongly aligned with the objectives of Widening instruments. However, such collaborations should be structured to ensure active involvement and meaningful contributions from all partners, avoiding imbalances where certain partners remain marginal.

To strengthen proposals, consortia should also ensure the inclusion of actors with a clear pathway to implementation, such as distribution system operators (DSOs), technology providers, or municipalities. Their involvement increases the credibility of the proposal by demonstrating the feasibility of testing, validation, and potential deployment of the proposed solutions.

Beyond consortium composition, additional measures can further improve proposal quality:

- Clear definition of roles and value propositions: Each partner should have a well-defined role linked to specific outputs and expected impact, avoiding overlaps or vague contributions.
- Integration of exploitation and business perspectives from the outset: Proposals should demonstrate how results will move beyond pilot stages, including preliminary considerations on commercialisation, scalability, and market uptake.
- Alignment with regulatory and policy frameworks: Early consideration of regulatory conditions can strengthen the relevance and feasibility of the proposed solutions, particularly in the energy sector where regulatory constraints are significant.
- Use of existing networks and long-term collaborations: Building on established partnerships can improve coordination efficiency and increase trust among partners, while also enhancing the credibility of the consortium.

Furthermore, successful consortia often invest additional effort in proposal co-creation processes, including iterative discussions, alignment workshops, and internal reviews prior to submission. This helps ensure coherence across work packages, consistency between technical and impact sections, and a shared understanding of project objectives. Finally, improving competitiveness requires a shift from viewing proposals as funding applications to treating them as strategic project blueprints. This implies that proposals should be designed not only to meet evaluation criteria, but also to deliver tangible value for all partners, particularly in terms of innovation uptake, market relevance, and long-term collaboration.

4.3.1 Examples of good practice

Beyond the structural recommendations above, three concrete examples from the Croatian innovation ecosystem illustrate how the gap between research, industry and SMEs can be bridged in practice. Each of the three initiatives described below addresses a different stage of the innovation pathway (venture building, early-

stage incubation, and digital transformation) and together they offer a practical reference for similar initiatives in other less R&I performing regions.

4.3.1.1 Nuqleus: A Deep-Tech Venture Builder for Science-Industry Integration

The name Nuqleus is derived from the Latin nucleus meaning core or essence and represents the fundamental drive to transform scientific excellence into market-ready innovation. To strengthen applied research and support the transfer of knowledge from academia to industry, the Faculty of Electrical Engineering and Computing (FER) founded the Nikola Tesla Innovation Centre (ICENT) in 2015 and the startup incubator SPOCK in 2016. Building on six years of experience during which SPOCK supported over 125 participants and saw 30% of its recent startups successfully raise over €100,000, ICENT has leveraged this expertise to launch Nuqleus as a specialised deep-tech venture builder. Nuqleus serves as a strategic bridge within the rapidly growing Croatian high-tech ecosystem where success stories like Infobip, Rimac, and Gideon have already established a global presence. By aligning with the New European Innovation Agenda and capitalising on new funding opportunities such as the €40 million EIF/HBOR fund for scientific commercialisation and the European Digital Innovation Hub (EDIH) Crobohub++ initiative, Nuqleus provides a structured framework for innovation. Its primary mission is to foster more efficient collaboration between research institutions, industry, and startups, ensuring that scientific discoveries solve real-world social and industrial problems. Beyond networking, Nuqleus actively showcases the immense research capacity of FER, which encompasses 12 departments and over 250 active projects, to potential industrial partners. It moves beyond traditional academic boundaries by identifying problems worth solving directly from the industry and addressing them through scientific expertise.

The core of this initiative is the Nuqleus Startup Builder, a comprehensive 12-month program that begins each December and is designed to guide projects from initial ideation to industry partnership. The first phase, spanning from December to March, focuses on connection and validation. Participants engage in the Emerging Science bootcamp to master market opportunity navigation and design thinking while working with mentors on intellectual property, market research, and public speaking. This phase culminates in a presentation before the Scientific Committee, which selects the top ten teams to advance.

The second phase runs from April to June, focusing on structured education and development planning. Selected teams participate in weekly workshops led by top-tier mentors from successful startups, covering essential topics such as business development, prototyping, and investment readiness. This stage concludes with the Nuqleus Demo Day at the Liftoff event, where progress is presented to the program's Investment Committee. The final phase, occurring from July to December, is reserved for projects with the highest market potential. In this stage, the focus shifts to personalized support, offering individual guidance on product development, customer acquisition, and brand building to ensure the scientific results achieve successful commercial exploitation.

4.3.1.2 ZICER – Zagreb Innovation Centre

The Zagreb Innovation Centre (ZICER) represents a premier example of best practice in fostering organic startup growth and building market resilience while serving as a key instrument for the Small and Medium Entrepreneurship Development Program of the City of Zagreb. By employing a well-rounded approach to turn innovative high-tech ideas into strong and successful companies, ZICER allows founders to focus entirely on their core development while the institution manages the complexities of the entrepreneurial ecosystem. Its primary mission is to expand the production and technological capabilities of the city by attracting modern, high-clean, and profitable technologies. This support begins at the most fundamental level through ZICER Plavi ured, which provides specialised workshops and individual consulting sessions aimed at demystifying entrepreneurship for anyone interested in starting a business venture. By providing essential business, technical, and educational services, ZICER lowers the barriers to entry and ensures that high-potential ideas are not lost due to initial knowledge gaps.

The institution acts as a vital link between science, innovation, and the market, facilitating the transfer of knowledge from research institutions to industry. This is achieved by attracting capable experts and allowing them to realize their entrepreneurial ideas, specifically assisting young professionals who wish to operate independently or in cooperation with existing businesses after graduation. ZICER offers a structured developmental path that caters to the specific lifecycle stage of each venture. For individuals and teams without a registered company, the three-month Pre-incubation Program serves as a free foundational phase designed to

help innovators become entrepreneurs. Once an entity is established, it transitions into the Incubation Program, where startups benefit from a subsidized pricing model. This financial flexibility allows startups to reinvest their limited resources back into product development and team expansion, fostering a sustainable growth trajectory in line with the city's strategic goals.

In addition to physical infrastructure and consulting, ZICER operates intensive six-month acceleration programs from June to December. These programs offer a comprehensive experience featuring intensive bootcamps, hands-on workshops, and personalized mentoring from an experienced team. Participants benefit from networking events, in-kind support, and significant financial incentives, including the opportunity to compete for a share of a 300,000 EUR prize pool. All participating teams have the chance to receive an initial 5,000 EUR at the start of the program, with maximum financial support reaching up to 50,000 EUR per startup. The program culminates at the Zagreb Connect startup conference, where founders showcase their progress and pitch their solutions, fully integrating them into Croatia's largest startup community and connecting them with global opportunities.

4.3.1.3 EDIH CROBOHUB++

The European Digital Innovation Hub CROBOHUB++ represents a benchmark of best practice in strengthening industry and society through the Digital Europe Program (DIGITAL), an EU initiative designed to place digital technology at the core of business and public services. As one of only four such hubs established in Croatia within a network of over 150 centers across Europe, CROBOHUB++ serves as a vital non-profit mechanism for micro, small, and medium-sized enterprises (SMEs), small mid-caps, and public sector institutions. Its primary objective is to raise digital maturity and facilitate green transformation across key sectors including manufacturing, agriculture, energy, and the environment. By providing expert services and access to advanced project consortium infrastructure, the hub helps businesses become more competitive and efficient while ensuring all services remain entirely free for end-users.

The hub specialises in three critical technological pillars: Artificial Intelligence (AI), Cybersecurity (CyberSec), and High-Performance Computing (HPC), all of which are uniquely applicable to enhancing energy systems and power grids. The strength of this model lies in its collaborative approach with academic institutions, which allows startups and SMEs to test and develop their services before committing to major investments. Through the Test Before Invest service, users gain access to the analysis, optimisation, and testing of digital technologies in real-world conditions. This includes strategic advice on technological scouting, intellectual property, and technology transfer, alongside support for accessing EuroHPC resources and advanced computing for machine learning. This direct link to university-led research ensures that companies can validate their innovative solutions with scientific precision.

Beyond technical testing, CROBOHUB++ focuses extensively on skills development and training through an expansive range of educational programs. These include an AI Academy, Cybersecurity Academy, and specialised HPC training, as well as bootcamps designed to connect SMEs with researchers and guide public sector institutions in startup incubation. These educational efforts are complemented by support for accessing financial resources, where the hub provides digital maturity assessments and consulting on EU funds, R&D financing, and HAMAG-BICRO programs. Finally, the hub strengthens the innovation ecosystem through matchmaking events and B2B networking, connecting technology providers with end-users and expert networks. By bridging the gap between scientific expertise and market needs, CROBOHUB++ empowers the entrepreneurial community to navigate the complexities of the digital age while fostering a sustainable and internationally competitive economy.

4.4 Recommendations for SMEs

The cases examined above demonstrate that effective cross-actor collaboration depends critically on the active participation of SMEs. Yet, as the next section shows, SMEs themselves face a specific set of incentives, hurdles and strategic considerations that warrant a dedicated set of recommendations. This chapter is based on insights collected through a targeted questionnaire distributed to SMEs actively collaborating within the SynGRID project. The objective of this exercise was to capture first-hand experiences, challenges, and expectations of SMEs operating in the energy and innovation ecosystem.

The responses provided a valuable basis for identifying key barriers that limit SME participation in funding programmes, market activities, and collaborative research initiatives, as well as highlighting existing opportunities and support mechanisms. Building on these inputs, the chapter aims to outline the main issues faced by SMEs and to formulate practical recommendations for both policymakers and SMEs themselves.

By integrating real-world feedback from project partners, this analysis contributes to a more grounded understanding of SME needs and supports the development of more effective, inclusive, and market-oriented solutions.

4.4.1 Incentives for SME

SMEs can benefit significantly from existing national and EU support mechanisms, particularly those aimed at innovation, technology development, and market uptake. Instruments delivered through national organisations such as HAMAG-BICRO have already demonstrated value in supporting SME growth and development.

In addition, EU programmes offer opportunities not only for funding but also for collaboration, knowledge transfer, and access to new markets. Participation in collaborative projects can enhance credibility, provide access to research expertise, and support the advancement of technology readiness levels.

Dynamic pricing models, flexible market participation, and emerging energy system innovations also create new business opportunities for SMEs, particularly in areas such as energy services, storage, and digital solutions. When combined with targeted incentives, these developments can strengthen the role of SMEs in the energy transition.

To fully benefit from these opportunities, SMEs are encouraged to actively monitor funding calls, engage with national contact points, and explore partnerships with research institutions and industry actors.

One good example or best practice example of an incentive to encourage the participation of small and medium-sized enterprises (SMEs) in research, development and innovation projects is the possibility of applying a higher co-financing rate when SMEs participate in partnership or within a consortium with other companies and/or research organisations. This approach is consistent with Regulation (EU) 2021/1060 laying down common provisions for the Cohesion Policy Funds, which explicitly promotes collaborative projects, knowledge transfer and the strengthening of innovation ecosystems. In addition, EU State aid rules, in particular Commission Regulation (EU) No 651/2014 (General Block Exemption Regulation – GBER), as amended, allow for an increase in aid intensities for SMEs in the case of industrial research and experimental development, notably where projects involve effective collaboration between independent partners or broad dissemination of results. Together, these provisions establish a clear legal framework in which SME participation in partnerships and consortia is actively incentivised through higher public support rates. Particularly in Slovenian national calls (organised by the respective Ministry and funding authority) prove as an important incentive for SME's, several successful consortia with SME's were and are being established within the Important Project of Common European Interest (IPCEI) process.

4.4.2 Hurdles for SMEs

SMEs face a combination of structural, financial, operational, and strategic challenges that significantly limit their participation in funding programmes and collaborative research projects.

A fundamental constraint is limited internal capacity. SMEs must simultaneously manage product development, market validation, and revenue generation, often with small teams and limited resources. As operations scale, this challenge evolves into balancing ongoing project execution with continuous efforts to secure funding and maintain cash flow.

Access to funding remains a major barrier. The predominance of reimbursement-based funding models creates liquidity constraints, as SMEs are required to pre-finance activities before receiving support. In parallel, the complexity of application procedures introduces a substantial administrative burden, often requiring engagement of external consultants. This adds cost and risk, as consultants are compensated regardless of project success, while SMEs bear the financial and operational consequences of unsuccessful applications.

Intellectual property (IP) considerations represent an additional and often decisive barrier. SMEs are typically cautious about engaging in collaborative projects where IP ownership, usage rights, and commercialisation pathways are not clearly defined from the outset. Uncertainty in this area creates a risk that SMEs contribute valuable know-how without securing proportional benefits, which directly discourages participation.

Market access barriers further constrain SME involvement. In sectors such as energy, markets are often dominated by large, established players with complex procurement processes, long approval cycles, and strict requirements regarding references and certifications. As a result, SMEs may remain effectively excluded despite having technically competitive or innovative solutions.

A critical structural issue lies in the misalignment between research outputs and market needs. SMEs frequently perceive that EU-funded projects focus on increasing Technology Readiness Levels (TRLs) rather than delivering market-ready solutions. While achieving a high TRL is often considered a project success indicator, it does not necessarily translate into commercial viability. From an SME perspective, it is possible to develop a technically advanced solution that remains far from real market deployment due to missing business models, regulatory alignment, or customer demand. As a result, SMEs that prioritise near-term commercial outcomes often see limited value in participating in such projects.

This perception is reinforced by the long timelines associated with EU programmes. The period between call publication and project start can exceed one year, followed by multi-year project execution. In fast-evolving sectors, such delays significantly reduce the relevance of project outcomes. By the time results are available, market conditions, technologies, or regulatory frameworks may have changed, diminishing the practical value of participation.

In addition, limited awareness and ineffective communication further hinder SME engagement. Although funding opportunities exist, they are often presented in institutional or academic language that does not resonate with SMEs. Many SMEs do not clearly understand the practical benefits of participation, leading to low motivation to engage.

Overall, these factors contribute to a broader perception among SMEs that participation in programmes such as Horizon Europe involves high effort, high uncertainty, and delayed or unclear returns. Without clearer pathways to market impact, faster processes, and better-aligned incentives, SMEs are likely to remain cautious in engaging with such initiatives.

4.4.3 Recommendations for SMEs

In order to better leverage available incentives and overcome the identified barriers, SMEs should adopt a more targeted, strategic, and market-oriented approach to participation in funding programmes and collaborative projects.

A key priority for SMEs is to focus on opportunities that directly support commercial objectives going beyond purely technological development. Given the observed gap between high Technology Readiness Levels (TRLs) and actual market readiness, SMEs should prioritise projects that offer clear pathways to deployment, customer validation, and revenue generation. Participation should be driven by tangible business value, not solely by access to funding.

SMEs are also encouraged to place strong emphasis on intellectual property protection from the outset. Before engaging in collaborative projects, clear agreements on IP ownership, usage rights, and commercialisation pathways should be established. This reduces risk and ensures that SMEs can effectively capture value from their contributions.

To address financial constraints, SMEs should carefully assess the funding structure of programmes and prioritise those that minimise cash flow pressure, such as schemes offering pre-financing or milestone-based payments. Where reimbursement models are unavoidable, SMEs should plan participation in line with their financial capacity to avoid operational strain.

Building internal capabilities for navigating funding programmes is another important step. While external consultants can provide support, SMEs should aim to gradually develop in-house expertise to reduce dependency, lower costs, and improve alignment between funding activities and business strategy.

Strategic partnerships should be actively pursued, particularly with research institutions and industry actors. However, SMEs should ensure that their role within such collaborations is clearly defined and aligned with their core competencies. Effective partnerships should provide mutual value, combining academic knowledge with real-world application and commercial perspective.

SMEs should also adopt a more selective approach to participation in large-scale programmes such as Horizon Europe. Given the long timelines and administrative complexity, engagement should be limited to projects that are highly relevant to their business, offer clear added value, and justify the required investment of time and resources.

Finally, SMEs can benefit from actively engaging with emerging market opportunities linked to energy system transformation, such as dynamic pricing, flexibility services, and digital energy solutions. These areas offer potential for new business models and revenue streams, particularly when combined with available incentive schemes.

By focusing on commercially relevant opportunities, securing their strategic position within collaborations, and aligning participation with their operational and financial capacities, SMEs can significantly increase the value derived from funding programmes while mitigating the risks associated with participation.

5 Conclusions

This deliverable has presented an integrated set of policy recommendations and actionable guidance to support the uptake of innovative energy solutions in low-voltage grids, with particular attention to the SynGRID target countries (Slovenia, Greece and Croatia) and to the broader category of Widening countries and less R&I performing regions. The findings have been developed through a stakeholder-driven, people-centric methodology that combines direct engagement with regulatory authorities, system operators, industry, SMEs and research institutions with empirical evidence from prior Horizon projects, ensuring that the recommendations reflect operational realities and are grounded in evidence.

A central conclusion of the analysis is that technology readiness is no longer the binding constraint on the uptake of innovative low-voltage grid solutions. Validated tools for grid management, observability and local flexibility markets already exist at TRL 7–8 from EU projects and the obstacles preventing their wider deployment are predominantly regulatory, institutional and market-related. This shifts the focus of intervention from further technology development to the alignment of enabling conditions, and it makes the period 2026–2027 a particularly decisive window. With the ACER proposal for an EU Network Code on Demand Response submitted in March 2025, with national flexibility assessments due by July 2026 and with indicative flexibility targets to be set by January 2027, all three target countries face a narrow but well-defined opportunity to shape national frameworks proactively rather than transpose mandatory rules reactively.

Although the country pathways differ, they converge on a common set of needs. Slovenia must convert an existing legal base for energy communities and active customers into an operational mandate for DSO flexibility procurement; Greece must move from project-by-project pilots to a structured distribution-level flexibility framework, leveraging its evolving energy communities legislation and Croatia must address structural barriers to self-consumption, modernise tariff methodologies and systematise dynamic and time-of-use tariffs. In each case, the underlying requirements are the same: clarity of legal mandate, operational tools for DSOs and enabling conditions for smaller market actors. Achieving these conditions also requires regulatory authorities to be repositioned as strategic partners in innovation, moving away from reactive compliance bodies, which can only happen through institutional measures such as dedicated staff time, internal innovation units, regulatory sandboxes, structured peer collaboration and the formal integration of R&I participation into strategic plans and performance indicators.

The analysis also highlights that the gap between Technology Readiness Levels and market readiness must be closed at programme design level, through earlier involvement of market actors and regulators in proposal preparation, clearer commercialisation pathways within projects and faster funding cycles in sectors where technological and regulatory conditions evolve rapidly. SME and industry participation, in turn, depends on procedural and financial reforms that lower entry barriers, including pre-financing or milestone-based payments, simplified procedures, plain-language outreach and clearer intellectual property frameworks. Cross-border partnerships are confirmed as an effective vehicle for capacity transfer, particularly when consortia are structured around complementarity and shared objectives, and the Croatian examples of Nuqleus, ZICER and CROBOHUB++ demonstrate that institutional structures bridging science, industry and SMEs can be replicated in other regional contexts. Research institutions in less R&I performing regions, as illustrated by the case of FERIT, require targeted support in administrative capacity and human resources to translate scientific potential into competitive participation in EU-funded projects.

The recommendations contained in this deliverable will inform the regional capacity-building activities planned within Work Package 4 of SynGRID and the showcase events of Work Package 5. They are intended to be operational and concrete, with each recommendation identifying a specific actor, a specific intervention and a specific time horizon, and the forthcoming engagement of regulatory authorities, industry, SMEs and research institutions in these activities will provide the opportunity to refine, validate and disseminate the proposed measures.

Beyond SynGRID, the analysis presented here contributes to the wider European debate on how to ensure that the energy transition is geographically inclusive. The cohesion of that transition will ultimately depend on whether less R&I performing regions can move from being recipients of mature solutions to being active co-developers of the next generation of innovations, and the conditions for this shift are achievable provided that EU institutions, national authorities, system operators, industry and the research community act in a coordinated manner informed by the practical, evidence-based perspectives that stakeholder-driven projects such as

SynGRID can offer. In this sense, this deliverable should be read both as an analysis and as a call to action: the opportunity to align European, national and regional efforts around a coherent flexibility framework is open now, and the next eighteen to twenty-four months will determine whether that opportunity is taken.

6 References and acronyms

6.1 References

1. SynGRID project. Deliverable D2.2 – Research Outcome Mapping. Horizon, Grant Agreement No. 101160145.
2. SynGRID project. Deliverable D2.1 – Technology Environment and Regulatory Gap Analysis Report. Horizon Europe, Grant Agreement No. 101160145
3. STREAM project. Deliverable D2.1 – User-centric service design and energy service design. Horizon Europe project, Grant Agreement No. 101075654
4. Directive (EU) 2019/944 of the European Parliament and of the Council of 5 June 2019 on common rules for the internal market for electricity and amending Directive 2012/27/EU.
5. CEER (2025). NRAs' Approach to DSO Flexibility Procurement: Justifications for Derogations from Article 32 of the Electricity Directive (EU) 2019/944. Council of European Energy Regulators, November 2025.
6. SmartEN & LCP Delta (2026). Market Monitor for Demand Side Flexibility, 2025 edition.
7. ACER (2025). Proposal for an EU-wide network code on demand response, submitted to the European Commission on 7 March 2025. European Union Agency for the Cooperation of Energy Regulators.
8. Directive (EU) 2018/2001 of the European Parliament and of the Council of 11 December 2018 on the promotion of the use of energy from renewable sources (recast).
9. STREAM project. D4.3: Conclusions &Regulatory Aspects of Local Flexibility Markets.
10. Republic of Greece. Law 5037/2023 transposing Directive (EU) 2018/2001 and Directive (EU) 2019/944, including the framework for Renewable Energy Communities and Citizen Energy Communities.
11. Commission Regulation (EU) No 651/2014 of 17 June 2014 declaring certain categories of aid compatible with the internal market in application of Articles 107 and 108 of the Treaty (General Block Exemption Regulation – GBER), as amended.
12. Eurelectric (2025). Position paper on DSO flexibility procurement and the role of distribution system operators in the energy transition.
13. HERA (2025). Public consultation document "Incentive framework for promoting and facilitating the development of self-consumption of energy from renewable sources". Croatian Energy Regulatory Agency.
14. Regulation (EU) 2021/1060 of the European Parliament and of the Council of 24 June 2021 laying down common provisions on the European Regional Development Fund, the European Social Fund Plus, the Cohesion Fund, the Just Transition Fund and the European Maritime, Fisheries and Aquaculture Fund (Common Provisions Regulation).
15. Republic of Croatia. Electricity Market Act and related secondary legislation.
16. Republic of Greece. Law 4001/2011 on the operation of the electricity and gas energy markets, exploration, production and transmission networks of hydrocarbons and other provisions.
17. Republic of Greece. Law 4513/2018 on Energy Communities and other provisions.
18. Republic of Greece. Law 4951/2022 on the modernisation of energy legislation, the connection of new RES and storage installations and other provisions.
19. Republic of Slovenia. Act on Electricity Supply (ZOEE), 2021.

6.2 Acronyms

Acronyms list	
ACER	Agency for Cooperation of Energy Regulators
ADMIE	Independent Power Transmission Operator (Greece, also IPTO)
CEER	Council of European Energy Regulators
COMPILE	Integrating Community Power in Energy Islands (Horizon 2020 project)
CSA	Coordination and Support Action
DEDDIE/HEDNO	Hellenic Electricity Distribution Network Operator (Greece)
DSO	Distribution System Operator
EC	European Commission
EDIH	European Digital Innovation Hub
ELES	Slovenian Electricity Transmission System Operator
ENTSO-E	European Network of Transmission System Operators for Electricity
EU	European Union
EURELECTRIC	Union of the Electricity Industry (European association)
EV	Electric Vehicle
FER	Faculty of Electrical Engineering and Computing, University of Zagreb (Croatia)
FERIT	Faculty of Electrical Engineering, Computer Science and Information Technology Osijek (Croatia)
GBER	General Block Exemption Regulation (Commission Regulation (EU) No 651/2014)
HAMAG-BICRO	Croatian Agency for SMEs, Innovations and Investments
HBOR	Croatian Bank for Reconstruction and Development
HEP-ODS	Croatian Distribution System Operator
HERA	Croatian Energy Regulatory Agency
HOPS	Croatian Transmission System Operator
HPC	High-Performance Computing
ICCS	Institute of Communication and Computer Systems (Greece)

ICENT	Nikola Tesla Innovation Centre (Croatia)
ICT	Information and Communication Technology
IP	Intellectual Property
IPCEI	Important Project of Common European Interest
IPTO	Independent Power Transmission Operator (Greece, also ADMIE)
IRI UL	Institute for Innovation and Research, University of Ljubljana (Slovenia)
JRC	Joint Research Centre
KPI	Key Performance Indicator
LV	Low Voltage
MOPE	Ministry of the Environment, Climate and Energy (Slovenia)
NRA	National Regulatory Authority
NTUA	National Technical University of Athens (Greece)
PCD	People-Centric Design
PV	Photovoltaic
R&D	Research and Development
R&I	Research and Innovation
RAAEW	Regulatory Authority for Energy, Waste and Water (Greece, formerly RAE)
RAE	Regulatory Authority for Energy (Greece, now RAAEW)
RES	Renewable Energy Sources
RE-EMPOWERED	Horizon 2020 project on island energy systems
SME	Small and Medium-sized Enterprise
SODO	Slovenian National Distribution System Operator
STREAM	Horizon Europe project (Grant Agreement No. 101075654)
ToU	Time-of-Use (tariffs)
TRL	Technology Readiness Level
TSO	Transmission System Operator
WP	Work Package
X-FLEX	Horizon 2020 project on flexibility integration
ZICER	Zagreb Innovation Centre

ZOEE	Act on Electricity Supply (Slovenia, 2021)