European Commission

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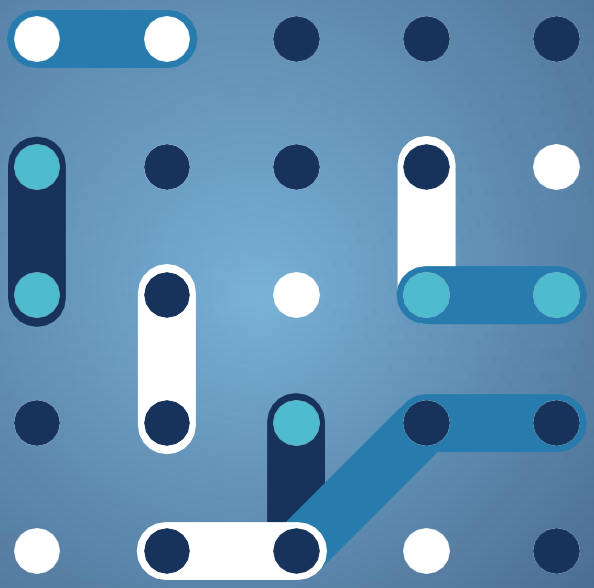
Annual Report 2025-2026

Regulation Working Group



July 2026

BRIDGE

Regulation Working Group
Annual Activity Report 2025-2026

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ACRONYMS

AC	Alternating Current
AFIR	Alternative Fuels Infrastructure Regulation
AI	Artificial Intelligence
CAPEX	Capital Expenditure
CEP	Clean Energy Package
CET	Central European Time
CHP	Combined Heat and Power
DER	Distributed Energy Resources
DHC	District Heating and Cooling
DSM	Demand-Side Management
DSF	Demand-Side Flexibility
DSO	Distribution System Operator
EV	Electric Vehicle
EU	European Union
LFM	Local Flexibility Market
NLP	Natural Language Processing
OCPI	Open Charge Point Interface
OCPP	Open Charge Point Protocol
OPEX	Operating Expenditure
P2P	Peer-to-Peer
PV	Photovoltaic
RWG	Regulation Working Group
SO	System Operator
TOTEX	Total Expenditure
TSO	Transmission System Operator
V2G	Vehicle-to-Grid
WG	Working Group

EXECUTIVE SUMMARY

The BRIDGE Regulation Working Group Annual Activity Report 2025–2026 brings together evidence from a wide range of Horizon 2020 and Horizon Europe projects to assess how regulation can better support Europe's energy transition. The report shows that innovation in flexibility, energy sharing, sector coupling and network operation is advancing rapidly, but regulatory frameworks are not evolving at the same pace. Across all actions, a common message emerges: Europe now needs a more coherent, interoperable and implementation-oriented regulatory framework to move from pilots to large-scale deployment. The report is structured around four core actions.

Action 1 examines peer-to-peer exchange, energy sharing and energy communities, with a focus on the market access of active citizens. The findings show that legal recognition of energy sharing and community models is increasing, but implementation remains uneven across Member States. Dedicated peer-to-peer market frameworks are still rare, market participation is often indirect and dependent on aggregators or suppliers, and administrative, technical and financial barriers continue to limit scale-up. The report recommends reducing entry barriers to wholesale, balancing and flexibility markets, improving data access and interoperability, strengthening consumer protection, and creating supportive tools such as one-stop shops, open data spaces and regulatory sandboxes.

Action 2 focuses on the coordination and integration of energy and flexibility markets. Based on survey evidence from 23 responses across 17 projects and 16 countries, the report finds that flexibility procurement is becoming a central concern for DSOs, with local flexibility markets emerging as the most widely tested mechanism. However, projects consistently show that no single flexibility mechanism is sufficient on its own. Instead, coordinated combinations of several flexibility acquisition mechanisms such as dynamic network tariffs, local flexibility markets, flexible connection agreements and rule- or cost-based approaches are considered more effective. The report highlights that coordination is essential to avoid conflicting signals and inefficiencies, yet current regulations provide only limited support for such coordination. It therefore calls for clearer regulatory guidance, improved interoperability, better verification and penalty frameworks, and more explicit support for coordinated procurement through pilots and sandboxes.

Action 3 addresses sector coupling and system integration. The analysis confirms that sector integration is no longer a theoretical ambition, but an operational necessity for a decarbonised and resilient energy system. At the same time, barriers differ significantly across use cases. Household-level integration is most constrained by stakeholder coordination and data governance issues. Heat integration is dominated by interoperability barriers. Other sector-coupling applications are mainly limited by network regulation, while EV-based services face a more balanced mix of market, data and interoperability constraints. The report concludes that sector integration challenges follow a maturity-driven pattern: early-stage initiatives struggle with coordination and governance, while more advanced implementations increasingly encounter technical interoperability and market-design barriers. This points to the need for adaptive regulation, harmonised standards and governance frameworks capable of supporting value stacking and cross-sector participation.

Action 4 examines how system operators can prepare the grid for 2030. The report finds that DSOs face growing challenges linked to electrification, the integration of renewables, and the need for new planning and operational tools. Projects show strong interest in local flexibility markets, flexible connection agreements, improved digitalisation and advanced planning models. More than two-thirds of Action 4 survey participants favour market-based flexibility options, and many see combinations of mechanisms as essential to cope with future congestion and operational challenges. However, the report also identifies a major barrier in current DSO remuneration schemes. While innovation is often supported through pilots and sandboxes, many jurisdictions still use cost-of-service or hybrid remuneration models that bias investment towards CAPEX and discourage the procurement of flexibility as an operational solution. The report therefore recommends moving towards ex-ante remuneration with profit-sharing mechanisms, introducing more adaptable planning approaches, and aligning incentives so that flexibility can compete fairly with conventional grid investment.

Across all four actions, several cross-cutting conclusions emerge. First, **regulatory fragmentation across Member States remains one of the main obstacles** to the scale-up of innovative solutions. Second, **data access, interoperability and digital governance are foundational enablers** for energy sharing, flexibility and sector integration. Third, **coordination among actors, including DSOs, TSOs, aggregators, consumers and local communities, is critical** but still insufficiently reflected in current frameworks. Fourth, while **pilot projects and sandboxes** are valuable, their lessons need to be translated more systematically into durable and harmonised regulatory solutions. Finally, consumer participation and protection must remain central to the design of future frameworks, especially as active consumers, energy communities and local flexibility models become more widespread.

The report concludes that Europe's energy transition is now entering a phase where regulatory implementation matters as much as technological innovation. To unlock the full value of flexibility, active consumer participation, sector coupling and smarter grid operation, policymakers and regulators will need to reduce fragmentation, clarify roles and market rules, support interoperable data infrastructures and create incentives that reward efficient and scalable solutions. The BRIDGE Regulation Working Group will continue to contribute to this process by translating the lessons of EU-funded projects into practical recommendations for a more resilient, inclusive, and decarbonised European energy system.

1 INTRODUCTION

1.1 The BRIDGE Regulation WG

The BRIDGE Regulation Working Group (WG) was established from the beginning of the BRIDGE initiative to foster knowledge sharing among projects funded by Horizon 2020 and Horizon Europe programmes, which address different regulatory aspects in the field of energy.

The Regulation WG, as the entire BRIDGE initiative, structures its activities on a yearly basis. In the last years, different topics have been addressed, resulting in most cases in specific reports that can be shared not only within the BRIDGE community, but with a larger audience.

The Regulation WG is a live group where projects join and leave as they evolve. This “staff rotation” facilitates a dynamic environment for the introduction of new topics of interest. The WG continuously looks for synergies with other BRIDGE working groups, and with those outside BRIDGE (ISGAN, ETIP SNET, …). The WG defines the most important regulatory challenges to be addressed, proposes best practices from the BRIDGE projects and formulates recommendations for policy makers. In addition, thematic knowledge sharing sessions are organised to present best practices from projects that are close to their end date.

This report presents the main results achieved during 2025 and reflects the continued commitment of the BRIDGE Regulation Working Group to bridging the gap between innovation and regulation. By combining evidence from projects, discussion, and targeted knowledge-sharing activities, the report offers a forward-looking perspective on how European regulation can evolve to support a resilient, inclusive, and decarbonised energy system. Its findings are intended not only to inform the BRIDGE community, but also to contribute to the broader policy debate on the governance of the energy transition in Europe

1.2 The Main Challenges Ahead

The European energy sector is entering a decisive phase of its transition towards climate neutrality, characterised by rapid electrification, higher shares of variable renewable generation, increasing digitalisation and the progressive decentralisation of energy resources. In this evolving context, regulatory frameworks are being asked to perform a more demanding role than ever before: not only to ensure market efficiency and system security, but also to enable innovation, empower consumers and facilitate the coordinated integration of distributed resources, flexibility services and cross-sector solutions. Against this background, the BRIDGE Regulation Working Group (WG) continues to provide a collaborative platform through which EU-funded projects can exchange knowledge, identify regulatory barriers, and formulate policy-relevant recommendations grounded in practical implementation experience.

As part of the wider BRIDGE initiative, the Regulation WG brings together projects funded under Horizon 2020 and Horizon Europe to analyse regulatory developments affecting energy markets, consumer participation, flexibility, digitalisation and system integration. Its annual work is shaped by the experience of projects operating at different stages of maturity, across different technologies and in diverse national contexts. This diversity is one of the WG’s main strengths as it allows the identification of recurring challenges across Member States while also highlighting emerging best practices, regulatory innovations and transferable lessons. In 2025, the WG included a broad network of ongoing projects engaged in cross-cutting activities and it structured its work around four dedicated actions addressing some of the most pressing regulatory issues in the energy transition.

The topics addressed in this report reflect the increasing complexity of the European regulatory agenda. Recent and forthcoming initiatives at EU level, including the Digitalisation of Energy Action Plan and the Strategic Roadmap for Digitalisation and AI in the Energy Sector, the reform of the Electricity Market Design, the European Grids Package, and the evolution of the framework for energy sharing are reshaping the conditions under which markets, networks and consumers interact. At the same time, the energy crisis has reinforced the importance of designing a resilient and inclusive market architecture capable of protecting consumers while accelerating decarbonisation. In this context, questions related to market access, flexibility valorisation, peer-to-peer exchange, energy

communities, sector coupling, and network planning are no longer isolated policy debates, but interconnected building blocks of the future energy system.

To respond to these challenges, the WG's 2025 work programme was organised around four main actions:

- **Action 1** focused on peer-to-peer exchange, energy sharing, and energy communities, with particular attention to market access for active citizens and the regulatory barriers limiting wider uptake.
- **Action 2** examined the coordination and integration of energy and flexibility markets, moving beyond high-level discussion to evidence on flexibility acquisition mechanisms, their interaction, and their implementation maturity.
- **Action 3** explored the regulatory and organisational challenges of sector coupling and system integration, including e-mobility, heat, household-level integration, and other cross-sector use cases.
- Finally, **Action 4** addressed the role of system operators in preparing electricity grids for 2030, focusing on flexibility mechanisms, planning and operational tools, and remuneration frameworks capable of supporting innovation and efficient network development.

A common thread across all four actions is the recognition that **technical innovation is advancing faster than regulatory adaptation**. Projects participating in the BRIDGE initiative are already testing new market arrangements, digital tools, flexibility products and integrated energy solutions. However, their experience also shows that the transition from pilots to scalable implementation remains constrained by fragmented national rules, limited interoperability, insufficient coordination between actors and mechanisms, and remuneration structures that do not always reward efficient outcomes. The WG therefore aims not only to document these barriers, but also to translate project-based evidence into practical recommendations for designing a more coherent and future-proof regulatory framework.

1.3 Overview of Action Plan 2025

In 2025, the BRIDGE Regulation WG focused on four main objectives, each of which was operationalised through a dedicated action. These actions were designed to address key regulatory challenges and priorities identified by the WG, ensuring a structured and goal-oriented approach throughout the activity year. (Table 1.1):

Table 1.1: Regulation WG's Action Plan 2025

Action n.	Action title	Note
Action 1	**Peer-to-peer and energy sharing**	*Continuation of Action 2 (2023)*
Action 2	Energy and **flexibility market coordination** and **integration**	*Continuation of Action 3 (2022)*
Action 3	Support the potential synergies coming from **increased sector coupling/sector integration/system integration**	*Continuation of Action 4 (2023)*
Action 4	Support the **system operators to prepare the grid for 2030**	*Continuation of Action 5 (2023)*

The following sections present the results achieved during 2025.

1.4 Regulation WG Projects

In 2025, the BRIDGE Regulation WG included a total of 50 ongoing projects engaged in cross-cutting activities. These projects are considered part of the WG network insofar as they are registered to the mailing list, participate in the monthly meetings, and/or receive communication and updates pertaining to the WG (listed in Figure 1.1**Errore. L'origine riferimento non è stata trovata.** for reference). For details on which projects actively participated in specific WG actions, please refer to the individual chapters of each action.

Figure 1.1: List of projects in the Regulation WG

2 ACTION 1 – PEER-TO-PEER AND ENERGY SHARING

Action leaders: Karine Laffont-Eloire (**LocalRES Project**); Quentin Donnette (**FEDECOM Project**)

2.1 Introduction of the Action

Action 1 addresses regulatory frameworks related to peer-to-peer, energy communities and energy sharing. After investigating how energy communities could provide grid services (2021-2022), the action then centred on energy sharing and peer to peer trading, while also expanding its focus to include energy communities and their capabilities in conducting energy sharing or P2P trading (2023-2025).

In the past year (2025-2026), Action 1 has focused on market access for active citizens, through P2P or energy communities:

- What are the enabling legal and regulatory frameworks for citizens to **access local energy markets** (or other relevant markets) thanks to **P2P** or through **energy communities?**
- What are the **barriers** to integrate those markets today? What are the (new) **drivers**?
- What are the **recommendations** from BRIDGE projects, based on their lessons learnt?

2.1.1 Regulatory background

Energy communities are a new market actor created by the Clean Energy for all Europeans Package, adopted in 2019, with the aim of organising collective and citizen-driven energy actions that help pave the way for a clean energy transition. The activities they are allowed to carry out include joint generation and consumption of renewable energy – in other words they can take part in energy sharing.

'Energy sharing' allows citizens to share self-generated electricity with their neighbourhood (or even beyond) on a contractual basis. It is defined in Directive 2024/1711[1], which operationalises energy sharing by establishing relevant roles, rights and responsibilities and expanding the right to wider categories of active customers (i.e. not limited to energy communities).

[1] DIRECTIVE (EU) 2024/1711 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 13 June 2024 amending Directives (EU) 2018/2001 and (EU) 2019/944 as regards improving the Union's electricity market design. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32024L1711

Figure 2.1: Regulatory framework covered by Action 1

2.1.2 Methodology Adopted in Action 1

The different steps undertaken in the implementation of Action 1 are illustrated in Figure 2.2 below:

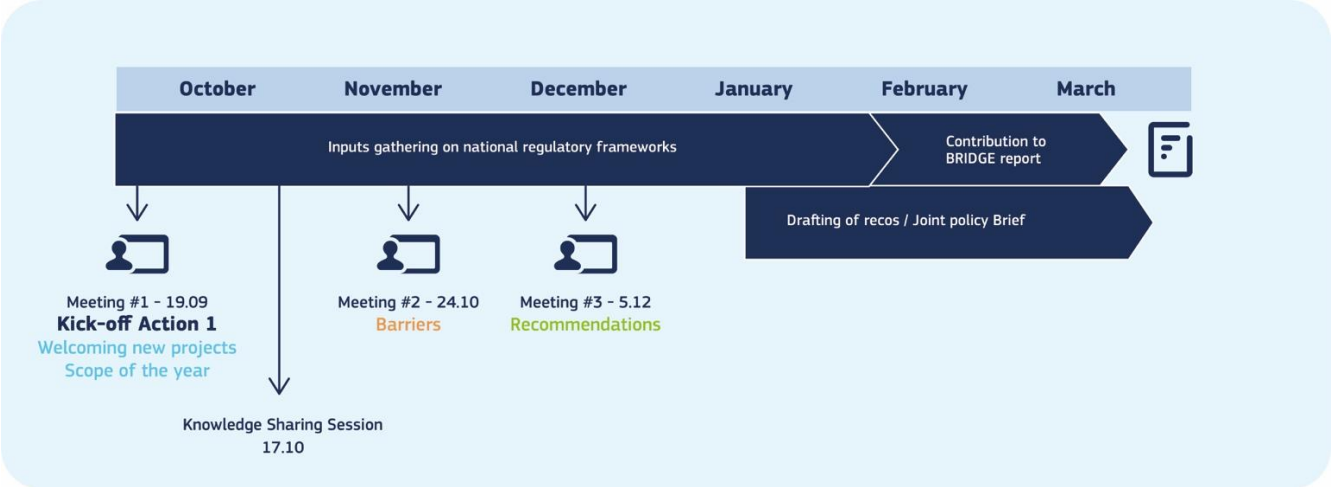


Figure 2.2: Steps of the methodology adopted in Action 1

Three online meetings were organised between September and December 2025, all with a mix of presentations and interactive discussions (using an online board). The first meeting welcomed the new projects participating in the action and presented the results of the work done the previous year, and the objectives and timeline for the new year. Projects then had to contribute to the regulatory overview related to the scope of the year's work by providing details for the countries in which they had a demonstration site, using a common template (Excel spreadsheet) hosted on BRIDGE SharePoint. To avoid duplication of effort, each volunteering project was assigned the description of 2 to 3 Member States. The second meeting was dedicated to identifying barriers and drivers. The final meeting focused on the proposition of recommendations.

After the third meeting, contributing projects were regularly reminded to provide inputs to the regulatory overview. As a result, a total of 9 countries were covered.

In addition, a smaller group of projects worked on developing a policy brief to further elaborate on the recommendations.

2.1.3 Participating projects in Action 1

Overall 15 projects participated in Action 1 this year, either through participation to interactive sessions, or through the collaborative documents shared on BRIDGE SharePoint: **AHEAD, CELINE, Data Cellar, EU-DREAM, FEDECOM, FlexChess, HYSTORE, HVDC4Islands, LocalRES, ODEON, OPENTUNITY, PEDvolution, SOCIAREM, STUNNED, Thumbs Up, U2DEMO.**

Projects **LocalRES, PARMENIDES OMEGA-X, ECHO, BeFlexible, OPENTUNITY, RESCHOOL, PEDvolution, POCITYF** answered the survey on consumer rights last year.

Most projects are focusing on energy sharing or P2P trading schemes. In parallel, several other projects are concentrating on the development of renewable or citizen energy communities, actively engaging community members as part of their pilot implementations. Some of the projects cover broader topics such as flexibility services or data management, which nonetheless incorporate energy communities or energy sharing models as relevant use cases within their overall frameworks.

2.2 Regulatory overview

Last year, a detailed review of regulatory frameworks for energy sharing was carried out by participating projects, covering 15 countries, and was presented in a standalone report[2]. This year, work has focused on access to local energy markets (or other relevant markets) thanks to P2P or through energy communities. Nine countries have been covered by the analysis.

Country	Project in charge of the review
Austria	ODEON & LocalRES
Belgium (Brussels)	FEDECOM
Finland	CELINE
France	STUNNED
Germany	PEDvolution
Italy	STUNNED
Portugal	U2DEMO & INTELLIGENT
Spain	STUNNED
Switzerland	INTELLIGENT

As identified in previous analyses, this overview shows that citizen participation in electricity markets through energy sharing / P2P trading and energy communities is increasingly recognised but remains unevenly implemented throughout Europe. Legal recognition exists in most countries; however, dedicated P2P market frameworks remain rare, with most countries embedding P2P exchange within collective self-consumption or energy community schemes.

[2] European Commission: European Climate, Infrastructure and Environment Executive Agency, Directorate-General for Energy, Fina, B., Laffont-Eloire, K., Monsberger, C. et al., Report on energy sharing, Laffont-Eloire, K.(editor), Publications Office of the European Union, 2025, https://data.europa.eu/doi/10.2926/8653694

Key observations include:

- **Direct P2P trading frameworks emerging:** Since December 2025, Austria has explicitly allowed peer-to-peer trading between active customers with grid fee differentiation based on proximity. In Belgium (Brussels), P2P is recognised in the country alongside exchanges within a common building and exchanges through an energy community. It should be noted that Belgium's three regions (Flanders, Wallonia, and the Brussels-Capital Region) each have distinct regulatory frameworks governing energy sharing and P2P trading.
- **Energy communities widely recognised but mainly focused on self-consumption:** Countries such as Italy, Spain and France enable communities to produce, share and sell energy, but often limit market access or require intermediaries such as suppliers or aggregators.
- **Market participation remains mostly indirect:** Access to wholesale, balancing or flexibility markets generally requires **aggregators or suppliers** due to minimum bid sizes and balancing obligations.
- **Distribution system operators play a central role**: DSOs are typically responsible for metering, allocation of shared energy, and settlement, often through dedicated digital platforms or APIs.

Overall, local energy exchange is mostly implemented as an extension of retail markets rather than as autonomous local markets.

Despite progress, several structural barriers remain:

- Limited market integration: Energy communities rarely have direct access to wholesale or flexibility markets, participation typically requires intermediaries (e.g., aggregators, which are not allowed yet in all Member States).
- Administrative and technical complexity: Market participation requires compliance with balancing and licensing rules designed for large market actors.
- Smart metering and data management requirements remain uneven across Member States.
- National frameworks related to energy communities and P2P vary widely in their definitions and operational implementation. This fragmentation limits scalability and cross-border innovation.
- Financial viability and investment barriers: Uncertainty around licensing, long-term contracts, or pricing rules can hinder project financing.

The analysis also highlighted that **P2P trading and local electricity markets should be defined** more explicitly in EU legislation, and that entry barriers to flexibility, balancing and wholesale markets should be reduced for energy communities.

2.3 Barriers identified by projects

In parallel to the regulatory overview, Action 1 projects collectively identified the main barriers faced by their projects and demonstrations. Technical, financial and social barriers were added to the regulatory and market barriers already identified thanks to the regulatory overview.

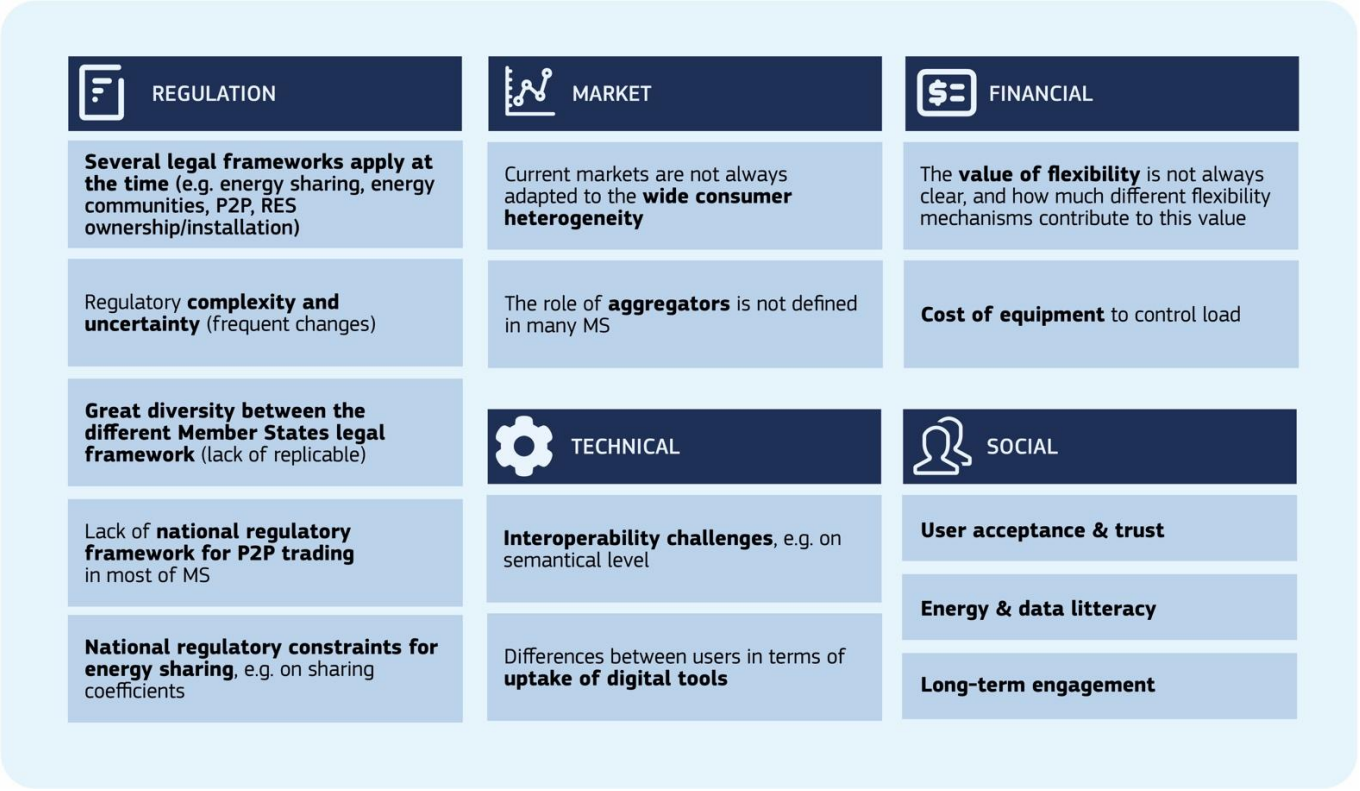


Figure 2.3: Main barriers identified by projects

2.4 Consumer rights – in cooperation with the CCE WG

Early 2025, activities were launched together with the Citizens and Consumers Engagement WG to develop a survey focusing on consumer rights in energy sharing schemes. The survey was circulated to projects involved in the Regulation WG, and inputs from 9 projects were collected in March 2025, however too late to be presented in the standalone report on energy sharing and in last year's annual report.

Country	Contributing project
Austria	Parmenides & LocalRES
Estonia	Energenius
France	BeFlexible
Greece	Opentunity, RESCHOOL
Italy	Energenius, LocalRES, BeFlexible
The Netherlands	RESCHOOL
Portugal	BeFlexible, POCITYF
Spain	Opentunity, OMEGA-X, ECHO, BeFlexible, LocalRES, RESCHOOL
Sweden	RESCHOOL
Switzerland	PEDvolution

Key points, as of April 2025, were as follows (the detailed analysis can be provided on demand):

- Energy sharing arrangements are overall well framed by regulation in countries where energy sharing is allowed.

- The process to develop an energy sharing arrangement can be very streamlined in some countries (e.g. Portugal), but much more cumbersome in others (e.g. Spain).
- With regards to consumers' rights, no major problem has been identified for now by the respondents.
- Information sharing and communication between DSOs (or the entity responsible for managing data), the consumer and the community are sometimes very slow.
- Terms and conditions are not established in Italy and Spain, but are so in most other countries, with Portugal and Greece probably as the best practices (e.g. provision of a contract template with standardised terms regarding termination, renewal and other conditions),
- Inclusion of vulnerable citizens is nowhere detailed.

The following recommendations were communicated to the European Commission in March 2025:

- In some countries, members of energy communities aren't allowed a free choice of energy supplier, and allocation schemes (sharing coefficients) vary strongly between countries: harmonisation at EU level (e.g. through implementing guidelines) would be helpful.
- Managing and exchanging data between involved entities (usually community, user, and DSO) can be challenging. Creating standards and implementing the Energy Sharing Organiser as a new market actor is seen as solution.
- Inclusion of vulnerable citizens remains challenging. No clear concept seems to exist.
- Consumer rights protection seems sufficiently covered at the moment, but it may become more challenging once energy-sharing becomes more mainstreamed (and creates new opportunities for private companies). Recommendations on dispute settlement and on how to cover risks related to collective projects (e.g. shared ownership) would therefore be valuable.

2.5 Recommendations

Action 1 projects proposed recommendations to address the barriers previously identified. A list of recommendations was first developed during an interactive workshop and was then elaborated by a smaller group of projects, with the objective of delivering a joint policy brief that will be disseminated to specific target groups.

The recommendations are as follows:

1. **Ensure that all European DSOs set up or connect to an open data space, with a clear data protection framework**

Both EU and national regulatory frameworks should enable secure, standardised and real-time data access for aggregators, energy service providers and energy communities. Clear data governance and protection rules, including roles, responsibilities and access rights (e.g. strict access control based on ‘need-to-know’ principles) need to be established. Common, interoperable data models, commonly agreed data exchange standards and formats, and standardised APIs will be used to facilitate integration of heterogeneous energy management systems. Open data spaces should support both real-time and historical data availability to enable forecasting, optimisation and verification of energy exchanges.

2. **Enable the development of advanced solutions through a comprehensive set of rules governing energy sharing**

Requirements include: energy sharing across an extended area with an extended proximity criterion (e.g. over several kilometres), price differentiation within the community / energy sharing scheme, dynamic sharing coefficient and the communication of the sharing coefficient ex-post (with consistency between sharing coefficient updates and the ex-post submission timeline).

3. **Streamline the set-up of regulatory sandboxes which will enable the development, testing and comparison of the effectiveness of local flexibility markets**

EU services should develop guidelines for all Member States to set up national legal frameworks enabling regulatory sandboxes in the energy sector, and provide assistance and best practices to the competent authorities to remove barriers that may prevent sandboxes from developing fully, in line with recommendations published by JRC[3] and ENTEC[4].

4. **Make sure there is alignment between implicit and explicit flexibility mechanisms**

In many Member States, these mechanisms are developed in parallel without sufficient coordination, leading to conflicting signals, reduced efficiency and limited participation of end-users and energy communities. To address this, regulatory frameworks should ensure a coherent design and interaction between implicit and explicit flexibility mechanisms. In particular, policymakers should avoid overlapping or contradictory incentives between price-based signals and flexibility activation schemes; ensure that aggregators and energy service providers can simultaneously access and optimise across multiple mechanisms and markets; establish clear rules for priority, compatibility and stacking of flexibility services; and enable consistent settlement and remuneration frameworks across different flexibility schemes.

5. **Remove barriers that prevent access to power exchange (e.g. minimum bid requirement, technical/ digital requirements).**

Current requirements such as minimum bid sizes, stringent prequalification criteria, and complex digital and IT interfaces are often designed for large market actors and are not proportionate to smaller, decentralised participants. Policymakers should enable aggregation mechanisms, lower entry thresholds and simplified participation procedures, while ensuring fair competition and system security. In parallel, standardised and user-friendly digital access to markets should be promoted to reduce transaction costs and facilitate broader participation.

6. **Simplify grid tariffs, especially for storage**

Member States have adopted very different strategies when it comes to the setting of network tariffs tailored to energy sharing schemes. The taxation, charges and levies applied to the self-consumed part also differ across Member States. Stronger guidance should be provided to national regulators on designing transparent network tariffs that encourage active customers to take part in energy sharing, including through energy communities. Specific network tariffs should also be designed to encourage the provision of flexibility and unlock the potential of 'grid-friendly' energy sharing thanks to storage.

7. **Ensure that settlement costs and fees imposed by suppliers to their customers taking part in energy sharing schemes are proportionate**

While it may be considered legitimate for suppliers to introduce compensation, such compensation should be duly justified and proportionate, so as not to create financial barriers for citizens willing to participate in an energy community or energy-sharing scheme. National policymakers should first assess whether such charges are justified.

[3] Gangale, F., Mengolini, A., Covrig, L., Chondrogiannis, S., Shortall, R., Making energy regulation fit for purpose. State of play of regulatory experimentation in the EU, Publications Office of the European Union, Luxembourg, 2023, doi:10.2760/32253, JRC132259. https://www.ceer.eu/wp-content/uploads/2024/06/JRC-study-Making-energy-regulation-fit-for-purpose.-State-of-play-of-regulatory.pdf

[4] European Commission: Directorate-General for Energy, Trinomics, Fraunhofer, Gorenstein Dedecca, J., Ansarin, M. et al., *Regulatory sandboxes in the energy sector – Final report*, Publications Office of the European Union, 2023, https://data.europa.eu/doi/10.2833/848065

If they are, any compensation should be proportionate to the volume of energy exchanged, so as not to create a barrier to the development of these services.

8. **Ensure consumer protection rights for energy sharing agreements between active consumers**

All consumers should have the freedom to choose their energy supplier, even when they are part of an energy community. Vulnerable citizens should be adequately included and protected. Clear rules or contractual templates need to be provided in all Member States in relation to dispute settlement and mitigation of risks related to collective projects (e.g. shared ownership).

9. **Set up one stop shops or similar structures to provide financial and technical support to municipalities to engage with energy sharing projects**

The EU should require Member States to set up one stop shops (OSS), or other support structures according to their national circumstances, to provide local authorities with technical and legal assistance.

Member States should in turn set up OSS (or similar) to improve access to finance for small municipalities, so they have the staff and resources to inform and mobilise local stakeholders. OSS would also help simplify public procurement rules for purchasing RES assets or electric assets (heat pumps, charging points, etc.), for buying locally produced energy or for putting public spaces at disposal of energy communities.

Finally, local authorities and municipalities should engage with local stakeholders by dedicating time to address environmental and/ or heritage related concerns with local organisations, and provide collaborative platforms to match available space with communities who could invest in RES. They should help local energy sharing initiatives or energy communities to deal with administrative procedures, legal issues, mobilising participants, setting up their business model including financing. And they should experiment innovative procurement practices to support the creation of energy sharing initiatives and energy communities.

10. **Create national working groups bringing together competent authorities, market actors, representatives of energy communities/ active citizens as well as EU funded projects**

Dedicated working groups can provide a structured and transparent platform for dialogue among all relevant stakeholders. Such fora can facilitate informed discussions on key regulatory issues and help mitigate unintended spillover effects of reforms across different actors within the energy system. These inclusive working groups would bring together all relevant stakeholders in order to support the coherent and effective implementation of EU legal provisions on energy communities and energy-sharing schemes, and to foster the scaling up of these initiatives across the European Union.

These recommendations are further detailed in the joint policy brief released in June 2026[5].

2.6 Conclusion

Action 1 built on the work carried out in previous years to explore how peer-to-peer (P2P) energy exchange and energy communities can enable citizens to participate in local energy markets and, more broadly, in electricity markets.

Through the contributions of several EU-funded projects participating in the BRIDGE initiative, the working group collected insights from national experiences and pilot implementations. While the level of regulatory maturity and

[5] Recommendations to empower citizens in the energy transition thanks to energy communities and energy Sharing: A joint policy brief by EU-funded projects LocalRES, FEDECOM, Masterpiece, STUNNED, INTELLIGENT and U2DEMO. June 2026. Available at the following link: https://fedecom-project.eu/wp-content/uploads/2026/07/BRIDGE-Regulation-WG-Action-1_joint-policy-brief.pdf

interpretation of concepts varies across projects and countries, this exchange provided a valuable overview of current practices and emerging regulatory approaches.

The analysis highlighted a number of recurring barriers to market participation for citizens and energy communities. These include limited integration of local energy exchange mechanisms into existing electricity markets, administrative and technical complexity linked to market participation requirements, fragmentation of national regulatory frameworks, and challenges related to financial viability and investment conditions. In addition, projects identified technical barriers such as data interoperability and access to metering information, as well as social challenges including trust, energy and data literacy, and the need to sustain long-term citizen engagement.

Building on these observations, Action 1 formulated a set of recommendations aimed at improving both EU-level and national regulatory frameworks. These recommendations focus on facilitating the effective participation of energy communities and P2P schemes in electricity markets, reducing unnecessary administrative barriers, improving data accessibility and interoperability, and ensuring that regulatory frameworks enable inclusive and scalable citizen participation in the energy transition.

3 ACTION 2 – FACILITATE ENERGY AND FLEXIBILITY MARKET COORDINATION AND INTEGRATION

Action leaders: Eliana Ormeño Mejía, Matteo Troncia, José Pablo Chavés Ávila (**BeFlexible Project**)

3.1 Introduction of the Action

The European electricity sector is undergoing a structural transition driven by decarbonisation targets, rapid growth of variable renewable generation, and the electrification of end-uses such as transport, heating and cooling. These challenges create new planning and operational concerns and increase the need for exploiting the system flexibility, particularly at distribution level, where high penetration of distributed energy resources (DERs) can intensify local congestion and voltage problems.

At the same time, the EU policy framework[6,7] increasingly promotes active consumer participation (including demand response, aggregation, storage and self-consumption), which expands the technical potential for flexibility provision beyond conventional generation-side. In this context, across Europe, DSOs and EU-funded projects are progressively testing a portfolio of flexibility procurement approaches.

In practice, flexibility at distribution level can be unlocked through different acquisition mechanisms, including (i) price-based instruments such as dynamic distribution network tariffs (implicit flexibility), (ii) market-based procurement through local flexibility markets (explicit flexibility), contractual-based mechanisms like (iii) flexible connection agreements, and (iv) rule- or (v) cost-based approaches[8].

However, these mechanisms are often conceived in isolation, and their simultaneous deployment can create uncoordinated signals resulting in inefficiencies, as already discussed in the previous year. Building on this context, BRIDGE Regulation Working Group (RWG) Action 2 aims to help to close these gaps by moving from general qualitative results to more quantitative evidence. In particular, Action 2 gathers EU-project inputs on the flexibility services targeted by DSOs, the acquisition mechanisms tested and their implementation maturity, the technical and operational requirements, model-based assessment perspectives and the extent to which coordination between mechanisms are considered.

3.1.1 Methodology adopted in Action 2

RWG Action 2 focuses on a model-based assessment of how energy and flexibility markets are coordinated and integrated across EU countries, with the aim of identifying best practices and the barriers that hinder effective flexibility mechanism design and coordination. Building on the methodology shown in Figure 3.1, this action compiles quantitative evidence and implementation insights from EU-funded projects, drawing on inputs from working group contributors and publicly available deliverables.

The results have been translated into lessons learnt and best practices, culminating in a set of evidence-based recommendations intended to enhance the coordination of flexibility procurement and support a more integrated market framework across the EU. Figure 3.1 shows the methodological steps considered for Action 2:

[6] European Parliament and Council Directive (EU) 2019/944 of 5 June 2019 on common rules for the internal market for electricity and amending Directive 2012/27/EU. https://eur-lex.europa.eu/eli/dir/2019/944/oj/eng

[7] European Parliament and Council. Regulation (EU) 2019/943 of 5 June 2019 on the internal market for electricity. https://eur-lex.europa.eu/eli/reg/2019/943/oj/eng

[8] European Commission: Directorate-General for Energy, European Climate, Infrastructure and Environment Executive Agency, Gerard, H., Pizzamiglio, A., Verez, D. et al., *BRIDGE, Annual report of the Regulation Working Group 2024 - 2025*, Publications Office of the European Union, 2025, https://data.europa.eu/doi/10.2926/4143543

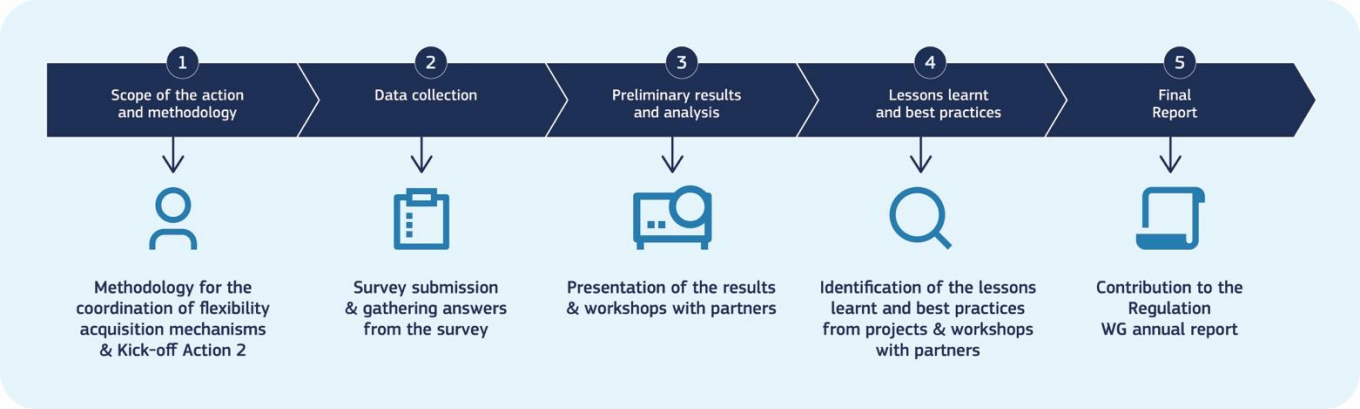


Figure 3.1: Steps of the methodology adopted in Action 2

1. **Scope of the action and methodology:** The scope of Action 2 encompasses: (i) flexibility acquisition mechanisms and services, (ii) the technical and operational information required from DERs, and (iii) the coordination of flexibility acquisition mechanisms and services across market and network processes.
2. **Data collection:** A survey was conducted to assess flexibility acquisition mechanisms. The structured questionnaire was circulated among the project partners to collect harmonised information aligned with the scope of Action 2. Respondents were explicitly asked to answer from the DSO perspective, focusing on flexibility services and acquisition mechanisms at the distribution level.
3. **Preliminary results and analysis:** The collected information was analysed to derive the initial insights. Several discussion sessions were held to deepen understanding of how flexibility-acquisition mechanisms are designed and implemented in practice, with particular attention to how they may interact and be coordinated. The main results of the survey are shown in section 3.2.
4. **Lessons learnt, best practices and recommendations**: Findings from the survey and partner workshops were consolidated to identify lessons learnt, best practices and areas for improvement (section **Errore. Il segnalibro non è definito.**3.2). Building on these insights and evidence from EU-funded partner projects, a set of recommendations was also put together (section 3.3).
5. **Final report:** The quantitative outcomes, lessons learnt, best practices, and recommendations have been consolidated into this report to facilitate decision-making on coordinated flexibility markets and flexibility acquisition mechanism designs.

The results of this process, presented below, were discussed with WG members during a dedicated workshop held on 27 January 2026.

3.1.2 Participating projects in Action 2

The Action 2 survey reached a broad set of EU-funded projects and demonstrator contexts. As summarised in Figure 3.2, a total of 23 survey responses were collected, covering 17 projects and 16 participating countries. Most projects

submitted a single response, while a small number provided multiple responses (up to three), reflecting distinct demonstration sites or implementation contexts within the same project.

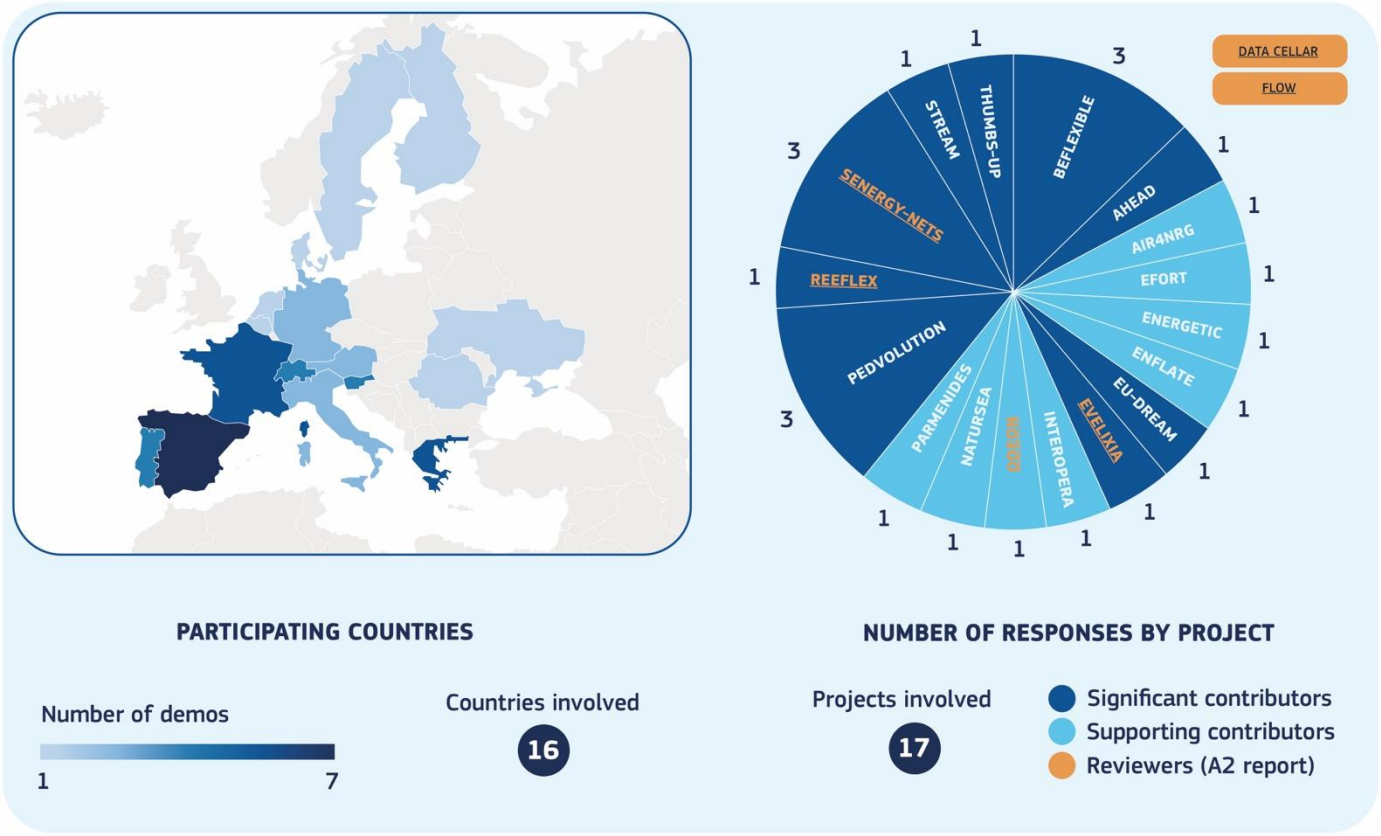


Figure 3.2: Projects participating in Action 2

From the perspective of their role in the report, survey participants were classified into three categories: significant contributors, supporting contributors and reviewers:

- Significant contributors provided the main inputs used to structure both the quantitative assessment and the qualitative interpretation in this section, as their responses covered flexibility procurement and included substantive information on the coordination of flexibility acquisition mechanisms, as well as best practices, lessons learnt and recommendations.
- Supporting contributors provided complementary responses that informed the analysis with limited direct impact on the report's core quantitative evidence.
- Reviewers are project partners willing to actively review and provide feedback on the Action 2 report.

3.2 Lessons learnt and best practices

3.2.1 Flexibility, acquisition mechanisms and services

This section summarises the main findings from the survey related to flexibility procurement, the types of acquisition mechanisms assessed across projects, their implementation status and the characteristics of the associated services. Figure 3.3 presents the responses collected in this section of the survey.

On the left, the key survey questions addressed in this section are presented. In the central part, the aggregated responses are displayed in stacked bar format, showing the distribution of answers across survey answers. On the right, the predefined answer options are listed and colour-coded, corresponding to the segments shown in the bars.

Figure 3.3: Survey responses from the section flexibility, acquisition mechanisms and services

These answers provide the basis for identifying lessons learnt and best practices as follows:

a. **Flexibility procurement remains a key focus for addressing current DSO challenges:** Most projects are actively assessing flexibility procurement mechanisms, typically in the design or pilot phase, confirming their relevance for addressing current DSO challenges.

b. **Local flexibility market (LFM) mechanisms are widely evaluated in most projects:** LFMs are the most common mechanism under study. Some projects incorporate in parallel dynamic tariffs, flexible connections, rule- or cost-based approaches, although their coordination remains limited.

c. **DSO flexibility services mainly target congestion management over voltage control:** Most of the solutions explored by projects are mainly focused on congestion management services; a few of them also consider voltage control.

3.2.2 Technical and operational information of DERs

This section summarises the survey findings related to the types of distributed energy resources (DERs) to enable flexibility procurement, the way these resources are represented in project methodologies, the aggregation approaches applied, the demand-side management (DSM) strategies considered and the treatment of penalties or

corrective measures. **Errore. L'origine riferimento non è stata trovata.** presents the responses collected in this section of the survey.

Figure 3.4: Survey responses from the section on technical and operational information of DERs

Based on these results, the following lessons learnt and best practices can be derived:

d. **Flexibility is multi-technology, involving a wide range of DERs:** Projects include a diverse portfolio of DERs (e.g. EVs, heat pumps, water heaters, controllable PV, and aggregated demand-side resources), indicating that flexibility is inherently multi-technology and acts as a bridge across sectors.

e. **Aggregation and demand-side management (DSM) play a central role in enabling flexibility:** Aggregation by customer segment, technology, service type or location is widely applied, while DSM strategies rely on load shifting for a large part.

f. **Clear corrective measures for DER misbehaviours reveal strategic risk gaps:** Without defined corrective actions for DER misbehaviours the system is vulnerable to strategic behaviours (gaming-risk).

3.2.3 Coordination of flexibility acquisition mechanisms

This section outlines the main survey results related to the coordination of multiple flexibility acquisition mechanisms when implemented simultaneously.

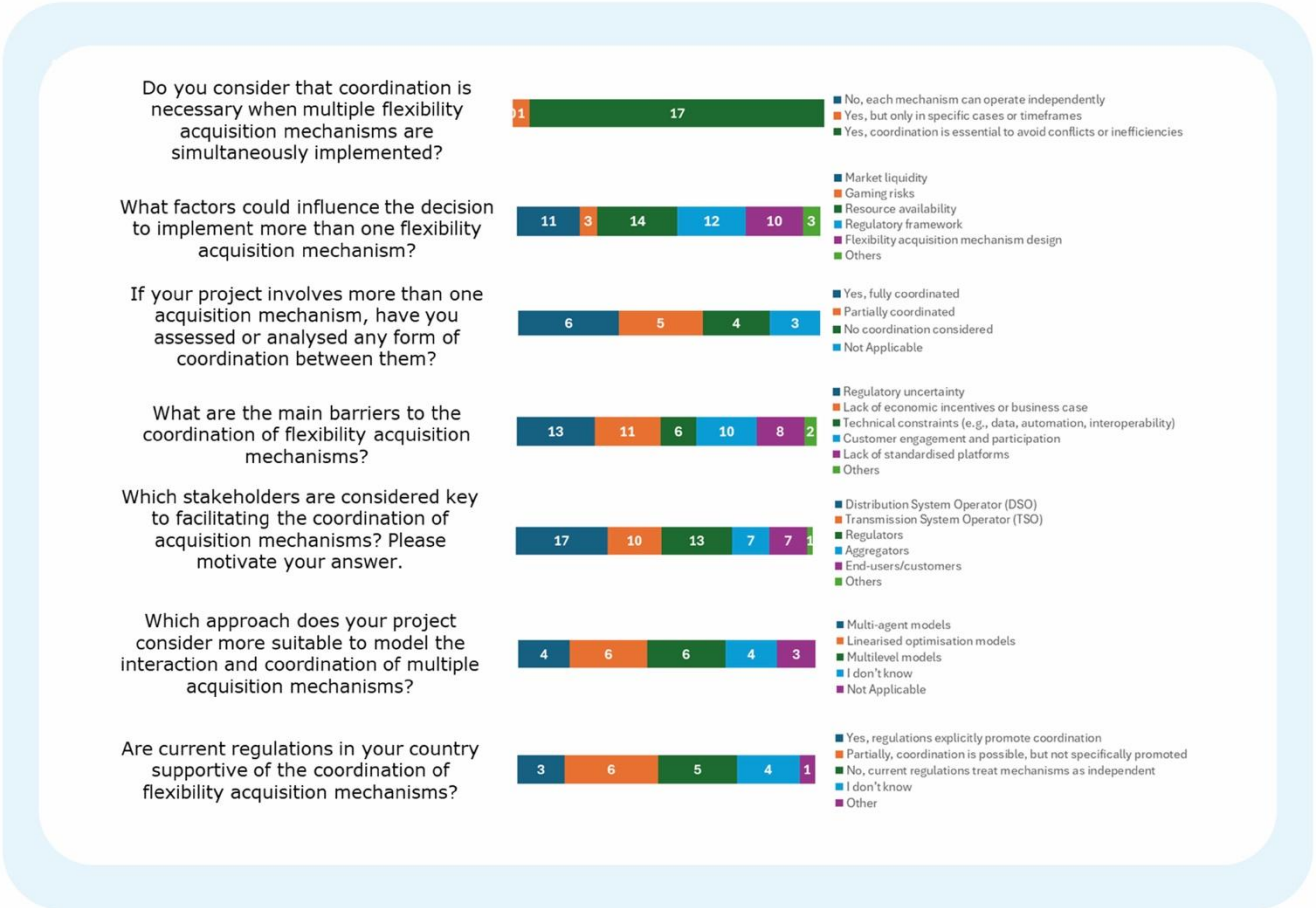


Figure 3.5 presents the partners' views on the need for coordination, the factors influencing multi-mechanism deployment, the degree of coordination assessed in the projects, key barriers, responsible actors, modelling approaches and the regulatory framework. It indicates a strong consensus that coordination is required when multiple flexibility acquisition mechanisms are deployed. Most respondents consider coordination essential to avoid conflicts and inefficiencies.

In addition, Figure 3.6 and Figure 3.7 provide a ranking of preferred combinations of mechanisms for congestion management and voltage control, respectively. This ranking reflects respondents' stated preferences collected through the Action 2 survey, where participants were explicitly asked to rank (first and second choices) the combinations of mechanisms they consider most suitable for coordinating multiple acquisition mechanisms to provide DSO services. Rather than evaluating a single mechanism in isolation, respondents were asked to indicate which combinations of dynamic distribution network tariffs, local flexibility markets (LFMs), flexible connection agreements, rule-based mechanisms and cost-based mechanisms they consider most suitable when jointly applied. Overall, the ranking illustrates that project partners do not consider a single mechanism sufficient to address network problems. Instead, coordinated combinations, tailored to the specific network needs, are perceived as more effective and efficient solutions.

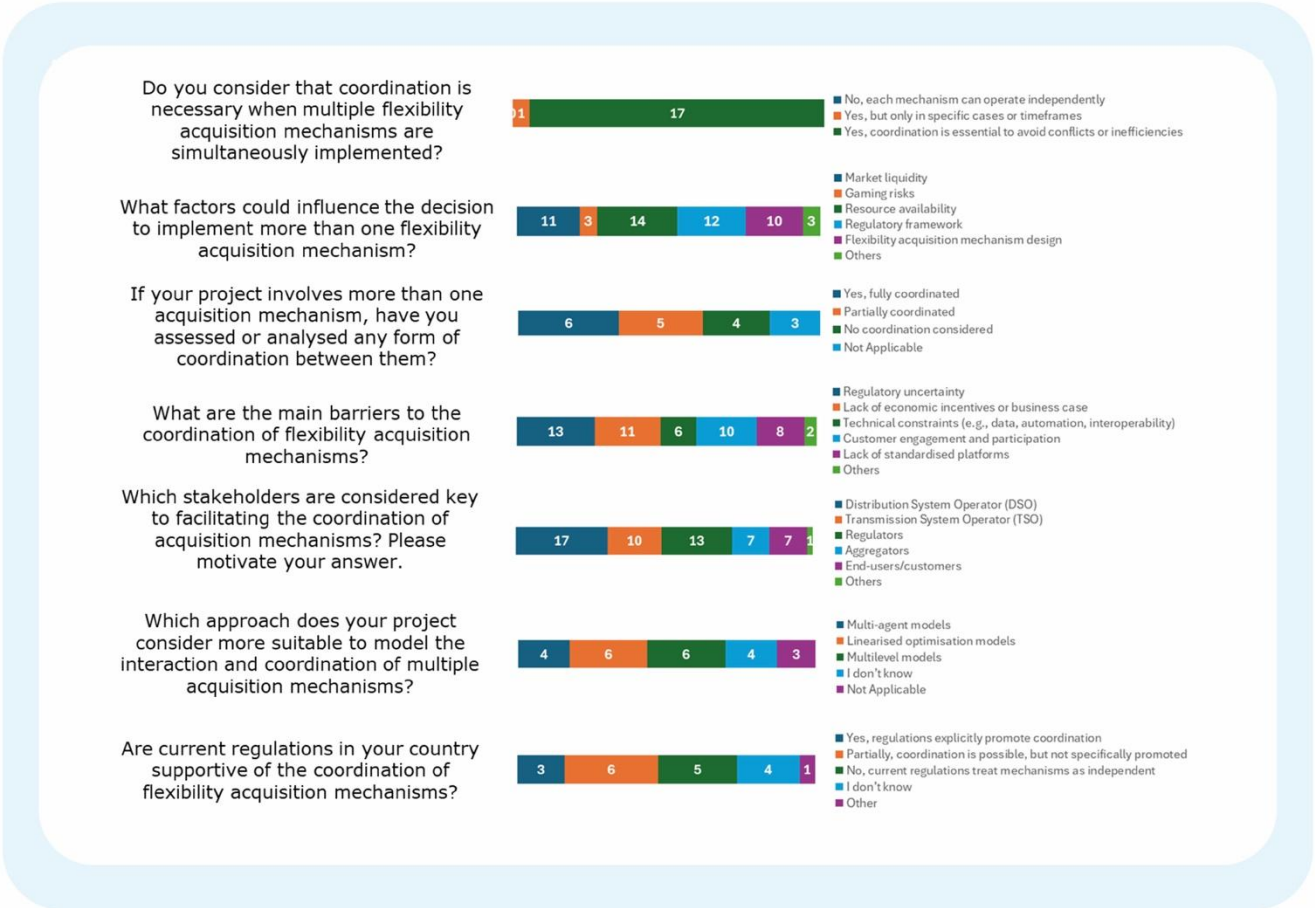


Figure 3.5: Survey responses from the section coordination of flexibility acquisition mechanisms

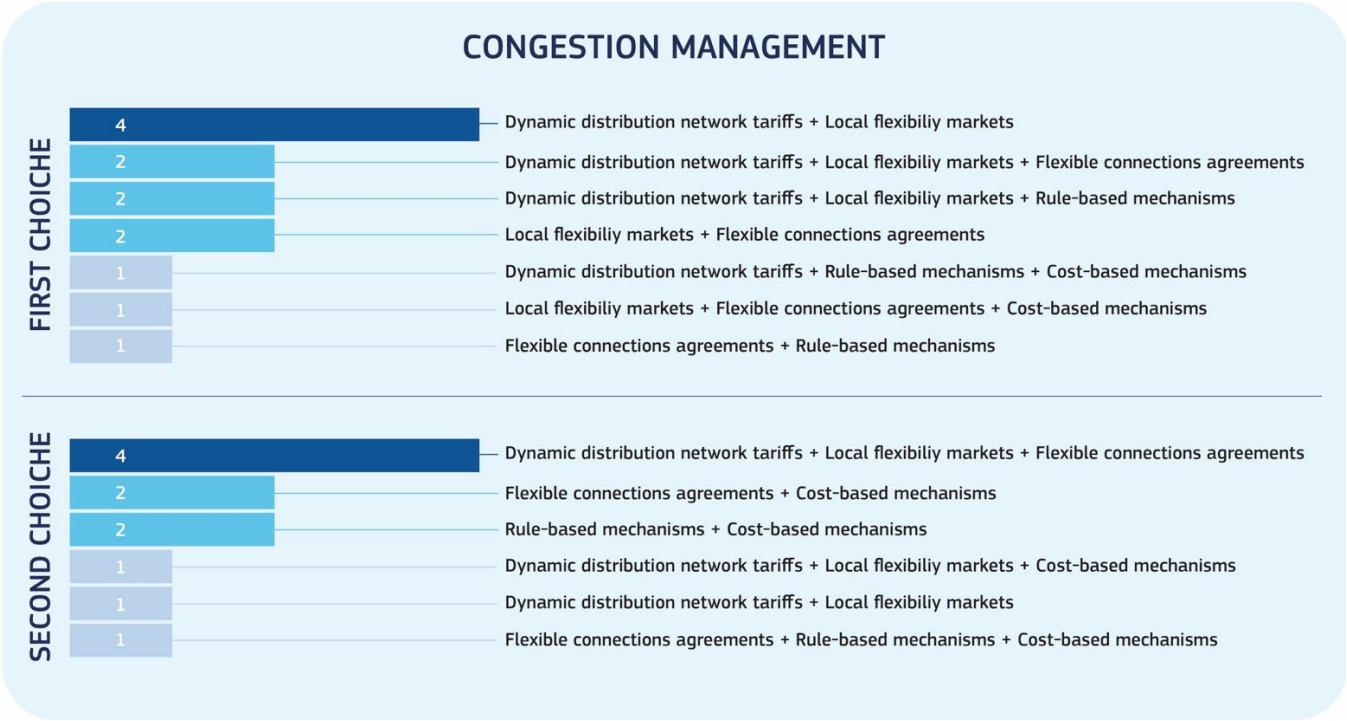


Figure 3.6: Ranking of combinations of flexibility acquisition mechanisms for congestion management

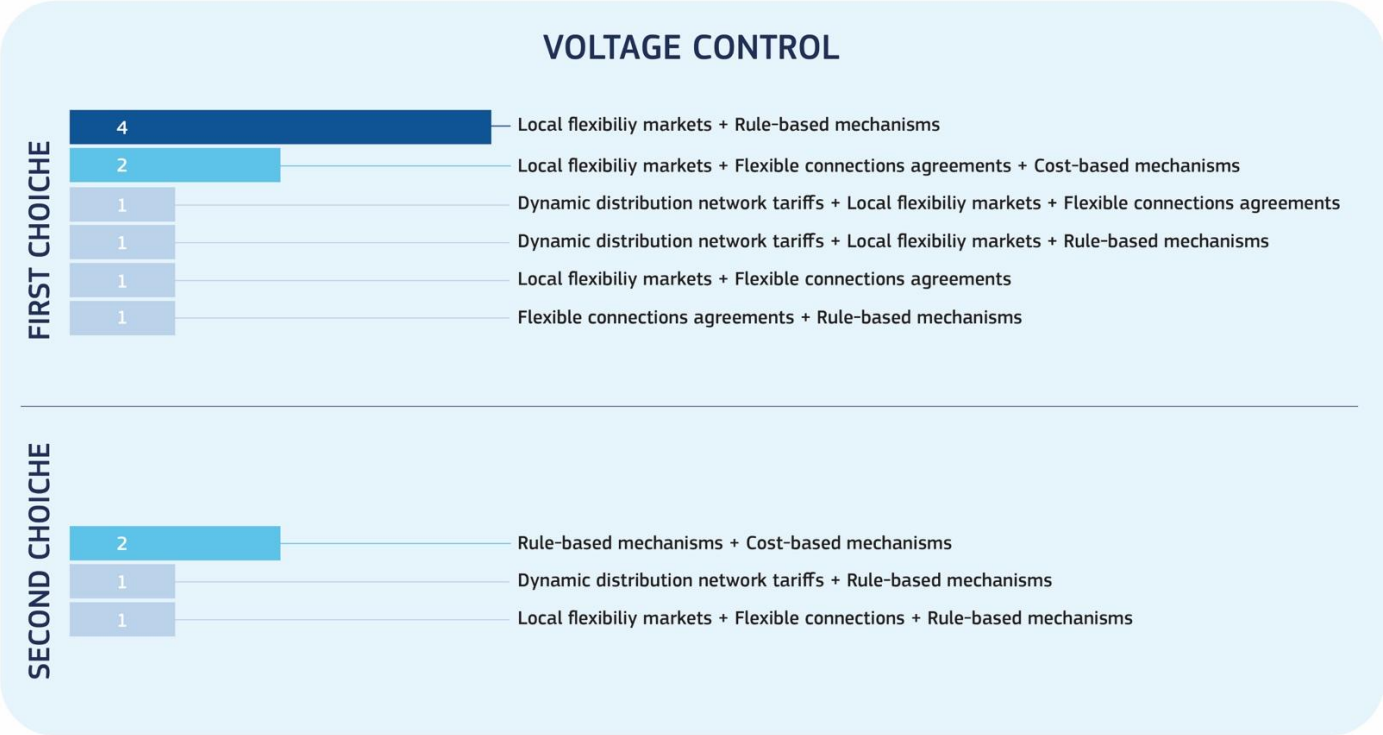


Figure 3.7: Ranking of combinations of flexibility acquisition mechanisms for voltage control

From these results, key lessons learnt and best practices can be outlined as follows:

g. **Regulatory and market conditions drive multiple flexibility acquisition mechanisms:** The decision to implement several mechanisms is primarily driven by the availability of flexible resources, regulatory frameworks, expected market liquidity and limitations in the mechanisms' design.

h. **Coordination between flexibility acquisition mechanisms is recognised as necessary:** Most projects consider coordination essential when multiple flexibility acquisition mechanisms are implemented simultaneously, particularly to avoid conflicting signals and inefficiencies.

i. **Regulatory, economic and technical barriers hinder effective coordination:** Lack of regulatory clarity, insufficient economic incentives and technical constraints are major barriers to effective coordination between acquisition mechanisms.

j. **Regulatory support for coordination remains limited:** Coordination is either only partially supported or not explicitly addressed in current regulations, with few cases of explicit regulatory promotion.

k. **Tariff-based and market-based flexibility acquisition mechanisms are complementary for congestion management:** In this case, the most frequently selected first-choice coordination is the joint use of dynamic distribution network tariffs and local flexibility markets, often complemented by flexible connection agreements. This highlights the value of combining long-term price signals with more targeted, short-term procurement mechanisms.

l. **Voltage control requires more locally targeted mechanisms:** For voltage control, projects tend to prioritise local flexibility markets combined with rule-based mechanisms, reflecting a preference for locally targeted schemes.

3.3 Recommendations and feedback from projects

This section provides recommendations that can be derived from the survey results and project experience across the three analytical blocks presented in Section 3.2: (A) flexibility, acquisition mechanisms and services; (B) technical and operational information of DERs; and (C) coordination of flexibility acquisition mechanisms. The recommendations below aim to bridge the gap between demonstrator-level insights into guidance that supports more harmonised implementation across EU countries. In particular, they emphasise the need for clearer regulatory frameworks that do not treat flexibility acquisition mechanisms in isolation but instead enable their effective coordination.

Recommendations related to flexibility acquisition mechanisms and services:

i. **Facilitate the transition from pilots to implementation:** Clear regulatory guidance, harmonised evaluation criteria and sandboxes are essential to scale up successfully tested flexibility acquisition mechanisms.

ii. **Promote coordination between flexibility acquisition mechanisms:** Establish frameworks to integrate and coordinate multiple acquisition mechanisms to provide consistent and effective signals to flexibility providers.

iii. **Broaden the scope of flexibility services (voltage control and multi-service provision):** Building on the observation that project implementations have largely prioritised congestion management over voltage control, extend the procurement of flexibility towards voltage control and multi-service provision (e.g., both DSO services) to meet a wider range of distribution network needs.

Recommendations related to technical and operational information of DERs:

iv. **Avoid technology-specific market designs by adopting technology-agnostic flexibility procurement:** Avoid technology-specific market designs by adopting technology-agnostic procurement frameworks and enabling flexible aggregation strategies adapted to grid conditions and service requirements.

v. **Set out clear rules for compliance and penalties to ensure reliable DER participation:** Establish transparent penalty and verification mechanisms to reduce gaming risks and ensure reliable DER participation without discouraging customer engagement (especially during early stages).

Recommendations related to the coordination of flexibility acquisition mechanisms:

vi. **Ensure consistency when multiple flexibility acquisition mechanisms coexist through clear coordination guidelines:** Apply clear coordination guidelines in the design and operation of flexibility acquisition mechanisms.

vii. **Address technical and economic coordination barriers by improving regulatory clarity, incentives and technical conditions:** Improve regulatory clarity, economic incentives and technical conditions (data, automation and interoperability) across acquisition mechanisms.

viii. **Move towards regulatory support for flexibility acquisition mechanisms coordination through pilots and sandboxes:** Move beyond partial or implicit support for the coordination of several flexibility acquisition mechanisms when they coexist by explicitly promoting harmonised coordination in regulatory frameworks, defining roles, responsibilities and interaction rules. Develop pilots and sandboxes to address regulatory uncertainty.

ix. **Harmonise modelling approaches to assess coordination and trade-offs:** Support the development and harmonisation of modelling approaches to better analyse interactions and trade-offs between multiple acquisition mechanisms.

x. **Exploit synergies by coordinating flexibility acquisition mechanisms across services:** Coordinated use of multiple mechanisms improves efficiency and effectiveness for solving network problems, with multi-layered mechanisms combinations supporting congestion management and voltage control.

xi. **Continuous monitoring of interactions among coexisting mechanisms to prevent emerging conflicting signals:** When multiple mechanisms coexist and are already coordinated, their interactions and signal consistency should be continuously monitored and periodically re-assessed to detect and mitigate emerging overlaps, misaligned incentives or inefficiencies as network response and stakeholder strategies evolve.

Feedback from projects:

The following points summarise the main feedback from projects, mapped to the Action 2 scope, and complementing the survey results with practical implementation experiences:

1. **Recognition of flexibility value is a key enabler (BeFlexible, EU-DREAM, STREAM):** Making the value of flexibility explicit and understandable is crucial to encourage participation and coordination. Economic incentives drive engagement, and penalties (especially at early stages) may discourage participation.

2. **Lack of coordination between flexibility acquisition mechanisms leads to conflicting signals (BeFlexible, THUMBS UP):** Standalone or uncoordinated acquisition mechanisms may lead to overlapping or contradictory signals, reducing efficiency.

3. **Enable coordinated flexibility procurement through regulation (BeFlexible, EVELIXIA, THUMBS UP, REEFLEX, SENERGY NETS):** Establish clear regulatory frameworks that allow the coexistence of different flexibility acquisition mechanisms, favouring transparency and competitiveness, while preventing uncoordinated signals leading to distortions and non-efficient economic behaviours.

4. **Stakeholder engagement is critical (BeFlexible, EVELIXIA, THUMBS UP, PEDvolution, REEFLEX, AHEAD):** Early and continuous involvement of DSOs, aggregators and end-users is essential to reduce conflicts and build trust across flexibility acquisition mechanisms. Effective coordination requires close collaboration among multiple stakeholders.

5. **Start simple and scale progressively (THUMBS UP, PEDvolution):** Simple, rule-based coordination and small-scale, voluntary pilots help build confidence and technical robustness before introducing more complex schemes.

6. **Standardisation and interoperability improve transparency and traceability (BeFlexible, EVELIXIA, PEDvolution, REEFLEX, THUMBS UP):** Clear data-sharing standards, interoperable systems and harmonised platforms enhance coordination of acquisition mechanisms, market liquidity and the operational value of flexibility.

7. **Coordination requires both frameworks and model-based assessments (BeFlexible):** Structured coordination frameworks help identify synergies and conflicting signals between acquisition mechanisms, while model-based assessments are needed to evaluate their operational impacts on the network.

3.4 Model-based outcomes: Experience from the BeFlexible project

This subsection builds on the BeFlexible Deliverable D7.1[9] and provides model-based evidence on the coordination of flexibility acquisition mechanisms. The assessment draws on the three BeFlexible demonstrators (Italy, Sweden, and Spain & France) and compares how the mechanisms for network tariffs, LFMs, and flexible or conditional connection mechanisms interact across different national contexts. The main contribution is therefore not the assessment of each mechanism in isolation, but the identification of complementarities and potentially conflicting signals when they coexist.

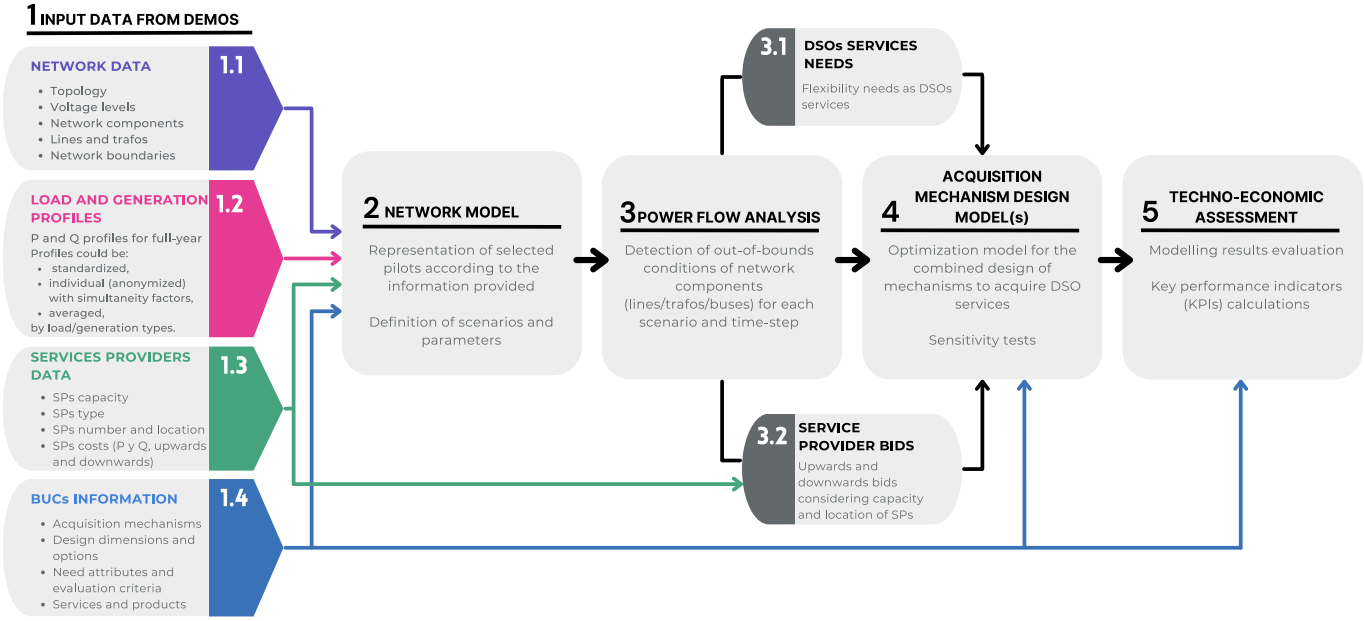


Figure 3.8: Methodological framework: BeFlexible Task 7.1. 1. Source: Deliverable D7.1

As shown in Figure 3.8**Errore. L'origine riferimento non è stata trovata.**, the methodology for the assessment comprises demonstrator data, network modelling, power flow analysis, modelling of acquisition mechanism designs, and techno-economic assessment within a simulated environment based on real operating conditions. Within this framework, BeFlexible analyses the interaction among price-based, market-based and contractual signals embedded in different flexibility acquisition mechanisms. Flexible resources such as EVs, heat pumps and water heaters are explicitly represented to capture their response to these mechanisms and assess the resulting impact on grid operation. The outcomes rely on optimisation models and power flow analyses implemented in a Python-based environment, using Pandapower and Gurobi as the main tools, to evaluate network performance through both economic KPIs (e.g., flexibility procurement costs) and technical KPIs (e.g., line and transformer overloads, and bus under- and over-voltage).

Overall, the BeFlexible results show that flexibility acquisition mechanisms should not be analysed separately when they coexist because their signals interact through the response of flexible resources and their impact on network operation. The modelling confirms that tariff design is a key driver of synchronised demand shifts, which may originate or worsen congestion, while locally targeted mechanisms such as LFMs, ex-post local tariffs and flexible connections can play a complementary role in mitigating these effects when properly coordinated. At the same time, the results show that poorly aligned combinations of predictable global and local signals may shift problems to other hours or network elements rather than mitigate them. The results also show that acquisition mechanisms

[9] BeFlexible Project, D7.1 – Evaluation of the proposed market designs and regulatory framework and analysis and selection of flexibility-centric business models, February 2026

focusing mainly on congestion management may not be sufficient to address all network needs, such as voltage issues, which underscores the importance of complementary approaches that incorporate voltage-related tools.

For Action 2, these outcomes are especially relevant because they show that coordination requires both a clear framework and quantitative assessment. The BeFlexible experience, therefore, supports a broader lesson in this report: when multiple mechanisms coexist, they should be evaluated not only by their standalone designs, but also by the consistency of the signals they send when operating jointly.

3.5 Conclusion and final remarks

Action 2 confirms that flexibility procurement is still a concern for DSOs, with most participating projects already testing flexibility acquisition mechanisms in the design or pilot phase. Local flexibility markets are the most widely assessed mechanisms, often complemented by dynamic network tariffs, flexible connection agreements and rule- or cost-based options. However, the results consistently shows that standalone flexibility acquisition mechanisms are rarely perceived as sufficient; projects increasingly converge on combined approaches to better address network planning and operational needs.

Furthermore, across projects, the technical and operational effective DER participation remains a decisive enabler. Flexibility portfolios are inherently multi-technology and depend strongly on aggregation and demand-side management strategies to deliver DSO services, such as congestion management and voltage control. At the same time, the limited use of established verification rules and corrective measures reveals implementation gaps for transparent participation conditions, opening the door to strategic behaviours increasing the exposure to inefficiencies like gaming risk or market power.

Finally, there is strong consensus that coordination is essential when multiple flexibility acquisition mechanisms coexist, yet regulatory, economic and technical barriers continue to limit practical coordination. For DSO services, the results indicate that coordinated combinations, tariff- and market-based mixes for congestion management, and more locally targeted schemes for voltage control are perceived as more effective than standalone approaches. Besides, model-based assessments may complement implementation insights by providing measurable results on how different mechanisms interact under realistic network conditions, helping to predict when mechanisms are complementary versus when they create conflicts (e.g., synchronised shifts, inefficient behaviours or signals, etc.). This supports quantitative evidence-based recommendations for coordinated mechanism designs. Moving forward, clearer regulatory guidance, improved interoperability and structured coordination frameworks supported by pilots and sandboxes are critical to shift from experimentation to harmonised and scalable deployment across EU countries.

4 ACTION 3 – SUPPORT THE POTENTIAL SYNERGIES FROM INCREASED SECTOR COUPLING/SECTOR INTEGRATION/SYSTEM INTEGRATION

Action leaders: David Verez (**HYSTORE Project**); Diana Moneta (**FLOW Project**); Edoardo Corsetti (**SENERGY NETS**)

4.1 Introduction to Action 3

4.1.1 Topics and goals

Traditionally, the EU energy system has been organised in separate segments: electricity, oil and natural gas, each with its own infrastructure developed and operated in isolation. This separation has led to one-way links between specific infrastructure and end-use sectors, creating linear energy flows.

As end uses become increasingly electrified, sectors are now more interconnected. In this context, a model based on unidirectional energy flows is no longer technically or economically efficient for supporting a decarbonised energy system. Evidence shows that coordinating the operation of different energy systems and infrastructure can lower the costs of the energy transition by making better use of existing assets (see Figure 4.1). Managing energy flows as a unified system also improves the ability to handle the intermittency of renewable energy sources while maintaining grid stability and reliability.

In the EU, integrating different energy systems is considered a cornerstone of the future energy model. The European Commission has launched several initiatives to link sectors and infrastructure, aiming to accelerate renewable deployment and reduce emissions. A key milestone is the Energy Sector Integration Strategy of July 8, 2020, which promotes a holistic view of the energy system rather than a siloed approach. While significant progress has been made, important gaps remain.

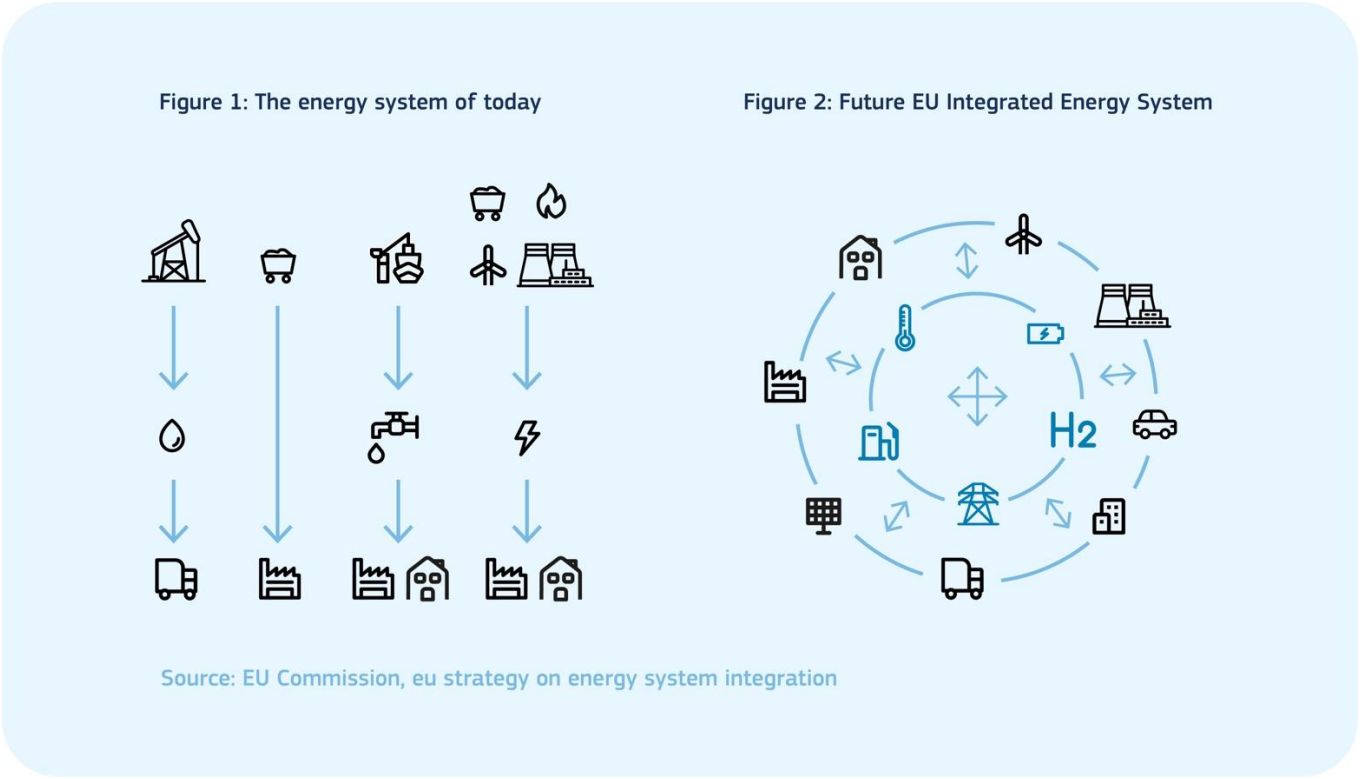


Figure 4.1: Comparison between the current linear and segmented EU energy system and the envisioned integrated energy system of the future. Source: European Commission, EU Strategy for Energy System Integration (2020)

4.1.2 Participant projects in Action 3

The following list shows the projects that have contributed to the 2025-2026 survey. Projects with an asterisk also participated in the 2024-2025 survey (named “Action 4” in the previous activity):

- AHEAD
- DATA CELLAR
- eFORT
- ENFLATE *
- EU-DREAM *
- EV4EU
- FLOW
- HVDC4ISLANDS
- InterSCADA
- NaturSEA-PV
- NEVERFLAT
- PARMENIDES
- PEDvolution
- SenergyNets (with 2 demos) *
- SINNOGENES
- STREAM *
- THUMBS UP *
- WinDTwin.

4.1.3 Methodology

As part of BRIDGE's mission to build on the efforts within various H2020 and Horizon Europe projects, Action 3 explores sector coupling from a broad perspective. Sector coupling encompasses various elements, including buildings and energy storage, and can be analysed through the lenses of:

- Regulatory challenges
- Business models
- Grid implications.

Although there is no universally accepted definition of sector coupling, for the purposes of this report, it is understood as follows:

> Sector coupling involves the increased integration of energy end-use and supply sectors with one another to improve the efficiency and flexibility of the energy system as well as its reliability and adequacy.

In this context, the main goal of Action 3 is to provide insights into sector coupling and discuss the regulatory perspective considering different end-use and supply sectors. In particular, it has focused on:

- Service provision by EVs
- Sector integration with heat
- Integration at household level
- other sector integration/sector coupling barriers.

This year, Action 3 has benefitted from joint leadership, bringing together diverse backgrounds and technologies. This report builds on the findings of last year's edition, which identified key barriers to sector coupling based on input from participating projects.

In particular, the projects' participation in Action 3 followed a 5-step methodology:

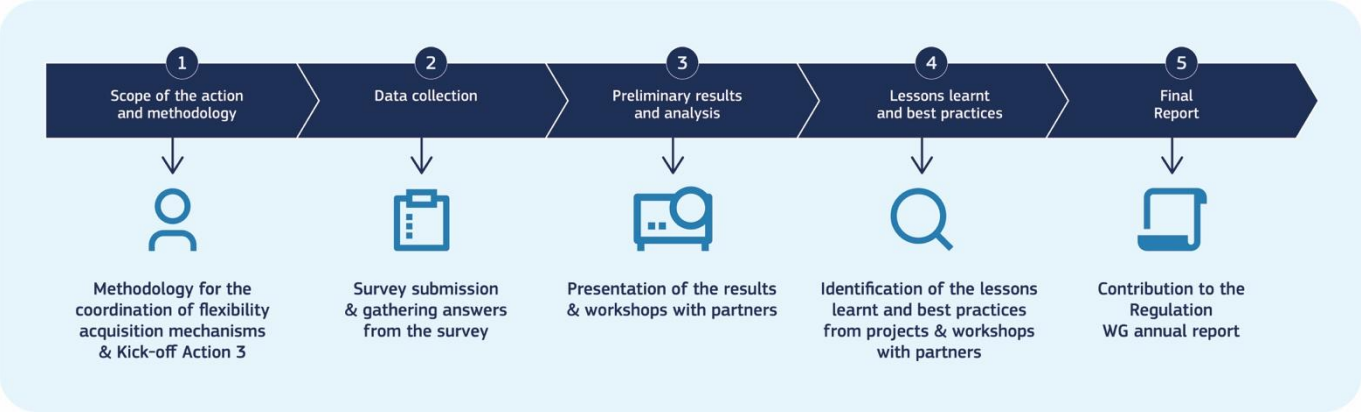


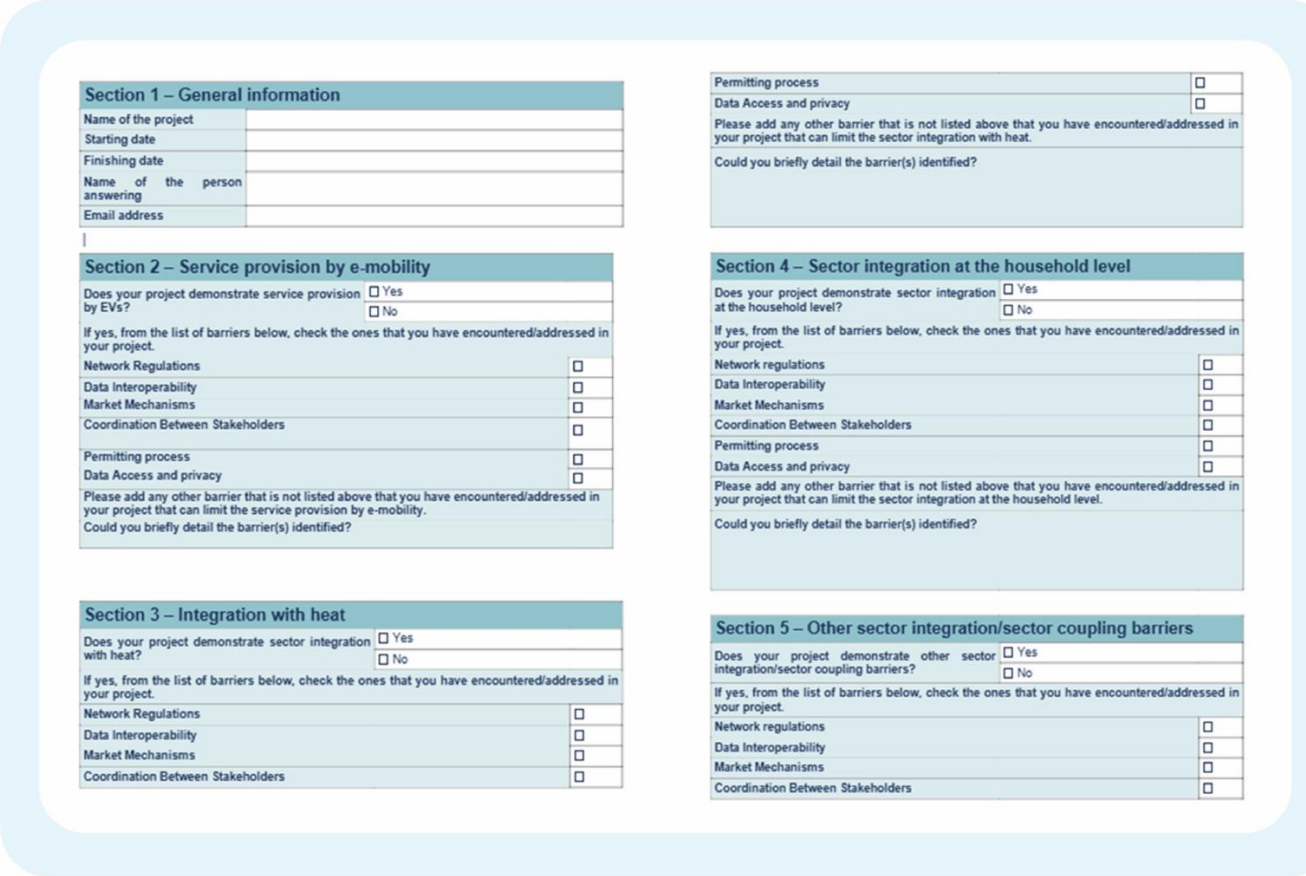
Figure 4.2: Action 3 five-step methodology followed during 2026

- **Scope of the action and methodology:** Establishment of the objectives, analytical framework and methodological approach used to assess sector integration barriers and opportunities across the participating projects. This phase established the scope of the analysis and the common structure for collecting and interpreting project inputs.
- **Data collection:** Compilation of inputs from the projects, including the results from the survey conducted in 2023 and the additional survey carried out with new project participants in 2024. This step focused on identifying key problems, barriers and potential pathways to address them.
- **Preliminary results and analysis:** Assessment of the collected data to identify recurring barriers, trends and emerging insights across projects. The analysis provided an initial understanding of the main challenges affecting sector integration.
- **Lessons learnt and best practices:** Identification of successful approaches and practical experiences from the participating projects. On 12 December 2025, the action leaders organised a knowledge-sharing session where projects presented how specific barriers were addressed and discussed solutions with potential for replication across initiatives.
- **Final report:** Consolidation of the analysis, lessons learnt and recommendations into a final report aimed at supporting the advancement of sector integration in the EU.

4.1.4 Problem statement

The traditional unidirectional energy flow model has proved to be inadequate for a decarbonised energy system, necessitating the integration and synergy of various energy sectors. However, a **comprehensive understanding of the primary barriers and best practices for enhanced sector coupling and wider adoption remains elusive.**

This section provides an overview of the main barriers identified by the projects participating in Action 3. It first presents the results of the 2025-2026 survey and then those of the 2024-2025 survey. The goal is to showcase the trends and changes of two consecutive years to gather insights on the evolution of the existing barriers for sector coupling/sector integration/system within the EU energy system. The survey is divided into five sections (following the stated methodology), each explained in detail below.



Section 1 – General information

Name of the project	
Starting date	
Finishing date	
Name of the person answering	
Email address	

Section 2 – Service provision by e-mobility

Does your project demonstrate service provision by EVs?	☐ Yes ☐ No
If yes, from the list of barriers below, check the ones that you have encountered/addressed in your project.	
Network Regulations	☐
Data Interoperability	☐
Market Mechanisms	☐
Coordination Between Stakeholders	☐
Permitting process	☐
Data Access and privacy	☐
Please add any other barrier that is not listed above that you have encountered/addressed in your project that can limit the service provision by e-mobility.	
Could you briefly detail the barrier(s) identified?	

Section 3 – Integration with heat

Does your project demonstrate sector integration with heat?	☐ Yes ☐ No
If yes, from the list of barriers below, check the ones that you have encountered/addressed in your project.	
Network Regulations	☐
Data Interoperability	☐
Market Mechanisms	☐
Coordination Between Stakeholders	☐
Permitting process	☐
Data Access and privacy	☐
Please add any other barrier that is not listed above that you have encountered/addressed in your project that can limit the sector integration with heat.	
Could you briefly detail the barrier(s) identified?	

Section 4 – Sector integration at the household level

Does your project demonstrate sector integration at the household level?	☐ Yes ☐ No
If yes, from the list of barriers below, check the ones that you have encountered/addressed in your project.	
Network regulations	☐
Data Interoperability	☐
Market Mechanisms	☐
Coordination Between Stakeholders	☐
Permitting process	☐
Data Access and privacy	☐
Please add any other barrier that is not listed above that you have encountered/addressed in your project that can limit the sector integration at the household level.	
Could you briefly detail the barrier(s) identified?	

Section 5 – Other sector integration/sector coupling barriers

Does your project demonstrate other sector integration/sector coupling barriers?	☐ Yes ☐ No
If yes, from the list of barriers below, check the ones that you have encountered/addressed in your project.	
Network regulations	☐
Data Interoperability	☐
Market Mechanisms	☐
Coordination Between Stakeholders	☐

Figure 4.3: Structure of the Action 3 survey used to collect insights on regulatory, technical, and operational barriers to sector coupling.

The survey was divided into five sections addressing general project information, service provision by e-mobility, integration with heat, household-level integration, and other sector coupling barriers. The responses were used to identify trends, compare data across years, and support the formulation of policy recommendations.

4.2 Results from the survey

Table 4.1 below depicts the overall view of the projects that had participated in the 2025-2026 survey, with respect to the four sectors: services from EV, integration with heat, integration at the household level, other sector integration.

Table 4.1: Mapping of the projects *vs* the sectors

	AHEAD	DATA CELLAR	EFORT	ENFLATE	EU-DREAM	EV4EU	FLOW	HVDC4ISLANDS	INTERSCADA	NATURSEA-PV	NEVERFLAT	PARMENIDES	PEDVOLUTION	SENERGY NETS	SENERGY NETS (FRENCH DEMO)	SINNOGENES	STREAM	THUMBS UP	WINDTWIN
Does your project demonstrate service provision by EVs?	Yes	No	No	No	No	Yes	Yes	No	No	No	Yes	No	No	Yes	No	Yes	No	No	No
Does your project demonstrate sector integration with heat?	No	Yes	No	Yes	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	No	Yes	No
Does your project demonstrate sector integration at the household level?	No	Yes	No	Yes	Yes	No	Yes	No	No	No	No	Yes	Yes	No	No	No	Yes	Yes	No
Does your project demonstrate other sector integration/sector coupling barriers?	No	No	No	No	No	No	No	Yes	Yes	No	No	No	No	No	No	Yes	No	No	No

The most addressed sector is the integration at the household level, followed by heat integration and service provision by EV; other sector integration is covered by 3 projects. Most projects deal with 2 sectors, 6 projects with one, only 1 project with 3 sectors and none with all the four cases. (Note: one project declared no sector integration).

Table 4.2 below summarises the feedback from the 2025-2026 survey. As described in the previous methodology section, the table depicts how different barrier categories are perceived (addressed and/or encountered) across the four integration contexts: service provision by electric vehicles (EVs), sector integration with heat, integration at the house level, and integration with other sectors.

Table 4.2: Percentage of participating projects that have selected each barrier in the 2025-2026 survey

	Service provision by EVs	Sector integration with heat	Integration at the house level	Other sectors integration
Network Regulations	33%	33%	33%	67%
Data Interoperability	50%	83%	67%	33%
Market Mechanisms	50%	17%	67%	33%
Permitting Process	17%	17%	17%	0%
Data Access and Privacy	50%	33%	83%	33%
Coordination Between Stakeholders	33%	50%	100%	33%

Firstly, results suggest that barriers are not uniformly distributed: some integration contexts concentrate challenges much more strongly than others, and each context can be either relatively balanced or dominated by one or two critical issues.

Integration at the house level emerges as the most "barrier-heavy" context overall: across all barrier categories, its average level is clearly higher than the other sectors, and it also contains the most extreme values in the entire table. The single highest cell is found here, Coordination Between Stakeholders at 100%, which is not only the peak of this column but also the maximum across the entire matrix. This prominence is reinforced by two other high values in the same column: Data Access and Privacy at 83%, and Data Interoperability at 67% (tied with Market Mechanisms at 67%).

Comments added in the survey confirm that the current regulation still lacks established market mechanisms to remunerate flexibility, and it is preventing an effective value stacking for actors involved in these business cases. Other comments highlight the barriers to the household data processing, such as energy consumption and production data. Access to data remains a challenge due to the wide variety of devices and differing technical standards. Addressing data privacy also requires special agreements with users, which can further complicate the process.

By contrast, *service provision by EVs* shows a much more even profile: values cluster 17% - 50%, with three barrier categories reaching the top score at 50%: Data Interoperability, Market Mechanisms, and Data Access and Privacy. This pattern is revealing because it suggests there is not a single dominant point; rather, EV service provision appears to sit at the intersection of (i) whether systems can exchange and interpret data, (ii) whether market rules and incentives allow the service to be monetised or valued appropriately, and (iii) whether data can be accessed and used in ways that meet privacy and governance requirements. Comments added in the form report that a standardised and common grid code for vehicle-to-grid (V2G) is lacking, and interoperability standards are missing in the EU Regulation on the alternative fuel infrastructure –AFIR (e.g., OCPP, OCPI etc.), since AFIR only requires ISO 15118 for the recharging points, not for the cars. As of June 2025, new cars with AC V2G are so far only delivered with proprietary charging solutions. As mentioned for other sectors, many actors do not share their sensitive business data. At the same time, Permitting Process is only at 17%, the lowest in the EV column, implying that, at least in this survey, administrative authorisation is not perceived (anymore) as the primary barrier compared with data and market design.

The column for *sector integration with heat* stands out for a different reason: it is highly dominated by one barrier, namely Data Interoperability at 83%. The next highest value, Coordination Between Stakeholders at 50%, is significant but much lower than interoperability, and the remaining categories are either moderate (33%) or low (17%). This configuration points to a more specific diagnostic than for house-level integration. In the heat context, the table strongly implies that the central issue is the ability to integrate systems, standards and datasets across domains that historically evolved separately. Coordination still matters, but as a second-order constraint compared to the "plumbing" of data exchange. Comments from the survey confirm there are still no standardised communication interfaces for controlling decentralised flexibility assets: extra hardware and dedicated solutions are often needed, which is a substantial cost factor. Data Access and Privacy is mostly related to obtaining consent, with legal and compliance complexity; Coordination Between Stakeholders is perceived as time-consuming, with administrative hurdles against obtaining data. Besides, business owners are often reluctant to allow external entities to interfere with their systems, especially when there is no clear benefit to them. Above all, the field is perceived as rapidly evolving.

A contrasting picture appears for the *other sectors integration*, where Network Regulation reaches 67%, clearly above all other categories. The remaining barriers, Data Interoperability, Market Mechanisms, Data Access and Privacy, and Coordination Between Stakeholders, are all equal at 33%, while Permitting Process drops to 0%, the minimum of the entire table. This pattern could imply that, when thinking about integration beyond EVs and heat, the main friction is perceived to come from the regulatory framework governing networks: connection rules, operational constraints, access conditions and compliance requirements. In other words, the limiting factor is less about whether actors can technically exchange data or coordinate in principle, and more about whether the

network regulatory environment enables or constrains integration in the first place. The fact that all other barriers converge at the same moderate level (33%) suggests a relatively "flat" secondary layer of issues once regulations are addressed.

Looking across the table by barrier category, Data Interoperability appears as the strongest barrier on average across contexts, appearing consistently high and peaking sharply in the heat column. Coordination Between Stakeholders follows closely, and it is the single most dominant barrier in the house-level context. Data Access and Privacy also maintains high relevance, especially at the household level, indicating that even when interoperability exists, the ability to legally and practically access data, and to do so under privacy constraints, remains a core condition for integration. In contrast, Permitting Process is persistently low across contexts and is even absent (0%) in "other sector integration." This does not mean permitting is never important in reality; rather, it means that within projects participating in the survey, permitting is not the barrier respondents most frequently elevate when compared with regulation, markets, data and coordination.

An additional nuance emerges when considering variability (taking into account the size of the analysed sample). Household-level integration shows the broadest spread of values, from 17% up to 100%, which indicates a barrier landscape that is highly concentrated around a few critical issues. EV service provision, in comparison, has a narrower spread, which implies a more balanced set of constraints, perhaps reflecting its relative high level of maturity. Heat integration also exhibits strong variability, but it is variability driven by a single steep peak (interoperability), suggesting a more targeted intervention point: if interoperability were improved, a large share of the perceived barrier might be relieved.

A comparison to the 2024-2025 survey is provided. It is worth noting that 2 different sets of projects answered the two surveys, so results are not completely comparable. In addition, some projects that participated in the 2025-2026 survey are in their earlier stage, so some barriers are not yet reported / addressed.

Table 4.3: Percentage of projects that selected each barrier in the 2024-2025 survey

(Note: a different set of projects w.r.t. the previous table)

	service provision by EVs	sector integration with heat	Integration at the house level	other sectors integration
Network Regulations	40%	40%	27%	67%
Data Interoperability	20%	60%	64%	0%
Market Mechanisms	20%	40%	45%	67%
Permitting Process	0%	20%	18%	67%
Data Access and Privacy	20%	40%	45%	0%
Coordination Between Stakeholders	60%	40%	45%	0%

In the previous Table 4.2, EV service provision looks like a three-way balance between data interoperability, market mechanisms and data access/privacy (all at 50%), with coordination at 33%. Conversely, in Table 4.3 the picture shows Coordination Between Stakeholders as the leading barrier (60%), network regulations reach 40%, and data interoperability / market / privacy each fall to 20% and permitting drops to 0%. These changes support a maturity-based reading of sector integration: coordination first, aligning roles between aggregators, DSOs, retailers and end users, before technical and data governance issues surface in detail.

Both tables agree that data interoperability is central for heat integration, suggesting a shift from a predominantly "technical integration" framing toward a more "economic" framing. Once interfaces/standards are clarified enough to proceed, attention turns back to incentives, remuneration and market access, i.e., how flexibility or coupling is valued and settled. Projects closer to implementation may have put governance structures and coordination

mechanisms in place (bringing perceived coordination barriers down), revealing more specific technical interoperability constraints that remain.

Besides, "house-level" projects are inherently multi-stakeholder (driving coordination to the top), while others are more technology-stack centred (driving interoperability to the top). In the previous survey, "other sectors" projects were probably at a stage where basic permitting, regulatory constraints and market access were the gating items, while the data/coordination layer had not yet been encountered. Another interpretation is that "other sectors" integration has involved domains where data exchange was less maturely framed (or less central), while formal approvals and market entry dominate attention.

4.3 Recommendations

The recommendations provided in the 2024 final report of Action 4[10] are still valid, especially those referring to the reform of market rules in terms of cross carrier to overcome the fragmentation among electricity, gas, heating and cooling, mobility, and flexibility markets. In the 2025 annual activity report, the national regulators were asked to develop standardised regulatory frameworks to overcome interoperability issues between platforms managing the transactions of the different energy vectors, defining stakeholder roles, market participation rules and transactional platforms. This reform should also revise the taxation mechanism that currently requires the payment for all the transfer of resources from one energy market to another.

These requests deeply impact the European regulation and thus it will likely take some time before adequate mechanisms are implemented. However, in this year's results, market reform and standardisation to increase interoperability are still among the top topics.

The recommendations provided by the different projects in the survey are reported below according to several dimensions: regulation, market, interoperability, household and data.

- **Regulation**

Bid size and prequalification criteria: currently the minimum bid sizes (often 1–5 MW) and technical prequalification are currently excluding market-access small-scale district heating and cooling (DHC) assets without aggregation. Lowering the market access barriers, reducing the minimum bid sizes to 100 kW, or below, for demand-response and thermal-storage products, allow multi-site aggregation and fast-track prequalification for DHC operators with certified control systems.

Tariff structures: retail electricity tariffs with high fixed or capacity components reduce the arbitrage value of load-shifting, while network charges often lack dynamic or locational signals that would reward congestion relief. The reform of tariff design should allow dynamic, locational network tariffs that reflect real-time scarcity and congestion, exempting or reducing fixed charges on flexibility-providing assets, and aligning levies to incentivise sector coupling rather than penalising electricity use for instance in heat pumps.

Cross-sector coordination gaps: electricity, gas and heat planning processes remain siloed; integrated infrastructure assessments and joint dispatch mechanisms are nascent.

Mandate integrated planning: requires TSOs, DSOs and municipal heat planners to coordinate 5–10-year flexibility-needs assessments (as now required by EMDR for electricity), identifying where DHC thermal storage and dispatch can defer grid reinforcement.

[10] European Commission: Directorate-General for Energy, European Climate, Infrastructure and Environment Executive Agency, Gerard, H., Pizzamiglio, A., Verez, D. et al., *BRIDGE, Annual report of the Regulation Working Group 2024 - 2025*, Publications Office of the European Union, 2025, https://data.europa.eu/doi/10.2926/4143543

Policy uncertainty: evolving efficiency criteria for DHC (percentage thresholds for renewables, waste heat, CHP) and the phase-in of stricter standards create investment hesitation. Clarify DHC efficiency pathways: provide stable, long-term roadmaps for the progressive renewable/waste-heat/CHP thresholds in RED III and EED, with grandfathering or transition support for networks investing in flexibility-enabling infrastructure (storage, large heat pumps, control upgrades).

- **Market**

In many European countries, there are a lot of different mechanisms with different characteristics, it is very complicated, and it is sometimes difficult to understand how they work and how they are coordinated between each other.

There is insufficient coordination between markets, the regulation of the electricity sector, and the heat sectors.

- **Household**

The goals of sector integration are to: i) support the complete integration of heat pumps, solar energy panels, etc.; ii) develop and empower data-driven and user-friendly digital solutions/tools for consumers, AI and NLP innovations that act as assistant tools and intermediators towards consumers (to provide information, give suggestions, etc.); iii) offer secure and interoperable data sharing with simplified digital platforms.

Besides the technological improvements introduced to enable household integration, the development of a novel set of market mechanisms is expected to support consumer (direct) access in energy markets.

- **Interoperability**

Coordination among stakeholders is time consuming and data is hardly shared due to the lack of communication between proprietary tools.

Missing interoperability standards in AFIR (e.g., OCPP, OCPI etc.) - AFIR only requires ISO15118 for the recharging points, not for the cars. New cars with AC V2G are so far only (as of June 2025) delivered with proprietary charging solutions.

- **Data availability**

Data exchange can be difficult due to a lack of a standardised data format. Furthermore, user consent and legal issues represent hurdles in sharing data.

There are no standardised and common grid codes for V2G between countries. The EU still doesn't have *ad hoc* standards like OCPI and OCPP. It's worth underlining that, while OCPP has achieved international standard status through IEC 63584, OCPI still is missing approval by an international standardisation organisation.

Besides, the lack of standardised protocols for real-time monitoring, settlement and verification of thermal flexibility limits TSO/DSO confidence in DHC bids. Standardising data frameworks, by adopting common telemetry and M&V standards (building on EBGL and the emerging Network Code on Demand Response), can enable DHC fleets to bid on balancing and flexibility markets with transparent settlement.

4.4 Conclusions and next steps

Action 3 confirms that sector coupling and system integration are no longer conceptual pathways but operational necessities for achieving a cost-efficient and resilient decarbonised energy system. The evidence gathered from BRIDGE projects shows that while technical solutions are rapidly evolving, regulatory and organisational frameworks are still lagging behind, limiting the large-scale deployment of integrated energy systems.

The analysis highlights that barriers to sector integration are highly context-dependent. At household level, integration is primarily constrained by coordination challenges among multiple stakeholders and by data

governance issues, including access, privacy and interoperability. This reflects the inherently distributed and multi-actor nature of these solutions, where the alignment of incentives, roles and responsibilities becomes the critical enabler. In contrast, sector coupling with heat is predominantly limited by data interoperability, indicating that the absence of harmonised technical standards and communication protocols remains a structural bottleneck. For other sectors, network regulation emerges as the main barrier, pointing to the need for regulatory frameworks that better accommodate new use cases and cross-sector interactions. Finally, service provision by EVs shows a more balanced set of barriers, suggesting a higher level of maturity but also the need for coordinated progress across market design, data frameworks and interoperability standards.

A key insight from this year's work is that sector coupling challenges follow a maturity-driven pattern. Early-stage initiatives are primarily constrained by coordination and governance issues, while more advanced implementations increasingly face technical interoperability and market design limitations. This evolution suggests that regulatory frameworks should be adaptive and capable of addressing different stages of deployment, rather than applying uniform solutions across contexts.

Across all sectors, data-related barriers consistently emerge as a central theme. Interoperability, access to data and privacy management are not only technical issues but also regulatory and organisational challenges that directly impact the feasibility and scalability of integrated solutions. Without clear rules, standardised interfaces and trusted data-sharing mechanisms, the potential of sector coupling cannot be fully realised.

The findings also reinforce that sector integration requires a systemic approach. Addressing individual barriers in isolation is unlikely to deliver meaningful progress. Instead, coordinated action is needed across three dimensions: regulatory frameworks that enable cross-sector participation and value stacking, technical standards that ensure interoperability across devices and platforms, and governance models that facilitate coordination among actors while safeguarding consumer rights and system security.

Looking ahead, the next steps should focus on translating pilot-based evidence into scaleable regulatory solutions. This includes accelerating the development of harmonised data standards, clarifying the role of different actors in cross-sector services, enabling fair and transparent remuneration mechanisms, and adapting network regulation to support integrated use cases. In parallel, continued knowledge sharing across projects and stakeholders will be essential to consolidate best practices and reduce fragmentation across Member States.

Overall, Action 3 concludes that sector coupling is not limited by a lack of technological solutions, but by the need to align regulation, data frameworks and stakeholder coordination. Bridging these gaps will be critical to unlock the full value of integration and to move from isolated pilot projects to a fully integrated European energy system.

5 ACTION 4 – SUPPORT THE SYSTEM OPERATORS TO PREPARE THE GRID FOR 2030

Action leaders: Santiago Gallego and Miguel Ángel Ruiz (**BeFlexible Project**)

5.1 Introduction of the Action

The Regulation Working Group proposed this Action 4 (former Action 5) in light of the need to adapt electricity grids to an increasing electrification of the economy, where users will have a more active role in the future system. This action therefore seeks to enhance network planning and operations to help operators prepare for 2030, even more so, considering the renewed interest from policymakers and regulators in electricity networks (European Action Plan on Grids, new provisions of the Market Design reform)[11]. Considering that there are more than 2600 system operators (SO) across Europe with a wide spectrum of company sizes and disparities in national

[11] COM(2023) 757 final, 28/11/2023, Grids, the missing link - An EU Action Plan for Grids.

concentrations, it is essential that they can manage more flexibility systems with the help of innovative tools, which in some cases are being tested in European-funded projects. Action 4 focuses on identifying innovations to improve processes and tools, with key areas including integrating flexibility, balancing investments with flexibility, managing congestion, and developing remuneration mechanisms for system operators.

5.2 Methodology adopted in Action 4

The action started in 2023 with a questionnaire that was sent to the participating BRIDGE projects. Two more questionnaires followed, aimed at proposing complementary topics, building upon the previous learnings, and expanding the results.

The results from the surveys were analysed and disscussed at meetings with the participating projects. The perspectives of these projects have enabled a more complete picture to be built up and they shed light on how the projects help ensure that SOs have the networks they need.

From the first activity, an effort has been made to share the viewpoints with as many stakeholders as possible. For example, the results of the first questionnaire were shared with ISGAN, and the conclusions were discussed in a joint workshop. Similarly, there have been collaborations with DSO associations, such as the participation of the Working Group Chair in the E.DSO FutureGrid Innovation Summit. This has fostered a more open and enriching dialogue, allowing for a better understanding of all perspectives.
Finally, a knowledge sharing session was organised to disseminate the findings from the period this action was live. The **Flow** and **Opentunity** projects were invited to this session, and a recently published paper by GEODE and E.DSO on DSO remuneration, closely related to the topic under discussion, was also presented.

5.3 Flexibility mechanisms for DSOs and their trade-off with investments

The first questionnaire focused on the applicability and complementarity of different flexibility mechanisms (market-based, cost-based, rule-based, flexible connection agreements, dynamic tariffs) and the trade-off between investment and the use of flexibility.

In 2024, the workshop "Applicability of different flexibility mechanisms for DSOs and their trade-off with investments", was held in cooperation with ISGAN WG6. This workshop was part of the '2023.01 Active System Management by Distribution System Operators – Online workshop series', comprising three workshops. During the workshop, the participants discussed each of the factors more in detail (i.e., the type of DSO need or service that is considered). The results of a poll were presented showing which flexibility mechanisms are considered most suitable for solving congestion and voltage issues in DSO grids. The flexibility mechanisms were ranked from 1 to 5, with different colours indicating the first and last choices (corresponding to the most to least suited) made by respondents.

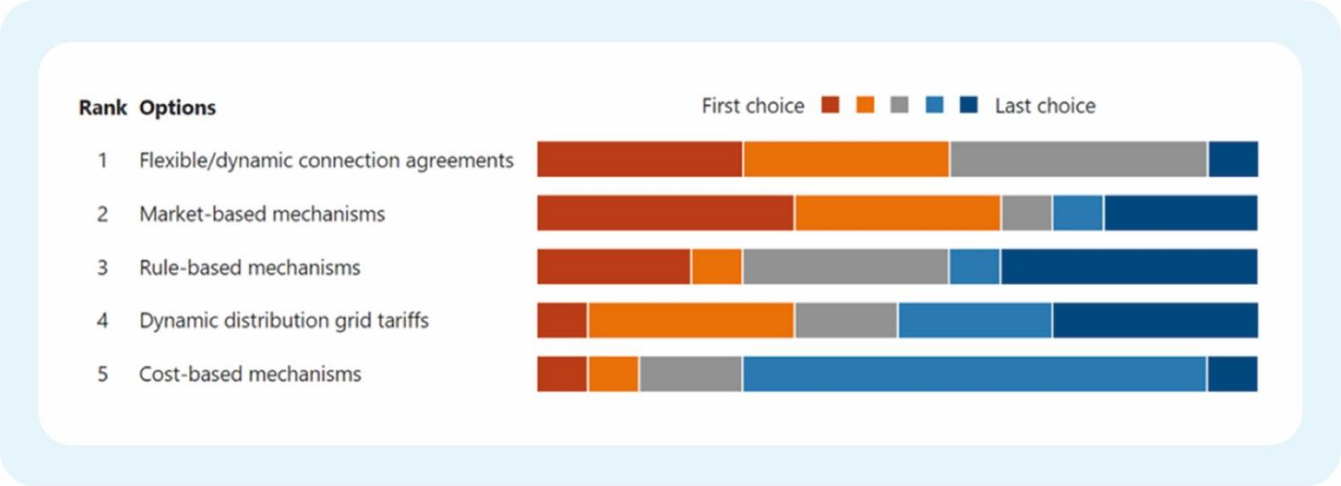


Figure 5.1: Poll answers on which flexibility mechanisms are most suited to solve congestion in DSO grids (input from workshop 3)

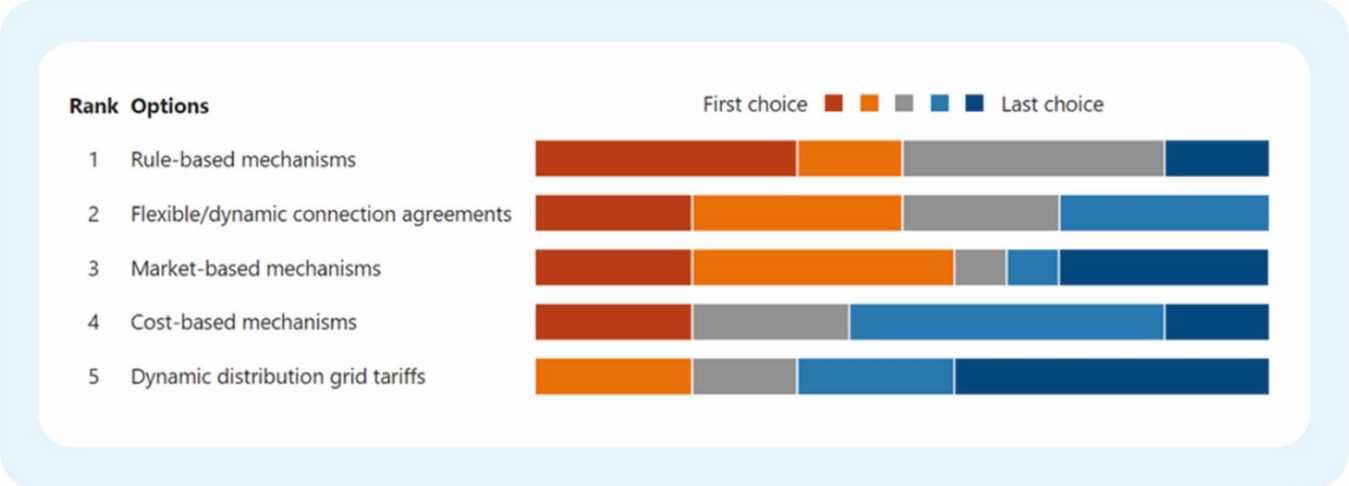


Figure 5.2: Poll answers on which flexibility mechanisms are most suited to solve voltage issues in DSO grids (input from workshop 3)

Another topic discussed during the third workshop was the limitations in the existing designs of flexibility mechanisms. These mechanisms are traditionally designed to operate as independent solutions without considering their potential for integration and complementarity. This standalone approach overlooks the synergies and conflicts that may arise when different mechanisms coexist and interact. For instance, network tariffs can provide long-term signals for infrastructure investment, while market-based solutions can address short-term operational needs. Similarly, dynamic connection agreements can provide immediate SO services that can be later managed through (local) market transactions, fostering cooperation between short-term and long-term flexibility solutions. On the other hand, designing these mechanisms without considering their interactions can lead to conflicts such as overlapping signals to consumers, which may lead to distorted consumer behaviours. Thus, each mechanism should be designed to signal an independent cost segment separated from another mechanism.

There were 5 main takeaways from the workshop:

- DSOs should carefully select flexibility mechanisms (market-based, dynamic connection agreements, tariffs, rule-based) tailored to needs and efficiency – customised to the voltage levels.
- The combination of multiple flexibility mechanisms is essential, with more than 2/3 favouring growth in

market-based options.

- Market-based flexibility proves effective for short- and long-term solutions, with long-term solutions especially relevant for DSOs in deferring grid investments.
- There is no standardised methodology to make a trade-off between grid investment and flexibility by DSOs – a challenge that is being actively discussed in many countries.
- Anticipatory investments are crucial, especially for enabling use cases like untapped RES potential and e-mobility growth. Future scenario robustness is key.
- It is important to consider that the output of this action shows some synergies with that of Action 3.

5.4 Innovations needed to advance processes and tools of network planning and network operation.

The second questionnaire was circulated to participating projects on 3 December 2024, with a deadline on 10 January 2025. The questions were:

• What do you think is the biggest challenge SOs face when designing their network in the next five years?

• Which of the mentioned SO solutions does your project contribute to?

• Regarding the ones you have marked, indicate the degree of maturity.

• Which measures used by SOs do you think need to be adopted more quickly?

• Describe in one or two sentences how your project can help SOs improve the planning and operation of their network.

The targeted projects were: BEFLEXIBLE, DATA CELLAR, EFORT, ELECTRON, ENERGETIC, FLEXCHESS, HEDGE-IoT, ODEON, OMEGA-X, OPENTUNITY, R2D2, SENERGY NETS, STREAM, TWINEU, ENFLATE, PARMENIDES, REEFLEX, DRIVE2X, FEDECOM.

After the survey, a meeting was held with the participating projects to discuss the results and to draft recommendations.

The process began by asking about the role of the respondents in order to understand the context in which the answers were formulated.

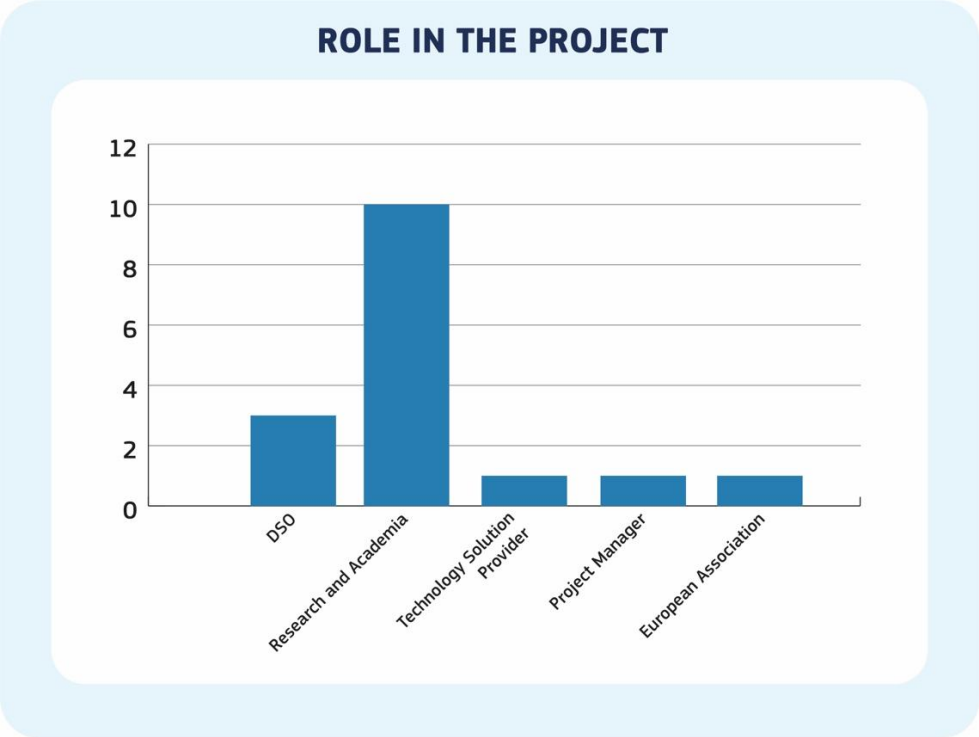


Figure 5.3: Poll answers on the roles of the respondents in the projects.

The first question was designed to understand the projects' perception of the real problem facing SOs. This was highly relevant for addressing the solutions in the following questions. As can be seen in the Figure 5.4, the biggest challenge perceived by the participants was the large amount of renewable resources that SOs must continue to integrate between now and 2030. It is important to note that the technical and economic problems were perceived as issues that needed solving. The first of these is particularly interesting because it is the area where projects can be most helpful by proposing and developing new solutions.

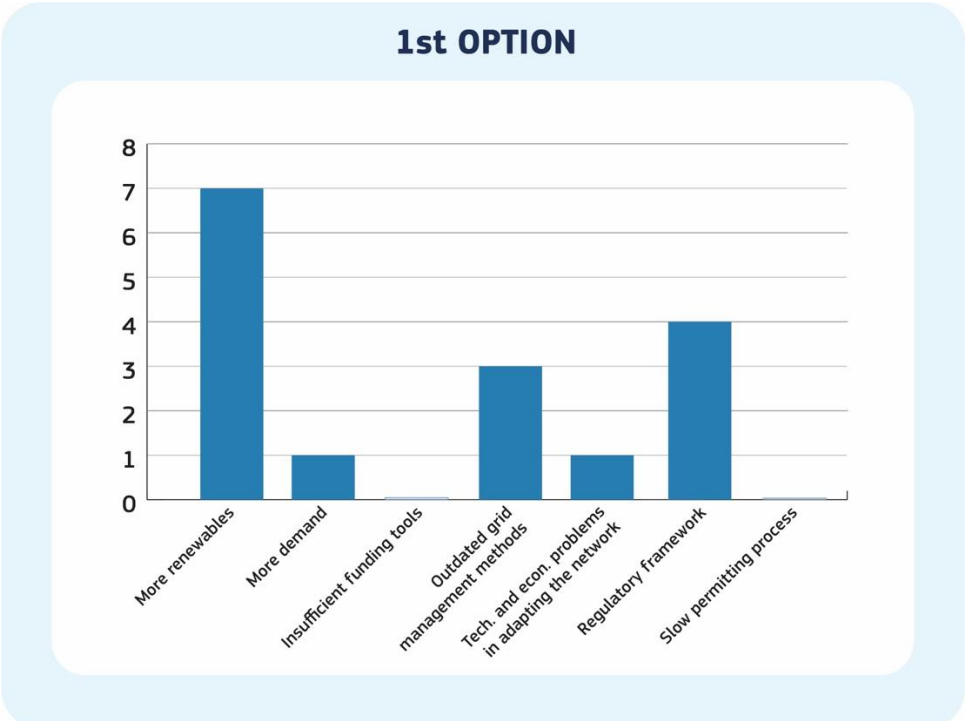


Figure 5.4: Poll answers on what the projects think is the biggest challenge SOs face when designing their network in the next five years.

In order to avoid losing the information from the responses, which allowed multiple choices, the following two graphs were intended to group where most of the attention of the participating projects was directed.

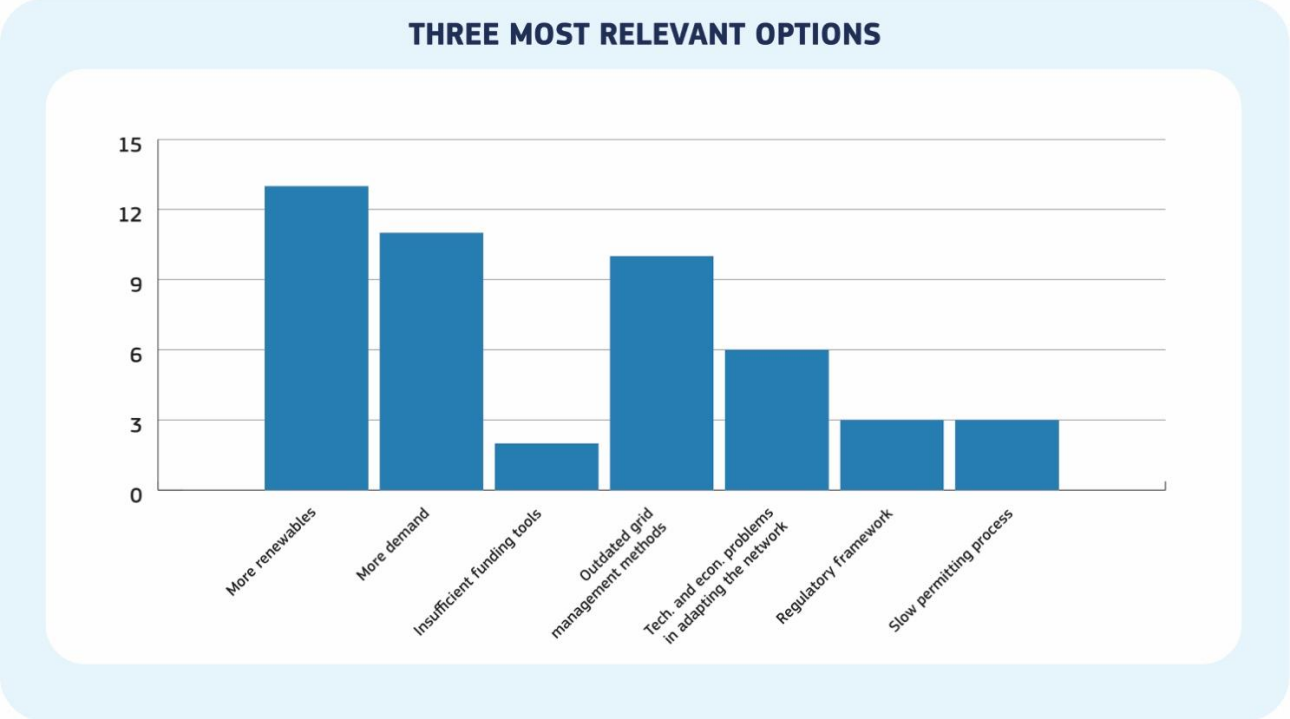


Figure 5.5: Poll answers on what the projects think is the biggest challenge SOs face when designing their network in the next five years (three most relevant options).

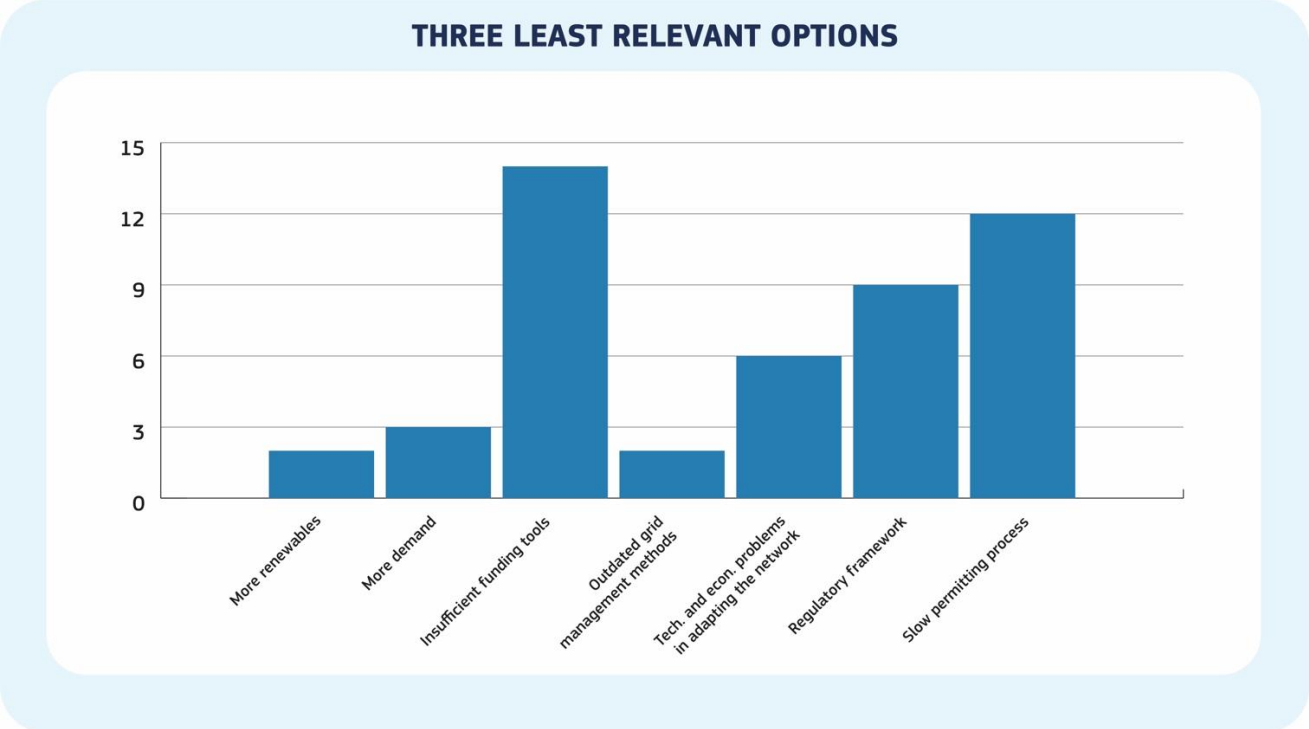


Figure 5.6: Poll answers on what the projects think are the three least challenges SOs face when designing their network in the next five years.

The following question sought to capture the idea that the projects have about how they are helping to solve the problems of the OS, which is the main objective of Action 4.

We can see that the most frequent response was the one that included local flexibility markets, a topic that many of the projects are working on directly or indirectly. Models and tools to improve planning, and increasing digital tools are two other selected options.

The following question and its answers must be read together with the previous one because the intention is to help understand how close or far the chosen solutions are from the real application.

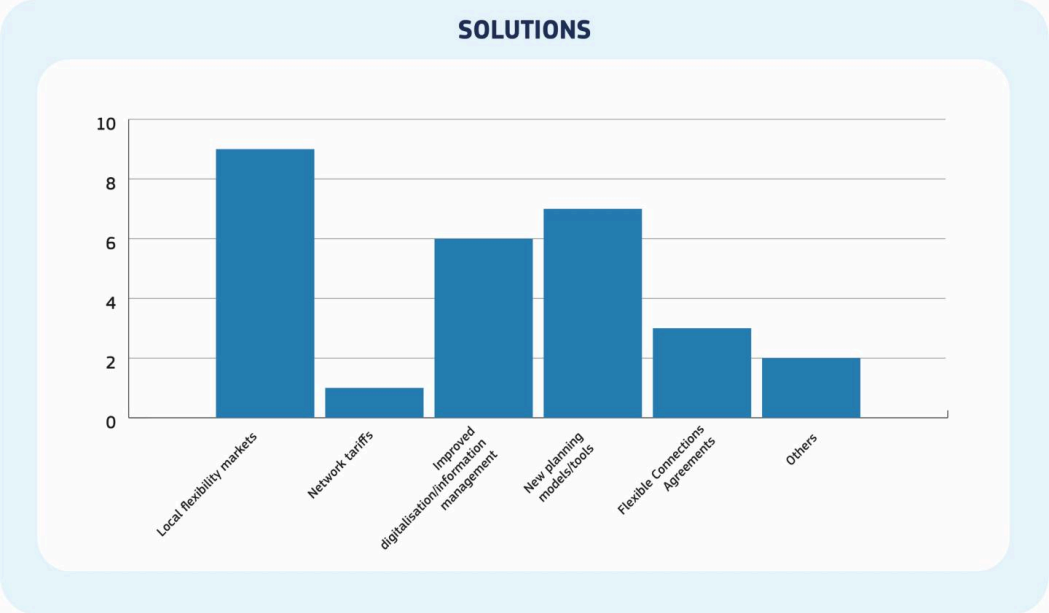


Figure 5.7: Poll answers on SO solutions projects contribute to.

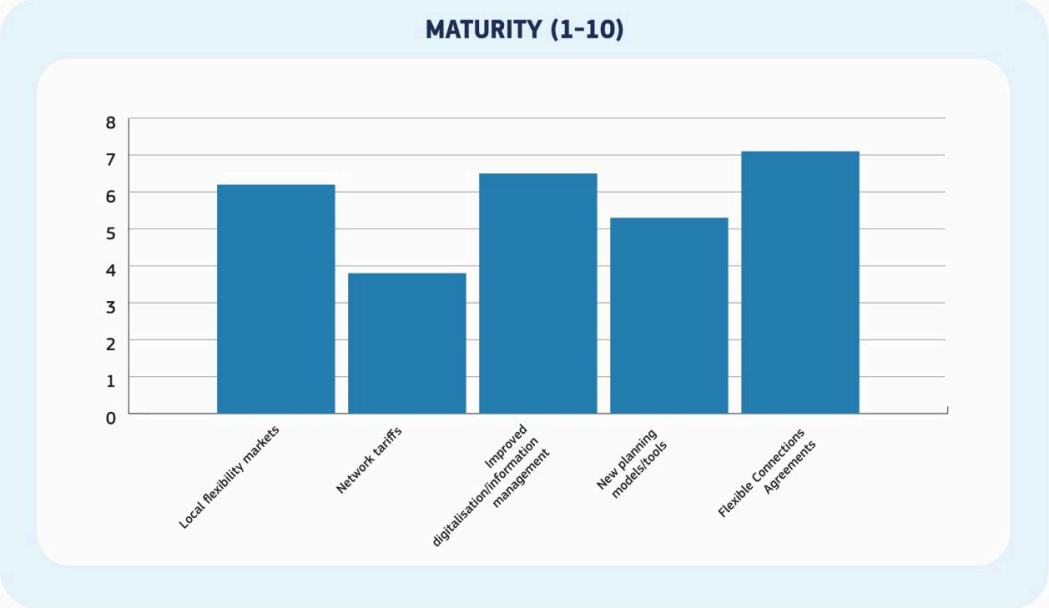


Figure 5.8: Poll answers on average degree of maturity of the solutions as rated by participants.

Finally, and considering the three previous questions (OS challenges, solutions under development and maturity level), the projects were asked which of the measures should be adopted most urgently. This part of the questionnaire is perhaps the most relevant because it shows, in a way, the final perception of the participants regarding the multidimensional importance of challenges, the degree of development of the solutions, and the contribution to real-world environments that the projects are making.

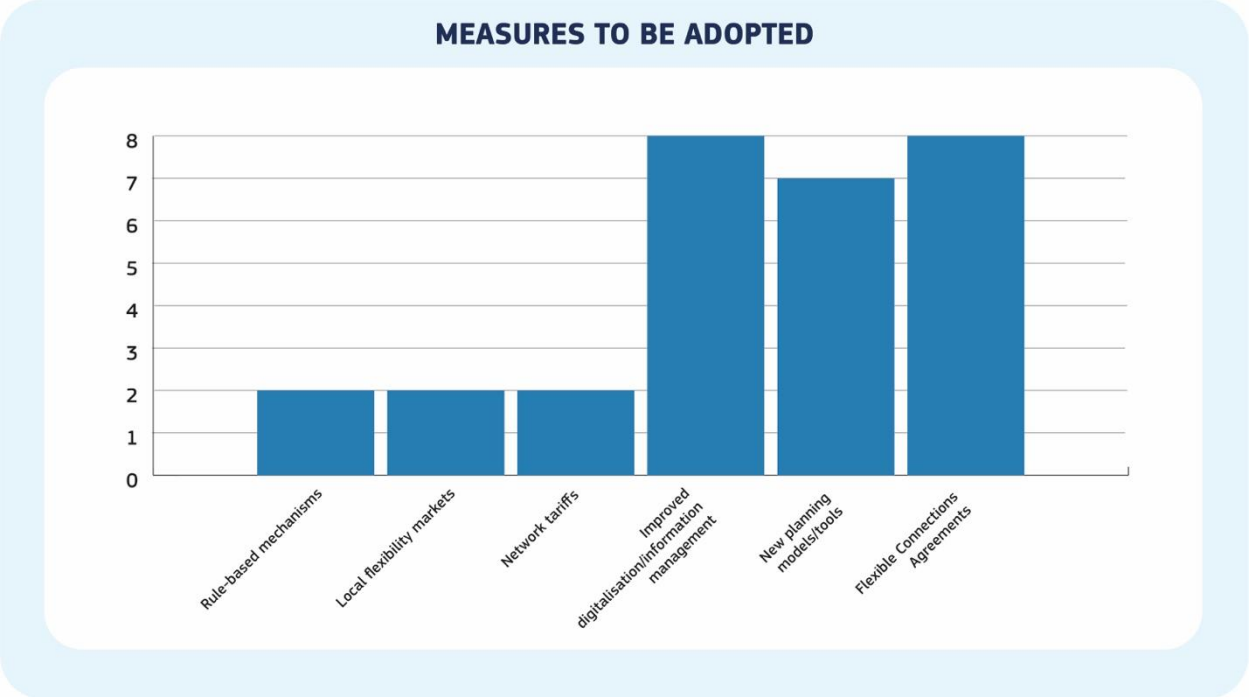


Figure 5.9: Poll answers on which measures used by SOs they think need to be adopted more quickly.

In conclusion, a trend can be seen in the correlation of responses regarding the challenges, the contribution of projects and the most urgent measures. The correlation is represented in the following figure, and it can be seen that flexible connection agreements are a relatively mature solution for addressing increases in generation and demand.

The next conclusion is that, to tackle outdated network management methods, the projects propose improving digitalisation and implementing new planning tools and models. These are precisely the areas the projects are consistently working on, and therefore it makes sense for them to move from the pilot phase to real-world implementation.

Main challanges for SOs:	Projects are mainly contributing to:	Most urgent measures to be adopted:
Increasing renewables	Local flexibility markets	Flexible Connection Agreements
Outdated grid management methods	Improved digitalization/information management	Improved digitalization/information management
Increasing demand	New planning mode/s/tools	New planning mode/s/tools

Figure 5.10: Correlation between responses

5.5 DSO remuneration schemes

The third questionnaire was circulated on 12 June 2025 to gather information about the current remuneration schemes for electricity distribution in the jurisdictions of the projects' participants. The aim was to try to draw some conclusions that will ultimately help to remove barriers to the use of flexibility solutions. The EU Action Plan for Grids[12] highlights the need for regulatory frameworks to evolve toward performance-based remuneration schemes, while reflecting the costs of flexibility procurement and introducing profit-sharing mechanisms.

The Action 4 survey reached a broad set of EU-funded projects; a total of 14 survey responses were collected, covering 10 projects and 11 jurisdictions. The respondents, who are significant contributors to this topic in Action 4, include the following projects: AHEAD, BeFlexible, effort, ENFLATE, Flexchess, FLOW, OPENTUNITY, SENERGY NETS, STREAM, and TwinEU.

Figure 5.11 summarises survey responses to the innovation incentives present in the different remuneration schemes. Results show that most jurisdictions have implemented mechanisms to promote innovation, such as pilot projects and sandboxes.

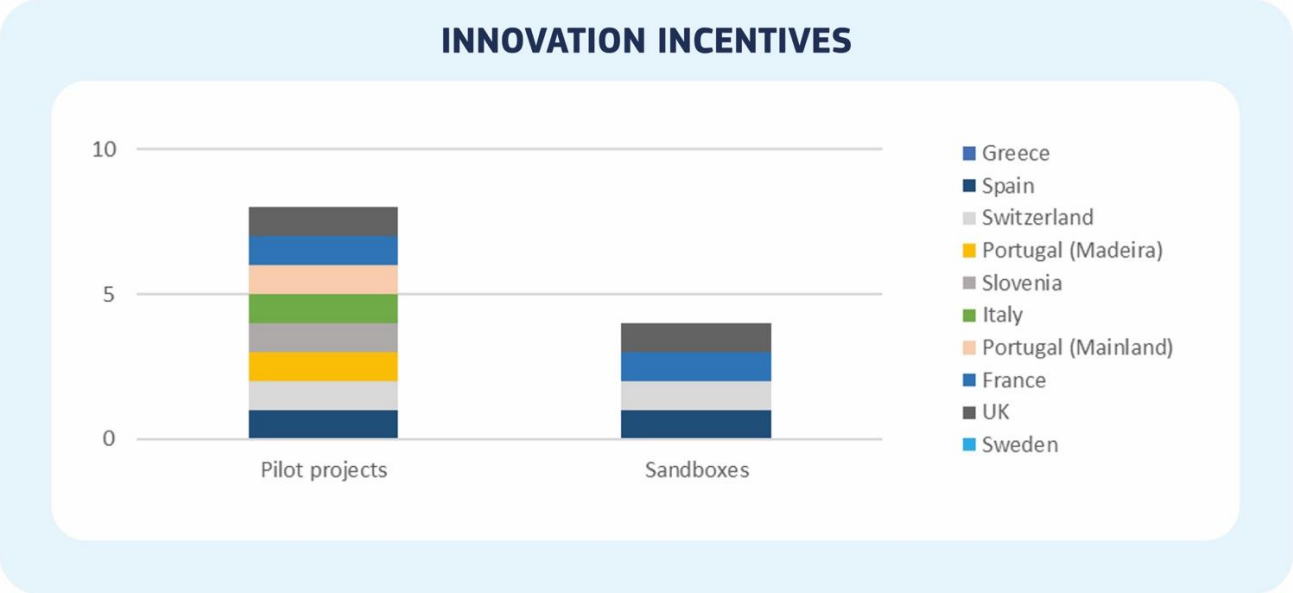


Figure 5.11: Survey responses to the presence of innovation incentives in DSO remuneration schemes in different jurisdictions

Regarding the remuneration for flexibility, Figure 5.12 shows that 5 out of 10 jurisdictions have not yet included flexibility services in their remuneration schemes. Regulation needs to advance towards incentivising efficient operative solutions, such as flexibility through markets, bilateral contracts, flexible connection agreements, etc.

[12] COM(2023) 757 final, 28/11/2023, Grids, the missing link - An EU Action Plan for Grids.

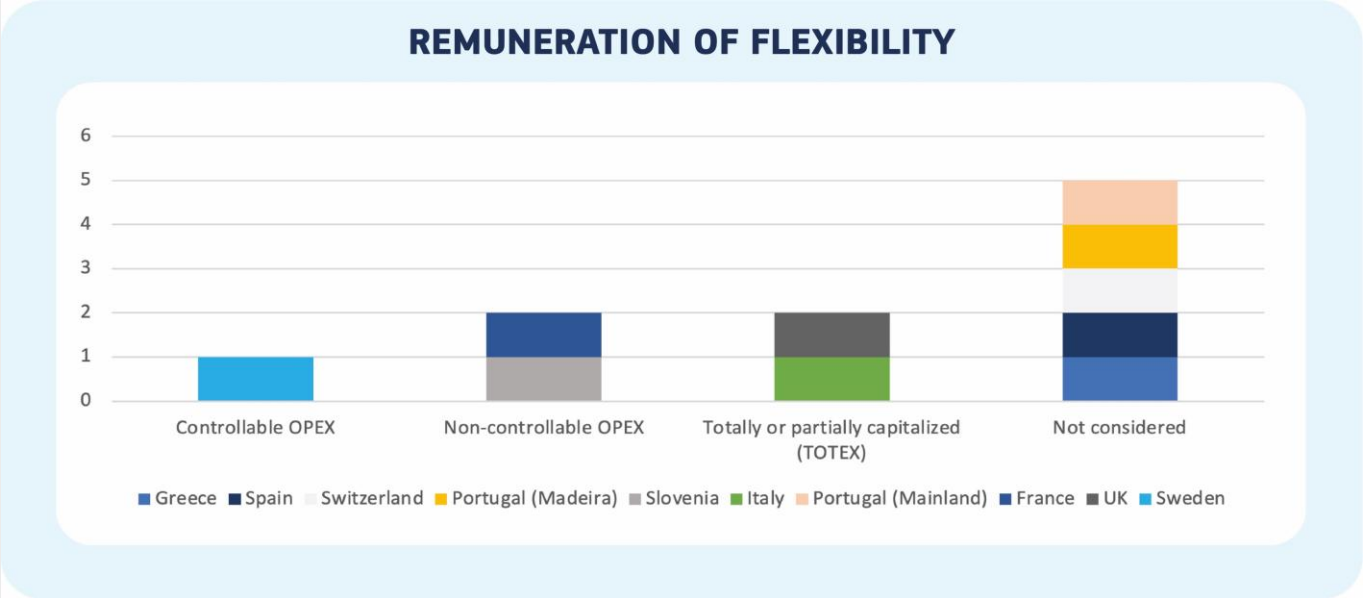


Figure 5.12: Survey responses to the remuneration of flexibility in different jurisdictions

Even if flexibility is remunerated, some remuneration schemes may disincentivise the procurement of flexibility services[13]. Remuneration schemes can be classified according to their revenue calculation mechanism as ex post (e.g., cost-of-service) or ex ante (e.g., revenue cap or price cap). It is often recommended to combine both approaches by establishing an ex-ante framework with a profit-sharing mechanism. Ex-post or hybrid regulatory frameworks present a CAPEX bias, disincentivising OPEX solutions such as flexibility procurement[14]. A common approach in European jurisdictions is the hybrid approach, which combines an ex-post approach on CAPEX with an ex-ante approach on OPEX. This hybrid approach presents a CAPEX bias and fails to incentivise flexibility solutions, even if cost-efficient[13].

Next, Figure 5.13 classifies remuneration schemes across jurisdictions based on the questionnaire responses. It analyses the results based on the learnings from a quantitative analysis performed in the BeFlexible project[15].

[13] CEER, "Paper on incentives in regulatory frameworks with a focus on OPEX/CAPEX neutrality." 2025. https://www.ceer.eu/publication/ceer-paper-on-incentives-in-regulatory-frameworks-with-a-focus-on-opex-capex-neutrality/

[14] COM (2023) 757 final, 28/11/2023, Grids, the missing link - An EU Action Plan for Grids. https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52023DC0757

[15] M. A. Ruiz, T. Gómez, and J. P. Chaves-Avila, "Promoting efficiency with neutral operational/capital incentives under large uncertainty: A comparison of electricity distribution remuneration schemes," *Int. J. Electr. Power Syst. Res, 176*, 2026, https://www.sciencedirect.com/science/article/pii/S0142061526001778?via%3Dihub

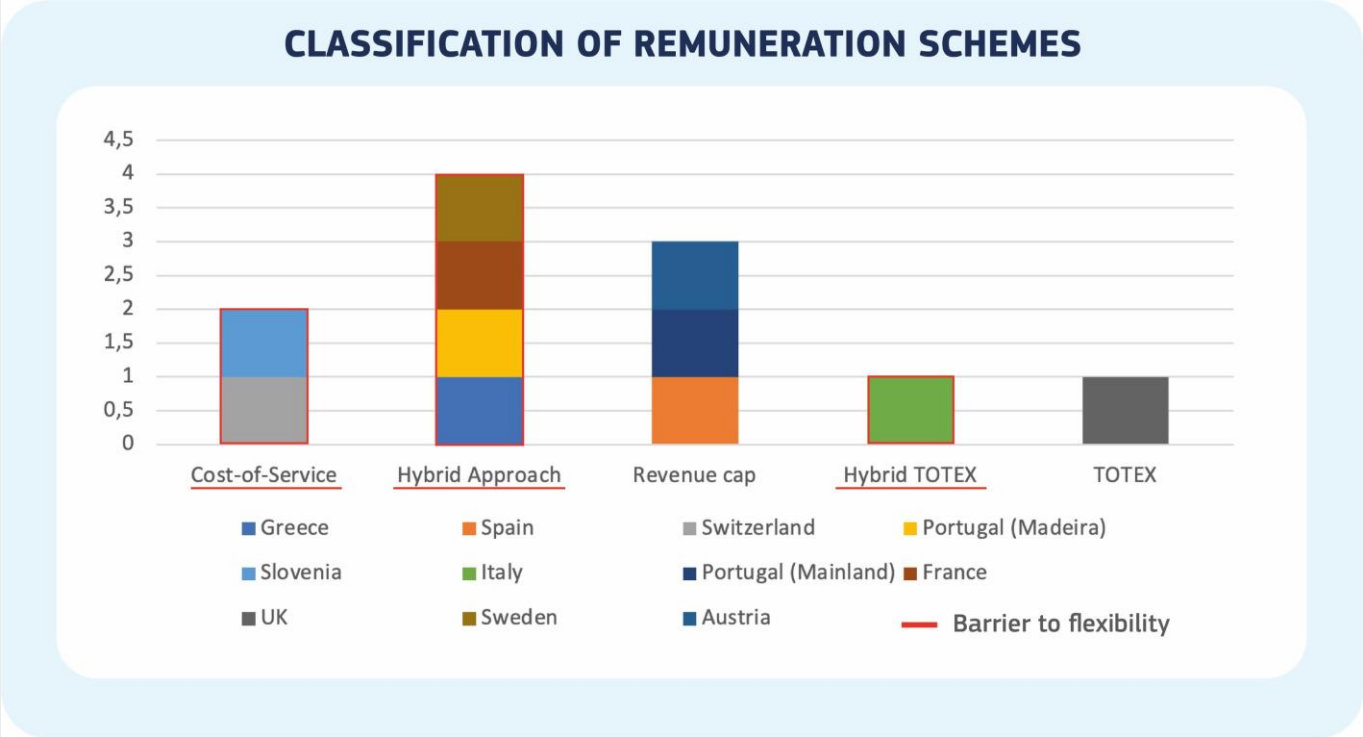


Figure 5.13: Survey responses to the remuneration of flexibility in different jurisdictions

Results show that 7 out of 11 jurisdictions use either a cost-of-service or a hybrid scheme, which poses a barrier to the use of flexibility for investment deferral. This is an important result because, while innovation is promoted through pilot projects and sandboxes in most jurisdictions, 70% of the evaluated jurisdictions face barriers to the use of flexibility, disincentivising its use when the projects come to an end. It is important to address this, and the Beflexible project proposed a regulatory roadmap to guide the evolution of remuneration schemes in the current context of decarbonisation[16]. The roadmap prioritises reforms with higher impact based on empirical evidence and quantitative analyses. The first priority is to move from ex-post to ex-ante schemes with profit-sharing to promote productive efficiency; the second is to mitigate allocative inefficiency by decoupling investment plans from ex-ante revenue calculations and introducing drivers to adjust these calculations; the third is to enable adaptable planning which can increase the value of flexibility, enhancing efficiency in a context characterised by high uncertainty. As a last step, a mechanism for neutralising incentives is presented as an alternative to the extensively recommended TOTEX with a fixed capitalisation rate. Neutralising incentives is the last priority because the revenue cap approach with profit-sharing, given a sufficiently high incentive rate (>=50%), already mitigates the CAPEX bias to a large extent[17]. Moreover, the TOTEX with fixed capitalisation rate is not recommended as it introduces an OPEX bias[15].

5.6 Conclusions

Action 4 highlights the need to address a variety of topics to prepare the grid for 2030 in the context of decarbonisation:

- The combination of multiple flexibility mechanisms is essential for addressing upcoming challenges in distribution network planning and operation. More than 2/3 of survey participants prefer market-based options.

[16] M. A. Ruiz, T. Gómez, and J. P. Chaves-Avila, “A regulatory roadmap for electricity distribution remuneration under decarbonization: A European perspective”, IIT [Working paper], 2026.
[17] COM(2023) 757 final, 28/11/2023, Grids, the missing link - An EU Action Plan for Grids. https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52023DC0757

- The challenges of connecting more generation and demand are among the biggest that operating systems are facing.
- The projects are already working on solutions to address the aforementioned challenges. They are primarily focused on gaining a better understanding of local flexibility markets and proposing new models and tools for network planning, along with improving their level of digitalisation.
- Regulatory frameworks generally support innovation (pilot projects and sandboxes). However, remuneration schemes can hinder innovation once temporary support ends. Remuneration schemes may pose a barrier to the use of flexibility solutions (e.g., flexible connection agreements, market-based flexibility procurement, bilateral contracts, etc.), which play a crucial role in the current context.
- It is urgent to move from ex-post remuneration schemes to ex-ante schemes with profit-sharing mechanisms and use drivers to adjust ex-ante revenue calculations, promoting both allocative and productive efficiency. Then, enabling adaptable planning should be a priority because it can deliver substantial efficiency gains in the current decarbonisation context, characterized by high uncertainty.

6 KNOWLEDGE SHARING

During the reporting period, the WG chairs organised, with assistance from the Secretariat, a series of knowledge-sharing sessions on regulatory challenges, innovative solutions and practical experiences. These sessions were designed to allow projects to discuss common barriers, share approaches adopted during implementation, and formulate recommendations that may be relevant for other initiatives facing similar issues.

In the first part of the activity year, all ongoing and completed projects within the BRIDGE Regulation WG were contacted to assess their interest in participating in knowledge-sharing activities. Potential topics were noted through these interactions. Following additional feedback gathered after the WG kick-off meeting in May 2025, a plan for knowledge-sharing sessions was drafted and presented during the WG plenary in July. The plan included four proposed sessions whose topics were identified by clustering proposals submitted by the projects. The sessions covered the following themes:

1. Market design in energy sharing, P2P and energy community models (17 October 2025)
2. Flexibility acquisition mechanisms (28 November 2025)
3. Support the potential synergies coming from increased sector coupling, sector integration, system integration (12 December 2025)
4. Support the system operators to prepare the grid for 2030 (23 January 2026)

Each knowledge-sharing session lasted one hour and followed a common structure, articulated around three main discussion blocks: (i) barriers encountered by projects, (ii) innovative solutions and approaches adopted during implementation, and (iii) best practices and recommendations with potential for replication.

The table below provides an overview of the sessions carried out, together with the projects that presented in each session.

Session number	Date	Topic	Projects presenting
1	17 October 2025	Market Design in Energy Sharing, P2P and Energy Community Models	• FEDECOM • STUNNED
2	28 November 2025	Flexibility acquisition mechanisms	• FLOW • ENFLATE
3	12 December 2025	Support the potential synergies coming from increased sector coupling, sector integration, system integration	• SENERGY NETS • AHEAD
4	23 January 2026	Support the system operators to prepare the grid for 2030	• FLOW • OPENTUNITY • EDSO

Figure 6.1: Summary of knowledge sharing session

7 CONCLUSIONS AND NEXT STEPS

The work carried out by the BRIDGE Regulation Working Group during 2025 confirms that regulation remains one of the decisive enabling factors for the success of the European energy transition. Across all actions, participating projects consistently show that technological solutions are developing rapidly and that innovative approaches to flexibility, energy sharing, sector integration and network management are already being tested in real-life settings. Yet these same projects also reveal that large-scale deployment is still constrained by an incomplete regulatory environment, where national fragmentation, weak coordination, insufficient interoperability and uncertain economic incentives continue to slow progress. Taken together, the findings of this annual report point to a clear conclusion: the challenge is no longer to demonstrate that new solutions are technically feasible, but to ensure that regulation evolves fast enough to allow them to scale up.

The analysis of peer-to-peer exchange, energy sharing and energy communities shows that citizen participation in electricity markets is increasingly recognised across Europe, but remains unevenly implemented. In most countries, legal recognition exists; yet practical market access is still limited by administrative complexity, reliance on intermediaries and insufficient integration into wholesale, balancing or flexibility markets. The experience gathered through Action 1 also highlights the importance of data accessibility, consumer protection and inclusive governance, including the need to better address vulnerable consumers and to create frameworks that enable long-term participation and investment. Energy communities and energy-sharing arrangements can play an important role in the transition, but only if regulation moves beyond formal recognition and creates workable conditions for implementation.

The evidence from Action 2 confirms that flexibility procurement is becoming a central concern for DSOs and other market actors, but that effective coordination remains underdeveloped. Projects widely assess local flexibility markets, dynamic tariffs, flexible connection agreements and rule- or cost-based mechanisms, yet there is broad agreement that no single mechanism is sufficient on its own. Instead, coordinated combinations are seen as more effective for addressing network needs, particularly congestion management and, increasingly, voltage control. However, regulatory, technical and economic barriers continue to hinder the practical coordination of these mechanisms. The report therefore underscores the need for clearer frameworks that set out interaction rules, support interoperability and facilitate the transition from pilots to scalable and harmonised implementation.

Action 3 demonstrates that sector coupling and system integration are moving from strategic ambition to operational necessity. The analysis shows that barriers vary depending on the use case: household-level integration is strongly affected by stakeholder coordination and data governance; heat integration is especially constrained by interoperability issues; other sector-coupling cases are often limited by network regulation; and EV-related services sit at the intersection of market design, data access and technical standards. A key finding is that these barriers follow a maturity-driven pattern, with coordination and governance challenges often dominating early phases and technical or market issues becoming more visible as projects progress towards implementation. This suggests that regulatory responses must be adaptive and context-sensitive rather than one-size-fits-all.

The findings from Action 4 further reinforce the need to align network regulation with the realities of a decarbonised and increasingly decentralised energy system. System operators face growing pressure to integrate new demand and renewable generation, while also adopting more advanced planning tools, digital solutions and flexibility mechanisms. The projects contributing to this action indicate that flexibility can play a critical role alongside conventional grid investment, but that current remuneration schemes often fail to provide the right incentives, particularly where ex-post or hybrid models continue to favour CAPEX over more efficient operational alternatives. This points to the urgency of reforming remuneration frameworks so that they reward innovation, flexibility procurement and adaptive planning rather than locking system operators into traditional investment patterns.

Across all actions, several cross-cutting priorities emerge. First, the development of interoperable and secure data frameworks is essential. Data access, data quality, privacy and standardisation are not marginal issues; they are

foundational conditions for flexibility, sector integration and active consumer participation. Second, stakeholder coordination must be strengthened at all levels, including between DSOs and TSOs, between market actors and consumers, and across sectors that have historically operated in silos. Third, pilots and regulatory sandboxes remain valuable tools, but their lessons need to be translated more systematically into durable regulatory solutions. Finally, future regulation should place greater emphasis on simplicity, transparency and scalability, ensuring that innovative solutions can move from demonstrators to mainstream implementation without excessive administrative or technical burdens.

Looking ahead, the next phase of work should focus on turning project-based evidence into practical regulatory pathways. This includes advancing harmonised standards for data and interoperability, clarifying roles and responsibilities for new and existing market actors, enabling more effective and coordinated procurement of flexibility, and adapting network planning and remuneration frameworks to support investment efficiency under uncertainty. Continued knowledge sharing within BRIDGE and with external stakeholders will remain essential to consolidate best practices and reduce fragmentation across Member States. In this sense, the BRIDGE Regulation Working Group is well positioned to continue acting as a bridge between innovation and policymaking, helping ensure that regulatory reform remains grounded in operational evidence and aligned with Europe's broader decarbonisation objectives.

Overall, this report confirms that the European energy transition is not only a technological transformation, but also a regulatory one. Building a resilient, inclusive, and integrated energy system will require rules that can accommodate new forms of participation, new combinations of services, and new interactions across networks, markets and sectors. The BRIDGE Regulation Working Group will continue to contribute to this objective by translating the experience of EU-funded projects into practical recommendations that support a fairer, smarter, and more sustainable energy future.

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