FutuRed

IV CONGRESO DE REDES INTELIGENTES

II WEBINAR ONLINE

22 de ABRIL 2026

9:30h – 10:30h

Congreso organizado por:

ITE CENTROTECNOLÓGICO

FutuRed

Patrocinado por:

Schneider Electric

ormazabal velatia

SIEMENS

ZIV Making the Smart Grid Real

MathWorks®

TOWARDS COORDINATED FLEXIBILITY ACQUISITION MECHANISMS: A FRAMEWORK FOR AN EFFICIENT DESIGN

- Ponente(s) / organización(es)
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COMILLAS ICAI

IIT INSTITUTO DE INVESTIGACIÓN TECNOLÓGICA

BEFLEXIBLE bridge ISGAN INTERNATIONAL SMART GRID ACTION NETWORK

This work received funding from the European Union's HORIZON Innovation Actions under grant agreement No 101075438 (BeFlexible project).

Agenda

Who we are and what we work on

COMILLAS ICAI
IIT INSTITUTO DE INVESTIGACIÓN TECNOLÓGICA

IIT Research groups

1. Energy Economics & Regulation
2. Smart and Sustainable Grids
3. Energy System Models
4. Electric Power Systems
5. Intelligent Systems
6. Fire Safety, Thermal and Fluids Engineering
7. Railway Systems
8. Bioengineering
9. Smart Management for Sustainability

REDES

Smart and Sustainable Grids

Analysis, **modeling**, and **simulation** of future **distribution systems:**

- **Planning and operation**
- **Distributed resources electrification and sector coupling**
- **Regulation, flexibility services, and markets mechanisms**
- **Digitalisation, grid data interoperability and AI-driven applications**

Projects 2019-2025

28 Competitive Public Calls EU Administrations

European Commission

29 Competitive Public Calls national & regional funds

GOBIERNO DE ESPAÑA VICEPRESIDENCIA DEL GOBIERNO MINISTERIO DE LA PRESIDENCIA
IDAE

165 R&D, technology support & consulting projects for industry & non-profits

The BeFlexible Project

Length: 2022-2026 (48M)
Partners: 21

Markets and Regulation
Platforms and Architecture
Customer Engagement, Value Proposition
Services Ecosystem

Consortium

DSO	TSO	Aggregator	Research Center	ICT	Social expertise	Consultancy
i-DE Grupo IBERDROLA, e-distribución, e-distribuzione, areti, e.on Energidistribution, E.DSO	Terna	IBERDROLA ESPAÑA, THERMOVAULT, e.on Energiinfrastruktur	COMILLAS, RSE, ENGINEERING, INESCTEC, RWTH AACHEN UNIVERSITY	SAP, Schneider Electric	Soulsight, SMART INNOVATION NORWAY	TIMELEX, zabala innovation consulting

11 pilots in 4 countries in 3 demos structured by climatic areas (South, North and Southwest Europe)

BEFLEXIBLE REGULATORY FRAMEWORK AND SOCIAL ENGAGEMENT REQUIREMENTS

WP1

Regulatory analysis, proposals for efficient flexibility mechanisms

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LESSONS LEARNED, MARKET UPTAKE AND SCALABILITY

WP7

Evaluation, impact analysis, replicability and business models

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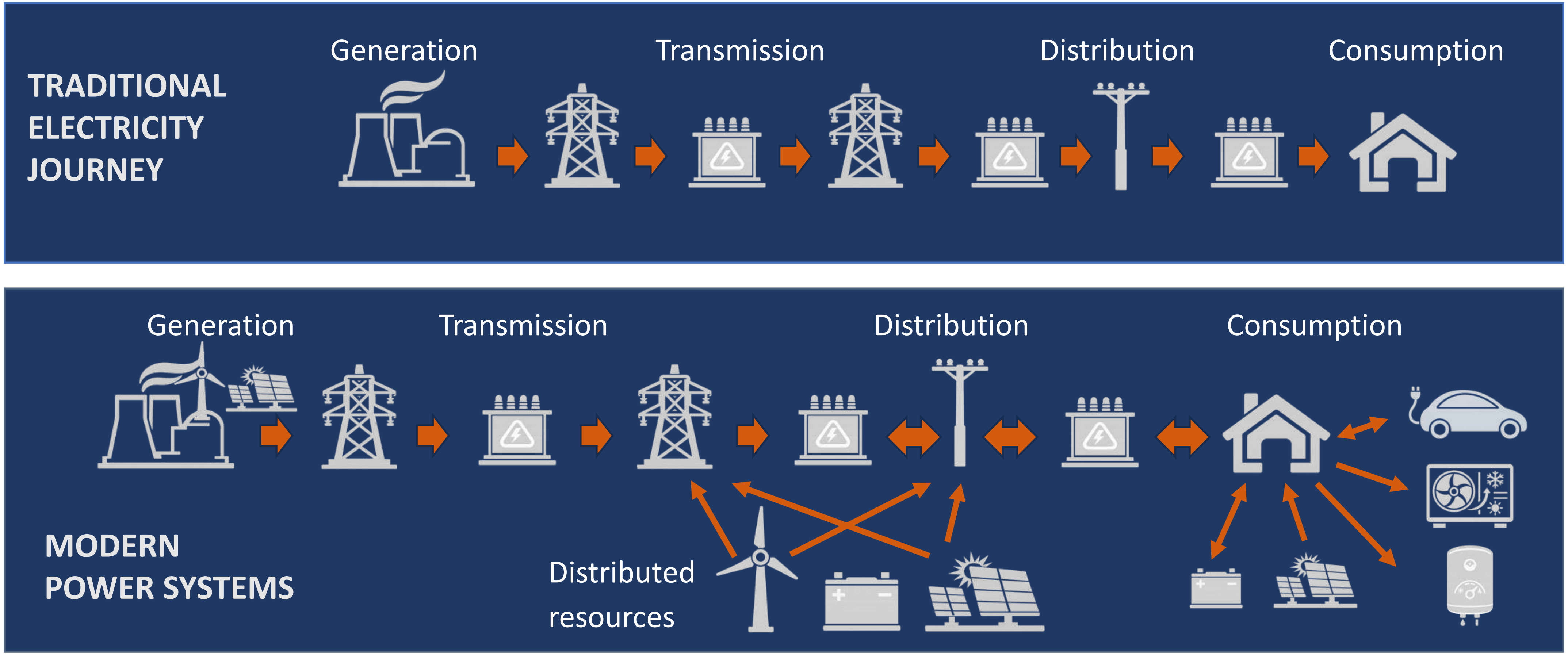
Introduction

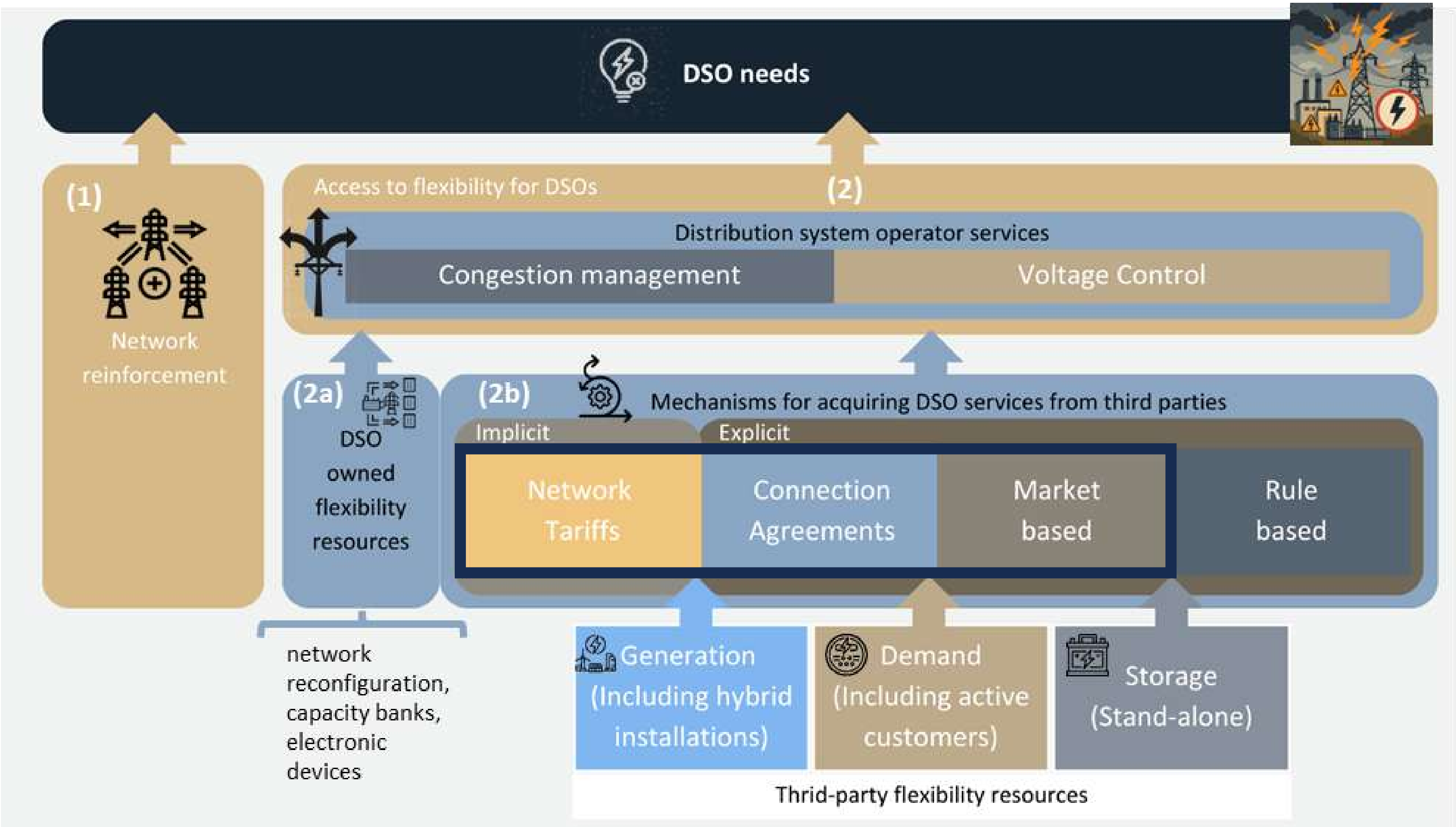


As power systems become more decentralised and dynamic, they **need to become more flexible.**

This calls for suitable mechanisms that **can unlock and effectively exploit the flexibility potential** of distributed energy resources.

How to acquire flexibility

- The figure illustrates approaches for addressing network operational needs at distribution systems:



Source: E.C. Ormeño-Mejía, J.P. Chaves, M. Troncia, Unlocking flexibility from third-party resources: decoding the interaction between mechanisms for acquiring Distribution System Operator services. Current Sustainable/Renewable Energy Reports. Vol. 11, pp. 45 - 67, September 2024.

DSO needs:

- Overloads in line and transformers
- Under- and over-voltages in buses

Well-designed acquisition mechanisms are required, such as *network tariffs, flexible connections and local flexibility markets.* However, **these mechanisms are often designed as independent entities, which may lead to uncoordinated signals.**

How can different acquisition mechanisms interact and be effectively coordinated to enable the acquisition of flexibility for DSO services?

Conceptual framework for the interplay and coordination of flexibility acquisition mechanisms

BEFLEXIBLE REGULATORY FRAMEWORK AND SOCIAL ENGAGEMENT REQUIREMENTS
WP1
Regulatory analysis, proposals for efficient flexibility mechanisms
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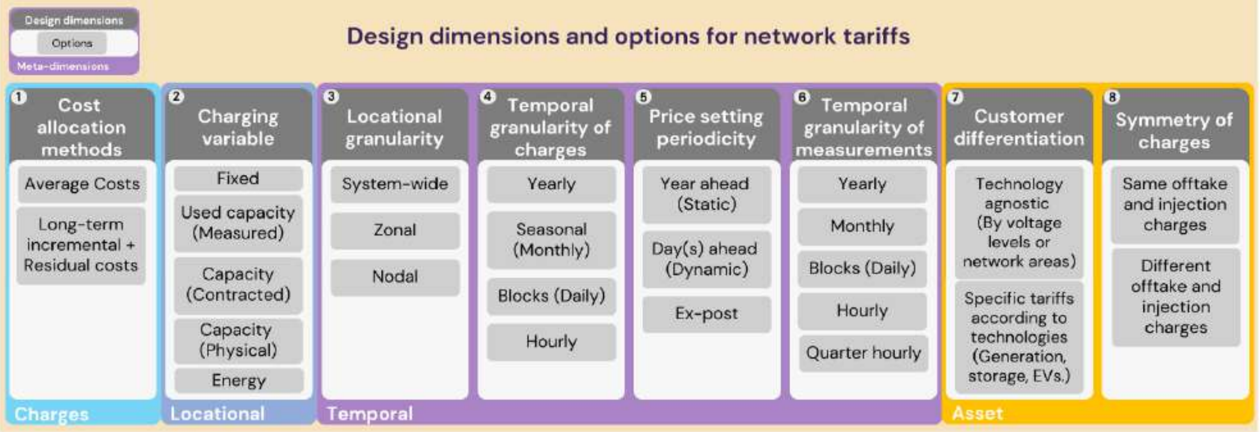
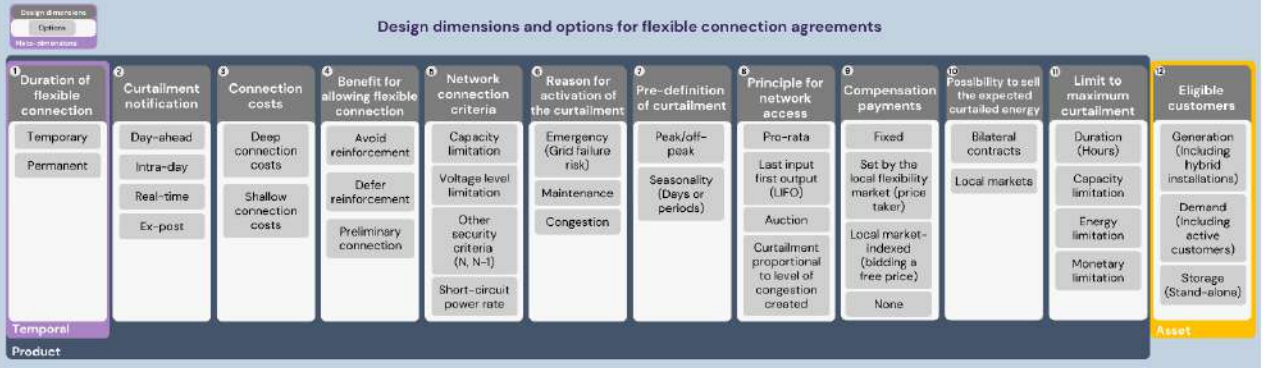
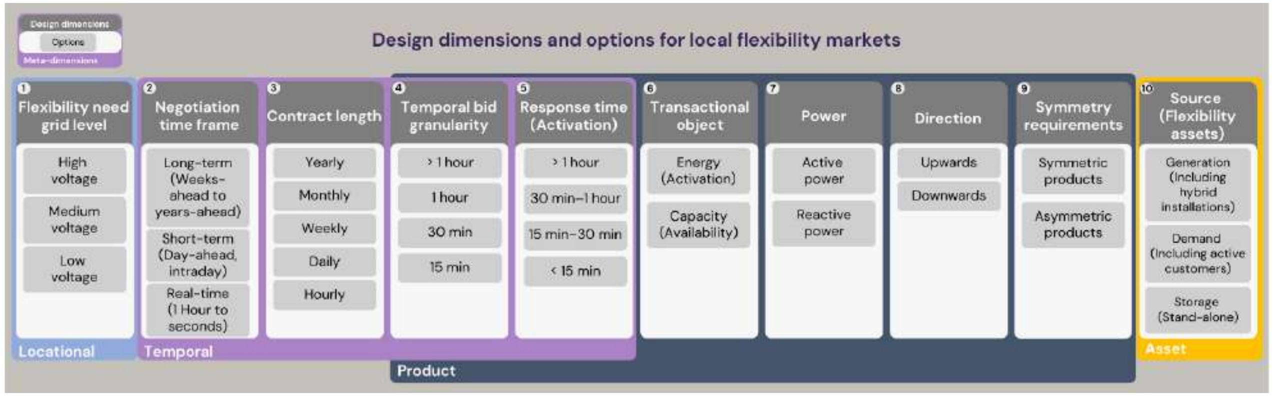
How to incorporate signals into the flexibility acquisition mechanisms?

Network tariffs, flexible connection agreements, and local flexibility markets are analysed **in terms of design dimensions** (constitutive characteristics) and **their options** (implementation values), and **<u>signals are used to identify potential synergies and conflicts in joint acquisition mechanism designs.</u>**

Acquisition mechanisms can complement each other to unlock the full value of flexibility in distribution networks.





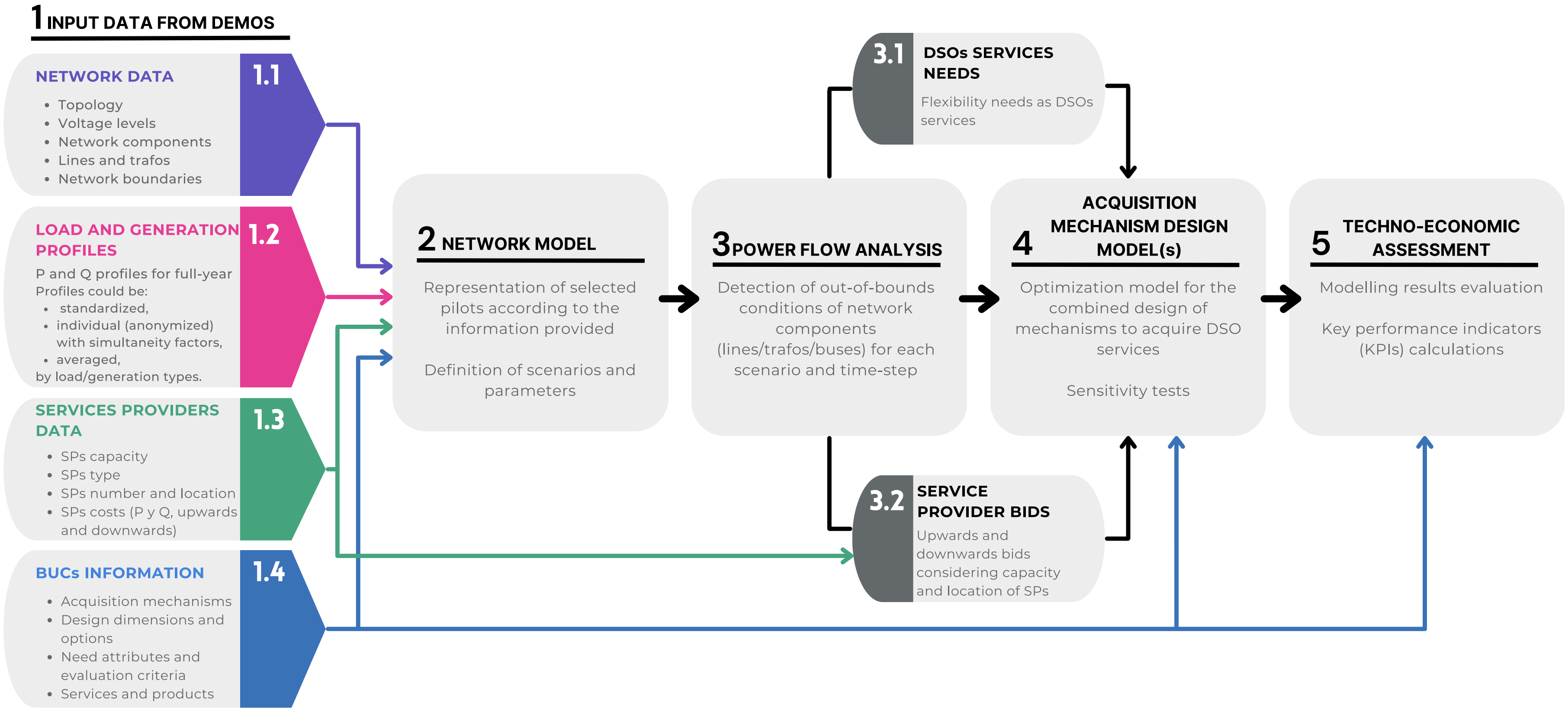


Source: E. C. Ormeño-Mejía, J. P. Chaves, and M. Troncia, “Towards Coordinated Flexibility Acquisition Mechanisms: A Framework for an Efficient Design,” IV Congreso Redes Inteligentes, Madrid, Spain, Nov. 2025.

Modelling approach for the interplay and coordination of mechanisms for acquiring DSO services

Objective:

Assess optimal combinations for the **interplay and coordination of mechanisms for acquiring DSO services** tailored to the specific needs and contexts of the BeFlexible project for effective flexibility management, **incorporating performance analysis, and regulatory framework compliance**



Source: Deliverable D7.1 Evaluation of the proposed market designs and regulatory framework and analysis and selection of flexibility-centric business models, BeFlexible, Feb. 2026.

Cases for analyses, simulation steps and KPIs

		Network model	Electricity price	Temperature	id	
NT + LFM	Case 1: Impact of tariff designs	Same for all	Spain (time blocks)	Same for all	sp1	Demo-specific
			Italy (flatter tariff)		it1	
			Sweden (volumetric)		sw1	
	Case 2: Impact of temperature		Spain (time blocks)	Spain	sp1	D3
			Italy (flatter tariff)	Italy	it2	D1
			Sweden (volumetric)	Sweden	sw2	D2
	Case 3: Impact of tariff taxes		Spain (time blocks)	Spain	sp2	
NT + LFM & FC	Case 4: Impact of flexible connection mechanism		Sweden (volumetric)	Sweden	sw3	

Load and generation profiles

Temperature profiles

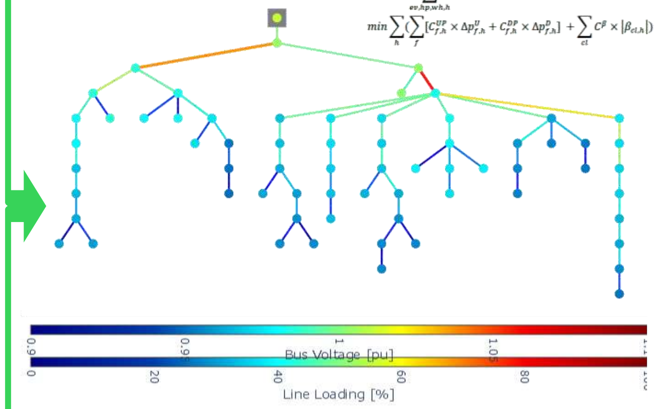
Electricity costs

Flexible demand:

Randomly assigned based on contracted capacity

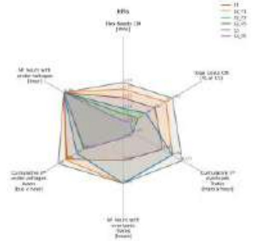
$$\min \sum_{ev,hp,wh,h} (pEV_{ev,h} + pHP_{hp,h} + pWH_{wh,h}) \times Ce_h$$

$$\min \sum_h (\sum_f [C^{UP}_{f,h} \times \Delta p^U_{f,h} + C^{DP}_{f,h} \times \Delta p^D_{f,h}] + \sum_{cl} C^\beta \times |\beta_{cl,h}|)$$



NETWORK DATA (synthetic data)

Main KPIs:
- Avoided congestion (Lines and trafos)
- Density plots for loading [%] for lines and trafos
- Total flexibility activated and costs
- Volume of transactions
- Flexibility not supplied and costs



A comparative simulation-based assessment was carried out to **analyse how different mechanisms** for acquiring DSO services **interact under comparable network conditions:**

Cases 1–3 examine the interaction between tariff-based signals and LFM activations, considering a proposed ex-post local tariff as a corrective local measure to overcome limitations in national tariff designs, **across different tariff structures, temperature conditions, and regulated charge adjustments.**

Case 4 assesses how **flexible connection agreements interact with tariffs and LFMs.**

Main outcomes

Case 1: Assess how tariff signals influence flexible resources and to what extent LFMs reduce congestion/voltage problems.

Key Takeaways:

- **Predictable** tariff signals **can synchronise** demand-side devices and trigger congestion; LFM alone helps but **may be insufficient under strong synchronisation and limited flexibility**.
- **Ex-post local tariffs can reduce predictability and local congestion,** and **combined with LFM, are more effective** under limited flexibility.
- **Congestion-oriented** mechanisms based only on active power **cannot fully solve voltage deviations.**

Case 2: Assess how temperature affects flexible resource behaviour and the effectiveness of tariff–LFM signals

Key Takeaways:

- **Temperature affects the magnitude** of network impacts, but not their overall pattern; **tariff design remains the main driver**.
- Effects are stronger in colder climates, while in moderate climates, congestion patterns change little.
- **LFM remains effective for congestion management as flexibility increases**, but voltage deviations persist, confirming that **active-power-only mechanisms are insufficient.**

Case 3: Assess how system charges in a time-block tariff may affect tariff signals and network performance.

Key Takeaways:

- Removing system charges changes (time-blocks) intra-day price differentials, **reshaping load-shifting incentives**, potentially increasing flexible resources concentration.
- LFM still reduces congestion, but **higher flexibility volumes may be needed** to achieve similar improvements.
- **The impact of charge adjustments depends on coordination with local corrective signals.**

Case 4: Assess how flexible connection agreements impact network performance and interact with tariffs and LFMs

Key Takeaways:

- **Well-calibrated flexible connection limits can reduce network problems and LFM needs** without causing rebound effects**, whereas overly restrictive limits may shift congestion to adjacent hours.**
- Flexible connections, network tariffs, and local flexibility markets **should be coordinated,** considering the network needs and availability flexibility **to provide consistent signals.**

Flexibility acquisition mechanisms should not be assessed or designed in isolation, as their signals interact through flexible resource behaviour and resulting network impacts

Source: Deliverable D7.1 Evaluation of the proposed market designs and regulatory framework and analysis and selection of flexibility-centric business models, BeFlexible, Feb. 2026.

Bridge Working Regulation Group – Action 2
Final Remarks

- **Flexibility procurement remains a key concern**. BeFlexible reflects a wider trend across Europe, where multiple EU-projects are already designing and testing mechanisms to acquire flexibility to support network needs.
- **Effective DER participation, aggregation, and demand-side management** are essential to provide system services such as **congestion management and voltage control.**
- **Standalone mechanisms are rarely sufficient**; **combined approaches are increasingly needed** to support network needs more efficiently and effectively, given the interactions among their signals and grid impacts.
- Effective and scalable flexibility procurement requires **coordinated mechanism design, supported by clearer regulation, interoperability, and evidence from pilots and sandboxes** to overcome current regulatory, economic, and technical barriers.

Source: BRIDGE Regulation Working Group Annual Activity Report 2025–2026 (Under review).

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Gracias por su atención

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