

Training Day

Regulatory framework for infrastructure investment and system flexibility - Clara Poletti

- 1 Why has power systems flexibility become a regulatory issue, and what it means**
- 2 Needs, solutions and enablers**
- 3 Regulating flexibility**
- 4 Mobilising and procuring flexibility**

Why has power-systems flexibility become a central regulatory issue?

MAIN DRIVERS



Variable generation

Increasing penetration of wind and solar generation



Electrification

Transport, heating and industry shifting to power



Distributed resources

Distributed generation, storage and active consumers



New large loads

Rapid emergence of data centres and industrial demand

The timing mismatch

New generation and loads seek connection faster than networks can be expanded, driving congestion and connection constraints

Flexibility as alternative and bridge

A long-term option to additional grid investment, and a bridge while permanent reinforcement is delivered

How would you describe flexibility needs in your jurisdiction today? (Poll 1)

- 1** A material and recurring issue
- 2** Emerging and increasingly relevant, but still localised
- 3** Mainly a prospective issue for the next few years
- 4** Not currently a significant regulatory issue

What do we mean by power-system flexibility?

EU ELECTRICITY MARKET DESIGN - REGULATION (EU) 2024/1747

“The ability of an electricity system to adjust to the variability of generation and consumption patterns and to grid availability, across relevant market timeframes.”

The definition implicitly distinguishes two sources of need:

- Generation and consumption patterns
- Grid availability constraints

OPERATIONALISING THE CONCEPT FOR REGULATORY PURPOSES

1

Define the flexibility need



2

Identify the capability required



3

Identify the service that provides it



4

Assess the mechanism to mobilise it

What are the main network flexibility needs?

TWO MAIN NETWORK FLEXIBILITY NEEDS *

Preventing or resolving congestions

Managing flows where network capacity binds

Staying within technical operating limits

Maintaining secure operation, mainly through voltage control

These needs can be distinguished according to the circumstances in which they arise:

- **Structural growth or change in network use**

Accommodating future changes in injections and withdrawals, while maintaining reliability

- **Temporary capacity need**

New generation or demand seeking connection before permanent reinforcement can be made available

A broader set of solutions to network needs

TRADITIONAL RESPONSES

—
Network
reinforcement

—
Generation
redispatch

—
Conventional
operating actions

NEW OR NEWLY SCALABLE ALTERNATIVES



Demand response

EVs, heat pumps, commercial and industrial loads



Aggregation of DER

Small resources acting as one controllable unit



Grid-enhancing technologies

Dynamic line rating, advanced power-flow control



Storage

Standalone or co-located



Advanced network operation

Reconfiguration and topology optimisation



Third-party flexibility services

Contracted from market parties

Main enablers: not only technology

THREE ENABLERS

a Technology

Smart metering, observability and monitoring, automation, power electronics, data and communications

b Governance/participation

TSO/DSO neutrality and coordination; observable and controllable DER; customer participation

c Regulation

Adapting network planning, incentives and procurement so operators source flexibility alongside network solutions

A broad organisational and behavioural shift is also required:

TSOs/DSOs Internal capabilities

New decision-making and planning processes

Third-party resources

Relying on customer-controlled flexibility

Consumer trust

As important as the technology as automation expands

What would make the biggest difference in unlocking more network flexibility? (Poll 2)

- 1 Technology, data and network observability**
- 2 Regulatory incentives and network planning practices**
- 3 Greater participation of customers, aggregators and flexible resources**
- 4 Other**

Need for an upgrade of traditional network regulation beyond flexibility

TRADITIONAL INCENTIVE REGULATION DEVELOPED UNDER

- Predictable location and timing of network use
- Centralised generation, one-way flows
- Low short-term variability
- Limited customer participation
- Slow technological change



WHAT THE ENERGY TRANSITION BRINGS

- Investment needed ahead of observable demand
- Network and non-network combinations
- Existing capability raised without new build
- Temporary or modular solutions affect optimal timing of investment
- Third-party and customer participation

Traditional regulation designed to **extract efficiency from relatively mature networks**. Regulation must now govern how network capabilities are adapted and used under greater uncertainty, and **incentivise operators to explore a broader set of options**

Flexibility should enter planning before the investment solution is selected

The aim is not to favour flexibility over other investment, but to find the efficient combination and timing of both

Needs-based, not asset-based

Planning starts from an identified network need and compares credible network and non-network options.

EXAMPLE: AUSTRALIA Regulatory Investment Test

Options assessed against the need itself, rather than a pre-selected asset solution.

Flexibility-first is not mechanical

As expectations about demand, costs and delivery risks change, the optimal balance shifts with them.

EXAMPLE: GREAT BRITAIN RIIO-ED3

From “flex first” to a balanced “build and flex”: assess non-wire alternatives, but reinforce in time where delay would raise costs.

How is flexibility currently treated in network planning in your jurisdiction? (Poll 3)

- 1 Flexibility is systematically integrated into network planning**
- 2 Flexibility must be considered but the assessment is not standardized**
- 3 Flexibility is assessed only in pilots or selected projects**
- 4 There are no specific provisions for flexibility**

Regulation must widen the option set and manage uncertainty: adaptive network regulation

There is no single model of “adaptive regulation” but a variety of different approaches

1

Conditional approval

Investment is approved up front but only released when pre-defined triggers are met

E.G AUSTRALIA - contingent projects

2

Adaptive allowances

Expenditure moves automatically with observable drivers

E.G GREAT BRITAIN - RIIO-ED2 / ED3

3

Reopenable settlements

The settlement itself can be revisited when circumstances turn out materially different

E.G. NEW ZEALAND – prospective reopeners

THE TRADE-OFF

More flexibility means more monitoring, regulators need stronger information and governance to keep spending discipline

Does the remuneration framework reward the most efficient solution?

Given alternative solutions, 3 biases can push the operator away from the efficient choice

CAPEX bias

- TOTEX regulation, but it does not remove the pull towards owned assets
- Share of the savings from a lower-cost solution
- Benefit-based and performance-based remuneration

Ownership / make-or-buy bias

- Competitive procurement obligations; test external options against own investment
- Explicit remuneration for third-party procurement

Weak pull towards innovation

- Pilots and demonstrations
- Innovation allowances or dedicated funds
- Risk-sharing for uncertain technologies

How can network flexibility be mobilised?



Price signals



**Connection
conditions**



Markets & tenders



Regulated access

Choice depends on the nature of the need and of the potential providers.

Mechanisms can coexist and interact; coordinating them is itself a regulatory issue.

If the efficient solution is external flexibility, how is it procured?

Bilateral contracts

Few providers, specific need

Flexibility tenders

A competitive call for a defined need

Local flexibility markets

Recurrent trading where liquidity allows

WHAT DRIVES THE CHOICE

Location and type of need · number of providers · liquidity · frequency of use · standardisation

Market-based procurement curbs make-or-buy bias — but contracts may be better where competition is weak.

Which mechanisms are currently used in your jurisdiction to mobilise network flexibility? Select all that apply (Poll 4)

- 1** Network tariffs
- 2** Connection agreements
- 3** Contracts or competitive tenders
- 4** Local flexibility markets
- 5** No mechanism is yet significantly developed

Final remark: why are we not already doing what we can do today?

The capabilities exist. Deployment, use and integration lag behind

WHAT IS ALREADY POSSIBLE

WHAT ACTUALLY HAPPENS

Smart meters

Rich consumption data

➔ **Still underused**

Network data

Visibility of the grid

➔ **Digitalisation uneven**

Grid-enhancing tech

More capacity, same lines

➔ **Deployment limited**

The nearest-term gains come from using what is already installed



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