ESB NETWORKS

Phased Flexibility Market Development Plan

NATIONAL NETWORK, LOCAL CONNECTIONS PROGRAMME

DOC-230921-GYU

OPENING STATEMENT

The decarbonisation of Irish society relies on fundamental changes to how energy is generated and consumed. To enable these changes at the right pace and the right price, we will rely on the electricity network, and we need to make the connection between how renewable energy is generated, and how we use or store it. Every Irish home, farm, community, and business is being called on to play a part. The National Network, Local Connections Programme has been established to work with, and for, customers to make this possible.

We are entering a period of rapid change and uncertainty. Over the coming years, technologies will change and Irish homes', farms' and communities' energy needs will too. We will need to be able to adapt to meet changing needs and emerging challenges. In this document we have sought to develop a proposed plan that accounts for uncertainty and delivers that adaptability. For example:

For example:

1. **An initial market framework proposal to support the piloting and coordinated development of market products and processes so that we can learn what works well and what needs to be done differently as we prepare for a national rollout.**
2. **Options for the future development of products/services and alternative market frameworks that can support future development.**
3. **Extensive commitment of resources to communications and collaboration, working with partners and customers to understand their needs and how they change, so we can adapt.**

Over the life of this programme we will face uncertainties and risks. If we proceed too quickly, we increase the risk that customers will not be ready, or technologies will not be as mature. But if we do not proceed quickly enough, there is a risk that the solutions will not be in place when then need to be. Without taking the initial steps now, there is a risk that we and our partners could not replicate solutions that we pilot or commence a national rollout until later in the decade.

We will need to commit people and capital to deliver this programme, and we are reaching a critical decision point regarding the level of resources to commit. ESB Networks serves, and is funded by, all electricity customers. All our customers will share in the benefit, but they will also share in the costs and the risk if we act too slowly or too soon. As such, we want to give all customers an opportunity to consult.

1. **Do you think we should take a more measured pace and begin to scale closer to 2030, or commit resources needed to begin build towards a national rollout commencing in 2024 / 2025?**
2. **There are trade offs between different developments in this plan that we could prioritise. What do you think we should prioritise, and how will this affect your business.**

We need your input to determine the path forward. So please have your say!

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Have Your Say

1 NATIONAL NETWORK, LOCAL CONNECTIONS – HAVE YOUR SAY!

The Electricity Market Directive [2019/944 Articles 31, 32] sets out new responsibilities for DSOs to develop the use of flexible market-based services to meet the needs of the distribution system and its customers in an efficient, secure and reliable manner. Consistent with these responsibilities, ESB Networks has developed a Phased Flexibility Plan within this document for the consideration of the Commission for Regulation of Utilities (CRU). This document is the proposed Phased Flexibility Market Plan. In this document we set out:

1. **The set of proposed products for piloting flexibility services and their sequenced introduction.**
2. **The proposed short term market framework.**
3. **Options for the medium to long term local market framework.**
4. **Options for the funding arrangements associated with different flexibility services, depending on the value driver or objective in question.**
5. **The legislative basis underpinning the introduction of flexibility services on the distribution system.**

It is critical that we implement solutions that optimally meet the wishes and needs of the customers and industry participants in Ireland. As per our DSO license requirements to develop the distribution system in a safe, secure, reliable, economical, and efficient manner, in developing these proposals, we have taken time to seek and utilise stakeholder input from round tables and focus groups, as well as to research and utilise exemplar international experiences. This has enabled us to develop the proposed approaches within this document. While we have confidence that these can meet the overall programme objectives, the coordination of these proposals with our stakeholders, including the CRU, TSO and market participants is of prime importance. There were several key dimensions on which we based this document and it is important to us that we develop an understanding of your perspectives, objectives and concerns across each of those. It may be useful to consider the below questions while reading this document. Please note when responding to this document, it is not necessary to respond to each of the below questions; responding to a specific question or a general response is welcomed and appreciated.

PRODUCT CRITERIA
Do you support the proposed product criteria?
Are there other critera you think we should use?

TARGET USE CASES
Do you support the proposed use cases in the market framework?
Do you think other use cases should be addressed? Why?

NUMBER OF CUSTOMERS PARTICIPATING
What aspects of the market framework (for example minimum bid sizes) could increase customers' ability to participate?

TYPES OF CUSTOMERS PARTICIPATING
How could the market framework maximise the range of customers who can participate or benefit?

PILOT SEQUENCING
Do you support the sequenced introduction of these products and frameworks?

1 NATIONAL NETWORK, LOCAL CONNECTIONS – HAVE YOUR SAY!

It is also important to us that we maximise the overall value of the programme across our stakeholders. As such, we would invite perspectives on additional considerations that we could fold into our approach:

LEARNING OBJECTIVES
Are there learning objectives we should pursue prior to making a full proposal to the CRU regarding the local market framework?

CUSTOMER & POLICY OBJECTIVES
Are there other upcoming policy developments or customer needs and capabilities which should be accounted for in the proposed product roadmap and future market framework?

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Glossary

2 GLOSSARY

TERM	DEFINITION
CEP	Clean Energy for all Europeans Package
CRU	Commission for Regulation of Utilities
DER	Distributed Energy Resource
DNO	Distribution Network Operator
DUOS	Distribution Use of System
DSO	Distribution System Operator
ENA	Electricity Network Association
FSA	Flexible Service Asset
FSP	Flexible Service Provider
FSU	Flexible Service Unit
HV	High Voltage
ISEM	Integrated Single Electricity Market
LV	Low Voltage
MEC	Maximum Export Capacity
MPRN	Meter Point Reference Number
MV	Medium Voltage
MWH	Megawatt Hour
PR5	Price Review 5
PSO	Public Service Obligation
RESS-1	Renewable Energy Support Scheme
SEM	Single Electricity Market
TSO	Transmission System Operator

3

Background

3 BACKGROUND

3.1 CLEAN ENERGY PACKAGE

In 2018 and 2019 the EU adopted the Clean Energy for all Europeans Package (CEP) which consists of eight legislative acts with the aim to facilitate a transition in the EU towards cleaner energy. Of particular relevance to this submission are the internal market for electricity (EU) 2019/943 (the 'Regulation') and the Directive on common rules for the internal market for electricity (EU) 2019/944 (the 'Electricity Directive').

The Electricity Market Directive 2019/944 defines several key activities with respect to DSO's and the requirement to consider flexible alternatives to capital reinforcement. This includes:

1. **Development of flexible products and services for distribution system needs [2019/944, Article 31]**
2. **The procurement of products and services necessary for the efficient, reliable, and secure operation of the distribution system [2019/944, Article 31]**
3. **Development of objective, transparent and non-discriminatory market-based rules governing flexibility services [2019/944, Article 31]**
4. **Establishing the technical requirements for participation of demand response in all electricity markets based on the technical characteristics of those markets and the capabilities of demand response. [2019/944, Article 17 (5)]**
5. **Ensure the effective participation of all qualified market participants, including energy from renewable sources, demand response, energy storage facilities and market participants engaged in aggregation. [2019/944, Article 31]**
6. **Cooperation with transmission system operators for the effective participation of distribution customers in retail, wholesale, and balancing markets. Delivery of balancing services from resources located in the distribution system shall be agreed with the relevant transmission system operator [2019/944, Article 31(9)]**
7. **Distribution system operators and transmission system operators shall cooperate with each other to achieve coordinated access to resources such as distributed generation, energy storage or demand response that may support particular needs of both the distribution system operators and the transmission system operators. [2019/943, Article 57]**
8. **Regulatory authorities and distribution system operators in close cooperation with all market participants, as well as transmission system operators, shall establish the technical requirements for participation in those markets on the basis of the technical characteristics of those markets and the capabilities of all market participants [2019/944, Article 31].**

3 BACKGROUND

3.2 PRICE REVIEW 5 (PR5) PERIOD

ESB Networks as DSO has a license obligation to develop the distribution system in a safe, secure, reliable, economical and efficient manner. Traditionally, we have fulfilled this role through the development and reinforcement of the distribution system infrastructure. Consistent with the DSO responsibilities set out in the Electricity Market Directive (EU 2019/944), ESB Networks is now responsible for the development of market-based flexibility services. These services will play a role in ESB Networks meeting its license obligation with the support and approval of the CRU and in coordination with stakeholders. Flexibility services will be used to complement, or as an alternative to, reinforcement where they offer a more secure, efficient or timely solution.

Over the course of the PR5 price review period, ESB Networks set out plans for transformation of the DSO. This involves introducing the use of flexibility services as a means of managing security and capacity on the distribution system. Under the PR5 final determination CRU/20/153, the CRU has granted an initial provision of €16.9m of opex to facilitate the use of flexibility to address medium or high voltage reinforcement needs. In addition to this, the CRU put in place a "flexibility mechanism" within the agile framework, which allows ESB Networks substitute opex and capex solutions where this delivers a more cost-effective solution. Pending the full allocation of the initial €16.9m to flexibility projects, this would allow ESB Networks continue to procure flexibility services as an alternative to reinforcement activities at high, medium, or low voltage.

However, the potential to adopt flexible solutions is substantially greater than that provided for within the current regulated DSO model. For example, flexibility services have the potential to:

1. **Provide generation or demand customers with quicker connections.**
2. **Provide generation or demand customers with lower cost, lower security connections.**
3. **Reduce dispatch down of renewables.**
4. **Manage local security of supply.**
5. **Manage short circuit level challenges.**
6. **Manage dynamic stability.**
7. **Support customers' maintaining supply under storm conditions.**

We propose to explore these capabilities throughout the programme with market participants. To support the introduction of these services, appropriate funding arrangements will need to be developed over the life of PR5.

3 BACKGROUND

3.3 INTERACTION WITH CURRENT MARKET ARRANGEMENTS

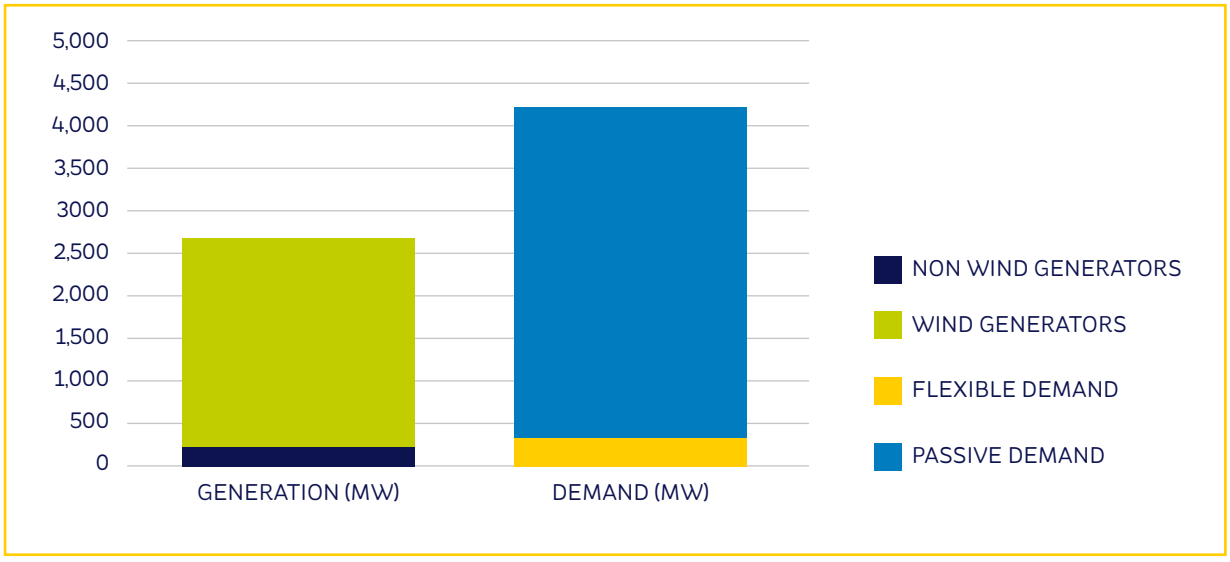
Currently there is no market for local flexibility services on the Irish electricity distribution system. The introduction of local flexibility markets on the distribution system is the subject of this document. It will be important that the local market arrangements introduced are operationally compatible with other market arrangements, to enable the stacking of services.

The Single Electricity Market (SEM) on the island of Ireland consists of a wholesale energy market with day ahead, intraday, and balancing market arrangements following a centrally dispatched model. In addition, a capacity market coordinated with the energy market underpins longer term supply adequacy.

All distribution customer can participate in these markets, though in the main this is through intermediaries such as their supply companies or aggregators. Many customers participate passively such as passive demand and variable renewable generators with priority dispatch.

In addition to this, there is a transmission system ancillary services market called “DS3”. The ancillary services products traded in this market are needed to support secure real time transmission system operation. A small volume of distribution connected customers currently participates in this market in a limited capacity, facilitated by the DSO.

FIGURE 1 **DISTRIBUTION CUSTOMER MAKE-UP**



3 BACKGROUND

3.4 FLEXIBILITY MARKET PLAN

The Clean Energy Package sets out a development role for market services for ESB Networks to complement our existing conventional physical network development role. This document sets out a roadmap for introducing local flexibility market arrangements, including the set of products to be introduced and their sequenced introduction, and short term and longer-term options for the overarching market framework.

Flexibility Market Development Objectives:

1. **Develop proposals for market-based solutions which can cost effectively and securely support the electrification of heat and transport, as per the requirement set out in Articles 31 and 32 of the Electricity Market Directive 2019/944.**
2. **Develop proposals for market-based solutions which facilitate faster connections, to cost effectively and securely accommodate new renewable generation on the distribution system, and enable increased renewable energy to be delivered on the distribution system, as per the requirement set out in Articles 31 and 32 of the Electricity Market Directive 2019/944.**
3. **Develop cost competitive non wires solutions as an alternative to conventional reinforcement and build choices, as per the objectives set out by the CRU for the PR5 period.**
4. **Facilitate distribution connected customers' participation in all organised markets, including in distribution flexibility markets, wholesale markets, and transmission system services.**
5. **Ensure transparency in nascent distribution system markets and pursue price discovery as an effective route to ensure value for customers.**
6. **Put the processes and capabilities in place to deliver effective market structures and market operations, applying an iterative, learning based approach.**
7. **Deliver in a co-ordinated way with the transmission system operator (EirGrid), customers and industry.**

3 BACKGROUND

3.5 INTERNATIONAL EXEMPLAR RESEARCH

A review of international exemplars of distribution flexibility and TSO/market interaction in other jurisdictions was carried out as part of the development of these proposals.

PROJECT	2025	JURISDICTION	MAIN ACTORS
Coordinet	TSO, DSO pilot collaboration for flexibility.	Greece, Spain, Sweden	TSO, DSO, customers, prosumers, aggregators, storage, and generators.
Transpower Demand Response	Demand side response programme	New Zealand	TSO, DSOs, customers across industrial, commercial,& residential.
ENA Open Networks	DSO led flexibility services programme	GB and NI	UK DNOs customers across industrial, commercial & residential.
GOPACS	TSO-DSO congestion management scheme	Netherlands	TSO, DSO, large scale generators/customers
Enera	TSO-DSO congestion management	Germany	TSO, DSO, distribution connected customers
Project Edge	TSO-DSO flexibility trial	Australia	TSO, DSO, Market Operator, distribution connected customers

4

Market Flexibility Phased Approach

4 MARKET FLEXIBILITY PHASED APPROACH

4.1 MARKET DEVELOPMENT AND DEMONSTRATION

ESB Networks has completed a number of innovation trials investigating the impacts of demand side flexibility, including the Dingle Project. However, market-based solutions for distribution system flexibility have not been tested to date in Ireland.

Consistent with the regulatory framework introduced for PR5, under the National Networks, Location Connections Programme, ESB Networks will roll out flexibility services in which customer distributed energy resources (DER) can participate using market-based approaches on a phased basis.

As part of this programme, ESB Networks proposes the piloting of proof-of-concept market solutions which will demonstrate the application of flexibility from generation, storage, or demand, in different network use cases.

As augmented operational systems are developed and deployed over the course of the price review period, market-based flexibility solutions can be refined and scaled. This will consider pilot learning, stakeholder feedback and regulatory decisions. (For more detail on the technologies involved and their rollout, please see the National Network, Local Connections Programme Operational Systems Roadmap.

The rollout of appropriate operational technologies designed to support these activities will make it possible to broaden customer participation and enable new technologies participate. This includes residential demand side response at scale. Key pilot stages over the PR5 period are further outlined in the National Network, Local Connections Programme Piloting Roadmap.

4.2 MARKET ACTORS

Distribution System Operator - ESB Networks is the license holder for operating the distribution network in Ireland

Transmission System Operator - EirGrid is the licence holder for operating the transmission network in Ireland.

Electricity Suppliers are licenced by the CRU to supply electricity to final customers.

Generators - Generators are licensed by CRU to generate electricity. Generators consist of technologies including:

1. **Dispatchable generation from renewable or conventional sources.**
2. **Controllable generation from renewable sources such as wind and solar.**
3. **Small scale generation of various types not subject to centralised control.**
4. **Electricity storage including batteries.**

Passive demand - Final customers who consume electricity, without specifically responding to market based signals.

4 MARKET FLEXIBILITY PHASED APPROACH

4.2 MARKET ACTORS continued

Demand side response - Final customers who consume electricity but can alter demand in response to market based signals.

Aggregators - Market actors who aggregate demand or generation for the purposes of participating in energy, capacity, and system operator services markets.

Renewable Energy Communities - 'renewable energy community' means a legal entity: (a) which, in accordance with the applicable national law, is based on open and voluntary participation, is autonomous, and is effectively controlled by shareholders or members that are located in the proximity of the renewable energy projects that are owned and developed by that legal entity; (b) the shareholders or members of which are natural persons, SMEs or local authorities, including municipalities; (c) the primary purpose of which is to provide environmental, economic or social community benefits for its shareholders or members or for the local areas where it operates, rather than financial profits. [2018/2001]

Citizen Energy Communities citizen energy community' means a legal entity that: (a) is based on voluntary and open participation and is effectively controlled by members or shareholders that are natural persons, local authorities, including municipalities, or small enterprises; (b) has for its primary purpose to provide environmental, economic or social community benefits to its members or shareholders or to the local areas where it operates rather than to generate financial profits; and (c) may engage in generation, including from renewable sources, distribution, supply, consumption, aggregation, energy storage, energy efficiency services or charging services for electric vehicles or provide other energy services to its members or shareholders [2019/944]

4.3 CO-ORDINATED MODELS FOR MARKET SERVICES

Several different models for interaction between these different actors, customers and the system operators have been trialled in several jurisdictions. The unique characteristics of each jurisdiction's electricity system determines which model is the best fit. The Irish electricity market and distribution system has some unique features which include

1. **A sparse distribution network, particularly at MV and LV, due to low population density and industrial base.**
2. **An island network .**
3. **A very high penetration of variable renewable generation, with ambitious targets for further increases under the Climate Action plan.**
4. **Existing markets for energy, capacity, and transmission system services with unique features.**

The combined impact of these factors is a high expectation of localised congestion in Ireland over the coming years. Research and trial industry experience (See Appendix D)indicates that localised markets for flexibility services are favoured over other system management models in cases where distribution networks are congested. Several specific cost benefit analyses have been carried out in other jurisdictions which support this development.

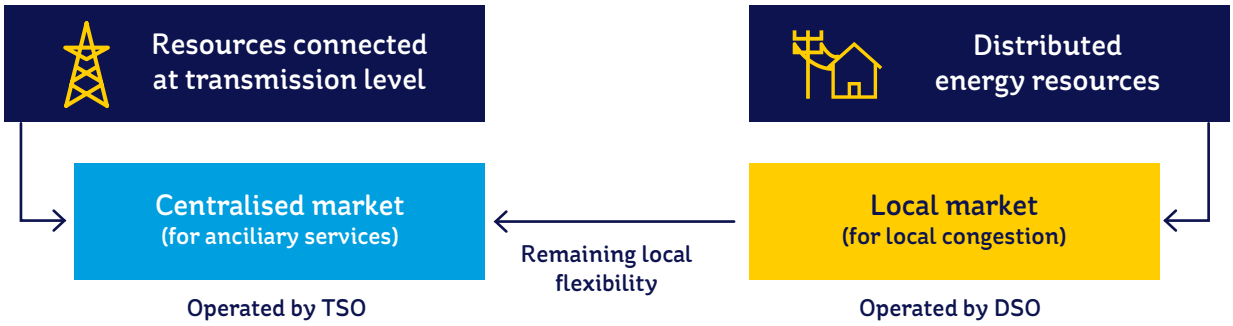
4 MARKET FLEXIBILITY PHASED APPROACH

4.3 CO-ORDINATED MODELS FOR MARKET SERVICES continued

Several EU funded innovation projects and industry bodies have modelled different frameworks for flexibility services, ancillary services, and DSO-TSO coordination. The SmartNet project offers a particularly clear characterisation of the different models for coordinating transmission and distribution system services. These are set out in Appendix B.

Based on these considerations, the SEM Committee System Services Future Arrangements - Decision Paper 1 [SEM-21-021]] and the 2021 Roadmap for the Clean Energy Package's Electricity and Renewables Directives [CRU/21019], a market framework similar to the SMARNET decentralised approach offers a good fit for Irish conditions. The detailed options within this plan are based on that archetype.

FIGURE 2 **SMARTNET DECENTRALISED MARKET MODEL**

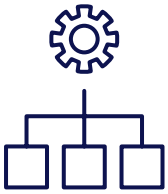


Description

Separate local flexibility market for DSOs, in addition to the ancillary services market for TSO procurement

Market organisation

TSO (centralised market) and DSO (local market)



Allocation principle of DER flexibility

DSO priority

Role of DSO

DSO operates a local market for resources connected at DSO level and is responsible for local congestion management. DSO has a priority to use the flexible resources on the local grid. DSO aggregates and transfers the remaining bids to the TSO market after all local constraints are resolved, while ensuring that only bids respecting DSO grid constraints can take part in the ancillary services market.

Role of TSO

TSO manages the central ancillary services market and can only acquire the remaining local flexibility from DSO with technical validation from DSO to ascertain feasibility of the orders

4 MARKET FLEXIBILITY PHASED APPROACH

4.4 FLEXIBILITY SERVICES

Service based flexibility is the use of market-based incentives to procure flexibility from distribution system customers (generation, storage, and demand). This form of flexibility is the primary focus of this paper, because they are an efficient and practical means of providing location specific, time varying economic signals for flexibility. Similar market based ancillary services are an integral part of transmission system operations in many jurisdictions. Flexibility services enabled by active system management technology (covered in detail in the National Network, Local Connections Programme Operational Systems Roadmap) has been developing at distribution level over the last decade. Their use is becoming established business as usual practice in some jurisdictions. A list of exemplars researched in the development of these proposals is listed in Appendix A.

4.5 FLEXIBILITY USE CASES

A number of key use cases for flexibility are introduced below, to provide context for the market framework options and products described in later sections.

To support new or increased demand

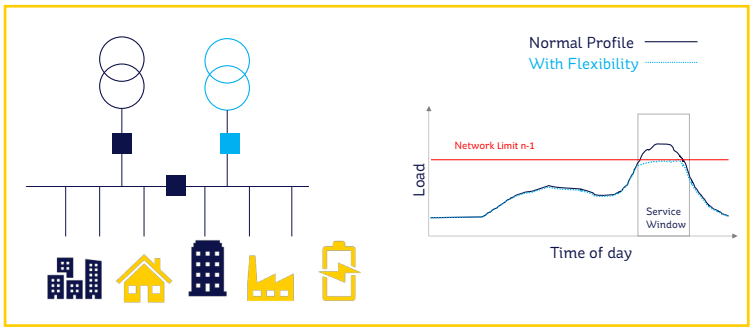
As described in the National Network, Local Connections Programme 2030 Power System Requirements, the electrification of heat and transport will lead to significant load growth. Even with reliable data sources and modelling methods available, the timing and distribution of this load growth is inherently uncertain. The use of flexibility services to manage supply and demand on a local level can play a role in ensuring there is capacity to meet this increased load while allowing for this uncertainty. These services may also provide an alternative to conventional reinforcement in cases where such reinforcement is difficult, more expensive or slower to deliver.

Example: Heavily loaded Urban 38kV load growth

Load growth on a heavily loaded 38kV substation in an urban centre could drive the need for a large capital investment project involving the development of a new 110kV/MV substation and installation of the associated underground cabling. Securing a site with the necessary footprint and managing disruptive construction works is costly and typically takes an extended time to deliver.

Demand management involving embedded generation, storage or demand side response (active resources highlighted in yellow) could prove a more cost effective and faster solution for customers. The network is planned to a particular reliability standard (P2 equivalent standard). This delivers the necessary redundancy to maintain load under n-1 (representing the loss of a single item of plant) contingency conditions. This means that calling on flexibility at times when peak demand exceeds the n-1 rating would likely be sufficient to defer or even avoid the need for reinforcement as illustrated in Figure 3.

FIGURE 3
DEMAND DRIVEN USE CASE – URBAN ENVIRONMENT



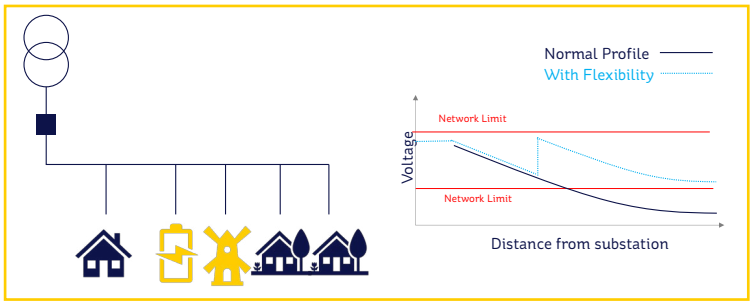
4 MARKET FLEXIBILITY PHASED APPROACH

4.5 FLEXIBILITY USE CASES continued

Example: Voltage limits on rural networks
Particularly in rural networks, extended feeder lengths and/or low demand combined with high generation is often the limiting factor on network capacity.

The provision of active or reactive power injection at a point in the network can be used to manage the overall voltage profile within network limits. It should be noted that the Volt/VAr or Volt/Watt effect is location specific, and thus the network location of a resource will heavily impact its ability to address a voltage-based constraint.

FIGURE 4 **VOLTAGE CONSTRAINT USE CASE**



To increase renewable energy on the system
As more renewables are connected onto the distribution system, this creates increased competition for network capacity. Like demand, growth in generation gives rise to thermal and voltage congestion in the network, driving the need for reinforcement. Given the pace of renewable generation connections needed over the coming decade, alternative approaches are needed to allow the system operator:

1. **Connect renewable generators more quickly and in a more cost effective manner**
2. **Increase local consumption of local renewable generation**

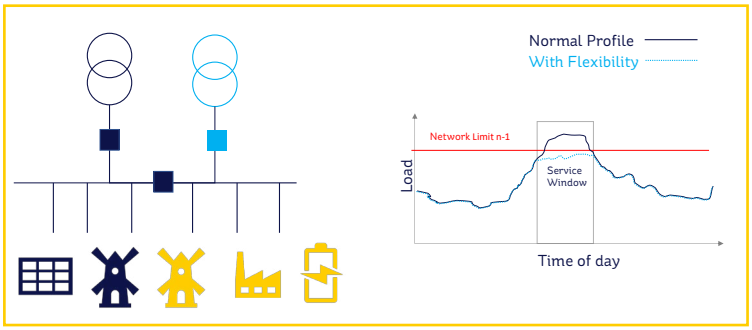
The use of flexibility in the form of demand response, storage, or the dynamic allocation of network capacity amongst generators could create opportunities to make greater use of the existing network infrastructure. For example, if network capacity were allocated dynamically, then when some generators are unavailable (due to weather conditions or because they are out of market), the available network capacity could be used to allow other renewable resources on the network increase their output. This would allow new generators to be connected more quickly and cost effectively and create opportunities to reduce dispatch down in comparison to non firm access without any supporting market based solutions. Similarly if the level of load in the area was greater than minimum load and if the network configuration were optimum (with no outages), the renewable resources could also increase their output

4 MARKET FLEXIBILITY PHASED APPROACH

4.6 FLEXIBILITY USE CASES continued

As demonstrated in Figure 5 the combinations of different energy resources on a network can result in greater use of network capacity by renewable generation on a local level.

FIGURE 5 **OPTIMISATION OF RENEWABLE ENERGY**



To address technical scarcities on the network

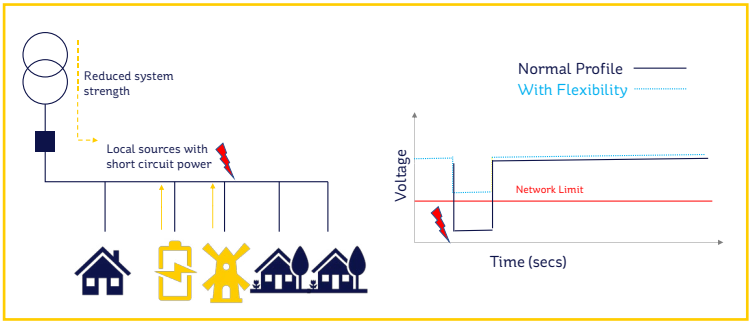
In addition to the demand and generation related challenges identified above, there are many network management challenges which could be supported or addressed through the use of flexible solutions.

These include:

1. **Short circuit levels which are too high, in urban locations**
2. **Short circuit levels which are too low, in rural locations**
3. **Dynamic stability and coordinated protection management**
4. **Delivery of required outages to upgrade and maintain the infrastructure**

Figure 6 illustrates how customers at a location could support locations with low short circuit levels, whereby customers provide additional reactive power transiently to support network voltage and correct operation of network protection.

FIGURE 6 **SHORT CIRCUIT LEVEL**



These use cases and associated market frameworks are explored in greater detail in Sections 6-9. ESB Networks will adopt a pilot-based approach to the rollout of use cases, flexible services, and market frameworks over the course of PR5 and build towards an enduring solution. This will enable market designs and the associated operational systems to be tested and built iteratively.

Further details on the outline timings and sequencing of the Pilots are described in the National Network, Local Connections Piloting Roadmap.

5

Flexibility Products

The use of standardised flexibility products has been pursued in several jurisdictions and markets. Some key advantages in defining standard products include.

- a standardised set of requirements for the customer in terms of technical and operational requirements
- Well-designed products allow repeatability, transferability, and scalability across various use cases
- Products translate complex technical scarcities and customer needs into recognised solutions that build market participant familiarity and drive standardisation.
- Can be developed in a technology neutral manner

EU wide standardised products have not been developed. There is still significant scope for innovation in this space.

5 FLEXIBILITY PRODUCTS

5.1 PRODUCT PROPOSAL CRITERIA

ESB Networks, in its capacity as DSO, has developed several system operator criteria for the development of products. These criteria are used to inform the appropriateness and usability of a product prior to detailed design. We would welcome stakeholder perspectives on these criteria as part of this consultation.

Product Proposal Criteria

1. **Products should be linked to a distribution network technical scarcity and should deliver an identified benefit to customers collectively.**
2. **Products should reflect a set of specific technical and operational requirements for service that a flexible service provider must meet.**
3. **Products should be in so far as possible, be functional in nature and neutral of the provider's technology to provide a level playing field for competition.**
4. **Products should where possible, be scalable to different volumes and voltage levels on the network.**
5. **Products should be repeatable for different times of day/times of year.**
6. **Products should be transferable, so can be applied to various network locations and use cases.**
7. **Products should be quantifiable in terms of volume, timeframe, and technical characteristics.**
8. **Products should be observable and measurable to international standards and using commercially available system operator or customer instruments and monitoring & metering technology.**

5.2 ENA STANDARD PRODUCTS

ESB Networks has researched approaches used in several different jurisdictions. Under the Open Networks project, managed through the Electricity Network Association (of which ESB Networks is a member), UK DNOs have combined to develop standardised flexible products specifically for distribution system needs.

These products are used to support distribution system needs, for demand driven use cases. The products are at a level of maturity in the UK where the DNOs have been using them commercially in a flexibility market since 2018.

ESB Networks will procure some or all of these products from flexible service providers, for initial pilots in several zones.

The products described below share some common features. All require a change in kW export or import, and have similar minimum product size thresholds, granularity, and settlement periods.

The products are differentiated by how they are scheduled, payment structure, notice period and response times

5 FLEXIBILITY PRODUCTS

5.2 ENA STANDARD PRODUCTS continued

SUSTAIN: MW scheduled utilisation service

Scheduled congestion management: regular procurement of an active power service, scheduled ahead of time, to ensure that network capacity is not exceeded.
For example, a consistent known issue in a particular area every day at peak time.

SECURE: MW scheduled availability, utilisation on medium notice (days)

Pre-fault congestion management: procurement of an active power service, ahead of time but utilised based on conditions closer to real time, when a network limit is forecast to be breached. For example, to manage a pre-planned outage or cover an N-1 contingency (overloaded if lose one transformer).

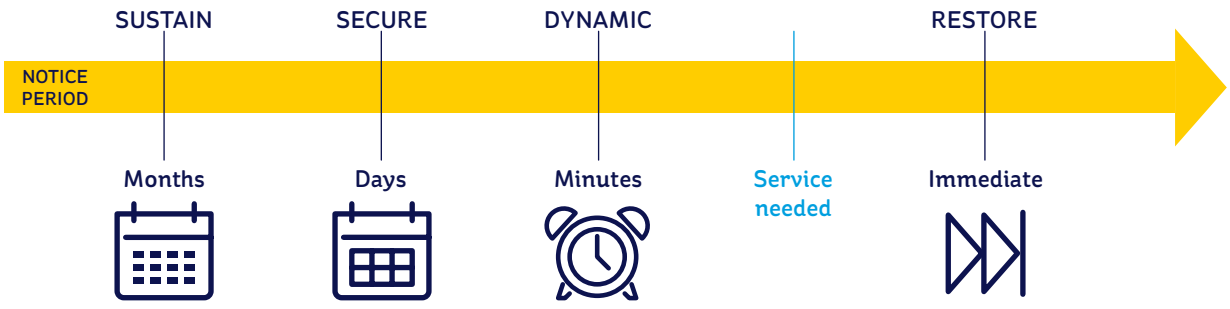
DYNAMIC: MW scheduled availability utilisation at short notice (minutes)

Post fault congestion management: procurement of a service, utilised based on a fault or unforecastable event occurring, to return network to within capacity limits. For example, the Dynamic product can be used outside of an already defined service window when there is an unexpected fault.

RESTORE: MW unscheduled utilisation on rare events

Procurement of a service following loss of supply where ESBN will instruct a flexible service provider (FSP) to either remain off supply, or to reconnect with lower demand, or to reconnect and supply generation to support increased and faster load restoration under depleted network conditions.

FIGURE 7 **TIMELINE FOR SCHEDULING OF SERVICES**



5 FLEXIBILITY PRODUCTS

5.3 PRODUCT DESIGN CRITERIA

To specifically adapt these products for use on the Irish distribution system and in an Irish market context, product design criteria have been applied from the system operator perspective. Due consideration has been given to the need to balance broad customer participation while meeting our obligations to ensure secure, reliable supply for all customers. We would welcome feedback on these criteria as part of this consultation.

Product Definition Criteria

1. **The product satisfies a technical scarcity / customer need and the linkage between provision of the product and meeting the need will be clearly defined.**
2. **The timeframe in which the need can be accurately and reliably forecast and product delivery requirements such as notification period, provider speed of response shall be defined.**
3. **DSO operational requirements shall be considered such as response times, network equipment operating and protection limits.**
4. **The product granularity and divisibility requirements for volume, time interval and upper/ lower limit values where applicable shall be defined.**
5. **The point of measurement of the product (point of connection, metering point) and unit of measurement of the product shall be defined.**
6. **Relevant characteristics from other markets/services shall be considered where feasible for alignment and to facilitate service stacking.**

Based on these considerations the following characteristics are proposed:

PRODUCT CHARACTERISTICS	SUSTAIN	SECURE	DYNAMIC	RESTORE
Scheduling	Utilisation scheduled at contract stage, service reminder week ahead	Indicative schedule week ahead, utilisation confirmed day ahead	Scheduled for availability, utilisation based on instruction	Unscheduled, utilisation on instruction
Full activation time (from instruction to delivery)	N/A instructions will not be issued, routine service delivery.	Provider to nominate, must be less than period from day ahead notification to delivery.	15 mins	Zone specific
Payment structure	Utilisation only	Availability and Utilisation	Availability and Utilisation	Utilisation only*
Minimum Flexible Service Unit Capacity (kW)	Zone and competition specific (more localised zones will imply smaller assets)			
Minimum Flexible Service Asset Capacity (kW)	1kW			
Minimum/maximum duration of delivery period	Zone and competition specific			
Recovery period (between utilisation events)	Zone and competition specific			
Settlement period	15 mins			
Point of measurement	Customer metering point			

5 FLEXIBILITY PRODUCTS

5.4 FUTURE DEVELOPMENT OF STANDARD PRODUCTS

The standard ENA products described in Section 5.2 are based on pre-contracted availability and utilisation pricing with prescribed timings. Over the course of PR5, ESB Networks will work with CRU, the TSO and industry stakeholders to further develop these products so they are operationally compatable with energy / TSO ancillary services markets and timings to facilitate value stacking and service optimisation.

5.5 REACTIVE POWER SERVICES

Reactive power is required to manage the system within acceptable voltage limits during normal operation. Reactive power is also required transiently under fault conditions to support network voltage and ensure proper functioning of protective equipment. Hence reactive power can be split into two products, reactive power and transient reactive power reflecting different system needs and service provider capabilities.

1. **Reactive Power: regular procurement of a service to support the network under normal operation of the system by flexible service providers producing or absorbing reactive power at the point of connection in response to an instruction from the DSO. This could take the form of a reactive power instruction or voltage setpoint to the provider.**
2. **Transient Reactive Power: regular procurement of a service to support voltage under system disturbance. FSPs can either inject or absorb reactive power automatically based on a system event. This will be based on a declared and tested capability and could be utilised at any time.**

5.6 ADDITIONAL PRODUCT DEVELOPMENT ROADMAP

Over the course of the price review cycle ESB Networks will develop further products for distribution connected customers to participate in. Future Product Development which will be considered during the price review cycle will include:

Islanding Services

New control room technologies may enable providers to offer islanding services, to support a portion of the network when disconnected from the overall system.

Restoration Services

Like islanding service, used to restore supply to a de-energised islanded portion of the network following loss of supply.

Stability Services

As the level of non-synchronous generation on the power system increases, technical scarcities may arise associated with stability, whereby oscillations of power or voltage arising following system disturbances or system equilibrium is difficult to restore following faults. These generally can be categorised in terms of voltage stability and power angle stability. The requirements for services to improve transient stability will be considered further based on the output of studies.

6

Initial Market Framework

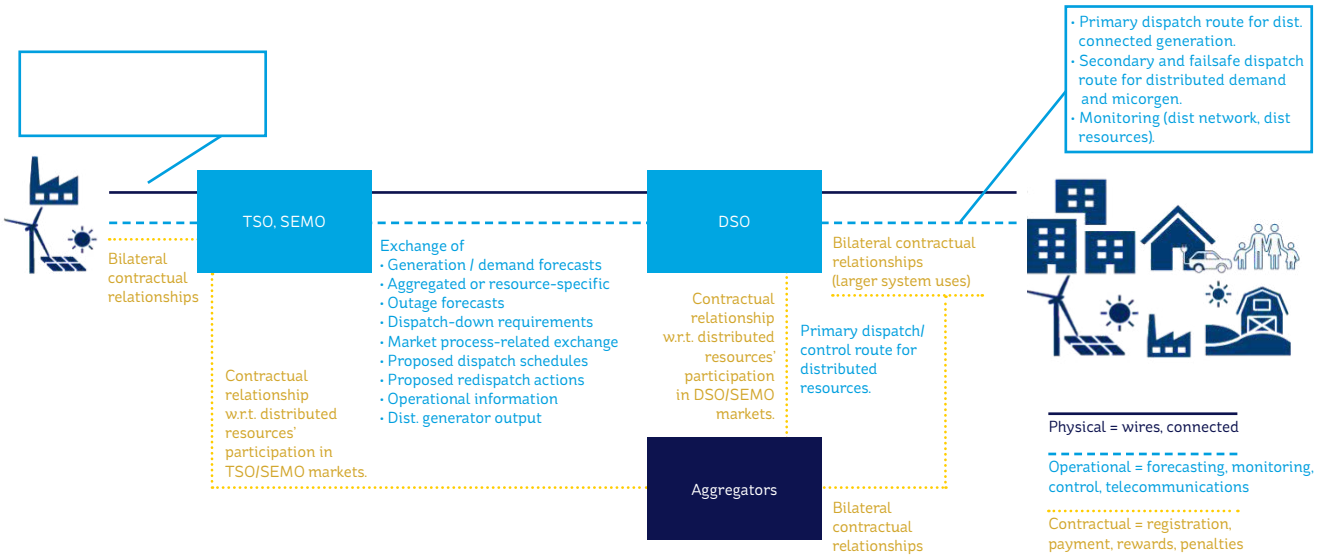
6 INITIAL MARKET FRAMEWORK

6.1 OVERVIEW

A basic market framework is proposed for initial piloting purposes. It is not proposed that this would be the enduring market framework for which regulatory approval is required as per the Electricity Market Directive 2019/944. The use of a basic market framework for the first piloting activity will be used to inform proposals for a local market framework on the distribution system, adding to the proposals set out later in this document. This market framework can be used to address cases where the following apply

- **Demand driven use cases funded within the existing DSO revenue model**
- **Flexible solutions are procured by the DSO to defer conventional demand driven reinforcement**
- **Standard flexible products market tested in GB and NI (and as described in Section 5.2) can be used.**

FIGURE 8 **MARKET FRAMEWORK**



As set out in Figure 8, ESB Networks as DSO will buy services from distribution connected demand, generation or storage facilities. ESB Networks will also facilitate the trade of services between customers, and will facilitate customers provision of services to EirGrid and into the SEM, including via aggregation.

Overall system demand and supply balance and system frequency remain the responsibility of the transmission system operator. Generally, these types of ancillary service products procured by the TSO can be provided by resources system wide. Detailed discussion of these services is not within the scope of this submission.

6 INITIAL MARKET FRAMEWORK

6.1 OVERVIEW continued

Distribution flexibility service needs are localised to the specific network locations where they arise. Distribution system services will be required now, and in the future, to address thermal or voltage constraints, high or low short circuit levels, security and stability. In general, these can be addressed through active or reactive power management or availability, depending on the network characteristics and asset locations. As such for each kind of technical scarcity on the system, the precise network location in which it arises must be defined.

ESB Networks will publish service requirements for specific network locations on a pilot basis. Following a pre-qualification process, suitably qualified service providers with assets connected to the relevant networks can bid for services.

ESB Networks proposes to adopt some standardised technology neutral definitions for the purposes of common language and market definitions for flexibility.

DEFINITION	DESCRIPTION
Distributed Energy Resource (DER)	An individual generator, storage facility or site providing demand response which is connected to the distribution system
Flexible Service Asset (FSA)	A single standalone distributed energy resource and/or installation capable of providing a flexibility service. A flexible service asset shall have the technical and operational capability to deliver flexible services in response to instructions from the relevant system operator in accordance with the relevant grid code or distribution code.
Flexible Service Unit (FSU)	Single or aggregated flexible service asset(s) in the same network location acting collectively to provide a flexible network service. FSUs, and assets within, shall have the technical and operational capability to collectively deliver flexible services in response to instructions from the relevant system operator in accordance with the relevant grid code or distribution code.
Flexibility Product	A discrete change in electrical characteristic of an electricity system user such as active power, reactive power , or stored energy over a specific timeframe that is quantifiable and measurable.
Flexibility zone	A defined electrically connected portion of the distribution network where a flexibility product is required
Flexibility Service Provider (FSP)	A legal entity which has rights to operate and offer services of Flexible Service Unit(s) consisting of Flexible Service Asset(s)

6 INITIAL MARKET FRAMEWORK

6.2 RULES AND GOVERNANCE

A set of standard terms and conditions of service and detailed tendering and bidding rules will be published with the request for tender for initial pilots. A number of mature contracts for flexibility services are being used as basline models for informing the basis of the terms and conditions of service.

Bilateral contracts will be put in place, and on conclusion of the period of the pilot contract, future contracts may be put in place based on the prevailing market framework at that time. Future market frameworks will be informed based on operational experience and feedback from service providers as this develops through piloting activities. Appropriate governance as determined by the CRU will be put in place for enduring contract arrangements.

6.3 PROCUREMENT PROCESS

Through procurement processes compliant with the Utilities Directive 2014/25/EU, ESB Networks propose to procure services from flexibility service providers in line with identified requirements. Outline technical requirements will be published at pre-qualification stage. The proposed process and outline timings are illustrated below in Figure 9. The detailed process and timelines will be published in the pre-qualification and request for tender documentation.

FIGURE 9 **QUALIFICATION AND TENDERING PROCESS**

Q4 YEAR AHEAD	Q1 SERVICE YEAR	Q1 SERVICE YEAR	Q2 SERVICE YEAR	Q3 SERVICE YEAR	Q4 SERVICE YEAR
Sign post locations and service needs; conduct preliminary market consultation	Prequalification of providers and assets completed	Request for tender for prequalified providers issued	Tender evaluation completed	Contracts awarded	Service provision commences

Contract Duration

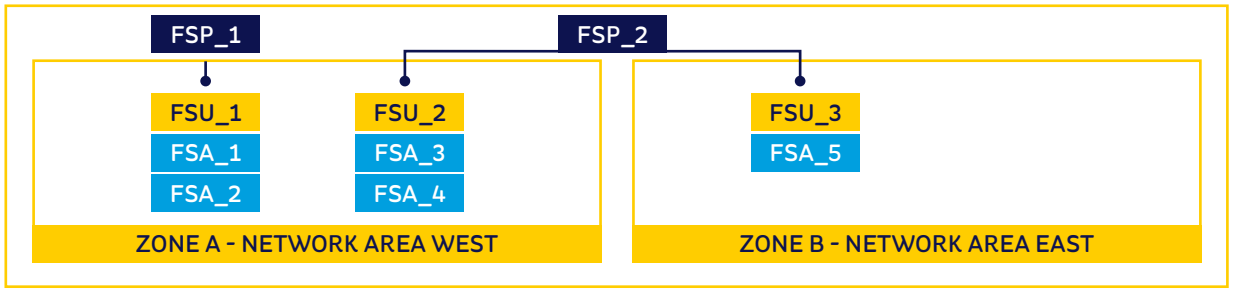
It is proposed that a bilateral contract with ESB Networks, with a fixed duration of 2 years will be offered, with an option to extend for a further limited fixed period. Due to the locational nature of the services, and the purpose of the services to defer or reduce the requirement for network reinforcement, fixed term contracts are preferred. More dynamic procurement methods within a long term market framework are discussed in the Section 8.

6 INITIAL MARKET FRAMEWORK

6.4 COMPETITION RULES

Detailed competition rules will be published in the request for tender documentation. For each flexibility zone a target volume of each flexible product type will be set out. The initial products are described in further detail in Section 5.2.

FIGURE 10 **ZONES AND ASSET ELIGIBILITY**



Flexible service providers can bid in multiple flexible zones as part of each competition, using unique FSU's within each zone.

For FSUs consisting of aggregated assets, only assets within the zone relevant to a given tender can be bid. Flexible service assets will be uniquely identified by their associated Meter Point Reference Number (MPRN) and could only be registered as part of a single FSU.

If there is more than one product in a zone, FSPs can submit bids (per FSU) for each product but can only be contracted for its entire capacity once. ESB Networks will consider the FSU a single operational entity so the unit operating will be required to meet the required product specification.

Each zone shall be tendered separately within the procurement competition. Where a zone is nested within another zone, all FSUs from the nested zone may be eligible to bid in the broader zones in which they are located (Example: Per Figure 10 above, Zone A and Zone B). Eligibility will be determined by the nature of the network in each respective zone, the nature of the technical scarcity to be addressed, and appropriate power flow checks.

6 INITIAL MARKET FRAMEWORK

6.5 PAYMENT STRUCTURE

Depending on product type, services could be remunerated for availability or utilisation as appropriate. Product types with a low expectation of utilisation will likely operate on the bias of predominantly availability-based payment. Products with higher contracted utilisation could operate based on utilisation price only.

It is proposed that, availability payments will be paid with respect to defined service windows. During these service windows, service providers will be required to be able to provide a response, within agreed timeframes. Availability payments will be subject to performance criteria, and routine declaration of unavailability or failure to respond to utilisation requests will be addressed in these. ESB Networks will work with service providers to address any performance issues during initial pilots.

It is proposed that both availability and utilisation prices will be fixed at contract award stage, on a pay as bid basis.

6.6 CLEARING OF A ZONE

For each competition, the required volume would be cleared in line with economic merit order. Where relevant, effectiveness factors/operating envelopes may need to be applied to an offered FSA asset based on network location.

Detailed bidding and evaluation rules will be published in Request for Tender documentation.

For the purposes of price discovery and transparency, ESB Networks proposes to publish the highest cleared price or average price of successful bids for each product and zone.

Where there is insufficient prequalified volume for all participants in a zone ESB Networks would reserve the right to run additional qualification processes or not proceed to tender stage.

6.7 NETWORK CONNECTIVITY MODEL

For each zone, ESB Networks will use the relevant network connectivity model to determine whether assets are connected to the network location represented by the zone. For demand driven use, cases will generally be at the identified substation or circuit on which the technical scarcity arises.

6 INITIAL MARKET FRAMEWORK

6.8 EFFECTIVENESS FACTORS AND OPERATING ENVELOPES

Flexible service assets may be more or less effective at relieving a particular technical scarcity, depending on their electrical location along a circuit. Where this arises, asset-specific effectiveness factors will be calculated during the qualification stage.

Similarly, where an asset delivering the full volume of a service may create a local network issue under certain circumstances, it will be necessary for that asset to operate within a specific operating envelope determined by the DSO. This will be addressed during the qualification stage

6.9 SERVICE SCHEDULING

Service scheduling will be defined per contract. The process is specific to the product types and will depend on the ability to forecast certain network contingencies. Products with lower utilisation rates will tend to have shorter notice periods to respond to faults and other contingencies with lower forecasting certainty. Scheduling will be timed to avoid service conflicts with other market commitments and is proposed to take place ahead of gate closures for energy markets.

6.10 INITIAL ACCESS RIGHTS FRAMEWORK

Access rights refers to the connection principles for customers connecting onto the distribution network and is governed by connection policy. For the initial market framework, changes to existing access rights are not envisaged. In heavily congested areas where market services alone may be insufficient to deliver reliability of supply for customers, future options for customers to avail of actively managed connections with interruptible or non-firm import capacities may be considered to allow such customers avail of earlier access to the distribution system. These are detailed further in Section 7

6.11 FUNDING ARRANGEMENTS

Funding of the services under the existing market frameworks will be based on the net present value of deferred investment as set out in the PR5 Determination and recovered via DUOS.

7

Long Term Market Framework

The initial proposed flexibility products are based on standard products which have been introduced in other jurisdictions. These are based on fixed term contracts, and thus suitable for operation within the initial market framework.

Due to the highly locational nature of distribution system needs, it will be important to develop liquidity and service provider reliability on the way to establishing shorter procurement cycles. It is likely that for use cases related to investment deferral, service provider availability for the term of deferral would need to be underpinned by some form of fixed term conditions.

A layered market design provides an option which would balance the relative need for and merit of long term and shorter procurement cycles. This could operate on the basis of longer term availability contracts with utilisation pricing which is fixed closer to real time, to allow broader participation. The benefits of a framework of this nature include (1) improved liquidity and (2) allowing service providers to manage their positions with respect to other market opportunities, supporting more efficient pricing.

7 LONG TERM MARKET FRAMEWORK

7.1 FLEXIBLE ACCESS RIGHTS CONSIDERATIONS

Customers' access to the distribution system is underpinned by access rights. These rights are managed through the customer's connection agreement, and in line with the prevailing connection policies and standards.

ESB Networks' connection policy has historically granted generation customers with firm network access rights. More recently non-firm options have been introduced as part of the Smarter HV & MV Customer Connections Innovation Project. These are available for generators in specific network topologies and circumstances. A limited number of non-firm large demand connections have been implemented.

Advances in distribution system management capabilities create greater opportunities to provide non-firm or flexible connections which could be managed in near real time. Future local market arrangements could allow the reallocation of these rights between different system users in a market-based manner. Similar concepts have been trialled in other jurisdictions. As ESB Networks' augmented operational systems are rolled out, this would be operationally feasible on the Irish system.

ESB Networks is proposing a pilot form of flexible connection in locations where new renewable generators are preparing to connect, as outlined in further detail in the Piloting Roadmap. This would facilitate early access on a timebound basis for eligible projects, in locations where the timing of deep reinforcements could impact on their RESS1 longstop date. Based on forecasted network power flow forecasts, participating generators or demand would be advised of their operating envelope day ahead.

In future, within the local market framework, it would be possible to supplement flexible connections with market based incentives for other generators or demand side response located on the same network to offer a response service to facilitate the export.

A range of potential funding models for this are set out in Section 8.

7.2 DSO LED PROCUREMENT FOR DEMAND DRIVEN CONGESTION

Option 1:
Long term contracts could be used for availability and utilisation. This option would build on and refine the initial market framework, but with reduced registration and procurement cycle durations, and the roll out of more schemes to secure broader participation.

Option 2:
(DSO Recommended) Long term contracts could be used to secure availability, coupled with nearer to real time competition for utilisation. This approach would balance the need for reliability with the need to drive liquidity and broaden participation. To progress this approach, it would be necessary to implement a market management system.

Option 3:
Short term contracts could be used for both availability and utilisation. ESB Networks does not recommend this option at this point in time, on the basis that the market is insufficiently mature for this approach to deliver confidence that the services needed would be available until reinforcement could be completed.

7 LONG TERM MARKET FRAMEWORK

7.3 FACILIATING RENEWABLE GENERATION (SPEED OF ACCESS, REDUCING DISPATCH DOWN)

Localised flexibility markets could offer a solution to relieve network congestion and increase capacity for renewable generation. This could be used to allow new generators connect more quickly, or at a lower cost. It could also be used to reduce dispatch down of renewables (for example by shifting in local demand to align with renewables output).

Localised flexibility markets could support higher network utilisation. For example when a subset of generators are not generating (solar at night, generators on outage, low wind) or when one customer's market income exceeds another, there are opportunities to allocate network access rights in a dynamic and market based manner. A range of options to achieve this are set out in the table below and then summarised later in this section.

	OPTION 4	OPTION 5	OPTION 6
Commodity	MEC-hour (dynamic)	MEC-hour (dynamic)	MWh (in the form of reduced export, Increased import)
Buyer	Non-firm generator (holds non-firm MEC)	All generators (who hold non-firm/firm MEC)	DSO, TSO could also act as buyer for higher level congestion in the network
Seller	Firm generators (holds MEC)	DSO (holds all MEC)	Generation, Storage, Demand Response
Role of DSO	Predicts long term constraint based on studies/modelling Forecasts constraint based on: Demand, generation forecast, scheduled frequency reserves, Neutral Market Facilitator for access rights, credit risk Operational final dispatch path, Updates TSO on reserve impacts Advises SEM of non-firm status	Predicts long term constraint based on studies/modelling Forecasts constraint based on: Demand, generation forecast, scheduled frequency reserves, Sells access rights Operational final dispatch path, Updates TSO on reserve impacts Advises SEM of non-firm status	Predicts long term constraint based on studies/modelling Forecasts real time constraint based on: Demand, generation forecast, scheduled frequency reserves Publishes congestion need Assesses effectiveness of bids to relieve constraint Operational final dispatch path, Updates TSO on reserve impacts
Wholesale Interactions & Balance Responsibility	Not a MWh commodity so balance responsibility remains with the market participants per SEM rules. Capacity market obligations would need to be respected by FSPs.	Not a MWh commodity so BRP, remains with the market participants per SEM rules Capacity market obligations would need to be respected by FSPs	DSO has requested a change in energy position to manage congestion (possibly on behalf of non-firm generator). Options around BRP could be: FSPs build BRP costs into their bid DSO buys counterbalancing bid from balancing market Capacity market obligations would need to be managed by FSPs.

7 LONG TERM MARKET FRAMEWORK

	OPTION 4	OPTION 5	OPTION 6
Funding Model	Generators responsible for funding their trades DSO levies a market management fee from participants or socialises costs Balancing costs – by the market participants	Non firm generators would pay for their additional access costs more than the provisions in their connection agreement. DSO Compensates firm participants who don't clear their volume, funded by the access costs levied on non-firm generators. Where firm participants clear their volume, they are automatically refunded. Balancing costs – by the market participants	DSO procures service. The service could be funded by non-firm generators as a pass-through cost up to the level of their agreed constraint or as a form of market-based re-dispatch cost. TSO could fund transmission-imposed constraints as appropriate. Balance costs would need to be determined.
Other parties to coordinate with	TSO, SEMO	TSO, SEMO	TSO, SEMO

Options are proposed as follows:

Option 4:
Introduce a DSO led market for allocating network capacity. The DSO would be responsible for fulfilling a neutral market facilitation role. The DSO would forecast network congestion generators could exchange access rights subject to oversight and information exchange facilitated by the DSO. For example under certain conditions non-firm generators might pay firm generators for the use of their excess capacity.

Option 5:
Introduce a DSO led market for allocating network capacity, in which the DSO holds and auctions off all capacity. Generators, storage and demand response providers in an area bid for capacity which is sold to the highest bidder. The revenue is used to compensate unsuccessful customers who hold firm access rights but were outbid. This would take the form of a refund or redistribution from non-firm to firm customers.

Option 6:
Introduce a DSO led services market approach. This is like Option 2, involving a similar product structure. The DSO would forecast the level of constraint and seek to procure services near to real time to address this. The solutions could be delivered equally by increasing demand or reducing generation. An advantage of this approach is that it would facilitate the participation of demand (upward regulation). The costs of the market could be funded by generators with non-firm access rights, who can set a limit on the cost of resolving the constraint in their own bid prices.

8

Funding Options

Options for funding the different applications of flexibility are set out within, to support stakeholder consultation and the CRU's consideration of this matter. ESB Networks has set out the candidate options, based on an assessment of the relevant value drivers that these flexibility services support.

A funding framework for remunerating the socialised portion of demand-related capacity managnet has been included within the PR5 determination.

For distribution flexibility services proposed within this paper, the underlying need for the service and associated value drivers are tabulated below. Some outline options for funding these services ar ealso defined. It will be necessary for appropriate funding arrangements to be developed prior to going to market for the services identified.

8 FUNDING OPTIONS

NEED FOR PRODUCT/ SERVICE:	CUSTOMER & SOCIETY VALUE DRIVERS	Socialised Through DUoS	Market Imperfections Charge	Individual Customer Funded	Individual Customer & Socliased DUoS	Other (e.g. PSO)
		FUNDING OPTIONS				
To accommodate new demand	Economic and societal development, increased pace of decarbonisation of heat and transport. Reflected by Deferred capital expenditure.	Alternative option to seed the market			Reflects current CRU policy.	
To improve reliability for existing demand	Economic and Societal benefits. Reflected in customer reliability metrics and the ability to facilitate maintenance.	Reflects current CRU policy		Alternative option in locations where individual customer(s) seek enhanced reliability connection.	Alternative option in locations where individual customer(s) seek enhanced reliability connection.	
To connect new generators	Increased decarbonisation of generation, faster pace of connections, more viable projects.	Alternative option to seed the market.		Reflects current CRU policy.	Alternative option to seed the market.	
To reduce global renewables dispatch down	Increased decarbonisation of generation, more viable projects. Reflected in curtailment levels.	Alternative option to seed the market.	Reflects current CRU policy			Alternative considered in government supports (RESS scheme).
To increase local renewable energy	Increased decarbonisation of generation, Demand customers benefit. Reflected in constraint andcurtailment levels.	Option to seed the market.				Alternative considered in government supports (RESS scheme).

9

TSO and Energy Market coordination

9 TSO AND ENERGY MARKET COORDINATION

As described within the market framework and product sections, due consideration has been given to impact on facilitating participation in TSO markets and allowing providers to stack services across different markets.

In early 2021, EirGrid, in its role as TSO, and ESB Networks, in its role as DSO, established a Joint System Operator Programme to ensure that we are working together in a collaborative and effective manner to jointly address electricity system and customer needs, and to deliver whole-of-system solutions.

During 2021, together we progressed the 2021 work programme submitted to CRU in January and put in place the necessary programme management and governance structures to develop and deliver the plan.

In October 2021, we launched a consultation on a joint 2022-2026 work plan. The plan reflects areas where the TSO and DSO must work in partnership to enable new technology on the transmission and distribution systems participate in new solutions, apply whole-of-system approaches to resolving system needs, and work collaboratively to reduce dispatch down of renewable generation and enhance security of supply.

The multi-year plan comprises four workstreams that are focused on outcomes as defined in the CRU PR5 Incentive framework, as follows:

1. **Whole-of-System Approaches.**
2. **Facilitating New Technology.**
3. **Reducing Dispatch Down.**
4. **Security of Supply.**

The plan will be finalised after taking into account the consultation feedback received from stakeholders. The workstream plans can be found in our Joint System Operator multi-year plan submission for 2022-2026.

ESB Networks will work with the CRU and SEM Committee where applicable to ensure that relevant aspects of energy, capacity and service market rules are considered and are operationally compatible with distribution services. The establishment of service prioritisation arrangements and associated rules will be agreed and tested during pilot stages and consulted throughout. Effective arrangements could include but are not limited to:

1. **Sequencing and coordination of procurement processes**
2. **Sequencing and coordination of scheduling processes**
3. **Dynamic allocation of local capacity to distributed resources (based on prioritization criteria to be defined)**
4. **Development of appropriate value stacking rules between markets, where resources participate in multiple markets.**

Facilitating customers' access to all markets and compatible market arrangments will be of paramount importance to realising the benefits of flexibility services for customers and system operators. In many cases distribution flexibility services will align with the overall drivers for energy and overall system wide security for example reducing peak winter demand.

10

Appendices

Appendix A
INTERNATIONAL EXEMPLARS

Appendix B
SMARTNET MARKET FRAMEWORKS

Appendix C
CHARACTERSIATION OF FLEXIBILITY

Appendix D
REFERENCES

8 APPENDIX A: INTERNATIONAL EXEMPLARS

COMPARATIVE ANALYSIS	UK (OPEN NETWORKS)	NEW ZEALAND (TRANSPOWER)	NETHERLANDS (GOPACS)	AUSTRALIA (PROJECT EDGE)	GERMANY (PROJECT ENERA)
What are the types of products/ services?	Congestion management	Demand reduction	Congestion management	Congestion management, critical peak demand	Congestion management
How is the service procured (tariff, bilateral process, auction contracts, real time market) and who procures it?	Competitive contract	Competitive contract	Continuous market, neutral market facilitator	Competitive contract	Continuous market
How is the service funded (is the SO procuring directly or a neutral market facilitator) ?	DSO funded	TSO procure service directly	Price spread of matched bids/offer for congestion is funded by the SOs.	Market Operator/ TSO procured	The grid operator (DSO or TSO) acts as a buyer. Local supply and local demand for flex services
What is the level of DSO /TSO coordination and their respective roles?	DSO led market	DSO aggregate flexible demand to TSO	Collaboration between Dutch TSO and DSO to resolve congestion.	DSO will check operating envelopes for TSO services.	DSO's can procure services and also perform checks for assets to offer TSO services. TSO procures congestion service from DSO DERs
How are balance responsibility / other market considerations dealt with for the service provider?	Participants are responsible	No capacity market or balancing market.	DSR is not a part of the wholesale market.	Counterbalancing bids results in limited imbalance	Participants responsible TBC
What's the pay-ment structure (availability, utilisation, one or both?)	Service de-pendent (both availability and utilisation apply)	2 products; security product which is both; price responsive product which is utilisation only	Utilisation	TBC	Utilisation
How it's activated (automatic, phone, app etc.)	Various DNO specific	An App and a DERMS called FlexPoint	API	TBC	API

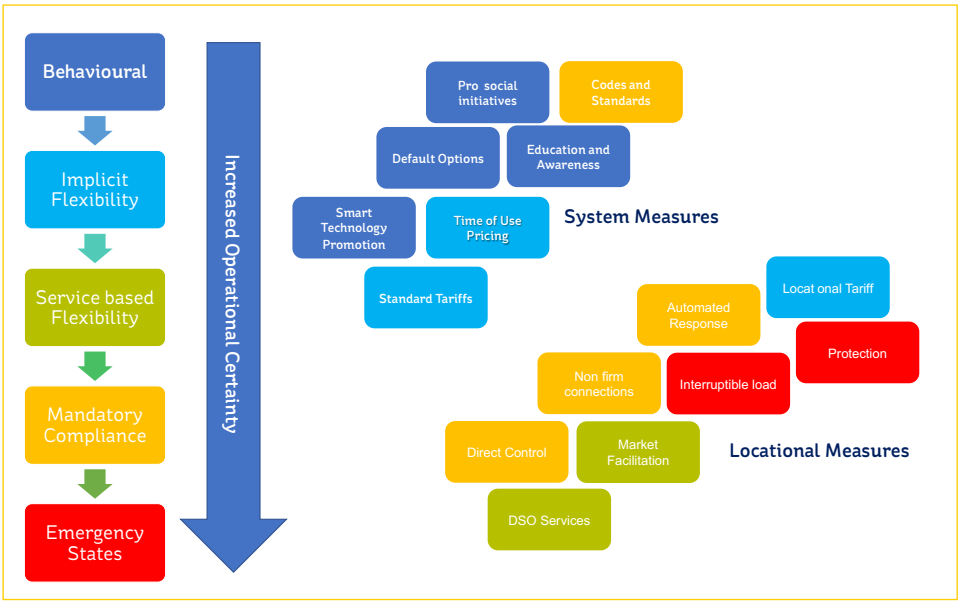
8 APPENDIX B: SMARTNET MARKET FRAMEWORKS

MODEL	BENEFITS	CHALLENGES
CENTRALISED ANCILLARY SERVICES MARKET A common market for ancillary services for transmission and distribution resources procured by the TSO.	Optimal scheme if there were no / low distribution system congestion. Efficiencies in market operations if there were no / low distribution system congestion.	Inefficient / insecure because distribution complexity is not adequately considered. Requires perfect information / data transfer (TSO visibility of DSO network).
LOCAL FLEXIBILITY MARKETS Separate local flexibility market for DSOs, in addition to the ancillary services market for TSO.	Constraints are relieved at local level and so can optimise aggregation and volumes offered to system level. Suited to distribution systems with high congestion. Avoids issue where resources assumed to be available are constrained. Market alignment with where data ownership and operational control lies. Local markets can have lowest entry barriers for small-scale DERs.	Centralised and local market cleared sequentially. Need for extensive communication between the centralised market and the local market. Local market should have of a "reasonable" size and guarantee a sufficient number of actors are in competition in order to prevent scarcity of liquidity and exercise of local market power.
SHARED BALANCING RESPONSIBILITY Similar model to the local flexibility market model with the exception that the remaining local flexibility is not offered on to TSO.	TSO will need to procure a lower amount of ancillary services. Local markets can have lower entry barriers for small-scale DERs. Clear boundaries between TSO and DSO responsibilities.	Defining a schedule methodology agreed by both TSO and DSO might be challenging. Local congestion markets should have a "reasonable" size and guarantee a sufficient number of actors are in competition in order to prevent scarcity of liquidity and exercise of local market power. Total amount of ancillary services procured by TSO and DSO together will be higher in this scheme. Requires DSO to operationally manage full suite of both TSO and DSO products. Incompatible with EGBL..
COMMON TSO-DSO ANCILLARY SERVICE MARKET MODEL Common market for flexible resources connected at the transmission and distribution level, with allocation of flexibility to the system operator with the highest need.	Total system costs for ancillary services are minimised. TSO and DSO collaborate closely, making optimal use of the available flexible resources.	Allocation of costs between TSO and DSO might be challenging. High computational complexity since constraints on both transmission and distribution grids are resolved in a single mechanism. Explaining and demonstrating transparent and fair market outcomes may be challenging considering the complexity.
INTEGRATED FLEXIBILITY MARKET MODEL Common market for flexible resources connected at the transmission and distribution level. Both regulated (system operators) and commercial market parties participate to procure flexibility. It is the most complex model proposed.	High liquidity and competitive prices due to large number of buyers and sellers. Increased options for balancing responsible parties to solve imbalances.	TSO and DSO need to share data with the independent market operator. Which adds additional cost and complexity. High computational complexity since constraints on both transmission and distribution grids are resolved in a single mechanism. An independent market operator needs to be established to operate the common services markets.

8 APPENDIX C: CHARACTERISATION OF FLEXIBILITY

There are several different forms of demand flexibility operating in electricity markets today. These are as outlined in Figure 11

FIGURE 11 **CHARACTERISATION OF FLEXIBILITY**



Behavioural Flexibility

Pro-social incentives, gamification, default settings or other behavioural nudges are used to encourage customers to use electricity at off-peak times. This is a form of implicit flexibility. While this has been proven effective in several international trials, its impact is generally at a system wide level. On the basis that location specific, time varying services are the subject of this market plan, these approaches are outside the scope of this document. However, within the wider National Network, Local Connections Programme, a range of platforms and dashboards are proposed for development, to achieve a similar purpose. Giving consumers greater awareness of their local energy environment is a first step towards driving behavioural change. This is addressed in the National Network, Local Connections Programme Platforms and Dashboards Roadmap. More locationally targeted behavioural programmes may be given further consideration in the future.

Implicit Flexibility

Time of use tariffs for energy and use of system can incentivise implicit flexibility from customers. However, tariffs are typically non-locational and static (i.e. the same signal is sent at the same time every day) and thus not a good fit for flexibility services which are location specific and time varying. Further considerations relating to tariff design are outside the scope of this document.

Mandatory Compliance

The use of codes and standard technology requirements needed to deliver flexibility play a central role in any integrated approach to flexibility. Proposed technology standards relating to flexibility are set out in the National Network, Local Connections Programme Data, Control & Signals Guidance In some jurisdictions mandatory control requirements are coupled with mandatory or non-market based control.

8 APPENDIX D: REFERENCES

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