ESB NETWORKS

Phased Flexibility Market Development Plan

NATIONAL NETWORK, LOCAL CONNECTIONS PROGRAMME

DOC-230921-GYU

Updated following consultation in Q4 2021

CONTENTS

CONTENTS

1

Introduction

1 INTRODUCTION

The core objective of the National Network, Local Connections Programme is to enable all electricity customers and communities to play an active role in climate action, by using or storing renewable electricity when it is available to them locally. As set out in the Electricity Market Directive of the Clean Energy Package, as distribution system operator, with the approval of the CRU, we are responsible for establishing flexibility products and services which achieve this on the distribution system.

In Q4 2021, we consulted on this Phased Flexibility Market Plan which sets out initial proposals for the development of market-based flexibility products and services on the distribution system. A proposed Joint System Operator Work Programme addressing the associated need for DSO / TSO coordination was published at the same time.

This document updates the consulted document based on the feedback received. Positive and constructive stakeholder feedback was received, with over 70 items of feedback received on this document. Feedback which fell within its scope was considered in updating the Phased Flexibility Market Plan.

The key themes arising in stakeholders' feedback were:

1. **ESB Networks' role as a neutral market facilitator, and the importance of transparency in actions and decision making in a phased market design process with direct input from stakeholders;**
2. **Compatibility with existing electricity market arrangements and expected changes in these markets, as well as close co-ordination with the TSO;**
3. **The need for market design, procurement arrangements and signposting of opportunities which provide clear investment signals for participation;**

For more information on the detailed stakeholder feedback received and how it has been incorporated into the National Network, Local Connections Programme delivery plans, please refer to the Consultation Core Response Paper available on the National Network, Local Connections Programme website.

2

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	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 aiming to facilitate a transition in the EU towards cleaner energy. Within that legislative package, 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') are foundational to this document. The Electricity Market Directive 2019/944 defines the role of the distribution system operator (DSO) including as relates to the introduction of flexibility services. This includes:

1. **The development of flexible products and services necessary for the efficient, reliable and secure operation of the distribution system. [EU2019/944, Article 31]**
2. **Member states' provision of the necessary regulatory framework to allow and provide incentives to distribution system operators to procure flexibility services. [EU2019/944, Article 32]**
3. **The procurement of products and services necessary for the efficient, reliable, and secure operation of the distribution system and establish technical specifications for same. [EU2019/944, Article 31, Article 32]**
4. **The development of objective, transparent and non-discriminatory market-based rules governing flexibility services. [EU2019/944, Article 31]**
5. **The establishment of 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. [EU2019/944, Article 17 (5)]**
6. **Ensuring the effective participation of all qualified market participants, including energy from renewable sources, demand response, energy storage facilities and market participants engaged in aggregation. [EU2019/944, Article 31]**
7. **Cooperation with transmission system operators for the effective participation of distribution customers in retail, wholesale, and balancing markets. [EU2019/944, Article 31(9)]**
8. **Cooperation between distribution system operators and transmission system operators to achieve coordinated access to resources such as distributed generation, energy storage or demand response. [EU2019/944, Article 57]**
9. **Regulatory authorities' and distribution system operators' establishment of technical requirements for participation in those markets in close cooperation with all market participants, as well as transmission system operators. [EU2019/944, Article 31]**

3 BACKGROUND

3.2 PRICE REVIEW 5 (PR5) PERIOD

ESB Networks' role as distribution system operator (DSO), as per our DSO licence, is 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.

In the PR5 price review process, ESB Networks set out plans for transformation of the DSO. This involves introducing 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 operational expenditure to fund the use of flexibility services 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, the flexibility mechanism would allow ESB Networks continue to procure flexibility services.

However, the potential to adopt flexible solutions is substantially greater than that provided for within the current regulated DSO model. For example, flexibility services could be used 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 our efforts to maintain and restore customers' supply under fault conditions.**

And critically, flexibility services can be used to support the Climate Action Plan target of increasing the proportion of renewable electricity consumed and facilitating the uptake of nearly one million electric vehicles and the installation of 600,000 heat pumps.

3 BACKGROUND

3.2 PRICE REVIEW 5 (PR5) PERIOD continued

To support the introduction of services achieving these broader objectives, appropriate funding arrangements will need to be developed over the life of PR5. To support this, we propose to explore and develop these capabilities throughout the programme, working in partnership with market participants in the delivery of the pilots (as per the National Network, Local Connections programme Piloting Roadmap). As set out in the National Network, Local Connections Programme Consultation Framework Delivery Plan, a Consultative Stakeholder Group will be amongst the channels for stakeholder and market participant engagement on the development of products and services.

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.

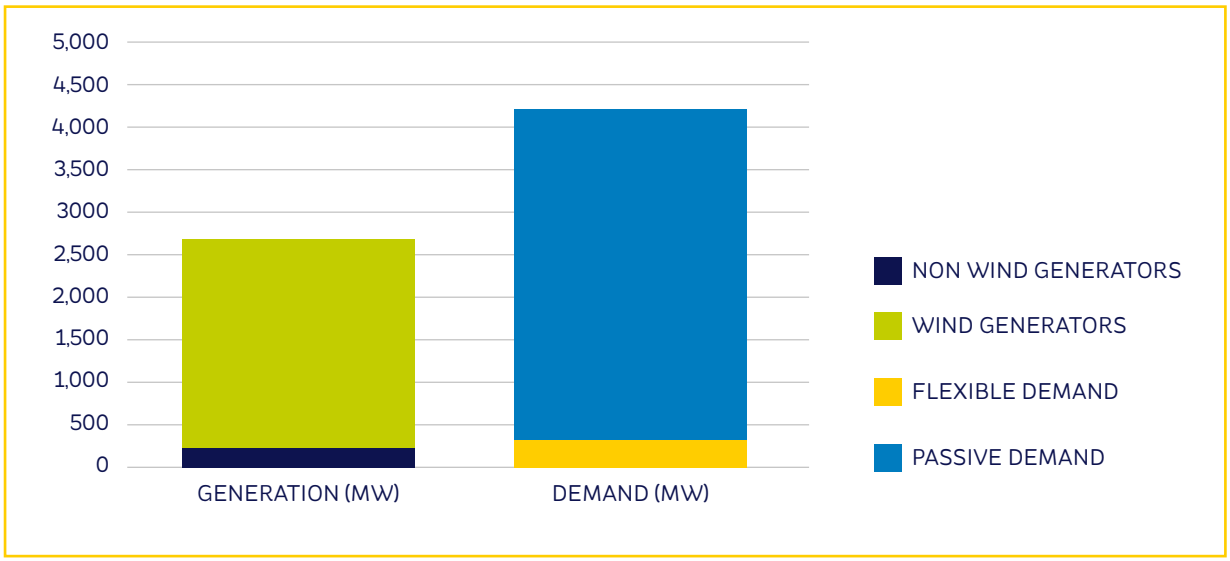
It will be important that the local market arrangements introduced are operationally compatible with other market arrangements, to enable customer choice in participating in markets and to facilitate market participants who want to stack services and revenues across different markets[1].

The Single Electricity Market (SEM) on the island of Ireland consists of a wholesale energy market with day ahead, intraday, and balancing market arrangements and a capacity market to secure longer term supply adequacy. All distribution customers can participate in these markets, though in the main this is through intermediaries such as their supply companies or aggregators. Many customers participate "passively", meaning that they consume or generate electricity without consciously or actively interacting with the electricity market.

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.

As illustrated in Figure 1 below, a large proportion of the current make up of distribution customers consists of passive demand. The updated Climate Action Plan published in 2021 sets a target for 20-30% of the system demand to be flexible, or actively managed, by 2030.

FIGURE 1 **DISTRIBUTION CUSTOMER MAKE-UP**



[1] Stacking services refers to a market participant participating in more than one market with the same flexible assets to increase their overall revenues.

3 BACKGROUND

3.4 FLEXIBILITY MARKET PLAN

The Clean Energy Package sets out ESB Networks' responsibility for the establishment of flexibility services and standardised market products for such services. This document sets out a roadmap for introducing local flexibility market arrangements. It provides initial proposals for products to be introduced and their sequenced introduction, as well as short term and longer-term options for the market framework within which these services are procured.

Our objectives in the development of a market for flexibility services are to:

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 requirements 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), market participants and customers.**

3 BACKGROUND

3.5 INTERNATIONAL EXEMPLAR RESEARCH

A review of distributed flexibility arrangements internationally and TSO/market interaction in other jurisdictions was carried out as part of the development of these proposals.

PROJECT	SCOPE	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

Further details on these projects are available in Appendix A.

4

Market Flexibility Phased Approach

4 MARKET FLEXIBILITY PHASED APPROACH

4.1 MARKET DEVELOPMENT AND DEMONSTRATION

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

Consistent with the regulatory framework introduced for PR5, under the National Networks, Local Connections Programme, ESB Networks will roll out flexibility services in which customers can participate using market-based approaches on a phased basis. As part of this programme, ESB Networks proposes to pilot proof-of-concept market solutions.

As ESB Networks' operational systems are augmented to support this over the course of the price review period, market-based flexibility solutions can be refined and scaled. This will be done in a manner which accounts for pilot learnings, 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 to 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.

We note the importance of stakeholder feedback in informing the market design, products and services. A consultative approach will be employed over the life of the programme, as set out in more detail in the National Network, Local Connections Consultation Framework. A Consultative Stakeholder Group will have a central role in this.

In response to stakeholders' queries, we can confirm that the National Network, Local Connections Programme is an ESB Networks' initiative which will involve the introduction of flexibility services in our operational jurisdiction only. However, ESB Networks and NIE Networks engage and collaborate on an ongoing basis and are continuously sharing insights and learning regarding the introduction of flexibility services. ESB Networks is committed to the development of flexibility services in ways which support stacking services and are operationally compatible with transmission system services and energy market operations.

4 MARKET FLEXIBILITY PHASED APPROACH

4.2 MARKET ACTORS

Distribution System Operator - ESB Networks is the license holder responsible for managing and developing the distribution system in Ireland.

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

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

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 necessarily responding to market signals.

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

Aggregators - Aggregation means a function performed by a natural or legal person who combines multiple customer loads or generated electricity for sale, and 'Independent Aggregator' means a market participant engaged in aggregation who is not affiliated to the customer's supplier.

Active Consumer - An individual who generates renewable energy for their own consumption, or sells or stores excess generated electricity, or participates in energy efficiency schemes, or provides flexibility services, provided these activities are not their primary profession.

Energy Community - A group of active consumers, who voluntarily commit to providing environmental, social, or economic welfare by engaging in renewable energy generation, energy sharing or trading, storage, or supply, provided these activities are not for commercial purposes and do not constitute the primary profession of the members of the community. Energy communities can include:

- **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. [EU2018/2001]

4 MARKET FLEXIBILITY PHASED APPROACH

4.3 CO-ORDINATED MODELS FOR MARKET SERVICES continued

- **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. [EU2019/944]

Note: Some definitions have been updated to reflect CRU consultation [CRU/21028] and conclusions [CRU/21126] on active customers and energy communities in 2021.

4.3 CO-ORDINATED MODELS FOR MARKET SERVICES

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. **Ambitious targets for the growth of electrification of heat and transport in the next decade.**
5. **Existing markets for energy, capacity, and transmission system services with distinct features[2].**

The combined impact of these factors is a high potential for localised congestion in Ireland over the coming years, as illustrated in more detail in the National Network, Local Connections 2030 Power System Requirements published alongside this document. Research and 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 internationally which demonstrate this.

[2] Distinct features of Irish electricity markets include, ex-post imbalance pricing, a broad suite of system services products for frequency, reactive power and inertia products, central dispatch and a capacity market with a reliability option.

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 clear characterisation of the different models for coordinating transmission and distribution system services. These are set out in Appendix B.

Based on these considerations, alongside 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 SMARTNET decentralised approach offers a good fit for Irish conditions. The options set out in this plan are based on that archetype.

Figure 2 is based on the SMARTNET model, and the basic structure is outlined below. Detailed arrangements are indicative only, as prioritisation rules, data exchange and other interactions with the TSO and market operators will need detailed definition and agreement.

FIGURE 2 **SMARTNET DECENTRALISED MARKET MODEL**

Description

Separate local flexibility market for DSO procurement in addition to the ancillary services market for TSO procurement.

Market Organisation

TSO (centralised market) and DSO (local market).

Allocation Principles

DSO priority where distribution system limits are violated.

Role of DSO

DSO operates a local market for resources connected at DSO level and is responsible for local congestion management. DSO qualifies distributed resources participation in the TSO market ensuring that bids respect DSO grid constraints.

Role of TSO

TSO manages the central ancillary services market and can acquire the 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 means 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, as it offers 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) have been developing at distribution level over the last decade. A list of examples researched in the development of these proposals is provided in Appendix A.

4.5 FLEXIBILITY USE CASES

A number of 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

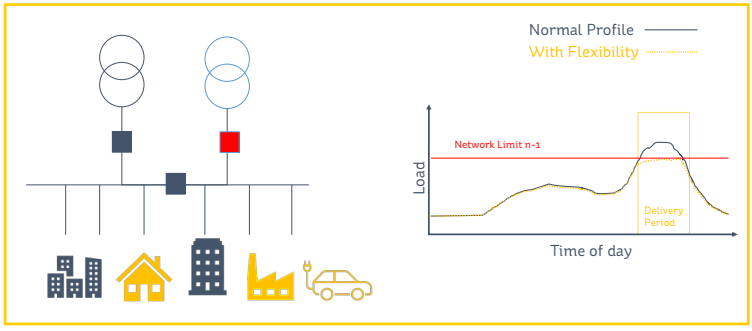
As described in the National Network, Local Connections Programme 2030 Power System Requirements, the electrification of heat and transport will lead to significant load growth. Even with reliable data sources and modelling methods available, the timing and distribution of this load growth is inherently 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. These could come from industrial and commercial customers, or equally from residential technologies such as responsive demand, in home storage, or electric vehicle charging technologies. The network is planned to a particular reliability standard (P2 equivalent standard).

FIGURE 3
DEMAND DRIVEN USE CASE – URBAN ENVIRONMENT



4 MARKET FLEXIBILITY PHASED APPROACH

4.5 FLEXIBILITY USE CASES continued

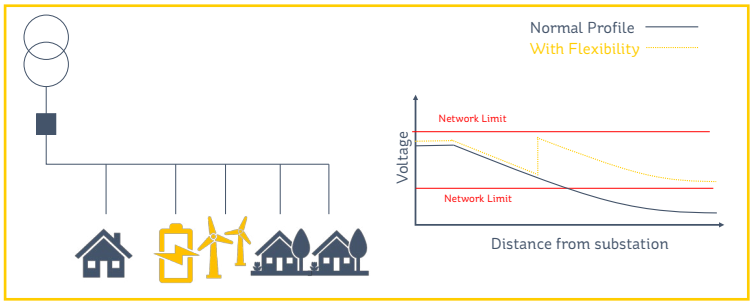
This delivers the necessary redundancy to maintain load under n-1 (representing the loss of a single item of plant) contingency conditions for MV and HV networks.

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.

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.

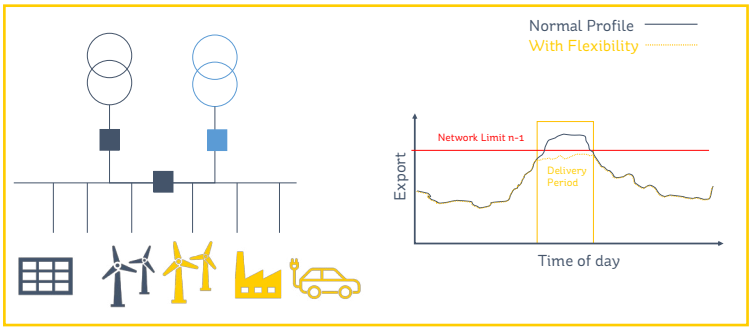
4 MARKET FLEXIBILITY PHASED APPROACH

4.5 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.

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

FIGURE 5 **OPTIMISATION OF RENEWABLE ENERGY**



These include:

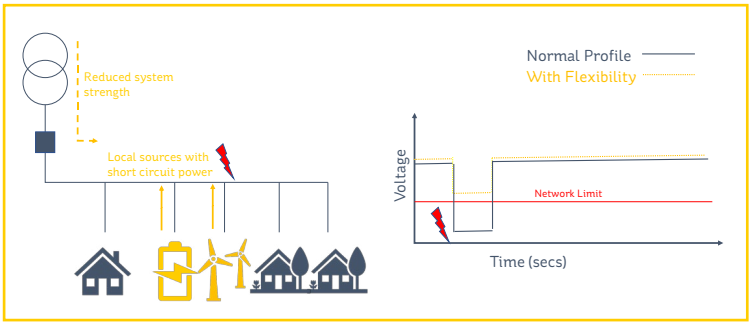
1. **Short circuit levels which are too high, in urban locations**
2. **Short circuit levels which are too low, in rural locations**
3. **Dynamic stability and coordinated protection management**
4. **Delivery of required outages to upgrade and maintain the infrastructure**

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

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

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

FIGURE 6 **SHORT CIRCUIT LEVEL**



5

Flexibility Products

The Clean Energy Package mandates the distribution system operator with the development of standardised market products for flexibility services. Some key advantages in defining standard products include:

- Products translate complex technical scarcities and customer needs into recognisable solutions, building familiarity and consistency amongst market participants;
- Products provide a standardised set of terms, conditions and requirements for the customer;
- Products support repeatability, transferability, and scalability across various use cases;
- Products can be described and developed in a technology neutral manner.

EU wide standardised products have not been developed. While standardized product descriptions have been developed in the UK, these products are evolving, and none of these products have been designed with a view to supporting renewables integration. As such, there is significant scope for product innovation.

5 FLEXIBILITY PRODUCTS

5.1 PRODUCT PROPOSAL CRITERIA

ESB Networks, in its capacity as DSO, and consistent with requirements under Article 31 of EU2019/944 has developed several system operator criteria for the development of standardised flexibility products. These criteria are being used to inform the quality and usability of a product prior to detailed design. Following the consultation of Q4 2021, we now plan to adopt these as working product criteria within the programme.

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 a service that a flexible service provider must meet.**
3. **Products should, 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 they 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 use commercially available system operator or customer instruments and monitoring & metering technology.**

We note stakeholder feedback received regarding the observability and measurability of products and have included an outline description of candidate baseline methodologies in Section 5.4.

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 distribution network operators have developed standardised flexible product definitions specifically for use in distribution system management.

These products are used to support distribution system management for demand driven use cases. The products are maturing in the UK where the distribution network operators have been using them commercially in a flexibility market since 2018. The products share some common features.

5 FLEXIBILITY PRODUCTS

5.2 ENA STANDARD PRODUCTS continued

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.

Following the consultation period of Q4 2021, ESB Networks now proposes that some or all of these products proceed for use in the definition phase for initial proposed pilots.

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 (overload following loss of one transformer).

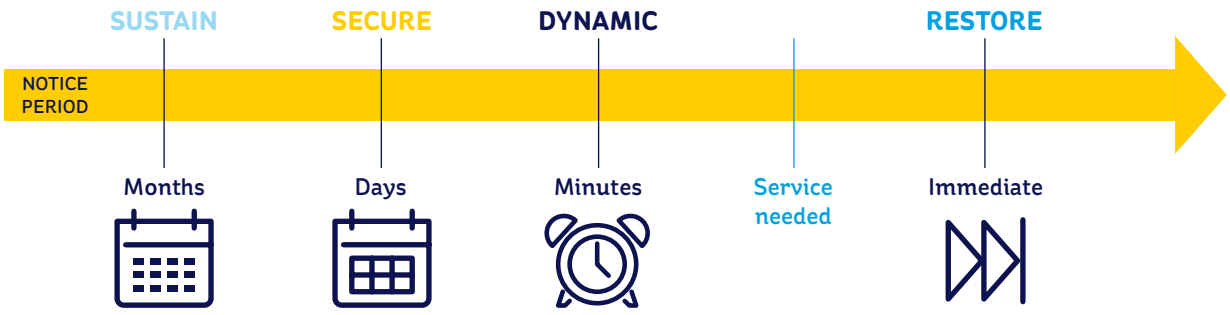
DYNAMIC: MW scheduled availability utilisation at short notice (minutes)

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 ESB Networks 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, system operator product design criteria have been developed. Care has been taken to develop criteria which balance the need to facilitate broad customer participation while meeting our obligations to ensure secure, reliable supply for all customers.

Product Definition Criteria

1. **The product satisfies a technical scarcity / customer need. The link between the product and the need it meets will be clearly defined.**
2. **The timeframe for accurately forecasting the need, and product delivery requirements such as notification period and speed of response, shall be defined.**
3. **Technical/operational requirements such as response times, network equipment operating and protection limits, shall be accounted for.**
4. **Product parameters like volume, time interval and upper/ lower limit values, and their granularity and divisibility, 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 alignment is feasible, to facilitate service stacking.**

5 FLEXIBILITY PRODUCTS

5.3 PRODUCT DESIGN CRITERIA continued

Based on these considerations the following characteristics have been 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 MEASUREABILITY

Stakeholder feedback has highlighted that the observability and measurability of services delivered by different customer types may vary. For example, it is easier to measure a generator delivering a defined change in generation output than it is to measure whether a demand customer's behaviour has changed from what it would otherwise have been.

As such, for delivery of active power services, a customer's "baseline" position against which their behaviour is measured, is an important parameter to accurately validate and assess delivery of a contracted service. A baseline is the normal expected behaviour of a flexible service asset if/when they are not providing a flexibility service.

ESB Networks' working proposal for initial piloting purposes is:

1. **To baseline demand side response using historical meter data. For each flexibility zone, ESB Networks will identify the top 10 days of highest peak demand, in the required service window, over the previous year. The baseline for each flexible unit will be calculated as their average metered import/export during the delivery period over the specified 10 peak days.**
2. **To baseline generators and storage units at zero as that is considered the default behaviour before any market incentives are put in place.**
3. **To baseline auto-producers as either generation or demand, based on whether their characteristics more closely resemble exporting generators or importing demand sites.**

5.5 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:

1. **Are operationally compatible with energy / TSO ancillary services markets and timings to facilitate value stacking and service optimisation;**
2. **Can support a broader range of operating conditions (for example continuous or close to real time procurement and scheduling) and use cases (for example supporting renewables integration).**

5 FLEXIBILITY PRODUCTS

5.6 REACTIVE POWER SERVICES

Reactive power can be used to efficiently manage the system within acceptable voltage limits during normal operation. Reactive power can also support system operation transiently under fault conditions to support network voltage and ensure that protection equipment functions properly. Hence two distinct reactive power products can be defined, for reactive power and transient reactive power delivery respectively. These two products reflect different system needs and different service provider capabilities.

1. **Reactive Power: a service delivered under normal operating conditions, whereby flexible service providers produce or absorb reactive power at the point of connection in response to an instruction from the DSO. The instruction could take the form of a reactive power instruction or voltage setpoint, depending on the operating mode specified by the DSO. (For more details on operating modes and signals, please refer to the Data & Signals Guidance also published here)**

2. **Transient Reactive Power: a service delivered following a system disturbance, whereby flexible service providers inject or absorb reactive power automatically triggered by a system event. This service would be based on a declared and tested capability and could be utilised at any time.**

5.7 ADDITIONAL PRODUCT DEVELOPMENT ROADMAP

Over the life of the National Network, Local Connections programme, further products will be developed for distribution connected customers to participate in. Future products for consideration include:

1. **Islanding Services**
   New control room technologies may enable providers to offer islanding services, to enable customers remain on supply when disconnected from the overall system.

2. **Restoration Services**
   Used to restore supply to a de-energised islanded portion of the network following loss of supply.

3. **Stability Services**
   As the level of non-synchronous generation on the power system increases, oscillations of power or voltage arise following system disturbances may make it difficult to restore stability following faults. The potential for services to improve transient stability will be considered further based on the output of studies.

6

Initial Market Framework

6 INITIAL MARKET FRAMEWORK

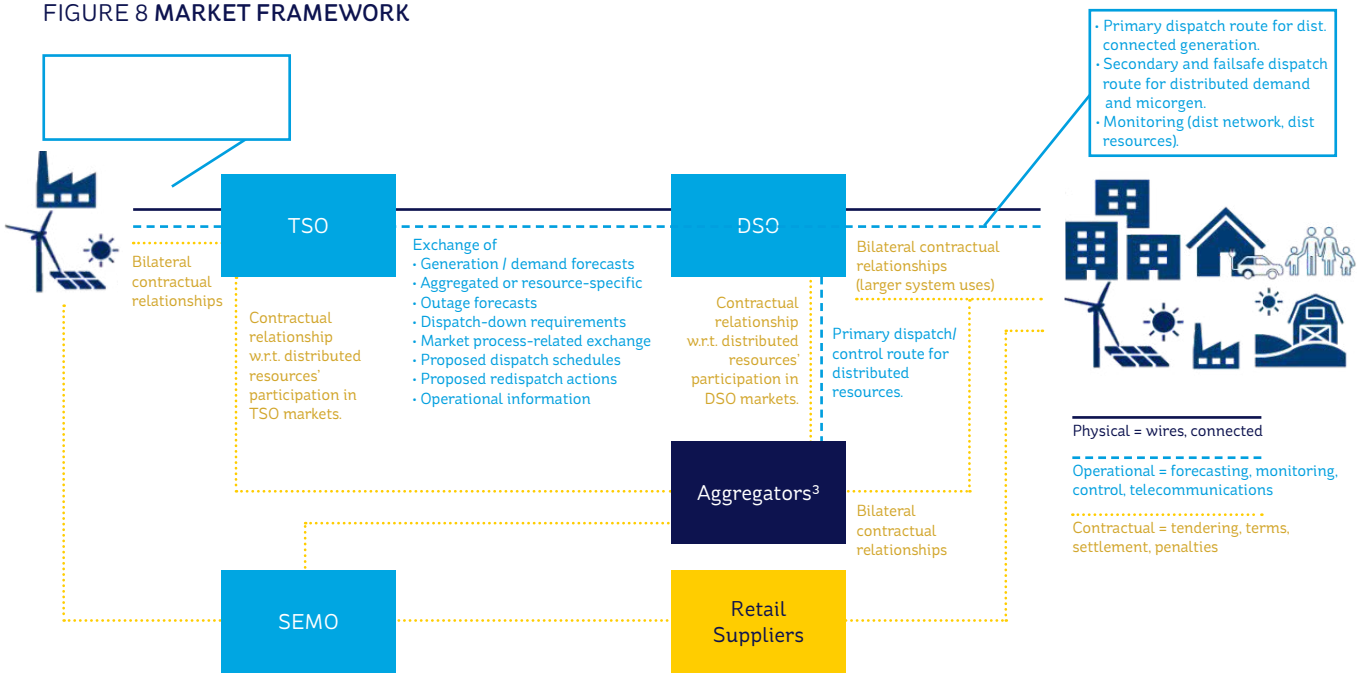
6.1 OVERVIEW

A basic market framework will be established for initial piloting purposes. Unlike an enduring or long tern market framework for which regulatory approval is required as per the Electricity Market Directive 2019/944, based on consultation with the CRU, it is not deemed necessary to secure regulatory approval for piloting market frameworks.

The use of a basic market framework in piloting will help to inform proposals for a longer term or enduring local market framework on the distribution system, in consultation with stakeholders and regulatory authorities. This initial market framework can be used to address cases where the following apply:

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

FIGURE 8 **MARKET FRAMEWORK**



[3] Aggregators may include Independent aggregators, suppliers engaged in aggregation activities, intermediaries or community-based models.

6 INITIAL MARKET FRAMEWORK

6.1 OVERVIEW continued

As set out in Figure 8, ESB Networks as DSO will buy local 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[3].

Overall system demand and supply balance and system frequency remain the responsibility of the transmission system operator. Most of the ancillary service products procured by the TSO can be provided by resources at any location across the system.

The need for distribution flexibility service is always localised to specific network locations. 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.

[3] Aggregators may include Independent aggregators, suppliers engaged in aggregation activities, intermediaries or community-based models.

6 INITIAL MARKET FRAMEWORK

6.1 OVERVIEW continued

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 templates or models for informing the terms and conditions of service.

Bilateral contracts will be put in place for the duration of pilots. On conclusion of the period of the pilot and associated 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 as well as broader consultation. 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 EU2014/25, ESB Networks proposes to procure services from flexibility service providers in line with identified requirements.

Outline technical requirements will be published at pre-qualification stage. The 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

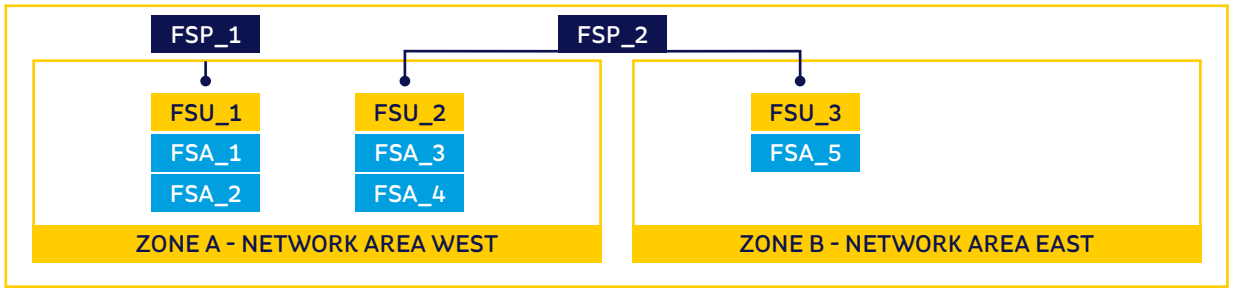
For pilot purposes, a bilateral contract with ESB Networks, with a fixed duration of 2 years will be offered with an option to extend for a further limited fixed period. Due to the locational nature of the services, and the purpose of the services to defer or reduce the requirement for network reinforcement, 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 FSUs within each zone.

For FSUs consisting of aggregated assets, only assets within the zone relevant to a given tender could participate. 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 as 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, assets in Zone A and Zone B could participate in a combined Zone AB). 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 basis of predominantly availability-based payment. Products with higher contracted utilisation could operate based on utilisation price only.

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.

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 will take place ahead of gate closures for energy markets.

6.10 INITIAL ACCESS RIGHTS FRAMEWORK

Access rights refers to the principles applying for customers connecting to the distribution network, and are governed by connection policy. For the initial market framework, changes to existing access rights are not envisaged. In congested areas, options may be introduced in future for customers to avail of actively managed connections. These connections, as per Section 7, would involve interruptible or non-firm import capacity, and may offer a solution to allow new customers avail of earlier access to the distribution system.

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 flexibility products proposed are based on standard products which have been introduced in other jurisdictions, for a limited number of use cases. 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. For use cases related to investment deferral, service provider availability for the term of deferral would likely need to be underpinned by fixed term arrangements.

A layered market design could balance the relative need for, and merit of, long term and shorter procurement cycles. This may involve longer term availability contracts with utilisation pricing fixed closer to real time, as well as routes to market for utilisation-only services. A framework of this nature could support improved liquidity and allow 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 involved only one option for generation customers: 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, and may offer a more market based solution to managing network capacity. As ESB Networks' augmented operational systems are rolled out (per the National Network, Local Connections Operations Systems Roadmap available here), this would be operationally feasible on the Irish system.

Within the National Network, Local Connections Piloting Roadmap, ESB Networks is proposing the definition of a series of pilots targeting flexible connection in locations where new renewable generators are preparing to connect. The first of these pilots would facilitate early access on a timebound basis for eligible projects, in locations where the timing of deep reinforcements could impact on their RESS 1 longstop date. Based on forecasted network power flow forecasts, participating generators would be advised of their operating envelope on a rolling day-ahead basis. The second pilot will look to facilitate community owned, RESS 2 generators, by providing an alternative flexible arrangement where there are deep re-enforcement works required under their connection offer relating to N-1 contingency conditions.

In future, subject to stakeholder appetite, 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. Although this was the basis of ESB Networks' original proposals for supporting non-firm or flexible connection arrangements within the piloting roadmap, based on the stakeholder feedback received, we understand that there is limited appetite for arrangements of this nature at the outset of the programme.

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

7 LONG TERM MARKET FRAMEWORK

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 in place of reinforcement.

7 LONG TERM MARKET FRAMEWORK

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

Localised flexibility markets could offer a solution to 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 local demand to align with renewables output).

Localised flexibility markets could support higher network utilisation. For example, when a subset of generators is 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.

7 LONG TERM MARKET FRAMEWORK

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

	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 counter balancing bid from balancing market. DSO requests TSO counterbalancing action. Capacity market obligations would need to be managed by FSPs.

7 LONG TERM MARKET FRAMEWORK

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

	OPTION 4	OPTION 5	OPTION 6
Funding Model	Generators responsible for funding their trades A market management fee is levied from participants or the cost is otherwise socialised costs Balancing costs – borne by the market participants	Non firm generators would pay for access costs which exceed the provisions in their connection agreement. Firm participants who don't clear their volume are compensated, with the compensation funded by the access costs levied on non-firm generators. Where firm participants clear their volume, they are automatically refunded. Balancing costs – borne 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. (Transmission-imposed constraints to be funded separately and beyond the scope of this document, as appropriate). Treatment of 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-managed market for allocating network capacity, where the DSO's role is neutral market facilitation. The DSO would forecast network congestion, and facilitate generators' exchange of access rights subject to DSO oversight and information exchange. For example, under certain conditions non-firm generators might pay firm generators for the use of their excess capacity.

Option 5:
Introduce a DSO managed market for allocating network capacity, in which the DSO as neutral market facilitator holds and auctions off all capacity. Generators, storage and demand response providers operating in an area bid for capacity which is sold to the highest bidder. The revenue collected through this process 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-managed 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 which address constraints near to real time. 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

Whereas a funding model has been established within the PR5 Agile Framework to support the use of flexibility services to support electricity demand-on the distribution system, a new funding model would be needed to support the use of flexibility services to support increased renewables.

Options for funding flexibility services, depending on what they are being used for, are set out in this document, to support stakeholder consultation and the CRU's consideration of this matter. ESB Networks has set out candidate options based on an assessment of the purpose for which flexibility is used, and how value is generated.

For distribution flexibility services set out within this paper, the purpose of the service and associated value drivers is tabulated below, along with outline options for funding these services. It will be necessary for appropriate funding arrangements to be developed prior to piloting or going to market for the services identified.

8 FUNDING OPTIONS

		FUNDING OPTIONS				
NEED FOR PRODUCT/ SERVICE:	**CUSTOMER & SOCIETY VALUE DRIVERS**	Socialised Through DUoS	Market Imperfections Charge	Individual Customer Funded	Individual Customer & Socialised through DUoS	Other (e.g. PSO)
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 And curtailment 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 in the previous sections, due consideration has been given to facilitating participation in TSO markets and allowing providers to stack services across different markets.

In early 2021, ESB Networks, in its role as DSO and EirGrid, in its role as TSO, established a Joint System Operator Programme. This programme supports and provides transparency of our 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.**

9 TSO AND ENERGY MARKET COORDINATION

The plan is being finalised after taking the consultation feedback received from stakeholders in Q4 2021 into account. 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. We will seek to ensure that the establishment and testing of service prioritisation arrangements and associated rules will be included in the definition of piloting undertaken within the National Network, Local Connections Programme 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 prioritisation 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 arrangements 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 CASE STUDIES

Appendix B
SMARTNET MARKET FRAMEWORKS

Appendix C
CHARACTERSIATION OF FLEXIBILITY

Appendix D
REFERENCES

10 APPENDIX A: INTERNATIONAL CASE STUDIES

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 dependent (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

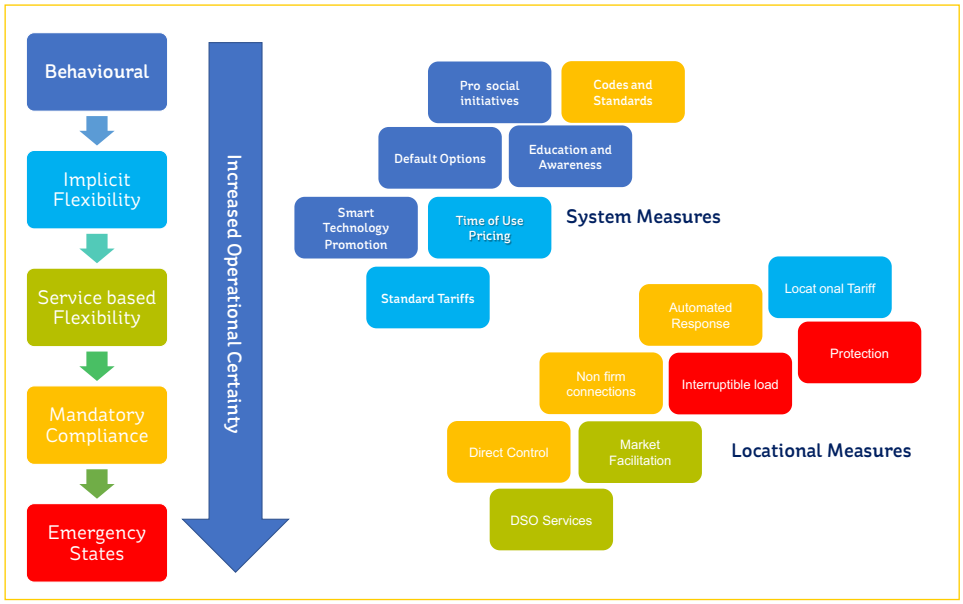
10 APPENDIX B: SMARTNET MARKET FRAMEWORKS

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.

10 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 will be developed, 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.

10 APPENDIX C: CHARACTERISATION OF FLEXIBILITY

Service Based Flexibility

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.

Mandatory Compliance

The use of codes and standard technology requirements needed to deliver flexibility play a central role in any integrated approach to flexibility. 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.

10 APPENDIX D: REFERENCES

Poyry Management Consulting, April 2019, Assessing The Potential Value From DSOs, Energy Catapult Report, Recovered online.

Schittekatte, Tim & Meeus, Leonardo. (2020). Flexibility Markets: Q&A with Project Pioneers. Utilities Policy. 63. 10.1016/j.jup.2020.101017.

Gómez, Inés & Riaño, Sandra & Madina, Carlos & Rossi, Marco & Kuusela, Pirkko & Koponen, Pekka & Aghaie, Hamid & Migliavacca, Gianluigi & Rivero, Enrique & Xu, Han & Kockar, I (2019). SmartNet D4.3 Cost-benefit analysis of the selected national cases. 10.13140/RG.2.2.11733.58080.

Eurelectric, (April 2019), TSO–DSO Report An Integrated Approach To Active System Management With The Focus On TSO–DSO Coordination In Congestion Management And Balancing.

Energy Networks Association, (31 July 2018), Open Networks Future Worlds: Developing change options to facilitate energy de-carbonisation, digitisation and decentralization.

IRENA (2020), Innovation landscape brief: Co-operation between transmission and distribution system operators, International Renewable Energy Agency, Abu Dhabi.

Eurelectric (Nov 2021) A flexible power system in Europe, Integrated vision for flexibility to enable the clean energy future.

ESB Networks (2021), The Distribution System Security and Planning Standards.