SMART GRID CONSULTANCY

SMART THINKING FOR A BRIGHTER FUTURE

WESTERN POWER DISTRIBUTION

GAMMA FLEX

(GENERATING ADDITIONAL MARKETS FOR MATURE ACCESS TO FLEXIBILITY)

DRAFT MARKET DESIGN & STAKEHOLDER QUESTIONNAIRE

VERSION 1.8– 10/08/2022

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Document Control -		
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Approved by:	Jacob Lynch	10/08/2022

Revision History -		
Date	Issue	Status
10/08/2022	1.8	Published

2 BACKGROUND

GAMMA Flex is a follow on from the 'IntraFlex project[1]', which trialled closer to real-time flexibility procurement, identifying several areas that require further development for the market to mature. As part of IntraFlex, WPD purchased flexibility services as 30-minute products, opening 7 days ahead of delivery and remaining tradable up until 90 minutes ahead of delivery. The primary focus of the overall trial was directed to the external arrangements downstream of the newly designed market and operated by NODES to the potential flex providers. The primary objective was to establish the viability of such a service and determine the likelihood of it being utilised to increase the opportunities for participation and increased liquidity.

The IntraFlex project successfully demonstrated that closer to real time flexibility procurement works and can add value. However, with its limited scope, the project identified a number of gaps that need to be addressed to build a liquid, well-functioning market. The majority of these 'gaps' are focussed on the upstream components of efficiently operating the services in an integrated manner with the conventional DNO activities alongside the growing DSO responsibilities.

The gaps identified for resolution within GAMMA Flex include:

- **Secondary trading** – IntraFlex only allowed flexibility service providers (FSPs) to sell their own flexibility services. This prevents FSPs from trading out positions, e.g. in case an FSP is operationally unable to deliver flexibility it has sold or wishes to trade out of its position for commercial reasons. Over the longer term, secondary trading would be expected to build market liquidity and is a key OFGEM expectation. This is very different from more conventional markets for commodities due to the geographic dependencies that limit participation to only those flexibility providers located within a potentially small area. This is a critical dynamic to the way the market design can operate for both primary and secondary trading and necessitating an entirely unique and novel approach. With the introduction of penalties for non-delivery alongside the well-established payment mechanics, it is expected that secondary trading will be employed as a tool to ensure reliability rather than for financial speculation. This has been largely absent from the way flexibility services have been operated to date, but a necessary addition as the market matures and the increasing need to ensure that providers take every endeavour to deliver what they forecast. The secondary trading element of the new market design not only enables providers to ensure that they can avoid incurring

[1] Full details of IntraFlex can be accessed via ENA (Energy Networks Association) Smarter Networks Web Portal - https://smarter.energynetworks.org/projects/nia_wpd_046/

penalties but an opportunity to reoptimize their position due to changing circumstances that may occur over time.

- **Demand Turn Up (DTU) services** – IntraFlex included up regulation (generation upturn/demand downturn) only. In areas of the network with a high penetration of renewable generation, including down regulation (generation downturn/demand turn up) could help free up network capacity and enable new renewable assets to connect.
- **Suitable baselining methodology** - IntraFlex applied a default baseline, calculated as a simple average across historic meter readings, and allowed FSPs the option of overriding the default baseline with a baseline calculated by themselves (submitted prior to trading). Feedback from FSPs that relied on the default baseline highlighted that methodologies using historic meter readings can get distorted when the calculation includes periods for which the FSP has already delivered flexibility services. There is value in exploring the impact of different baselining methodologies further to better reflect positions. This will take place in coordination with wider industry work on baselines including that of Open Networks, to ensure that standardisation is carried out with industry-wide coordination.
- **Link to longer-term flexibility procurement** - There needs to be a link between the near-term market and flexibility purchased as longer-term availability agreements, such as Flexible Power. The link is needed to ensure that the lowest cost flexibility is activated, whether that means activating a longer-term agreement or purchasing flexibility in the near-term market.
- **Increased coordination and cooperation with the ESO** – At present there is no direct link between DNO level flexibility procurement and ESO procurement of balancing services. A link would help ensure flexible resources are activated where they add the most value to the system as a whole. A link would also be expected to help build liquidity in the DNO level flexibility market, as it would encourage FSP participation by enabling them to participate with assets located both inside and outside of WPD's congestion zones and enable revenue stacking.
- **Blueprints** – In order to fulfil the DNOs regulatory requirement to act as a facilitator of neutral market it is important to enable potential market operators to be given the opportunity to transact for flexibility between the DSO and providers. This needs to be done in a fair and transparent manner, giving equal opportunities to each market but not limiting their scope to develop their own proposition. The purpose of having blueprints is to set out a standardised approach to enabling market operators to interface with the DSO and covers a number of areas, both commercial and technical. This document includes a questionnaire that stakeholders are invited to respond with relevant views that aim to ensure that a reasonable balance is achieved between limiting barriers to participation whilst ensuring that quality is not sacrificed.

The intention is to address these gaps through this project where the near-term procurement developed as part of IntraFlex is continued through an entirely new market design.

In order to fulfil the DNO commitment, to be a facilitator of neutral markets, the standardisation of the principals, by which external markets can be enabled to participate in network flexibility, should enhance the opportunities for competition rather than the DSO pick winners in advance. Should new third-party providers wish to allow their users the opportunity to trade their flex capacity the creation of a blueprint will reduce the technical and contractual barriers to enabling enablement.

3 PROJECT OVERVIEW

WPD along with other DNOs have committed to a 'Flexibility First' approach to network investment and will increasingly see that capital investments will be deferred to sweat existing assets ahead of inevitable reinforcement. This will become more and more important for managing asset replacement as we see the impact of the changing behaviours right across the electricity networks. Due to the combination of growth within the demand and generation on the distribution network, it is likely that they will experience unprecedented levels of work to expand the network and accommodate national plans to facilitate Net Zero.

Fortunately, much of the new demand requirements are for low carbon technologies such as transportation, heating, hydrogen and energy storage schemes, which mean that as well as presenting challenges, their inherent latency can potentially be harnessed, and contribute to flexibility schemes.

The situation is similar with renewable generation schemes where there appears to be an unabated appetite to install solar, wind and other technologies on the lower voltage areas of the distribution network, as opposed the old convention of large thermal plants on the transmission network. This can already be observed across the DNO industry with most now publishing their requirements and procuring flexible capacity in areas of forecasted constraints rather than automatically opting to replace and upgrade assets.

WPD has been at the forefront of this movement and in doing so developed a flexibility toolkit called 'Flexible Power' to facilitate this new approach. Flexible Power was created through strategic innovation work and specifically as an output from 'Project ENTIRE' [2]. Its purpose is to be more than just an exclusive WPD service and has been successfully expanded in its use through the creation of a collaboration that currently includes six DNOs:

- Scottish and Southern Electricity Networks (SSEN)
- SP Energy Networks (SPEN)
- Electricity Northwest Limited (ENWL)
- Northern Powergrid (NPg)
- Northern Ireland Electricity Networks (NIEN)

[2] Full details of ENTIRE can be accessed via ENA (Energy Networks Association) Smarter Networks Web Portal - https://smarter.energynetworks.org/projects/nia_wpd_017/ and WPD Website https://www.westernpower.co.uk/innovation/projects/project-entire

The collaboration group is highly aware of the change that this approach presents over the traditional attitude to customers, where DNOs have very limited direct contact. Unless there is a power cut or some form of new connection required, most customers have no necessity to contact their DNO and in many cases households and business may even be unfamiliar with the role of the DNO. This is understandable as DNOs typically don't have any real relationship with most customers, although there are exceptions in the case of vulnerable customers or large developers, who represent the extreme edge cases. For the vast majority, the only DNO interactions relate to the payment of network usage fees and these and these are levied indirectly through a customer's supplier.

The Flexible Power toolkit has provided DNOs with a system that addresses many of the challenges to the provision of Flexibility Services and established a direct capability between the network control room and providers with flexible assets. Much of this has been achieved in a manner that has ensured very low barriers to entry and provision of services, without the need for any proprietary hardware or significant burden on manpower resources.

In the absence of any existing marketplace that DNOs could access, Flexible Power was originally established around a limited number of specific services. These were created to address specific needs and productised to simplify how they are communicated to providers. These services are called 'Secure', 'Dynamic', 'Restore' and 'Sustain' and are detailed later in this document. As a result of the productisation approach the services are heavily constrained in terms of the operational rules that limit the ability of some potential providers to participate in network support activities.

However, as the wider industry is evolving it is within the remit of DNOs to act as 'neutral market facilitators' and help enable other services such as the ones demonstrated by IntraFlex. Rather than just having the initial services as created by the DNO, plurality of service options further lowers barriers to entry and increases potential to address structural challenges such as the continued difficulties of engaging multiple markets and stacking revenues.

External marketplaces are committed to enabling market participants to access opportunities within distribution, transmission, system level and even commodities trading. This has the added attraction of creating a single access point to achieve greater value for providers through a single contract and technical interface. By taking a 'whole system' approach that can offer more value to providers it is likely that we will see more capacity made available, leading to greater liquidity, and improving overall efficiency, in turn reducing the overall cost to customers.

IntraFlex successfully demonstrated that while some providers of flexibility services appreciate the simple productised services, they can provide directly to the DNOs, there are also others that require a more market-based approach. The scope of IntraFlex was mainly limited to establishing whether or not the market was seeking more advanced methods through a trading arrangement, rather than the direct procurement approach of Flexible Power.

With that now confirmed it is the objective of GAMMA Flex to ensure that any external marketplaces can be effectively integrated into the Flexible Power toolkit. By standardising this through the creation of a technical and commercial blueprint, the DNOs can fulfil their mandate to facilitate markets and establish a consistent and fair mechanism for trading.

With Flexible Power acting as the "hub", it is then possible for a DNO / DSO that uses Flexible Power to allow multiple markets act as spokes and easily utilise the blueprints, including API's and standardised contracts, to submit offers or respond to bids submitted by the DNO. This should allow the developers of external marketplaces to design their services to attract providers on a legitimate basis and without bias resulting from differing DNO agreements. It is the expectation of the project team that when this is successfully demonstrated then it will be possible to roll this out across all the DNOs who already collaborate on Flexible Power. The benefits of this would be significant, not only in sharing costs, but the more standardised the environment around flexibility services across Great Britain the easier it should be for providers to participate.

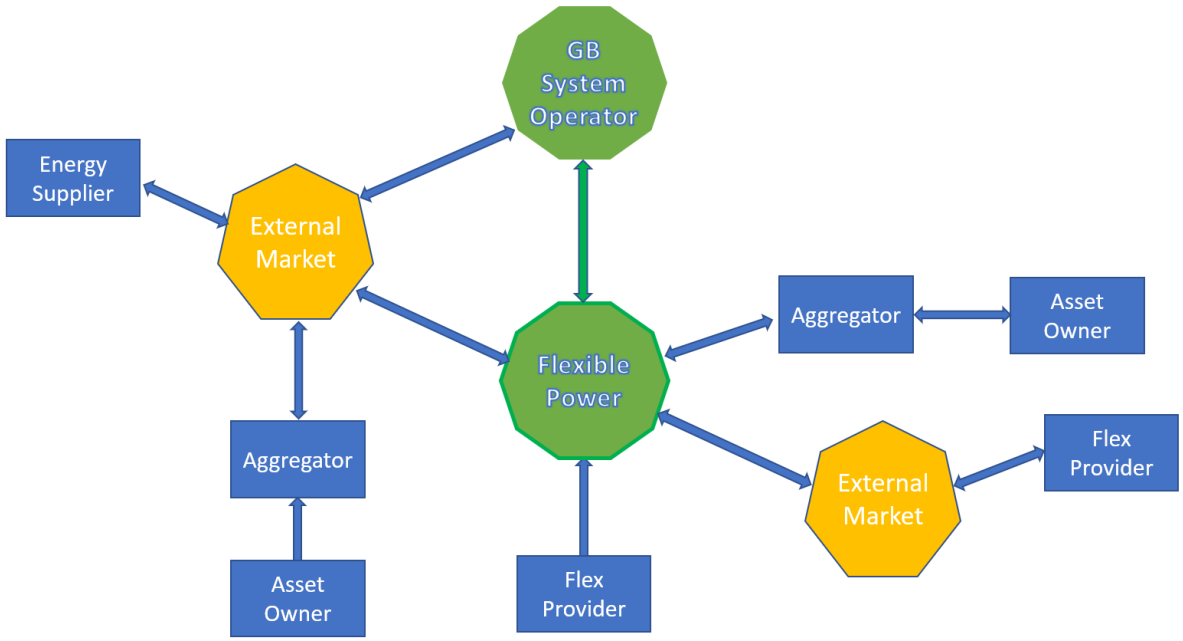

Figure 1- Simplified schematic of interactions within a hub and spoke arrangement

4 APPLICATION OF FLEXIBILITY BY DSO

The objective of the market design is to establish a set of rules that enable the range of interactions between the associated parties and expand the scope of opportunities for participation, while enhancing the current arrangements. To achieve this, the design has been developed along the timeline of initial assessment of the network requirements

through to the real-time support of flexibility events and post-operative settlement of payments. The overall timeline can vary on a case-by-case basis but the principal of the stages and the order they occur should remain relatively consistent.

Unlike the capital works approach where the DNO can unilaterally decide what reinforcement works are necessary, the DNO does not own the flexibility assets on which it will rely. With flexibility, it is necessary to establish what capacity is likely to be available and the level of appetite to contract for network support services. Each DNO will set its own criteria for what they deem to be a sufficient response during this assessment phase before confirming their intention to procure flexibility from providers. This is notionally set out in the diagram below.

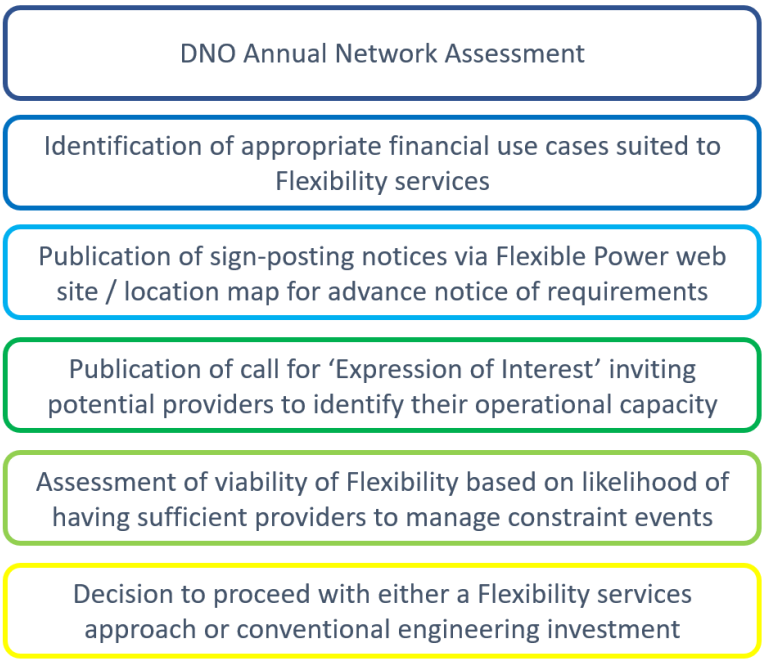

Figure 2 - Assessment process for viability of Flex Services

Once there has been a fact-based decision confirming that there is adequate flexibility provision within a proposed constraint zone to proceed with flexibility, a procurement process will commence. WPD published a consultation document September 2019 entitled 'Delivering A Flexibility First Approach' [3] which offers a detailed breakdown of the overall approach to Flexibility if you require additional information or context to understand the application of Flexibility in GAMMA Flex.

Currently the DSO flexibility requirements process is linear and is based upon the use cases defined within Open Networks (ON), which were derived from the original services created in Project Entire. This linear approach to their procurement can potentially create

[3] https://yourpowerfuture.westernpower.co.uk/downloads/39199

limitations for some providers who are unable or unwilling to commit themselves more than six months in advance for a whole variety of reasons.

Similarly, the DNO/DSO could be left with difficult to manage operational situations if a provider is unable to fulfil the commitment made many months in advance. Feedback from previous innovation work has confirmed that while the current service definitions create opportunities there is much more capacity available now, as well as future growth, that would benefit from a market solution that is based more on trading rather than procurement principals. A description of the current services that are procured for use within Flexible Power are outlined below.

Secure service

(ON Service definition – pre-fault constraint management)

The Secure service is used to manage peak demand on the network and pre-emptively reduce network loading. This service is expected to be required on weekday evenings and may occur throughout the year due to the seasonal ratings of assets. (Specific requirements are defined later in the document).

As these requirements are predictable, Secure requirements are declared each Thursday for the following week (commencing Monday). Payments consist of an Arming fee which is credited when the service is scheduled, and a further utilisation payment awarded on delivery. The week-ahead declarations are scheduled to allow customers to participate in alternative services when not required for the Secure service.

Dynamic service

(ON Service definition – post-fault constraint management)

The Dynamic service has been developed to support the network in the event of specific fault conditions, often during summer maintenance work. (Specific requirements are defined later in the document). As the service is required following a network fault, it consists of an Availability and Utilisation fee. By accepting an Availability fee, participants are expected to be ready to respond to Utilisation calls within 15 minutes. Dynamic availability windows are declared each Thursday for the following week (commencing Monday). The week-ahead declarations are scheduled to allow customers to participate in alternative services when not required for the Dynamic service.

Restore service

(ON Service definition – restoration support management)

The Restore service is intended to help with restoration following rare fault conditions. Such events are rare and offer no warning as they depend on failure of equipment. Under such circumstances, response can be used to reduce the stress on the network. This is the purpose of Restore.

As the requirement is inherently unpredictable, Restore is based on a premium ‘utilisation only’ service. This will reward response that aids network restoration but will pay no arming or availability fees. Participants declared available for the Restore service will be expected

to respond to any utilisation calls within 15 minutes and will receive an associated utilisation fee.

	Secure	Dynamic	Restore
Use Case	Pre-fault mitigation	Post-fault recovery (often under planned outages)	Post-fault network restoration
Advanced Payment	Yes, an arming payment for the accepted availability time: £125/MW/h	Yes, an availability payment for the accepted availability time: £5/MW/h	No
Utilisation Payment	£175/MWh	£300/MWh	£600/MWh
Availability Declarations	By midnight every Wednesday for the following week (Mon-Sun)		
Availability acceptance	By noon every Thursday for the following week (Mon-Sun)		
Dispatch Notice	Week Ahead, on acceptance of availability	15 minutes ahead of requirement	15 Minutes ahead of requirement

With the rigidity of the current service model, it is understandable that some providers have difficulty making this work with their own operational constraints. Some of these limitations can be technical, such as with aggregated groups of Electric Vehicles (EVs). The uptake of EVs and the infrastructure development that affects the operational capability of such aggregators also mean that so much can change within a few months, thus causing difficulties for accurate forecasts around the predicted capacity they will be able to offer.

Alternatively, asset owners such as those with large batteries can probably make a relatively accurate technical assessment of their capabilities well into the future but want to optimise their earning potential, this will often prevent them making commercial decisions too far in advance in case it conflicts with other more valuable opportunities that typically arise closer to real-time.

The new market design principles, that will be the outputs from GAMMA Flex are intended to enable a multiplicity of opportunities to enter the Flexibility Market as well as the ability to change position or transfer responsibilities. By introducing non-linear mechanisms that will make the service provision more pliant the market should accommodate a wider range of participants. All of this is with the underlying objective to maximise liquidity which is widely acknowledged to be the key to building resilience around the services and accelerating its expansion.

5 MARKET STRUCTURE LIMITATIONS

The productised offerings that currently represent the bulk of Flexibility Procurement by UK DNOs were established in the absence of any independent offerings from the wider market. This has stimulated an initial interest in providing services in return for financial compensation but has many limitations, not least of all the ability to incorporate this with other demand side opportunities such as national system balancing for the ESO.

The services within Flexible Power are not themselves the issue as there are no exclusivity clauses within the contracts that providers sign up to. However, there are within the contracts from National Grid that are likely to be breached if a provider attempts to service both opportunities. This alone is a significant barrier to value stacking of assets, forcing a potential participant to weigh up the benefits and obligations of both services and ultimately selecting just one to pursue. When this is then set against the wider landscape of other opportunities, it can become quite confusing and require expert analysis to determine what is the optimal approach for the greatest financial returns vs the level of input required.

The analysis and operational burdens can to an extent be mitigated by working with an expert partner such as an aggregator or electricity supplier with smart grid capabilities. However, bringing in a partner, to help maximise the potential gross value that can be achieved from assets, will come at a cost for their management. More importantly the managed services and specialist knowledge they can offer does not allow them to bypass the structural limitations of the current market. Instead, they use their experience to help them actively manage their portfolios of assets to navigate the rules and limitations of what is acceptable under existing rules.

The impact of the enhancements that we intend to deliver through this project should resolve many of the issues and shift the market towards a future where greater coordination and collaboration enables better overall efficiency and flexible asset utilisation.

5.1 SECONDARY TRADING

The current services operated through Flexible Power recognise the importance of reliability and the basic principles intended to encourage providers to act in accordance with the terms of their procurement. Week ahead declarations help ensure that providers re-commit their capability near to the expected service delivery dates, coupled with a payment mechanism[4] that regulate delivery that falls below agreed levels.

The payment mechanism is currently limited to reducing the payments that a provider will receive in comparison to the theoretic maximum that would be awarded if they deliver 100% of what is expected. The mechanism only leverages the ‘loss of opportunity’ but doesn’t apply any additional punitive measures to penalise a provider who has a contract to provide flexible capacity and is unable to provide any capacity. Under this scenario, the provider

[4] Flexible Power payment mechanics explanation https://www.flexiblepower.co.uk/downloads/52

would be deemed to have failed completely which may result in them not receiving any payments, but they are also unlikely to have incurred costs so there is little at jeopardy to encourage 'best efforts'. The only additional action that may be taken under current arrangements is withholding their participation from future tenders which is counterproductive when the primary objective is to encourage a long-term growth in liquidity. While the payment mechanism uses the cost of operating an asset as the penalty vs the earning potential, it could encourage a provider who has over forecast what they can deliver to simply do nothing when contracted to deliver, if they are unable to meet their commitments. Although they would not earn anything, they would avoid the inherent penalty of the operating costs vs reduced or even a zero service payment.

In order to ensure that providers recognise the importance of making their best endeavours to fulfil their service contracts, it is necessary to introduce additional penalties that ensures at least one of the following conditions occur:

- If a provider does not give advance notice of the inability to meet obligations, their payment is reduced in line with the level of under delivery through application of the payment mechanics.
- If a provider gives sufficient advance notice (nominally 1 month) of their inability to fulfil any of their awarded capacity, they have the option to annul their contract and allow the DSO the opportunity to reallocate capacity to another provider. Failure to do so will result in an obligation for the provider to resolve through secondary trading.
- If a provider gives sufficient advance notice (nominally 1 month) of their inability to fulfil a portion of their awarded capacity, they have the option to retain what they can fulfil and allow the DSO the opportunity to reallocate the remainder of the capacity to another provider. Failure to do so will result in an obligation for the provider to resolve through secondary trading.
- If a provider gives insufficient advance notice (nominally, less than 1 month) of their inability to fulfil any of their awarded capacity, they will be required to access secondary trading market to place sell orders and transfer responsibility for whatever proportion they can't meet. Failure to do so will result in a penalty in line with the capacity that is outstanding.

We will be seeking feedback on the penalty structure during the stakeholder workshop.

5.2 DEMAND TURN UP (DTU)

DTU services, sometimes known as Footroom services are not in themselves a new concept and they have already been the subject of a previous innovation trial in 2018 called SYNC (Solar Yield Network Constraints)[5]. Based on the previous learning it has been possible to adapt elements of the Flexible Power products so they can be used in

[5] Western Power Distribution - SYNC

reverse to address generation constraints rather than the more common demand scenarios.

There may also be additional opportunities for DTU outside of the direct reversal of the demand constraint use cases. Due to the high volume of renewable generation that has been connected to the network over recent years, some required to be granted connections on a 'managed' basis. This means that there may be times when the generators themselves have to be curtailed in order to accommodate a network constraint or by insufficient local demand. Such constrained sites may be interested in accessing the trading opportunity particularly where the addition of load within the same constrained zone would allow the generator to maintain a higher output, particularly where renewable incentives are awarded and there is an economic impetus that will benefit both the parties.

The DTU work within GAMMA Flex will build on the existing learning and ensure that the existing principles can be extended to operate within a trading environment and will align closely with the baseline and secondary trading aspects of the blueprint development.

5.3 BASELINING

As with DTU there has been a great deal of work that has taken place within this specific area of industry as it is absolutely vital to the development of services where a change of behaviour is being procured. Unlike the trading of commodities where the total volume delivered is often a sufficient mechanism by which to measure delivery, there is an often-misunderstood element to the mechanics of Flexibility Services relating to how its measured.

When flexibility is being purchased, it is not the power itself that is typically the subject of the procurement and is regarded as a by-product. The change of behaviour in generation or consumption is what the flexibility programmes are actually targeting. This is why it is so critical to quantify what the normalised behaviour would be if flexibility is not required. If a generation asset is being used to provide the flexibility to the DNO / DSO or even to ESO / TSO, the flexibility provider is entitled to use or sell the electricity over and above any remuneration they may receive for acting as instructed by the flexibility services programme. This can be relatively straightforward when considering asset types such as stand-by generation which for the most part is not operational as the assumed baseline will be zero. It becomes far more challenging when considering a part loaded generator, battery, EVs or reducing a demand asset such as a pump or chiller. It is for this reason that Open Networks have been reviewing options for baselines over a protracted period.

Within GAMMA Flex we will assess all of these for viability of application within market scenarios and develop appropriate blueprints for those that are congruous.

5.4 LINK TO LONGER TERM FLEXIBILITY

Combined with the secondary trading element, the link to longer term flexibility is the other main innovation GAMMA Flex is introducing to evolve the flexibility landscape. The ability to interact with markets over an extended period opens the potential for many more

providers to be able to participate but also changes the level of commitment they have with buyers who are seeking their services. Creating these opportunities will naturally attract more providers due to having options that can suit their individual needs.

GAMMA Flex is seeking to meet the objectives of Ofgem by enabling DSOs to facilitate neutral markets, as the expected outputs from this innovation work will be a set of technical, commercial, and contractual blueprints that will allow any external market operators to trade flexibility simply by adhering to the rules. These rules should be inclusive to allow multiple markets to co-exist and interact with DSO Flex Programmes without limiting each market's own ability to innovate and create attractive propositions to providers. This will enable a free exchange of contracts amongst approved providers via whichever marketplace is most suitable.

Links to longer term flexibility will ultimately take the step to open up a flexibility exchange rather than simply having the DNO / DSO engage potential providers with productised offerings that don't fit in with their other activities. It is unlikely that any providers will ever develop smart capabilities that enable them to buy and sell energy and or flexibility solely based on the limited benefits available to support the distribution networks. The DSO must therefore make every reasonable effort to open the marketplace up and facilitate the introduction of additional opportunities on a non-exclusive basis. The need for this is best demonstrated by the next section where we set out the goals for Increased coordination and cooperation with the ESO.

5.5 INCREASED COORDINATION AND COOPERATION WITH THE ESO

The ESO have been using flexibility for decades but for an entirely different purpose to that of the DSO. The primary use case for contracting demand response type services for the ESO generally relates to non-geographic services that help support the balance between demand and supply. This balance is of critical importance and effects the whole of the electricity system and a shift out of balance places the entire system at jeopardy. There are several different service variants within the balancing services portfolio, but there are some common principles that run throughout.

- The ESO has the ultimate real-time responsibility to ensure the system remains in balance between amount of energy being consumed and the amount of energy being supplied in.
- For the most part, these are non-geographic and providers can participate in services from any location as long as it is connected directly to the GB system.
- Services can be provided not just through the management of generation on the system, as the addition or reduction of demand can have a very similar impact in most cases.
- A variety of services are required in order to act at different timescales. Ranging from less than a second response for typically short duration through to keeping slower responding assets delivering for several hours.
- The reduction of system inertia from synchronous generation assets reduces the damping effect to frequency stability and increases the need for balancing services.

- The majority of providers who participate in balancing services with assets connected to the distribution network could also contract to support DSO services.

Another common principle relates to the manner in which National Grid procures its balancing services. Most capacity for balancing is procured in productised services, not dissimilar from the approach taken by Flexible Power although there is an increasing shift towards a market approach with some services that can be entered into via auctions. A list of services is provided below although these are subject to revision as National Grid continually seeks to improve the effectiveness and efficiency of its services within a changing environment. Please note those in **bold** are typically the services which can be provided by distribution connected assets, while others are limited to power stations and other large transmission connected assets.

- Black Start
- BM Start Up
- **Demand Turn Up (DTU)**
- **Enhanced Frequency Response (EFR)**
- **Enhanced Reactive Power Service (ERPS)**[6]
- Fast Reserve
- **Firm frequency response (FFR)**
- Inter-trips
- Mandatory response services
- Obligatory reactive power service (ORPS)
- **Short-Term operating reserve (STOR)**
- Super SEL

There is a fundamental difference to the way in which *ESO balancing services*[7] operate as opposed to distribution network constraint services that make it difficult for a provider to contract for both simultaneously. This is reflected in the contracts which are often exclusive for the ESO, even limiting providers to just one balancing service at a time and prohibiting any other commercial service programmes.

Balancing Services by their very nature are about continuous monitoring and regular adjustments made through actions where providers are instructed to respond very quickly in response to deviations away from the 50Hz frequency target. This can also be seen in the baseline methodologies that the ESO use to establish what the prior behaviour is, ahead of any instruction to then change behaviour such as increase generation or reduce demand. If a generator is already running at maximum or a load is switched off when a deviation occurs, then the assets are already included in the calculations and an adjustment action can't be made. The easiest way to ensure that this doesn't happen is to

[6] ERPS is unusual within NG ESO services as it does not require to be exclusive and can be contracted in parallel with other commercial services.

[7] Details of current balancing services available at https://www.nationalgrideso.com/industry-information/balancing-services

ensure that any participating assets are held in a state of readiness which can attract an availability payment in return.

Conversely, the main use cases and assessment of distribution constraints take place over a far longer timeline. Periods of increased risk can generally be predicted days, weeks or even months in advance with a correlation to planned maintenance work, weather and seasonal peaks. The underlying assessment of the network can be done in advance and instructions to operate placed with greater notice, potentially scheduling events days in advance.

The differences in the way that ESO & DSO has until now presented a real challenge to the programme operators as to how to make best use of the available assets, that have led to the common complaint that providers have to choose which they prefer to enrol in. This has a potentially serious limitation to the DSO in particular if providers prefer to support the ESO, which is commonplace due to the increased duration and frequency of paid events on offer. Due to the locational requirements of the DSO, providers have to be located within a specific section of network, typically downstream of a constraint which can often mean there is a very limited pool to select from. In contrast, the vast majority of ESO requirements are non-geographic and can choose from any location on the system and at any voltage level.

The dynamics outlined above set out a range of opportunities to improve the way services are designed and delivered to improve overall efficiency through increased market liquidity, ultimately leading to enhanced reliability and reduction in costs to customers.

This last point regarding the ‘costs to customers’ is a very important one, as not only is it an underlying objective form most innovation projects, it is particularly relevant when we consider ‘whole system’ approaches. Customers ultimately pay for the costs of operating the networks through DUoS, TNUoS and BSUoS. If we don’t address the conflicts between the way ESO & DSO access flexible assets and allow market designs to incorporate a competitive dynamic between them, we will drive up the underlying costs to the detriment of customers. This will not even necessarily benefit assets greatly as they will still be limited by the scale of participation opportunities being limited by exclusions to serve more than one opportunity.

Through better data sharing and coordination, GAMMA Flex will develop a view to eventually have a collaborative marketplace that serves both programmes where there is scope for very cogent improvements over the current arrangements.

6 DEVELOPMENT LANDSCAPE & ARCHITECTURE

Before we detail the proposed market structure within GAMMA Flex it is important to note that the current Flexible Services capabilities within the DSO / DNO are still in their infancy and therefore unsurprisingly limited. UK DSOs are amongst the most globally advanced, but as the DSO concept is not well established within the energy industry anywhere, there are minimal alternative examples on which to base the support systems needed to operate DSO services.

As part of this project, we have presented some gaps in the current suite of systems that it would be reasonable for the DSO to expect to have in support of their service obligations. Some of these have already been identified as requirements and are being investigated through alternative projects while others are further away on the development roadmap and may be impacted by the outputs of prior learning. In order to offer the readers of this document a better context of the market design within the wider environment, these additional system resources have been outlined at a high level.

6.1 Post-Event Performance Analytics

Services associated with Flexible Power all benefit from well thought out and proven payment mechanics which strike a balance between incentive and automatic application of penalties when service delivery falls below an acceptable threshold. The performance analysis that is carried out within Flexible Power is solely for the purposes of financial settlement and relies on the data submitted to the participant portal via the metering API. This takes readings at one minute intervals that the provider extracts from their asset(s) but this is not currently further validated against the actual impact that the network experiences because of their actions. The payments to providers are therefore assumed to be justified and accuracy is reliant on their unverified data.

Far from being an oversight, it was a considered decision when Flexible Power was originally established that it was more important to establish technical standards that did not unnecessarily present barriers to provider participation. That said, there is a critical mass at which the risk to the network is increased by not having any further checks to ensure the veracity of what is being reported through Flexible Power.

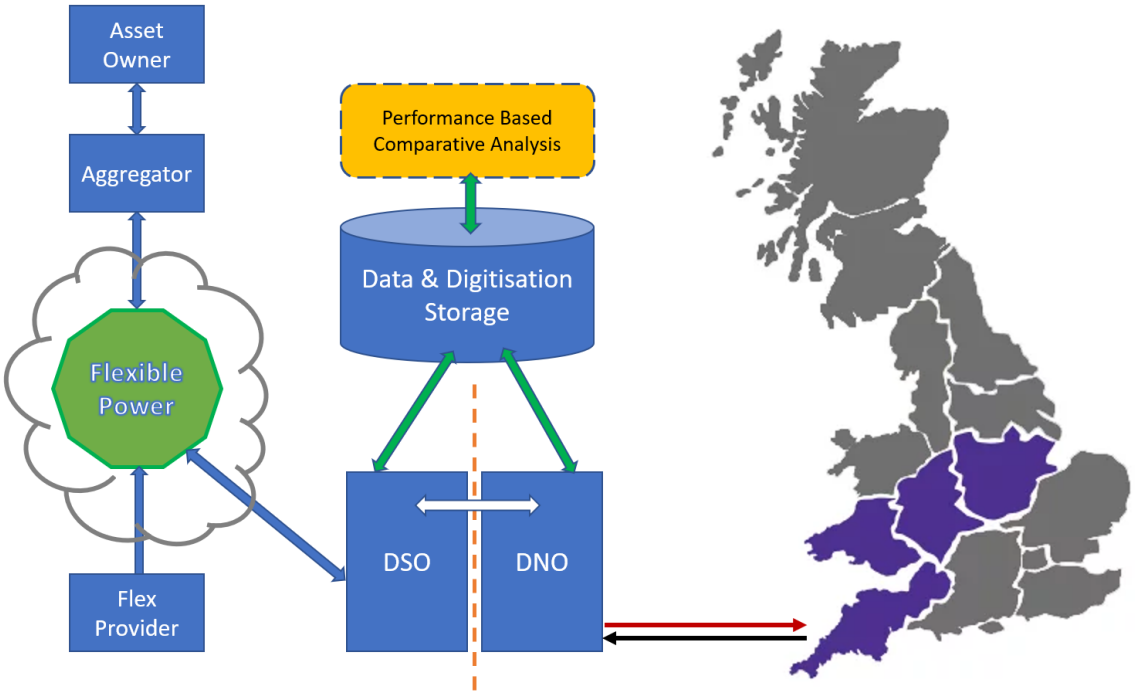

Figure 3 - 'Honesty Engine' data flow schematic

The 'honesty engine' as it has been colloquially referred to within strategic development discussions is intended to address the challenge of improving the efficacy of the services without complicating the participation requirements. The preferred approach is therefore to continue with the principal of trust in the first instance and accept the data provided for settlement processes. This can then be extracted by the DSO and stored for comparison alongside the data that DNOs already collect via their proprietary systems from all of their own network assets. We would then expect to see evidence of the flexibility event dispatch through on the DNO network reading and while this may not be to exactly the same value, we would surmise that observations would fall within a predictable range. Where results are out with an acceptable variance it would be flagged for a follow up and a supplementary audit to ensure that the divergence was legitimate and not the result of any false reporting.

6.2 Reliability Feedback Scenarios

As flexibility services continue to develop and increase in volume it is important that DNOs have a procurement and operating strategy that ensures we include a focus on reliability. Most customers have grown very used to a high quality of service with very rare occasional interruptions in service for several decades now and will maintain this expectation going forward.

In spite of the changing energy mix and increasingly active management of the network, customers will be unwilling to accept a reduction to their quality of services. Therefore, as we increasingly use flexibility to manage the networks it is vital that we have the new tools to ensure that service levels can be maintained. A very important aspect of this is to be

able to assess the data from real historic performance of Flexibility Providers and use this to continually improve the purchasing, ensuring that it is both efficient and reliable.

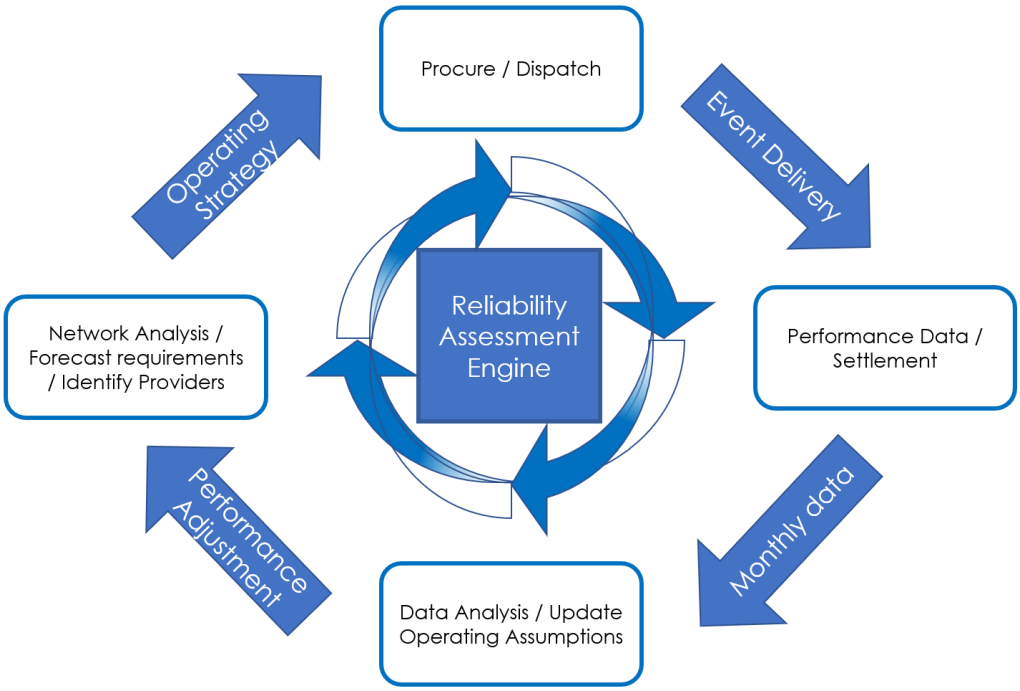

Figure 4 - Continuous feedback loop between procurement and operations

Different aspects of asset performance as well as the operational scenarios act as variables and can offer some valuable data that can be used to help advise in the awarding of contracts and ultimately the operational strategies. The variables range from technical categories such as asset type through to commercial considerations including price and the specific marketplace it was sourced. With the assistance of an analysis tool, procurement can use this intelligence to source the optimal mix of flexibility providers to meet the network's needs.

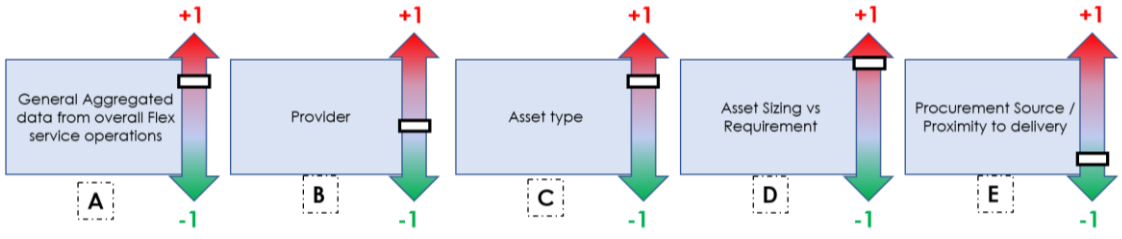

Figure 5 - Analysis parameter toggles - customisation of analysis with weighting against category variables

As not all scenarios are the same, different parameters can be included in the analysis as well as variable weighting of each for when greater accuracy may be necessary.

6.3 Data Accessibility & Reporting

The nature of the DNOs role means that for much of their work they operate in a monopolistic environment as it is generally accepted that there can only be a single electricity network. The same is not necessarily true of much of the DSOs activities and in spite of it making sense to evolve them from the DNO much in the same way National Grid ESO & TSO have, there requires to be transparency where possible.

To that end and in association with the wider move to being open with Data, this should include all the data that is collected and used for internal analysis. If necessary, any data that contains details that are deemed to be sensitive can be withheld or substituted with encoded alternatives to maintain the continuity. For example, removal of a providers trading name with an anonymised reference number instead.

In addition to making data available via a secure API, regular reporting will be necessary for regulatory compliance. With such rich data sources, it should be possible to exceed the regulatory expectations as part of the commitment to act as neutral market facilitators.

6.4 Operational Optimisation

The biggest additional component that will be required to ensure that DNO / DSO have an adequate toolkit to efficiently run flexibility programmes will sit at the heart of the control room and automate much of the background work. The control room operators have previously been presented with the potentially complex task of having to consider the potential scenarios that could occur during a constraint situation. They then try to resolve this with services from third parties, each of whom may have different operational limitations, cost of use and notice periods to dispatch. The learning from an earlier innovation trial modelled the impact of introducing increasing numbers of assets which is generally acknowledged as what we would like to achieve. The result of this however is an exponential increase in the number of different ways in which they can be arranged in order to support the network.

This will ultimately require a powerful tool that can process all the available information and assist the control engineers with a suitable operating strategy for each event. This may not necessarily be limited to lowest cost optimisation which represents one of the most obvious but there could be other priorities. By linking events it may be most appropriate to hold back using certain assets such as batteries to ensure that they are suitably charged for a subsequent event later the same day. Also, as part of being transparent and fair, it may be most appropriate to attempt to share contracts between providers and create extra opportunities to demonstrate good reliability rather than favouring limited few.

As the procurement and operational decisions do not happen at the same time, the optimisation processes will require to be repeated at a series of time horizons, and access different markets at the appropriate times to acquire providers. These may then change through secondary trading and require additional ad-hoc assessments to ensure that operational scenarios are updated accordingly.

7 MARKET DESIGN

The following market design proposal will cover a number of new features to the Network Flexibility Market, which have been alluded to in the prior sections of this document. These will be set along a timeline to reflect the multiple stages that occur during the overall procurement of the current services, which already have a number of well-established principles. The design is an evolution of the existing arrangements, so the following diagrams set out a typical timeline for the Flexible Power process through procurement to active use over a period of approximately 12 months. In reality, the assessments of the network are ongoing, and this may further increase in frequency as the rate of change continues to escalate within how the networks are used. The diagrams are intended to provide context for how the new market design is inclusive of current service arrangements and enhances these to improve the opportunities to participate

7.1 NEW MARKET DESIGN IN PARALLEL WITH FLEXIBLE POWER

The new proposed market design runs in parallel with the existing Flexible Power process to compliment the actions that already take place within the DNO / DSO and increase the scope for providers of different types to sell their flexibility. It is important to note that the existing services within Flexible Power were largely the result of a prior innovation project and to simplify this for any early adopters, the services were highly productised. This helped clarify what was required of providers but many aspect were simplified to the extent that they compromised the detailed requirements of the DNO / DSO. For example, providers would be limited to a single use per day, otherwise we would have to include the ability to specify recovery time between uses and other operational limitations. There is ongoing work to evolve the services within the Flexible Power services, but they are likely to remain to be focussed on a product based offering, while the GAMMA Flex design enables a more market based approach that will allow providers to define what they want to sell rather than comply with a potentially restrictive product specification.

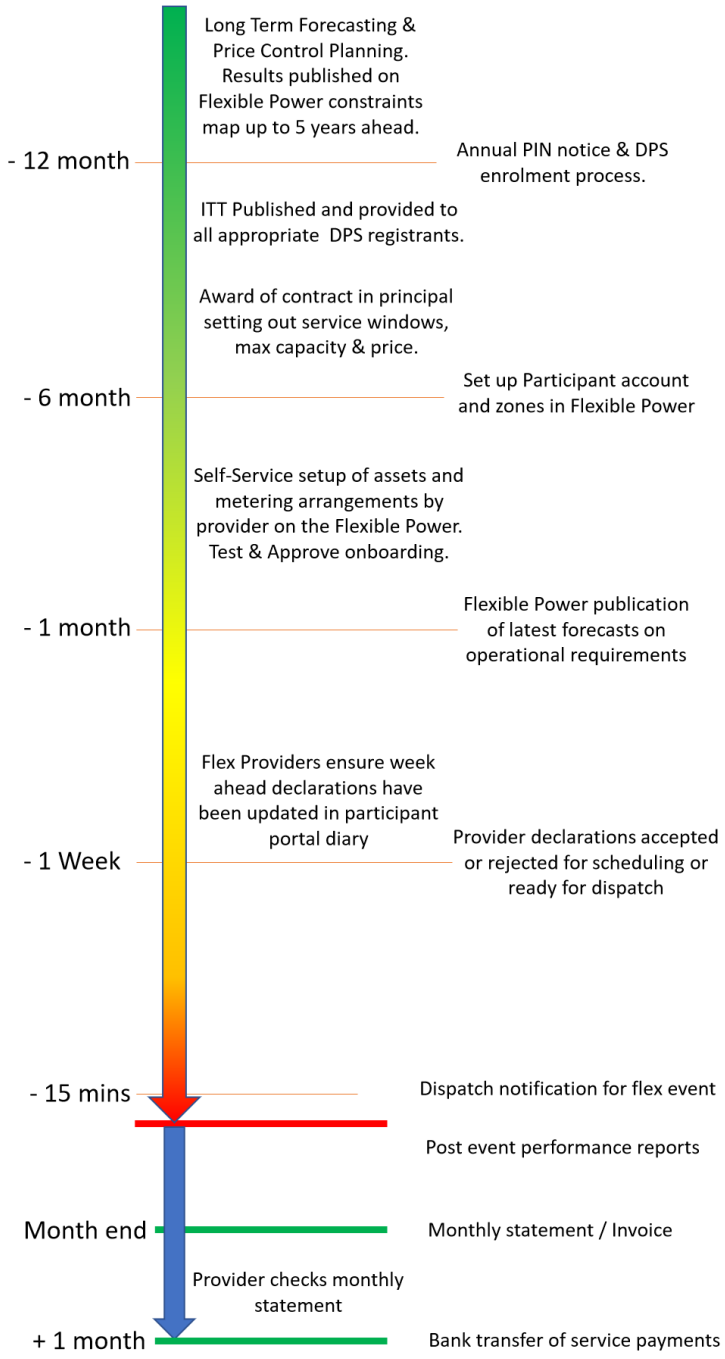

Figure 6 - Existing timeline for procurement through Flexible Power

As the prior diagram demonstrates, the established processes are linear with very specific actions occurring at predefined time horizons. This can be very limiting as, in order to be in a position to provide services to the DSO, it is necessary to be engaged as much as a year in advance to identify suitable locations and respond to the procurement department's publication of the PIN notice. While this has been succesful in attracting and engaging adequate providers to progress many CMZ (Constraint Management Zones) for WPD over

recent years, a greater number have been unable to contract sufficient capacity to make non-engineering interventions viable.

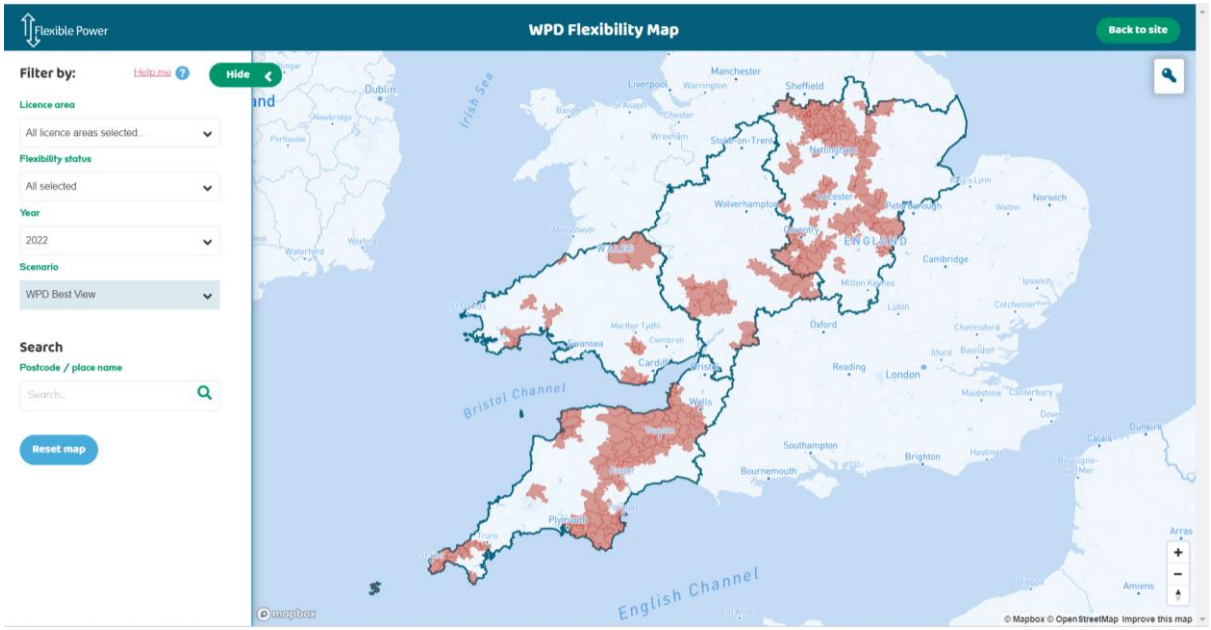

Figure 7 - Flexible Power interactive constraint map outlining future requirements

Stakeholders and potential providers have also intimated that even when they are aware of a CMZ that they could support through the existing service models, there is insufficient total value for them to commit so far in advance. In many instances they would rather await the results of other commercial opportunities before contracting with the DSO in case they miss out on a more valuable opportunity, particularly in an environment which can change quite quickly.

A good example of this has been apparent over the past year where global conditions have dramatically impacted the prevailing costs for fuel which in turn has impacted the profitability of flex contracts to providers. Providers would ideally like to be able to service opportunities that give access to the multiple layers of value such as peak pricing, non-commodity cost avoidance, ESO services, TSO services and finally DSO flexibility. As long as this is not possible, they will attempt to optimise their position and achieve the maximum total value that can be accrued while not breaching any of their terms of service.

Unfortunately, DSO flex services tend to be of limited duration, so despite offering greater certainty and non-exclusive contract terms, participants often withhold in favour of retaining the opportunity to bid in for ESO services which will conceivably yield increased gross value. The existing arrangement does allow the provider to engage in the linear procurement process and not commit their asset at the week ahead stage, but this would result in not receiving any payments and leave the DSO unexpectedly short on flex capacity. This has already been partially addressed in the IntraFlex trial by introducing the additional mechanism of operating a trading environment that operates in the T-7 days down to just 90 minutes ahead of real time.

The new market design and blueprints do include the close to real time service, but also extends to use the same basic principles to include medium and long-term access to trading.

7.2 Expanded Access to Markets

Several of the topics being covered in this market design document are closely linked to each other and where this is the case that explicit dependencies exist, we will endeavour to highlight to ensure that requirements are clear. The expanded access to markets facilitates the ability to allow additional market access points along the timeline so that providers are given multiple chances to secure a service contract. This cannot be considered in isolation, and we advise that this needs to be read in conjunction with registration and tracking and secondary trading.

In addition to the Flexible Power existing services, we would like to introduce three additional service categories which reflect the time horizons at which they take place. The logic to separating them in this way is not just for convenience, but instead should reflect the certainty of the need at that time against potential value. The time horizons are categorised as follows.

- **Long-Term Flex** Several years to 1 year ahead of real time
- **Mid-Term Flex** 1 year down to 1 month ahead
- **Near-term flex** 1 month down to 15 minutes

In the research and design work being carried out it is evident that some trading platforms including the one they have already demonstrated in IntraFlex can support all three flex-trading variants while future platforms from other operators may opt to focus on just one or two.

It's also worthy of note that an FSP is not restricted to only operating within one of the markets and we would expect that any FSP that is responsible for a portfolio of assets within a single zone may benefit from making multiple bids over the duration of all three options. It is reasonable to assume that if the overall duration is up to four years, there may be changes to the portfolio or varying levels in confidence as to what capacity may be available so far into the future. An FSP may therefore opt to secure some contracts in the long-term market and supplement these with further bids in mid-term and near-term markets that takes advantage of improved forecasting closer to an event.

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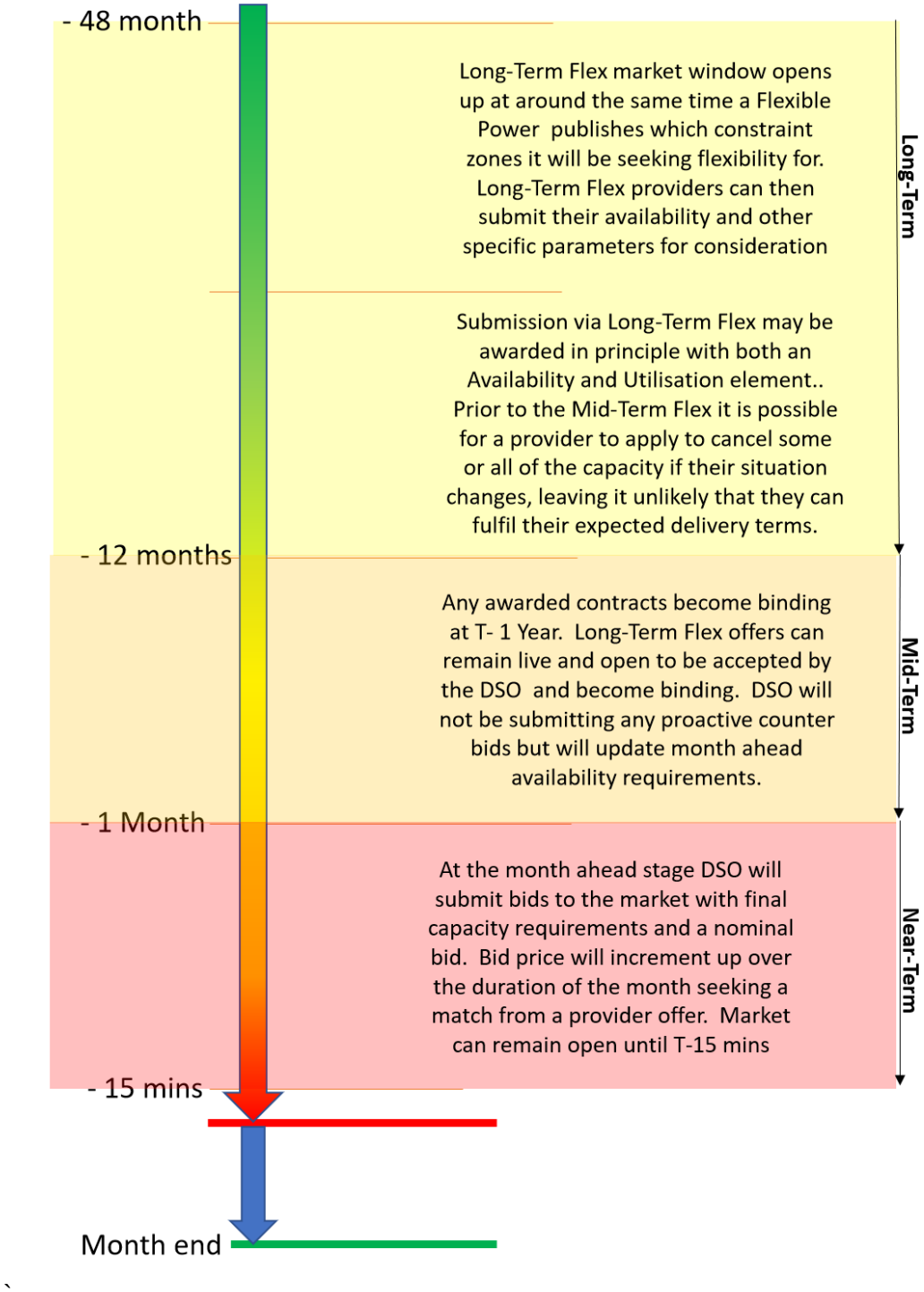


Figure 8 - Market phases by timeline

7.2.1 Asset registration/information

If a market platform has the facility for FSPs to upload assets and the DSO pre-approves them, the market design offers the functionality for a provider to pre-emptively present assets in the market along with any relevant parameters that they want the DSO to be aware of. These will include the capacity along with optional parameters such as max / min duration per event, recovery time, cumulative max / min duration. This is of benefit to the DSO when scenario planning and assessing a CMZ for feasibility before proceeding through the remainder of the procurement process. This is done in parallel with Flexible Power but the asset approval process will ensure that an asset cannot be duplicated within marketplaces or from multiple providers. It will be down to individual market place software as to how the process will be completed and we would expect some to develop simple access and the ability to bulk upload assets, particularly where they are portfolios consisting of large quantities of smaller capacity providers.

7.2.2 Long-Term Flex

The new 'Long-Term Flex' market proposal has some parallels with the procurement of Secure or Dynamic services within Flexible Power, but with a few key differences that open up contracting opportunities to new providers who may not have been attracted by the more productised service offerings.

Long-Term contracts can be awarded via different market platforms that might be provided by different independent market operators or through a mechanism such as Flexible Power.

We suggest that Long-Term contracts are awarded in line with the Flexible Power procurement process commence. Contracts could be awarded 'in principle' as much as four years in advance but become fully binding a year in advance. This reflects the need for a decision to be made on whether flexibility offers a viable solution with sufficient time to carry out conventional reinforcement if that is the preferred outcome.

Long-Term contracts will include both a utilisation and an availability payment.

The allocation process is auction based:

- The DSO publishes its flexibility needs, including volume, location and the maximum expected value of flexibility. This market cap is possible as there should always be the alternative of conventional reinforcement on which the flexibility value is calculated.
- The DSO will develop a range of hedging strategies as to the quantity of flexibility they intend to procure from each market. (Long, mid & near).
- FSPs respond with the flexibility they wish to offer, prior to a fixed deadline, no later than the T-1 year after which the mid-term market will operate or the constraint will be addressed by conventional reinforcement.
- FSP responses are evaluated based on price and where relevant other parameters
- If the total volume offered by FSPs is lower or equal to the volume required by the DSO, then FSPs are awarded contracts at the price ceiling.

- If the total volume offered by FSPs is higher than the volume required by the DS, then FSPs are awarded contracts on a pay as clear basis with the maximum clearing price being awarded to all contracts.
- Long-Term contracts cascade into mid-term contracts after which they are binding. FSPs may apply to cancel Long-Term contracts without penalties up to one year prior to the start. This is intended to allow FSP to manage risks and should not be used as an opportunity to speculate.

7.2.3 Mid-Term Flex

In the same way that Flexible Power agrees the overarching terms of the contract, but these are not binding until the week ahead declarations. A similar light touch approach is used in the award of a Mid-Term Flex agreement in principal but with a few differences.

With the agreement in principle secured during the Long-Term window, a provider can then attempt to stack revenues from complimentary commercial opportunities as they know what their operating state will be in advance. If however, they encounter issues out of their direct control and they are unable to operate they can apply to cancel the contract up until T-1 year from the date of delivery. At this point the Long-Term flex markets ceases and is replaced by the Mid-Term Flex rules which remain active until Near term flex at T-1 month.

Mid-Term contracts are firm and may not be cancelled by the FSP. However, FSPs can trade out of their position via the secondary market described further down in this document.

At the year ahead point, Flexible Power publish updated availability requirement which coincides with Long-Term flex contracts becoming committed for the providers who have previously held an agreement in principle. If a provider wishes, they can leave or amend any outstanding sell offers on the platform with updated terms which may be more informed by the latest availability requirements publication. If the DSO wishes, it can then accept any offers, which then become confirmed contracts under the terms of the Mid-Term Flex market.

The Long-Term Flex and Mid-Term Flex markets create the potential for multiple access points for providers based upon new markets that may be created to run in parallel with the existing Flexible Power services. This should help address any concerns that may arise and suggest that DNO / DSO are seeking to go beyond their regulated requirement to act impartially in facilitating markets. The Long-Term Flex and Mid-Term Flex present an opportunity for providers to submit their preferred operating regime with increased specificity and may therefore be a preferred route to contract through than the relatively prescriptive products used by Flexible Power for procurement.

7.2.4 Near-Term Flex

The ‘Near-Term Flex’ market is intended to create an opportunity for asset owners who are unable to commit in advance to their participation until after the month ahead stage. There are a variety of reasons that this is can be the preference of a provider even if its not a technical limitation that is difficult to overcome. Specific examples of these were apparent from IntraFlex and common in the feedback from the aggregators of EVs or other

domestic loads. Often it is within the final 24 hours or even day of delivery before an accurate forecast and baseline is feasible.

From the DSO's perspective, keeping the market open and enabling providers to still contract their assets down to the day of service delivery not only improves overall liquidity it may offer the control room valuable opportunities to replace capacity that didn't declare available at week ahead through Flexible Power. Additionally, it could displace more expensive contracts with better value ones or simply supplement existing contracts with additional capacity to increase overall reliability if offered at an attractive rate. This is not necessarily to the detriment of the FSP with the more expensive contract as they would still likely be entitled to their availability payment even if an alternative FSP with a lower utilisation payment is ultimately dispatched on the day.

With the success of IntraFlex and subsequent positive feedback following wider industry dissemination there is very little new to add to the main facets of the Near-Term Flex design and bidding strategy.

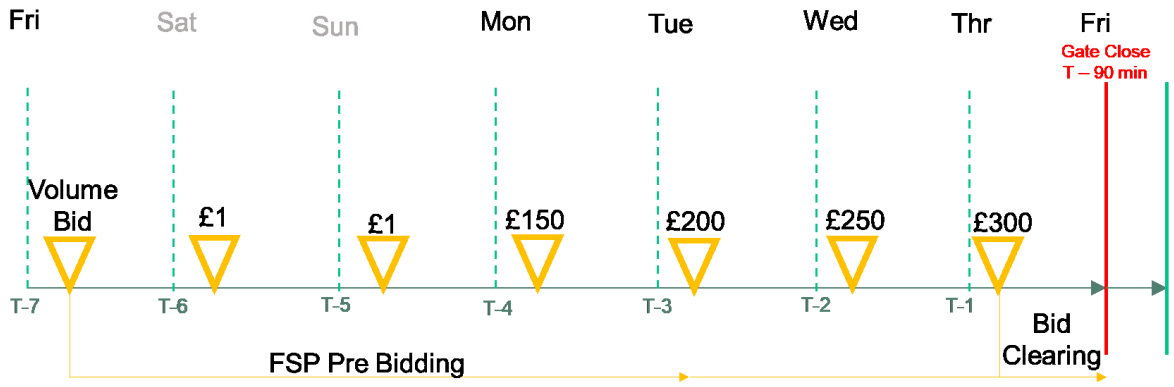


Figure 9 - Incremental bidding actions on Near term flex

Within IntraFlex at T-7 days from delivery date the DSO placed a bid on the market platform to indicate the outstanding requirements it is still interested in filling. The bid will typically contain details including:

- ½ hourly period of day
- Capacity requirement
- Location
- Price

Crucially this was done initially at a very low price at which there was no expectation of achieving a matched offer against. It should however be sufficient to signal any providers as to whether it is suited to any of their assets and give them the opportunity to track the opportunity over time. Over the following week, the bid price from the DSO was incrementally increased and providers could submit competing offers until they coincide, and a transaction was cleared. All metering and operational data required under the terms of the marketplace rules were fed to the platform operator via a metering portal that WPD developed in parallel with Flexible Power Following delivery, the data relating to the event

was provided by the marketplace along with their invoice for the services based on performance data and application of the standard payment mechanics.

After an agreed validation period and payment terms the settlement payment was made to seller according to the market operator's processes. Recognising there could be a chain through which the payments require to be transferred, it is important that bureaucracy should be minimised, and automation should be used to facilitate a rapid payment turnaround in any final market design

With the success and positive feedback from stakeholders, we have preserved most of the key features of the patented Short-Flex service that NODES provided, with some critical adjustments. The most significant alteration has been the extension from a T-1 week duration to T-1 month, to increase the opportunity for the increasing quantity of aggregated small assets we expect to see active in flexibility, such as EVs and domestic low carbon technologies. Technical changes to the design also include the removal of an independent metering portal and this will instead be sent directly to the marketplace. Commercially, we will follow the same bidding process as with IntraFlex but this will instead be spread over the period of 1 month rather than just 7 days. We do not believe that this will in itself dictate that another innovation funded trial will be necessary and propose that the merits of different DSO bidding strategies can be undertaken in BaU.

7.3 Registrations and Tracking of Assets / Trades

WPD are committed to enabling markets and therefore developing in this project the concept of standardising the way in which markets will interact and contract with the DSOs and by utilising the existing Flexible Power collaboration will potentially extend these benefits across the majority of the UK. This concept of openness and multiplicity while very positive in its endeavours, does bring with it additional challenges to be able to track centrally what actions are being taken and by whom within a distributed environment. For this reason, it will be necessary for all assets and their providers to be registered in advance. Whether specific to each DSO or tackled nationally, a register of all participating assets is vital so that each one has a unique identification code ensuring that there is no duplication within procurement, but also so that they can be notified of any flexibility requirements they could potentially be bidding to support. The mechanisms and systems relating to any proposed registration facility falls outside of the scope of this project and therefore we have included this reference to the expected dependency for completeness.

If all assets carry their own unique reference, then it should be clear at all times to the DSO which providers and assets hold the current responsibility to deliver capacity, which is very important for the assessment and management of operational risk. Furthermore, it should allow multiple market platforms to operate in parallel without conflict or exclusion. When a DSO order or even a secondary trade is fulfilled on a trading platform, then notice of this requires to be issued in a timely manner so as to avoid any duplication in the event the either counterpart is active on multiple platforms. The responsibility will then lie with the DSO to ensure that actions are coordinated across market platforms, utilising the unique asset ID to identify potentially conflicting orders. This may not be as a result of any intentional attempt to deceive, as with the role of commercial aggregators as well as direct

participation it is possible that an asset could transfer between providers and an up to date register will ensure that the ability to trade is tracked.

7.4 BASELINES

Baselines are an ongoing topic for the development of flexibility services and the widely recognised piece of work seeking to standardise these is taking place within Open Networks. WPD has fed into the working group as well as having directly tested several options in previous innovation projects. It is not the intention of the GAMMA Flex project to develop and propose any new baseline methodologies and expects the options being considered will be adequate for the measurement accuracy levels necessary to support the market designs. The purpose of including baselines within the scope of the market design is in recognition of the growing complexity of varying market entry points along the timeline and that it is unlikely a single baseline method will be workable. Similarly, the range of large asset types and new providers keen to innovate by aggregating large quantities of small loads will need to be supported by whichever baseline options are most suitable. For this purpose, we will analyse a range of mixed scenarios to establish the efficacy of each and make recommendations on rules as to which baseline method should be used for the fairest results in each scenario.

7.5 PAYMENT MECHANICS & PENALTIES

The payment mechanics in IntraFlex were adopted from those originally established by Flexible Power. These have now become the most used within the industry and due to their success and familiarity we will be continuing to include these in the new market designs. The underlying purpose of the mechanism is to encourage realistic if not accurate forecasting of capacity that will be provided on delivery as well as encouragement to maintain a high quality of service throughout an event. This is achieved by inclusion of a small grace factor (5%), automatically rounding up any performance of 95% or above to 100%. This is then countered with a punitive ratchet that reduces payment by 3% for very 1% below 95%.

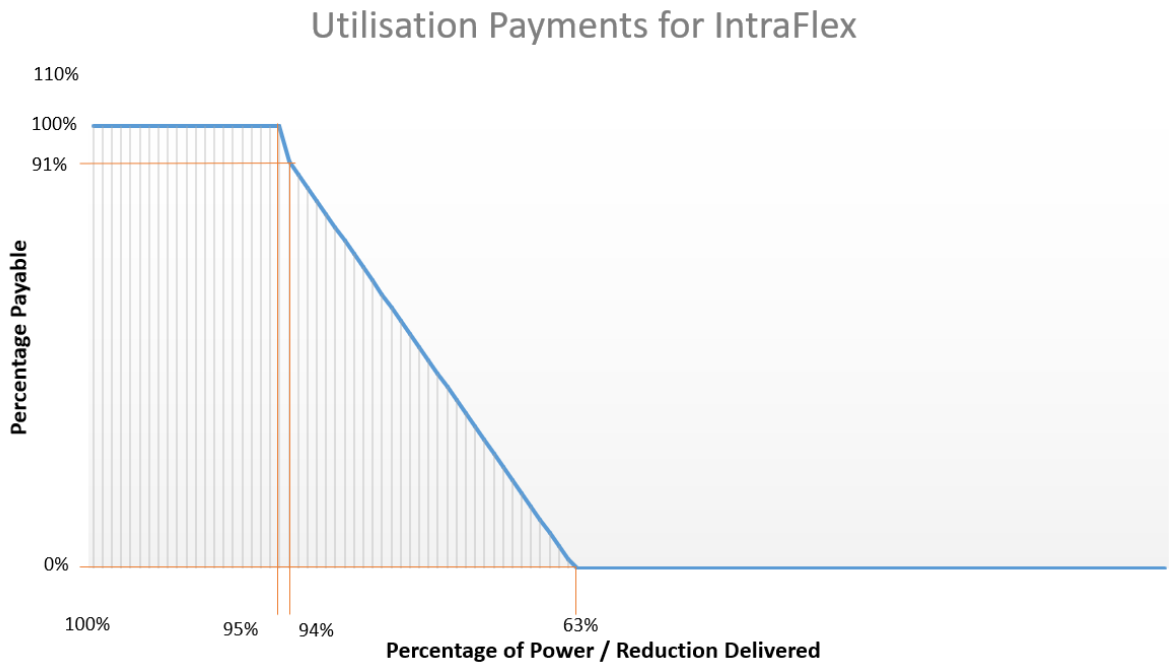


Figure 10- Flexible Power Payment Mechanism

GAMMA Flex includes availability payments under the Long-Term Flex and Mid-Term Flex timescales and so the additional payment mechanisms for this and reconciliation for underperforming will be similarly adopted from Flexible Power. However, as this has been written about previously and published by Flexible Power in its BaU service documents [8] so we will not repeat the details but they can be accessed by following the link in the footnote.

Under the current payment mechanism, FSPs are penalised for partial delivery through a reduction to the payment received but there is no penalty for non-delivery. In addition, we would expect that Market Operators have established rules setting out the consequences for non-delivery. An example of this could be that FSPs are excluded from the market if they consistently fail to deliver. The market design therefore recognises the need for a penalty structure that promotes positive actions on behalf of the providers without introducing excessive castigation that would unreasonably discourage participation. This can be seen as a controversial topic in spite of a widely recognised need to have penalties that balance the incentives. The greatest concerns tend not to be about the wider purpose, but instead the timing of their introduction so as to not inhibit liquidity. It is necessary to recognise that liquidity is not just impacted by willingness to participate, but also the perceptible risk that a DSO undertakes when opting to adopt a flexibility approach over conventional reinforcement. To have any expectation of market growth it is vital that the flexibility services are dependable in order that constraint zones are approved and activated. We propose that we work with FSPs to identify what penalties could look like at

[8] https://www.flexiblepower.co.uk/locations/western-power-distribution/tools-and-documents

this early stage of market development, ahead of future regulatory proposals in this domain. (We recognise that in the longer-term penalties may become part of the regulatory framework set out by Ofgem.) Through consultation with all key stakeholders and inviting their views we expect that the introduction of a well-balanced penalties structure that the result will be improved reliability, leading to increased application of flexibility services and ultimately accelerate the progression towards liquid markets.

Penalties will be automatically introduced at T-1 Year following the activation of the Mid-Term Flex market and issuing of the binding orders. There is also scope to include penalties in the Long-Term market but these would be aimed at addressing any issues that arise from FSP securing contracts then seeking to withdraw without any reasonable justification. If providers are uncertain of their ability to deliver or even more seriously, they become aware that they won't be able to fulfil their order, then they will have the opportunity to request to hand back during the Long-Term phase or post sell bids during the Mid-Term Flex and Near-Term flex phases to transfer some or all of their contracted capacity. This is covered in greater detail in the next section regarding Secondary Trading.

A further aspect of penalties relates to the payment of availability fees and we propose that this too should be aligned with the payment mechanics already developed and being used successfully within Flexible Power. The primary reason for keeping these linked is the desired outcome for setting a reconciliation of availability payments is to further encourage FSPs to endeavour to provide the best quality service they can and provide a realistic forecast of what they can achieve. Flexible Power achieves this by using the following principles:

- If an event does not take place, then the FSP is assumed to have been ready and available, accruing their availability payments as expected.
- Availability is calculated using the actual utilisation performance.
- Each event has an expected kWh volume of delivery is calculated as the forecast capacity multiplied by the event duration.
- The average volume delivered is then calculated as a percentage of the total volume expected across the events for an entire month.
- The FSP is then paid the calculated percentage of the total accrued availability.

One particular sensitivity that could influence the way that an FSP regards the potential reconciliation could be the period over which the reconciliation percentage is calculated. This could range from a per event granularity to daily, weekly or monthly as with Flexible Power and in doing so vary the emphasis of the incentive / disincentive. As with other penalty mechanisms proposed within the market design, we wish to ensure that these are fair and proportionate, and so have included this in the questionnaire rather than explicitly specifying which is most appropriate.

7.6 Secondary Trading / Contract Surrender

As mentioned, previously within the document, Secondary Trading is probably the most important and eagerly awaited features of the market design and is the primary driver for other developments including asset tracking and penalties. Secondary trading allows FSPs

to trade out of a position if the FSP realises that it cannot deliver on what it has contracted. Secondary trading should in theory build liquidity in the market by encouraging new participants who have previously found the contracting structure rigid and unable to accommodate uncertainties around their ability to forecast future capacity.

In the current early stages of market development, we see benefit in limiting market participation to FSPs with physical generation or demand assets. This is because the market is at present extremely illiquid. There would be a high risk that an FSP without generation or demand assets could not find a counterpart who has assets, dramatically undermining the reliability that the DSO is seeking from flexibility schemes.

As the market develops, we do not rule out allowing FSPs without physical assets to participate, but this is not expected to become a feature within the foreseeable future.

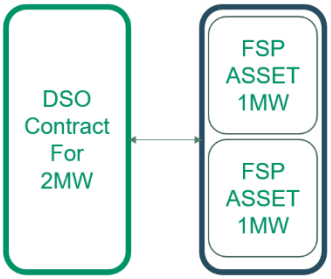
We are also initially proposing a capacity limit, corresponding to the maximum flexibility that could be delivered by the FSPs assets. An FSP would not be able to enter into contracts in excess of their capacity limit. On the one hand, if FSPs are allowed to sell a total quantity that exceeds what the FSPs own assets can deliver, there is a risk that the FSP will not be able to secure the volumes to fill the gap from another provider – particularly in a very illiquid market. Additionally, with penalties for non-delivery, FSPs have an incentive to not sell flexibility that exceeds what its assets can deliver which will then have a knock on negative impact on their potential to earn due to the payment mechanics adopted from Flexible Power. It is important to note however that an FSP can continue to add assets, create new portfolios and submit bids to the market so as to ensure that they can continue to secure capacity as their capabilities grow. The market design is intended to encourage and enable increasing liquidity throughout the life of a constraint requirement but with the underlying emphasis on reliability of forecasting and delivery that ultimately protect the network as a top priority. It may even result that the opportunity to secure contracts for proposed assets may help accelerate their commissioning in order to be obtain the award.

The main motivation for introducing a secondary trading function is to improve the level of control afforded to providers over their contracts to help ensure they are not be deterred from participation by being locked into operational decisions, which they may have to later alter. To make this as attractive as possible there are two mechanisms that are designed to help providers retain control of their operations. The first is the ability to engage in the Long-Term flex phase of the market design and obtain agreements in principle which do not become automatically binding until T-1 year from delivery, when the Mid-Term Flex market is activated. Right up until the end of the Long-Term Flex period, it is permitted for a provider to submit a request to cancel the 'contract in principle'. If approved by the DSO, the capacity they were expected to deliver is returned to the pool, and the DSO will try to award to another Long-Term Flexibility provider or include in the requirements update that coincides with the Mid-Term Flexibility phase.

Once in the Mid-Term market the responsibility to find an alternative provider and transfer the responsibility to deliver service reverts to the provider holding the contract. They can then use their ability to place sell orders on the trading platforms so that they can then find an alternative provider for some or all of their contract. As with seller bids posted by the

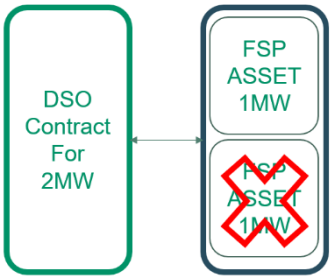
DSO, they can only be accessed by other providers who have assets in the correct location and limited to the capacity of the assets they have already had approved by the DSO. There is a great deal of work necessary to create the rules and the technical capabilities that will enable this and could result in some unusual challenges to other work packages such as those within baselines.

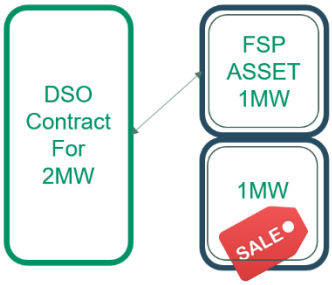
An illustration of the secondary trading why it should be attractive to an FSP is outlined below.



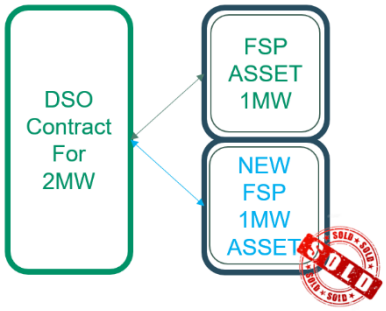
In this simple scenario the DSO publishes a requirement for a 2MW contract which is then awarded to an FSP who has 2 x 1MW assets. On this basis they should have adequate capacity to fulfil the expected delivery. If they then unfortunately encounter an issue that renders one asset out of use their maximum delivery would be only 50%. This is a major issue due to the way the payment mechanics work, as shown in section 7.5

With utilisation payments ceasing at 63% then if they were to run the single remaining asset, they would encounter the operational cost, but for no financial benefit. It is therefore reasonable to assume that in the absence of penalties their most likely response will be to do nothing and just default on the event. This is clearly not what the DSO would prefer, and therefore we want to present an opportunity to reoptimise.





By allowing the FSP to split the commitment into 2 x 1MW contracts they can realign their expected delivery with their reduced operating capacity and reinstate the full incentive for the remaining asset. This will in turn reduce the penalty of non-delivery from a 2MW exposure to just 1MW. This could then be paid from the income generated from the smaller contract if a counter party can't be established.



The ideal outcome for everyone is if an alternative provider can be identified for the residual 1MW and a new contract created to transfer to a viable asset. Although the original FSP publishes this within the secondary market, the contract award is directly between DSO and the new provider with the default value being that which was associated with the original rates from the 2MW contract. In order to make the opportunity for a new FSP to take up the contract more attractive it is feasible that the original holder of the contract could supplement the rate being offered up to the equivalent of the penalty they will otherwise receive if a new FSP doesn't take over the contract.

7.7 Reverse Services / DTU

'Reverse Services' are often referred to Demand Turn (DTU), so as to include the turn down of generation, providing the same net effect as increasing load. There have been previous services operated by the TSO & DSO to demonstrate this capability as well as BaU deployment of a simplified service to manage the risk of high renewable yields during Covid lockdown in 2020. This was generally targeted at the renewable generator operators and favoured the principle of completely reducing export to zero to make the administration of the service very simple. The reality for a market-based trading arrangement is likely to be far more complex and as with the secondary trading work package will require the project to consider edge cases and present solutions to stakeholders for feedback before establishing rules for the blueprints that will be published as ultimate deliverables of the of the project.

The initial viewpoint can easily mistake the service rules will only require a direct reversal of those used for load constraints and turning generation down where it would otherwise be increased and increase load when it would otherwise be reduced. If we again consider how a baseline may be applied in the circumstance where a renewable resource such as a wind farm or solar generator might consider constraining their generation. With DTU the easiest way to instruct a provider is to set an arbitrary export value which they should not breach during the DTU event. However, the way the market works for conventional DSR is to establish what the expected behaviour will be i.e. the baseline output and submit offers to the market based upon how much will be reduced. With uncertainty in this example around what the actual output of the renewable generation may be at the time of the event, it can make it very difficult to simply use the normal flex services and simply swap the direction the response is paid to shift.

Another potential use case will be directly between providers with the DSO being a relatively passive party in the arrangement. In this example 'Provider 1' has a renewable generation farm that operates on an ANM (Active Network Management) scheme that reserves the right to reduce generation if the network is lacking localised load or capacity to move the electricity to where load exists. 'Provider 1' is also in receipt of government incentives which is offered on top of the direct value of the electricity being sold. As such

'Provider 1' when notified of a potential curtailment window, could place a buy order to secure increased load or turndown of another generator so that they can continue to operate and collect their incentives as long as the net income after paying 'Provider 2' to increase load is profitable.

This is a procedure we are keen to introduce as it compliments Ofgem's recent proposal where the DNO could be fined for excessive curtailment of generating assets. Rather than introducing fines it would be preferable to establish a market solution. However, it will prove challenging to explicitly ring-fence the capacity that 'Provider 1' has enabled through transacting with 'Provider 2' and ensure that this is allocated to them in reduced curtailment capacity. To make this possible it will be necessary to review existing rules for ANM operation and the technical solutions necessary to integrate ANM control with any market actions intended to impact it.

8 WHOLE SYSTEM COORDINATION

The initial concept for whole system coordination is initially focussed on addressing conflicts with the services provided by the ESO & TSO which are referred to in section 5.5 so as to highlight the conflicts that currently exist. The TSO requirements are quite different and previous research has managed to establish a far better alignment of requirements. This was documented in the close down report of Project SYNC[9] that identified correlation between excess solar generation on the distribution networks in the southwest and limited capacity on the transmission network. Based on the findings it should be possible for distribution and transmission to both derive benefit from the acquisition of DTU services from an asset that is contained in both constraint areas. This is shown below in figure 9 as a simplified representation constrained generators (shown in pink) within the transmission and distribution network hierarchy.

In this example, you can see that depending on the point of connection of the sites belonging to the eight flexibility providers it directly impacts their ability to support constraint events. The optimal sites for impact are from providers 3 & 4 as any action they take will be realised at the transmission, high voltage and low voltage constraints. The assumption is therefore likely to be that through coordinated action the TSO should share the costs of using sites 3 & 4 or at the very least exchange operational information so that they don't find themselves competing on price to in effect dispatch identical actions for different purposes.

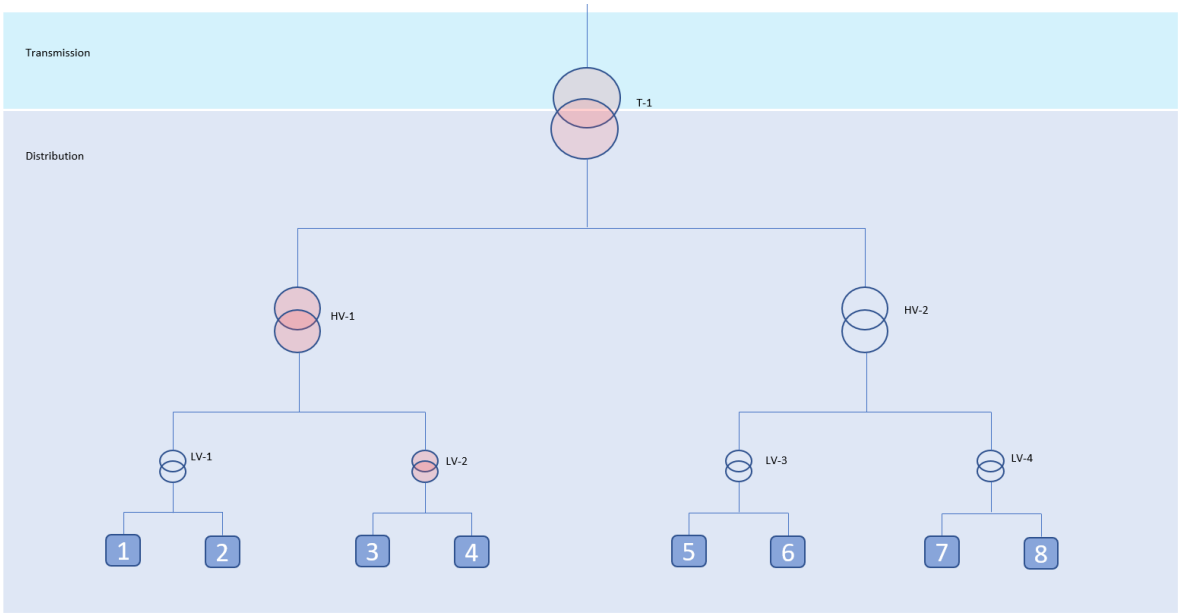


Figure 11- Simplified schematic of DTU constraints at multiple voltages

The sharing of information between network operators is also important, as it is feasible that due to the lack of operational conflict the provider could sell their service to the DSO and TSO simultaneously and be paid for the benefits they deliver for assets T-1, HV-1 and LV-2. There is a strong case as to why this should be possible but could result in unintended negative consequences.

Once the payments for reducing demand exceed the cost of electricity it creates a paradox where a provider could consume electricity in a wasteful manner such as switching on lighting and running heating in unoccupied buildings as they would still profit from their actions. It is therefore important that the method of providing an event response is appropriate or the payment is capped no greater that the cost of electricity.

By opening up the opportunity for platforms to create independent markets there is a reasonable likelihood that they will ultimately want to offer services to all interested parties and not just DSO Flexibility. From this ubiquitous approach it should be possible for new markets to develop their own solutions to greater coordination of forecasting and DSR events by identifying scenarios like those above where multiple outcomes can be achieved from the optimal asset selection.

Whole system coordination could be extended to other areas such as combining wholesale markets with assets that can attract service payments, combining the benefits of ancillary services such as the ones covered in this document, with commodity trading that is a well-established component of the energy industry.

The whole system approach should also ensure that there are no barriers between marketplaces. The DSO should be able to simultaneously post requirements and bids across all platforms and when they are matched with offers ensure that real time updates

proliferate across all outlets. Similarly, if a provider is granted a contract via one market platform it should be free to transfer that responsibility and resell its contract by whichever market platform they wish and not be restricted to go back through the one they were awarded from in the first place.

9 BLUEPRINTS FOR MARKET INCLUSIVITY

In order to fulfil the regulatory requirement of facilitating neutral markets, it is the expectation that there needs to be a fair and transparent structure on which all markets are based. Markets can then differentiate themselves through the offerings they present to providers whilst maintaining consistent standards in the way they interact with the DSO and the Flexible Power hub which encompasses all the operational tools they require. Managing this conflict between the desire to standardise some aspects of the interactions while granting market platforms the autonomy to innovate and compete with each other is a significant challenge. For this reason we have adopted the principle of 'blueprints' that set out the minimum requirements in many of the key areas that require coordination without becoming overly prescriptive. The blueprints will provide guidance and a compliance checklist that should make it relatively simple for any new platforms to ensure that they will be able to contract with the DSO without the need to negotiate individual terms or that they will be limited by another platform being granted exclusive rights.

We have identified a number of areas where blueprints would be required. In this release of the document, we have not yet commenced the contents for each and invite feedback from stakeholders as to what should be included;

9.1 LEGAL FRAMEWORK

The legal framework is not the contract that will require to exist between the DSO & the market platform but instead, reflects the relationship between flexibility providers and the platform operator. There may then be a further relationship that exists between the asset owner and the asset operator if, for example, an aggregator or other such entity is in place to manage the bidding and commercial operation of assets as highlighted in Figure 1, Section 3 of this document. On this basis it is important that we ensure that whatever the contractual relationship between the actual asset and the organisation buying or selling flexibility, the legal framework will be required to capture specific terms and conditions. Some of these may be able to be lifted from the DSO / Market Operator contract to ensure that they ensure a back to back of responsibilities while others could require to be tackled differently to ensure that they don't overly restrict the ability to innovate and create novel offerings that enhance the services that are developed.

9.2 DATA PROTECTION / STORAGE / ACCESS

Data is a critical aspect of the services and relationships between the multiple parties that interact in order to create the capabilities that make up the Flexibility Markets. These could feasibly transfer between asset owner, asset operator, supplier, aggregator, market

platform and DSO, so it is important to ensure that any data is handled appropriately. The blueprint relating to data handling is intended to ensure that all data is appropriately categorised and any rules relating to how it is transferred, processed or stored are clear to ensure that there are no breaches of rules, which may be set within the contracts or broader legislations such as General Data Protection Regulation (GDPR).

9.3 ASSET REGISTRATION / TRACKING

The actual registration of assets and the ability to track them is out of scope for the GAMMA Flex project itself and there has already been some level of discussion within the energy industry, highlighting the need for such capabilities due to the continued growth of Distributed Energy Resources (DER). DER can range from very small 'behind the meter' devices at a domestic level through to relatively large assets such as generators or batteries of several tens of MWs connected to distribution networks. Many of the use cases behind having comprehensive registers are intended to ensure that the DNO/DSO can operate the networks safely and ensure reliability in spite of so many potentially active users. This may result is registers developed by each DNO/DSO or a more coordinated approach involving organisations with a national view such as National Grid, Elexon, ENA or Electralink to highlight just some of the potentially interested parties. We would therefore expect that the blueprint for the Flexibility Market Design should only represent a stakeholder view that ensures that any register that addresses the wider challenges of tracking DER takes the operation of Flexibility Markets into consideration. The main objective is to ensure that all assets regardless of size can be verified as to their suitability for providing services, which will include such parameters as location, asset type, permits and authorisation to operate. This needs to be possible, regardless of whether the asset is operated directly or within a portfolio with multiple intermediaries, which highlights the need to create a unique identifier that can be used to track who and when has control of every assets and avoid conflicts such as duplication.

9.4 REALTIME OPERATIONAL DATA EXCHANGES / API

Data exchanges and in particular APIs have been the subject of industry discussions as to whether there is benefit to standardise across multiple industry bodies including the ESO, TSO and DSO. As with the previous section on registration, it is deemed 'out of scope' for this project to attempt to set an API specification. Instead, the blueprint seeking to determine an API should be focussed on identifying all the functions and potential data fields that could be contained within and identifying which should de mandated or optional. The leading principle of the GAMMA Flex design is to open up the opportunity for Neutral Market Facilitators to retain the ability to build their platforms as they wish and as much as possible, we should avoid introducing limits on their creativity. The proposal would therefore be to create a blueprint that would be associated with a resource very similar to a 'GitHub' that would enable platforms to comply with industry standards without limiting their own scope to enhance and develop operational advantage between platforms.

10 STAKEHOLDER QUESTIONNAIRE

Although the GAMMA Flex Project has the objective of producing a new market design for the purposes of neutral facilitation of Flexibility Markets, there are several aspects of the design that we would like to approach on a consultative basis. There are at least four different categories of key stakeholders, and it is reasonable to expect that they may have a differing viewpoint on certain functions or features of the overall design. Therefore, rather than being prescriptive and finalise every aspect of the model, it is recognised that in some of these areas where options are apparent and may impact the success of the final outcome, we should seek feedback.

10.1 AVAILABILITY PAYMENTS (LONG-TERM AND MID-TERM CONTRACTS)

10.1.1 For competitive bidding which would be most appropriate in order that a clearing price can be stablished **A) Fixed ratio between Availability & Utilisation and total price** **B) Fixed Availability price and competition on Utilisation Price** **C) Fixed Utilisation price and competition on Availability Price**
Feedback:

10.1.2	**Should market design specify award on 'pay as bid' or 'clearing price' basis or should this be at discretion of each DSO's individual terms?**
	Feedback:

10.1.3	**Availability payments should be clawed back if utilisation thresholds aren't achieved. If utilisation delivery volumes are used to determine the proportion of availability payment that should be paid it is necessary to determine the period over which this is assessed.** **Which of the following examples would be best suited?** ***A. Any events not dispatched assume full availability and should be paid.*** ***B. Any dispatched events have delivery volume % used to calculate availability payment on a per <u>event</u> basis*** ***C. Any dispatched events have delivery volume % used to calculate availability payment on a per <u>day</u> basis*** ***D. Any dispatched events have delivery volume % used to calculate availability payment on a per <u>week</u> basis*** ***E. Any dispatched events have delivery volume % used to calculate availability payment on a per <u>month</u> basis***
	Feedback:

10.2 Non-Delivery Penalties (separate from partial / under delivery)

10.2.1 What would be deemed to be a fair and acceptable financial penalty for 'non-delivery' that would not present barriers to the development of liquidity in the market?
Feedback:

10.2.2 Should financial penalties be applied on a ½ hourly basis or for an event when there are multiple consecutive ½ periods that make up a longer event?
Feedback:

10.2.3 Below what % of delivery should be regarded as non-delivery as opposed to partial delivery for which the payment mechanics already exist to manage?
Feedback:

10.2.4 Without the introduction of additional 'non-delivery' financial penalties, is the threat of suspension or termination appropriate incentive to participate in the secondary market?
Feedback:

10.3 SECONDARY TRADING ARRANGEMENTS

10.3.1 Our market design proposes the rule that there should be no provision for non-physical participants to trade within the marketplace. i.e. The ability for a participant to bid capacity should be limited to a maximum capacity of the approved assets they have within the specific constraint zone. **Do you agree with this assertion?** **If not, then please explain why and where inclusion on non-physical trading in the future would be of any wider benefit to development of a reliable market.**
Feedback:

10.4 BASELINE *METHODS*

10.4.1 Are you aware of the standard baseline workstream that has been operating within Open Networks?
Feedback:

10.4.2 Do you agree with the findings?
Feedback:

10.4.3 Have you seen or used the tool ON have developed in conjunction with TNEI to calculate flexibility baselines?
Feedback:

10.4.4 Would you like to see this embedded as a standardised tool for all marketplaces?
Feedback:

10.4.5 Are there any other methods of baselining that you believe should be included in order to improve the arrangements for the proposed market design?
Feedback:

10.5 BLUEPRINTS

10.5.1 Are there any additional headings that you think should be included in the blueprints to standardise market design?
Feedback:

10.5.2 What rules would you like to see included within the following areas? ***10.5.2.1 Legal Framework /*** ***10.5.2.2 Data Protection / Storage / Access*** ***10.5.2.3 Asset registration / Tracking Principles*** ***10.5.2.4 Realtime Operational Data Exchanges / API***
Feedback: Legal Framework /
Feedback: Data Protection / Storage / Access
Feedback: Asset registration / Tracking Principles
Feedback: Realtime Operational Data Exchanges / API