Primacy Draft Rules Increment 1

Open Networks

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Introduction

About ENA

Energy Networks Association (ENA) represents the owners and operators of licenses for the transmission and/or distribution of energy in the UK and Ireland. Our members control and maintain the critical national infrastructure that delivers these vital services into customers' homes and businesses.

ENA's overriding goals are to promote UK and Ireland energy networks ensuring our networks are the safest, most reliable, most efficient and sustainable in the world. We influence decision-makers on issues that are important to our members. These include:

- Regulation and the wider representation in UK, Ireland and the rest of Europe
- Cost-efficient engineering services and related businesses for the benefit of members
- Safety, health and environment across the gas and electricity industries
- The development and deployment of smart technology
- Innovation strategy, reporting and collaboration in GB

As the voice of the energy networks sector, ENA acts as a strategic focus and channel of communication for the industry. We promote interests and good standing of the industry and provide a forum of discussion among company members.

About Open Networks

Britain's energy landscape is changing, and new smart technologies are changing the way we interact with the energy system. Our Open Networks project is transforming the way our energy networks operate. New smart technologies are challenging the traditional way we generate, consume and manage electricity, and the energy networks are making sure that these changes benefit everyone.

ENA's Open Networks Project is key to enabling the delivery of Net Zero by:

- opening local flexibility markets to demand response, renewable energy and new low-carbon technology and removing barriers to participation
- providing opportunities for these flexible resources to connect to our networks faster
- opening data to allow these flexible resources to identify the best locations to invest
- delivering efficiencies between the network companies to plan and operate secure efficient networks

We're helping transition to a smart, flexible system that connects large-scale energy generation right down to the solar panels and electric vehicles installed in homes, businesses and communities right across the country. This is often referred to as the smart grid.

The Open Networks project has brought together the nine electricity grid operators in the UK and Ireland to work together to standardise customer experiences and align processes to make connecting to the networks as easy as possible and bring record amounts of renewable distributed energy resources, like wind and solar panels, to the local electricity grid.

The pace of change Open Networks is delivering is unprecedented in the industry, and to make sure the transformation of the networks becomes a reality, we have created six workstreams under Open Networks to progress the delivery of the smart grid.

2022 Open Networks Project Workstreams

- WS1A: Flexibility Services
- WS1B: Whole Electricity System Planning and T/D Data Exchange
- WS2: Customer Information Provision and Connections
- WS3: DSO Transition
- WS4: Whole Energy Systems
- WS5: Communications and Stakeholder Engagement

Our members and associates

Membership of Energy Networks Association is open to all owners and operators of energy networks in the UK.

- Companies which operate smaller networks or are licence holders in the islands around the UK and Ireland can be associates of ENA too. This gives them access to the expertise and knowledge available through ENA.
- Companies and organisations with an interest in the UK transmission and distribution market are now able to directly benefit from the work of ENA through associate status.

ENA members

Cadent – Your Gas Network
electricity north west – Bringing energy to your door
ESB NETWORKS
gtc
nationalgrid
nationalgridESO
Northern Gas Networks
Northern Ireland Electricity Networks
NORTHERN POWERGRID
Scottish & Southern Electricity Networks
SGN – Your gas. Our network.
SP ENERGY NETWORKS
UK Power Networks – Delivering your electricity
WALES&WEST UTILITIES
WESTERN POWER DISTRIBUTION – Serving the Midlands, South West and Wales

ENA associates

- Chubu
- EEA
- Guernsey Electricity Ltd
- Heathrow Airport
- Jersey Electricity
- Manx Electricity Authority
- Network Rail
- TEPCO

Executive Summary

This report summarises the Primacy Rules selected to trial across the chosen Use Cases within Product 5 of WS1A of the ENA's Open Networks project.

Following the initial use case prioritisation process, work was carried out on the interaction between different assets operating as part of ESO's Short Term Operating Reserve (STOR) and DNO Active Network Management (ANM) schemes in the same area. This highlighted a number of complex trade-offs, with the potential for impacts on various market participants. As such, following discussion with Ofgem and BEIS, the focus of initial rules development was changed to the simpler interactions between ESO and DNO procured flexibility services. The ANM Use Cases have been deferred to the next rules development increment to allow for more robust analysis on the cost and benefits. The product is seeking consultancy support to drive this work forward in parallel.

In this report, the product team have focussed on the delivery of the Transmission Constraint Management Service and the DNO active power services (other than Restore). We have also assessed a number of use cases within the Balancing Mechanism and how these may interact with DNO services. All of these cover different assets in each service, but that are in the same area.

These use cases are simpler than those involving ANM, as they include no credible options to give the ESO priority where conflicts arise. Due to the geographic constraints surround DNO Flexibility Services, there are limited alternative options. As such the rules have focussed on different variants of "DNO priority" rules, each with differing timescales for the sharing of data, and the consideration/or not of outages.

Given the deadline of the end of ED1 for the testing then roll out of some primacy rules as set out in the Smart Systems and Flexibility Plan, the simpler rule, 1a, which includes basic data sharing ahead of real time has been selected for trial and roll out. However, given the benefits of further data sharing, we support the further investigation into the design and trial of Rule 1b, which includes more extensive sharing of data, so that we can roll out the benefits as early as possible.

We recognise that rules will need to evolve and improve over time to include enhanced exchanges of data to (i) understand system issues across both transmission and distribution, (ii) identify markets behaviour and (iii) coordinate the dispatch of market participants (e.g., generators, storage and DSR). We will allow for ongoing review of the explicit Rules (to ensure they continue to meet the overall Primacy Principles), whilst also improving forecasting ability and, ultimately, the overall decision-making process.

The rules associated with the TCM Use Case will be taken forwards to trial as part of the Regional Development Programmes (RDPs), with the implementations assessed and reviewed ahead of the publishing of final rules. Rule 1a will be tested within the WPD RDP in the South West. UKPN and the ESO will continue to investigate the elements of Rule 1b that can be delivered as part of the RDP in the South East, recognising that new processes need to be developed in relation to the additional data sharing requirements within this Rule. The sub Use Cases highlighted in relation to the Balancing Mechanism will also be further developed and rules applied where possible ahead of ED1. Due to the limited expected conflict the trial will focus on the creation of mutual robust data sharing processes between the ESO and DNOs and will be implemented to the extent where these are achievable ahead of the end of ED1.

Finally, the development of the rules has highlighted the need for a robust planning process to assess the benefits of actively managing conflicts. These will need to identify and then balance the costs and benefits of active conflict management against alternative options to ensure the most efficient outcome. This will ensure that the operational decision making developed in the primacy rules, continue to deliver an operable and economic whole system.

Introduction to Primacy

The ESO and DNOs manage the respective transmission and distribution networks in accordance with applicable standards and licence conditions. Each organisation may require one or more services for this purpose. Conflicts between one or more of these services lead to inefficiencies within the whole electricity system. This will likely increase given the rising procurement of services and limited coordination to date. Hence, in order to manage this potential service conflict and to enable networks to be optimised efficiently and transparently, there is a need to develop a set of clear principles and "primacy" rules. These will enable procurement, planning, scheduling and dispatch of services to be influenced by whole system value and ensure that the division between market/price-driven actions and the electricity system hierarchy of operational needs is clear and transparent.

These rules will look to balance: the local networks' technical requirements; the risks to the overall operability of the whole system; the value for Service Providers through the facilitation of market / price driven actions; the needs of emerging market-based platform developers; and ultimately the overall cost impact on end consumers.

Last year, the Open Networks project started work to develop these rules and will then consider the likely processes, data exchange and systems required to implement a consistent approach across GB. This started in July with the review of existing work in the field and the development of a product plan. This is highlighted below and available in more detail on the ENA website here.

Ref	Product Element	Activities	Duration	Timeline	Deliverables
0.1	Develop and agree primacy principles for a range of likely scenarios; prioritised by value to networks and FSPs, the likely needs timeframe and deliverability.	Map out and define expected use cases / flexibility scenarios where close coordination and co-optimisation in both planning and operational timescales are required. Prioritise the Use cases and feed them into the project plan. Also define the Primacy Principles. These overarching principles will help determine the value of subsequent rules.	3 months	Sep - Nov 2021	Report setting out primacy principles for network coordination and co-optimisation for a range of defined scenarios / use cases prioritised by value to networks & FSPs, likely time to need and deliverability.
0.2	Set up Primacy focus group	Establish a Primacy focus group consisting of users with relevant experience and / or currently navigating both DNO and ESO service provision, to review and challenge the use cases / scenarios; their value and timings	1 month	Sep-21	Focus group in place with clear Terms of Reference
1	**Iteration 1 Development & Deployment (Limited Use Case(s))**		16 months	Dec 21-Mar23	
1.1	Develop draft Primacy Rules	Using the principles develop a draft set of Primacy Rules for the specific use case. Also determine the success criteria for the	4 months	Dec 21-Mar 22	Report setting out the draft Primacy Rules identified and approach to trialling. Report to also

		testing of the rules. Leverage focus group input.			assess high level impacts on networks, FSPs and platform providers.
1.2	Develop the necessary processes and information sharing needed to support the rules	Understand the required changes to ESO, DNO, and FSP processes to accommodate the draft rules for the relevant use case.	3 months	Jan-Mar 22	Tied to the above
1.3	Implement the designed processes and information flows	Implement the above processes to allow testing of the primacy rules. This will leverage existing testbeds such as RDP, TEF or other projects.	3 months	Apr-Jun 22	N/A
1.4	Test the rules	Run the rules and identify any issues (against the earlier defined success criteria)	3 months	Jul-Sep 22	N/A
1.5	Review the rules and processes and establish roll out process	Review the rules, identify any changes needed. Sign off a full roll out programme to accommodate the Primacy Rules	3 months	Sep-Nov 22	Report setting out the learning and outcomes from the testing of the Primacy rules.
1.6	Publish V1.0 of Rules, proposed review periods and target date for roll-out at scale	Accommodate the trial learnings into a V1.0 of Primacy Rules Consider the need for further review and improvement of the proposed rules at both T and D.	2 months	Dec 22 - Jan 23	V1.0 of the Primacy Rules published.
1.7	Establish Governance process for Primacy rule reviews	Determine governance of Primacy Rules; and review periods to check Primacy Rule validity against evolving system operability challenges in future.	5 months	Nov 22 - Mar 23	Primacy governance paper. This will determine a short terms means of governing the rules as well as a route towards an enduring governance framework.
1.8	Implement Rules and Processes across DNOs and the ESO	Roll out the rule across the relevant use cases. This may or may not include all DNOs depending on the use case need.	5 months	Nov22 - Mar 23	N/A
2	**Iteration 2 Development & Deployment (Limited Use Case(s))**		19 months	Apr 22-Oct 23	
3	**Iteration 3…..**	….	..	..	

The timeline was accelerated from the initial Open Networks PID to align with the expectations of the Smart Systems and Flexibility Plan with the first rules expected to be rolled out by the start of ED2.

Due to the wide nature of potential service conflicts, the product is taking an iterative approach to the formation and then the subsequent implementation of Primacy Rules, based on the common set of principles. These have been determined through an earlier deliverable and are highlighted below.

Each Primacy Rule must (in priority order)
Deliver the least Whole Electricity System cost to consumers
Facilitate Fair, Accessible and Efficient Markets.
Be clear, transparent, consistent, inclusive and deliverable.

Underpinning these principles there is a requirement to ensure that ESO and DNOs deliver on where and when applicable to (in priority order without compromising the others):

- efficiently manage national system balance and overall operability
- ensure Transmission Network Security, and
- ensure Distribution Network Security.

This should continue to align with the latest industry standards (as they evolve) whilst also allowing the consistent treatment of both asset and non-asset solutions.

The priority of these Principles will be reviewed throughout the product and the development of the Use Cases. Any updates will be covered as part of the development of the governance documentation/process.

This report focuses on element 1.1, the development of the initial Primacy Rules within Iteration 1.

We will continue to prioritise the potential use cases using the defined Use Case matrix and scoring criteria, select a number to take forward, develop, test and roll out the rules, and then repeat the process. With each iteration we expect to increase our understanding of conflict management, the required data elements, systems and the rules that can be associated with it. In order to roll out the first set of Use Cases and associated Rules, the Product team expect that these will take a simple, but consistent, approach, with additional sophistication being built in and refined over time.

ESO Principle Caveat

Product group members recognise that this is a complex and evolving topic which may necessitate future changes to the Rules, processes and Principles following further development work and subsequent implementation. The Product group will continue to monitor this and ensure any changes are consulted upon through an appropriate governance process and the agreed ENA channels.

Initial Use cases

In our previous Primacy Principles and Use case prioritisation report we detailed the process for the definition and selection of Use Cases to be considered as part of the first iteration.

This involved the development of an extensive framework for the identification and prioritisation of the Use Cases through a mixture of negative and positive prioritisation. We are intending to use the same process to identify Use Cases throughout future iterations. The Use Cases chosen for Iteration 1 were:

Prioritised Use Case	Example
Short-Term Operating Reserve (STOR) and Generation led ANM on different assets in the same area.	Site A is providing a STOR service and is located in a DNO ANM zone. If it is called at a time of ANM curtailment, then any increase in export will be offset by a reduction in generators with ANM connections (as a result of the ANM not being 'aware' of the STOR instruction and simply seeing an increase in generation on the monitored boundaries).
DNO Services, coupled with the DER Transmission Constraint Management service (TCM) being developed via the Regional Development Programmes (RDPs) on different assets in the same area.	Site A is a participant in the DER TCM service (generation turn-down). It may be located in an area that also contains procured DNO flexibility services. If Site A is called by the ESO to reduce export at a time when a DNO flexibility service (in the opposite direction) is also required, then the net effect of the delivery of both services will lead to nullification of the output and inefficient expenditure for both the DNO and the ESO. In addition, if the DNO active power flexibility service is sustaining localised flows on the distribution network, an uncoordinated instruction to reduce MW from the ESO on a different asset in the same geographical area may create and/or exacerbate the DNO network constraint being managed.
The Balancing Mechanism and Generation led ANM on different assets in the same area.*	Site A is an embedded BMU on the DNO network. The DNO has an ANM scheme in place to manage generation export. If Site A is called to increase generation at a time of ANM curtailment, then any increase in export from the BMU will be offset by increased ANM curtailment.

**We foresee significant complexity in this use case and so we aim to investigate potential rules and systems in ED1 with implementation expected to commence in ED2. Due to its scale and importance, we will be taking it forwards so that progress can be made, with testing and implementation of the rules expected in the subsequent increments[1].*

Following extensive work on the development of rules for the STOR and ANM use case, a number of challenges were identified. Due to the nature of the conflict, a number of potential rules identified had the potential to cause impacts on existing parties, be they ANM connectees or providers of STOR services. Robust analysis of the best options to take forwards was not possible within the required timelines for delivery by the end of ED1 as required by the Smart Systems and Flexibility Plan (SSFP). In addition, the simpler rules that were considered as deliverable in the timescales could increase the negative impacts on parties, due to their conservative design. Finally, the operation of ANM systems is being reviewed as part of the Access and Forward Looking Charges Significant Code Review. As such, following extensive discussion with Ofgem and

[1] https://www.energynetworks.org/industry-hub/resource-library/on21-ws1a-p5-primacy-rules-for-service-conflicts-use-case-prioritisation-supporting-slide-(22-dec-2021).pdf

BEIS, it was decided to defer all ANM use cases into rules development iteration 2, where further analysis can be conducted.

Following these discussions, the product team have focussed on the delivery of the TCM and DNO Services use case. For the purposes of clarity, the ESO currently uses services from Balancing Mechanism Units (BMUs) (that are embedded within the distribution network) for TCM purposes however, the specifics of this Use Case will be covered in more detail as part of the further work on the BM sub-Use Cases.

Hence, we have also identified use cases within the Balancing Mechanism that could benefit from the work we have undertaken with in the TCM and DNO services use case. We have explored how the BM could be split into smaller use cases in a later section.

Rules Development Framework

To develop robust rules, a framework was developed.

This considered:

- The pros/cons of each rule.
- The impacted parties (e.g. ESO, DNOs, Providers etc.).
- Alignment with the agreed principles.
- The existing capabilities of the DNOs, the ESO and Providers.
- The further process and system-based development required to take the rules forwards.
- The different timescales for data sharing and decision-making.

An example of the initial framework is shown in Figure 1.

Use Case							
Service 1 Description							
Service 2 Description							
				Timeframe 1	Timeframe 2	Timeframe 3	Timeframe 4
What we have now		Existing Processes & Systems	ESO				
			ENWL				
			SPEN				
			SSEN				
			UKPN				
			WPD				
			Common DNO				
		Legal Limitations	ESO				
			ENWL				
			SPEN				
			SSEN				
			UKPN				
			WPD				
			Common DNO				
Rule 1	Overview	Potential Rule					
		Operating conditions under which relevant					
		Pros					
		Cons					
		Mitigations					
		Impacted parties					
		Rule enforced by					
	Requirements	Required Process & Systems	ESO				
			DNO				
	Alignment with Principles	Delivers the least Whole Electricity System cost to consumers					
		Facilitates Fair, Accessible and Efficient Markets.					
		Is clear, transparent, consistent, inclusive and deliverable.					
	Implementation	New Processes & Systems required to implement	ESO				
			ENWL				
			SPEN				
			SSEN				
			UKPN				
			WPD				
			Common DNO				
	Future	Potential for Improved Processes & Systems	ESO				
			DNO				

Figure 1 - Rules Development Framework

The framework was then expanded to also consider the detailed data sharing requirements as well as compare the various rules selected. This work was carried out to ensure the design of a consistent process between the ESO and all DNO regions across GB.

Transmission Constraint Management and DNO Flexibility Services

Use case overview

This Use Case involves a possible scenario in which the ESO is trying to reduce the export of a single/multiple generator(s) to manage a Transmission Export Constraint when, at the same time, the DNO is trying to procure a Generation Turn Up (GTU)) / Demand Turn Down (DTD) service from different assets in the local area.

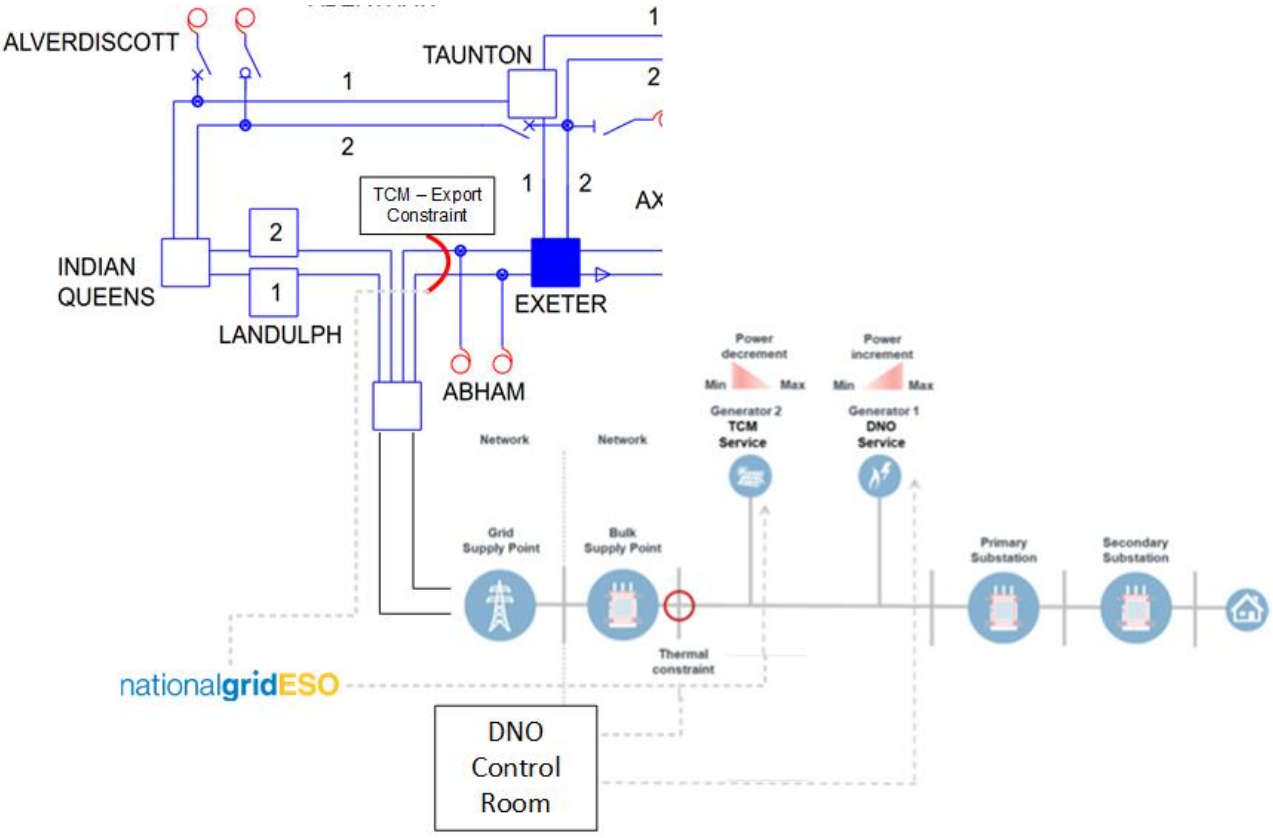


Figure 2: TCM - DNO Service Use case Overview

Transmission Constraint Management

Through the ongoing Regional Development Programmes between the ESO, WPD and UKPN, we are developing the MW dispatch service. This is a Transmission Constraint Management compensated service aimed at DER of 1MW or more whose active power output may be curtailed following an instruction from the ESO. This service allows DER to fulfil their connection terms and conditions as part of the respective Bilateral Connection Agreements between the DER and DNO and then subsequently between the ESO and the DNO. The original RDP study work determined that is likely to be more cost efficient overall for GB consumers in allowing DER to connect under 'Visibility and Control' terms and conditions, in lieu of large transmission reinforcement works. This service is aimed at those parties that don't wish to provide high levels of flexibility within larger market arrangements (such as the BM) however, these alternative options remain open as a means of fulfilling these connection terms and conditions.

As part of the first release, this new service will employ existing DNO network infrastructure up to the DER point of connection to facilitate TCM service. Instructions from the ESO control room will flow through to DNO control room and then on to DER. This will ensure efficient use of existing infrastructure between the DNO and DER with communication or dispatch routes as needed. The ESO will continue to work with DNOs to develop various communication and coordination arrangements, which will include the use of third party routes as part of future releases across of their respective RDPs.

In addition to existing BM participants, this new TCM route complements traditional options for the management of transmission constraints and, should DER choose to provide visibility and commercial control to the ESO via one of these existing routes, this will also satisfy the connection terms and conditions. The deployment of such a service, that is fully coordinated between ESO and DNO processes, will enable the 'connect and manage' principles to be applied on a deeper level, whilst continuing to enable connections in areas where there is high DER activity.

A requirement to participate in the service is included in the connection agreements of generators in the specific RDP areas (South West Peninsula and South Coast). Initial deployment will focus on DER with obligations to provide the service but will extend to voluntary participants in future releases to improve the liquidity of the market and the efficiency of coordination between the ESO and DNOs.

The service is expected to form part of the first roll-out of a fully co-ordinated constraint management service between the ESO and DNOs. Upon successful completion, we will enforce the Visibility and Commercial Control obligations whilst seeking to improve the service over time based on stakeholder feedback and in accordance with the project roadmap. DNOs and the ESO are considering how other visibility and control mechanisms can be built into the service, such as the use of third party applications/infrastructure.

- DNO Flexibility Services

We are covering all DNO Generation Turn Up/ Demand Turn Down services except the Restore service, which is used in rare scenarios. The key parameters, agreed as in P3 of WS1A in 2020, are highlighted below. It should be noted that these are being reviewed as part of WS1A P6 this year.

Service Parameter	DNO Flexibility Products				
	Sustain	Secure (Scheduled)	Secure (Dispatched)	Dynamic	Restore
When required?	Scheduled forecast overload	Pre- fault / peak shaving		Network abnormality / planned outage	Network Abnormality
Risk to Network	Low	Medium		High	High
Utilisation Certainty	High	High		Low	Low
Frequency of Use*	High	Medium		Low	Low
Minimum Flexible Capacity	0-50kW				
Minimum Utilisation Duration Capability	30 mins				
Minimum Utilisation	15 - 30 mins				
Maximum Ramping Period	N/A	N/A	<15 mins	<15 mins	<15 mins
Availability Agreement Period	N/A	Contract stage	Week ahead	Contract stage if applicable	Contract stage if applicable
Utilisation Instruction Notification Period	Scheduled in advance**	Contract stage	Real Time	Real Time	Real Time

* Frequency is location specific defined at the point of procurement

** Utilisation requirements may differ to schedule and be instructed in real time

Table 1 - DNO Active Power Products

Level of Conflict Mitigation

The level of conflict mitigation will depend on the rules selected (see section below) as a result of the level of information sharing between licensees and their forecasting assumptions.

Where conservative assumptions are built into DNO flexibility service dispatch (building on planning assumptions as set out in ER P2/7 and EREP 130) then impact of conflict is minimised. For example, if the DNO assumes minimal contribution to network security from non-contracted generators[2], it will dispatch more contracted assets. The TCM actions of the ESO will counteract the services but will not impact network security.

Forecasting DNO dispatch requirements closer to real time will improve the overall efficiency of DNO services as it can consider a more realistic perspective on non-contracted generation. Feeding in additional data from the ESO, and wider markets on the positions of generators will further enhance dispatches, and whole system outcomes. The additional targeting of services should reduce the periods of conflict. However, this does create more dependencies between parties and more coordinated primacy scenarios. With less leeway (i.e., margin for error between forecasts) in the scenario, the impact of conflict could be higher.

As closer to real time forecasting rolls out further, it will be important to adequately consider the uncertainty of data shared (for example BM participant-submitted data at the Day Ahead is indicative and subject to change)

[2] Non-Contracted from the DNO perspective. This means the DNO does not have an active commercial contract with the asset for the period of time considered.

and the actions still to take to avoid overly constraining future actions and ensure that no undue risk is carried by either the DNO or the ESO.

Optioneering

The product team developed 2 core rules, each with 2 variants.

	Variant A	Variant B
Rule 1: DNO Priority	DNO Priority – Information Shared Ahead of time	DNO Priority – Closer to Real Time Information Sharing
Rule 2: Management of Planned Outages	Additional Coordination of Planned Outages	Closer to real time Planned Outage cancellation

It is broadly envisioned that 'Ahead of time' relates more to timelines up to Week Ahead and 'Closer to Real Time' involves exchange of information at Day Ahead or beyond during control room timescales. It should be noted that the presence of an option within this optioneering process does not place any judgement of merit on the option. At this stage the aim was to understand the available options. The next section highlights the evaluation process undertaken to progress an option through to recommendation.

The rules developed are highlighted in the flow charts below. The flow charts are for illustrative purposes only and do not reflect a detailed delivery model for RDPs, since they present a high-level approach to achieve mitigation of conflicts and coordinated dispatch of ESO and DNO services. It should be noted that there could also be other approaches/variables (not presented as part of this report) that could offer similar or more efficient solutions, which we will further explore as we develop the detailed processes for the primacy rules.

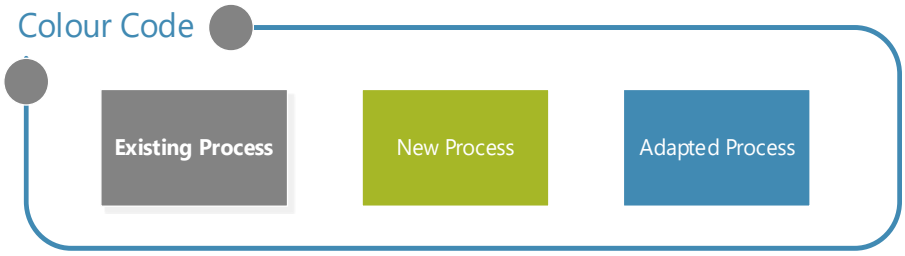


Figure 3 - Flow Charts Colour Code

As RDPs are further developed, and Primacy Rules begin trial, the ESO and DNOs will develop further the details of these processes.

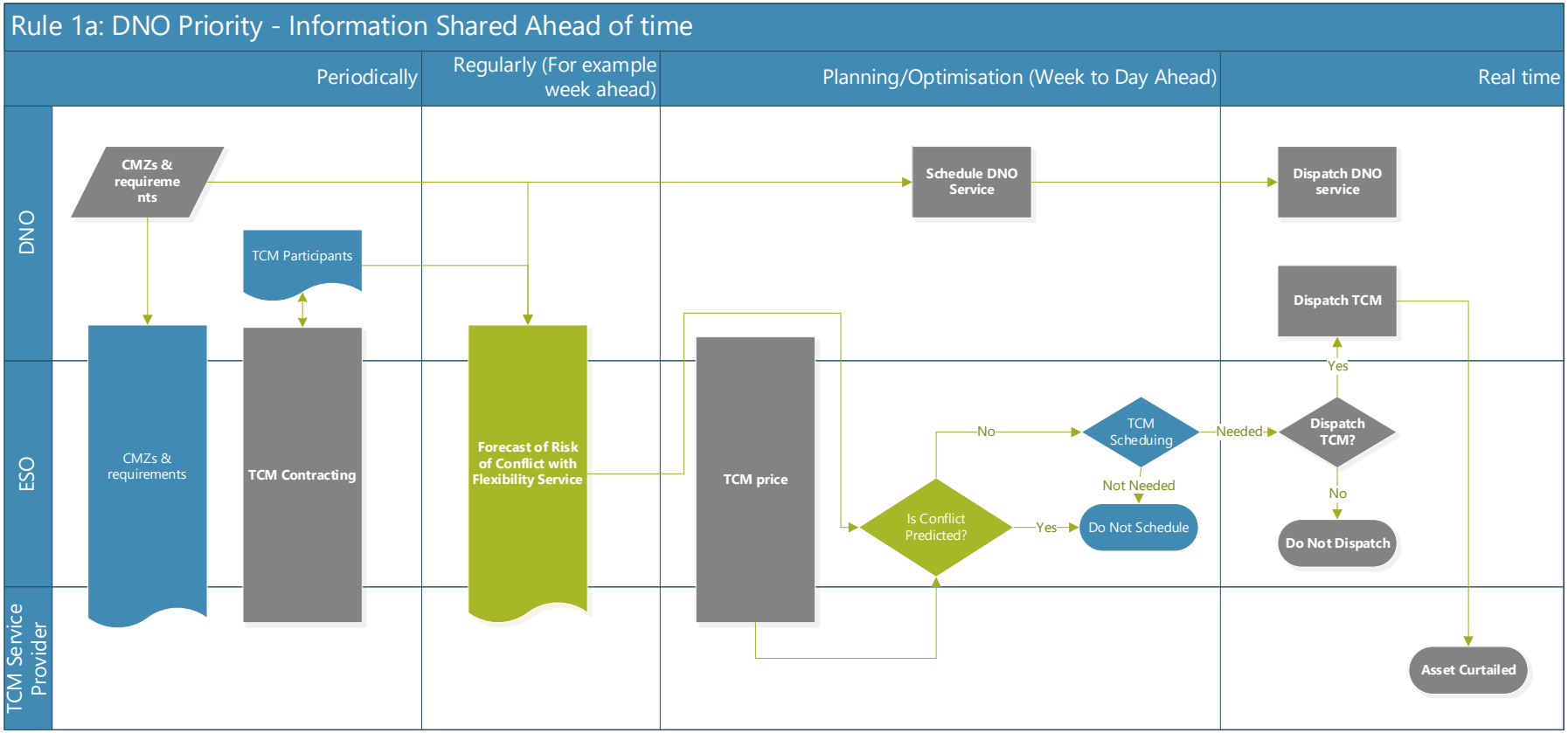


Figure 4 - Rule 1a

In this Rule:

- The DNO services hold priority over the ESO TCM service due to local nature of DNO flexibility and limited alternative options.
- This rule involves the sharing of a commonly agreed “Risk of Conflict” forecast between the DNO and ESO. This would reflect the DNOs approach to forecasting (as highlighted earlier) and translate it into the identification of risk of conflict. This may initially be quite simplistic but will evolve as DNO processes mature. Enhancing the required data elements from the ESO to the DNO may be necessary to improve this forecasting.

- So far, the RDP work has concluded that the “Forecast Risk of Conflict” will be fed into the ESO’s planning processes for the TCM service, with the ESO rejecting TCM sites where the DNO has identified a risk of conflict. This allows for a consistent, simple implementation for the ESO, with the onus for conflict identification residing with the DNO in a regular data sharing process in planning timescales.
- The data sharing processes in this use case are relatively simple. As they are not near real time, they can rely on the upload and download of data from an online portal, or the sending of CSVs via Email.

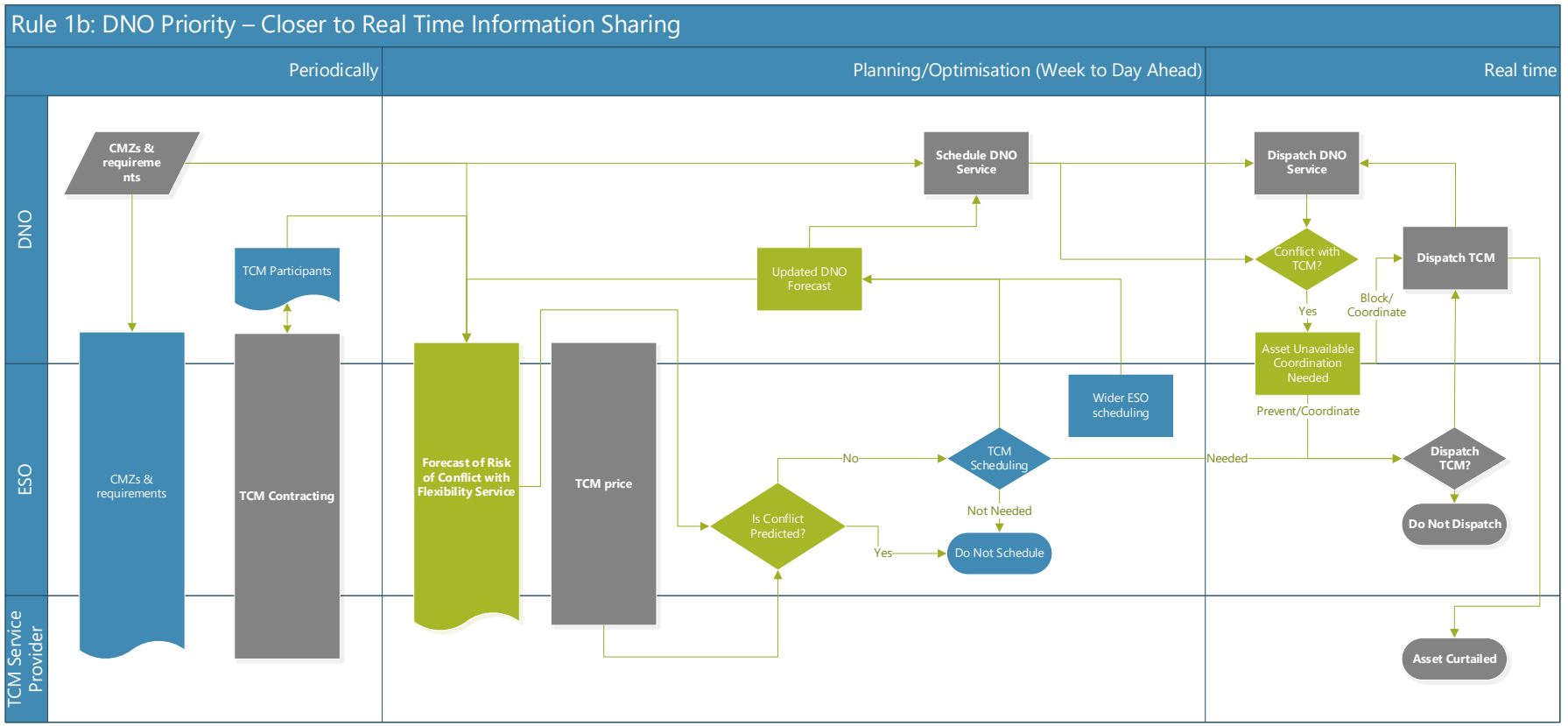


Figure 5 - Rule 1b

This Rule builds on 1a and adds:

- Additional required information flows from the ESO to the DNOs (in agreed timescales) to allow for better forecasting of flexibility requirements and potential risk of conflict.
- Enhanced real time systems that allow for the assessment of distribution of network conditions and constraints at Day Ahead. This will inform the understanding of conflicts by the DNO and the sharing of this information with the ESO.
- As such, this combines the longer term information from 1a (which can serve as an indication from and to the ESO), with the closer to real time view from the DNO serving as the final view on whether conflict is likely to materialise. This should be much more accurate as it improves forecasting accuracy and takes account of real-time network dynamics.
- The DNO holds the ability to enforce the rules, due to the current implementation of this service and the use of DNO equipment to implement dispatch.

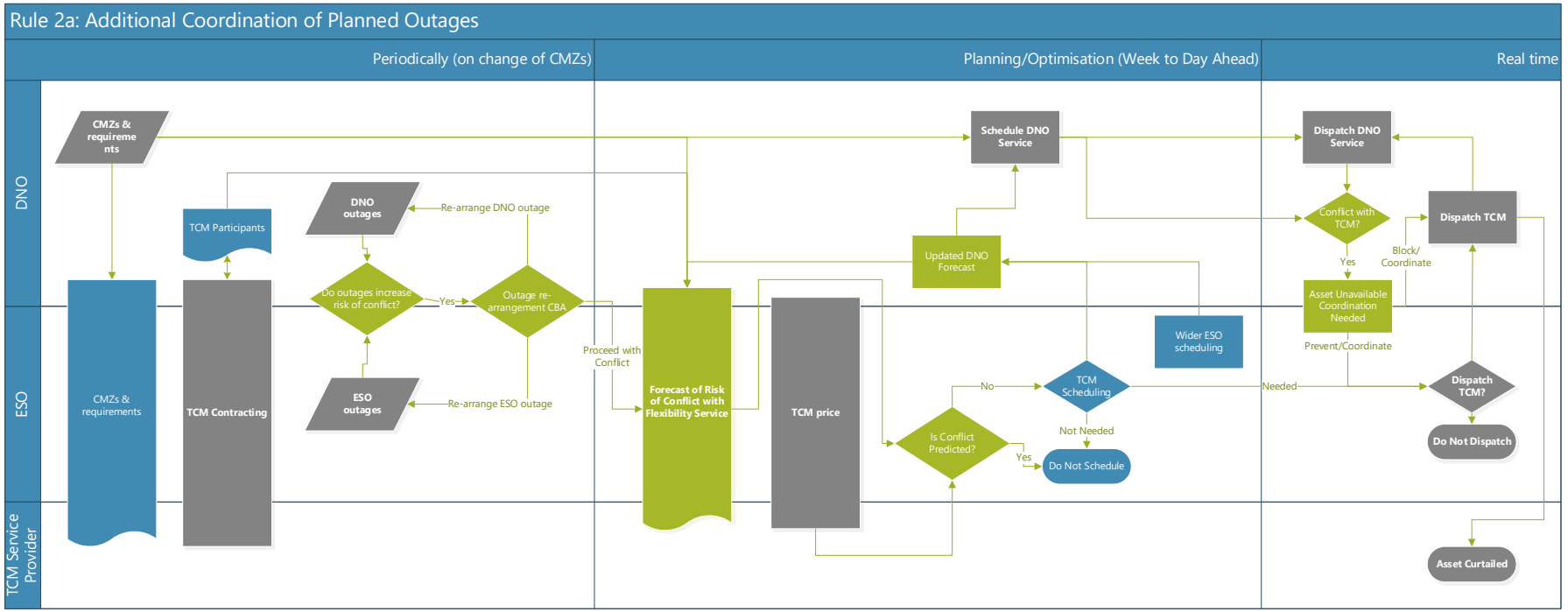


Figure 6 - Rule 2a

This Rule builds on rule 1b and adds:

- An additional process to existing planned outage coordination processes to allow for the assessment of the whole system cost impact of the outages. This builds on the fact that some requirements for both TCM and DNO services are linked to both transmission and distribution outages. Where this is the case, and the release of an outage is likely to increase the overall risk of conflict, the cost impact of allowing the outage to proceed should be weighed up against the cost of rescheduling the outage through a joint CBA.

An equivalent Rule could be created building on the simpler 1a.

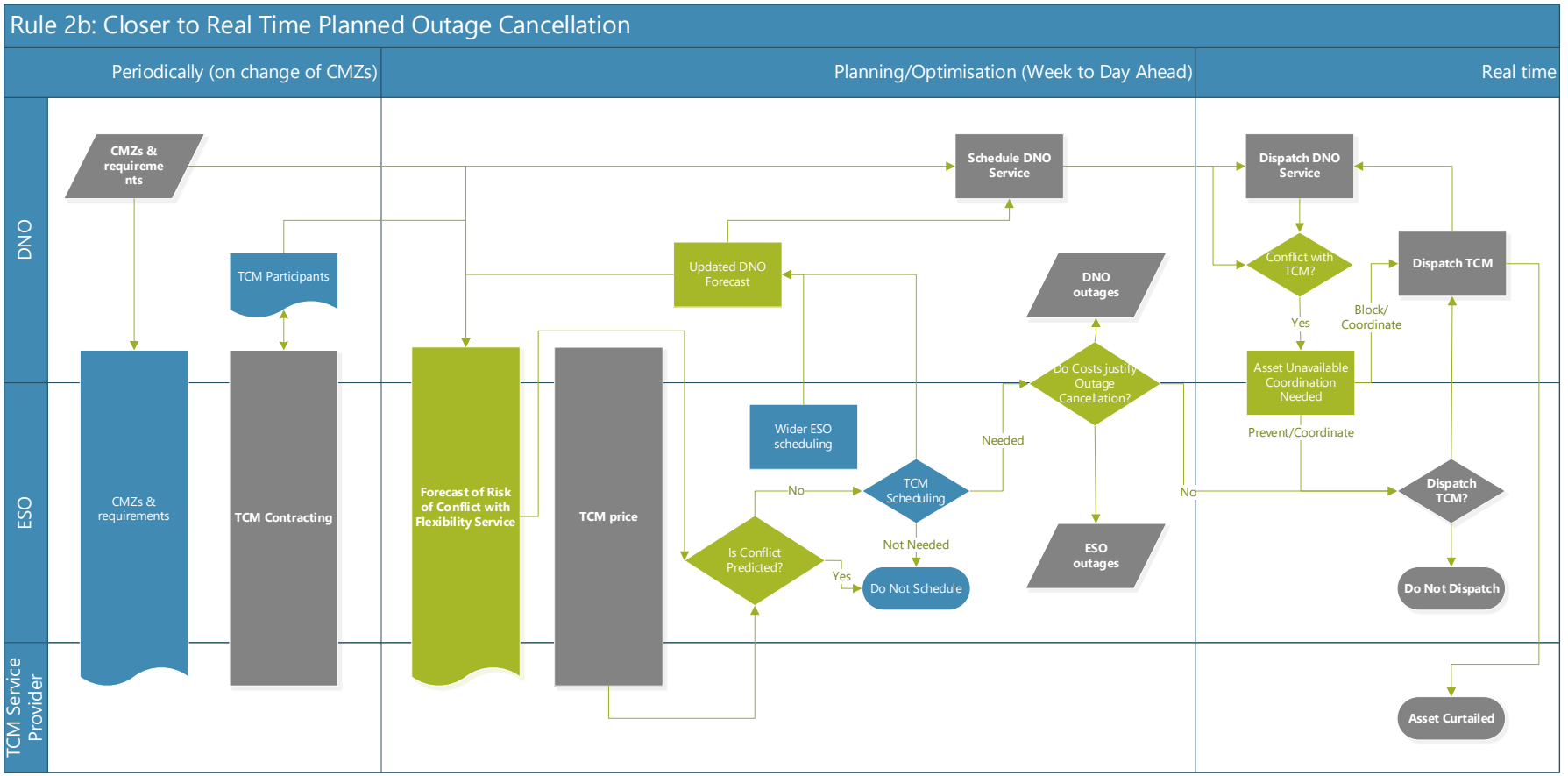


Figure 7 - Rule 2b

This Rule removes the advanced planning of rule 2a and instead focusses on closer to real time coordination.

This would require the ESO to liaise with the TO and possibly cancel/move their outage where high dispatch costs are expected. This would allow for operability risks to be managed, but as detailed in the later sections this is not done in an efficient way.

Due to the timescales, a robust CBA of all options is not possible and so sub optimal outcomes are expected.

Alongside the flowcharts, a review of the key data to be exchanged under each option was undertaken.

This was used to understand the likely data that will need to be collated and exchanged during the Rules implementation phase.

Data Being Shared	CMZ Locations	CMZ requirements	List of TCM generators	Forecast of Conflict	ESO Planning outputs	DNO outages	Transmission outages
Description	The geographic boundaries of CMZs	The temporal and magnitude of service requirement	Which generators are subject to TCM	A view as to which areas (linked to CMZs) would see conflict if the ESO were to curtail a TCM generator. TCM info from the ESO (including service scheduling) (for 1b onwards).	Day Ahead ESO planning assumptions. Used to improve DNO scheduling and dispatch for both DNO flexibility services and TCM dispatch.	List of DNO outages that would trigger Flex procurement	List of transmission outages that would trigger TCM procurement
Direction	DNO to ESO	DNO to ESO	ESO to DNO	DNO to ESO, ESO to DNO (for 1b onwards)	ESO to DNO	DNO to ESO	ESO to DNO
Timing	Periodic	Periodic	Periodic	Regular rolling intervals, ahead of TCM/in line with planning/optimisation processes	Regular rolling intervals, in line with planning/ optimisation	Weekly	Weekly
Currently available?	Yes	Yes	No	No	No	No	Partly
Commercially Sensitive?	No, currently published by DNOs	No, currently published by DNOs	Covered in the TCM tripartite contract.	Not if published beyond ESO.	TBC but highly likely. Subject to legal review.	No	No

						Information would be limited to Primacy requirements		
DNO priority	1.a: Information shared ahead of time	Needed	Needed	Needed	Needed	N/A	N/A	N/A
	1b: Closer to Real Time Information Sharing	Needed	Needed	Needed	Needed	Needed	N/A	N/A
Management of outages	2a: Additional Coordination of outages	Needed	Needed	Needed	Needed	Needed	Needed	Needed
	2b: Closer to real time outage cancellation	Needed	Needed	Needed	Needed	Needed	Needed	Needed

It should be noted that unlike the ANM use case, there is no option for ESO priority in shorter term operational timeframes. The exchange of information and coordination through RDPs will enable the DNO and the ESO to identify the DER that can provide an efficient and cost-reflective TCM service. The TCM service is a location-specific service, and this has been considered when optioneering some of the Rules.

If the DNO has committed to the use of flexibility services to manage the network, then any option that would limit the ability of the DNO to procure services in the local area would impact the security of the network.

Given the wider geographic bounds of transmission network, the ESO should have alternative options to dispatch in other areas, either adjacent DNO areas or from transmission connected assets, which the DNO does not require, or cannot access. It is, however, important, that the deployment of any Rule recognises the need to cater for ultimate operability of the Whole System and, as such, there may be events where additional flexibility within the application of the Rule is required.

This use case highlights the importance on a robust process to assess the risk of conflict in planning and closer-to-real-time timescales to understand and manage risk. The exclusion of service providers from the ESO market will reveal the true Whole System cost of the service while catering for DNO constraints. The lack of coordination could have led to the previously mentioned nullification of services and the potential for increased costs. This needs to be picked up as part of the planning process such as NOA or DNOA, to identify solutions for limiting the scale of conflict (like network reinforcement) and conduct suitable cost benefit analysis.

Rules Selection

Once the core requirements of each rule were understood, a rules selection process was undertaken. The key Pros and Cons are highlighted in the table below. The formal scoring is then shown in the subsequent table. This rates each rule against the key primacy principles (scored out of 5)

	Variant A	Variant B
Rule 1: DNO Priority	DNO Priority - Information Shared Ahead of time PRO: • Simplest to implement • Limited impact on wider parties. CON: • Use of forecasting introduces uncertainty • Forecasting techniques may not align between DNOs	DNO Priority – Closer to Real Time Information Sharing PRO: • Limited impact on wider parties. • Reduced forecasting uncertainty CON: • Forecasting techniques may not align between DNOs • More complex to implement
Rule 2: Management of Planned Outages	Additional Coordination of Planned Outages PRO: • Limited impact on wider parties. • Reduced forecasting uncertainty • Addition of CBA for outages improves efficiency CON: • Complex to implement	Closer to real time Planed Outage cancellation PRO: • Limited impact on wider parties. • Reduced forecasting uncertainty CON: • Complex to implement • Inefficient consideration of Planned Outages

Category	*Rule*	Short term (by April 2023)				Medium term (throughout ED2)				Long term (beyond ED2)			
		Criteria 1	Criteria 2	Criteria 3	Total	Criteria 1	Criteria 2	Criteria 3	Total	Criteria 1	Criteria 2	Criteria 3	Total
DNO priority	**1.a DNO Priority - Information**	3	3	4	**10**	3	3	4	**10**	3	3	4	**10**

	shared ahead of time												
	1b: DNO Priority – Closer to Real Time Information Sharing	4	3	2	**9**	4	3	4	**11**	4	3	4	**11**
Management of outages	**2a: Additional Coordination of outages**	5	3	1	**9**	5	3	2	**10**	5	3	4	**12**
	2b: Closer to real time outage cancellation	3	3	2	**8**	3	3	2	**8**	3	3	2	**8**

The Criteria Are:

1. Delivers the least Whole Electricity System cost to consumers
2. Facilitates Fair, Accessible and Efficient Markets
3. Is clear, transparent, consistent, inclusive and deliverable.

The key elements to highlight in this scoring are:

- The Facilitates Fair, Accessible and Efficient Markets is even across all rules
- 1b is scored higher than 1a on the “Delivers the least Whole Electricity System cost to consumers” category. 2a, scores higher again
- The key differentiator in the “Is clear, transparent, consistent, inclusive and deliverable” category is the deliverability. Those rules requiring more complex systems and processes were marked lower in the short term. As the timelines extend out beyond ED2 this deliverability becomes less of a concern.

We recommend that rule 1.a DNO Priority - Information shared ahead of time is taken forwards for testing and GB-wide roll out by the end of ED1. Given the additional value unlocked by rule 1.b, it’s deployment should also be investigated, acknowledging the additional processes and timescales necessary for delivery.

Required Systems and process for rule

To enable rule 1a the following processes are needed:

1. The provision of DNO data on the location and needs of CMZs (already available)
2. The development of DNO risk of conflict forecasts. This will need to build on individual DNO processes for forecasting flexibility requirements.
3. The development of a sharing mechanism for this information. This could be through wider publication on data portals, CSVs shared over email or both.
4. A process for the ESO to ingest the forecast and feed into their scheduling.

These will be investigated as part of deployment. As noted previously, a robust planning process will be needed to ensure that no operability issues emerge as part of the real time coordination. This will conduct suitable cost benefit analysis to ensure the best overall outcome for the end consumer. These will be investigated as part of deployment.

Next Steps

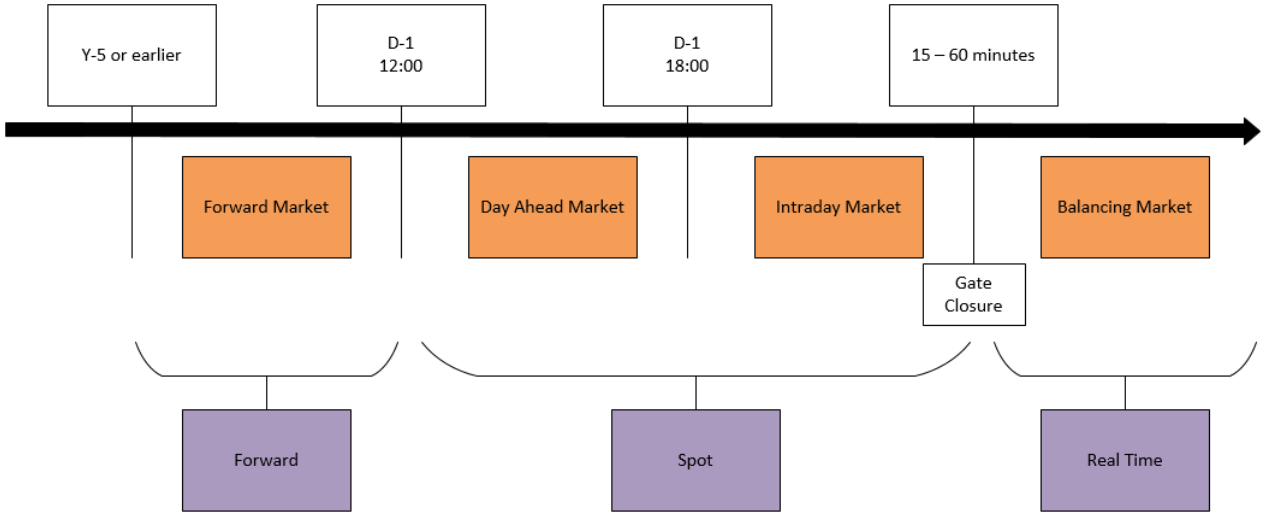
- Rule 1a will be implemented and tested as part of the Regional Development Programme in the South West Peninsula between WPD and the ESO.
- This testing will focus on the efficacy of data sharing processes as there is expected to no conflict.
- However, testing the end to end process will allow us to understand the ability to scale up.
- In parallel, Rule 1b will be taken forwards and further investigated as part of the UKPN RDP in the South East.
- Once tested the rules and processes will be reviewed and a set of full Primacy rules will be published.
- The roll out of these specific Primacy rules will be tied to the roll out of the TCM service where needed.
- The product team are also assessing the best way to take the planning CBA forwards.

Balancing Mechanism Use Cases

Use Case Overview

The core role of NGESO is to operate the GB electricity network to ensure that supply and demand are continually balanced, and that power is able to flow across the network reliably and safely.

In order to deliver the core elements of the ESO's role, there is a reliance on service providers to help balance the overall system and ensure specific operability challenges can be resolved. While Forward Markets resolve energy requirement in advance and to a half-hourly resolution, the Balancing Mechanism (BM) enables the ESO to balance the system in real time on a minute-by-minute basis – an illustration of current market timeframes is provided in Figure 8*:



[3]

Figure 8 – Illustration of Market timescales

The Balancing Mechanism is therefore used by NGESO to balance electricity supply and demand close to real-time. This is similar to market arrangements in other countries where comparable mechanisms are used to balance the system post gate closure.

The key operating parameters and requirements for Balancing Mechanism participants are highlighted across several industry codes, including the Balancing and Settlement Code (BSC) and the Grid Code (GC). These codes define the information and data that should be submitted to NGESO, across various timescales, to declare the Balancing Mechanism Unit's market position and its ability to deviate from this, following an instruction from NGESO. The operation of the BM is heavily reliant on the flow of defined data between NGESO and market participants and vice versa, with much of this data being exchanged close to real-time.

As part of the key information supplied through the BM, Balancing Mechanism Units (BMUs) are required to submit Final Physical Notifications (FPNs) ahead of gate closure – this indicates the final position of each BMU's output for each half hour period. In addition, the BMU must also submit further information that enables the ESO to instruct a unit to deviate from its FPN for the reasons noted above.

Within the BM, there are a number of reasons why NGESO may need to alter the output of a BMU – these can broadly be split into 'System' and 'Energy' actions. The former seeks to instruct units to manage specific system needs (e.g., maintaining transmission network flows within pre-defined constraint limits) and the latter would issue an instruction to alter the active power output of a BMU to maintain overall energy balance.

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[3] Illustration of BM Market Timescales

NGESO generally carries out the role of ‘residual energy balancer’ for the GB market, with the vast majority of overall energy requirements being met by market activity ahead of real-time. Changes in the outturn of actual national demand, plant failure and weather-related events are some of the reasons why NGESO may need to intervene and re-balance the system.

NGESO publishes regular information (in addition to the close-to-real-time data published by Elexon) in the form of our Monthly Balancing Services Statement. This information covers some of the broad reasons why a BM instruction may be issued to a market participant and, as can be seen from Figure 9, highlights the total volume of instructions (by reason) for any given month.

In forming an approach for introducing Primacy Rules into the BM Use Case, the product team evaluated ways in which the Use Case could be broken down into manageable pieces – this is to ensure deliverability and consistency across GB as the BM is so fundamental to overall system operation today.

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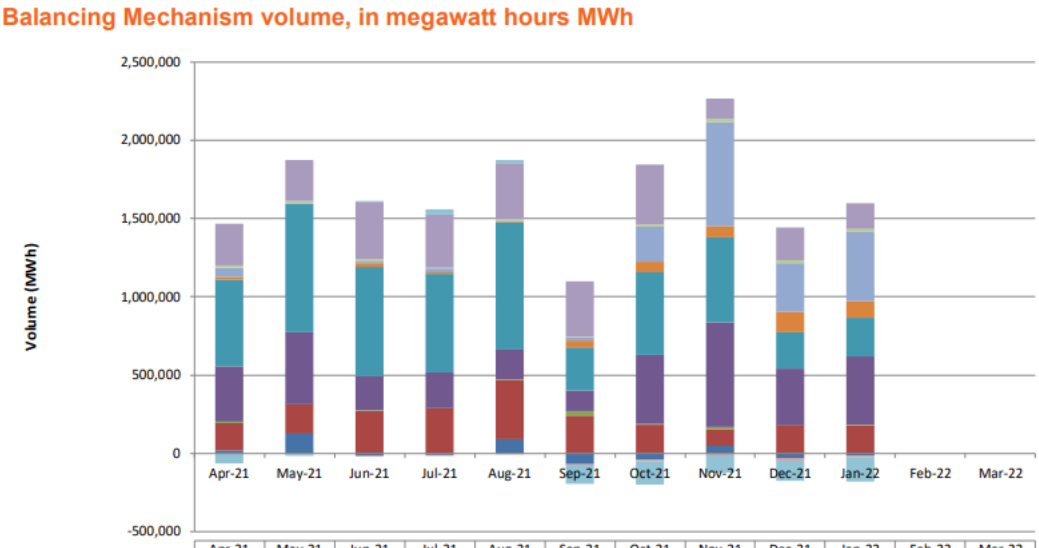


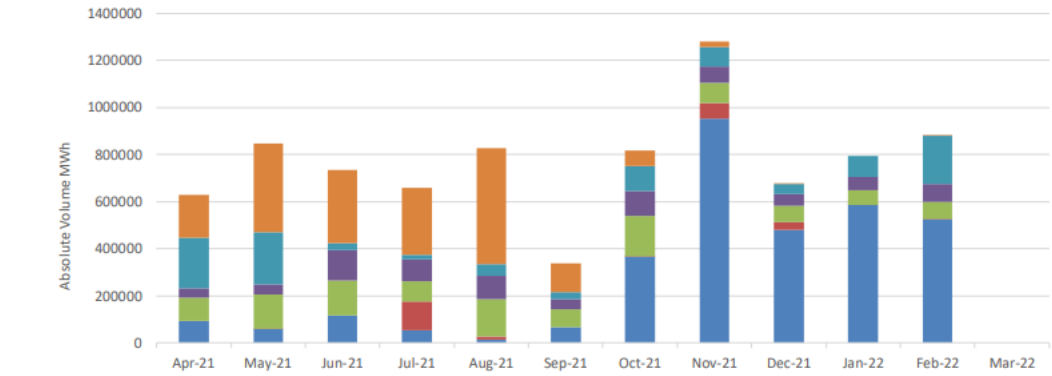
	Apr-21	May-21	Jun-21	Jul-21	Aug-21	Sep-21	Oct-21	Nov-21	Dec-21	Jan-22	Feb-22	Mar-22
BM - Minor Components	-61,004	-11,079	3,786	33,833	18,018	-114,957	-148,607	-110,750	-130,594	-153,887	0	0
BM - Response	267,501	260,104	370,252	338,557	356,027	352,964	381,778	129,611	208,970	166,757	0	0
BM - Fast Reserve	14,346	14,212	11,800	8,436	11,145	8,451	13,224	20,975	14,976	18,039	0	0
BM - Negative Reserve	-4,227	-5,173	-2,452	-2,436	-3,865	-9,288	-13,037	-13,148	-13,215	-10,146	0	0
BM - Constraints Scotland	60,087	4,138	12,126	23,095	4,724	19,494	223,297	663,131	310,378	440,842	0	0
BM - Constraints Cheviot	19,396	0	21,379	8,041	5,478	43,788	68,452	75,729	134,599	107,130	0	0
BM - Constraints E&W	550,033	820,336	700,774	629,115	816,487	274,553	527,138	541,327	230,423	246,596	0	0
BM - Constrained Margin	355,013	462,049	219,209	228,318	189,633	130,012	442,818	669,255	363,864	434,717	0	0
BM - STOR	11,713	1,548	2,811	2,750	1,103	28,139	4,301	12,868	2,991	6,642	0	0
BM - Operating Reserve	171,008	187,909	270,403	288,031	380,875	242,540	183,536	106,722	175,355	178,181	0	0
BM - Energy balancing	19,705	123,734	-18,202	-11,565	89,447	-71,216	-39,535	48,061	-32,066	-15,293	0	0

Figure 9 - NGESO Monthly Balancing Service Statement (January 2022)

Figure 9 highlights that the bulk of instructions generally focus on the need to manage ‘system’ challenges, hence the product team has focused on breaking these down into sub-Use Cases relating to instructions required to manage specific system needs. With this data in mind, focussing on ‘system’ based instructions would allow for the higher volumes of instructions to be catered for under the initial roll-out of Primacy Rules. In addition, it will allow the DNOs and the ESO to learn from a simple implementation across some BM Use Cases, whilst seeking to deploy more sophisticated data exchange and decision making processes through future iterations.

The BM constraint costs are broken down by England and Wales, Scotland and Cheviot regions in the BM costs section of this report. ROCOF and Voltage costs are recorded in the England & Wales category.

Constraint volume, in megawatt hours (MWh)



	Apr-21	May-21	Jun-21	Jul-21	Aug-21	Sep-21	Oct-21	Nov-21	Dec-21	Jan-22	Feb-22	Mar-22
Trades - ROCOF	181463	376846	309717	286225	489998	123174	68045	23116	270	0	524	0
BM - ROCOF	214234	219148	30278	19477	50723	29599	104677	81624	43775	89994	205040	0
Trades - Voltage	40343	44944	130194	93873	99760	42290	105737	70716	47319	53938	75692	0
BM - Voltage	98750	143742	145961	85794	160001	76380	171994	84541	71549	63076	73725	0
Trades - Transmission	0	58	0	121035	10338	0	1147	66143	33040	1130	2267	0
BM - Transmission	94725	61500	118130	53848	15869	66392	367287	954042	479878	586431	525173	0

Figure 10 - BM areas of consideration, by instruction volume

Analysing the different types of 'system' instructions in more detail – as shown in Figure 10, the product team have proposed the following areas to investigate further with regard to the deployment of Primacy Rules:

- Voltage Management
- Thermal Constraints
- System Inertia Instructions

Further work has also been carried out to highlight some of the core elements of the ESO's processes that are currently carried out, in order to ascertain where the deployment of new Primacy Rules will ultimately slot in. Given the work completed already under the TCM Use Case, it is highly likely that similar Rules could apply however, the deliverability of changes to existing BM processes and systems will need to be considered throughout the next stage of work.

Level of Conflict

As with the details provided under the TCM Use Case, comparing similar actions on BMUs in areas where the DNOs have also procured flexibility services is likely to yield a similar degree of anticipated conflict. It is also likely that the frequency of conflict could increase when considering BMUs as this is the primary mechanism used by NGESO to operate the system. Furthermore, the larger the Use Case pool grows, the more instances will arise whereby conflicts could materialise – this is one of the key reasons why the product team have considered a staged approach to the inclusion of BM Use Cases as part of the first iteration.

It should, however, be noted that there are additional layers of complexity to consider when assessing conflicts between BM participants and those procured under the current DNO Flexibility services as the newer BM Wider Access tools allow participants to aggregate multiple secondary BMUs across larger geographical areas. This will further be explored in the next stage of the product but also highlights the need to take a staged approach to implementation.

As the procurement of DNO flexibility services increases, it will require further analysis to determine how the implementation of additional Primacy Rules will impact specific roles within NGESO's control room. Learning

from these earlier implementations will enable the appropriate adaptation of processes and the creation of requirements to feed into some of NGESO's system change programmes.

Optioneering

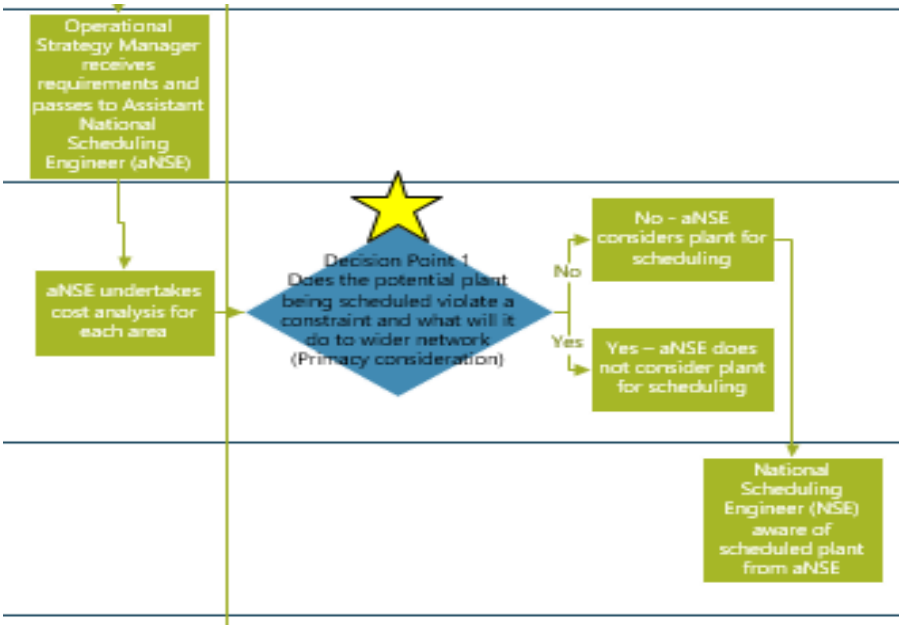
The Product team has spent time working closely with the ESO Control Room balancing teams and subject matter experts to understand the various processes that underpin the sub-Use Cases noted above. The primary driver for this work was to fully understand and record current operational processes and decision-making points to gather an initial view on where the potential Primacy Rules could reasonably be applied.

The decisions at this stage, with the likely limited level and relative infrequent exchange of data, are likely to need to be fairly rudimentary and limited in their agility, however, as the data exchanges become more agile and comprehensive this may well change and more complex Rules are expected to be delivered.

The descriptions of the high level processes and associated process flow diagrams for managing voltage fluctuations, system inertia and import constraints are in noted below.

Voltage Management

The ESO needs to ensure that the various voltage levels across the transmission network are maintained within the limits set out within the Security and Quality of Supply Standards (SQSS). In order to achieve this, Figure 11 shows some of the process elements and decision making points that are considered:



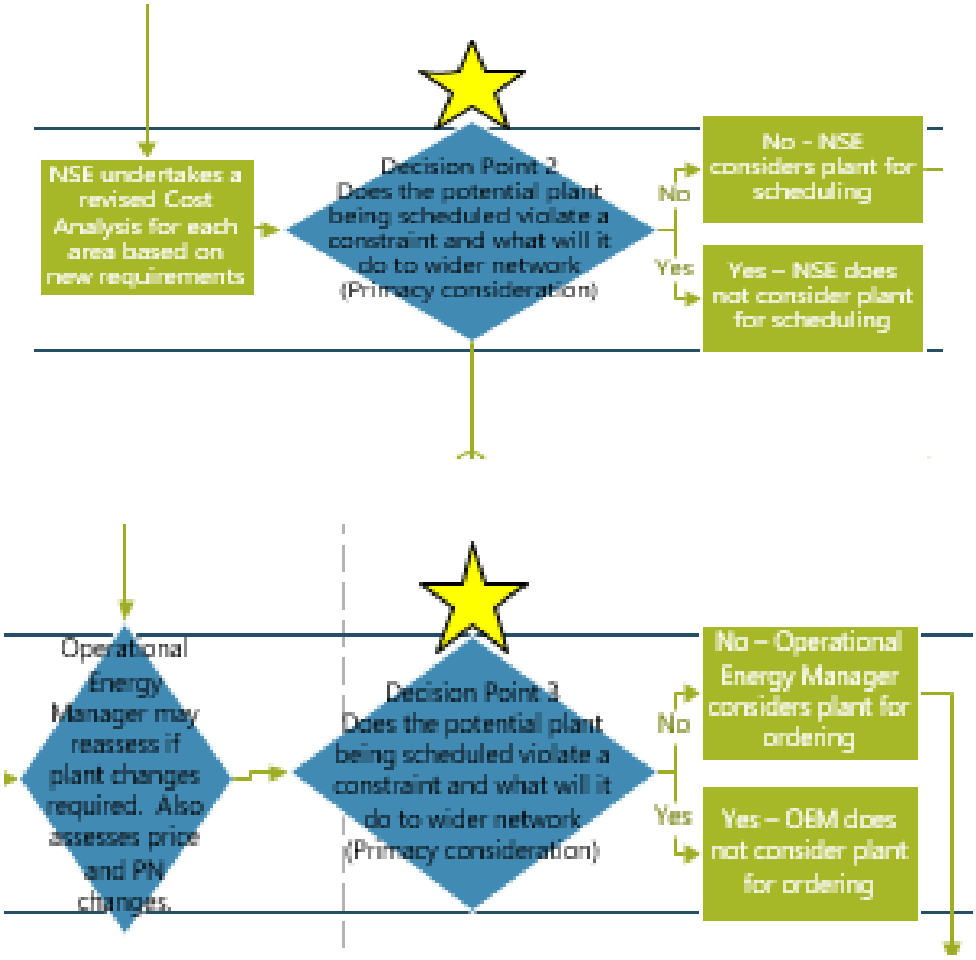


Figure 11 - High level voltage management process

System Inertia Management

The ESO needs to ensure that the overall level of inertia on the system at any one point in time is sufficient to manage the forecast Rate of Change of Frequency (ROCOF) for credible events. In order to achieve this, Figure 12 shows some of the process elements and decision making points that are considered:

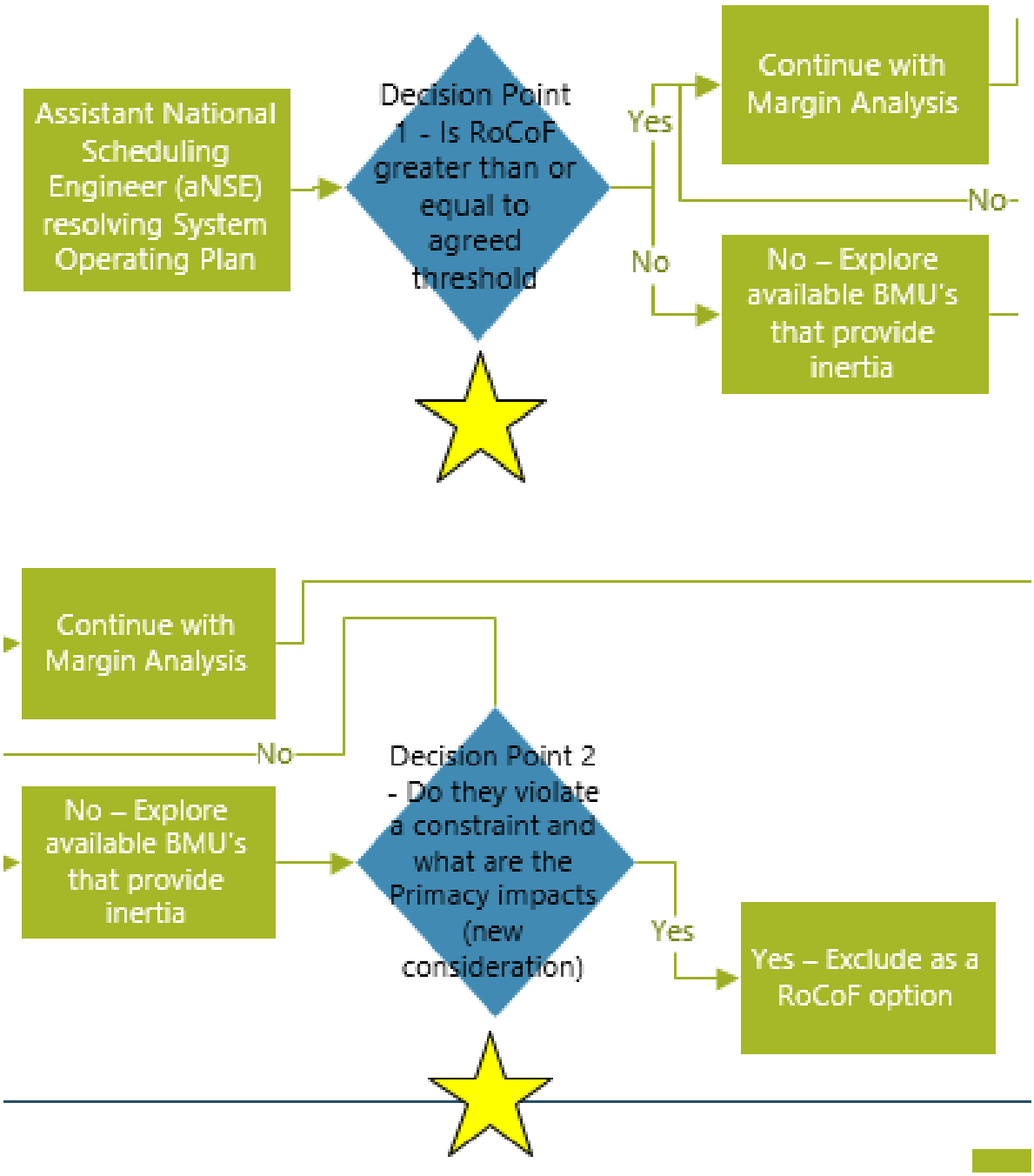


Figure 12 - High level system inertia management process

Constraint Management

As with the TCM example, the ESO needs to ensure that each defined constraint limit across the transmission network is managed in accordance with asset ratings. In order to achieve this, Figure 13 shows some of the process elements and decision making points that are considered:

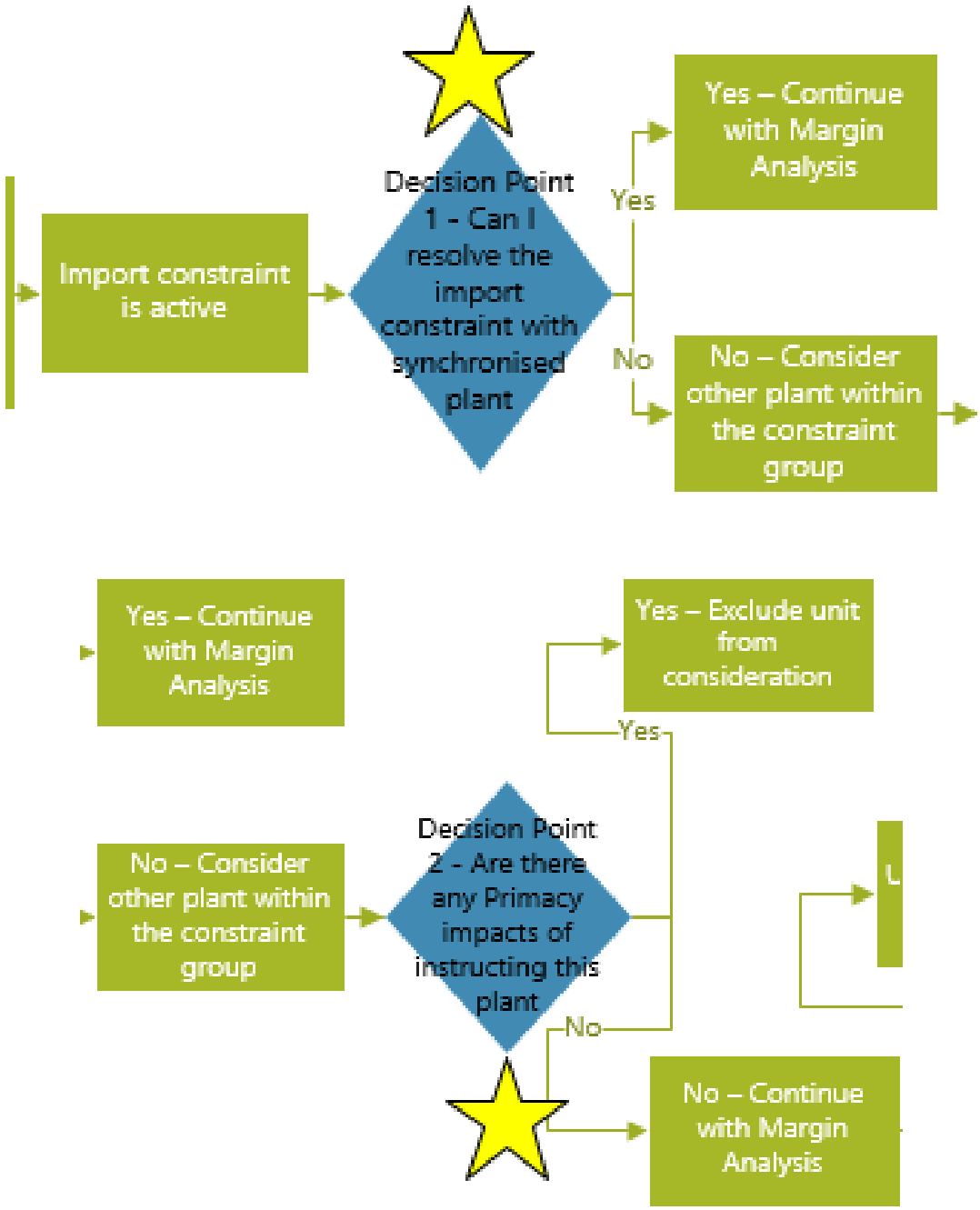


Figure 13 - High level process for constraint management in the BM

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Rules Selection

The BM Use Cases have many similarities with the TCM and DNO service use case. As per TCM there is no option to allow the ESO priority, due the DNO's geographic limitations, and so the rules available focus on DNO priority and the various ways of exchanging data to support them.

Also, as the use cases are not all driven by outages, the variants of rule 2 do not apply. As such we recommend the trial of a simple DNO priority, akin to Rule 1a of the TCM service. In parallel, Rule 1b will be further investigated as part of the UKPN RDP in the South East.

As per the TCM Use Case, given the wider geographic bounds of transmission network, the ESO should have alternative options to dispatch in other areas, either adjacent DNO areas or from transmission connected assets, which the DNO does not require, or cannot access. It is, however, important, that the deployment of any Rule recognises the need to cater for ultimate operability of the Whole System and, as such, there may be events where additional flexibility within the application of the Rule is required.

This use case also highlights the importance on a robust process to assess the risk of conflict in planning and closer-to-real-time timescales to understand and manage risk. The exclusion of service providers from the ESO market will reveal the true Whole System cost of the service while catering for DNO constraints. The lack of coordination could have led to the previously mentioned nullification of services and the potential for increased costs. This needs to be picked up as part of the planning process (DNOA or NOA), to identify solutions for limiting the scale of conflict (like network reinforcement) and conduct suitable cost benefit analysis.

Mitigations to impacts on ESO operations include:

- Understanding the accuracy of DNO Risk of Conflict Reports. Due to the timescales of data sharing in the initial rules, there is the potential for forecasting uncertainty which could increase the perceived risk of conflict. As such we will need to monitor these outputs to ensure the cost of mitigating potential conflicts is proportional to the risk they pose. This may lead to recommendations on more complex rules as the risk increases.
- Developing the appropriate planning processes needed to ensure that Primacy is only deployed where cost effective. This will require the development of a CBA to ensure that costs and operability risks are understood and effectively mitigated where necessary.

Required Systems and Process for Rule

The required systems and processes, along with the data required, to support and allow implementation of each rule are anticipated to be very similar to those required to manage the TCM and DNO service and will be defined and drawn out during the design to implementation phase.

Next Steps

- The requirements for implementation are similar to those in the TCM Use Case.
- As such we will look to build out the functionality within the South West RDP and South East RDP. Due to the wider nature of the BM, we will also look at alternative options for trialling to build cross DNO experience and understanding.
- We will also use this implementation period to review the rules with stakeholders, legal teams and internal SMEs to ensure the rules continue to align with the Primacy principles.
- In parallel we will look at Rules development iteration 2, the assessment of rules benefits for ANM.

Glossary

TERM	DEFINITION
ANM	Active Network Management
DNO	Distribution Network Operator
ESO	Electricity System Operator
RDP	Regional Development Programme
STOR	Short Term Operating Reserve
TCM	Transmission Constraint Management
TEF	TEF relates to the close collaboration between the three Ofgem NIC funded projects, TRANSITION (from SSEN and ENWL) EFFS (from WPD) and FUSION (from SPEN). These three projects together form the T.E.F. collaborative forum, with the overall aim of coordinating innovation requirements, sharing key learnings, and broadening the application of this knowledge to trials and test-bed in a variety of UK DSO regional settings to better inform the wider ENA Open Networks Project activity.

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