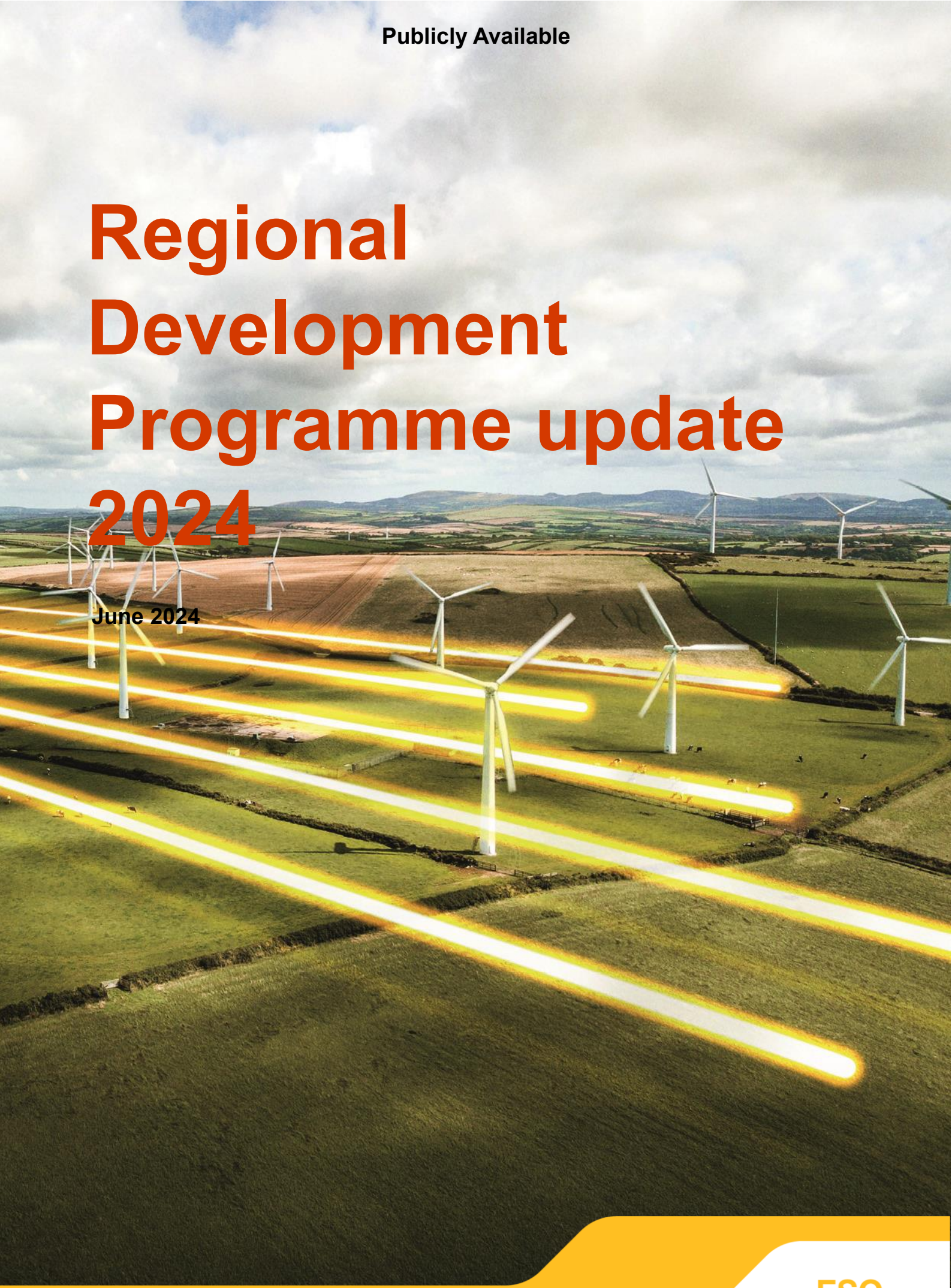
Publicly Available

Regional Development Programme update 2024

June 2024



ESO

ESO

Contents

Executive Summary

Regional Development Programmes (RDPs) were first introduced as a co-ordinated response to the challenge of connecting new Distributed Energy Resource (DER). Working with Distribution and Transmission network organisations we have facilitated earlier connection of new DER at lower cost to the consumer than had the connections been dependent on lengthy timed delivery and costly network reinforcements.

With the drive to decarbonise the electricity system by 2035, and increased volumes of new connection applications, the need for bespoke tactical solutions, such as RDPs has never been greater. In the last 12 months we have significantly expanded our RDP discussions with other network organisations and are now in active conversation with all Distribution Network Owners (DNOs) and Transmission Owners (TOs) to explore the feasibility of non-build alternatives that will get customers connected.

Our earlier projects N-3, MW dispatch (RDPs 1 & 2) achieved Go-Live status. We are building from initial go live and looking to expand the capabilities of MW Dispatch via RDPs 3 & 4 with a series of enhancements which build on the initial deliveries with UK Power Networks (UKPN) and National Grid Electricity Distribution (NGED), also we are in discussion with Scottish Power Distribution (SPD) to implement MW Dispatch in the Dumfries and Galloway region following on from the change of direction with Generation Export Management System (GEMS) project.

RDPs have adopted an agile delivery framework. As such we continuously monitor other cross vector developments and looking for opportunities to scale up RDP solutions where possible and deploy them across GB in a consistent way. Grid Supply Point (GSP) technical limits are an example where we are implementing a solution across all DNO areas that looks to accelerate DER connections.

A small number of RDP projects were discontinued as it is determined that the need cases, are now adequately covered by the GSP Technical Limit Project. More details available in Appendix 2

Further details of specific projects can be found at the end of this report. For additional details please see RDP pages in ESO website.

1. Introduction

The last decade has seen significant volumes of smaller generating technologies seeking connection to their local distribution networks. This trend is forecast to continue into the future with Future Energy Scenarios (FES) projections indicating that there may be over 60GW of DER connected by 2032.

Smaller generating units, whether solar, wind or battery storage, can often connect quicker than the necessary network infrastructure required to enable their connection. This presents new challenges for the industry as required infrastructure build may lag behind generation connection timescales. Such challenges first manifested themselves in the south of England. In these regions, we had to work closely with the local DNOs to understand in more detail the relevant details of each other's networks and develop new methodologies that would help facilitate the connection of DER. We discussed opportunities to connect parties via non-network solutions at lower cost to the consumer. It was from these discussions that the first RDPs were developed and are being implemented.

As DER connections have continued to grow, the use of the RDP ethos has spread across GB and we have ensured that the learnings from the initial programmes have informed new challenges. We

have a number of development discussions in progress across different areas of GB which are discussed in more detail within this report, along with the processes around their development.

RDPs are potentially multi-year undertakings. This paper provides an overview of our RDPs and an update of the work we have done and are planning to do, in collaboration with stakeholders, over the last twelve months and in future.

2. Regional Development Programme Overview

RDP is a project or study that looks at the complex interactions between distribution and transmission networks in areas with large (or potentially large) volumes of DER. This section provides an overview of our work on RDPs from initial development through to delivery in our control centre.

RDPs are designed to apply a whole electricity system lens and assess a variety of options to resolve specific network needs that can facilitate the connection of new DER. These projects are significantly enhancing transmission and distribution systems coordination and control which is key to enabling Distribution System Operator (DSO). This will create efficiencies for the whole electricity system and provide new tools and resources to manage system constraints – ultimately reducing costs for customers.

Recognising the increasing maturity of DSO flexibility markets, RDPs are coordinating and building on the work of the Energy Network Association (ENA) Open Networks projects. RDPs make sure standardised approaches are used wherever possible. In turn, learnings from RDPs are fed back into the Open Networks project, shaping its work and facilitating wider rollout of best practice.

RDPs resolve issues in specific regional areas of the transmission system, often smaller than the granularity used in the Network Options Assessment (NOA) process. As such they are complementary to the ESO's NOA process ensuring that more local issues are resolved efficiently and facilitate the connection of DER.

In some cases, RDPs can be time limited, facilitating non-firm connections of DER ahead of transmission infrastructure build. In other cases the resolution of some RDPs will be through the development of regional constraint markets. Once delivered these solutions can be used to help resolve broader constraints through the provision of DER flexibility markets (i.e.RDP solutions can be used as a tool for initiatives such constraint management pathfinders and can help enable the deployment of additional tools such as the new Local Constraints Market being developed by the ESO).

RDPs can be considered as a two-stage process:

- A Strategy/development process consisting of issue verification and option development; and
- A delivery process where the detailed IT solution, tools and processes are developed and implemented. This process will be initiated where required.

Engaging with stakeholders

RDPs are collaborative programmes of work requiring frequent engagement with prospective service providers as well as DNO/DSO project partners and TOs on areas requiring their expertise. Supporting this are requirements for broader engagement, which ensure RDPs develop consistently across GB.

ENA Open Networks project

RDPs are closely connected to the ENA Open Networks project. This relationship works both ways with RDPs both informing Open Networks policy as well as utilising policies developed through Open Networks. Our RDP team are actively involved across the project including supporting the development of primacy rules and representing the ESO on its transmission – distribution workstream.

DER provider engagement

Engagement with DER service providers is critical to the successful development and delivery of RDPs. For RDPs under development, we have supported DNOs with communications and ongoing engagement with their customers. For RDPs in delivery, in 2022-24 period we have jointly hosted 4 webinars with partner DNOs on our proposals for MW dispatch, ensuring that service arrangements work for providers and they are kept informed of our progress. As we conclude our IT development work, we will be further engaging with providers to keep them appraised of progress.

RDPs and the ESO thermal constraint 5-point plan

In March 2021 we published a 5-point plan for how we intended to manage network constraints in the years ahead. The elements in this plan included:

1. Clearer forecasts for BSUoS costs
2. Developing intertripping capability through our pathfinders
3. Continuing to improve our existing network
4. Exploiting storage potential in a heavily constrained network
5. Working with regional networks on a whole-system approach

3. ESO learnings from RDPs

We are continuously learning from initial development work on RDPs through to final delivery of IT solutions into our Control Centre. This section highlights some of the lessons learnt over the last 24 months and how we are taking these forwards both internally and with stakeholders.

From a development perspective, RDPs are informing future whole system policies on:

- DER construction planning assumptions;
- Use of cost-benefit analysis;
- Development of non-build solutions; and
- RDP process steps.

These are explained further in the table below

Function	Learnings	How we're taking forwards
DER construction planning assumptions	• Increased volume and diversity of DER applications mean a greater value is placed upon more granular / accurate assumptions going into connection application studies undertaken by TOs. This should ensure that the most efficient solution is taken forward.	• The ESO's Construction Planning Assumptions (CPA) for embedded connections are exploring: • Regional scaling factors based upon engineering knowledge of a region and prevailing technology types, including batteries. • Monitoring the proportion of number of contracted projects that progress to completion. • Diversity and relative volumes of technology types
Use of cost-benefit analysis	• It is beneficial to ensure all required inputs are understood and requested from relevant parties before carrying out a CBA and that we apply a consistent approach.	• We have developed a standard approach to collating and documenting CBA inputs. • Consistent and transparent use of CBA tools
Development of RDP solutions	• Development of options can raise wider policy questions and challenge current methods which can take time to resolve.	• Be as transparent as possible about the issue and timelines to resolve – engage stakeholders on possible solutions to policy issues. • Progress policy related activities in parallel within the project where possible • One specific policy issue that we are taking forward is whether and how DERMS can be employed at sites that are not solely used by one DNO.
RDP process steps	• It can be difficult to know where to start and how to tackle a potentially very large problem, particularly when working across a number of organisations.	• We are now working to a more structured process as set out above which also provides more transparency to DNOs / customers on progress. • Provides ability to standardise approach to different projects as much as it possible.

From a delivery perspective, RDPs are developing co-ordinated functionality with DSOs in four areas:

- Communications - establishing Inter-Control Communication Protocol (ICCP) links and providing real time visibility of DER
- Control - utilising the DSO's Active Network Management (ANM) and Distribution Energy Management (DERMs) equipment to provide dispatch functionality to DER.
- Co-ordination - developing and implementing primacy rules for dispatch co-ordination.

- Contractual arrangements - building on the work of Open Networks to develop tri-partite framework agreements for transmission constraint management services.

Function	Learnings	How we're taking forwards
Communications	• Whilst overall IT system requirements can remain consistent, detailed specifications may need to differ between different DNO control centres. • There is value beyond the RDPs in installing ICCP links to DNO control centres.	• Earlier engagement with individual DNOs to understand their IT requirements. • Inclusion of ICCP functionality with other DNO control centres in our business plan proposals.
Control	• ESO control engineers and DER prefer consistent systems and processes that can be called upon in different regions. • We have learnt lessons regarding the infrastructure and security required to deploy web services. • Automation of data flows in the future will be required to enable full scalability.	• We are seeking to combine requirements for similar services to enable more consistent roll-out of functionality. • To improve resilience and security of our new data flows, we are considering alternative approaches to our enduring web services architecture. • We are building data flows and fields that can easily be migrated to a web service, when appropriate systems can support this.
Co-ordination	• We have identified the need to coordinate data sharing and decision making across various time horizons. • We have already identified areas where further improvements on data consistency could be made. • Work undertaken so far through delivery is helping to inform the requirements for new ESO platforms.	• Our initial deployment will trial a simple approach with a view to automating in future releases • We are deploying control room processes that actively consider Primacy Rules as part of core decision making. • More detailed consideration of DNO and DER needs in the ESO's new, strategic platforms.
Contractual arrangements	• Common contract development through the ENA has helped to ensure parties are familiar with the basis of the agreement. • Service providers value transparency and want clarity on the contractual process.	• In the interests of transparency and efficiency of alignment of documentation, a trilateral approach has been adopted.

4. Broader roll out of RDP functionality

As well as providing specific learnings, RDPs as 'design by doing' activities are informing wider ESO and DSO processes and frameworks. These are broader learnings that we believe will inform and enhance existing ESO processes, making them appropriate to support DSO. Currently RDPs are informing four areas of functionality:

Connection and design of future RDPs – embedding processes such as Appendix G and moving from a reactive process for RDP initiation to pro-active development.

Market design for co-ordinated DER markets –including the broader roll out of tri-partite contractual arrangements as well as leveraging experience of facilitating market access for DER connected to ANM and DERMS schemes. This also includes how we can widen market access to RDP markets through the use of third party platforms.

Trialling GB primacy rule implementation – our MW dispatch programmes will implement the first IT functionality in GB utilising primacy rules.

Enabling communication pathways – establishing the protocols and systems that facilitate greater visibility of DER.

These areas are described in greater detail below. In all four areas we will continue to develop our thinking over the next 12 months to develop an overall roadmap for broader roll out.

Connection and design of future RDPs

Early elements of RDP design work have already been adopted in our Business as Usual (BAU) processes. This includes the 'Appendix G' process established across GB and formalised in code through the Connections Use of System Code (CUSC) modification process CMP 298. Other elements of the RDP design process are still in development and earlier in this report we highlighted learnings from our work on connection planning assumptions, cost benefit analysis and development of non-build options.

Further work is needed to bring these areas into mainstream industry connection and development processes. In part this is due to the specific nature of each RDP, where different challenges require different solutions. However, as we move forward, we are finding increased areas of commonality. Over the next 12 to 18 months, we will be working with others to produce a plan to embed RDP development activities into industry BAU processes. We believe we need to go further than simply embedding the current process which is reactive to specific connections by moving towards a more strategic view of future system needs.

We believe that a new ongoing process could be established within the ESO to routinely and proactively examine the data from DNOs to determine future need for new solutions or identify where to implement an existing RDP tool. These forecasts of future needs would be for each GSP (potentially similar to the NGED Distribution-NOA) and would allow us to be more transparent with connecting customers as to what to expect when connecting in different areas.

In 2024/25 we will be working with stakeholders to further develop our thinking in this area, pulling in learnings from our current development RDPs. We would then be looking to roll out processes from the start of 2024/25.

Design of co-ordinated DER markets

Contractual arrangements

Through the MW dispatch projects we have worked with partner DNOs to develop the contractual frameworks which facilitate DER provision of transmission system services whilst also acknowledging the key roles of the DSO in both facilitating market access and ensuring operational co-ordination through primacy.

These tri-partite framework agreements, which build on and utilise the ENA Open Networks common framework agreement (WS1A P4[1]), can then be used more broadly to provide clarity to contractual roles and responsibilities in the delivery of DER services for transmission system needs.

Use of DERMS to enable market participation

A number of DERMs are being rolled out across DNO areas to manage local DNO constraints and / or to manage constraints at the GSP where such sites are classified as 'connection' sites. We believe that these schemes provide an opportunity to facilitate transmission-based MW dispatch market access for parties already connected to such schemes for the management of distribution constraints. This would result in larger, more liquid markets for managing local transmission constraint issues, whilst making use of existing infrastructure in a cost effective and coordinated manner. Wider roll out of RDP functionality could facilitate greater DER entry into constraint management services including from parties within current ANM zones, where these systems can be technically linked together to provide additional operational visibility and service coordination. It would also facilitate co-ordinated market access and the development of ESO-DSO co-ordination processes.

Utilising other routes to market

We are aware that the use of DNO infrastructure as a means of facilitating transmission constraint instructions does not work as a solution for all service providers. We received feedback through our MW dispatch work in the South of England that while it seemed pragmatic to employ DNO systems for the current projects, there should be a solution developed that does not solely rely on such systems for dispatch. We are therefore keen that while DERMS can provide low-cost solutions, we are looking to develop web-based means to dispatch services through the RDPs. Our Local Constraints Market (LCM) is also looking at the use of third-party platforms as another alternative and all solutions should also be comparable with BM participants. This should ultimately result in higher numbers of service providers and more liquid markets including those within RDP areas.

Trialling GB primacy rule implementation

Our MW dispatch projects with NGED and UKPN is the first programmes in GB to deliver operational systems and coordinated processes to begin to manage service conflict in control room timescales. Going forwards these systems will inform policy work on primacy rules within the ENA Open Networks project (WS1A P5[2]), which in turn will lead to a greater roll out of the IT infrastructure needed to embed primacy rules between ESO and DSO control centres from 2025. Furthermore, the ESO will actively feed learning from these initial rollouts into the design of our new IT platforms across a variety of our core processes.

---

[1] https://www.energynetworks.org/publications/(archived)-on21-ws1a-p4-standard-agreement-for-procuring-flexibility-services-ver-2.0-(aug-2021)

[2] https://www.energynetworks.org/publications/on22-ws1a-p5-primacy-draft-rules-increment-1-(28-apr-2022)

Enabling communication pathways

ESO's need for greater visibility of DER and the benefits that this would bring for the ESO and therefore consumers. This includes the ability to more widely adopt an RDP approach to operability issues. Learnings from existing RDPs set a blueprint for establishing real time operational visibility into our control room operating systems allowing us to deliver a national roll-out more efficiently. A key step will be the installation of ICCP communication links to all DSO control centres which is something that is already underway.

Appendix 1: Update on Inflight RDPs

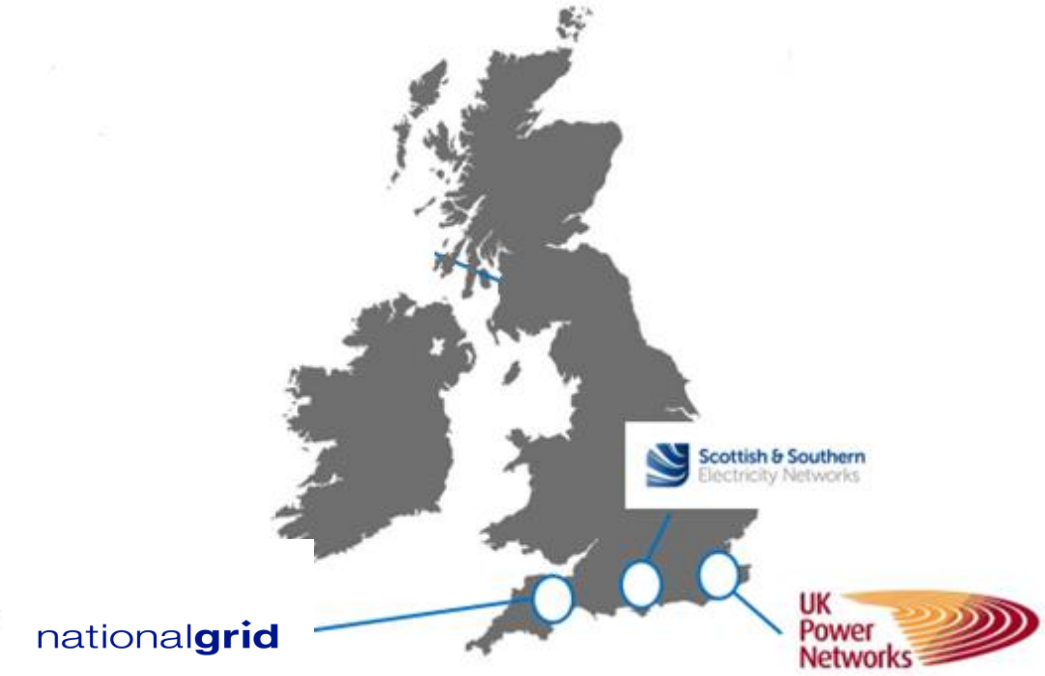
In this section we provide detail on the RDPs that are completed and currently in delivery across GB. We have provided a progress chart for relevant project.

N-3 intertripping

These projects have delivered DER intertripping functionality along the south coast of England. N-3 intertripping is used in the rare occasion when a double circuit transmission fault occurs during a planned network outage period. In such circumstances the N-3 intertripping works to quickly disconnect (or de-load) DER, removing any system overloads from the transmission network. The solution is yet another positive step in the direction of achieving a zero-carbon future. It will allow renewable distributed energy resources to ensure energy generation and continued operability of the network until a real system fault happens.

In addition to an increase of network capacity benefiting consumers, the N-3 intertripping solution will allow connection of more renewable generation into the DNO network enabling them to generate energy without restrictions until there is a fault.

The delivery of technical systems for the solution completed with UKPN, SSEN and NGED with the last project went live in Jan 2024.



MW Dispatch

Our MW dispatch programmes are developing new thermal constraint management service for DER. Host DNOs are key project partners in this work providing DER visibility and dispatch functionality. A further key aspect is the introduction of primacy rules embedding DSO co-ordination. The solution has been delivered with UKPN and NGED. Details of each project are as below.

RDP1- South West (NGED)
Our MW dispatch project in the South West of England is facilitating the connection of additional 1900MW of DER to the region. This project with NGED, has entered Business-as-Usual status on March 2024 after successfully completing MVP development, testing & Implementation. The overview of the project scope can be found in our published Project Initiation Document [3](PID).

During the execution of the project, the delivery team worked closely with internal business teams and NGED to refine the process. Delivery Team also developed additional tools required to ensure the successful delivery of the Minimum Viable Product. RDP 1 will ultimately enable an increased number of connections at minimal cost to customers and risk to network reliability.

RDP 2 – South East (UKPN)
Our work with UKPN in the South East of England is facilitating the connection of an additional 1500MW of DER. Currently Project went live on Mid-March 2024 and soon be become business as usual after completion of an operational trial. Project faced challenges across core project areas, especially on the scheduling and dispatch phases of the end-to-end process. This was due to the additional complexities that highly interconnected to the nature of transmission and distribution networks in this area.

Delivery Team coordinated effectively with both internal stakeholders & UKPN for the successful delivery of the solution, which includes additional requirements from UKPN.

RDP 3 and 4 –MW Dispatch Enhancement
This is an enhanced version of RDP 1 & 2, leveraging the rich experience learned from the previous version. Both projects have completed a large amount of work related to scoping of the solution development enhancements and are currently going through IT requirement & design phase.

In conjunction with the IT requirement & design work, the delivery team have been working closely with a number of internal business teams and respective DNOs to refine data exchanges and additional tools required to ensure the delivery of the enhanced MW Dispatch service and associated processes. We are also working on our internal and external testing strategy and associated plans towards more test automation to improve test efficiency.

[3] https://www.nationalgrideso.com/document/224726/download

issues	Confirm constraint details	Option assessment	CBA of options	Confirmation of solution	Defined solution development	Delivery- IT MVP requirements & design	Delivery – IT MVP development & testing	Delivery – MVP implementation	Go-Live

RDP 5 – GSP Technical Limit

ENA has published a 3-Point Plan to speed up connections to the distribution system and this work is being progressed through the Strategic Connection Group (SCG). As we are part of the ENA and SCG, the RDP programme supporting the ENA's GSP Technical Limit implementation.

The idea behind GSP Technical Limits is that if the power flow through a GSP is kept within an agreed MW level, then DERs connecting behind the GSP won't impact on the transmission system. This allows distribution customers to connect prior to completion of transmission reinforcement work. A DER connecting under GSP Technical Limits will have non-firm access to the network (i.e., may have their output curtailed), until the transmission reinforcement works identified for their connection have been completed.

Project currently in its initial phase, defining the scope, deliverables, and timeline. Once these detailed discussions have concluded, we will capture these outputs in the Project Initiation Document and proceed.

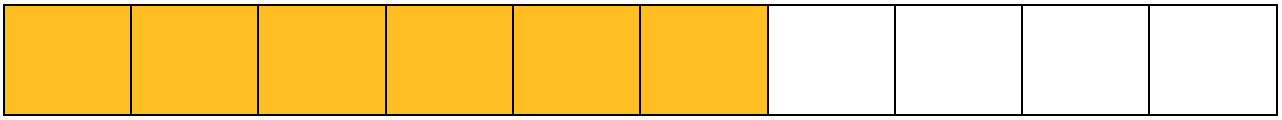
issues	Confirm constraint details	Option assessment	CBA of options	Confirmation of solution	Defined solution development	Delivery- IT MVP requirements & design	Delivery – IT MVP development & testing	Delivery – MVP implementation	Go-Live

RDP 6 – MW Dispatch (Scottish Power Distribution)

This RDP is in lieu of functionalities that GEMS project would have delivered to manage DERs in SPD's Dumfries and Galloway network. The requirements for DERs on the SPD distribution network will now delivered through MW-Dispatch project. This is expected to be similar the solution delivered with NGED and UKPN in England.

Currently Project going through the solution development stage, We are in continuous collaboration with SPD and other stakeholders to finalise the contract terms & conditions for the MW Dispatch implementation.

issues	Confirm constraint details	Option assessment	CBA of options	Confirmation of solution	Defined solution development	Delivery- IT MVP requirements & design	Delivery – IT MVP development & testing	Delivery – MVP implementation	Go-Live



Abernethy

The transmission and distribution network between Errochty and Charleston has, in recent years, seen large increase in the connection of renewable technology. Recently, Scottish Hydro Electric Distribution (SHEPD) received over 100MW of battery storage connection applications at their Burghmuir and Abernethy GSP networks. This together with existing generation in the area pushed the potential flows on the transmission circuit between Errochty and Charleston beyond their limit.

Due to the renewable and flexible nature of the confectioned capacity ESO, SHEPD and Scottish Hydro Electric Transmission (SHET) explored various operational solutions against a build solution. ESO conducted a cost-benefit analysis of the options. Managing the network via an operational solution was recommended as the most economical option. Operational aspect of a possible transmission ANM are currently being assessed and will be further developed during the delivery phase of this RDP.

issues	Confirm constraint details	Option assessment	CBA of options	Confirmation of solution	Defined solution development	Delivery- IT MVP requirements & design	Delivery – IT MVP development & testing	Delivery – MVP implementation	Go-Live

Appendix 2: Discontinued RDPs

As agile projects, the RDPs always look for opportunities to deliver best value and rationalise the treatment across DNO areas. We recognised the need to carefully coordinate with fast-changing connection landscape and priorities. For example, some of the RDPs were on hold for some time while the ESO's connection Five Point Plan and the ENA's Three Point Plan were taking shape to allow us to gauge and understand how the ongoing RDP delivery programme may best support these key initiatives. We have worked with ENA initiatives closely and helped to develop the GSP technical limit proposal. It should be noted that the GSP technical limits considered a number of RDP learnings such as Appendix G process, real-time data links etc. This collaboration will now allow us to rationalise the treatment across DNO areas and should deliver best value.

Some of the RDPs that were planned to be delivered are now covered by the Grid Supply Point (GSP) technical limit proposal. This will now deliver a consistent solution across multiple DNO areas in parallel. Based on this we have discontinued the following RDPs.

East Anglia

Original Scope: UKPN have received a large number of connection applications for new distributed energy resource to connect in the broader East Anglia area. This is a challenging area of the network with the TO, NGET, already working to deliver additional transmission infrastructure by 2028. Until then there are a variety of different operational constraints in the area depending on the generation mix which include voltage and stability. Since Autumn 2021, we have been working with both UKPN and NGET to understand the limitations of the network and develop options to get parties connected ahead of 2028 wherever possible.

Current Status: We are anticipating the execution of GSP Technical Limit will accelerate the connection in this area and helps to manage operability challenges.

Heysham & Lancaster

Original Scope: Electricity North West (ENWL) have received a number of new applications for the connection of DER in the Heysham and Lancaster area, across a mix of technologies including energy storage. These will potentially connect into Heysham GSP which is a complex site effected by the proximity of a nearby nuclear power station as well as several contracted transmission connected offshore windfarms. Currently, we are anticipating the execution of GSP Technical Limit will accelerate the connection.

Current Status: the thermal capacity issues will be addressed by GSP Technical Limit's and it will help to accelerate the connections including battery storage.

North East

Original Scope: We were working with Northern PowerGrid in the north east of England to explore options to connect DER sooner than timescales identified to deliver additional transmission infrastructure, and have started to identify which GSPs may benefit most from an RDP solution.

Current Status: GSP Technical Limit's GB will accelerate the connections and helps in constrain management.

Generation Export Management Scheme (GEMS)

The GEMS delivery did not make progress as initially expected in 2023/24. This is because our project partner and their third-party supplier could no longer move forward with the original GEMS design having encountered a number of impassable technical issues, cyber security concerns and concerns over the implications for a transmission company of full compliance with BSC (BM dispatch rules). We evaluated other options with our project partner and after discussion with the Open Balancing Programme (OBP) it was determined that given the slower rate of new generation connections, the needs case for securing this network now aligned with the roadmap and timescales of the OBP delivery schedule.

The OBP has already delivered 'bulk dispatch' functionality which we can use to automate generation dispatch to a certain extent. This added to our confidence that the adoption of OBP will deliver benefits and will not have any negative impact on generation connection or system operation.

The new proposed way forward will deliver a more streamlined and lower risk and scalable solution for the consumer, providing consistency in approach GB wide, whilst not impeding new connections in this part of Southwest Scotland.

The Transmission Owner will continue to deliver works to upgrade the transmission network as always intended to make it a radial network and implement the Super Grid Transformer (SGT) automatic protection scheme at Kilmarnock South 400kV substation.

We will take over the full scope of the automatic boundary monitoring and dispatch functionality as part of the OBP activities. Already delivered bulk-dispatch functionality will cover the short-term needs case. Additional capabilities to manage nested constraints and fully automate dispatch will be delivered over the coming years.

The requirements for GEMS on the distribution network will revert to a MW-Dispatch like project, mimicking the developments underway with NGED and UKPN DNOs in England.