Distributed ReStart

A high level outline of commercial and regulatory arrangements

October 2020

In partnership with:

tnei

SP ENERGY NETWORKS

nationalgridESO

Contents

Abstract

The Distributed ReStart project is a partnership between National Grid Electricity System Operator (ESO), SP Energy Networks (SPEN) and TNEI (a specialist energy consultancy) that has been awarded £10.3 million of Network Innovation Competition (NIC) funding.

The project is exploring how distributed energy resources (DER) can be used to restore power in the highly unlikely event of a Total or Partial Shutdown of the National Electricity Transmission System. Past and current approaches rely on large power stations but as the UK moves to cleaner, greener and more decentralised energy, new options must be developed. The enormous growth in DER presents an opportunity to develop a radically different approach to system restoration. Greater diversity in Black Start provision will improve resilience and increase competition leading to reductions in both cost and carbon emissions. However, there are significant technical, organisational and commercial challenges to address.

The project is tackling these challenges in a three-year programme (Jan 2019 – Mar 2022) that aims to develop and demonstrate new approaches, with initial procurement strategy and activity for Black Start services from DER expected to commence from mid-2022 if deemed feasible and cost effective. Case studies on the SP Distribution (SPD) and SP Manweb (SPM) networks will be used to explore options then design and test solutions through a combination of detailed off-line analysis, stakeholder engagement and industry consultation, desktop exercises, and real-life trials of the re-energisation process.

Project description

The project is made up of five workstreams. The Project Direction and Knowledge Dissemination workstreams cover the effective management of the project and sharing of learning. The other three workstreams cover the wide range of issues to enable Black Start services from DER:

- The Power Engineering and Trials (PET) workstream is concerned with assessing the capability of GB distribution networks and installed DER to deliver an effective restoration service. It will identify the technical requirements that should apply on an enduring basis. This will be done through detailed analysis of the case studies and progression through multiple stages of review and testing to achieve demonstration of the Black Start from DER concept in 'live trials' on SPEN networks. Initial activities have focused on reviewing technical aspects of DER-based restoration in a number of case study locations that will support detailed analysis and testing within the project. Each case study is built around an 'anchor' resource with 'grid forming' capability, i.e. the ability to establish an independent voltage source and then energise parts of the network and other resources. Then it is intended that other types of DER, including batteries if available, will join and help grow the power island, contributing to voltage and frequency control. The ultimate goal is to establish a power island with sufficient capability to re-energise parts of the transmission network and thereby accelerate wider system restoration.
- The Organisational, Systems and Telecommunications (OST) workstream is considering the DER-based restoration process in terms of the different roles, responsibilities and relationships needed across the industry to implement at scale. It will specify the requirements for information systems and telecommunications, recognising the need for resilience and the challenges of coordinating Black Start across a large number of parties. Proposed processes and working methods will be tested later in the project in desktop exercises involving a range of stakeholders.
- The Procurement and Compliance (P&C) workstream will address the best way to deliver the concept for customers. It will explore the options and trade-offs between competitive procurement solutions and mandated elements. It uses a strategic process to develop fit-for-purpose commercial solutions that are open and transparent, stakeholder endorsed, and designed end-to-end with the commercial objectives of the project and workstream in mind. It will feed into business as usual activities to make changes as necessary in codes and regulations.

For an overview of the project and current progress click on the link: **Distributed ReStart Progress Report – June 2020**[1a]

Executive summary

This report is the second deliverable from the Procurement and Compliance (P&C) workstream, and should be read in conjunction with and following on from the first deliverable, Functional Requirements for Procurement and Compliance (FRPC). It provides a high level outline of possible commercial and regulatory arrangements through an iteration of the strategic process, as well as considering code change requirements in more detail.

Throughout the Distributed ReStart project, the focus of P&C has been to use a strategy development process to provide a mechanism and rigour for the required commercial solutions, once all the inputs needed are available. In this 'Design Stage' of the project, an iteration of this strategic process has been undertaken (taking into account updates from the PET/OST workstreams and outputs from continued stakeholder engagement). As a result it has been possible to propose options for procurement and commercial structures, further developing an approach for industry review.

Procurement and commercial

Strategic process

To investigate and further develop options for commercial solutions and the procurement process, the strategic process detailed in FRPC has been iterated and updated, based on updated outputs from PET and OST, cross-workstream collaboration on base assumptions for the project, and wide-ranging stakeholder engagement with industry colleagues. By feeding these new inputs into the process, it has been possible to develop new, more fitting initiatives, and, with review from industry, ascertain which approach holds the least regrets so that it can be developed further (noting that certain aspects of the commercial solutions are dependent on finalisation of engineering and organisational aspects).

This report should be read in conjunction with and following on from the output of the 'Options Stage', 'Functional Requirements for Procurement and Compliance' (FRPC).

Stakeholder engagement

The intention following the publication of FRPC was to use the report as a 'thought piece' to provoke review and feedback from across the sector to support the refinement of the proposals.

The P&C stakeholder plan identified a broad range of industry colleagues who may have an interest in the workstream, and used tailored methods to get targeted feedback on certain areas, including: numerous one-to-one and group sessions, a survey, the Distributed ReStart Virtual Conference and the Open Networks WS1A workgroup at the ENA (Electricity Networks Association). A summary of the engagement events is available in table 0.1 below.

Table 0.1

Table of P&C stakeholder events

Event	Details
Distributed ReStart conference	30 January 2020
Objectives survey	26 May 2020 – 4 June 2020
Objectives one-to-one engagement sessions (15 mins)	1 June 2020 – 4 June 2020 16 sessions offered
Distributed ReStart Virtual Conference	30 June 2020 – 2 July 2020
Commercial interactive sessions (20 mins)	30 June 2020 – 16 July 2020 14 sessions offered
Codes interactive sessions (30 mins)	1 July 2020 – 9 July 2020 6 sessions offered
DNO interactive sessions	16 July 2020 – 28 July 2020 6 sessions

The continued stakeholder engagement following the initial considerations in FRPC and throughout the Design Stage have helped to shape the approach and steered the direction of the most appropriate course to develop further.

Proposals for implementation

As a result of the strategic process and input from stakeholders, it has been possible to identify and further develop what is believed to be the least regrets approach (approach two) for implementation (subject to further development and review).

The approach, in summary, proposes to procure the anchor generator (AG) capability through an open tender process, similarly to how current services are contracted for, due to the complexity and study work that is likely to be required. It proposes to use a more flexible framework approach for the remaining 'top-up services' (TUS), offering more flexibility in timeframes and contract durations optimised to suit different types of capability/requirement. The key characteristic of the approach is that, although it uses different strategies to access AG and TUS capability, it utilises a combined value assessment to stimulate competition both within the Distributed ReStart Zone (DRZ) and between potential DRZs in a distribution network operator (DNO) area.

This approach, which is discussed in more detail later in the report provides the most flexibility around the design specifics of the approach, and also boasts the lowest barriers to entry:

- It is expected that providers could submit top-up service pricing for a number of capabilities they already have without having to make investment on site.
- Top-up services could be procured in different timeframes, potentially up to one day or even one hour ahead (over the longer term), allowing easier and lower risk participation from intermittent generators.
- Top-up services contracted directly through the party responsible for procurement rather than sub-contracted through another provider ensures transparency more easily.

It is expected that the combination of these factors will create the most optimal conditions for competitive pricing to ensure value for end consumers.

The key dependencies for this option are the design and development of a smart system with the ability to assimilate separate bids for different service components, from different providers, back together for the delivery of a DRZ, and formulation of 'rules of play' to base this system on.

The feedback received regarding the proposed procurement approaches has been invaluable in supporting the development of the most suitable approach and has assisted in steering the decision to proceed with further development of approach two, which is explained in full in section 4.5.2.

Codes

The review of industry codes has progressed from the initial high level assessment presented in the FRPC. A more detailed and comprehensive examination of specific codes and clauses has been carried out and interdependencies between these have been mapped out. The key industry codes discussed are the Grid Code and Distribution Code, where changes will be required to enable further participation from distribution parties, DNOs/DER, in Black Start.

Collaboration with other Distributed ReStart workstreams, OST and PET, has identified key areas of focus. This includes the organisational model proposed by OST, a central model, where there is a combination of responsibilities shared between the ESO and DNOs. The codes will require changes to enable this model.

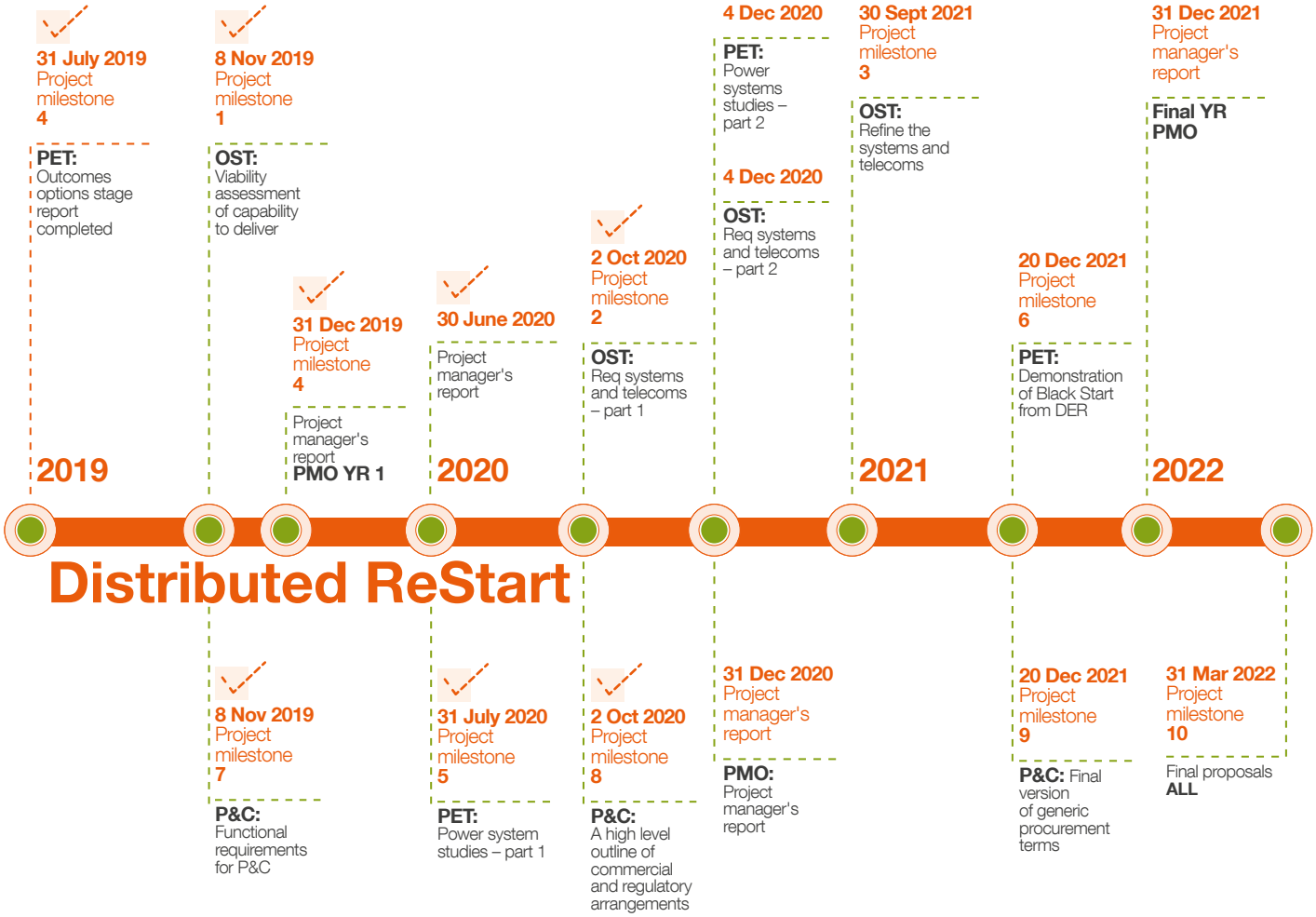
What's next for P&C?

This section summarises a horizon scan, highlighting the need to monitor upcoming events and industry changes, including the expected Black Start Standard, the DSO transition, and the European Emergency Restoration Network Code (NCER), for their impact on the workstream and on the suggested commercial solutions and code change proposals.

The next steps for the workstream include:

- Continued stakeholder engagement to gather feedback on the recommended proposal ('approach two') to support in further developing and refining it.
- Subject to dependencies being met, a 'dummy' procurement event to trial assessment protocols.
- Development of key contract principles ahead of contract drafting (to allow for development to continue while waiting for finalisation of operational and organisational structures).
- Developing a codified definition of a DRZ and other terms; for example, anchor generator.
- Further engagement to understand how to enable the central model within the industry codes.
- Continued collaboration with the PET workstream to understand code implications of live trial outcomes.
- Input to the Emergency and Restoration Code Phase II industry workgroup.

Figure 0.1
Project milestone (10) – timeline



1. Introduction

This report is the second deliverable from the Procurement and Compliance workstream. It should be read in conjunction with and following on from the first deliverable, 'Functional Requirements for Procurement and Compliance', which was published in Nov 2019.

1.1 Background

At present, the Electricity System Operator (ESO) is obliged under the Grid Code (OC9) to maintain the capability to restore the network from a Total or Partial Shutdown. The procedure to perform this recovery is known as Black Start, and the ESO procures this capability under Special Condition 4G of its licence to support this procedure through Black Start and/or restoration contracts.

The network conditions under a shutdown scenario and the early stages of a restoration are complex and challenging and require a wide span of technical capability to manage. The ESO currently employs a top-down skeletal restoration strategy, whereby a number of contracted Black Start providers re-energise parts of the transmission system, enable the start-up of non-contracted secondary generation and the restoration of demand. The current technical requirements, which are aligned to the top-down restoration approach, are published on the ESO website and provide the basis on which the current commercial design of the service and procurement mechanism have been established.

See link below.
https://www.nationalgrideso.com/balancing-services/system-security-services/black-start?technical-requirements[2]

Historically, the types of provider who have been able to meet all of the technical requirements for restoration services have been large, conventional generators. The key to providing a Black Start service is the ability to start up without external supplies (power taken directly from transmission/distribution networks). However, as the obligation to provide Black Start capability lies with the ESO, there is a limited case for generators to install this capability in their designs for the plant, so most assets in GB are built without this. Installing this capability for a large thermal generator can typically require auxiliary generators in the region of 5–25 MW to be installed (depending on the characteristics of the main units), along with retrofitting of control and instrumentation systems to ensure the ability of the plant to control and regulate a power island. These changes contribute a large proportion of the costs of delivering a Black Start service and are central to the commercial framework and procurement mechanism for the service today. In addition, they require a lengthy and complex process from concept to implementation; to assess the feasibility of the proposals, provide assurance to the ESO of the capability, and to contract can take (end-to-end) up to four years in some cases. Although significant changes have been implemented to broaden participation and reduce barriers to entry, such as introducing competitive procurement events, the process for achieving restoration was developed on the basis of a top-down restoration strategy, which is more easily delivered by certain types of providers.

As a number of the stations that historically have had Black Start capability (and may have had it built into the design for the stations) are now coming to the end of their expected life, we are approaching a period where a larger scale of investment is required to replace this Black Start capability. Given the rate at which the energy landscape is evolving, it is prudent to ensure that where investment is necessary to ensure capability, Black Start should be futureproofed as far as possible. This should take into account that the number of large thermal generators connected to the transmission system has decreased and is likely to continue to do so. This is likely to require adjustments to the Black Start Strategy and Procurement Methodology (BSSPM) in order to deliver new commercial frameworks and procurement mechanisms to access Black Start services from DER utilising a bottom-up approach as well as the current top-down approach, which it may eventually replace.

The aim of this report, which should be read in conjunction with "Functional Requirements for Procurement and Compliance" (FRPC), is to further consider and develop proposals for an effective method to access the various technical capabilities required to deliver a Distributed ReStart service.

Given the dependency of this workstream on outcomes of the PET and OST workstreams, this report will iterate the strategic process developed in FRPC, feeding in more detailed base assumptions, and with greater emphasis on the "Initiatives" and "Refine" Stages.

The codes chapter within this report provides an update on progress made since the FRPC report was released, and sets out the work being done for Distributed ReStart in the context of the current code landscape. Interdependencies between industry codes, a more detailed review of key documents, and workshops with codes experts has led to the development of ideas and potential options to enable changes within the codes. The report presents the development of a roadmap to show timelines of potential code changes/solutions.

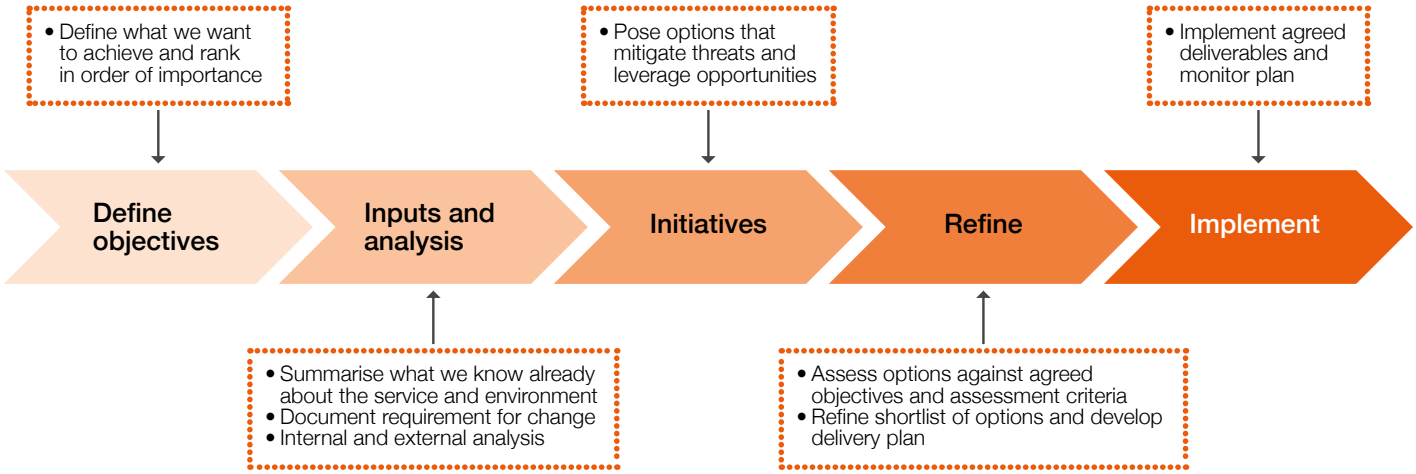
1.2 Re-cap of functional requirements for procurement and compliance – strategy

The focus throughout the FRPC paper was to propose a strategy development process that would provide structure and rigour for determining the required commercial solutions. The report analysed the information that was already available, including the current procurement and commercial processes for Black Start services, as well as the outputs from the PET workstream, and the OST workstream, and called for industry review and challenge on the insights that produced. The paper used commercial tools to help us better understand these factors, and how they might need to change in a future Black Start service from DER, and uses a strategic process that should achieve fit-for-purpose commercial solutions that are designed end-to-end with the commercial objectives of the project and workstream in mind.

The FRPC report developed a five-stage strategy through which Distributed ReStart could design, develop and ascertain the most effective procurement approach and commercial structure for Black Start from DER, which can be seen in figure 1.1 below.

Figure 1.1

Five-stage strategy development process



In the first stage, the report proposed objectives for the commercial outcomes for review, which have subsequently been reviewed and refined through stakeholder engagement. The aims for procurement mechanisms are typically based on the need to reduce cost and increase value, and we expect the objectives for the Distributed ReStart commercial outcomes to reflect these factors too.

During the Inputs and Analysis Stage, the report considered the current processes and commercial structures, and used various commercial analysis and market analysis tools to draw insight that could be taken forward for consideration. A collated list of these can be found in the appendices of the FRPC report.

The purpose of the Initiatives Stage is to develop ideas and solutions in an unconstrained way to mitigate any risks or creatively address any of the insights raised during the analysis. These are further developed and honed through the Refine Stage, where impact versus effort is considered and options assessment is conducted, before the implementation plan is developed in the fifth and final stage.

In the first report, as it was so early on in the project, there was a much stronger focus on objectives, inputs and analysis, and initiatives; taking in information, processing it, and idea generation. In the 'Design Stage' of the project, the focus naturally shifts towards further developing initiatives, refinement and eventually implementation, once there is a clearer view of a final solution and actions can be taken with no regrets.

Since the publication of the FRPC report, the Design Stage has involved stakeholder engagement on the sections of the strategic process and development of options to help us to develop our thinking and shape our approach.

1.3 Re-cap of functional requirements for procurement and compliance – codes

To enable Distributed ReStart, changes will be required within the GB codes and policies which underpin the connection to and operation of the electricity system. These codes have been written and adapted over time, based on the principle that large, conventional generators are the primary providers of Black Start services. An assessment of the gaps and blockers in relevant codes was undertaken to highlight areas where changes need to be made to enable greater participation from DER and distribution network and system operators (DNO/DSO) in a restoration. Table 1.1 shows the different codes that were initially reviewed, with an assigned RAG (Amber, Yellow, Green) status for the changes thought to be needed:

Table 1.1
Code change requirements from initial code review

Code	Change requirement
BSC	Changes made to reflect greater involvement of DERs and DNOs during restoration.
CUSC	Potential changes dependent upon the procurement mechanisms used.
DCUSA	Potential changes dependent upon the procurement mechanisms used.
Distribution Code	Additional detail could be added to DOC9 or, alternatively, adequate signposting to the Grid Code may be appropriate. Inclusion of new parties in specific roles and responsibilities.
ESQCR	The earthing policy from this documentation could lead to an un-earthed power island below 132kV without review.
G5	Minor alteration or relaxation under restoration scenarios may be appropriate.
G91	This could include clearer requirements for telecommunications resilience for DERs in the event of power outages.
G99	Clauses relating to island operation, protection, frequency response, voltage control, reactive capability, and fault ride through may be subject to change, review or derogations for a Black Start restoration scenario.
Grid Code	Principally inclusion of new parties in specific roles and responsibilities and a review of specific sections of the Grid Code to include and not limited to the ECC, OC5, OC9 and BC2.9.
P2	No changes required.
P28	Minor alteration or relaxation under restoration scenarios may be appropriate.
P29	Minor alteration or relaxation under restoration scenarios may be appropriate.
SQSS	No changes required.
STC	A review may be required, where adaptation could include all relevant participants, or an equivalent distribution equivalent document could be created. The STC and STCPs would also need to consider the potential linkage with the establishment of DRZs.

Progress made on the codes, and work undertaken in this area since the FRPC, is detailed in the codes chapter of this report[3].

1.4 Assumptions

As described in FRPC, the P&C workstream continues to develop possible commercial structures and to outline potential regulatory requirements ahead of having a firm operational structure for the service. As a result, the workstream is basing developments in the Design Stage on a number of key assumptions that have been agreed across the project. These allow development to continue in a focused and efficient way in parallel with the operational and organisational structures.

Working from a number of key base assumptions has been critical for development to continue, however, there is a risk that as the project continues and developments are made in each area, that some of these may need to be amended or updated. Consequently, all of the development work here is shared under the caveat that it must be subject to change in the case that any of the base assumptions are amended over time. More detail on the specifics of the assumptions is available in section 3.2.

As with FRPC, this report is not intended to provide market signals for investment, rather to summarise the current position and thinking regarding the direction of travel for accessing a future Black Start service from DER.

For codes, there are two assumptions to highlight. There is an assumption that code change proposal design and agreement on specific changes cannot be finalised until decisions have been made within the project on various aspects of the technical, organisational and commercial elements. The other assumption is that some of the required changes can be passed through an ongoing Grid Code and Distribution Code modification (Emergency and Restoration Code Phase II) rather than proposing a code modification solely for Distributed ReStart.

1.5 Method

The intent throughout the drafting of FRPC was to use the report to inform stakeholder engagement throughout the Design Stage of the project. Since the publication of FRPC, P&C has been engaging with stakeholders and industry colleagues to collect detailed feedback to inform proposals for potential code changes, to iterate the strategic process and to shape the approach to developing future commercial structures and processes.

As the approaches to designing the procurement approach and commercial structure are so closely related, they will be discussed simultaneously using a combined approach. Following the strategic process proposed in FRPC, this report will build on the findings, with additional focus on the initiatives and refine stages where possible proposals for accessing a future Black Start service from DER are developed.

The proposals for regulatory and code changes will be discussed in a separate chapter, which summarises the more detailed development carried out through the Design Stage to ascertain what changes may need to be implemented to enable a future service.

1.5.1 Approach to engagement

Distributed ReStart continues to reach out to a broad stakeholder base and is actively seeking ways to engage with a range of parties. The strategic process from the FRPC report has been used to shape stakeholder engagement around the potential procurement approaches and commercial structures.

Figure 1.2
Distributed ReStart overall approach to stakeholder engagement

The P&C stakeholder plan identified various interested parties to engage with and used tailored methods to target a broad range of these, including: numerous one-to-one and group sessions (advertised through the Distributed ReStart mailing list and Virtual Conference), a survey, the Distributed ReStart Virtual Conference and the Open Networks WS1A workgroup at the ENA (Electricity Networks Association). A list of the various stakeholder events is available in table 1.2 below.

Table 1.2
Table of P&C stakeholder events

Event	Details
Distributed ReStart conference	30 January 2020
Objectives survey	26 May 2020 – 4 June 2020
Objectives one-to-one engagement sessions (15 mins)	1 June 2020 – 4 June 2020 16 sessions offered
Distributed ReStart Virtual Conference	30 June 2020 – 2 July 2020
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DNO interactive sessions	16 July 2020 – 28 July 2020 6 sessions

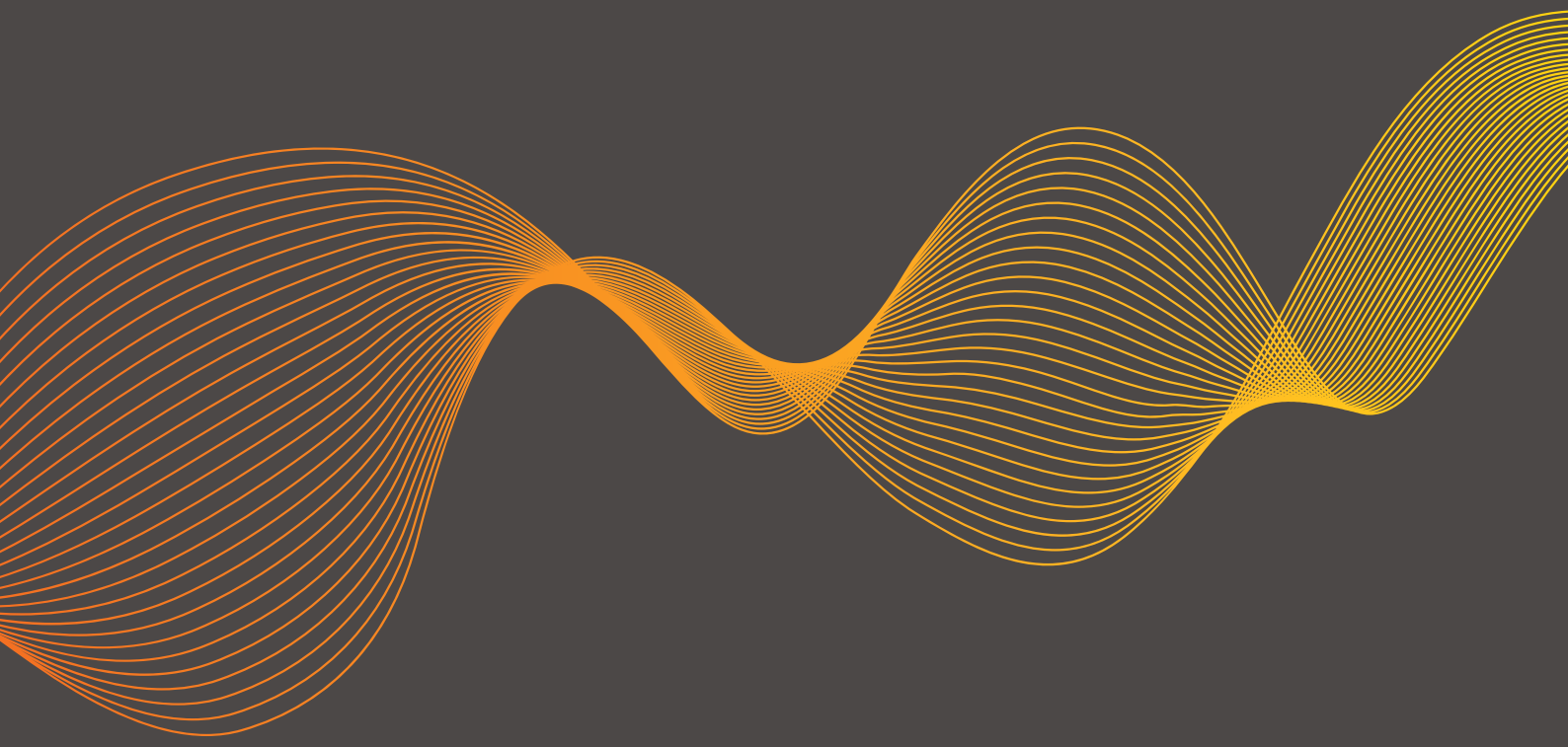
Full details of all engagement conducted can be found in Appendix 1 – Stakeholder Engagement, and is referenced as relevant throughout the report. For the P&C workstream in particular, many of the stakeholders engaged with are likely to have a vested commercial interest in the project outcomes, specifically in the development of potential new revenue streams, and this needs to be taken into consideration as outcomes are developed.

Gaps and blockers in relevant codes have been discussed and solutions proposed through workshops with code experts. There are a number of dependencies on other workstreams (PET/OST) for firm decisions on the code change proposals to be made. Engagement with industry has supported the refinement of code changes required and design of the code change proposals.

COVID-19 has had an impact on the industry/stakeholder engagement by reducing the ability for face-to-face conversations with stakeholders. This may have impacted the quality of the outputs from any engagement.

Distributed ReStart

Procurement and commercial strategy development



This chapter presents an iteration of the strategy development process from the previous report, summarising how our thinking and approach have developed and outlining potential options for commercial structures.

This chapter should be read in conjunction with and following on from the FRPC report, and should illustrate how, through stakeholder engagement and iteration, the approaches have developed.

2. Objectives

The first step of this strategic process is to define the commercial objectives for a potential future Black Start service from DER. Following stakeholder input and review which is described in this section, these have been iterated and refined since FRPC.

2.1 Procurement and commercial objectives

The P&C workstream had initially proposed the following six elements and sought stakeholder input to help review, rank and refine the ambitions for the procurement approach:

- increased competition
- reduced barriers to entry
- increased transparency
- financial value for the end consumer
- accelerated restoration times
- functional route to market for new service.

2.2 Survey results

One method employed for feedback on the objectives was a short poll asking stakeholders to rank the objectives in order of importance, with a free text option to make alternative suggestions. The results of which can be seen in figure 2.1.

At first look, the results seemed to show that the most important objective for survey respondents was 'reduced barriers to entry', and that the least important was 'financial value for the end consumer'. This unexpected result prompted further analysis of the responses, which highlighted that the majority of responses came from DER owners/operators who may have a commercial interest in this project. When the survey responses were split by DER owners/operators, and all other respondents, two very different response summaries were evident, as shown in figures 2.2 and 2.3.

Comparatively, the industry stakeholders that had not identified themselves as DER owners/operators found accelerated restoration times to be most important. This activity, whilst useful for the purpose of refining the objectives, was also invaluable in highlighting the need to ensure any feedback used to shape the approach is free from potential bias for commercial gain, and helped us to tailor our subsequent stakeholder strategy. More detail on the survey results can be found in appendix 1.

Figure 2.1

Graph showing objective rankings from aggregated responses across industry

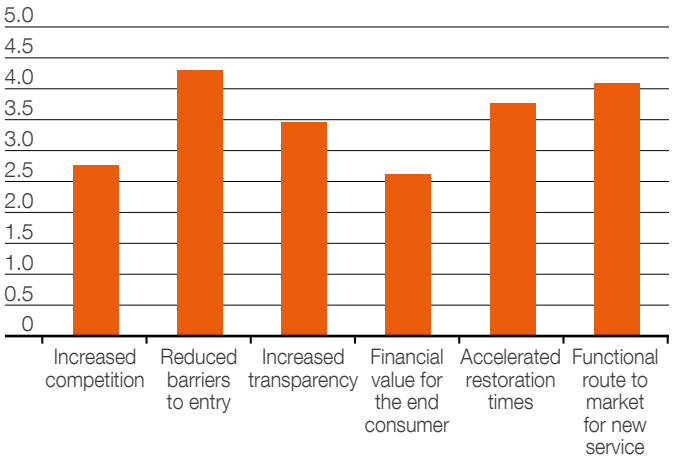


Figure 2.2

Graph showing objective rankings from DER owners/operators

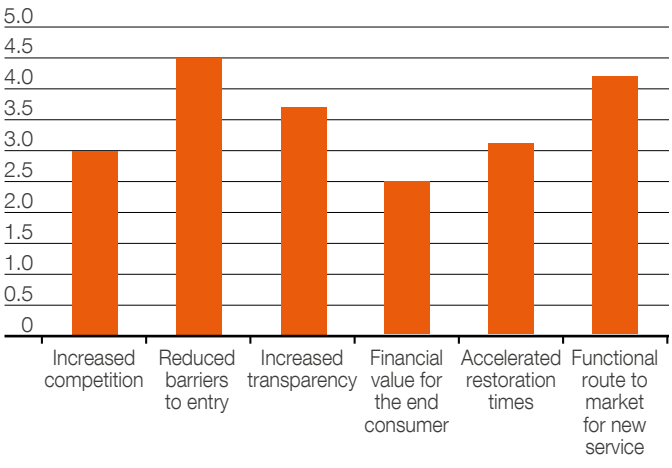
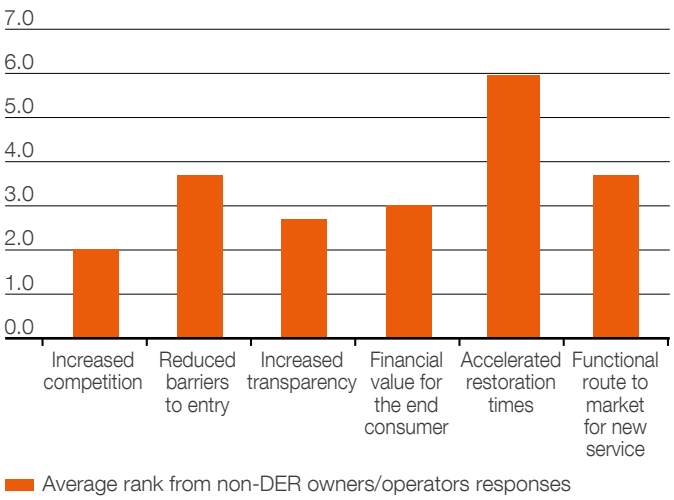


Figure 2.3
Graph showing objective rankings from non-DER owners/ operators



The key findings from this survey are as follows:

- There is a range of priorities and importance placed on the different objectives depending from which view point they are considered.
- Further information and engagement was needed to refine what the objectives should focus on.
- A common consideration which was important to both DER owners/operators and the other respondents was a functional route to market.
- No additional/new objectives were suggested at this point, and equally, no serious objections.

More engagement was required to follow on from the survey and understand the reasons behind the different rankings.

2.3 One-to-one engagement sessions

It was possible to gather more qualitative feedback on the proposed objectives through one-to-one engagement sessions. These 15 minute slots were offered to all Distributed ReStart mailing list recipients who had 'more to say' on the commercial approach. The stakeholders who signed up to the sessions were primarily DER owners/operators. Structured sessions with focused pre-read and targeted questions ensured these were fruitful and produced high quality feedback.

A summary of the discussions can be found in appendix 1, but the key findings and takeaways are as follows:

- Transparency and clarity are important for creating a market where potential providers can access information (timelines, market size, technical requirements, contract information etc) to make informed decisions. Clarity and notice in relation to the requirement were often more important to DER providers than the method of procurement.
- An ability to make informed decisions should mean the market accurately represents the correct prices and costs.
- It was also considered important to value the potential services in a fair way and for providers to have an ability to offer more than one of the services.
- It is important to understand the value for today's consumer versus the future consumer, and this should be taken into consideration during the development of the funding mechanisms to ensure the party responsible for procurement is empowered to make long-term decisions.
- Consideration must be given in the lotting structure to how capabilities are valued when they cannot be separated from another by some providers (for example, synchronous providers who cannot separate inertia from active power).
- It should be made clear to potential service providers how the future service will interact with other services and revenue streams, and if/how it can be stacked to form a business case.

More detailed notes from these sessions can be found in appendix 1.

Assessing the outputs from the engagement on the proposed objectives it became clear that four of the objectives facilitated the other two. It will be important to ensure there is increased transparency, increased competition, reduced barriers to entry and a functional route to market to reach accelerated restoration times and financial value to the end consumer. These supporting objectives will need to be built into the design of the procurement approach and commercial structure to make sure the approach provides the best value to the end consumer and achieves accelerated restoration times.

2.4 Resulting changes to objectives

As a result of the stakeholder feedback, the objectives have been reviewed, and are proposed to be structured as follows, with four sub-categories of two high level objectives:

Accelerated restoration times

- Functional route to market for new service.

Financial value for the end consumer

- Increased transparency
- Increased competition
- Reduced barriers to entry.

It is these two focused objectives that the rest of the process will be seeking to develop solutions in order to achieve.

3. Inputs and analysis

This section builds on the FRPC report and should be read alongside and in conjunction with it. It summarises the new/additional information that forms an input to the strategic process for consideration while developing initiatives.

3.1 Background

The previous report explained the inputs from the other project workstreams, Power Engineering and Trials and Organisational, Systems and Telecommunications, that will feed into the strategic process. It also outlined information around historical costs, forecast costs, market forces and current barriers to entry. This section adds more detail around the inputs required for the strategy development process in order for the proposed solution at the end of the project to be well informed and considered. The additional inputs we need to consider are assumptions made by the project, recent outputs from the other workstreams and the outputs from stakeholder engagement.

3.2 Project assumptions

The project assumptions have been a critical input to the development of commercial proposals. Using base assumptions agreed across the project has enabled development to continue despite outcomes from OST and PET not being confirmed.

The full list of project assumptions can be found in appendix 2, but a summary of the key assumptions impacting the P&C workstream is available in table 3.1 below.

These assumptions and impacts have helped to shape the approach to developing solutions, and supported the assessment and refinement of the initiatives proposed in this report.

Table 3.1

Table showing key assumptions and their impact on P&C

Summary of relevant assumption	Commentary/impact on P&C workstream
There will be at least one anchor generator per Distributed ReStart Zone.	The anchor generator will be an essential component of every DRZ, which should be accounted for in the commercial design when considering value levers.
For each DNO area, it is expected that there will be more possible DRZs (more anchor generators) than will need to be contracted.	This is a key enabler to competition between DRZs within a network area, and will feed into the selection of the most appropriate approach.
The DNO will be responsible for local operational actions within the DRZ on its own network in a Distributed ReStart event.	While there has not been any legal reason identified that the operator must also be responsible for procurement/contracting, it will be simpler and less complex for the operator to hold the contract with the DER. There are, however, other possible benefits for the procurement to be done by one central party, for example the ESO or an independent third party.
There will be a larger number of smaller providers participating in the future Black Start service.	The procurement approach and contracting strategy must take this into account, particularly considering the ability of the relevant organisations to resource these activities.
As the industry moves forward the service will continue to change and develop, and there may be varying speeds in uptake depending on need/investment requirements/appetite.	It may be inherently more costly to implement in the earlier stages, and less costly to implement as industry evolves and changes over time. This may be relevant when considering how to ensure optimal value for the end consumer.
The Black Start Standard, once approved by the Department for Business Energy and Industrial Strategy (BEIS), will require restoration of 60% of demand in 24 hours and 100% of demand in 5 days which will be applied on a regional basis as well (what constitutes a regional basis is currently open to interpretation).	It may be beneficial for the Black Start Standard to be updated to consider DNO areas instead of the current Black Start 'zones' for the purposes of: • Strategy and requirement setting • Procurement and contracting • Performance monitoring and reporting.
Once a requirement for a DRZ has been identified, it will be investigated as to whether the DRZ has the capability to energise up to the transmission network, to another DRZ or just the DRZ area.	Contract strategy and procurement approach will have to consider this and consider in conjunction with the PET and OST workstreams how this will be valued.
The opportunity to participate will be open to all but it will depend on the requirement in each area as to whether there is a need.	The technical requirements should be functional and technology neutral, reducing barriers to entry and valuing higher capability as appropriate.

3.3 Power Engineering and Trials

The commercial design for Distributed ReStart depends on power engineering requirements and technical capabilities identified in both the initial viability paper and the ongoing design process. This will require continual iteration between engineering solutions and procurement considerations to ensure that operational ease of functionality is balanced with ability to access the service in an economic and efficient way.

Alongside the development of functional technical requirements for each and any component of the operational structure of the service, 'rules of play' will need to be developed that govern the interactions between service elements. Collaboration is ongoing across the workstreams to achieve this by the end of the project.

For the purposes of the Design Stage, we are working to the assumption that it will be possible to develop 'rules of play' that will enable the proposed approaches that will be discussed later in the paper.

3.3.1 Key findings from the 2020 PET report, "Assessment of power engineering aspects of Black Start from DER – Part 1"[4a]

For P&C, the relevant key findings that impact the development of commercial structures from part one of the PET workstream's Design Stage report are as follows:

- Grid forming converters are agreed to provide the characteristics of a synchronous generator, meaning that if an asynchronous DER were to build new or retrofit a new inverter (where/if cost effective) it could potentially provide the 'anchor generator' service.
- Energy storage technology paired with a grid forming converter can provide a stability product which is far more effective per MW than a traditional synchronous machine, which may need to be considered in the assessment process with regard to assigning appropriate value respectively to different capabilities.
- 400kV protection is not possible with any combination of DERs at 33kV due to the fault infeed current being too low for fault detection, effectively limiting DER restoration to 132kV in Scotland and potentially 275kV in England and Wales (to achieve this at 275kV at least 200MVA of synchronous DER would have to be contracted, which is unlikely to be plausible in most network areas). This will have implications on the types of restoration service DER at 33kV can provide. This could require adding an additional fault infeed service at voltages higher than 33kV.

The full report is available on the Distributed ReStart **webpage**[4].

3.4 Organisational, Systems and Telecommunications

Iteration between organisational, systems and telecommunications design and procurement design is essential for project delivery. The specification for systems requirements could enable options for monitoring availability and performance, and potentially tendering or auctioning. Furthermore, highly functional systems may allow for procurement solutions and commercial designs for services that would otherwise be unfeasible because of resourcing requirements, enabling greater market participation. However, onerous requirements on the number of DERs per restoration plan or on automation requirements could affect liquidity.

The OST workstream developed four possible organisational models for on-the-day responsibilities in a Black Start situation in its viability stage report: the ESO led highly manual and highly automated models, and DNO led highly manual and highly automated models. Considering the analysis across the Design Stage, the feedback from industry and the wider developments in distribution system operator functions, the OST workstream now proposes a central case model that enables the ESO to coordinate nationally and the respective licence area DNO to lead locally. This cooperative method mitigates the risks whilst reducing the organisational change as far as possible. A legal review has highlighted that there is no specific requirement for the procurement model to follow the organisational model but it may affect the best party to undertake the procurement for a potential service. Later in the report we will discuss the options we have developed for the procuring entity and contracting structure.

The OST Viability Report[5] and **OST Design Stage Report can be found on the Distributed ReStart webpage**[6].

3.4.1 Distributed ReStart Zone controller

The PET and OST workstreams are working together on the design of a DRZ controller, with support from multiple expert active network management and microgrid developers. The aim of this controller is to execute power systems control procedures which require faster acting intervention than is possible with existing distribution management systems whilst reducing the labour requirement to execute a restoration procedure.

A DRZ controller is crucial for coordination within each DRZ. This will require P&C to make considerations around how this is funded/costs recovered. If it is not possible to have a DRZC then it is recommended there is only one DRZ per DNO area/control room to ensure coordination is possible.

The outputs from this work will need to feed into the Refine Stage because considerations will need to be made on system integration and possible assimilation of multiple contracts and parties working together within the DRZ.

3.5 Stakeholder engagement

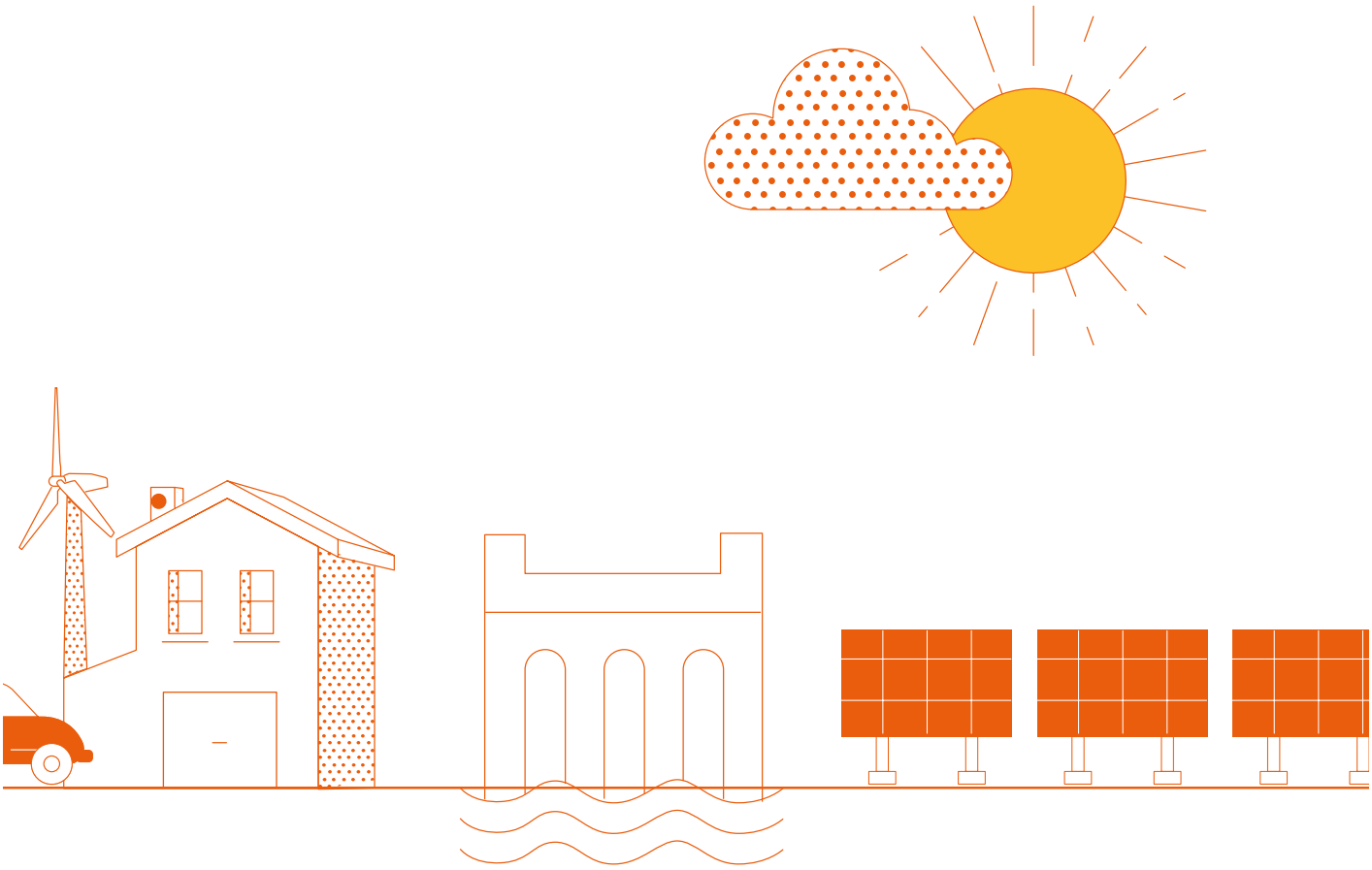
Stakeholder engagement and feedback is a key input to the strategy development process. The P&C workstream needs support and collaboration from stakeholders to inform and refine the design of the most suitable procurement approach and commercial structure.

The P&C workstream has undertaken several stakeholder engagement activities since the previous report. These have included one-to-one sessions, a survey and a Virtual Conference. More detailed information on the engagement undertaken is in appendix 1, and as relevant throughout the report.

In summary, stakeholders have supported P&C with feedback and refinement throughout the strategic process. This included feeding back on the objectives to arrive at the most suitable version. Stakeholders were also consulted on the proposed procurement approaches. Taking into consideration the feedback received has crucially supported the process of deciding which is the most suitable approach to take forwards.

The aggregated key findings from the ongoing stakeholder engagement activities will be referenced at the relevant points throughout this report.

Input from industry stakeholders remains a key input, and has been critical in evaluating the initiatives and shaping the proposals discussed within this report.



4. Initiatives

The purpose of the initiatives stage is to develop and discuss ideas and solutions in a relatively unconstrained way to address insights drawn from FRPC along with the additional inputs gathered in the Design Stage. In this section of the report, a summary is provided of the process explored to achieve this, along with a commentary to illustrate stakeholders' thoughts on these.

4.1 Process

Drawing on earlier insights and the more recent inputs already discussed, further consideration was given to a number of key areas of the commercial process to support development of approaches. These included: routes to market, lotting structures, commercial structures and risk and reward, considering throughout how well each of the variations meets the objectives of the workstream, and the risks, benefits and dependencies associated with them. Each of these will be summarised to illustrate how the overall approach has been shaped over the course of the Design Stage. Please note that for the purpose of this stage, there will be a neutral viewpoint on which party will be responsible for procurement and contracting.

For the purposes of illustrating this stage, an introduction to each of the different lenses used will be provided first, before discussing and analysing the merits of each approach in relation to these.

4.2 Lotting structures

A 'lot' or 'bundle' essentially describes how capabilities could be grouped for the purposes of procuring them in an efficient way.

The PET workstream has developed a set of required technical capabilities that are necessary for forming a Distributed ReStart Zone (DRZ), which are summarised in table 4.1.

More detail on these can be found in the 2020 PET report, "Assessment of power engineering aspects of Black Start from DER – Part 1", which is available **here**[7a].

Table 4.1
Table showing 'lotting' structure

Necessity	Capability
Essential for each DRZ	• Anchor generator
Potential for each/some DRZs	• Fast MW response • Fast MVAr response • Energy (MWh) • Fault Infeed • Inertia • Demand

We have split these into two 'lots' or categories of capabilities, 'anchor generator' (AG) capability, and 'top-up' services (TUS). In addition to the technical capabilities required, 'demand' has been included as a potential third 'lot', or 'top-up service', though whether it is operationally feasible to include contracted demand (as a separate commercial service) in a DRZ will need to be given further consideration.

Based on the defined required technical capabilities, we have developed three approaches for procuring these lots that could be used to access these to deliver a Distributed ReStart service in the future.

These lotting structures have also been used as the basis to assess the suitability of different procurement methods and commercial structures which will be discussed later.

4.3 Routes to market

The FRPC report introduced a number of routes to market, referenced in table 4.2 below.

Table 4.2
Routes to market

eAuction
May also require a framework agreement. Requires an online platform where providers can bid against a requirement. Generally allows greater flexibility and suits shorter-term requirements/closer to real-time procurement.
Frameworks
High level requirements are set and 'zero-value' contracts are agreed with more parties than are required. Closer to real-time, mini-tenders can be used to 'call off' these contracts based on pre-agreed terms bound by the frameworks.
Open tender/Request for proposal (RFP)
Requirements are set and published, providers submit a tender against an agreed timeline. New contracts are awarded each time. Generally useful for more complex requirements with solutions that take longer to develop.
Bilateral/Single source
Agreeing contracts independently with providers to access specific partnership/portfolio benefits. Typically useful in situations where liquidity is low, or where significant innovation is required to solve a challenge.
Mandated
A solution where certain capabilities are required as a condition of connecting to the network.

Analysis has been conducted on these procurement methods, to understand how well they meet the objectives, the benefits and challenges, and any enablers required. Assessment of the best fit for each method has been undertaken and suggestions for which method each proposed approach could use. Summaries are available in tables 4.3 through 4.7 below.

Table 4.3

Route to market table – eAuction

Objectives	Benefits	Challenges	Enablers
• Competitive – can switch providers easily (as long as there are enough providers). • Market information (e.g. price) is transparent and clear. • Most economical contract awarded – good value for the end consumer (as long as you have enough providers to drive the price down).	• Closer to real-time. • Ability to switch easily between providers, providers' ability to switch between services. • Providers need to meet all technical elements in advance, which means the selection is done solely from commercials (e.g. price). • Automated – algorithm works out the most economical contract award. • Allows varying requirement e.g. for seasonal demand. • Allows participation in the service when it suits providers (they can change their provision if they can make more money elsewhere).	• The more providers you have the better the prices will be – so needs a larger pool of providers. • If high capital investment is required, providers may struggle to have investment cases approved. • May be difficult to have regional aspects – each DNO has their own auction. • Possible difficulty for providers to forecast revenues.	• Would need to integrate with all other systems – data flows. • Would need to be able to take complex inputs – complex algorithm (assimilate all of the technical elements to meet the restoration times – how to assess). • Self-certification (for Black Start capability) would make this easier to implement. • Would require a pre-qualification process to set up providers on the system. • Good performance monitoring system(s) to make sure that providers are delivering on the contract.
Best fit for: shorter-term (more flexible) requirements: • Active power service component • Reactive power service component.			

Table 4.4

Route to market table – frameworks

Objectives	Benefits	Challenges	Enablers
• Ability to change providers between the 'mini tenders'. • Providers can offer a mixture of services (full/part)/timeframes which may make it cheaper – better value for the end consumer.	• Easy for providers to sign up and everyone is on the same standard terms. • Can have varying 'mini' tenders inc: geographic zones, timeframes (closer to real-time), service (full, individual, combinations). • Can use eAuctions for the 'mini tenders'.	• Requires resource to assess the tender submissions and organise the standard contracts to sign. • Less flexibility to change what is being procured because the standard terms are pre-agreed.	• Ability for providers to self-certify reduces resource constraints. • System for assessing and awarding contracts in the 'mini tenders'. • Would require systems to be integrated so the data can flow between tenders and operational processes. • Good performance monitoring system(s) to make sure that providers are delivering on the contract.
Best fit for: base requirement to meet restoration times and then 'top-ups' for seasonal demand fluctuations.			

Table 4.5

Route to market table – open tender

Objectives	Benefits	Challenges	Enablers
• Competitive at the tender stage but less ability to have multiple tenders because they tend to be longer contracts. • Slightly transparent – everyone can see the requirements but some contractual elements may need to remain confidential (due to sensitivities around plant).	• Ability to have stages within the tender – get assurance up front about provider capabilities. • It gives the ability to have more inputs and complexities within the tender. • Certainty of service provision and revenue for providers.	• Longer contract durations so less able to switch providers. • Less flexibility for varying what is bought e.g. to allow for seasonal demand. • Time it takes to go through the process (assessment etc) – contracting decisions far ahead of when you require the service. • Investing large sums of money and time into the process.	• Closest process to what we currently use for Black Start – there are not many blockers for using this process. • However, considerations would need to be made with regards to lots of new smaller providers – how would the assessment of tender submissions be resourced. • Good performance monitoring system(s) to make sure that providers are delivering on the contract.
Best fit for: longer-term or more complex contracts such as anchor generators or combined service submissions.			

Table 4.6

Route to market table – bilateral negotiation

Objectives	Benefits	Challenges	Enablers
• This process is not transparent for the market. • This method may be the best value option for the consumer in less liquid markets – ability to negotiate on price and the contracting party might be able to access levers, such as a portfolio approach (if they are in more than one 'zone').	• It is simple and easy to use when there are not many providers in the market. • If high capital investment is required it is only invested once rather than multiple times on multiple providers and then not utilised. • Negotiation is available.	• Longer contracts, less easy to change provider. • Difficult to manage if there are lots of providers contracted this way. • Risk missing out on innovative new approaches by bilaterally contracting with one provider with known capability, rather than approaching the whole market.	• Need to know who the providers are if you are not going to the whole market. • Resource for contract managing the providers and making sure they are delivering on the contract.
Best fit for: longer-term or more complex contracts or in lower liquidity markets.			

Table 4.7

Route to market table – mandated services

Objectives	Benefits	Challenges	Enablers
• Very transparent to the market. • Lower contribution to developing a market-based approach.	• All providers have to adhere to the requirements. • Cheaper for newer assets to meet requirements (they will have built in the requirements to the asset build).	• Which elements to mandate in the codes and to what extent (everything or only parts and then have a competitive market). • When creating code modifications there may be lots of objections. • Retro-fitting existing assets, as required, may be more expensive.	• Code modifications to add in the requirements + decisions on what would be required. • What has to be met (technical requirements) vs who has to meet it – what is put into the codes.
Best fit for: scarce resources OR very common resources.			

4.4 Commercial risk and reward

For each of the approaches, a high level outline of the best fit process was prepared. This activity allowed for extrapolation to speculate on the benefits, risks and dependencies in each approach, and how the contracts for each might need to be structured to balance these.

4.5 Approaches

4.5.1 Approach one

In approach one, there is one contract between the party responsible for procurement and a lead service provider for each DRZ. In this structure, the lead service provider (anticipated to most likely be the owner/operator of the anchor generator) may be able to provide the full suite of technical capabilities by themselves, or may wish to act as an aggregator or to sub-contract for some of the top-up services.

Figure 4.1

Structure of approach one

In this option (depending on the contractual structure), the lead service provider may take on additional risk should they not be able to deliver if one of their sub-contracted top-up services becomes unavailable, which may make this unpopular with service providers. In the one-to-one conversations, there were differing opinions on this, with some providers keen to take on the additional responsibility, and others concerned about relying on other parties.

The lead service provider may be able to procure the top-up services by whichever method seems most appropriate to them, but there is a risk that there may be extra costs built in if the lead service provider needs to sub-contract. It may also be difficult for providers to enter the market if they do not have all of the elements and are unable to find other DER to contract with.

To meet the likely assurance requirements, this option is likely to require detailed study work, and as a result, the open tender procurement method is considered the most suitable.

This option could be the simplest and quickest to implement for the party responsible for procurement. It has the least enabling work required (for the 'buyer') because it would most likely follow the current Black Start contracting process, reducing the need to create a new process. However, the success of the approach could largely depend on the risk appetite of the provider, and their ability as a result to take on the additional responsibility, and considerations do need to be made regarding constraints for resource for assessing tenders and managing contracts from a larger number of providers.

4.5.2 Approach two

In this approach, the party responsible for procurement contracts for all of the required elements of a DRZ with whichever parties create the best value proposition, and can hold one or multiple contracts per DRZ. The procuring entity would contract with the anchor generator and top-up services separately (as required) and the top-up services could be procured in different combinations (individually, all together or a combination of the two).

Figure 4.2

Structure of approach two

The procurement of an anchor generator will be complex and is likely to require detailed study work. There may also be study work required during the assessment process to consider which combination of contracts (anchor generator and top-up DER services) for each DRZ will be the best solution technically and commercially. It is expected that this would be the responsibility of the party responsible for procurement, and this activity of assimilating the separate components into a functional operational service that the control staff have confidence in is a significant dependency that will need to be addressed over a period of time. This not only depends on having smart enough and well-integrated systems over the longer term, but also 'rules of play' that provide enough rigour and instil enough confidence to go to market. To illustrate, 'rules of play' may include, for example:

- A geographical or electrical distance from an anchor generator (or a reactive capability) that could reach the AG.

Potential suitable procurement methods would most likely require an open tender approach for the anchor generator, but the top-up services could be delivered in a number of different ways to increase flexibility and reduce barriers to entry, including eAuctions or call-off contracts under a framework design.

This option provides the most flexibility around the design specifics of the approach, there could be separate procurement events for each of the elements or one procurement event which has different terms and timelines. Consideration must be given to the timelines for procurement of the AG and TUS, and it is expected that through sensible alignment of these, additional value could be driven for the end consumer.

This option also boasts the lowest barriers to entry:

- It is expected that providers could submit top-up service pricing for a number of capabilities they already have without having to make investment on site.
- Top-up services could be procured in different timeframes, potentially up to one day or even one hour ahead (over the longer term), allowing easier and lower risk participation from intermittent generators.
- Top-up services contracted directly through the party responsible for procurement rather than sub-contracted through another provider ensures transparency more easily.

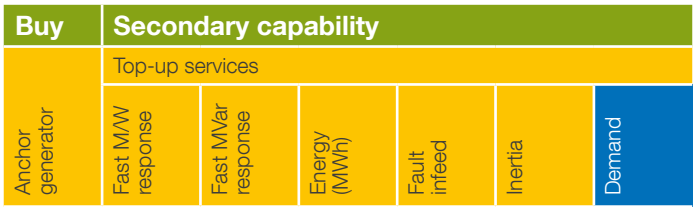
It is expected that the combination of these factors will create the most optimal conditions for competitive pricing to ensure value for end consumers. The key dependencies for this option are the design and development of a smart system with the ability to assimilate separate bids of service components from different providers back together for the delivery of a DRZ, and 'rules of play' to base this system on.

4.5.3 Approach three

In approach three, while AG capability is still contracted for, the proposal is that 'top-up' elements would be accessed through code mandated capability during market suspension in a Black Start situation as opposed to be contracted for ahead of time.

Figure 4.3

Structure of approach three



As with approach one, an open tender method would likely be most suitable for the procurement of the anchor generator. Mechanisms for accessing the 'top-up' technical elements would need to be added into the codes to ensure the correct requirements are in place for the entity who is responsible for operation on-the-day to be able to access the assets in a Black Start situation.

This option provides the least flexibility and may be controversial with providers wishing to diversify and maximise their revenue streams. It could also be more costly in the long term as, at present, only a proportion of generators are contracted, whereas code-mandated capabilities would likely apply to all generators of different categories (but possibly not all categories). As the cost of ensuring capability would eventually be passed on to billpayers (as generators seek to recover their costs in the wholesale market), this could effectively result in overholding at cost to the end consumer.

To enable this approach there would have to be fairly significant code changes implemented, which could be impacted by the opinions of code modification workgroups. Assuming for this report, the codes were changed as required, there would have to be a roll-out programme allowing time for existing assets and assets under construction to make changes and presumably recover the costs for these, and there could be an impact on financial decisions for projects in the planning stages.

4.6 Assessment of approaches

Through industry engagement and qualitative feedback, we have been able to both refine the objectives, and also qualitatively gauge and assess the options and approaches proposed.

As previously highlighted in FRPC, the aim of the strategic process proposed in this report is to support development of a tailored, fit-for-purpose solution with these objectives in mind throughout the end-to-end process, reducing the reliance on a pseudo-quantitative assessment at the end. However, alongside the qualitative, rich feedback from ongoing dialogue with industry colleagues, a suitability assessment has been conducted for the procurement approaches, which considers how appropriate the options and approaches are, and how well they meet the objectives. A summary illustrated by RAG status can be seen in figure 4.4 below.

Figure 4.4

RAG status of procurement methods

RAG status	e-Auction	Frameworks	Open tender/ Request for proposal (RFP)	Bilateral/Single source	Mandated
Meet objectives					
Benefits					
Challenges					
Enablers					

4.7 Stakeholder led approach

The rich, qualitative feedback gained through the stages of one-to-one conversations, Virtual Conference and follow-ups have had the most significant impact in our assessment of suitability of each of the approaches described above.

A description of the approach, aims, target audience and key findings of each of these activities can be found below. More detail can be found in appendix 1.

4.7.1 Virtual Conference and interactive sessions

The Distributed ReStart project held a Virtual Conference from 30 June to 2 July 2020. The aim of this event was to update the industry on where the project was in the Design Stage and to gather stakeholder feedback. During this event, there were sessions from each of the different workstreams (Power Engineering and Trials, Organisational, Systems and Telecommunications, and Procurement and Compliance), as well as sessions with a whole-project perspective.

The Procurement and Compliance workstream held two sessions: an overview on the procurement and commercial aspects and an overview of the codes and licences review. The aim for the commercial session was to update the industry on progress within the Design Stage by releasing the proposed procurement approaches. Following this, a number of interactive sessions were held, which were advertised during the event and subsequently through the mailing list, to gather more qualitative feedback from stakeholders who wanted to feed back on the proposed approaches. Structured 20 minute one-to-one sessions with targeted questions ensured these were constructive and useful, producing high quality feedback. The majority of stakeholders who signed up to these sessions were DER owners/operators.

Key findings from the Virtual Conference interactive sessions:

- Flexibility for providers to make an informed decision about which services to provide and the ability/scope to provide more than one service are considered important. Approach two provides most flexibility for providers.
- Clear requirements for the technical capabilities allow providers to make informed choices on which service to provide.
- Clearly defined contracting processes with notice of deadlines and milestones are crucially important, possibly even more so than the approach itself, to enable providers to make informed choices about participation.
- Price submissions likely to include required investment (asset enhancements, installation of communications equipment etc) to provide the service plus profit margins. Ensure that the contract structure enables efficient recovery of capital, perhaps by using longer-term contracts where capital investment is required.
- Ensure the contract structure appropriately incentivises performances and manages risk of non-delivery.

4.7.2 DNO engagement

The P&C stakeholder plan identified DNOs as key interested parties. As the DNOs currently procure flexibility services, one of the objectives of the engagement was to understand their processes and any lessons learnt from flexibility markets on the DNO networks as well as gather their feedback on the proposed procurement approaches.

The Electricity Networks Association (ENA) lead the Open Networks project which is a collaboration with industry aiming to transform how network operators operate and work for customers to deliver smart energy grids. Relevant to P&C, is Workstream 1A – Flexibility Services, which considers DNO flexibility markets. Through liaison via the ENA, it was possible to provide an overview of workstream progress in the Design Stage, and to reach the relevant teams within each DNO to arrange one-to-one sessions to discuss their flexibility services and the proposed procurement approaches for Distributed ReStart.

These were structured 30 minute sessions with the proposed agenda and proposed procurement approaches circulated beforehand, this ensured all attendees understood the aims of the sessions, resulting in high quality discussions.

Key findings from DNO discussions:

- Transparency is important.
- Reliability and resilience of delivery from contracts is important.
- Technical requirements need to be clear and technology neutral.
- Consideration must be given to how the service will be funded and what the roles of different parties (ESO/DNOs/DSOs) will be.
- Approach two appears to provide the most suitable options for covering risk for the different parties when contracting.
- A pool of pre-approved and registered assets is a tested method for assessing providers and allowing tendering in shorter timescales.

4.7.3 Other relevant projects

Where the work and outcomes of other projects has been identified as relevant, the workstream continues to seek and welcome collaboration.

4.7.3.1 RaaS[13]

Resilience as a Service (RaaS) is a project looking at developing and trialling methods to increase security of supply on the DNO networks. A session was arranged for both projects to share overviews on their respective work to identify any opportunities for collaboration. There are some similarities between the projects, and ongoing engagement is being led by the OST workstream.

4.7.3.2 Pathfinders

The ESO are running a number of pathfinder projects which consider commercial alternatives to transmission network investment. The P&C stakeholder plan identified that these projects may be able to share best practices on developing new markets that could support the Design Stage work. The projects start by identifying the service requirement and then determining the most suitable way to access this within a market situation, which aligns with the P&C strategy development process.

More information can be found on the ESO **webpage**[8].

4.7.3.3 CIGRE Paper C5-306[10]

This paper explored ancillary services market reform with regards to how TSO-DSO coordination might work and DSO procurement of flexibility services in the Italian context.

There were four potential options explored within the report, with two options aligning with what has been discussed within this P&C report. Option 1, a rules based approach with requirements being added to industry codes; and option 4, a market based platform, including spot markets with a flexibility platform, competitive tenders or long-term bilateral contracts. The discussion within the CIGRE report has been interpreted to validate the approach P&C has taken to develop the proposed approaches for this potential new Black Start from DER service.

As the Distributed ReStart project continues, P&C will continue to collaborate with other relevant projects, industry forums and businesses to gather insightful stakeholder feedback.

4.7.4 Outputs of stakeholder engagement

The continued stakeholder engagement following the initial considerations in FRPC and throughout the Design Stage have helped to shape the approach and steered the direction of the most appropriate course to develop further.

The feedback received regarding the proposed procurement approaches has been invaluable in supporting the development of the most suitable approach, and has assisted in steering the decision to proceed with further development of approach two. Approach two provides the most flexibility for the providers and the buyer, as a result of the ability to offer multiple services and the flexibility around how the procurement processes are structured for different service components. It is also expected that approach two has the greatest opportunity to drive value for the end consumer through meeting the commercial objectives of increasing competition, reducing barriers to entry, and improving transparency.

Approaches one and three were deemed through this process to be less effective at meeting the commercial objectives. For approach one, this was due to uncertainty regarding how the contracting structure would encourage competition and drive value, specifically in relation to the potential need for providers to indemnify each other for non-delivery. Approach three may have been the most controversial as it would access a number of components through mandatory mechanisms as opposed to market mechanisms, but could be beneficial where investment requirements are low. Despite these factors, all three approaches could work if the correct processes were in place, and there are no insurmountable barriers to any of them; however, taking into account feedback from industry, the least regrets approach for further development is approach two.

5. Refine

The purpose of the Refine Stage is to begin to hone in on a potential solution, and to create a focus that allows for it to be developed in more detail.

5.1 Developed proposal

As a result of the continued stakeholder engagement and updated project assumptions as described above, the natural course of development has led to the further development of approach two described in section 4.5.2, and summarised below.

> *In this approach, the party responsible for procurement contracts for all of the required elements of a DRZ with whichever parties create the best value proposition, and can hold one or multiple contracts per DRZ. The procuring entity would contract with the anchor generator and top-up services separately (as required), the top-up services could be procured in different combinations (individually, all together or a combination of the two).*

Figure 5.1
Structure of approach two

5.2 Procurement process

To optimise value for the end consumer, the proposal is to go to market for both Lot A – anchor generator (AG), and Lot B – top-up services (TUS) at the same time, to create a pool of pre-approved top-up services that could be assigned to any anchor generator (subject to 'rules of play'). As we anticipate there are more potential AGs than number of DRZs needed, competition would be stimulated between AGs in each distribution network operator area. In addition, as the technical requirements and barriers to market entry for TUS are expected to be potentially lower, it is expected that (possibly over the longer term) there ought to be competition within a DRZ for the TUS as well. As part of the assessment process, ideally, a mechanism will be developed for comparing the overall costs of each DRZ (including the AG and the TUS), to allow for contract award in merit order according to value. It is still being determined how this will be developed without removing flexibility and ongoing competition in the TUS, however, it is possible that a baseline volume could be procured in advance, with the remaining volume being procured in incremental intervals approaching 'real-time'.

As described in the initiatives section, the ability to assess the cost and capability of separate AG and TUS at scale could largely depend on the functionality of integrated systems to assimilate these separate components into an operationally functional service. The assessment would have to be able to assess all possible combinations that meet the 'rules of play', and determine which combination/s is/are the best value proposition. It is envisioned that over the longer term, this approach could be called off from a national pool across the DNO regions. However, for the meantime, it is expected that it would need to be developed and trialled at a much smaller scale, most likely requiring a manual solution.

If possible (and subject to outputs of PET and OST workstreams, particularly including the 'rules of play'), a trial 'dummy' procurement event may be carried out before the end of the project.

5.3 Anchor generator example process

The AG service and process are in many ways similar to the existing Black Start service, only on a smaller scale and at a lower voltage level. As such, the existing Black Start tenders may provide a useful precedent to base the process for procurement of AG services on. To illustrate, an indicative example process is provided in table 5.1 below.

Table 5.1

Example procurement process for anchor generators (AG)

AG process						
Process step	**Expressions of interest**	**Initial studywork**	**Detailed studywork and bid submission**	**Combined assessment**	**Construction period and commissioning assessment**	**Commercial operations and routine testing**
Description	Assessment of eligibility against technical requirements. Conditions of contract made available for informed decision to be made on participation. Procurer to gauge initial interest in event.	Technical elements to be developed further. Allows decision on whether project is worth pursuing. Could potentially be combined with Expressions of Interest (EOI).	Determines absolute capability and creates contract parameters.	AG submissions and TUS submissions are assimilated into potential DRZ combinations and assessed for overall value.	Enables works to develop the Distributed ReStart capability. Test determines whether the capability is present and to the agreed standard.	In line with the relevant codes, regulations and agreed technical standards proposed by the project. Service commences and delivers as per agreed parameters, top-up services may be delivered by different assets at different times.
Proposed timeline	2 months plus assessment time.	2 months plus assessment time.	6 months.	TBC	2 years (could be reduced significantly depending on works requirement).	5 years.
AG risk and reward						
Buyer	Meet obligations to maintain provision. Confirmation of eligibility. Ability to gauge interest ahead of contracting. Resource required to develop strategy and requirements ahead of contracting.	Enables informed decisions. Commitment/ investment made by provider gives confidence in process. Resource required for assessment.	Investment in provider that may not become a contract. Assurance that the provider has capability and a quality study has been completed. Study is otherwise a barrier to entry, so completion increases competition. Enables informed decision.	Resource required for value assessment. Combined assessment enables competition between and within DRZs.	Capital contribution during build (before service commencement). Assurance of capability. Test cost and time.	Service delivery means buyer meets their licence obligations. Test cost and time.
Provider	Informed decision about participation from clear technical requirements.	Delivers at own cost, making an investment in participation. Enables informed decision.	Assurance they can meet the requirements/ capabilities (informed decision). Protected from the costs if not capable. Non-competitive pricing may lead to non-successful bids.	Value is determined comparatively against other providers. Revenue certainty.	Late commissioning reduces revenue. Test cost and time.	Test cost and time. Certain revenue/ availability payments. Revenue lost in case of defaults on obligations.
End consumer	Assurance of service provision and quality in economic and efficient way (delivered through increased participation and competition). Protected from non-delivery by Events of Default or other mechanisms.					

5.4 Top-up services example process

Further development is needed in relation to the technical requirements and rules of play for TUS providers as these are most different from all current practices, however, a possible solution is outlined in table 5.2 below.

Table 5.2

Example procurement process for top-up services (TUS)

TUS process						
Process step	**Call for technical pre-approval**	**Deadline for all pre-approvals**	**Price submissions in pre-approved pool**	**Combined assessment**	**Commissioning assessment**	**Commercial operations and routine testing**
Description	TUS providers are able to complete their pre-approval and submit for review (possibly subject to a pre-booked assessment slot to manage resource). These may need to be accompanied by certification from an independent expert.	All pre-approvals to be submitted and agreed by a certain date ahead of bid submission by AGs.	All providers in the pre-approved pool to submit pricing for longer-term contracts (duration tbc). Deadline for this aligns with deadline for AGs to submit detailed studies and commercial bid information.	AG submissions and TUS submissions are assimilated into potential DRZ combinations and assessed for overall value.	Test determines whether the capability is present and to the agreed standard.	Service commencement may be delayed after contract award if there is no benefit of delivery before AG commencement. In line with the relevant codes, regulations and agreed technical standards proposed by the project.
Timeline	Opens with AG EOI.	1 month ahead of bid submission deadline.	Closes at AG bid submission deadline.	Timeline dependent on various factors, but should conclude in line with AG contract award.	Commissioning assessment may or may not be required if independent certification has already been achieved.	
TUS risk and reward						
Buyer	Meet obligations to maintain provision. Confirmation of eligibility. Ability to gauge interest ahead of contracting. Resource required to develop strategy and requirements ahead of contracting.	Pool of pre-approved assets enables competition and flexibility to switch between providers, meeting licence obligations.	Pool of pre-approved assets enables competition and flexibility to switch between providers, meeting licence obligations.	Resource required for value assessment. Combined assessment enables competition between and within DRZs.	Assurance of capability and service provision. Possible test cost and time.	Service delivery means buyer meets their licence obligations. Test cost and time.
Provider	Informed decision about participation from clear technical requirements. Can assess own ability through self-certification.	Deadline may be a long period ahead of service commencement. Informed position from which to submit pricing.	Non-competitive pricing may lead to non-successful bids. Informed position from which to submit pricing. Pricing submission in flexible timescales.	Value is determined comparatively against other providers. Revenue certainty.	Possible test cost and time.	Revenue certainty through availability payments. Revenue lost in case of defaults on obligations. Test cost and time.
End consumer	Assurance of service provision and quality in economic and efficient way (delivered through increased participation and competition). Protected from non-delivery by Events of Default or other mechanisms.					

5.5 Commercial structures

The contract and commercial structures will be key to enabling this proposal.

The agreed assumption is that DNOs will be responsible for local operational actions to restore the DRZs 'on the day' in a Distributed ReStart/Black Start event. As such, the proposal is that the contracts for the services should be between the DNO/DSO and the service providers, however, this does not necessarily mean that the DNO/DSOs must be the ones to conduct the procurement activity, which could be done by either the DNO/DSO, ESO, or other independent party.

It is proposed that AGs are awarded longer-term contracts to allow for more efficient recovery of capital investment, and to make best use where network investment is also required. The proposal for TUS is to use framework agreements that allow for greater flexibility to enable a broader range of providers to participate.

A risk and reward assessment was conducted and some of the key features that are expected to be required to secure for risks and appropriately reward performance in a way that ensures value to the end consumer are summarised below for both the AG and TUS.

AG contract key features:

- Mechanism to balance the risk of capital investment for the end consumer, which clearly details the agreed costs and is returnable in the case of late or non-delivery.
- Duration that enables efficient recovery of capital, and sufficient notice ahead of contract start date.
- Works programme for non-funded assets that aren't yet operational.
- Availability payment mechanism that incentivises agreed performance, balanced with clawbacks for non-delivery.

TUS contract key features:

- Framework agreement that allows flexible participation in multiple lots or baskets (subject to pre-approved assurance of capability).
- Ability to submit pricing in different timescales to allow intermittent generators to participate efficiently.

Following on from this report, and as confidence is gained in the technical solutions which will allow decisions to be made on the most suitable procurement approach and commercial structure, the contracts will begin to be drafted. This is to ensure the appropriate level of risk management has been applied for all parties involved, and that project resources are utilised efficiently with no regrets. The project will welcome and encourage review and feedback from our industry colleagues to support the development and refinement of any contract proposals.

Furthermore, the Energy Networks Association are creating a standardised distribution network operators contract for flexibility services through Workstream 1A, which will also need to be considered. This may inform some of the aspects which will go into the contract for the DRZs. We will be engaging with Workstream 1A to understand what would or would not work from the standard contract for distributed Black Start contracts.

6. Implement

Following satisfactory engagement with stakeholders and having received endorsement regarding the developed proposal or proposals, the project will develop an implementation plan which will detail how the proposals should be integrated and translated into holistic Black Start plans and procurement.

6.1 Considerations for implementation

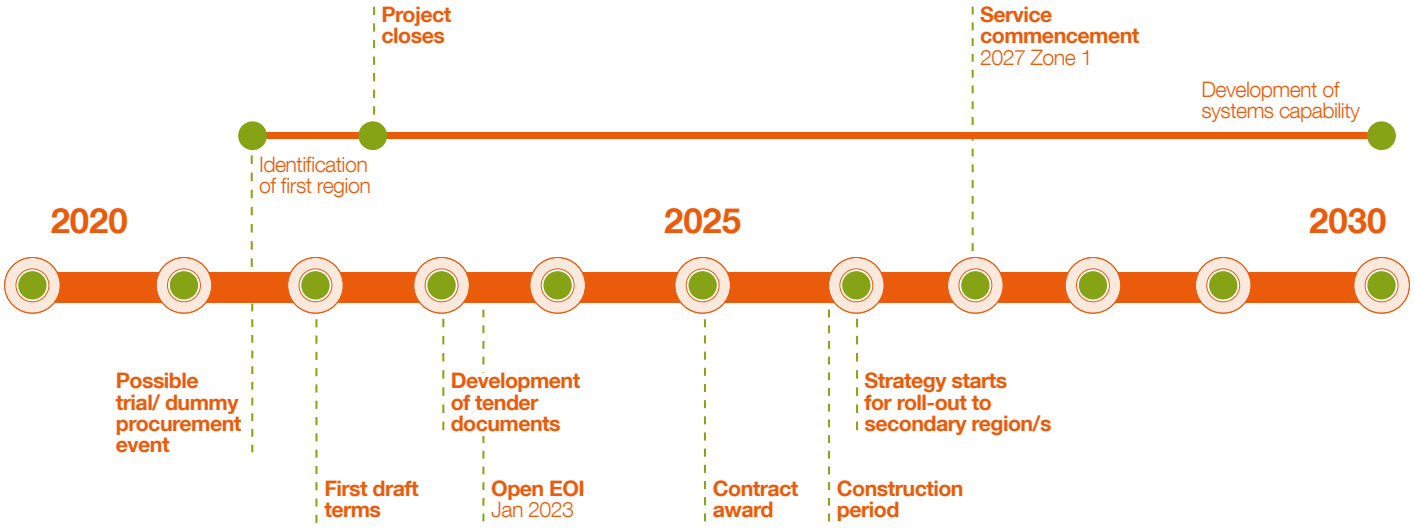
As the intention of the project is to be in a position to commence a procurement process as soon as reasonably practicable (and economic and efficient) to do so, consideration must be given early on to aligning procurement for the existing Black Start service with the project, an early **example of how this might look was provided in FRPC, page 31**[9] (subject to the ongoing development of the project).

6.2 Roadmap to 2030

Through continued development and iteration, and in line with the inputs already discussed in this report (including stakeholder engagement and updated project assumptions), it has been possible to create an updated roadmap of how an incremental roll-out could occur, once the project comes to its conclusion in March 2022, and activities begin to transition into BAU teams for implementation.

The roadmap, as with this report in its entirety, is purely for illustrative purposes. It is based on assumptions that may be amended as the project develops, and is subject to the outcomes of the project and the requirement for Distributed ReStart/Black Start services.

Figure 6.1
Example roadmap for phased roll-out of future services



6.2.1 Present to project close

In the next stage of the project, the P&C workstream will focus on further refinement of approach two with additional input from industry colleagues, and will aim towards contract development and drafting (subject to outcomes of PET and OST).

Should it be possible (subject to dependencies), the 'stretch' target would be to collaborate across the project to develop some of the assessment protocols to the extent that it is possible to run a 'dummy' procurement event to demonstrate the approach and refine it as needed.

In addition, the expectation is that during this next stage of the project, work will commence to identify potential distribution network areas that would be suitable for the early stages of roll-out and 'real-world' trials of procurement.

The final stage will be preparations for handover to BAU teams for implementation.

6.2.2 Roll-out phase one

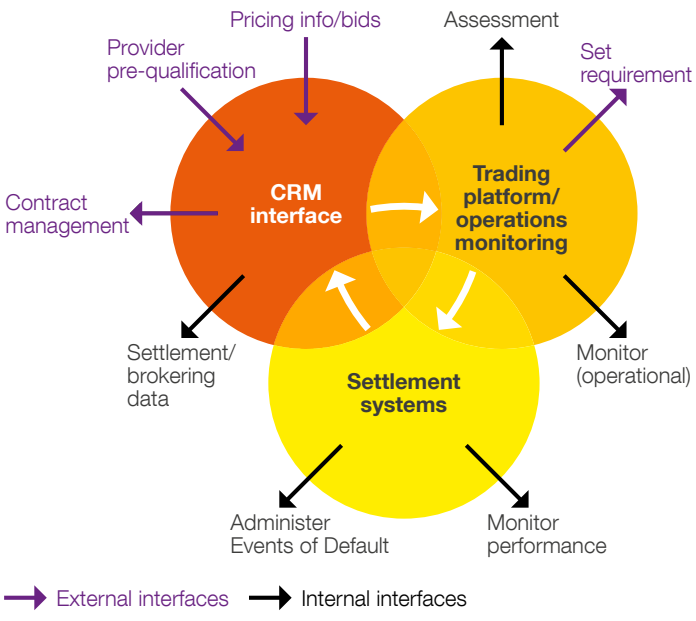
Following identification of suitable trial region/s, the BAU teams responsible for procurement (in liaison with all other BAU teams with responsibilities in the new process) will begin to prepare the tender documentation in line with recommendations from the project.

At present, it is anticipated that an Expression of Interest could be launched as early as Jan 2023, subject to requirements.

The early roll-out is likely to be tested in a smaller region, where there is a reasonable liquidity of anchor generators and DER for TUS. It is likely to be a simplified version of the approach discussed earlier on, and will most likely require a level of manual assessment.

Figure 6.2

Requirement for integrated systems



This simplified version will allow the approach to be tested rigorously in a relatively 'safe' environment, and allows for learning through the trial process to be taken into account in subsequent rounds. It also enables implementation to take place as soon as possible in a 'least regrets' manner, allowing the teams to learn as they go.

At present, a view of the possible timescales, which, for absolute clarity, are illustrative only, is that for an EOI in Jan 2023, there could be contract award in 2025, for service commencement in 2027. However, as the technical requirements are refined in the next stages of the project, these timelines may be updated accordingly.

6.2.3 Secondary roll-out phases

It is recommended at this stage that later procurement rounds are staggered to enable the processes to be updated and amended to take into account any lessons learned from the early stage roll-outs.

Although the approach is scalable, it is somewhat dependent on the development and implementation of smart assessment protocols, and ideally integration into other systems (as initially highlighted in FRPC, referenced in figure 6.2 below), due to expected resource bottlenecks for assessment at scale. Consequently, the timing for secondary procurement events ought to take this into consideration. If there are assessment systems in place, it may be possible to launch a secondary event for a much larger or even national requirement shortly after contract award for the first phase roll-out. However, if the assessment (and possibly other elements of the process) still rely on manual intervention and assessment, there may need to be a number of smaller, incremental second phase roll-outs to sensibly achieve the outcome.

7. Recommendations

7.1 Procurement and commercial recommendations

Throughout the 'Design Stage', consideration has been given to finding the least regrets pathway for development of commercial structures for a future Black Start service from DER. Until there is greater confidence in the operational structures that will make the service work, the commercial structures and contract drafting cannot be finalised, but it is possible to deliver a recommendation for implementation in the form of 'a high level outline of commercial and regulatory arrangements'.

7.1.1 Recommendations are subject to further development

The proposal at present is based on the project assumptions (which are subject to change as developments are made over the course of the project) and extensive stakeholder engagement (as permitted under the restrictions of COVID-19). In the opinion of the P&C workstream, approach two is believed to be the method by which a future Black Start service from DER can be accessed in the most economic and efficient manner on behalf of the end consumer.

7.2 Approach two

While further development will still be required, the proposed approach, approach two, as discussed in detail in section 4.5.2 is believed to best meet the commercial objectives of the workstream, and has the potential to deliver the most valuable service proposition on behalf of the end consumer.

In addition, approach two addresses a number of the insights raised for consideration in the conclusions of FRPC, as demonstrated in table 7.1 below.

7.3 In conclusion

As a result of work completed in the 'Design Stage' of Distributed ReStart, the recommendation for procurement and commercial aspects is to continue development of 'approach two' (as described in section 4.5.2) for implementation.

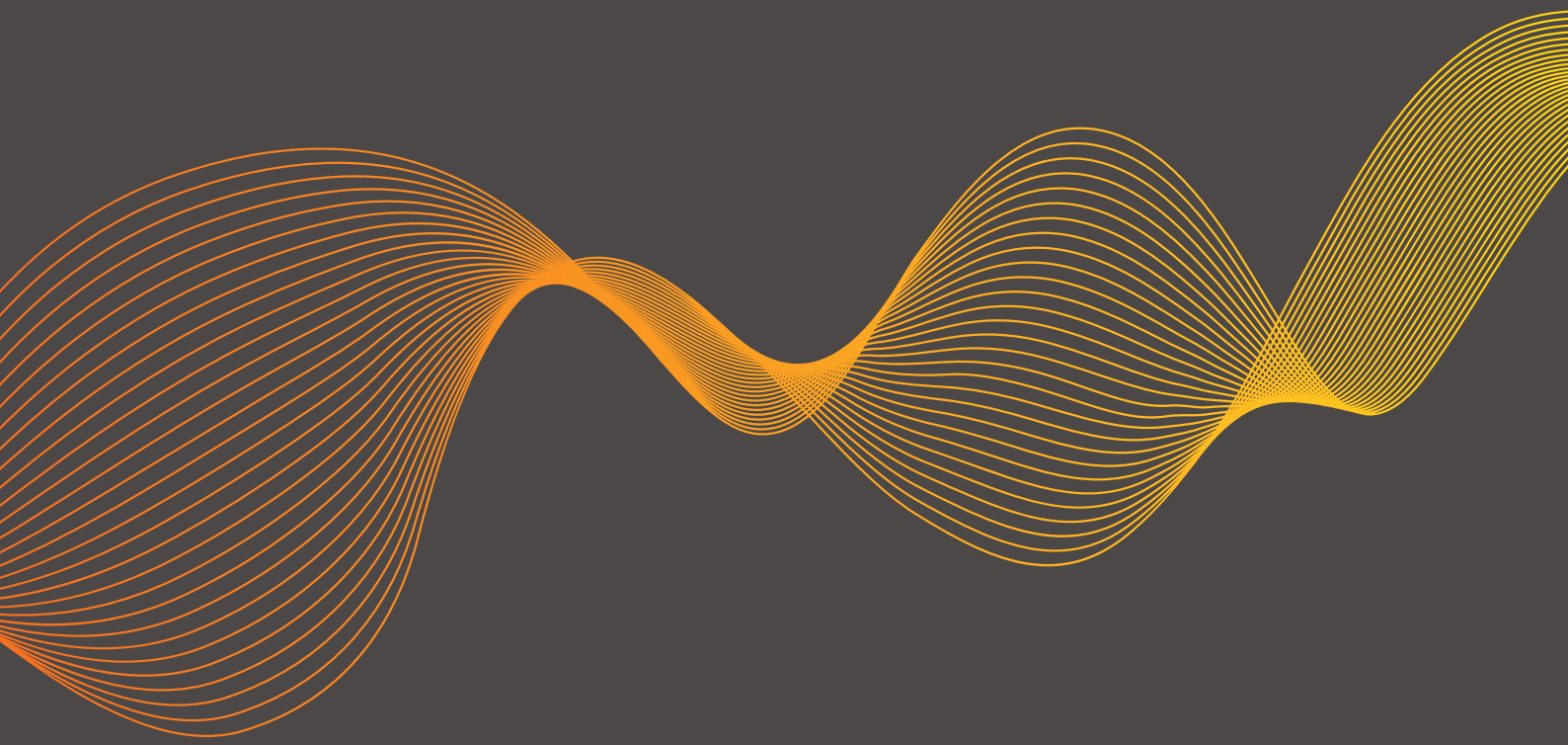
Table 7.1

Ability of approach two to meet the recommendations from FRPC

Key considerations from FRPC conclusion	Does approach two enable/ allow/mitigate this?
Develop a commercial structure that allows participation in multiple timeframes, for example, day ahead for 24 hour contracts, month ahead (for example) for quarterly contracts, and quarter to year ahead of time for one year contract periods. This would allow the party responsible for procurement to hedge the requirement and to take advantage of seasonal and other demand elasticity, at the same time as enabling intermittent generation to participate, thereby broadening participation and competition.	Yes – Approach two actively enables this
Refine technical requirements into functional elements that can be split into components or 'lots', that allow parties to participate based on their existing capabilities, to minimise the investment needed to meet a wide range of bundled technical requirements. A smart system would likely be required to assimilate these components to meet closer to real-time restoration timescales in line with minimum service levels, or a restoration standard following the introduction of one.	Yes – Approach two enables this
Systems integration to allow a provider interface, which would interact with the 'trading platform' style system, feeding in contract data to enable monitoring and dispatch.	Yes – Approach two allows for this
Develop a pre-qualification process and system interface where providers are able to self-serve and self-certify their capability to minimise resource bottlenecks for the party responsible for procurement.	Yes – Approach two allows for this (TUS)
Develop transparent requirements to empower potential providers to make informed decisions about participating.	Yes – Approach two enables this
Develop and be transparent regarding the full suite of restoration services to increase ability for buyer to 'substitute' and increase competitive rivalry.	Yes – Approach two enables this
Develop, if possible, leading performance measures to prevent Events of Default (EODs), which are more valuable to the end consumer than enforcing penalties ex-post. Consider whether an appropriate incentive mechanism could be developed in this context.	Yes – Approach two allows for this (subject to further development)
Design the end-to-end process to be lean and provider-led.	Yes – Approach two allows for this (subject to further development)
Develop a value assessment model that considers the total costs of the service, and consider strategic ways to reduce the high spend areas.	Yes – Approach two enables this
Greater efficiencies can be accrued through one organisation being primarily responsible for coordinating, including being able to carve out markets based on liquidity of capabilities, and the potential to take advantage of a national market for non-regional capabilities. The organisation responsible for procurement should continue to assess the liquidity of each capability, building on the assessment already carried out, taking into account geographical/ regional implications, and use this to inform the development of an appropriate approach that delivers value for the end consumer.	Yes – Approach two allows for this
The feasibility process will be largely dependent on the technical requirements for the service, however, at this stage we can assume that if we are able to revisit and refine this to reduce the time and cost, it will reduce barriers to entering relevant markets, and will allow for procurement over much shorter timescales.	Yes – Approach two allows for this (subject to further development)

Distributed ReStart

Codes



8. Introduction

The ongoing codes work has progressed through a detailed review where key areas of focus have been identified and specific code interdependencies have been mapped out.

8.1 Summary of initial code review

A review of industry policies, regulations, codes and standards was carried out previously, highlighting how some of these may have to be changed and adapted to enable a Distributed ReStart. The key codes which set out the requirements for a Black Start following a Total or Partial Shutdown were of particular interest, noting that these outline the present top-down restoration philosophy, while Distributed ReStart is seeking to enable restoration to be initiated on distribution networks using DER. Table 8.1 below provides a summary of the initial code review, assigning a RAG (Amber, Yellow, Green) rating to note those codes which require further consideration. Unsurprisingly, the codes which require the most attention, marked as Amber, are the Grid Code, the Distribution Code and Engineering Recommendation G99. A review of the ESQCR also highlighted a specific issue relating to earthing in distribution power islands.

Table 8.1

Code review summary

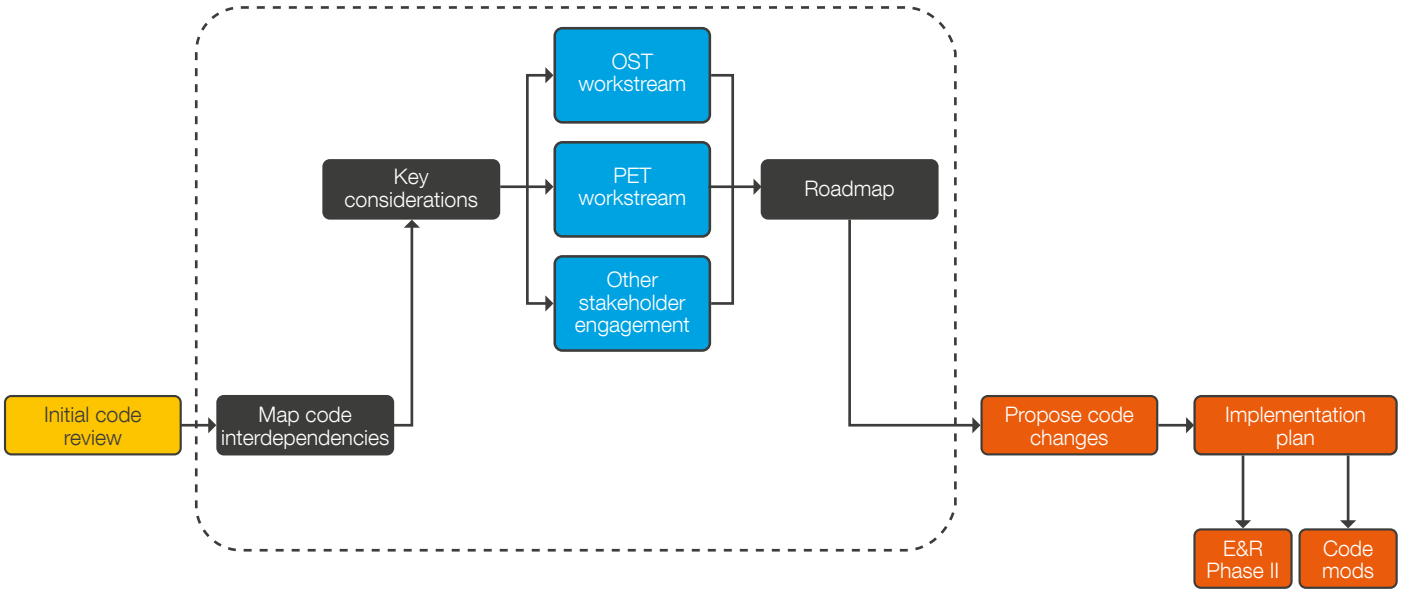
Code	Change requirement
BSC	Changes made to reflect greater involvement of DERs and DNOs during restoration.
CUSC	Potential changes dependent upon the procurement mechanisms used.
DCUSA	Potential changes dependent upon the procurement mechanisms used.
Distribution Code	Additional detail could be added to DOC9 or, alternatively, adequate signposting to the Grid Code may be appropriate. Inclusion of new parties in specific roles and responsibilities.
ESQCR	The earthing policy from this documentation could lead to an un-earthed power island below 132kV without review.
G5	Minor alteration or relaxation under restoration scenarios may be appropriate.
G91	This could include clearer requirements for telecommunications resilience for DERs in the event of power outages.
G99	Clauses relating to island operation, protection, frequency response, voltage control, reactive capability, and fault ride through may be subject to change, review or derogations for a Black Start restoration scenario.
Grid Code	Principally inclusion of new parties in specific roles and responsibilities and a review of specific sections of the Grid Code to include and not limited to the ECC, OC5, OC9 and BC2.9.
P2	No changes required.
P28	Minor alteration or relaxation under restoration scenarios may be appropriate.
P29	Minor alteration or relaxation under restoration scenarios may be appropriate.
SQSS	No changes required.
STC	A review may be required, where adaption could include all relevant participants, or an equivalent distribution equivalent document could be created. The STC and STCPs would also need to consider the potential linkage with the establishment of DRZs.

A number of other codes were marked as Yellow, noting that there may be some alterations required, but these were relatively minor. For the Engineering Recommendations (P28, P29 and G5), these issues are mainly related to quality of supply limits and/or the consideration of such during a restoration. It is understood many of these issues could be resolved by taking account of emergency conditions and relaxing some of these limits under restoration circumstances, if deemed necessary and appropriate. Regarding changes to the commercial codes (BSC, CUSC and DCUSA), these will be dependent on the proposed modifications to the Grid Code and Distribution Code and should be relatively straightforward to implement once these have been agreed. Full details of the review, and specific clauses within the different codes that potentially require modification, are available in the **Functional Requirements for Procurement and Compliance report**[11] (published November 2019). This report also highlighted several next steps necessary to examine the codes in more detail and map out potential future requirements for Black Start. These recommendations included:

- a thorough review of interdependencies between codes and the consequences of modification;
- further stakeholder engagement with the Distributed ReStart workstreams and wider industry to resolve key issues noted in the initial code review;
- ongoing liaison with other industry projects and initiatives to understand synergies relating to codes and potential code modifications; and
- producing a timeline of known code modifications and policy changes, and mapping where these might have implications for the Distributed ReStart project.

Considering these recommendations, figure 8.1 shows how these are being progressed.

Figure 8.1
Next steps for code review



The following sections outline progress against these next steps and an update on the work being done to understand and prepare for code modifications that could be required to enable a Distributed ReStart.

8.2 Regulatory and code landscape

Since the initial code review was conducted in late 2019, a number of key industry developments have taken place which must be taken into consideration. The most significant is the progress made in relation to the European Network Code on Emergency and Restoration (NCER), the pan-European requirements for emergency conditions and Black Start introduced by ENTSO-E (European Network of Transmission System Operators) in 2017. The NCER sits alongside the System Operation Guideline (SOGL) which provides harmonised rules for system operation across 35 countries in the European Union. The ESO is one of the 42 transmission system operators (TSO) represented by ENTSO-E and so they are obligated to meet all requirements set at the European level, which includes the NCER.

Implementation of the requirements is currently underway and is being progressed through a phased approach. Referred to as the Emergency and Restoration (E&R) Code in GB, E&R Phase I was completed in late 2019 and involved significant work in preparing the change proposals necessary to allow GB to become compliant with the NCER. The Grid Code modifications necessary for this change were achieved through Grid Code Modifications GC0125, GC0127 and GC0128. In addition, significant work was necessary to develop the System Defence Plan, System Restoration Plan and System Test Plan. As the implementation of Phase I was based on the current arrangements, consequential changes to the Distribution Code were not required. E&R Phase II was initiated in summer of 2020 and a Grid Code modification, GC0148 – Implementation of EU Emergency and Restoration Code Phase II, has been submitted which will capture all of the actions to be undertaken to ensure compliance with the NCER. The final modifications must be completed by 18 December 2024, while there are some interim milestones for completion of modifications by 18 December 2022.

Recognising the significant changes happening across GB through the energy transition and the associated Net Zero ambitions, E&R Phase II will also consider other changes and advancements related to Black Start and restoration over this time period. While it will not be possible for E&R Phase II to consider all code changes that may be proposed by the Distributed ReStart project due to the already large scope of work, there will be opportunities for greater alignment and efficiency throughout the change process, thus facilitating future code modifications coming out of the Distributed ReStart project.

9. Detailed code review

The focus of the detailed review has been on specific aspects of the Grid Code, Distribution Code, STC and G99. Specific sections and conditions within these documents outline the current requirements and instructions for Black Start and so it is vital to concentrate on these to ensure they are adapted appropriately.

9.1 Mapping code interdependencies

Mapping out interdependencies between the codes has been an important exercise. It is vital to understand the extent to which making changes in one industry code will impact others. The most obvious code interdependencies in the context of this work are those between the Grid Code and the Distribution Code, and establishing how the changing roles and responsibilities of Black Start participants can be appropriately captured across both documents. There is ongoing discussion around the relative merits of outlining Black Start requirements more fully in the Distribution Code versus signposting from the Distribution Code to the appropriate sections of the Grid Code relating to Black Start. The decision on which approach to take will ultimately depend on the governance process of a Distributed ReStart, the roles and obligations of the different participants, and the most appropriate document in which to outline the conditions and requirements. It is likely that changes will be required across both documents, while the extent of these changes will depend on how the organisation, coordination and procurement of Black Start services are carried out in future. The OST workstream is investigating different organisational models which will shape this process and associated decision making. More information on these organisational models and what they might mean regarding code changes is provided in Section 9.3.1 – OST Collaboration, below.

Leading on from the initial code review in 2019, and in the context of the mapping and understanding code interdependencies, a more in-depth review of the key codes has been performed. This has involved a detailed review of specific sections and clauses within the documents to understand how these can be adapted to provide comprehensive yet flexible requirements to future Black Start Providers and participants. The following section highlights some of the ongoing discussions that have come from the more detailed code review.

9.2 Detailed code review

One key observation from the previous code review was the term 'Black Start Station' which at present is understood to mean a single plant or site in England & Wales, and a group of plants or sites in Scotland. As part of the implementation of Phase I of the NCER (through Grid Code modifications GC0125, GC0127 and GC0128) the definition was amended to refer to "Black Start Providers" which extends the scope of Black Start to providers other than just power stations. In future, the ability to instruct Black Start Providers and Restoration Service Providers (noting that it is unlikely that a single DER site will be capable of providing the full suite of services typically offered by Black Start Stations today) will need to be integrated into the codes.

Related to this is the present disparity across the GB transmission licence areas in the definition of Large power stations whereby the threshold levels are currently: 100 MW for National Grid Electricity Transmission, 30 MW for Scottish Power Transmission and 10 MW for Scottish Hydro Electric Transmission.

There is an active Grid Code modification (GC0117 – Improving Transparency and Consistency of Access Arrangements across GB by the Creation of a Pan-GB Commonality of PGM Requirements) which is seeking parity across the licence areas for the same connection process dependent upon power station size rather than being dependent upon regional differences in transmission licence areas. Streamlining here would be very favourable in the context of Black Start service provision, as a lower threshold would bring a considerable number of DER under the requirements of the Connection and Use of System Code (CUSC), within which is the condition that all new connections must comply with Grid Code. This would provide a clearly defined path, and set of requirements, for Users subject to the CUSC who wish to participate in a Black Start.

There is, however, still some uncertainty around how smaller DER sites (i.e. those not bound by requirements of the Grid Code) could be mandated to meet the minimum requirements for Black Start if they wish to participate, but are not signed up to the CUSC. One potential option could be for any generator or other DER to apply for a Black Start service contract, where they would demonstrate independently that they meet the requirements of the service they wish to provide. In this situation, it is assumed an application would be submitted and a contractual agreement would be reached, though it is expected as part of the contract that they would need to meet specific requirements of the Grid Code – in particular, but not limited to, OC9. However, it is not yet clear with whom this agreement would be. This could be done directly with the ESO; or the role of the DNO/DSO in a Distributed ReStart situation might necessitate that the application be submitted through this route and an agreement be made between DNO/DSO and the DER site. An alternative could be the inclusion of Black Start requirements in a DER's connection agreement with

the DNO. Another option would be for the DNO to have contracts in place with specific providers to establish a Distributed ReStart Zone (DRZ). In the event of a Black Start situation, the ESO simply instructs the DNO to establish the DRZ through the Grid Code.

These options are being considered, amongst others, within the OST workstream where the roles and responsibilities of the ESO, TOs, DNOs and DER are under examination. The roles and responsibilities of the participants during a restoration will inform any necessary code changes to reflect these and provide appropriate guidance as such.

As noted above, following Grid Code Modifications GC0125, GC0127 and GC0128, a number of new terms such as Black Start Service Provider, Defence Service Provider and Restoration Service Provider were defined. These new definitions offer more flexible ways to think about how Black Start services can be set up and offered in a Distributed ReStart world. It is widely recognised that it is unlikely that a small embedded generator will be able to offer a full Black Start Capability, however it may be able to offer one or two individual services, contributing to the overall provision of a larger group. For this reason, the project is proposing the implementation of DRZs, which have some similarities to the Local Joint Restoration Plans (LJRPs) in place currently to manage the creation and management of transmission power islands during a Black Start. A DRZ will comprise, at least, an anchor generator which is able to self-start and provide a voltage signal to the local network and feed some demand. In addition to this, the DRZ is expected to utilise other DER which should be capable of providing support to the growth and management of a power island. The new definitions come into play when considering whether a DRZ is to be considered a Black Start Station, responsible for meeting the existing requirements by ensuring different elements within the DRZ can provide a full Black Start capability, or whether the individual elements will each be considered as Restoration Service Providers. For reference, the definitions of each are provided here:

Black Start Stations – Power stations which are registered, pursuant to the **Bilateral Agreement** with a **User**, as having a **Black Start Capability**.

Restoration Service Provider – A **Black Start Service Provider** or **User** with a legal or contractual obligation to provide a service contributing to one or several measures of the **System Restoration Plan**.

where:

Black Start Service Provider – A **Generator** with a **Black Start Station** or an **HVDC System Owner** or **DC Converter Station Owner** with a **Black Start HVDC System**.

and:

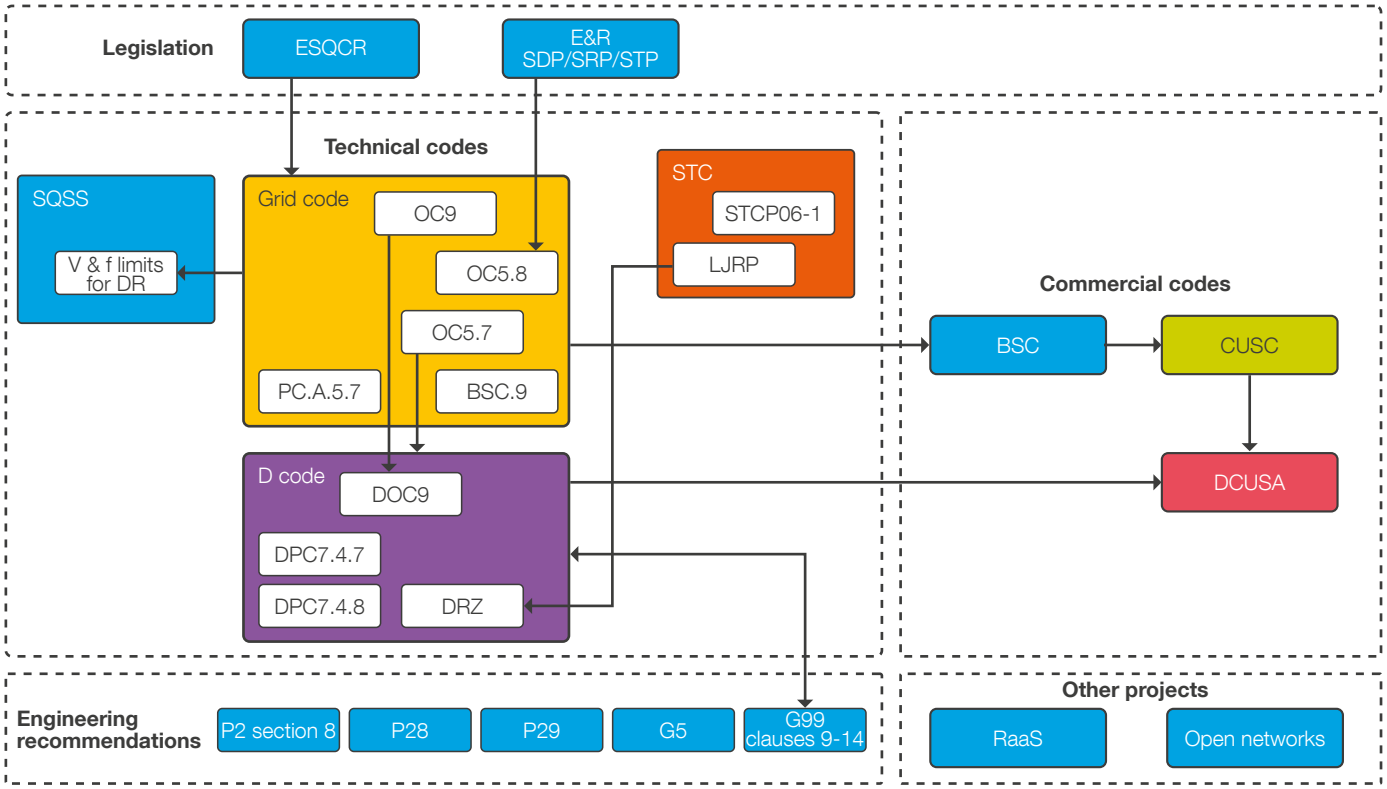
Black Start Capability – In the case of a **Black Start Station**, is the ability for at least one of its **Gensets** to **Start-Up** from **Shutdown** and to energise a part of the **System** and be **Synchronised** to the **System** upon instruction from **The Company**, within two hours, without an external electrical power supply.

In the case of a **Black Start HVDC System** is the ability of an **HVDC System** to **Start-Up** from **Shutdown** and to energise a part of the **System** and be **Synchronised** to the **System** upon instruction from **The Company**, within two hours, without an external electrical power supply from the **GB Synchronous Area**.

While several options are technically feasible, it will largely be a commercial decision as to how the DRZ is defined. In the event that a small embedded generator within a DRZ is defined as a Restoration Service Provider (RSP), this same generator would not necessarily be signed up to the CUSC (and consequently the Grid Code) depending on the outcome of GC0117 as discussed above. It must then be considered how the requirements of an RSP can be imposed upon the generator, if not by the conditions of the Grid Code. It is not proposed, or desirable, to impose strict Grid Code requirements on small generators connected to distribution networks, and so it is likely that RSP requirements would be mandated through another means, for example, through connection agreements or separate Black Start service agreements.

A high level map of the key interdependencies is provided below, in figure 9.1, it shows the links between the different industry codes, especially the relevant sections in the Grid Code and Distribution Code, and where changes might have consequential impacts.

Figure 9.1
Diagram showing code interdependencies



9.3 Collaboration with other workstreams

There has been extensive collaboration with the OST and PET workstreams, capturing the analysis and outcomes of each and identifying where there may be implications for codes. This is an ongoing exercise and there are few certainties as yet.

9.3.1 OST collaboration

The Organisational, Systems and Telecommunications workstream has been developing organisational model options to map out the roles and responsibilities of the various proposed participants of a Distributed ReStart. At present, the ESO has overall responsibility for a Black Start, and in this role, they assign specific actions to other parties, such as Black Start Stations and Transmission Licensees. In the latter case, the roles and responsibilities of these parties are outlined in the System Operator Transmission Owner Code (STC). Specific restoration actions are detailed through Local Joint Restoration Plans (LJRP). LJRPs are prepared and agreed between the ESO, Black Start Stations, the Onshore TOs and DNOs where required, and they set out the procedure for the creation of power islands in different network areas.

In future, a restoration is likely to involve many more participants, including DNO/DSOs and DER providers. Coordination between the ESO, the Onshore TOs, all GB DNOs and potentially a significant number of DER providers is a challenging proposition. In the viability report, the OST workstream initially developed two different ways in which this might be feasibly done: an ESO led approach and a DNO/DSO led approach. The different approaches outlined the roles and responsibilities for: declaring a Black Start; information gathering; LJRP instruction; pre-energisation; initial generator stabilisation; DRZ growth; transmission network energisation; and transmission power island growth. The sequence of events and instructions varied between the models depending on what parties and participants are involved at each stage, and the actions they must take.

Following detailed analysis and stakeholder engagement, OST are now proposing a central model, a collaborative approach to delivering Distributed ReStart. Details can be found in the OST Design Stage report on the **Distributed ReStart webpage**[12]. Table 9.1, provides a high level summary of the responsible parties for each stage of a restoration under this central model approach.

Table 9.1
High level summary of central model approach

Action	Responsible under current Black Start	Responsible control entity
Declare Black Start	ESO	ESO
Responsible for national strategy	ESO	ESO
Responsible for regional strategy	ESO/Scottish TO	ESO
Instruct start of plan	ESO/Scottish TO	ESO/Scottish TO, only withheld where a DRZ requires access to the transmission system to sustain supplies for an extended period
Instruct start of anchor DER	N/A	DNO
Instruct transmission switching actions	ESO	ESO
Physical transmission network actions	TO	TO
Physical distribution network actions	DNO	DNO
Physical actions of contracted generation	Black Start provider (or virtual lead party)	Multiple individual providers
Instruct DRZ energisation route	N/A	DNO/Scottish TO*
Instruct growth option outside of DRZ boundary	N/A	ESO
Instruct DERs within a DRZ	N/A	DNO/Scottish TO
Instruct DERs outside of DRZ boundary	ESO where Black Start provider	ESO
Instruct non-contracted DERs (emergency instruction equivalent procedure)	The ESO through DNOs (clarified by temporary code modification GC0143)	ESO via DNO instruction
Manage overall distribution power island voltage and frequency	N/A	DNO are frequency lead until synchronisation with an energy resource or demand outside of the DRZ

It is clear that changes to the Grid Code will be required to enable all parties to carry out their assigned actions and set the requirements which will ensure they are capable of doing so. Changes are also expected within the Distribution Code to capture distribution-connected participants who would not necessarily be bound by the requirements of the Grid Code.

9.3.2 PET collaboration

The Power Engineering and Trials workstream is undertaking extensive power system analysis to assess and determine suitable restoration plans for a number of case study distribution networks. Three case study networks have been chosen, each with a different network topology and/or different resource of local DER. This has allowed the study of the performance of different network topologies alongside various DER types in a restoration scenario.

Each of the case study networks has an anchor generator that is able to self-start, a key requirement of a Black Start Station, and then several other DER providers that are energised to form a power island. The studies are seeking to determine the frequency control requirements of an anchor generator, which will be used to manage the frequency of the power island as demand is brought on incrementally, and maintain the balance of generation and demand throughout. Frequency and voltage requirements for a transmission power island created through an LJRP during a Black Start are already set out in OC9, and in Scotland through STCP 06-1, whereby the nominal frequency should be 50Hz and be controlled within the limits of 49.5Hz and 50.5Hz (a 1% deviation), and voltage should not exceed +10% or –5% of nominal for more than 15 minutes. The studies being carried out in the PET workstream are seeking to determine if the anchor generation in the case study networks can meet these requirements and if not, what minimum requirements they can realistically meet. Alongside this is the consideration of whether the technical requirements of a DRZ must match those of an LJRP, or if larger frequency and voltage variations could be accepted during a restoration.

There is a separate set of requirements for non-anchor DER that is also being considered through the system studies. These requirements would include operational settings such as the controller modes being set to voltage control, or prescribing reactive power set points, etc.

As noted previously, it is highly unlikely that any one DER site will be capable of providing the full suite of Black Start services, and so the philosophy of how these services can be procured from multiple DER sites is under review in the wider P&C workstream in section 4. This raises the question of whether minimum technical requirements for technologies such as wind, solar and battery storage should be set, or if the requirements for a DRZ should be outlined and DER sites can determine what services they are able to participate in. The latter would give the option for DER sites to upgrade their capabilities to meet these requirements, while the former would ensure all participating sites have the necessary capability.

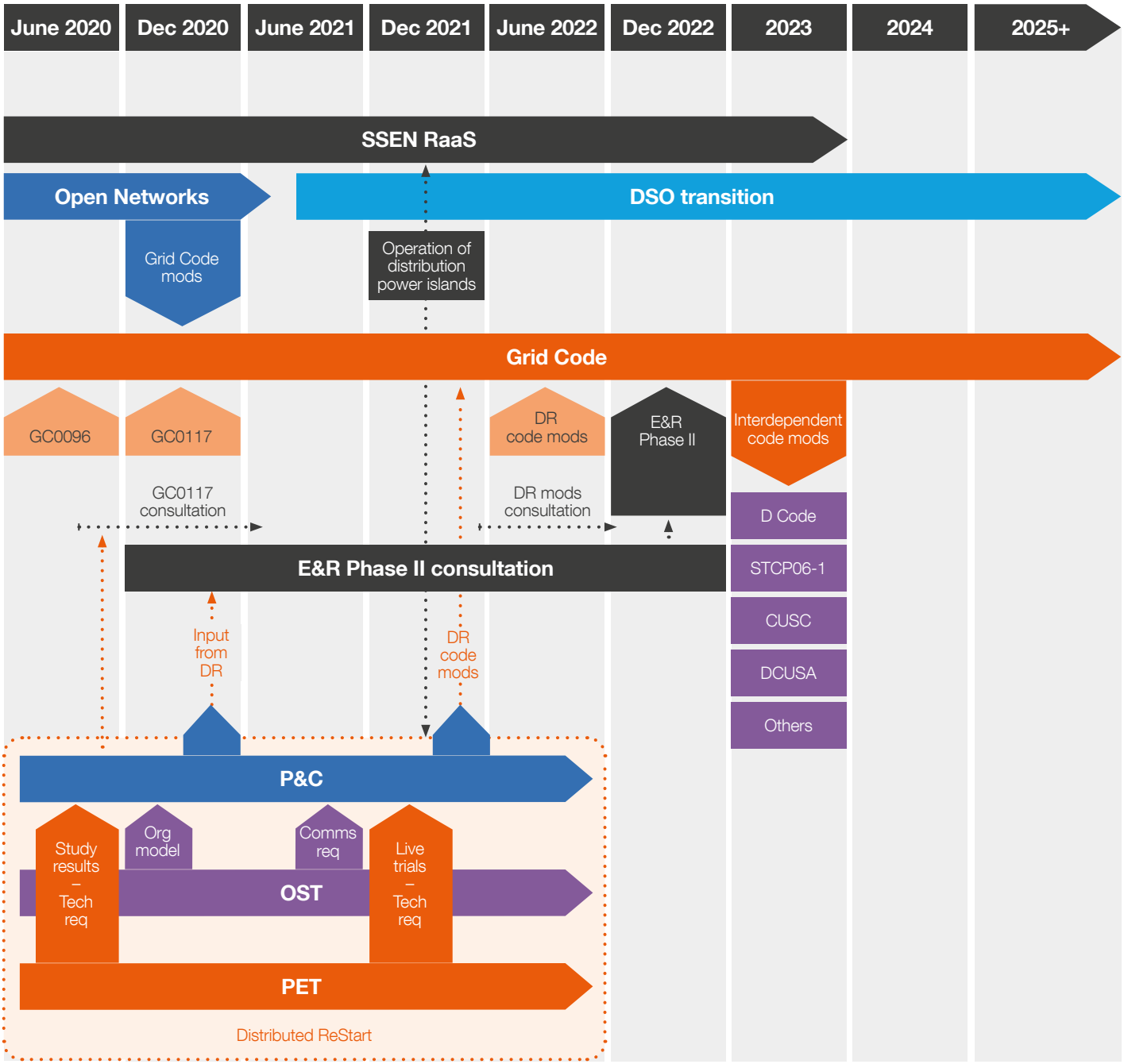
As discussed in section 9.1 above, it is still not fully understood how non-CUSC parties will be managed in a restoration. For this reason, it is still also uncertain how the technical requirements for DER will be mandated on smaller service providers i.e. will the requirements be outlined in the codes or can these be covered in the individual site connection agreements or new Black Start service agreements as suggested in section 9.2.

* (A DRZ may span sections of 132kV network inclusive of 132kV energy resources, in Scotland this is a transmission voltage meaning that the TO function would assume overall plan responsibility from the DNO post 132kV energisation).

9.4 Roadmap

Through the course of mapping code interdependencies, liaising with the different project workstreams and engaging with wider industry, an indicative roadmap and timeline has been developed, shown below in figure 9.2.

Figure 9.2
Indicative roadmap and timeline for code changes



The roadmap is a useful tool in relation to code development as, with innovative projects going on all across the industry, it is important to understand where there may be opportunities for efficiency and streamlining in adapting the codes. Two projects in particular have been highlighted in figure 9.2 above as having the potential for similar or overlapping outcomes which may result in code changes: Open Networks and Resilience as a Service (RaaS).

Open Networks is an industry wide project being led by the Energy Networks Association (ENA). The project is focused on the transition of DNOs to a more active DSO role. Facilitating smart distribution networks with flexibility markets will require greater access to, and better communication of, large quantities of data. As such, one recent code modification (GC0139 – Enhanced Planning Data Exchange to Facilitate Whole System Planning) has already been initiated. Other potential code changes could arise around telecommunications, in relation to more robust requirements to enable the flexibility markets to function adequately. There are potential synergies with Distributed ReStart here, which will have to ensure that DER sites participating in Black Start have suitably resilient telecommunications. Robust telecommunications are very much part of the E&R Phase II work being addressed through GC0148. Ongoing collaboration with Open Networks will ensure efficiencies are made where possible in relation to proposing further code modifications.

The RaaS project is a Network Innovation Competition (NIC) project being led by Scottish & Southern Electricity Networks (SSEN). This project is focused on improving the reliability and resilience of networks, particularly remote and isolated networks such as those found in the north of Scotland, using low carbon technologies. Rather than using carbon intensive standby generation, such as diesel gensets, the project will investigate novel ways to maintain supply to networks which may be disconnected from the main grid as a result of a fault, thus maintaining distribution power islands with a combination of renewable generation, storage, flexibility services and other smart controls. There is a clear synergy with Distributed ReStart around the management of distribution power islands, and close collaboration with the RaaS project will identify where code modifications made around this can support the outcomes and requirements of both projects.

The roadmap also illustrates some known ongoing and future code modifications. Grid Code modifications can be proposed through Grid Code Panel Members and their representative bodies and, following this, a working group will generally be formed, and an industry consultation carried out. Proposed changes are submitted to the Grid Code Review Panel who must first approve the modification, and in most cases final approval is then sought from Ofgem. A similar process is in place for modifications to the Distribution Code, and approval is sought from the Distribution Code Review Panel and then Ofgem. There are a number of ongoing Grid Code modifications that are of interest to the Distributed ReStart project and some of these are discussed here.

Grid Code Modification GC0096 – Energy Storage was concluded in June 2020 and outlines the technical requirements for electricity storage facilities connecting to the transmission network. Where previously it was not clear how these facilities should be treated within the Grid Code, the outcome of GC0096 means that electricity storage is now defined as a 'Generating Unit' and 'Power Generating Module'; essentially now subject to the same minimum technical requirements as a generator. Recognising the need for the same clarity on distribution-connected storage, a corresponding modification for the Distribution Code has been submitted to the Distribution Code Review Panel and a working group has been established. This is useful for Distributed ReStart as it is now understood how an electricity storage DER site could participate in a Black Start restoration, based on these minimum technical requirements.

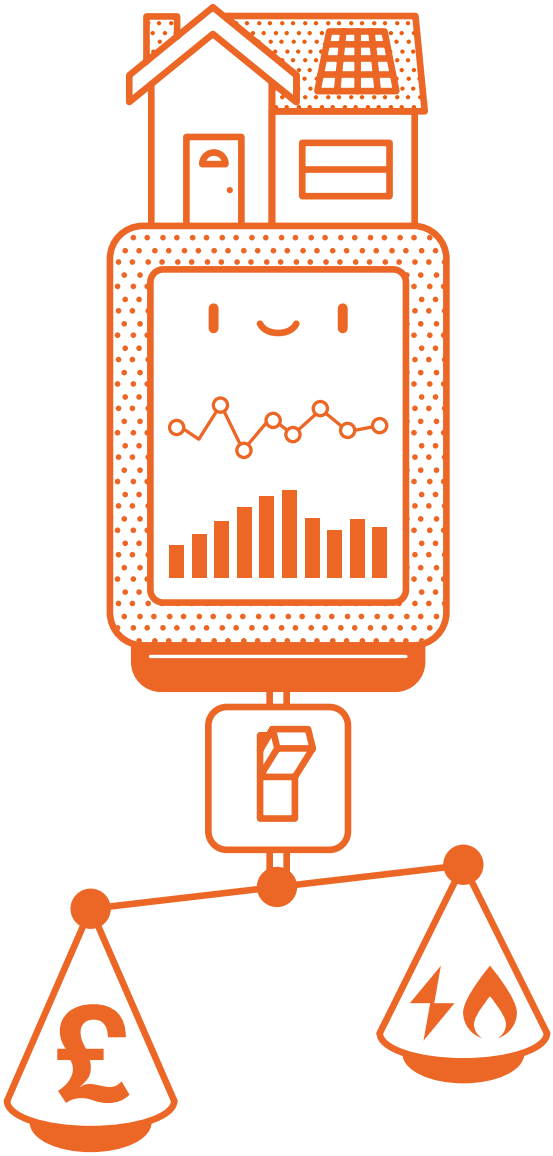
The workgroup on Grid Code Modification GC0117 – Improving Transparency and Consistency of Access Arrangements across GB by the Creation of a Pan-GB Commonality of PGM Requirements has recently been re-opened. As discussed in section 9.1 above, the outcome of this code modification will be greater parity across the transmission licence areas in the sizing threshold of Small, Medium and Large power stations and, consequently, what generator connections are obligated to meet Grid Code requirements under the CUSC. Without confirmation of the proposed minimum threshold for a Large power station, this could, if the threshold between Large and Small is reduced, bring a large number of generation sites into the category, particularly in England & Wales where the current threshold is 100 MW. Ultimately, a larger pool of DER will be required to meet Grid Code requirements, and this will provide a clearer path for those who would seek to participate in a Distributed ReStart.

The most relevant ongoing initiative in relation to the work being undertaken with the code review, is the implementation of the Emergency & Restoration Code Phase II work. As described in Section 8.2 – Regulatory and Code Landscape above, E&R Phase II is currently underway, with the next significant implementation milestone in December 2022. The E&R Phase II work contains a package of measures but, in summary, aims to address the issues required to be implemented in the NCER by December 2022 and December 2024 relating to Low Frequency Demand Disconnection, resilient telecommunications and the requirement for the provision of critical tools and facilities. In addition, outstanding issues from E&R Phase I are to be addressed including how non-CUSC parties would fall under the NCER requirements and how storage should transition from import to export during low system frequencies. The P&C workstream has close links with the E&R Phase II Working Group and, as mentioned previously, it is the intention to continue to liaise with them to understand how any proposed changes will impact the Distributed ReStart project, and possibly implement some changes through this mechanism, thus streamlining Grid Code modifications as far as is practical. However, additional project-specific Grid Code modifications will be raised towards the end of the project to ensure all aspects are captured, as noted in figure 9.2. Where additional Grid Code modifications are necessary, these will go through the standard process described above.

The changes being implemented through E&R Phase II will undoubtedly impact the Distribution Code, and potentially other codes, but to what extent is not yet known. Changes from the Distributed ReStart project will be more apparent and the interdependencies better understood as the project develops and trials are undertaken. Changes to the Distribution Code will be implemented through the Distribution Code modification process described above.

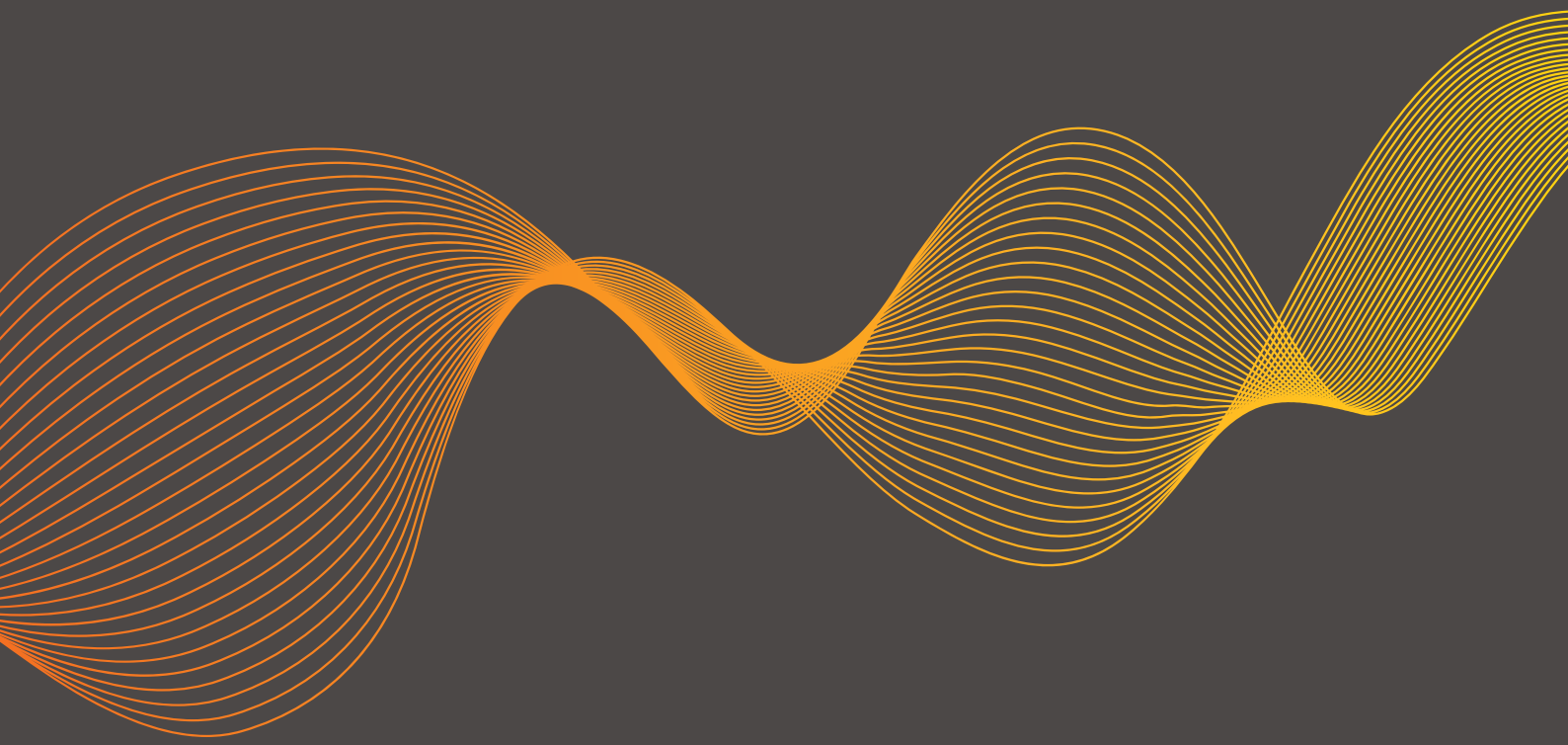
To simplify governance arrangements, it has been agreed to run E&R Phase II as a joint Grid Code/Distribution Code Working Group so approval can be achieved at the same time.

Modifications to commercial codes such as CUSC, DCUSA and STC will naturally follow those made within the Grid Code and the Distribution Code.



Distributed ReStart

What's next for P&C?



10. What's next for P&C?

This is a combined section, considering upcoming aspects for consideration for both procurement and commercial, as well as for regulatory, codes and compliance.

10.1 Horizon scan

10.1.1 Restoration standard

The proposed Black Start Standard has been under review with the Department for Business, Energy & Industrial Strategy (BEIS) and is awaiting review by the Secretary of State.

The likely impact, assuming the standard is approved for implementation, is that a greater level of capability could be required, and greater accuracy of operational monitoring and associated data will be needed for assurance.

10.1.2 DSO transition

Of key importance across all workstreams is the role of a future DSO because finding synergies with wider network and organisational changes will deliver the greatest value to the consumer. Distributed ReStart will align its outputs with the ENA Open Networks project to achieve this. Focus will be given to the flexibility services, whole electricity system planning and transmission-distribution data exchange, and DSO transition workstreams due to the potential impact on an optimised commercial design.

Ofgem will be putting forward a position paper which will set out their proposed approach and strategic outcomes for DSOs. It will bring an agreed industry approach to DSOs, including treatment of DNOs and contestable services, key enablers, and development of co-ordinated flexibility markets.

10.1.3 European Emergency Restoration Network Code (NCER)

As part of the implementation of Phase I of the NCER (Emergency and Restoration Code – E&R) (through Grid Code modifications GC0125, GC0127 and GC0128), the System Restoration Plan, System Defence Plan and System Test Plan were written and are currently with Ofgem for review and approval. As a project we need to be aware of when these will be approved and the impact they may have. The P&C workstream has close links with the E&R Phase II Working Group and it is the intention to incorporate as many requirements for a Distributed ReStart as is practical through this change mechanism.

10.1.4 Clean Energy Package

The ESO interpretation is that this potential Black Start from DER service is categorised as a "non-frequency ancillary service" under CEP, and the only obligations in CEP for such services apply to services with a MW component.

We believe the ESO meets any CEP obligations for Distributed ReStart as we consider there to be no change in MW profile.

In the event that Distributed ReStart is considered to result in a change to MW profile, the ESO would still meet all relevant CEP obligations (Regulation on the Internal Market for Electricity articles 12 and 13).

10.1.5 BAU Black Start procurement

As the intention of the project is to be in a position to commence a procurement process as soon as reasonably practicable (and economic and efficient) to do so, consideration must be given early on to aligning procurement for the existing Black Start service with the project. This is in progress already and, through close interaction with the BAU Black Start service leads, has been considered in the strategy for the ongoing 'Northern' and 'South West and Midlands' tenders.

10.1.6 Other projects

Where the work and outcomes of other projects has been identified as relevant, the workstream continues to seek and welcome collaboration.

10.1.6.1 Resilience as a Service (RaaS[13])

The RaaS project is looking at developing and trialling methods to increase security of supply on the DNO networks through the use of power islands. This project is very similar to Distibuted ReStart and will be looking to create a market for the service, so it is important to be aware of the outcomes from the project.

10.1.6.2 FUSION project[14]

The FUSION project, led by SPEN, aims to enable DNOs and other market participants to unlock the value of local network flexibility in a competitive and transparent manner. The P&C workstream will need to be aware of and engage with this project going forward to understand possible market designs and how the FUSION project works with the European Universal Smart Energy Framework (USEF).

10.2 Next steps

The next steps for the P&C workstream will be highly dependent on the finalisation of the operating structures for the future service. It will not be prudent and/or possible to develop or commence drafting of contract structures or take the proposals for commercial structures or code changes any further into development before particular elements of the operational and organisational structures are confirmed. This section outlines the steps necessary for further development and progression of P&C outcomes.

10.2.1 Procurement and commercial

10.2.1.1 Dummy procurement event

Should it be possible and should dependencies allow (including development of functional requirements and 'rules of play', as well as assessment protocols), P&C would like to trial a 'dummy' procurement event before the end of the project to encourage the demonstration of the commercial process.

10.2.1.2 Stakeholder engagement

The P&C workstream will continue seeking feedback from industry colleagues, including future engagement with potential providers to understand what does and does not work for their businesses; DNOs and the ENA to understand their views and thoughts on approach two; as well as other projects and forums, such as the Resilience as a Service project and the Association for Decentralised Energy.

It is important to continue close collaboration with the PET and OST workstreams to ensure that there is full integration between the developed technical solution, organisational and communications solution and the commercial solution.

10.2.1.3 Further development of solutions and contract drafting

It had been anticipated originally in the NIC bid document that contract drafting would commence in the third stage of the project. As noted, it will not be prudent to commence this activity until certain operational and organisational aspects are confirmed, however, the planned engagement and development activities (such as the 'dummy' event) will support the workstream to outline some of the key contract principles for the agreed approach ahead of drafting once the dependent factors are confirmed. As such, it is proposed that the next deliverable focuses on contracting principles to start with. To enable formulation of contracting principles, which will subsequently inform the drafting of formal contract structures, there are a number of key enablers and dependencies across the project. In particular, confirmation of functional requirements, the operational structure of the service, and 'rules of play' between anchor generators and top-up services. More information on dependent and enabling factors for formulating contracting principles can be seen in table 10.1.

Table 10.1

Dependencies and enablers for formulating contract principles

Dependencies and enablers	
Procurement approach and commercial structures	• Functional requirements for each of the services (AG and TUS) from the PET workstream • 'Rules of play' for AG and TUS interactions in assimilated model • Potential network upgrade costs from the PET workstream • Potential participants and availability and liquidity of services • DRZC requirements and potential costs • Development/design of system for procurement approach • Dummy procurement trial • Development and agreement of methodology for feeding into RIIO-ED2 funding additions and DNO licence changes
Contract principles and drafting	• 'Rules of play' and minimum requirements for each service (e.g impact of reactive capability versus the distance from the AG) to support writing the service description • Cost estimations for likely capital investment requirements • Process for how restoration will work on-the-day and defined responsibilities of each party to inform the formal contractual obligations • Process for assessing the regional and national requirement and determining 'how much' to procure • Design of commissioning and capability assessment processes for each of the services • Development of a payment structure, including availability and cost reimbursement (dependent on overall structure of service) • Ability to feed in system requirements for integration with the OST workstream outputs. Development of data flows between parties • Development and agreement of methodology for feeding into RIIO-ED2 funding additions and DNO licence changes

10.2.1.4 Proposals for future changes

As a result of analysis in the Design Stage, the workstream has identified several areas where it is anticipated that future changes or updates may be required.

As mentioned in section 10.1, the Black Start Standard has not yet been approved by BEIS. However, to support and incorporate Distributed ReStart there may need to be amendments suggested including, for example, the addition of regional requirements at DNO level to support and enable contracting, assurance, performance monitoring and reporting. The Black Start Standard as it is now will require changes to the ESO licence; if the Standard was updated with DNO regional responsibilities, this could result in changes needed to the DNO licences as well.

The **Black Start Strategy and Procurement Methodology**[15] may need to be updated. The current cost recovery regime for Black Start services is an ex-post assessment of whether spend incurred in each relevant year is determined to be in line with the agreed Black Start Strategy and Procurement Methodology. Respectively, these documents set out the restoration strategy, and the associated commercial mechanisms and principles that are used to contract against it.

Updates will either need to be made to these documents, or to the regime, to accommodate a new or amended Black Start service from DER, plus the possibility of DNOs incurring costs as a result of the implementation of the new service. The programme for making updates to these is to submit the amendments to the regulator for review no later than 12 months following the date on which the previously approved methodologies started, after which the Authority has three months to review and come to an approval decision. Updates can, however, be made more often as required.

This timeline will have to be considered, as updates or a new regime will have to be implemented ahead of any spend decisions being made under a new service.

In next year's iteration of these methodologies, Ofgem would like to see the ESO expand further on its intentions for the Distributed ReStart project which is due to reach completion in March 2022. The ESO is required to propose a plan in the next iteration of these Methodologies for how it will integrate the intermediary and final results of the project in its short, medium and long-term strategy for Black Start provision.

10.2.2 Codes

10.2.2.1 Next steps

The next steps in the code review work will be to:

- liaise with the OST workstream to clarify the roles of the ESO, TOs, DNOs/DSOs and DER in the context of the codes for the chosen central model
- continue collaboration with the PET workstream to capture outcomes of the live trials and understand code implications
- draft code definition of a DRZ in line with procurement and commercial decisions on how this should work
- feed into E&R Phase II Working Group discussions.

10.2.2.2 Proposals for future changes

As a result of the review completed and discussed in this report, it has been possible to identify a number of areas where it is anticipated that future changes or updates may be required outside of the normal industry codes.

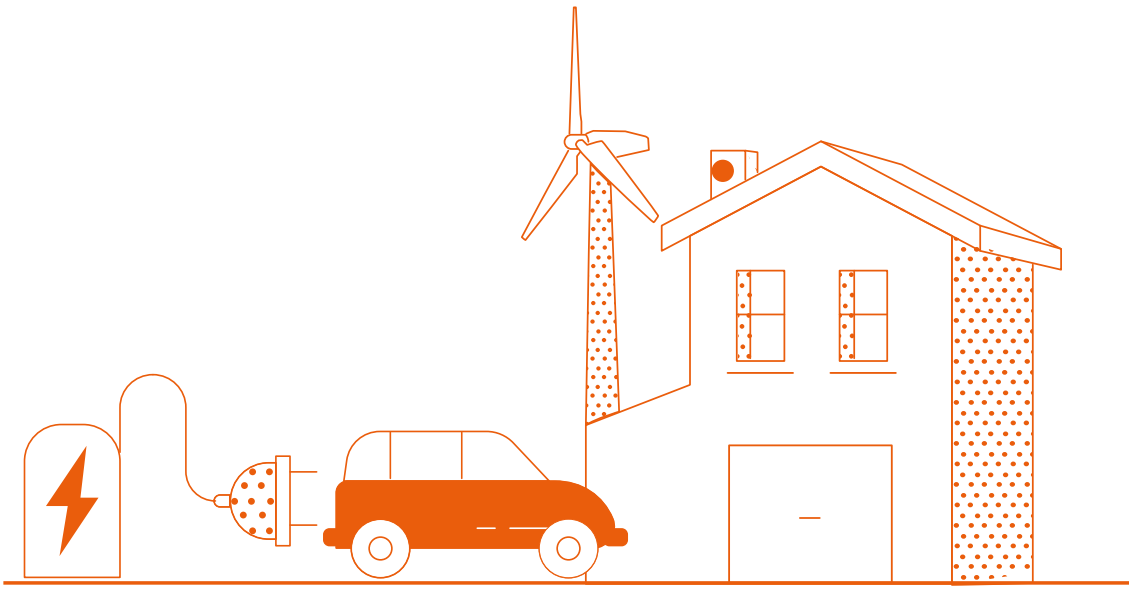
10.2.2.2.1 DNO licences

The DNO licences will need to be considered if, as anticipated, DNOs take on additional responsibilities for elements of regional restoration activities. There is currently nothing in the licences to stop DNOs procuring flexibility services, however, there is no explicit responsibility for Black Start restoration. There may be an update needed to reflect that DNOs are likely to have responsibility alongside the ESO for elements of regional Black Start processes, potentially including operational aspects such as testing and assurance, and possibly in relation to recovery of costs for additional responsibilities.

As mentioned in section 10.1.2, as a project it will be important to stay aware of the DSO transition. If DSO licences are introduced, it may be more appropriate for Black Start obligations to be included within DSO licences rather than DNO licences. This is because Black Start and restoration activities, through the Open Networks project, are considered a system operation responsibility compared to a network operation responsibility.

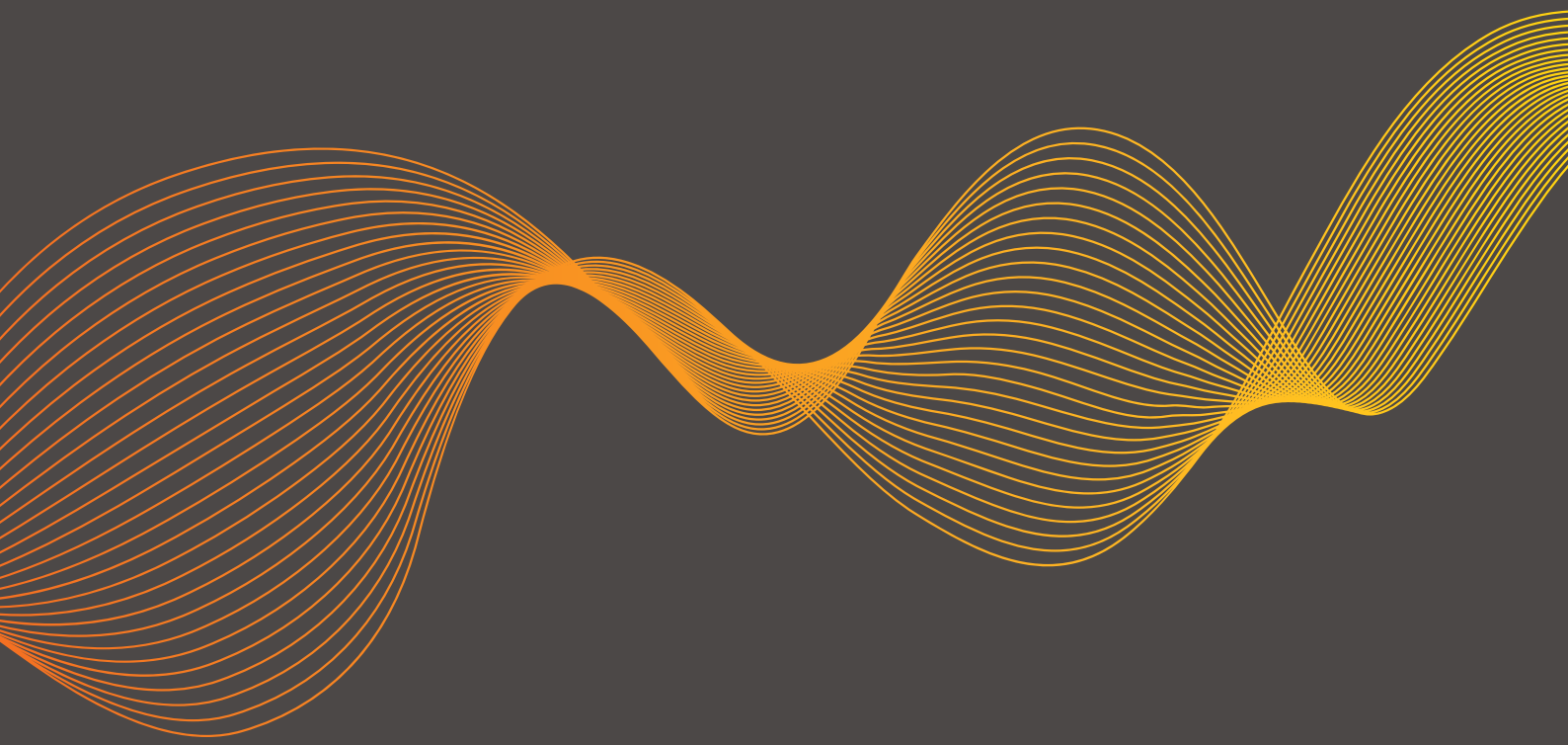
10.2.2.2.2 Electricity distribution 2 price control (ED2)

RIIO-ED2 is the price control mechanism for electricity distribution under **RIIO2**[16], which starts in April 2023. If the DNOs are required to have more responsibility for Black Start, there will need to be an appropriate mechanism in place that considers how these activities are funded. Consideration must be given to feeding into the price control review if and as necessary to reflect this.



Distributed ReStart

References and appendices



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Appendix 1 – Stakeholder engagement

Further information and detail in relation to the continued stakeholder engagement undertaken during the Design Stage.

Objectives engagement

We engaged on the proposed procurement objectives to support refining and ranking the objectives to feed into the inputs of the strategy development process. This was conducted via a short poll to rank the objectives in order of importance and the offer of follow-up 15 minute one-to-one sessions to gather more in-depth information. Reponses to this primarily came from DER owners/operators.

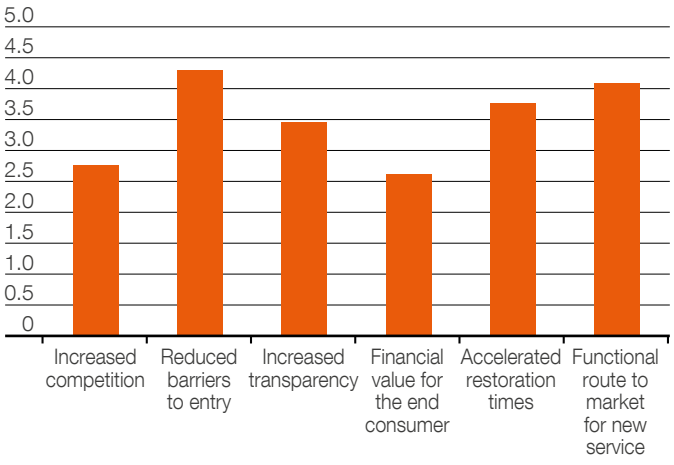
Survey

The survey had 13 respondents who were a mix of potential providers (DER owners/operators) and other industry colleagues.

At first look, the results seemed to show that the most important objective for survey respondents was 'reduced barriers to entry', and that the least important was 'financial value to the end consumer' figure A1.1.

Figure A1.1

Graph showing objective rankings from aggregated responses across industry

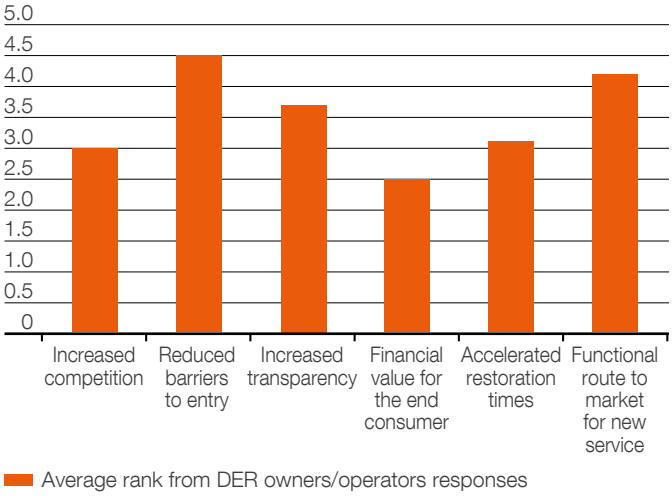


This unexpected result prompted further analysis of the responses, which highlighted that the majority of the responses came from DER owners/operators who may have a commercial interest in this project. When the survey responses were split by DER owners/operators, and all other respondents, two very different response summaries were evident, as shown in figures A1.2 and A1.3.

The responses from DER owners/operators show that the most important objective for DER owners/operators is reduced barriers to entry and the least important is financial value to the end consumer.

Figure A1.2

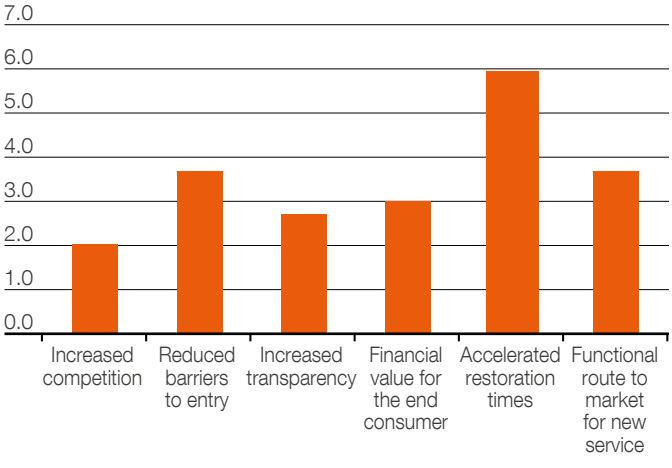
Graph showing objective rankings from DER owners/operators



However, comparing the DER owners/operators answers with the answers from all other industry stakeholders (the ESO, network operator (this could be distribution or transmission) and another respondent), the results change. For the other industry stakeholders, the most important objective is accelerated restoration time and the least important is increased competition.

Figure A1.3

Graph showing objective rankings from non-DER owners/operators



All of the DER owners/operators will have a commercial interest in this project, so there needs to be consideration to how their answers may be biased; as the results show, the priority areas for this type of respondent was ease of accessing the market, whereas for the other respondents it is to accelerate the restoration of the system.

The key findings and takeaways from this survey:

- There is a range of priorities and importance placed on the different objectives depending from which view point they are considered.
- Further information and engagement was needed to refine what the objectives should focus on.
- A common consideration which was important to both DER owners/operators and the other respondents was a functional route to market.
- No additional/new objectives were suggested at this point and, equally, no serious objections.

Raw survey results

The raw data from the survey can be found in table A1.1.

Table A1.1

Raw data from survey responses

Getting to know you… what's your main interest in the project? (DER owner/network operator/academia)	Increased competition	Reduced barriers to entry	Increased transparency	Financial value for the end consumer	Accelerated restoration times	Functional route to market for new service
DER owner	4	5	6	3	2	1
DER owner	5	6	3	1	2	4
Owner	1	3	4	5	6	2
Aggregator	4	3	2	1	6	5
DER owner	2	6	5	3	1	4
DER owner and operator	2	6	4	3	1	5
Project developer/technology owner	3	5	4	1	2	6
DER owner (battery)	4	6	3	2	1	5
DER owner	3	2	5	1	4	6
Vendor	2	3	1	5	6	4
Averaged totals	**3.0**	**4.5**	**3.7**	**2.5**	**3.1**	**4.2**

Getting to know you... what's your main interest in the project? (DER Owner/Network Operator/ Academia)	Increased competition	Reduced barriers to entry	Increased transparency	Financial value for the end consumer	Accelerated restoration times	Functional route to market for new service
ESO	1	3	2	4	6	5
Network operator	3	4	5	2	6	1
Operations/control	2	4	1	3	6	5
Averaged totals	**2.0**	**3.7**	**2.7**	**3.0**	**6.0**	**3.7**

Combined averaged totals	**2.8**	**4.3**	**3.5**	**2.6**	**3.8**	**4.1**

1:1 Engagement sessions

The first round of one-to-one engagement sessions were used as a follow up from the survey responses to gather more information to inform the refinement of the proposed objectives.

These 15 minute slots were offered to the Distributed ReStart mailing list recipients who had 'more to say' on the commercial approach. The stakeholders who signed up to the sessions were mainly DER owners/operators. Structured sessions with focused pre-read and targeted questions ensured these were fruitful and produced high quality feedback.

Summary of discussions:

- It is important for there to be reduced barriers to entry.
- Consideration needs to be made for capabilities of different providers.
- Increased transparency, clarity and certainty on what the service will look like will support the design of plant and service offerings. A lack of transparency creates a barrier to entry and can make it difficult to understand who has contracts, length and price. Hard to provide value if providers don't know what is valuable. Transparency gives confidence to participants to enter the market.
- Understanding revenue streams and routes to market is important for investors.
- Providers want the ability to stack the Black Start service with other ancillary services. Ensure this is considered through the contracts and funding (e.g. asset contribution costs).
- Consider availability of network connection points and how long these timelines would impact offering a service.
- Consider how to assign value to the number of services/ requirements one plant can provide us. Technical assessment criteria should value capabilities correctly. Clarity on what is valued by the contracting entity. A payment mechanism which values the services provided (full service vs supporting services).
- Clear explanations of why each technical requirement is needed and what is required will be helpful, as well as an explanation of how the technical requirements support the Black Start requirement (interactions between component parts and how assimilated together, then feed into system at national level).
- Providers need to understand what the contracting entity is looking for (what is being bought, where, what does the contract look like, feasibility studies, connection level etc), so potential providers can understand where to focus. Visibility required from aggregated assets – how it can work.
- Providers need clarity on the timelines and want to know the structure of the service including defined dates for RFIs, tenders, contract and delivery dates, and consideration of time for works on site. A long-term vision and strategy supports the market to understand direction of travel and what the enduring solution will be.
- Consider access for Balancing Mechanism Units (BMUs) vs non-BMUs/CUSC vs non-CUSC/Grid Code vs non-Grid Code.
- Consider risk with provider vs contracting entity.
- What extra equipment will be required/what needs to be put in place (control systems, comms etc).
- Consider the benefit to future consumers, not just consumers of today.
- Advanced restoration times are a priority.
- A key responsibility is the assessment to determine the requirement (how much to buy) – how much Black Start capability in each area and delivery from adjacent areas.

Key findings and takeaways:

- Transparency and clarity are important for creating a market where potential providers can access information (timelines, market size, technical requirements, contract information etc) to make informed decisions. Clarity and notice in relation to the requirement were often more important to DER providers than the method of procurement.
- An ability to make informed decisions should mean the market accurately represents the correct prices and costs.
- It was also considered important to value the potential services in a fair way and for providers to have an ability to offer more than one of the services.
- It is important to understand the value for today's consumer vs the future consumer, and this should be taken into consideration during the development of the funding mechanisms to ensure the party responsible for procurement is empowered to make long-term decisions.
- Consideration must be given in the lotting structure to how capabilities are valued when they cannot be separated from another by some providers (for example, synchronous providers who cannot separate inertia from active power).
- It should be made clear to potential service providers how the future service will interact with other services and revenue streams, and if/how it can be stacked to form a business case.

Virtual Conference

The Distributed ReStart project held a Virtual Conference from 30 June to 2 July 2020. During this event, there were sessions from each of the different workstreams (Power Engineering and Trials; Organisational, Systems and Telecommunications; and Procurement and Compliance), there were also sessions from the Design Architects.

The Procurement and Compliance workstream held two sessions: an overview on the procurement and commercial aspects and an overview of the codes and licences review. Following these sessions, we held a number of interactive sessions to engage directly with our stakeholders.

Codes

The aim of the codes session was to update the industry on progress with the codes review, and to share an updated codes interdependency map and a roadmap showing how the Distributed ReStart project would be incorporated into the relevant codes through code modifications. This session had 118 attendees, following this we advertised and offered 6 interactive sessions. However, there were only 2 attendees across these 6 sessions, the low uptake was surprising. This has been interpreted to mean that there are no major concerns or issues with the suggested code changes.

Procurement and commercial

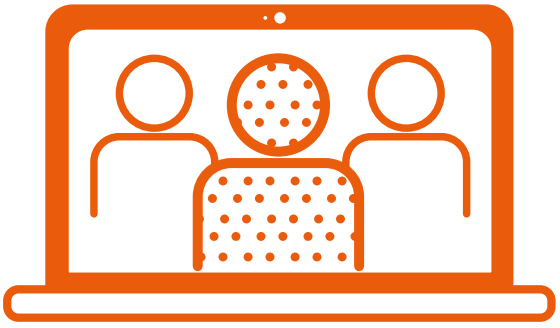
The aim for the procurement and commercial session was to update the industry on where we were within the Design Stage by releasing our proposed procurement approaches, there were 128 attendees for this session. Following this we held a number of interactive sessions, which were advertised during the event and subsequently through the Distributed ReStart mailing list, to gather more qualitative feedback from stakeholders who wanted to feedback on the proposed approaches. Structured 20 minute one-to-one sessions with targeted questions ensured these were constructive and useful, producing high quality feedback. The majority of stakeholders who signed up to these sessions were DER owners/operators.

Commercial interactive sessions summary

- Considerations on the cost elements which will make up a service, what they will be. Retrofit costs vs new builds costs. Price submissions likely to be the investment cost of enhancements to assets plus reasonable return. Investments in communications/security/manning sites to provide a service.
- Important to allow the ability to offer more than one service, could be inefficient for assets/providers to only provide one of the services. If approach two is the decided procurement approach, would there be the opportunity to submit 'all or nothing' bids, some providers can only provide more than one of the services.
- Clear published technical requirements for any service tenders. Clear guidelines and assessment of asset feasibility. Clear information on the technical parameters or rules for each service – what does the asset require to participate? This will allow all technology to participate if they can meet the correct technical parameters, and providers to make investment decisions if they want to participate in a service for which they don't yet have the capabilities but can make enhancements.
- Approach two provides the most flexibility for potential providers for picking and choosing which services to enter.
- Rigorous audit rights in the contracts to ensure capability and delivery. Have a penalty if the provider doesn't deliver but not more than the value of the contract.
- Approach one and two seem the most suitable for the buyer, all approaches would work as a supplier.
- There could be an opportunity in approach one for the role of an 'intelligent aggregator' to take responsibility for managing and coordinating other DER sites.
- Longer-term contracts seem more suitable for complex and long (procuring and tendering) processes, possibly where there are combined services, it could be resource heavy for both the supplier and buyer to go through the process regularly.
- A suggested granular approach to procurement where it is done at a smaller geographical area rather than across GB and all providers are paid the same within the zone, where there are providers on the boundary of zones and can provide benefit to both zones, they should be able to participate in both.
- It could be DNOs/DSOs who do the procuring, this makes sense because it is at a DNO level.

Key findings from Virtual Conference interactive sessions:

- Flexibility for providers to pick and choose which services to provide and the ability/scope to provide more than one service is considered important.
- Clear requirements for the technical capabilities allows providers to make informed choices on which service to provide.
- Price submissions likely to include required investment (asset enhancements, communications etc) to provide the service plus profit margins.



Distribution network operators engagement

Through the Energy Networks Association Workstream 1A Flexibility Services, we have been able to engage directly with each of the six DNOs on their flexibility services and gathered feedback on our procurement approaches.

Feedback on proposed procurement approaches

- Transparency is key.
- Reliability and resilience of asset delivery and capabilities. How to manage unavailability on-the-day? Contract considerations and capacity requirements when procuring.
- Communications structure, length of time for response is important.
- Relationship of Distributed ReStart with other services, stacking possibilities. Can assets provide multiple components?
- Once procured, could the services be used for other purposes not in a Black Start situation? Flexibility of usage in contracts.
- Technical requirements need to be clear and not advantage or disadvantage any technology type.
- How will the procurement of the service be funded? Provisions for DNO/DSO procurement?
- What will the role of each party be, e.g DNOs? This is being worked out through the OST workstream.
- How would the ESO access contracts on the DNO network? It may be DNOs doing the procuring so the ESO would not need to access contracts on the DNO network.
- Assets on the 11kV network will most likely not be technically capable to provide the proposed services.
- There is DER technology which will auto re-close (connect to the network and start-up) when they detect a voltage source on the network.
- DNOs are the most knowledgeable on what existing assets can do, which assets can already do the different technical capabilities.
- There is a preference for approach two where there are multiple contracts. With approach one, think that providers will not want to indemnify against the delivery of the other DER in the DRZ. Approach two seems the most sensible approach.
- Mandating not controversial unless a large investment required (approach three).

Summary from DNO Flexibility Services discussions

- There are four standard services which DNOs procure: sustain, secure, dynamic and restore. These are active power services, for post or pre-fault.
- The ENA are running a consultation on the DNO services, contracts and other elements to standardise the way DNOs procure flexibility services.
- Systems: registration, dynamic purchasing, dispatch and settlement, performance monitoring.
- Providers have the responsibility to meet service requirements.
- Identify requirement for services, assess against counterfactual of network reinforcement.
- Mixture of availability payments and utilisation or just utilisation payments. No exclusivity clauses, plus ability to stack.
- Procure for security of supply (P2 requirement). Over procurement – assurance of delivery.
- Payment mechanisms to incentivise delivery and claw back for non-delivery.
- Testing for response to dispatch signals, communications.
- A pool of pre-approved and registered assets who can then tender in for services, having already met the technical requirements.

Key findings and takeaways from DNO discussions:

- Transparency is important.
- Reliability and resilience of delivery from contracts.
- Technical requirements need to be clear and technology neutral.
- How will the service be funded and what will be the role of different parties (ESO/DNOs/DSOs)?
- Approach two appears to provide the most suitable options for covering risk for the different parties when contracting.
- A pool of pre-approved and registered assets is a good process to follow for assessing providers and allowing tendering.

Appendix 2 – Project assumptions

Table A2.1

Project assumptions

	Assumption
1	The roll-out of Black Start from DER and the transition to business as usual adoption will be at a different pace in different places. There will not be a single date when it is implemented everywhere. Implementation will depend on the need, costs and appetite in each area. The project aims to demonstrate viability and have Distributed ReStart become part of the roadmap for Black Start service development.
2	The overall Black Start strategy will continue to involve a mix of service providers and solutions appropriate to the requirements and opportunities in each area, including conventional large power stations and HVDC interconnectors. Distributed ReStart will become part of the overall strategy alongside these other options.
3	The electricity industry is changing at a rapid pace. With a transition to smarter networks, the capability of the network is likely to increase over time, and the incremental costs of 'converting' the network to being Black Start capable should decrease. Thus, while initial costs for implementing the Distributed ReStart concept may be high, there is significant scope for costs to reduce over time.
4	In most cases, but not necessarily all, the DRZ restoration process will include the connection of multiple DER to supplement the anchor generator. This is likely to be necessary to enhance the level of service, particularly if the DRZ is going to be used for transmission system energisation.
5	For DER considered 'Large' and therefore a CUSC signatory, emergency instructions can be used to have them participate in the overall DRZ restoration process. The anchor generator will still have to be contracted, like existing Black Start service procurement. Other DER contributing to DRZ formation and management will have to be contracted with and paid for providing restoration services, rather than rely on emergency instructions or other non-commercial method of progressing the restoration process.
6	The opportunity to participate is to be open to all who can satisfy the technical requirements and contribute to an effective restoration capability. The level of service and combination of resources required will depend on the specific needs in each location.
7	There is an assumption that 72 hours of power resilience is necessary and sufficient for all substations, telecommunications and protection in a DRZ. Distributed ReStart considers Operational Telecommunications only. Any telecommunications not between active Black Start participants is considered out of scope e.g. DNO to consumers, the ESO to BEIS.
8	The current (BAU) Black Start strategy (procurement and process) is about restoring the transmission system, it is not directly about restoring demand. We expect the new Black Start Standard to put an emphasis on demand restoration, and we assume it will require restoration of 60% of demand in 24 hours and 100% of demand in 5 days. There is a further assumption that the Standard will be applied on a regional basis as well as nationally. Whatever the definition of a 'region' we believe Distributed ReStart can help to meet the new requirement.
9	The project goal (and what we are investigating in all our case studies) is for a DRZ to be used for transmission network energisation, and thereby act like a virtual power plant providing services to transmission system restoration similar to what is currently procured from a large power station. However, we believe that when the resources available mean this is not possible, or cost effective, there is still value in being able to restore demand at the distribution level only or to help maintain operability of the network and associated resources for an extended period. This will help to improve restoration timescales and contribute to meeting the new Black Start Standard.
10	Inter Control Centre Protocol (ICCP) links will be available between the ESO and all DNOs within project timescales.
11	DER start-up procedures are not entirely automatic under control of the DRZC. For anchor generators we assume that start-up will not be an automated procedure. However, we do expect an automatic response to setpoint signals after start-up. For other DERs (both manned and unmanned sites), start-up procedures need not be automated, i.e. they may require human intervention. However, it is assumed that once a DER has started, it will accept control signals and respond automatically if required.
12	Communications can be provided directly to the DER to enable automation.
13	We aim to design solutions that will deliver Black Start capability with a similar level of risk to the current Black Start process.
14	When a single provider manages multiple sites, it is assumed that claimed availability of services at these sites will be consistent across sites regardless of the number of sites managed by that provider.
15	For each DNO area, it is expected that there will be more possible DRZs (more anchor generators) than will need to be contracted. There will therefore be scope for competition between possible anchor generators (and DRZs) across a DNO area (or across a Black Start region).
16	The DNO will be responsible for local operational actions within the DRZ on its own network, no matter whether the overall process is ESO-led or DNO-led.
17	The best strategy for energising a DRZ is to first restore supply to the additional participating DERs so that their auxiliary supplies are restored, and they are ready to provide support as and when required by the anchor generator. The next step, before connecting any non-participating customers, is to energise the larger grid/super grid transformers and any higher voltage circuits, so that any voltage dips and/or switching over-voltages will not cause quality of supply problems for non-participating customers.
18	A 33 kV-only DRZ is unlikely to be able to provide enough fault infeed for existing 400 kV protections to operate correctly. Energising 400 kV circuits will therefore require supporting resources to be connected at 132 kV or higher.
19	The Black Start from DER restoration process will require a level of automation to overcome technical issues and resource constraints. The concept of a Distributed ReStart Zone controller (DRZ controller or DRZC) has been developed to describe the system(s) that will enable monitoring, control and coordination of a range of DER and network resources to provide Black Start services.

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