

# Action Plan

December 2020



# ESO digitalisation action plan

December 2020

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## 1. Introduction

### 1.1. Context

Following the submission of our digitalisation strategy in December 2019, in parallel with our December 2019 RIIO-2 business plan, Ofgem issued an Open Letter on 10 June 2020 to all network companies. This set out Ofgem's overall evaluation and common feedback on all the strategies they had received. Ofgem also made a commitment to provide feedback to each network company to support the required update of the December 2019 digitalisation strategy and inclusion of an action plan by 31 December 2020. In response to this commitment, we held a bilateral with Ofgem on the 7 August 2020 to receive specific feedback to inform the development of our December 2020 digitalisation strategy and accompanying action plan.

This action plan is a companion document to our December 2020 digitalisation strategy and shows how we will progress towards becoming a digital ESO. It summarises a subset of content that has been shared in our December 2019 business plan, response to Ofgem's supplementary questions (January – July 2020), and our September/October 2020 consultation response to Ofgem's draft determinations. We show how the activities and deliverables that support our ambition also support the realisation of our December 2020 digitalisation strategy.

For the avoidance of doubt, this digitalisation action plan will not be explicitly assessed as part of our evaluative incentive scheme. The incentive scheme covers our performance under the three role areas of control room operations; market development and transactions; and system insight, planning and network development. Under RIIO-2, our performance against these three roles is assessed subject to five criteria: plan delivery (against the ESO's delivery schedule), metric performance, stakeholder evidence, demonstration of plan benefits, and value for money. Updates to deliverables and timelines will be communicated through the incentive scheme rather than through this digitalisation action plan.

#### **Relationship between artefacts**

Our December 2019 business plan (business plan) sets out how we will facilitate the transition to a flexible, low carbon energy system. Fundamental to this is the use of digital methods and practices. This extends from our customer-centricity, to agile/iterative change delivery, and flexible technology solutions. It shows how we will become a digital organisation and evolve our capability as an innovative, service-delivery organisation underpinned by technology.

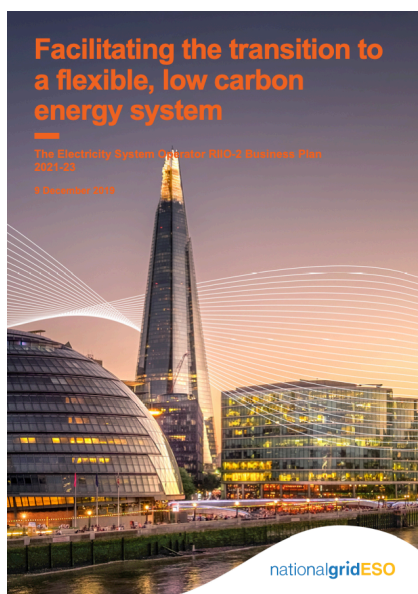


Figure 1 - Our December 2019 business plan

Our business plan is structured by roles/themes, activities and deliverables that define the measures of success. In October 2020, we developed a comprehensive delivery schedule (ESO RIIO-2 delivery schedule) that breaks down our ambition into activities, deliverables, and milestones (see Figure 2 below).

We have extracted the relevant activities and deliverables from the ESO RIIO-2 delivery schedule and included them within this action plan. Each deliverable has detailed 2021/22 and 2022/23 milestones, success criteria, and final deliverables. For ease of reference, the detail supporting this roadmap is attached in full in Appendix C – Delivery schedule.

#### A17 Transparency and open data

Our proposals for Transparency and Open data drive progress towards our Trusted Partner ambition as well as our ambition to be able to operate a zero carbon system. Through transparency of our actions, stakeholder and market participants will be able to understand, and have greater confidence in, the decisions that we take to balance the system in real-time. In addition, by providing far greater diversity and volumes of operational and market data we anticipate that we will stimulate a fresh wave of innovation in low carbon and whole electricity system operation solutions. These solutions may mature into tools that will help us to operate the zero carbon system of the future.

Sub activity	Deliverable	Related IT investment	Project or continuous	RIIO-1 end point	2021/2022 Milestones	2022/2023 Milestones	First year success	Second year success	Expected final delivery date and what success looks like.	Notes on changes to Dec 2019 Business Plan
A17 Transparency and Open Data	<b>Transparency Roadmap</b>  This new deliverable defines the outcomes, timescales and steps to achieve the ESO's ambition to provide the highest level of transparency possible. <small>Further detail on the</small>	<b>220 - Data and analytics platform:</b> It will be the key technology underpinning all our internal and external data management, pulling together data from a variety of sources and ensuring there is only one source of the truth.	Continuous	Initial Transparency Roadmap published with feedback on scope and methodology received.	Q1 – Publish Transparency Roadmap refresh.  Q3 – Publish Transparency Roadmap refresh.	Q1 – Publish Transparency Roadmap refresh.  Q3 – Publish Transparency Roadmap refresh.	ESO Transparency Roadmap refresh published informed by stakeholder feedback.  This will provide clarity on information that we share and future developments.  Positive stakeholder feedback received.	ESO Transparency Roadmap refresh published informed by stakeholder feedback.  This will provide clarity on information that we share and future developments.  Positive stakeholder feedback received.	N/A	This is a new deliverable, not included in December 2019 Business Plan.

Figure 2 - Excerpt from our updated ESO RIIO-2 delivery schedule (9 October 2020)

The ESO RIIO-2 delivery schedule also shows the related technology investments. The relevant investments are summarised in the main body of this action plan and additional detail is included in Appendix B – Technology investments. These provide information about the scope, architectural approach, deliverables, timelines, work breakdown structure, risks, and resourcing (see Figure 3). These are drawn from a number of sources including our December 2019 business plan: Annex 4 – Technology investment report and our ESO RIIO-2 consultation response – Technology investment detail parts 1-3. A mapping table is included in the appendix for cross reference with the source documents.



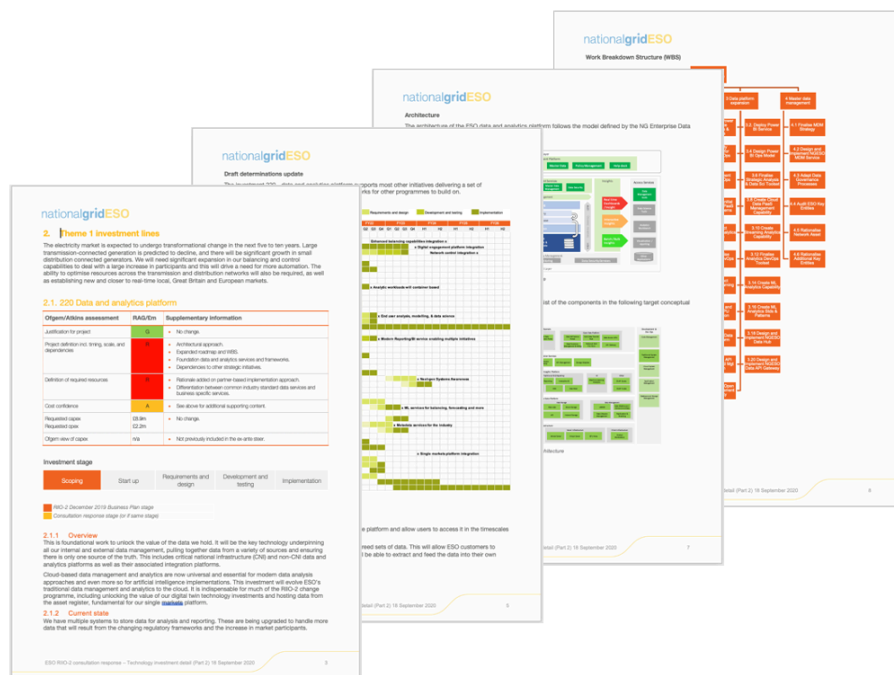


Figure 3 – Excerpt from our technology investment detail

Please note – this update does not consider the impact of Ofgem's IT model assessment which is running in parallel.

## 1.2. The three pillars and our digitalisation landscape

Our December 2020 digitalisation strategy is based on three pillars:

- Deliver open data and digital market enablement

Adopting the principle of ‘presumed open’ and making all of our shareable data available in an accessible format to inform efficient business decision-making across the industry and drive innovation. Removing barriers to market participation and transforming the customer experience through digital enablement.

- Build our core capability through digital technology

Transforming our business processes such as energy forecasting, system operation and network planning to enable secure and efficient operation of the electricity system and markets.

- Transform our organisational culture and digital ways of working

Developing the right capabilities and skills in our workforce alongside a supporting culture and behaviours to foster an agile, innovative and experimental operating environment.

Each pillar aligns to the findings of the energy data taskforce (EDTF) and the roles/themes within our business plan (see Figure 4 - Our digitalisation landscape). The EDTF findings are summarised in Appendix A – Energy data taskforce (EDTF) findings.

	Theme 1 Reliable, secure system operation, to deliver electricity when consumers need it	Theme 2 Transforming participation in smart and sustainable markets	Theme 3 Unlocking consumer value through competition	Theme 4 Driving towards a sustainable, whole energy future
Pillar 1 Deliver open data and digital market enablement	EDTF Recommendation 2: Maximising the value of data			
	Recommendation 3: Visibility of data			
	Recommendation 4: Coordination of asset registration			
	Control room decision-making transparency	Single markets platform Digitalised whole system Grid Code		Connections hub Planning and outage data exchange
	Data portal for operational and market data			
Pillar 2 Build our core capability through digital technology	EDTF Recommendation 1: Digitalisation of the energy system			
	EDTF Recommendation 5: Visibility of infrastructure and assets			
	Energy forecasting Balancing and control Digital Twin concepts	Market data Market simulation and analysis	Network modelling capabilities	Modelling and analysis for whole system operability Energy system data and analysis
Pillar 3 Transform our organisational culture and digital ways of working	New capabilities			
	Attracting and retaining talent			
	Collaborative, innovative culture			

Figure 4 - Our digitalisation landscape

## 2. Pillar 1 – Develop open data and digital market enablement

*Adopting the principle of ‘presumed open’ and making all of our shareable data available in an accessible format to inform efficient business decision-making across the industry and drive innovation. Removing barriers to market participation and transforming the customer experience through digital enablement.*

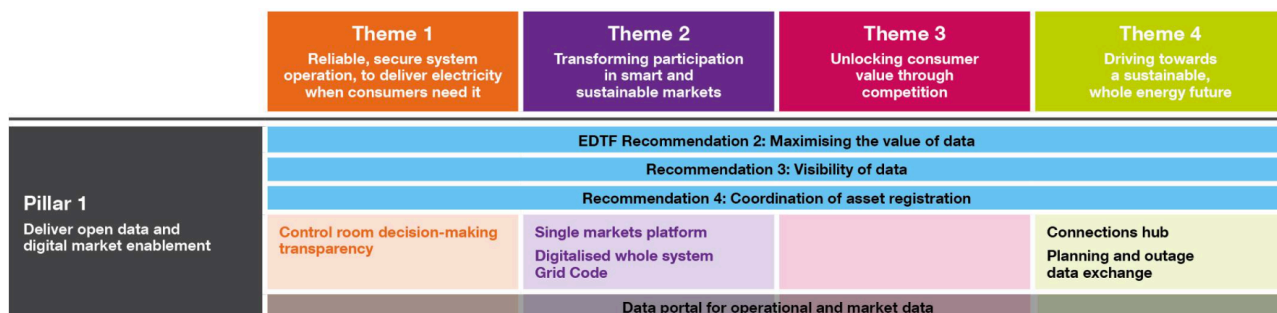


Figure 5 - Pillar 1 digitalisation landscape

### 2.1. Activity and deliverable roadmap

As outlined in our December 2020 digitalisation strategy, there are five key areas for success in pillar 1 – control room decision making transparency, single markets platform, digitalised whole system grid code, connections hub, and planning and outage data exchange.

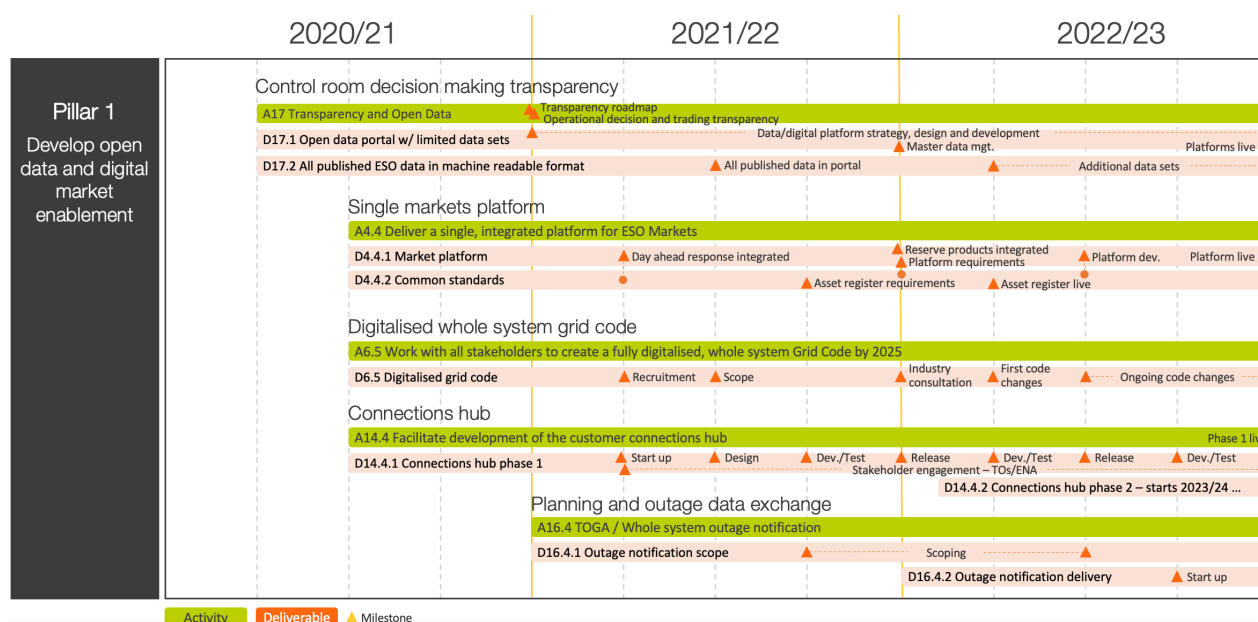


Figure 6 - Pillar 1 activity and deliverable roadmap

The detail supporting this roadmap is attached in full in Appendix C – Delivery schedule. The activities and deliverables are summarised below.

#### A17 Transparency and open data

Our proposals for transparency and open data drive progress towards our Trusted Partner ambition as well as our ambition to be able to operate a zero carbon system. Through transparency of our actions, stakeholder and market participants will be able to understand, and have greater confidence in, the decisions that we take to balance the system in real-time. In addition, by providing far greater diversity and volumes of operational and market data we anticipate that we will stimulate a fresh wave of innovation in low carbon and



whole electricity system operation solutions. These solutions may mature into tools that will help us to operate the zero carbon system of the future.

There are two related deliverables in this activity.

- D17.1 Open data portal with limited data sets (initial go live 2019). This deliverable refers to the foundational data portal acting as a proof of concept for the RIIO-2 data portal which will be powered by the Data and analytics platform and utilise the user interface of the Digital engagement platform.
- D17.2 All published ESO data in machine readable format.

#### **A4.4 Deliver a single, integrated platform for ESO Markets**

There are two related deliverables in this activity.

- D4.4.1 (shared with D5.2) A market platform through which market participants will be able to participate in balancing and capacity markets. The markets platform will cover the end to end process for market participation including: communications, data input and management, messaging and validation.
- D4.4.2 Common standards, including interoperable systems, a common data model and shared minimum specifications between ESO and other flexibility platforms as well as at the distribution level.

#### **A6.5 Work with all stakeholders to create a fully digitalised, whole system Grid Code by 2025**

There is one related deliverable in this activity.

- D6.5 The Grid code combines transmission and distribution codes in an IT system with AI-enabled navigation and, document and workflow management tools.

#### **A14.4 Facilitate development of the customer connections hub**

There are two related deliverables in this activity.

- D14.4.1 Implement first phase of the ESO connections hub, including online account management and integration with other network organisation websites
- D14.4.2 Phase 2 of the connections hub concluded

#### **A16.4 TOGA / Whole system outage notification**

There are two related deliverables in this activity.

- D16.4.1 Scoping exercise concluded for delivery of enhancements to outage notifications.
- D16.4.2 Delivery of enhancements to outage notifications, to stimulate flexibility markets as an additional tool for efficient outage management - we will develop the TOGA system to become a more interactive experience for customers, stakeholders and the market.

## 2.2. Technology investments

These investments represent the primary outputs that align to our December 2020 digitalisation strategy. Each of the investments within our business plan also support several additional outputs; a full list can be found in Appendix B – Technology investments including their associated inter-dependencies.

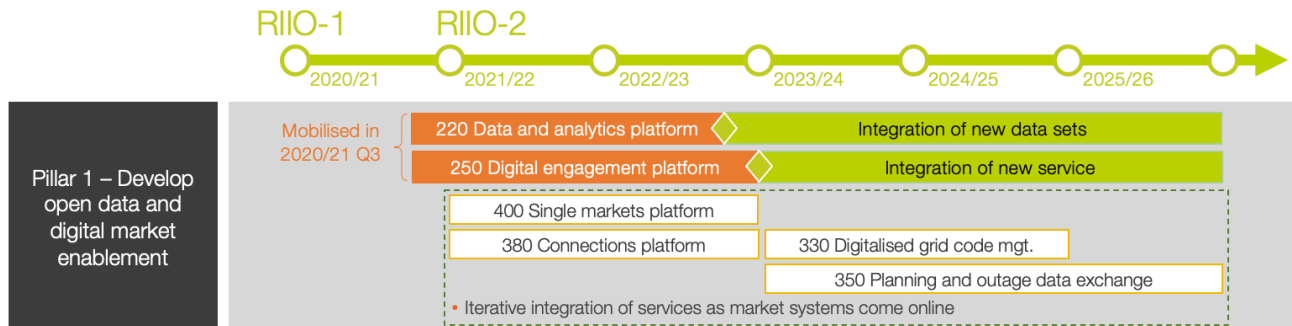


Figure 7 - Pillar 1 technology investment roadmap

### 220 Data and analytics platform

This is foundational work to unlock the value of the data we hold. It will be the key technology underpinning all our internal and external data management, pulling together data from a variety of sources and ensuring there is only one source of the truth. This includes critical national infrastructure (CNI) and non-CNI data and analytics platforms as well as their associated integration platforms.

Cloud-based data management and analytics are now universal and essential for modern data analysis approaches and even more so for artificial intelligence implementations. This investment will evolve ESO's traditional data management and analytics to the cloud. It is indispensable for much of the RIIIO-2 change programme, including unlocking the value of our digital twin technology investments and hosting data from the asset register, fundamental for our single markets platform.

More detail can be found in 220 Data and analytics platform.

### 250 Digital engagement platform

This investment will enable a single point of access for all ESO data and services, including the markets, connections, digitalised Grid Code management and data and analytics platform. It sits at the heart of our vision for digital capability across all our themes, providing a common engagement experience for stakeholders.

More detail can be found in 250 Digital engagement platform

### 330 Digitalised grid code management

Investment to transform the stakeholder experience of the code management process through artificial intelligence enabled navigation, and document and workflow management tools.

More detail can be found in 330 Digitalised code management

### 350 Planning and outage data exchange

Enhancement of outage planning and data exchange systems to enable a whole system approach to access networks, manage significantly increased data volumes, and provide interactive stakeholder engagement.

More detail can be found in 350 Planning and outage data exchange

### 380 Connections platform

We propose building a customer connections hub that will transform the connection journey and account management for all customers. The hub will provide a single point of contact for connections to electricity

networks it will guide customers through the connection process, it will provide account management functionality and will help customers identify where capacity opportunities exist on both the distribution and transmission networks.

The customer connections hub will provide a single point of contact for connections to electricity networks that will guide customers through the connection process and provide online account management functionality for all live projects. The hub will enable customers to see regular updates on the progress of their applications to connect as well as information on those projects under construction, providing information directly from the relevant network companies to ensure regular and accurate information on build time and cost. The platform will also facilitate enduring contract management during the operational phase of the project as well as providing a source of information for customers who are researching opportunities for connection and wish to understand more about capacity opportunities on both the distribution and transmission networks.

The connections hub will transform the user experience for stakeholders. It will provide an electronic platform to take customers through the connections journey and will be the interface with us regarding the projects we are working on.

More detail can be found in 380 Connections platform

#### **400 Single markets platform**

The single markets platform will provide a single route for providers to participate in our market and a full end-to-end customer journey allowing market participants to access the data relating to: how to become a provider (obligations, sign up, test, application progression), contract tender (see contracts status and manage contracts), unit management (see what units are registered for, see and change aggregation configurations), dispatch (access instructions), performance monitoring (see how units behaved under instructions), payment. This will include all ancillary service products plus EMR and CfD.

This investment includes a market sandbox to enable faster and more efficient trial of new products through the ability to integrate with the core systems.

More detail can be found in 400 Single markets platform



### 3. Pillar 2 – Build our core capability through digital technology

Transforming our business processes such as energy forecasting, system operation and network planning to enable secure and efficient operation of the electricity system and markets.

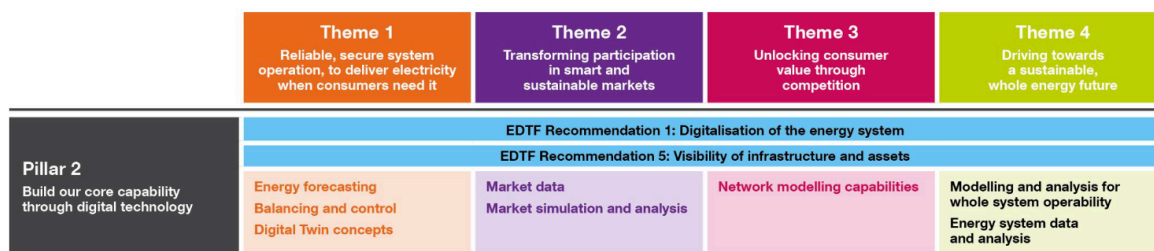


Figure 8 - Pillar 2 digitalisation landscape

#### 3.1. Activity and deliverable roadmap

As outlined in our December 2020 digitalisation strategy, there are seven key areas for success in pillar 2 – energy forecasting, balancing and control, market data, market simulation and analysis, network modelling capabilities, modelling and analysis for whole system operability, energy system data and analysis.

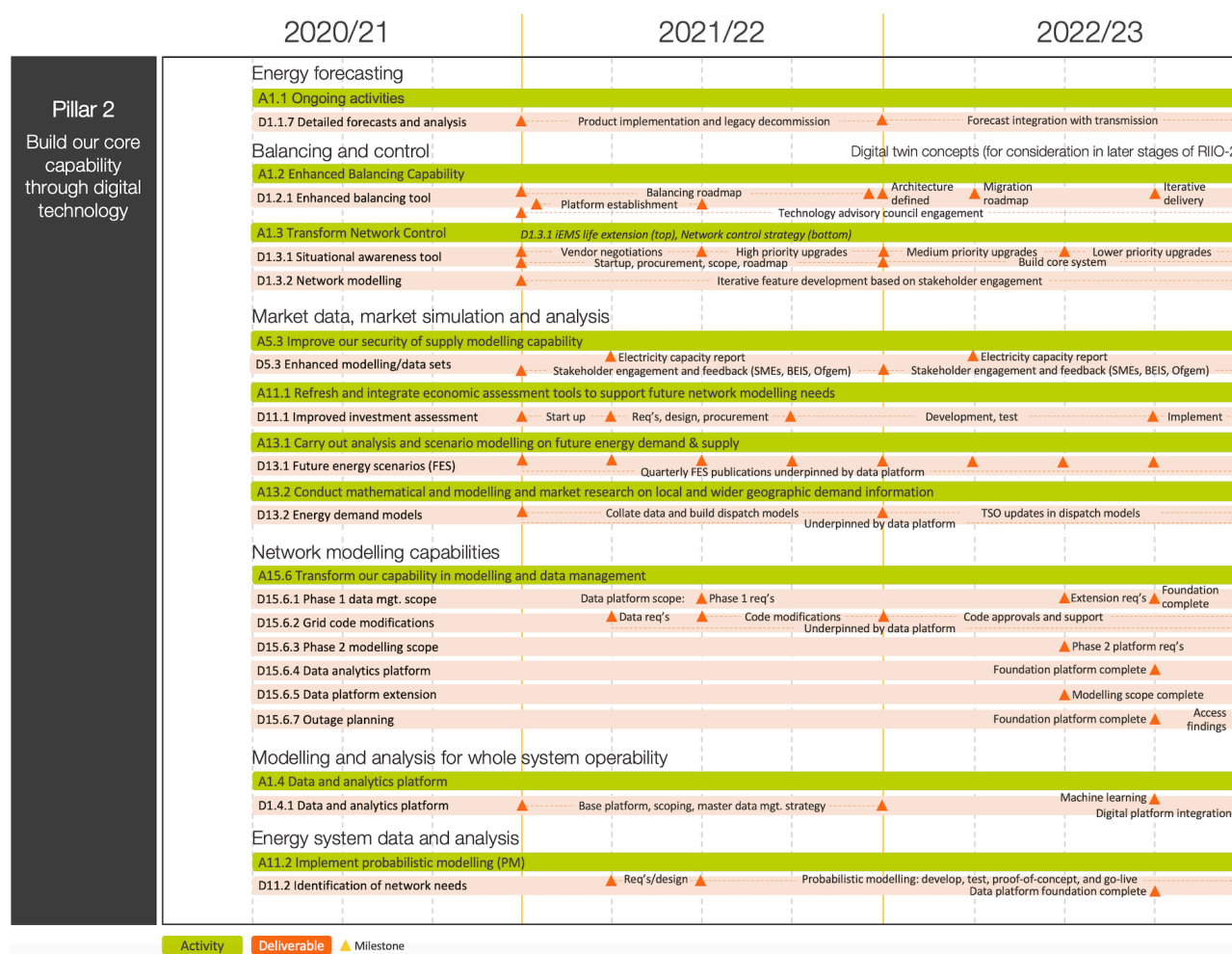


Figure 9 - Pillar 2 activity and deliverable roadmap

The detail supporting this roadmap is attached in full in Appendix C – Delivery schedule. The activities and deliverables are summarised below.

### **A1.1 Ongoing activities**

Ongoing activities allow us to continue running the electricity system safely, efficiently and economically.

D1.1.5 will provide the necessary legacy asset upgrades whilst we deliver our transformational capability. D1.1.7 will upgrade our forecasting capability, allowing us to provide more frequent better-quality forecasts, helping the market self-balance and operate efficiently.

There is one related deliverable in this activity.

- D1.1.7 Produce and publish detailed forecasts and analysis, for both demand and generation, published at day-ahead and other timescales. Forecasts will be enhanced using detailed statistical and machine learning approaches.

Provide data and insight to inform control centre decision making and performance review and integrate relevant IT projects into business as usual.

Our forecasting enhancements will provide the control room with better quality, more frequent forecasts, allowing them to make better operational decisions. This helps minimise balancing costs and reduce carbon emissions.

### **A1.2 Enhanced Balancing Capability**

There is one related deliverable in this activity.

- D1.2.1 Enhanced balancing tool built and developed in a modular fashion that will incorporate machine learning and artificial intelligence. It will enable us to schedule and dispatch a greater number of market participants than today.

### **A1.3 Transform Network Control**

There are two related deliverables in this activity.

D1.3.1 Develop and deliver new real-time situational awareness tool, so Control Centre engineers can better understand changing network limitations, leading to a more efficient risk-based operation of the system. Modules will integrate with the new Network Control tool to provide advanced situational awareness. These modules are developed as part of D1.3.2 / IT investment ref 150. The exact modules developed will be decided over the course of BP1.

D1.3.2 Enhanced network modelling capabilities with online analysis of voltage and power flow profiles closer to real time. This deliverable outlines the potential modules that will be incorporated into the new Network Control tool (D1.3.1). The exact tools and timing are still to be determined, but here we provide a view of what they could be.

### **A1.4 Data and analytics platform**

There is one related deliverable in this activity.

- D1.4.1 Creation of a data and analytics platform that will act as the foundation for our new Control Centre architecture. It will house all ESO internal data, including from the Control Centre systems, and allow users to access it in the timescales they need. External stakeholders will be able to access it through the data portal.

### **A5.3 Improve our security of supply modelling capability**

There is one related deliverable in this activity.

- D5.3 Use of enhanced modelling and more granular data sets to improve security of supply modelling.

In a world of rapidly evolving energy systems, we will need to deploy the latest modelling techniques to ensure we can keep pace with these changes. We will need to develop new data sets, models and methods to correctly model the growing interactions of new generation and the demand side. This will

ensure their contributions to security of supply remain appropriate and help to ensure the Great Britain reliability standard is met.

#### **A11.1 Refresh and integrate economic assessment tools to support future network modelling needs**

There is one related deliverable in this activity.

- D11.1 Improved identification of when is the most economical time to invest and the most efficient solution

#### **A11.2 Implement probabilistic modelling**

There is one related deliverable in this activity.

- D11.2 Improved identification of network needs

#### **A13.1 Carry out analysis and scenario modelling on future energy demand and supply**

There is one related deliverable in this activity.

- D13.1 Published Future Energy Scenarios (FES), Winter Outlook and Review, Summer Outlook and other regular external commentary such as blogs from ESO employees on our website.

#### **A13.2 Conduct mathematical and modelling and market research on local and wider geographic demand information**

There is one related deliverable in this activity.

- D13.2 Created pan-European and country level electricity and energy demand models

#### **A15.6 Transform our capability in modelling and data management**

Through activity A15.6 we will transform our capability in data and modelling ensuring also that regulatory frameworks are in place to support appropriate exchange and use of data by the ESO, network companies and other stakeholders through our data and analytics platform.

There are seven related deliverables in this activity.

- D15.6.1 Phase 1 data management scoping complete to feed into data and analytics platform (see Role 1 D1.4.1) – modelling and data expertise will be used to scope planning data requirements for the data & analytics platform
- D15.6.2 Further Grid Code modifications (arising, for example, from O/N 2020 work programme, discussions with industry participants and/or in response to Ofgem's Call For Evidence on Distributed Generation visibility)
- D15.6.3 Phase 2 modelling scoping complete to feed into data and analytics platform extension (see Theme 1)
- D15.6.4 Data analytics platform foundation in place (see Theme 1)
- D15.6.5 Data platform extension complete (please see deliverable D1.4.1 for further details) – once the data and analytics platform foundation is complete, an extension will be developed as new tools are delivered.
- D15.6.7 Deeper Outage Planning go live in Offline Network Modelling - this will enable higher volumes of network data, regional models and outage planning data to be exchanged, used and shared by network companies. D15.6.7 Deeper Outage Planning go live in Offline Network Modelling. Enables higher volumes of network data, regional models and outage planning data to be exchanged, used and shared by network companies. This activity enables the network access planning activity A16.3.



### 3.2. Technology investments

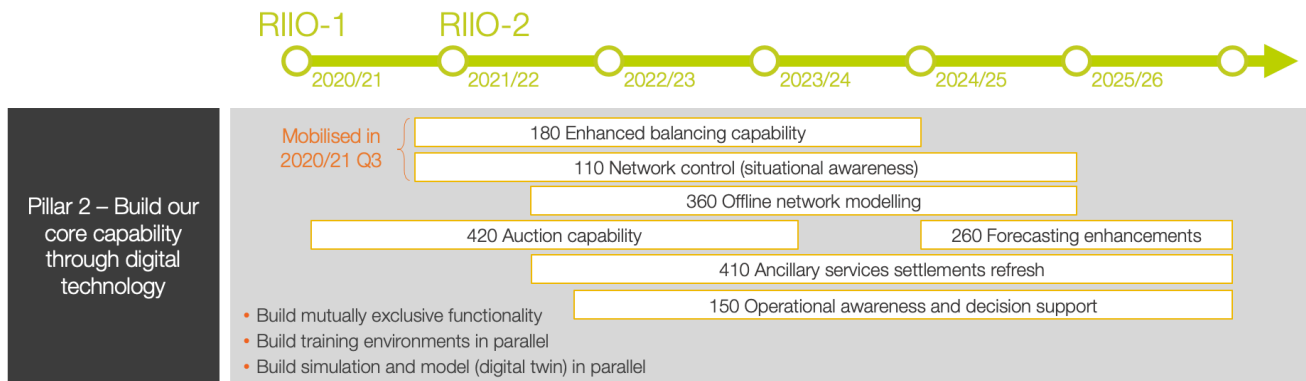


Figure 10 - Pillar 2 technology investments

#### 110 Network control

This investment will introduce new real-time situational awareness capability giving control centre operators a better understanding of changing network limitations, leading to a more efficient risk-based operation of the system. This capability will need new alarm management, modelling and visualisation tools. We will also deliver training simulation tools combined with artificial intelligence and digital twin technology relevant to this investment.

More detail can be found in 110 Network control.

#### 150 Operational awareness and decision support

This investment will enhance our network modelling capabilities by giving online analysis of voltage and power flow profiles closer to real-time. This will ensure the network is run securely and data exchanges with TOs and DNO / DSOs are timely and correctly assessed.

More detail can be found in 150 Operational awareness and decision support.

#### 180 Enhanced balancing capability

Our core balancing systems enable the real-time balancing of electricity supply and demand and are classed as critical national infrastructure (CNI). A major failure of these systems would result in widespread loss of supply, which would lead to economic and societal damage to the UK and put our licence at risk. It is essential that we invest in our core balancing systems to manage the rapidly evolving electricity market. We will also deliver training simulation tools combined with artificial intelligence and digital twin technology relevant to this investment.

More detail can be found in 180 Enhanced balancing capability.

#### 260 Forecasting enhancements

Continuing with the investment made under RIIO-1, to enhance our mathematical forecasting models and refresh the forecasting system in line with our policies.

More detail can be found in 260 Forecasting enhancements.

#### 360 Offline network modelling

Transmission analysis is carried out from ten years ahead through to real-time and post event to help design and run the network as securely and economically as possible. The offline network modelling tools deliver the day-to-day analysis required to operate the transmission system in a safe and secure manner, as well as deliver the Electricity Ten Year Statement (ETYS) and ENTSO-E reporting.

More detail can be found in 360 Offline network modelling.

#### **410 Ancillary services settlements refresh**

Replacement of, and ongoing investment in, the ancillary services settlement system, to manage the increased number of market participants and increasing rates of change.

More detail can be found in 410 Ancillary service settlements refresh.

#### **420 Auction capability**

We will invest in common auction capability and apply economies of scale for more efficient action-based procurement activities. This capability will be expandable to all types of auctions and allow for appropriate running frequency, including Electricity Market Reform (EMR), Contracts for Difference (CfD), reserve, response, reserve and response, and reactive power.

Where possible, efficiency benefits from auctions will also be implemented in tender-based service procurements.

More detail can be found in 420 Auction capability.

## 4. Pillar 3 – Transform our organisational culture and digital ways of working

*Developing the right capabilities and skills in our workforce alongside a supporting culture and behaviours to foster an agile, innovative and experimental operating environment.*



Figure 11 - Pillar 3 digitalisation landscape

### 4.1. ESO transformation

We have established a transformation programme (see Figure 11 above) that will deliver changes to our ways of working, tools, information, and culture.

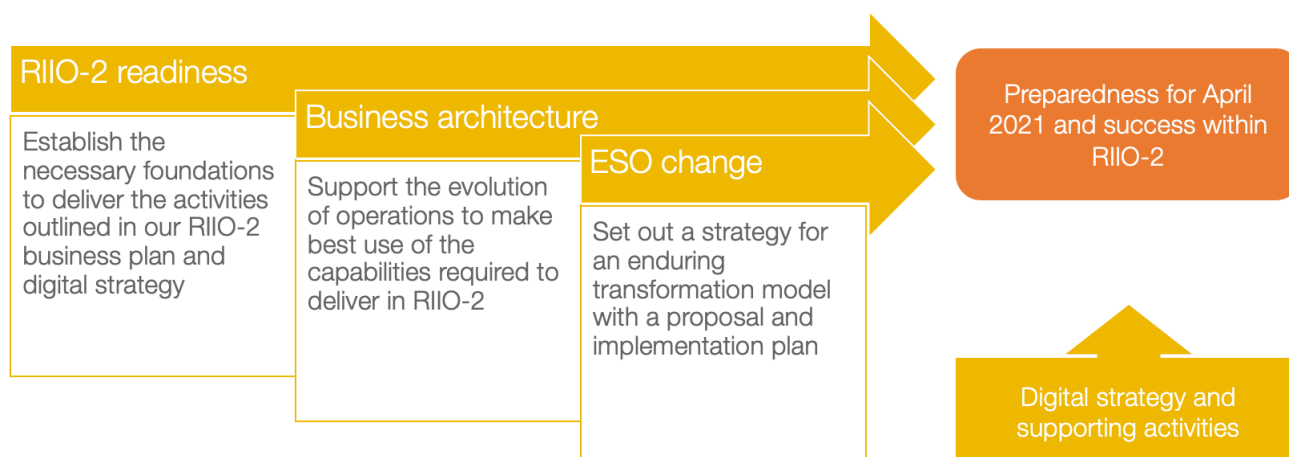


Figure 12 - Scope of ESO transformation

This programme is cross functional and centred around two primary phases.

- Phase 1 (to 1 April 2021): Ensure the RIIO-2 Transformation programme is on track in the lead-up to 1 April 2021 with close alignment of workstreams, management of programme-level risks and issues and change control.
- Phase 2 (1 April 2021 onwards): Ensure successful delivery of ongoing ESO change requirements. Monitor delivery of the RIIO-2 plan, ESO change portfolio (including digitalisation action plan), ensuring close alignment of workstreams, management of programme-level risks and issues and change control.

It will establish the necessary foundations for the ESO to be able to deliver on the activities outlined in the RIIO-2 business plan and digitalisation action plan:

- Creation of the future ESO delivery portfolio (beyond 2020/2021).



- Sourcing people and capabilities to meet future requirements of the business.
- Assessment of facilities required to deliver our business plan commitments, and options to efficiently meet them.
- Engagement with the leaders across the business to ensure the readiness programme delivers what they need to be ready for RIIO-2.
- Development and implementation of proposals to improve ways of working.

The programme is structured around the following workstreams (see Figure 13). We have expanded on people and capability (section 4.2 People and capability) and the technology workstream (section 4.3 IT enablement) below.

	Control centre operations (Role 1)	Market development and transactions (Role 2)	System insight, planning and network (Role 3)
	Develop RIIO-2 delivery plans for activities, including activity milestones, dependencies, critical path, process development, data requirements, frameworks and codes requirements, stakeholder engagement plans, people and capability requirements, technology delivery plans		
Customer experience and stakeholder engagement	In line with our trusted partner goal, provide 'getting it right first-time' support to ESO teams including effective 'co-creation stakeholder engagements for our RIIO-2 activities, and customer experience improvements.		
People and capability	Enable delivery of the ESO workforce requirements to meet the business needs for successful delivery of RIIO-2.		
Data and digital	Ensure that our RIIO-2 plans consider data and digital developments, including through updates to our digitalisation strategy.		
Regulation and regulatory engagement	Ensure the ESO has a strong regulatory relationship with Ofgem and provide expertise on the ESO licence and regulatory and incentive frameworks which ensure the ESO is financeable and enables us to deliver our ambitious business plan and consumer benefits.		
ESO change	Define the planning and prioritisation process, change governance, 'idea' lifecycle, portfolio mgt. governance, and single-source-of-truth portfolio reporting. Create an ESO change community that empowers people with tools and techniques that drive business change and support the ESO transformation.		
Technology delivery	Bring together applications as components of a modular, platform-based architecture and deliver this change portfolio in an iterative way through the use of Agile and SAFe. We must do all of this while ensuring safe, reliable system operation and managing our risks appropriately.		
Finance	Establish key finance processes for the RIIO-2 period, including annual planning and forecasting, governance of opex expenditure, revenue setting, collection process, and bad debt process.		
Support Areas	Corporate Affairs, HR, and Strategy		ESO Assurance provide assurance services across relevant activities

Figure 13 – ESO transformation programme workstreams

## 4.2. People and capability – recruitment

Our people are critical to success in becoming a digital organisation. Within our ESO transformation programme, we have a workstream dedicated to people and capability. In our business plan, we highlight our plan to transform across multiple dimensions of our operating model such as leadership, culture, capabilities, and organisation (see Figure 14).

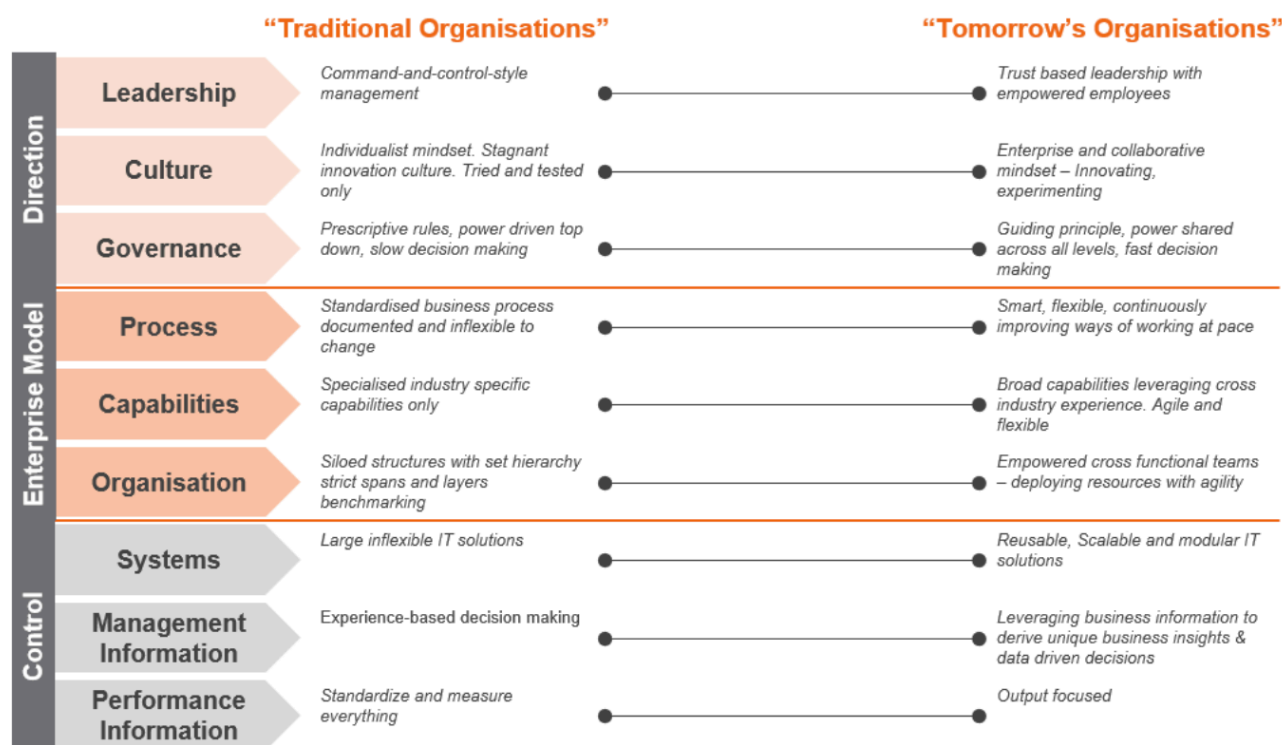


Figure 14 – Spectrum of change across and organisation's operating model dimensions.

The first wave of our recruitment campaign has started and is focused on the following areas.

### Data analytics and management

We will use data to provide rapid and automated predictive insights, providing value for system operation and market participants. This includes data science, analysis, modelling and programming capabilities, working with machine learning algorithms and AI, knowledge of statistics and neural networks this will improve our use of data throughout the timescales in which we operate. We will establish local data stewards and consider creating a central resource/centre of expertise to develop and share best practice. These capabilities will be embedded within teams to create a central pool of mobile, flexible and collaborative people that can support the accelerated roll-out of digital technologies across the ESO.

- Data analysis and advanced analytics – bring c. 25-30 data analytics specialists (data scientists) into the ESO over 2021-23 and upskill c. 40-50 people across the ESO in advanced analytics skills. The objective is to ensure our workforce can use the data we produce more effectively to drive improved decision-making.
- Data management – continue to build on the strong foundations that were built over the past three years (as a part of our Data BASICS project) and make sure we have high-enough proficiency levels in data management to handle the increasing volumes of data that are going to be needed across the ESO, both within the teams that handle the data (c. 30-50 upskilling interventions required)

### IT systems delivery and change management

We will need to strengthen our IT delivery and be able to interface with large IT transformation programmes; translate business requirements into IT technical requirements and vice-versa; deliver projects incrementally, to high standards, on time, and within budget. This will require a cultural shift towards more agility, flexibility and the ability to absorb change.

- IT systems delivery – significant increase required to build and deliver data and digital transformational systems. Three main things need to be done: resource c. 30 product manager/owner roles across the ESO (internal or external resourcing have proven to be successful); upskill a wide number of our team in Agile/SAFe methodology so they can support the work led by the product managers and owners; hire 5-10 digital technology subject matter experts to support digital projects (e.g., 250 - Digital engagement platform, 380 - Connections platform, and 33 - Digitalised grid code management)
- Change management – to ensure the ESO can deliver its transformational projects, be they IT projects or not. This is something that we have relied on National Grid Group for as a part of our shared services model.

### 4.3. IT enablement

Our technologies must enable the running of a carbon free network and a market where anyone can participate. Our objective is to bring together applications as components of a modular, platform-based architecture and to deliver this change portfolio in an iterative way through the use of Agile and SAFe methodologies. We must do all of this while ensuring safe, reliable system operation and managing our risks appropriately.

While we are already delivering an extensive portfolio of technology change, we aim to increase our capacity and flexibility. We will achieve this through the IT enablement workstream within our transformation programme. This is highlighted here as it is foundational in delivering the technologies that are integral to our digitalisation strategy.

The scope of this workstream is shown in Figure 15 below.

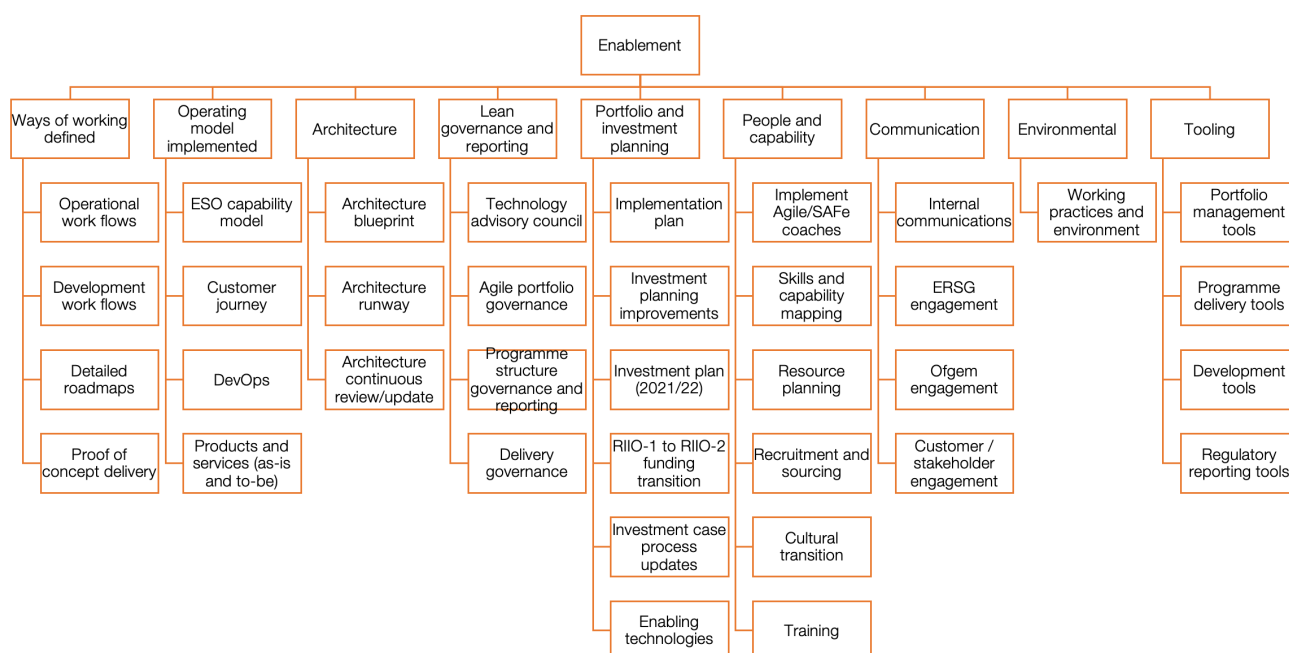


Figure 15 - IT enablement work breakdown structure

We are using this workstream not only to define and implement our future ways of working, but also to champion the delivery model that we are implementing. The enablement programme will deliver using agile techniques (e.g., two-week sprints) and become a role model for methods, practices, and culture.

Our work breakdown structure shown in Figure 15 above will be delivered using a sprint and increment approach. With support from our agile transformation office, we are working to establish a core capability,

extend that with pilot projects/teams, before scaling to cover our full portfolio. We are in the early stages of this transition; feedback has been positive.

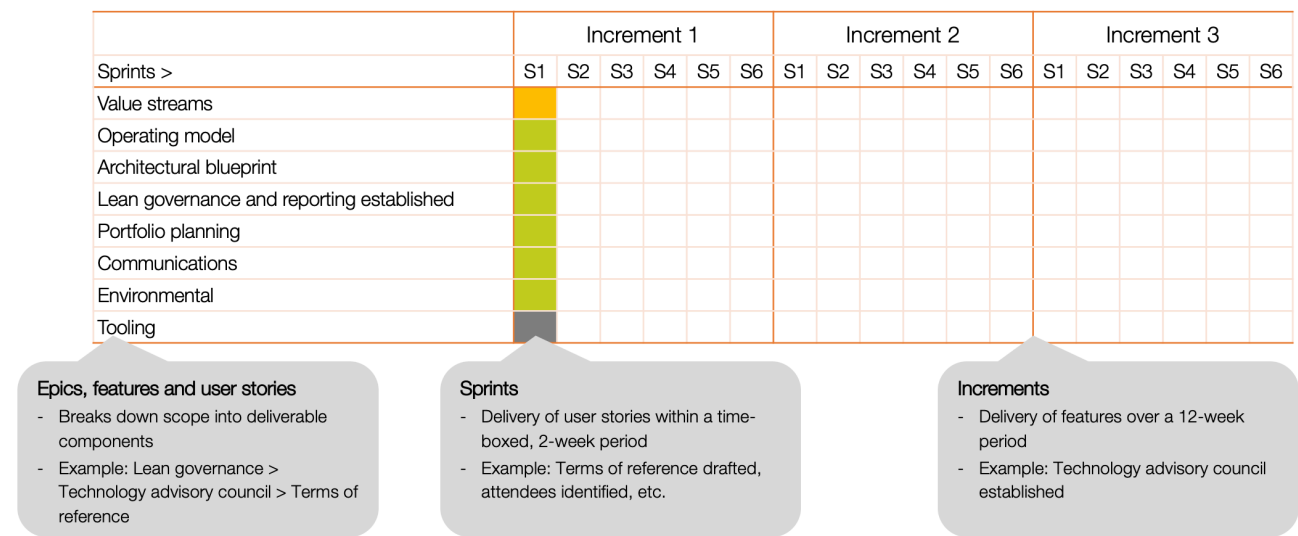


Figure 16 - agile delivery approach



## 5. Technology architecture plan

In our business plan (Chapter 10 – Technology underpinning our ambition, section 10.3 - Technology design underpinning our ambition, p.151) we show how a move to platform architecture will facilitate digital delivery. This architecture allows us to invest in building blocks, such as a data platform that can be re-used and extended to meet the use cases of our digital ambition.

The investments listed in Appendix B – Technology investments – along with those listed in Annex 4 of our business plan – contribute to the establishment and maintenance of these solutions.

While the milestones are embedded within individual investment lines, our approach to developing the architecture will follow a consistent process, iterating the design through increasing levels of detail (see Figure 17 below).

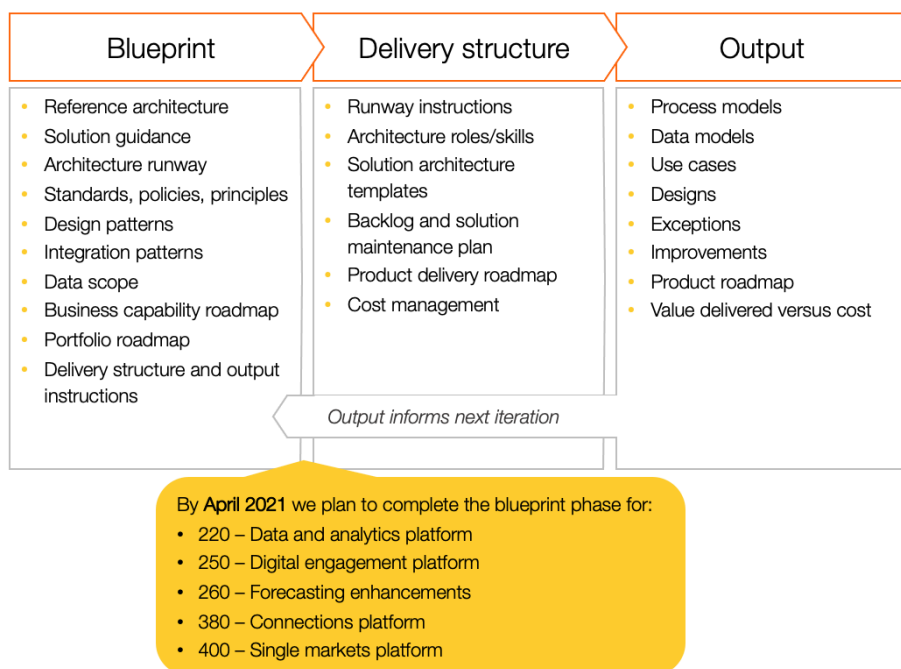


Figure 17 - High-level architecture roadmap

An example of the iteration is shown in the following diagrams. In Figure 18, we show the high-level reference architecture that will underpin our digital ambition. As we move to the next level of iteration, we map business capabilities to those technologies. This iterates through increase levels of detail through applications, to features, and individual requirements.

## ESO technology reference architecture

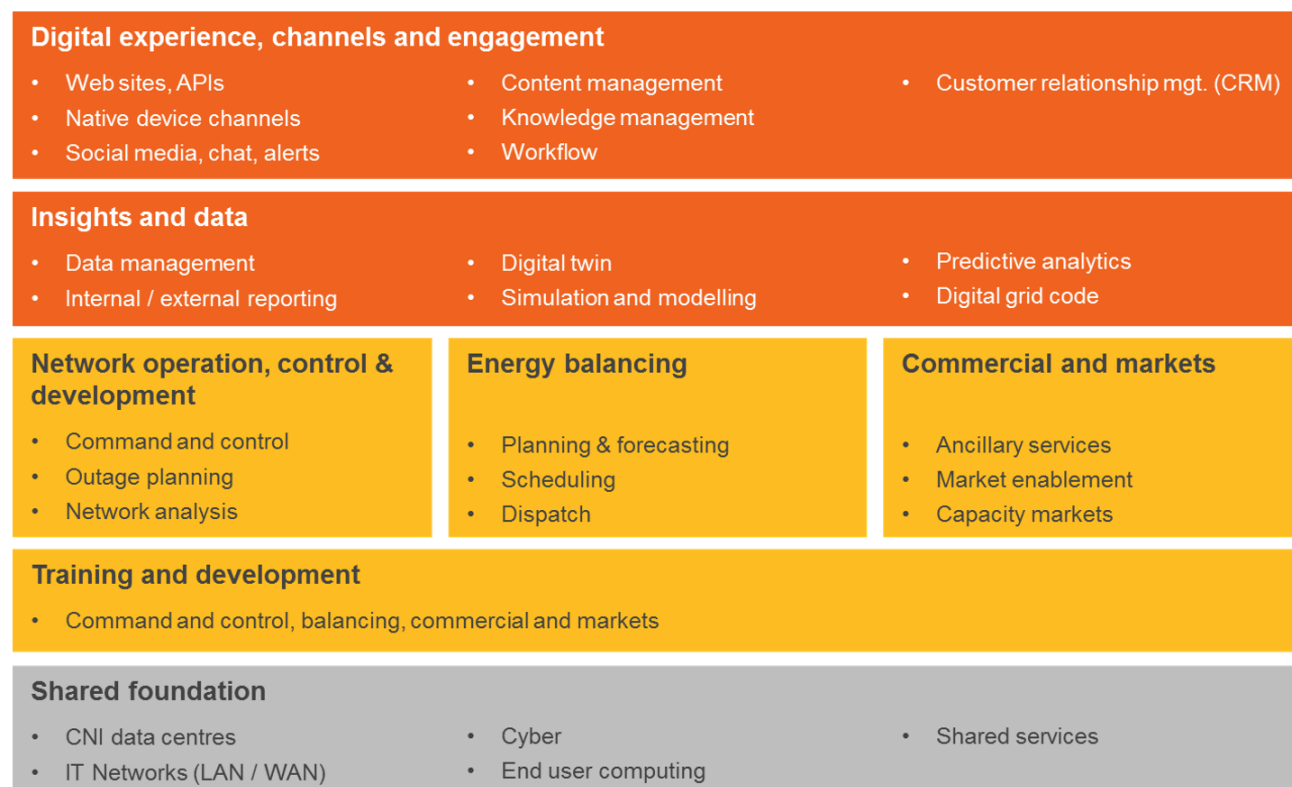


Figure 18 - ESO technology reference architecture (December 2019 business plan)

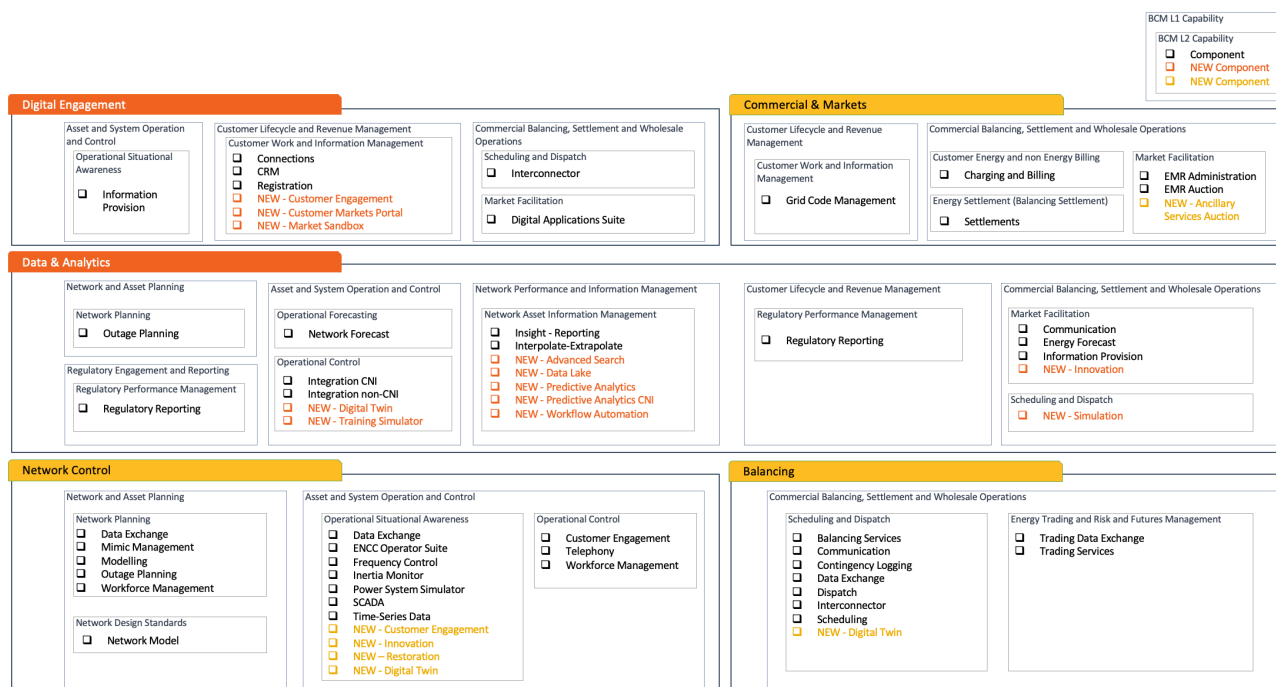


Figure 19 - ESO technology reference architecture, business capability view

## 6. Stakeholder engagement

During the development of our December 2020 business plan, we engaged extensively with stakeholders (summarised in Figure 20 below). This engagement also supported the proposals in our December 2019 and updated December 2020 digitalisation strategy. We plan to continue these high levels of engagement throughout the delivery of our ambition.

<b>Face to face engagement, including:</b> <ul style="list-style-type: none"> <li>• Bilateral meetings</li> <li>• Workshops</li> <li>• Webinars</li> </ul>	<b>To date we have held:</b> <ul style="list-style-type: none"> <li>• Around 135 bilateral meetings</li> <li>• 10 Workshops</li> <li>• 11 Webinars</li> </ul>	<b>Which has resulted in engagement with:</b> <ul style="list-style-type: none"> <li>• Over 900 individuals from</li> <li>• Around 350 organisations</li> </ul>
<b>ESO RIIO-2 Stakeholder Group</b>	<b>To date we have held:</b> <ul style="list-style-type: none"> <li>• 8 meetings</li> <li>• 1 workshop</li> <li>• 1 Control Centre visit</li> <li>• 1 IT webinar</li> </ul>	<b>This has involved:</b> <ul style="list-style-type: none"> <li>• 19 of our key stakeholders</li> </ul>
<b>Published communications, including:</b> <ul style="list-style-type: none"> <li>• Bi-Monthly bulletins</li> <li>• Website</li> <li>• Thought pieces</li> <li>• Podcast</li> </ul>	<b>To date we have published:</b> <ul style="list-style-type: none"> <li>• 8 bulletins</li> <li>• 4 stakeholder reports</li> <li>• 3 thought pieces</li> <li>• 1 podcast</li> </ul>	<b>These have reached:</b> <ul style="list-style-type: none"> <li>• Average of 900 individuals through our bulletins</li> <li>• 213 plays of the podcast</li> </ul>

Figure 20 - Summary of our RIIO-2 business plan stakeholder engagement

While specific stakeholder engagement will vary between activities and investments, there are four primary channels of stakeholder engagement (see Figure 21 below).

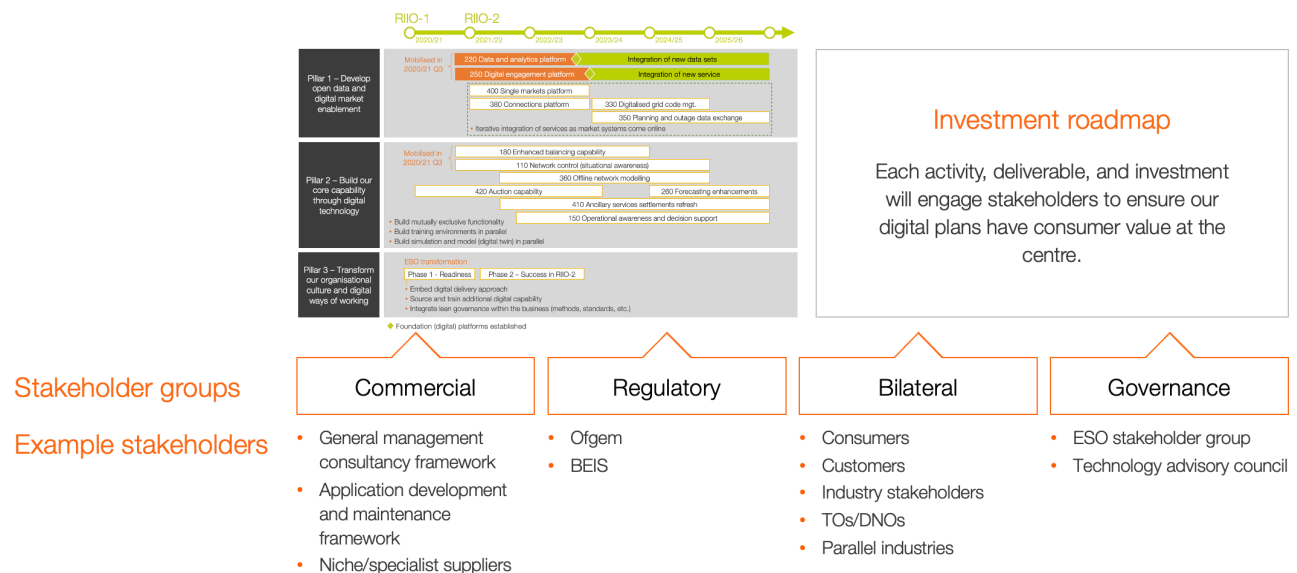


Figure 21 - Stakeholder engagement overview

**Commercial**

We will engage in commercial agreements with framework and niche suppliers to support in the design, delivery, and testing of individual investments. The specific suppliers will be identified through a competitive commercial agreement at the point of need.

**Regulatory**

We will have ongoing dialogue with Ofgem to ensure our roles, activities, deliverables, and IT investment remain aligned with consumer value. We have a number of formal and informal channels established that will continue to operate through the RIIO-2 period.

**Bilateral engagement**

We will continue to engage with stakeholders within industry and also outside our sector. We found it valuable to draw insight from parallel examples in other sectors that are further advanced in digital practices than we typically see in the energy and utilities sector. Specifically, industries with data and analytics experience as well as iterative delivery models.

Iterative development techniques allow us to release features and test them with customers and stakeholders. We can then respond quickly and integrate feedback into our release cycle as part of the development process.

**Governance**

We also value more formal governance that will challenge our assumptions. As we drafted the RIIO-2 business plan, the electricity RIIO-2 stakeholder group (ERSG) provided insight, wisdom, and challenge. We plan to continue to engage through the delivery process.

We are exploring opportunities to continue the ERSG as an ESO stakeholder group throughout RIIO-2.

Additionally, we are establishing a technology advisory council (see our December 2020 digitalisation strategy). This forum is open to external stakeholders, who we will work with to develop our technology strategy, approach, and delivery methodologies.

## 7. Risks

Given the integrated nature of our digitalisation action plan and our business plan, many of the risks identified apply to this context. Our primary risks are captured in Annex 2 – CBA report<sup>1</sup> and in our individual technology investments included within Appendix B – Technology investments.

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<sup>1</sup> Our December 2019 business plan, Annex 2 – CBA report is published here - <https://www.nationalgrideso.com/document/158061/download>



## 8. Appendix A – Energy data taskforce (EDTF) findings

The taskforce produced five recommendations – two principles that the energy sector is encouraged to adopt, and three building blocks that the sector should collaborate on to create the foundation for a modern, digitalised energy system.

- 1. Digitalisation of the energy system (Principle)  
The energy sector should adopt the principle of ‘Digitalisation of the Energy System’ in the consumers’ interest in line with supporting principles of New data needs, Continuous improvement and Digitalisation strategies.
- 2. Maximising the value of data (Principle)  
The energy sector should adopt the principle of ‘presumed open’ supported by requirements that data is discoverable, searchable and understandable with common structures, interfaces and standards.
- 3. Visibility of data (Building block)  
A Data Catalogue should be established to provide visibility through standardised metadata of the energy system datasets across Government, the regulator and industry.
- 4. Coordination of asset registration (Building block)  
An Asset Registration Strategy should be established to coordinate registration of energy assets, simplifying the experience for consumers through a user-friendly interface to increase registration compliance, improve the reliability of data and improve the efficiency of data collection.
- 5. Visibility of infrastructure and assets (Building block)  
A unified Digital System Map of the energy system should be established to increase visibility of the infrastructure and assets, enable optimisation of investment and inform the creation of new markets.

## 9. Appendix B – Technology investments

In this appendix, we provide detail for the relevant IT investments. Iterations of these investments have been shared with Ofgem in the business plan, supplementary questions (SQs), and our consultation response to Ofgem's draft determinations. Table 1 below shows where the content has been drawn from. They are included here for ease of reference and are not intended to supersede our December 2019 business plan.

We are working with Ofgem to define a six-monthly process to review and baseline the technology change portfolio.

Table 1 - Source of IT investment overview

ID	Investment	Reference
110	Network control	Consultation response for IT investments - part 3 20200925
150	Operational awareness and decision support	Dec. 2019 business plan, Annex 4 – Technology investment report
180	Enhanced balancing capability	Consultation response for IT investments - part 3 20200925
220	Data and analytics platform	Consultation response for IT investments - part 2 20200918
250	Digital engagement platform	Dec. 2019 business plan, Annex 4 – Technology investment report
260	Forecasting enhancements	RIO-2 business plan, Annex 4 – Technology investment report supplement 7 February 2020
330	Digitalised code management	Dec. 2019 business plan, Annex 4 – Technology investment report
350	Planning and outage data exchange	Dec. 2019 business plan, Annex 4 – Technology investment report
360	Offline network modelling	Dec. 2019 business plan, Annex 4 – Technology investment report
380	Connections platform	Consultation response for IT investments - part 3 20200925
400	Single markets platform	Consultation response for IT investments - part 3 20200925
410	Ancillary services settlements refresh	Dec. 2019 business plan, Annex 4 – Technology investment report
420	Auction capability	Consultation response for IT investments - part 1 20200911

## 9.1. 110 Network control

Ofgem/Atkins assessment	RAG/£m	Supplementary information
Justification for project	G	<ul style="list-style-type: none"> <li>n/a</li> </ul>
Project definition incl. timing, scale, & dependencies	A	<ul style="list-style-type: none"> <li>Additional roadmap detail provided for programme plan.</li> <li>Further information provided on future state, timings, and scope.</li> <li>Further information provided on approach to life extension, strategy work, and work breakdown structure.</li> <li>High level dependencies table added.</li> </ul>
Definition of required resources	R	<ul style="list-style-type: none"> <li>Parametric cost model table added.</li> <li>Resource type table added.</li> <li>Explanation of RTB increase added.</li> </ul>
Cost confidence	A	<ul style="list-style-type: none"> <li>n/a</li> </ul>
Requested capex Requested opex	£8.1m £0.9m	<ul style="list-style-type: none"> <li>No change.</li> </ul>
Ofgem view of capex	n/a	<ul style="list-style-type: none"> <li>Not included in ex-ante steer.</li> </ul>

### Investment stage

Scoping	Start up	Requirements and design	Development and testing	Implementation
---------	----------	-------------------------	-------------------------	----------------

	RIIO-2 December 2019 Business Plan stage
	Consultation response stage (or if the same stage)

### 9.1.1 Overview

This investment will introduce new real-time situational awareness capability giving control centre operators a better understanding of changing network limitations, leading to a more efficient risk-based operation of the system. This capability will need new alarm management, modelling and visualisation tools. We will also deliver training simulation tools combined with artificial intelligence and digital twin technology relevant to this investment.

### 9.1.2 Current state

Our integrated electricity management system (iEMS) provides our core network transmission control capabilities. This allows real-time operation and monitoring of the transmission system and is categorised as critical national infrastructure (CNI). It is a shared system with National Grid Electricity Transmission (NGET) as it enables the safe remote operation of substation equipment, and real-time monitoring of the network, receiving data from the other GB transmission owners (TOs) to give a full picture of the GB network.

As part of NGET / ESO legal separation, the dedicated iEMS hardware and software were updated in RIIO-1 and its data were also isolated so that both NGET and ESO can only see the data relevant to their role, as per regulation. An asset health upgrade/refresh will be required in RIIO-2, currently planned for 2023.

### 9.1.3 Case for change

As part of our RIIO-2 business plan submission, and given our legal separation obligations, we decided to review our network control capabilities in combination with NGET.

On the back of that review and considering our RIIO-2 ambitions we realised that we require capabilities to address its situational awareness needs. After assessing the capabilities of current supervisory control and data acquisition (SCADA) solution, we concluded that it does not address our needs or supports our business and stakeholder ambitions, such as data analysis and provision. We require a new tool to meet our license conditions that may interface with the iEMS tool which NGET has signalled it requires to run their business.

We no longer receive directly some network data and signals and will need different tools to continue to perform the role efficiently. These will deliver much more visualisation capabilities alongside a subset of network alarms.

#### By end of RIIO-1, I will manage ...

- BMUs connected at transmission level
- BMUs referenced to a single GSP point
- View of network at transmission level only
- Different interfaces for data for each TO
- Platform refresh times of 7 years



#### By end of RIIO-1, I will operate with ...

- Data received by direct telemetry of asset
- Integrated SCADA+analytics tools
- Different online & offline models, with dedicated analysis tools

#### IT Investment in ...

- Real-time situational awareness tools (alarm management, modelling)
- User experience and visualisation tools
- Data links to TOs and DNO/DSOs

will enable me in RIIO-2 to manage ...

will enable me in RIIO-2 to operate with ...



Figure 22 – Use case, investment and outcome expectation

### 9.1.4 Roadmap

During the remainder of RIIO-1, we will be working with NGET to validate:

- What current capabilities can or should be shared.
- What new capabilities we require.
- Extended support of current system after 2023.
- Total cost of ownership.
- High-level ESO and NGET programme plans.

The outcomes will inform our strategic project as we start RIIO-2.

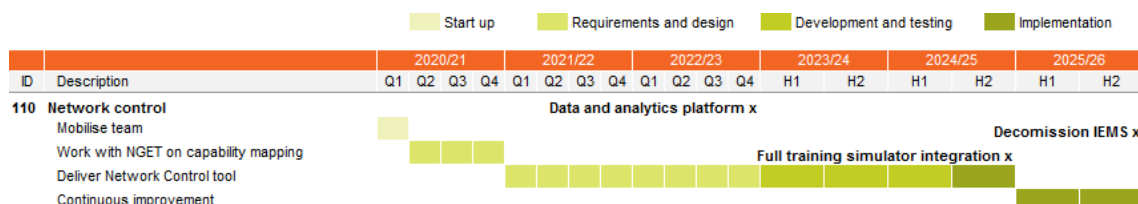


Figure 23 – Delivery plan



The new capabilities will integrate with IT investment 220 Data and analytics platform, ensuring a single network model for control centre operators.

## Draft determinations update

We envisage that the future situational awareness capability will comprise a core system, supplemented by modules providing enhanced situational awareness and modelling tools.

- Data exchange capability with the transmission operators (TOs).
- Integration with the data and analytics platform for data storage.
- State estimator.
- Basic alarm management.
- Display capability.



- Contingency analysis.

We plan to deliver the foundational core system in a non-operational state alongside the existing iEMS by the end of 2022/23. The core system will run initially in a non-operational sandbox environment alongside the existing iEMS. This will provide a basis for the testing of modules and the tuning of models. The plan for transition from the iEMS will be determined as part of the strategy work and agreed with NGET.

There are strong synergies between this investment and IT investment 150 Operational awareness and decision support, and we will deliver these as a combined programme with combined reporting. This will enable us to deliver functionality either on the core system or via the modules in an agile fashion as required.

The modules will provide the advanced situational awareness capabilities. Examples of these are listed below. The strategy work will develop this list further, and we expect this to evolve throughout RIIO-2:

- Visibility of current system conditions and predicted future conditions. As network conditions become more volatile, a 'lookahead capability' is vital. We plan to carry out proof of concepts of these in parallel with developing the core system, followed by full rollout in 2023/24 onwards.
- We also plan to implement a voltage stability analysis capability and improved fault level analysis capabilities in parallel with developing the core system. These will continue to be enhanced from 2023/24 onwards.
- Deeper analysis of the network – for example:
  - Using additional data sources (e.g. Phasor Measurement Units) to enable better running of the network.
  - Heatmaps of network issues.
  - More intuitive display of alarms to speed up root cause analysis.
  - Enhanced analytics.

We will deliver the modules in an iterative fashion from 2023/24 onwards. The advantage of the modular approach is that as new challenges arise on the transmission system, or as new analysis techniques mature, modules can be added, enhanced or replaced as necessary, without the need to modify the core.

### 9.1.6 Approach

We will develop new situational awareness applications for operators. These will capture, store, analyse, and present data from multiple new sources and forms in real-time.

These applications are supported by IT investment 220 Data and analytics platform and they will be developed to meet the RIIO-2 ambition.

A wide range of application and data integration styles, which will be used to exchange situational data with DSOs, TOs, and other industry participants. These data transactions provide a model of the network in real-time and allow combinations of balancing actions to be assessed against the current network state.

Artificial intelligence methods will identify actual and likely operational incidents from the new operational datasets in RIIO-2. We will use other artificial intelligence methods to identify the correct remedial or protective actions.

In the medium term, these integration capabilities will be used to support the current iEMS system.

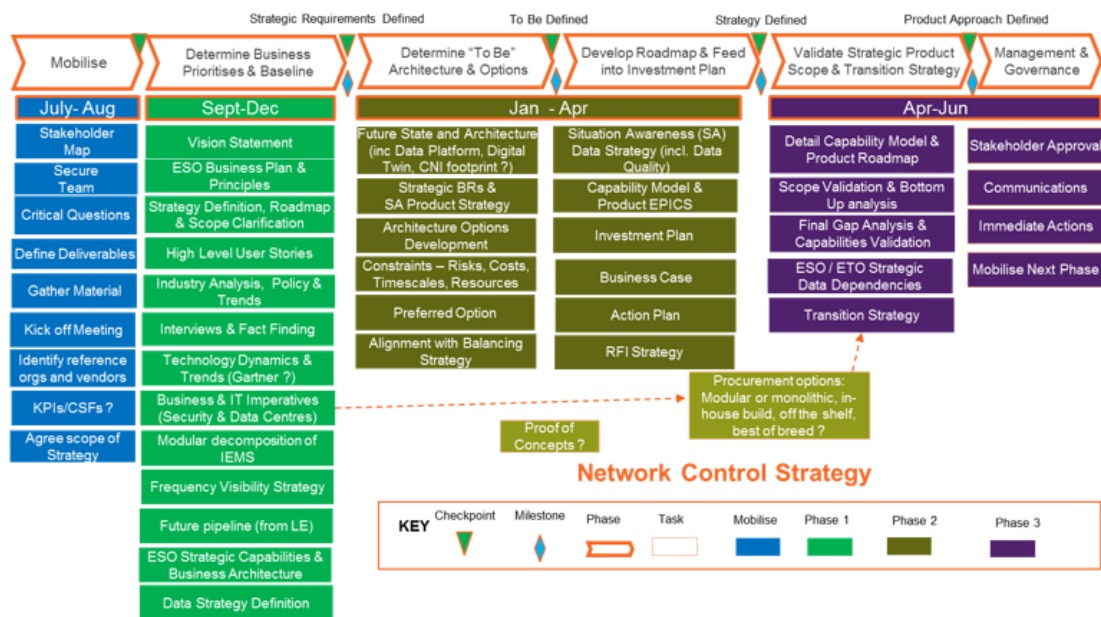
We expect to complete much of the development and integration work and scale through our partners as required.

The primarily cloud-based nature of IT investment 220 Data and analytics platform will align with the rest of the industry to allow the exchange of data via cloud storage.

### Draft determinations update

This investment is being progressed as two workstreams:

- iEMS life extension
  - The current iEMS will become end of life by 2023 when the option of GE vendor support ends. The life extension work-stream objective is to extend the support life to enable the operational efficacy and security of our CNI transmission system. It will need to cater for both NGET and ESO needs until the time when the strategic replacements for both are in place, currently planned for 2025/26.
  - The initial phase of this workstream is now in flight, and the objectives are:
    - Finalise the detailed asset health assessment, provide an agreed technical approach with stakeholders and the vendor to tackle complexity resulting from other CNI systems dependencies.
    - Complete an in-depth technical options analysis to ensure the life extension of the existing system for the next five years.
    - Explore asset risk mitigation options and agree the technical option plan with NGET.
    - Create a detail project plan to deliver the life extension work.
- Network Control Strategy:
  - Phase 1 of this workstream is also in flight, and is utilising the strategy development methodology set out below:



STRATEGY WILL EVOLVE THROUGHOUT THE PROGRAMME LIFECYCLE AND WILL BE ITERATIVE

Figure 25 - Strategy development methodology

## Architecture

The iEMS life extension work will focus on the refresh of technology that supports the iEMS domain.

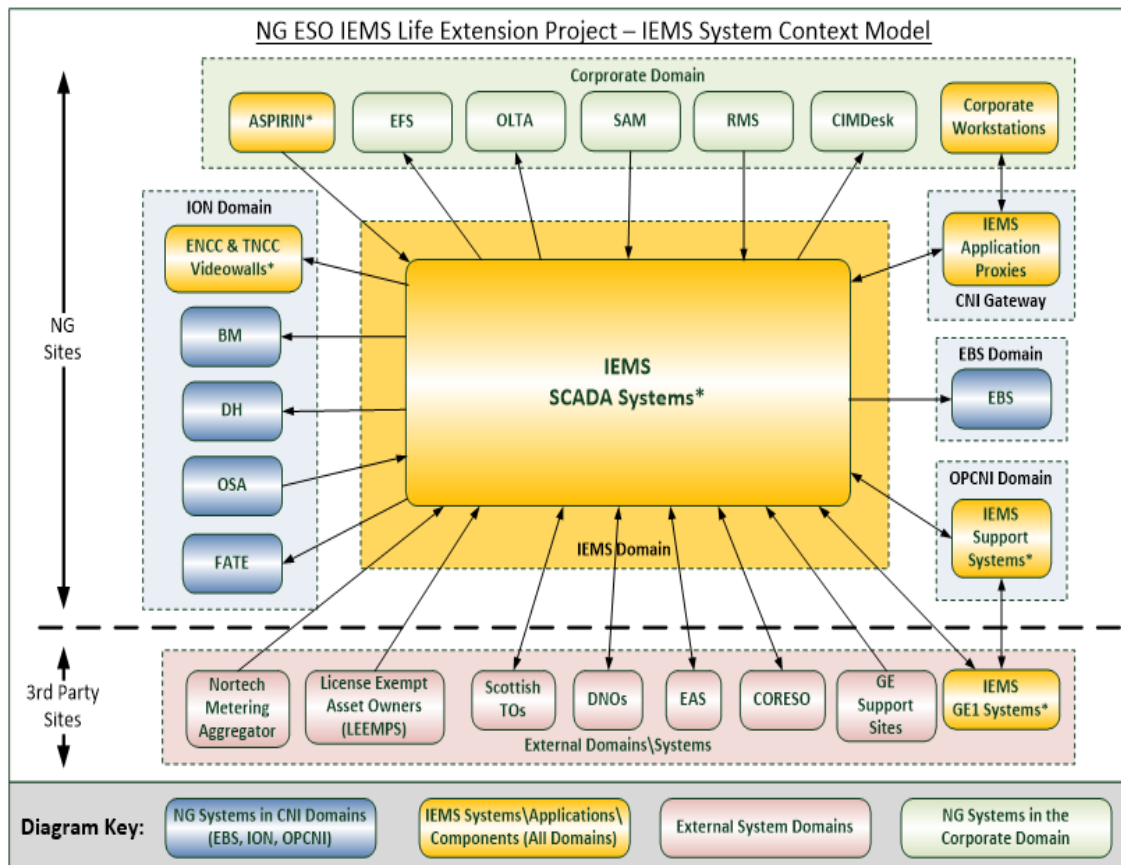


Figure 26 - iEMS system context model

The iEMS domain consists of multiple sub-systems, deployed across multiple data centres (to provide high availability/resilience) covering user experience/interface, field device communications (RTU), core application (Scada) functionality, compute and storage, local and wide area networks.

Work Breakdown Structure

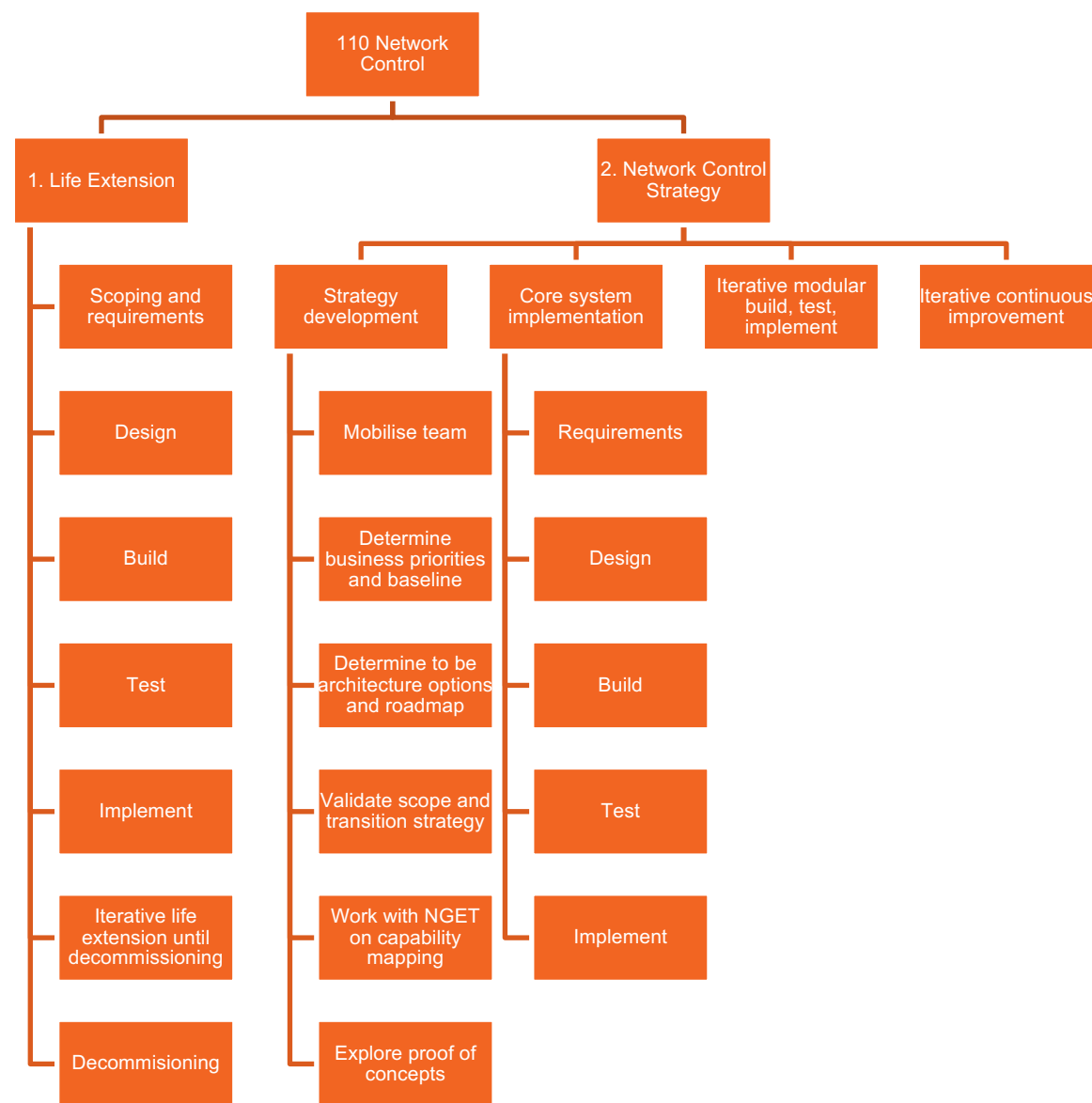


Figure 27 – work breakdown structure

Resource plan

The core delivery resource types are summarised in the table below. In addition, business consultant, PMO, security and enterprise architecture resources will be required as necessary.

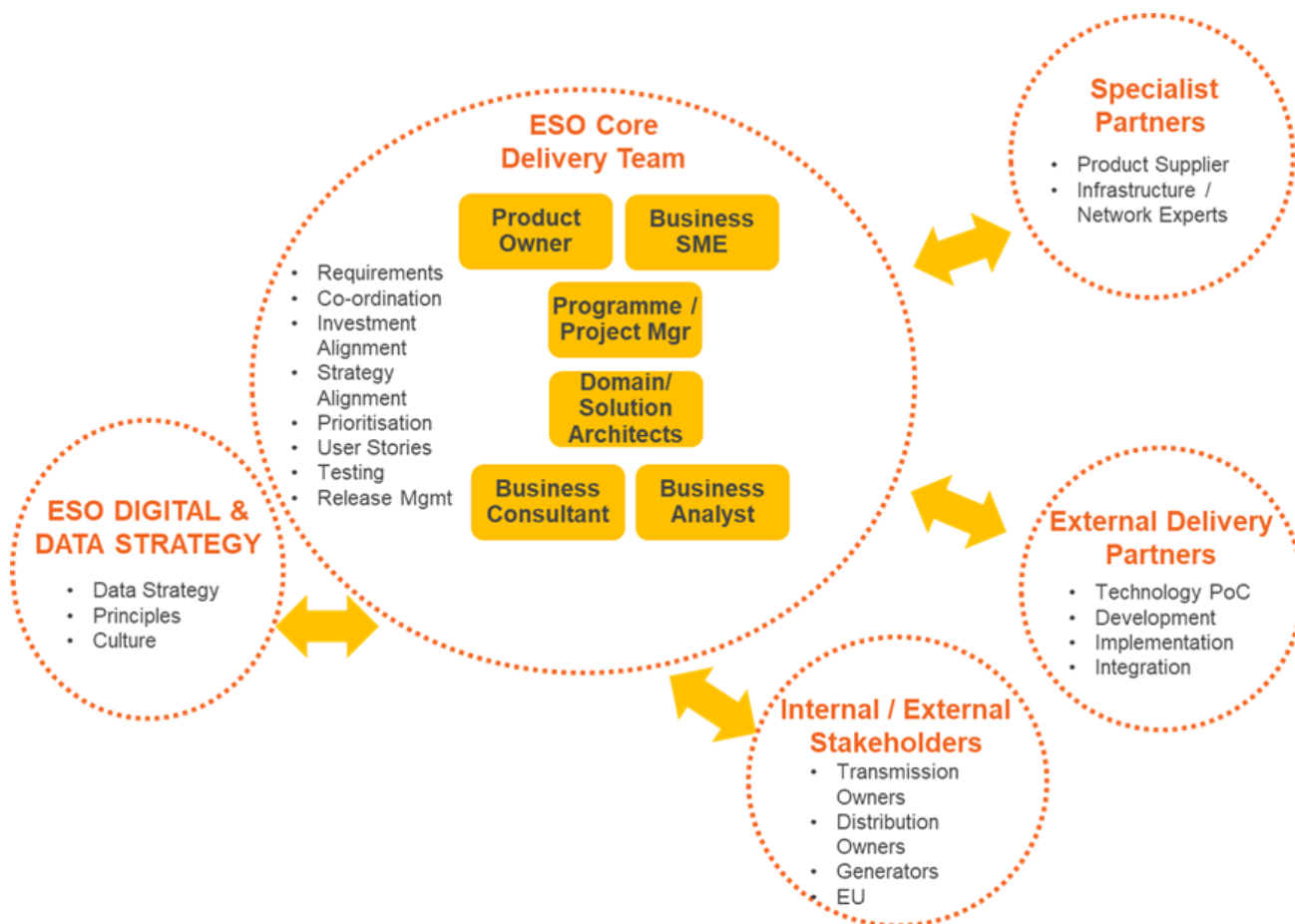


Figure 28 - Resource plan

Task	Resource type										
	Programme Manager	Product Mgr./ Owner	Project Manager	Business Analyst	Solution Architect	Business Subject Matter Experts	IT subject Matter Experts	Integration Partner	Tester	Service Transition	Procurement specialist
1 Life Extension											
1.1 Scoping and requirements	L	L	L	M	M	M	M			L	L
1.2 Design	L	L	M	L	H	L	M	M	L	L	M
1.3 Build	M	M	M	L	M	L	H	H	M	L	L
1.4 Test	M	M	M	L	L	M	M	H	H	L	L
1.5 Implement	M	M	M	L	M	M	M	H	M	M	L
1.6 Iterative life extension	L	L	L	L	L	L	M	M	L	L	L
1.7 Decommissioning	L	L	L	L	M	L	M	M	L	L	L
2 Network Control Strategy											



Task	Resource type										
	Programme Manager	Product Mgr./ Owner	Project Manager	Business Analyst	Solution Architect	Business Subject Matter Experts	IT subject Matter Experts	Integration Partner	Tester	Service Transition	Procurement specialist
2.1 Strategy Development	L	M	L	M	M	M	L	-	-	-	L
2.2 Core system requirements	M	H	M	H	H	H	M	L	L	L	M
2.3 Core system design	M	M	M	L	H	M	H	M	L	L	M
2.4 Core system build	M	M	H	L	H	M	H	H	M	L	L
2.5 Core system test	M	H	H	M	M	H	H	H	H	M	L
2.6 Core system implementation	M	H	H	L	H	H	H	H	M	H	L
2.7 Iterative modular build, test implement	H	H	H	H	H	H	H	H	H	H	M
2.8 Iterative continuous improvement	M	M	M	M	M	M	M	M	M	M	L

Low, medium, and high define the expected volume of resource relative to others for this activity.

	Highly specialised or difficult to source resources. Would require new frameworks or mitigation plans.
	Channels available but resources are hard to source, channels not currently available or market-wide constraints
	Established resource available or channels available to recruit,

### 9.1.7 Dependencies

#### Draft determinations update

The key investments that are interdependent with this investment are listed in the orange box below. These will form an overarching programme that will ensure that these dependencies are managed effectively.

The grey area depicts other investments that may interact with this one. These will be managed as external dependencies to the programme.

Included below is a view of investments which have interactions with Network control. In practice, many of these will run in parallel rather than consecutively as the chart could imply. It is intended to show the interconnected nature of the investments rather than a time bound roadmap.

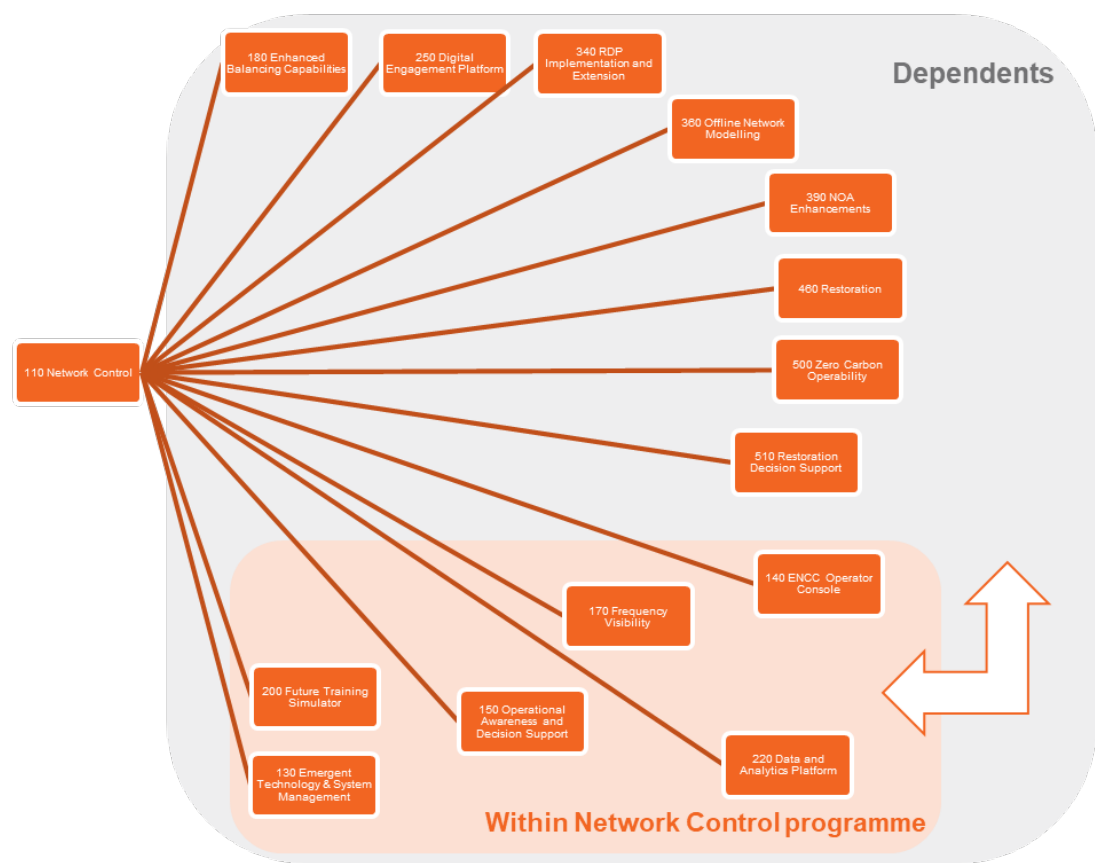


Figure 29 - Investment dependencies

9.1.8 Costs

Investment (£m)	2021/22	2022/23	2023/24	2024/25	2025/26	Total
Capex	2.9	5.2	6.5	7.9	4.5	27.0
Opex	0.3	0.6	0.7	0.9	0.5	3.0
Total	3.3	5.8	7.3	8.8	5.0	30.0
Cumulative RTB* increase	0.0	0.1	0.2	0.4	0.6	1.3

\*RTB - run-the-business on-going opex



Figure 30 - investment costs

Our costs for this investment present themselves within Gartner’s range. The reason for these being closer to the higher estimate is related to the need to expand our situational awareness capabilities beyond the average type of tools developed historically (which form the basis for Gartner’s benchmark). This need is justified given we are an island system with increasing levels of complexity and coordination.

Draft determinations update

A further breakdown of the costs based on our parametric model is shown below.

110 Network control		TI risk						
		TotEx £m GBP						
		FY21	FY22	FY23	FY24	FY25	FY26	Total
Network Control Strategy			1.3	3.8	6.3	8.8	5.0	25.0
iEMS life extension			2.0	2.0	1.0	-	-	5.0
Subtotal	30	-	3.3	5.8	7.3	8.8	5.0	30.0
Resource (Scoping, training)	10%	1.0	0.3	0.6	0.7	0.9	0.5	3.0
Resource (Dev., testing)	15%	-	0.5	0.9	1.1	1.3	0.8	4.5
Software	20%	-	0.7	1.2	1.5	1.8	1.0	6.0
Hardware	10%	-	0.3	0.6	0.7	0.9	0.5	3.0
Consulting	0%	-	-	-	-	-	-	-
Supplier	35%	-	1.1	2.0	2.5	3.1	1.8	10.5
Cyber	10%	-	0.3	0.6	0.7	0.9	0.5	3.0
Contingency	0%	-	-	-	-	-	-	-
Total	30	1.0	3.3	5.8	7.3	8.8	5.0	30.0

Figure 31 - parametric cost model

The core delivery resource types are summarized in the table above. In addition, Business Consultant, PMO, security and enterprise architecture resources will be required as necessary.

Ongoing or run-the-business (RTB) cost is expected to increase due to:

- Increased costs arising from the need to put in place extended support for iEMS.
- RTB costs of running the new situational awareness capability in parallel with the iEMS until decommissioning.

### 9.1.9 Risks

Risks specific to this investment are listed below. Generic portfolio level risks and a description of the scoring method for likelihood and impact can be found in our December 2019 Business Plan, Annex 4 - Technology investment report, Appendix C.

Risk	Mitigation(s)	Likelihood	Impact
Extension of legacy tool not possible, leading to unexpected levels of work or does not enable new tool implementation date.	Engage early on with tool suppliers and support teams to agree life extension plans. Reprioritise plan to decrease impacts. Engage with NGET to understand other available options.	3	3
NGET tool delivery gets delayed, meaning we will need to continue supporting the legacy tool for longer than intended.	Have close planning coordination with NGET through full project lifecycle. Agree to prioritise delivery of functionality that enables replacement of legacy tool as minimum viable product.	2	1

### 9.1.10 Options

Option(s)	Pros	Cons
Not invest in this area		<p>Leaves operational critical tools without support and underperforming.</p> <p>Increases inefficiencies in our processes and operational actions.</p> <p>Increases spend on other RIIO-2 investment lines.</p> <p>Leaves NGET with no support to invest in their tools.</p> <p>Increases cyber security risk.</p> <p>Puts at risk 2025 ambition to be able to operate a carbon free electricity system.</p> <p>Puts complying with regulatory changes at risk.</p>
Invest in legacy tools		<p>Does not enable economic data sharing.</p> <p>Requires refresh of current tools.</p> <p>Increases RTB risk.</p> <p>Adds risk of not being able to retain or attract legacy skill resourcing/SME.</p> <p>Does not support investment scalability and flexibility.</p> <p>Restricts alignment to industry changes.</p> <p>Increases delivery risk of making changes on time and efficiently.</p>
Deliver the new capabilities by 2023 aligned with NGET	<p>Faster delivery of this investment's benefits.</p> <p>Simpler data transfer between tools.</p>	<p>High delivery risk given previous similar projects have taken around five years to deliver.</p> <p>Puts other prioritised consumer value areas at risk in first years of RIIO-2 plan.</p>
Deliver the new capabilities by 2025 with NGET delivering in 2023	<p>Faster delivery of NGET benefits.</p>	<p>Double expenditure as a full refresh of the legacy tool will still be required plus supporting data transition between systems.</p> <p>Adds RTB increase until 2025.</p>
Deliver the new capabilities by 2025 aligned with NGET	<p>Meets our needs and NGET ambitions.</p> <p>Simpler data transfer between tools.</p> <p>Aligns milestones in delivery projects.</p> <p>Keeps prioritised customer value areas on their current plan.</p>	<p>Full benefits from this investment line are achieved towards end of RIIO-2 period.</p>

## 9.2. 150 Operational awareness and decision support

### Current stage:

Scoping	Start up	Requirements and design	Development and testing	Implementation
---------	----------	-------------------------	-------------------------	----------------

### 9.2.1 Overview

This investment will enhance our network modelling capabilities by giving online analysis of voltage and power flow profiles closer to real-time. This will ensure the network is run securely and data exchanges with TOs and DNO / DSOs are timely and correctly assessed.

### 9.2.2 Current state

Our online and offline network analysis tools were designed to assess the transmission system at a time when its complexity and conditions were stable. They can only study network conditions for specific time periods, a few times a day or for day-ahead purposes and based on offline models. They were developed as standalone tools, as the need for data sharing was not a priority.

### 9.2.3 Case for change

With the increasing complexity of the transmission network and the need to consider at least part of DNO / DSO networks, we need new tools as well as upgrading existing ones to enable effective decision-making (e.g., machine learning). This investment is also required to support whole system simulation and modelling, both online or offline.

As the generation mix moves towards more variable sources (e.g., wind and solar), the current business processes (based on estimates from historical data) will become unreliable and introduce higher system security risk.

Greater volatility closer to gate closure means we need to run at least high-level network assessments closer to real-time.

#### By end of RIIO-1, I will manage ...

- Offline models to look ahead at future transmission network
- Cardinal point analysis of system (only 5-6 studies per day)
- With online network model analysis output that isn't predictive as part of a wider suite



#### By end of RIIO-1, I will operate with ...

- Different online and offline models, with dedicated analysis tools
- Hard to modify online analysis tools that run 10 minutes in the past
- Multiple models on multiple platforms that need manual scenario configuration and output interpretation

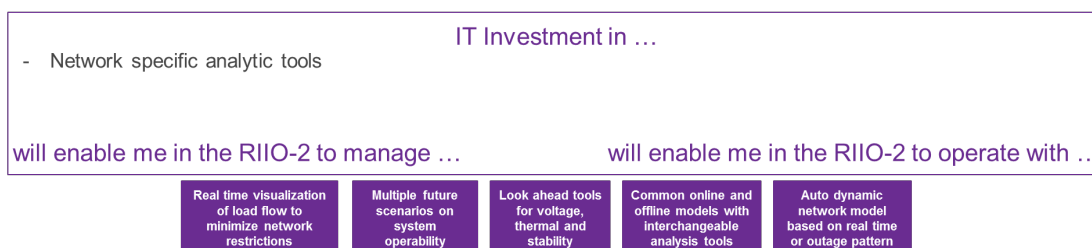


Figure 32 - Use case, investment and outcome expectation

### 9.2.4 Roadmap

This investment includes implementation of:

- an additional state estimator that operates closer to real-time to provide a high-level analysis of the network
- closer to real-time look ahead power flow capability that builds on the current Day Ahead Congestion Forecast (DACF)
- improved voltage stability assessment as the current tool only provides a restricted view of where we are on a voltage stability curve



- voltage flight path capability which provides real-time Mega Volt Amps reactive (MVAR) dispatch advice.
- All these tools will be prioritised and delivered throughout the RIIO-2 period based on industry and operational priorities.

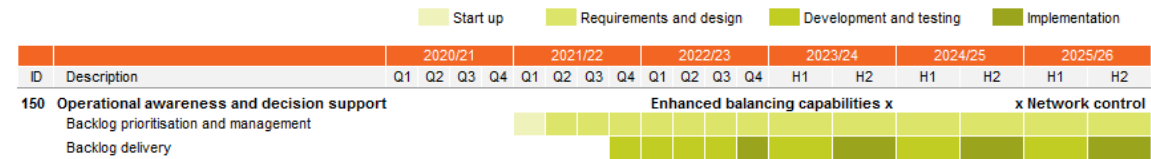


Figure 33 – Delivery plan

### 9.2.5 Future state

Enhanced look ahead capability will be required to predict transmission problems in a more volatile operating environment.

Apart from new tools or enhancements to current tools, we will need greater alignment between real-time online and offline tools to allow for a more efficient control centre operation. These tools will be integrated via the IT investment 220 Data and analytics platform (arrows reflect data flows):

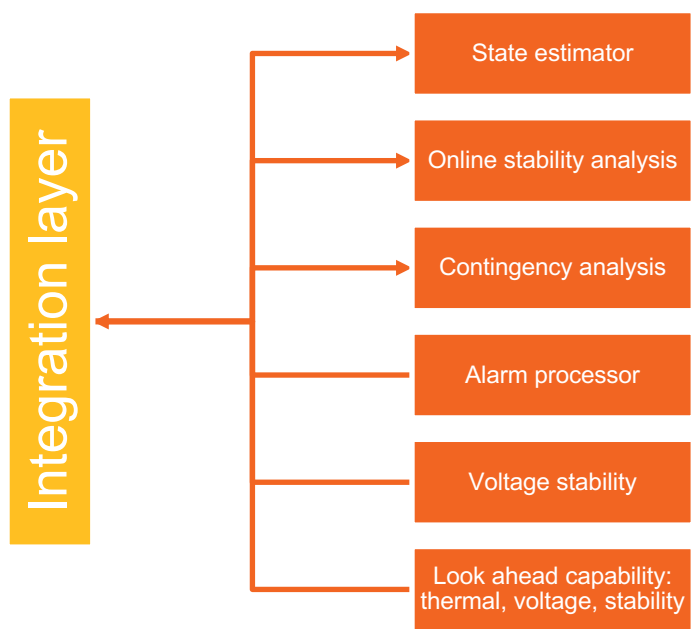


Figure 34 – Data flow integrations

### 9.2.6 Approach

We will take a similar approach to IT investment 110 Network control.

We will develop operational modelling and scenarios analysis tools. These will capture, store, analyse, and present data from multiple new sources in real time.

These rely heavily on IT investment 220 Data and analytics platform which will be the foundation to meet the needs of the RIIO-2 programme. The artificial intelligence and machine learning methods it enables will then be used to recommend or automatically execute actions.

### 9.2.7 Costs

Investment (£m)	2021/22	2022/23	2023/24	2024/25	2025/26	Total
Capex	0.4	1.7	3.4	3.8	1.7	11.1
Opex	0.0	0.2	0.4	0.4	0.2	1.2
<b>Total</b>	<b>0.5</b>	<b>1.9</b>	<b>3.8</b>	<b>4.3</b>	<b>1.9</b>	<b>12.3</b>
Cumulative RTB* increase	0.0	0.0	0.1	0.2	0.3	0.5

#### Gartner benchmark range

Low	15.0
High	20.0

\*RTB - run-the-business on-going opex

Figure 35 - investment costs

We expect investment synergies with IT investments 220 Data and analytics platform and 110 Network control to keep the costs associated with this investment line below Gartner's benchmark.

### 9.2.8 Risks

Risks specific to this investment are listed below. Generic portfolio level risks and a description of the scoring method for likelihood and impact can be found in Appendix C.

Risk	Mitigation(s)	Likelihood	Impact
It may prove difficult to achieve a common dataset for all modelling requirements or have the right data quality accessible to achieve new tools full potential. This may increase cost due to more complex implementation.	<ul style="list-style-type: none"> <li>Understand data needs early in project.</li> <li>Work with stakeholders, including the Government's Data Task Force and DSOs, to ensure the ESO has access to relevant data.</li> <li>Engage with other European system operators to ensure consistent operating regimes and reliability standards implementation across Europe as well as availability of consistent data sources or modelling.</li> <li>Data strategies to be considered in RIIO-1 to ensure we understand the necessary data requirements (quality criteria) to enable an effective transition into RIIO-2.</li> <li>Have data stewards and a data centric culture supported by data management tools in data and analytics platform.</li> <li>Engage closely with the business and monitor development of the whole system approach.</li> <li>Utilise the design authority to drive industry consensus.</li> </ul>	2	1

Risk	Mitigation(s)	Likelihood	Impact
System/market conditions change too quickly to be accommodated, rendering tools ineffective.	<ul style="list-style-type: none"> <li>Investigate dependencies in start-up phase of project.</li> <li>Ensure IT tools are configurable and adaptable.</li> </ul>	3	1

### 9.2.9 Options

Option(s)	Pros	Cons
Not invest in this area	<ul style="list-style-type: none"> <li></li> </ul>	<ul style="list-style-type: none"> <li>Increases operational risk.</li> <li>Increases cyber security risk.</li> <li>Puts at risk 2025 ambition to be able to operate a carbon free electricity system.</li> <li>Increases inefficient decision-making and associated operational costs.</li> <li>Does not enable transparency of operational actions.</li> </ul>
Invest in legacy tools	<ul style="list-style-type: none"> <li></li> </ul>	<ul style="list-style-type: none"> <li>Does not enable investment scalability.</li> <li>Puts at risk 2025 ambition to be able to operate a carbon free electricity system.</li> <li>Increases the risk that current tools aren't fit for purpose in a changing energy landscape.</li> <li>Does not support transparency of operational actions.</li> </ul>
Update tools and integrate with data platform, network control and enhanced balancing capability	<ul style="list-style-type: none"> <li>Supports 2025 ambition to be able to operate a carbon free electricity system.</li> <li>Ensures tools remain fit for purpose in line with industry changes.</li> <li>Enables investment scalability.</li> <li>Enables introduction of efficient processes.</li> <li>Improves operational decision-making.</li> </ul>	<ul style="list-style-type: none"> <li></li> </ul>

### 9.3. 180 Enhanced balancing capability

Ofgem/Atkins assessment	RAG/£m	Supplementary information
Justification for project	G	<ul style="list-style-type: none"> <li>n/a.</li> </ul>
Project definition incl. timing, scale, & dependencies	A	<ul style="list-style-type: none"> <li>Additional roadmap detail provided for programme plan.</li> <li>Further information provided on future state, timings, and scope.</li> <li>High level dependencies table added.</li> </ul>
Definition of required resources	A	<ul style="list-style-type: none"> <li>Resource type table added.</li> </ul>
Cost confidence	A	<ul style="list-style-type: none"> <li>n/a.</li> </ul>
Requested capex Requested opex	£18.2m £2.0m	<ul style="list-style-type: none"> <li>No change.</li> </ul>
Ofgem view of capex	£13.7m	

#### Investment stage

Scoping	Start up	Requirements and design	Development and testing	Implementation
---------	----------	-------------------------	-------------------------	----------------

	RIIO-2 December 2019 Business Plan stage
	Consultation response stage (or if same stage)

#### 9.3.1 Overview

Our core balancing systems enable the real-time balancing of electricity supply and demand and are classed as critical national infrastructure (CNI). A major failure of these systems would result in widespread loss of supply, which would lead to economic and societal damage to the UK and put our licence at risk. It is essential that we invest in our core balancing systems to manage the rapidly evolving electricity market. We will also deliver training simulation tools combined with artificial intelligence and digital twin technology relevant to this investment.

#### 9.3.2 Current state

The core balancing capability is currently provided by a hybrid solution of the electricity balancing system (EBS) for scheduling, a balancing mechanism (BM) for dispatch of balancing mechanism units (BMUs) and ASDP for ancillary services dispatch of non-BMUs. This is supplemented by the contingency logging system (CLOGS) which provides a rudimentary business continuity capability during planned or unplanned outages of the core systems. Most of these systems were designed against a traditional landscape of large transmission connected generation.

Currently we make around 200 instructions every hour. We expect this to double over the next few years due to wider access delivered through project TERRE, discussed in Themes 1 and 2. Having to handle this volume of instructions means the new balancing capability will need to be more flexible and more agile than today.

By the end of RIIO-1 we expect the main balancing system landscape to look like this.

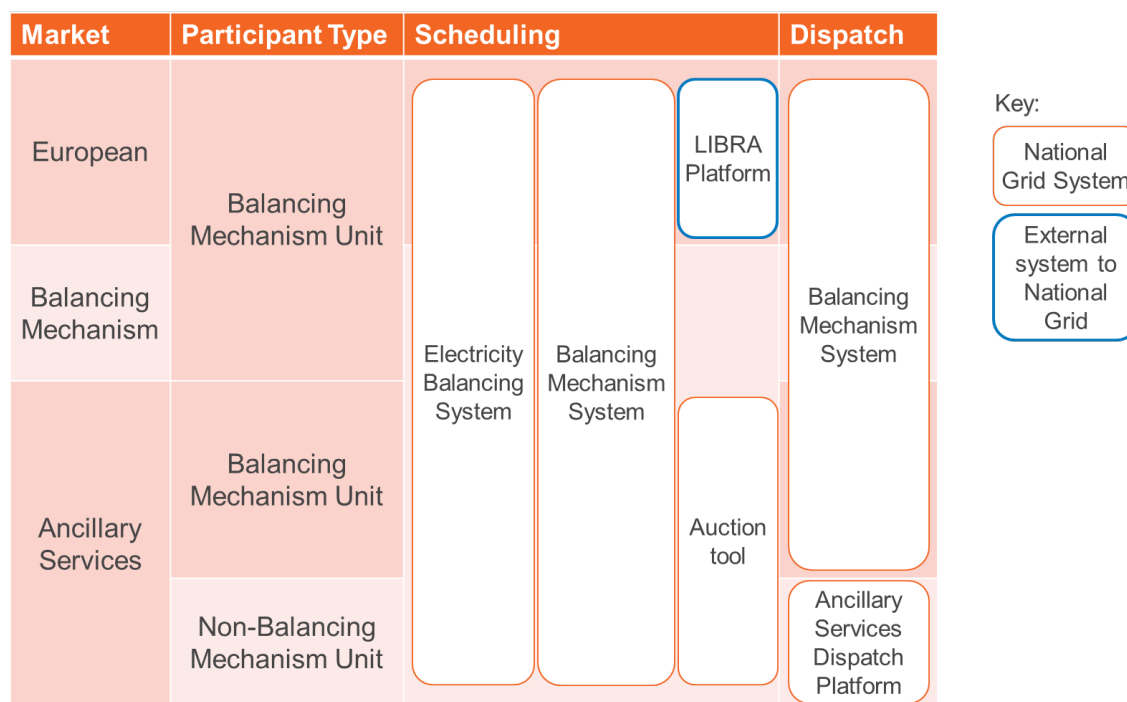


Figure 36 – Anticipated balancing system landscape

#### Draft determinations update

The anticipated balancing systems landscape pictured above has the LIBRA platform on hold, this is due to ongoing discussions on Brexit and our EU IEM (Internal Energy Market) membership which can affect our participation on TERRE (Trans European Replacement Reserves Exchange).

In the meantime, we have successfully facilitated the entry of greater numbers of participants into the BM market. This was achieved through the introduction of virtual lead parties and through the creation of the wider access API (Application Programming Interface). By using modern interface layers, this investment paves the way towards building a modular solution that enables higher volume of market participants access, whilst limiting impact on our core systems.

#### 9.3.3 Case for change

By 2023, a level playing field for all market participants 1 MW and above will require a new way to plan and dispatch participants to maintain system security. The balancing system will be dealing with more data from more providers and managing more actions and market interactions.

The image below shows the high-level decision process to dispatch one market participant. There are currently around 2,000 BMUs. These will increase as the market decentralises, and an engineer needs to consider not just impacts on the transmission network but also on the distribution ones. Decision-making complexity is expected to increase exponentially, and will be made in much shorter timescales, demonstrating the need for artificial intelligence and machine learning to continue to balance the network safely and economically.



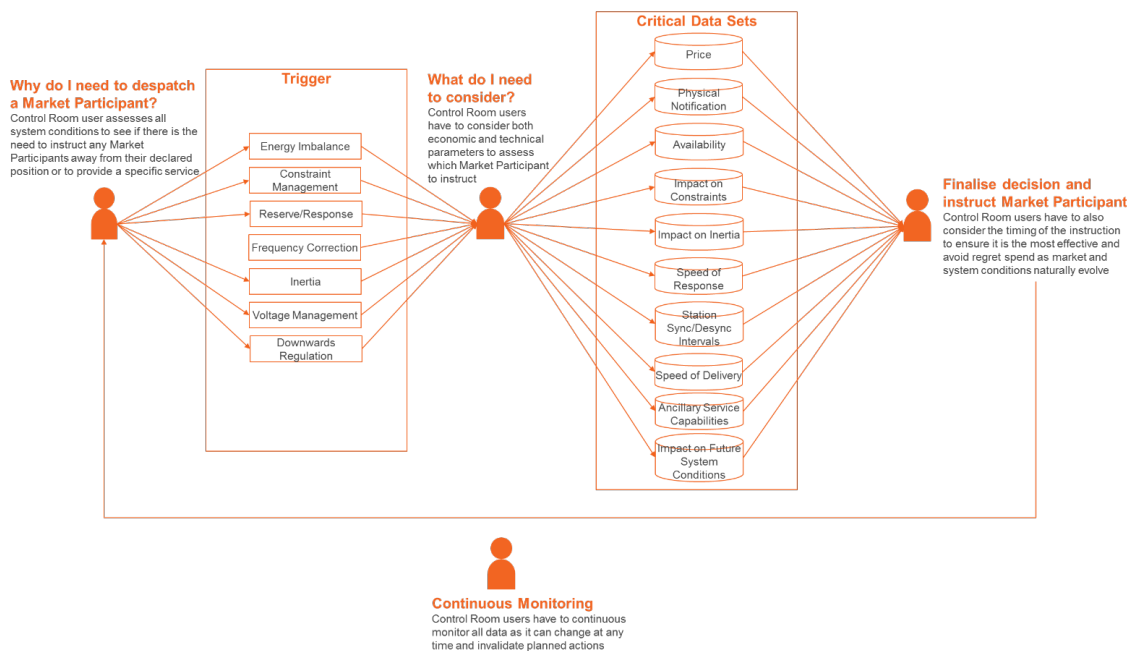


Figure 37 – High-level decision process for control centre engineers

The capabilities we invest in will have to allow control centre users to manage various RIIO-2 challenges as shown below.

**By end of RIIO-1, I will manage ...**

- BMUs connected at transmission level
- The network at transmission level only
- 4 number of ICs representing 4 GWs
- Specific critical interrelated subsets of data
- More volatile frequency deviations

**By end of RIIO-1, I will operate with ...**

- Operational data transmitted via secure dedicated EDU/EDT links
- Small to medium energy volumes from batteries
- Decreasing levels of inertia
- Years of experience with legacy systems and energy products (response, reserve, voltage) and processes (BOA creation, procurement of needs via tenders)
- Evolving Control Room roles and responsibilities
- Cardinal Points
- Environment where control engineer is the center of all decision making



**IT Investment in ...**

- Transforming our real-time situational awareness tools (alarm management, modelling, and training simulation tools)
- Enhancing online and offline network simulation and modelling tools
- Enhancing decision support tools (e.g. machine learning)
- Tools to enable bulk dispatch for all types of services
- New tools, processes and functionalities to manage outcomes and interactions of new auctions and markets
- Tools to manage Inertia as a service
- Modernising Control Room environment and supporting infrastructure

will enable me in RIIO-2 to manage ...

will enable me in RIIO-2 to operate with ...

A wider range of generation types and sizes (of 1MW and upwards) at individual and group level	BMUs referenced to various GSP points within a GSP group area (DNO area)	Exponential amounts of data with complex interactions	Operational data transmitted via secure but less expensive technologies	Increasing penetration from batteries and other technologies	New suite of AS and European Market products and processes
And coordinate with DNO/DSO networks and 15 number of ICs representing 17.9 GWs	BMUs connected at transmission and distribution level	Frequency deviations harder to predict	Wind and solar forecasts modelled as connected generation	Further lower levels of inertia	Work to as many analysis points as required
All Control Room activities with less manual intervention	Whole System demand forecast	A more complex system at lower cost	And dispatch economically agnostic of unit volume, technology, fuel source or location	Real time study tools that feed dispatch decisions	Dispatch units automatically
				Greater resilience to poor data	Clear and transparent actions based on economic and technical constraints

Figure 38 - Use case, investment and outcome expectation

### 9.3.4 Roadmap

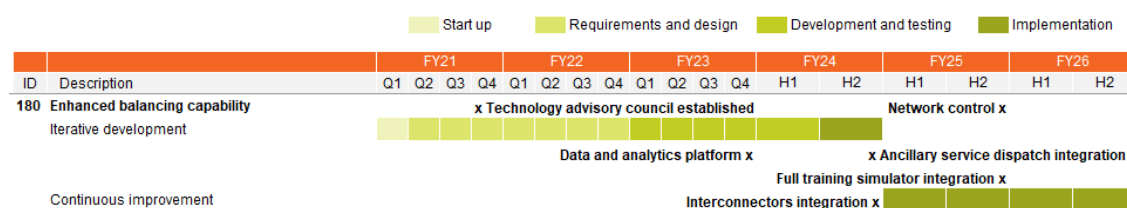


Figure 39 – Delivery plan

### 9.3.5 Future state

We will enhance our core balancing capability both in terms of systems and processes, in a modular fashion, during RIIO-2. We assume CLOGS functionality will become part of the core balancing capability and its use no longer needed given investment in dual resilience.

We will make better use of data by integrating these capabilities with IT investment 220 Data and analytics platform and apply machine learning and automated control to transform system balancing. This will underpin other IT investments, like 120 interconnectors and 130 Emergent technology and system management and allow us to add balancing simulation into future training simulators.

We will develop our core balancing systems and processes in a modular fashion to deliver dispatch and scheduling improvements. Our scheduling solution will be in line with the market gate closure<sup>2</sup>, flexible for any market change, including a new suite of ancillary services, and close to real time auction markets.

Our main specific electricity systems have bespoke components and are developed in house or with specialised partners. We do this, so we have not just reliable, but also flexible updates at market pace in a cost-effective way.

## Draft determinations update

This investment will also underpin investment 340 RDP implementation and expansion.

### 9.3.6 Approach

We will build new balancing market optimisers using a proven mathematical optimisation package.

These will be developed to run in a range of situations to satisfy the necessary live, simulated, test and analytical scenarios.

We will go to the market for the trialling, development and integration of the new optimisers. In parallel we will grow our in-house mathematical optimisation capability to manage the optimisers once the system is live.

The new optimisers will be exhaustively tested to ensure they perform well beyond the projected parameters before committing to their full development.

The new optimisers will sit in our service-oriented architecture (SOA) to give real time input and output.

In simulation, training, test, and analytical modes, the new optimisers will be driven by a discrete event simulation package to simulate real time inputs for the system combined with live data. This will be complemented by test data packs and extract transform load (ETL) processes (i.e. bulk data processes) to automate the capture and adjustment of live data.

## Draft determinations update

<sup>2</sup> The point where companies can no longer trade electricity for a designated 30-minute period (a settlement period). Gate closure is currently one hour before the start of the settlement period.

In 2020/21, we are undertaking foundational activities to develop future balancing capabilities and tools to set up for subsequent transformation as early in the RIIO-2 period as possible.



Figure 40 - definition phase

During the definition phase, we have defined the scope for the foundation areas that are needed to enable subsequent detailed specification phases for delivery of a future system.

Next, during the specification stage, we will create the artefacts that were agreed during the definition stage of the foundation phase. The key outcome of this phase is the development of roadmaps that will form the high level plans for building and implementing the future balancing platform. The roadmaps in scope are the business capability roadmap, the technology roadmap and a system features roadmap to support the delivery of the business capability.

This specification stage is being undertaken by our product delivery team, composed of our staff and all ADAM partners. The outputs will be delivered iteratively over a period of six months using agile ways of working. During this stage, emphasis will be placed on solidifying our product delivery core team that will commence the development transformation activities from 2021/2022. The outputs will be delivered iteratively with show and tell with appropriate stakeholders taking place every two weeks.

Key deliverables of this phase.

- Business capability roadmap for delivering the vision for 2025.
- Technology roadmap for supporting the build and operation of a balancing platform that enables the businesses capability roadmap.
- System functionality roadmap that will be the new balancing platform.
- Delivery lifecycle method for building the balancing platform.
- Governance model for support agile delivery.
- One balancing prioritised backlog and governance mechanisms.
- Demand planning process and tool for effectively managing the single balancing backlog.
- Balancing programme identification document and business case.
- Produce next phase investment paper (planned for March 2021)

Apart from the above, the programme of work will, between now and March 2021.

- Complete enhanced verification of the modern dispatch adviser as started in RIIO-1 through comparison to the existing optimiser, using comparable production input data.

- Establish engagement with University of Strathclyde and Industrial Systems Control and make some inroads into the designing of the Modern Dispatch Control and Modern Dispatch Instruct optimisers.
- In 2021/22 we will act on the knowledge gained from the work done this year, we will scale the team appropriately and start work on prioritised backlog items.

The prioritised backlog, will incorporate all items across the balancing product line, including maintenance activities, cyber updates, and investment driven change. As part of the backlog prioritisation we will actively drive decisions which are the most efficient for consumers and accelerate earlier delivery of transformation.

Our backlog includes examples such as multi-dispatch of distributed energy resources to a modern AI enabled applications. We will also enhance our optimisation algorithms which gives us the ability to operate with the higher levels of decentralised and renewable energy generation for the carbon free network of the future.

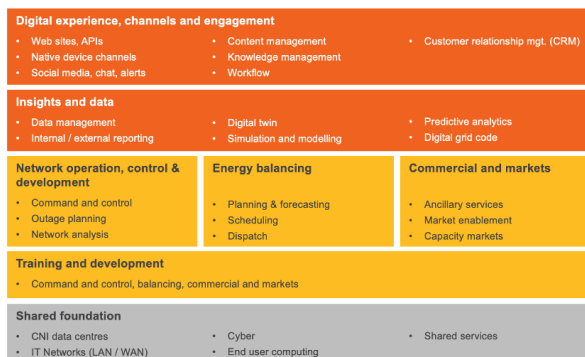
## Architecture

The end state architecture for enhanced balancing is an output of the start up activity and is still to be determined. The following images show the conceptual views we are developing that will enable the end state architecture to be defined.

Our design principle is to create future balancing services as a set of discrete modules that can be developed, enhanced and maintained independently to facilitate ease of change and accelerated feature / functional enhancement.

This diagram shows the relation of the enhanced balancing services platform to our wider platform landscape, including the markets platform, digital engagement, integration capabilities, data and analytics platform, and major external stakeholders.

### Electricity system operator landscape



### Balancing reference architecture

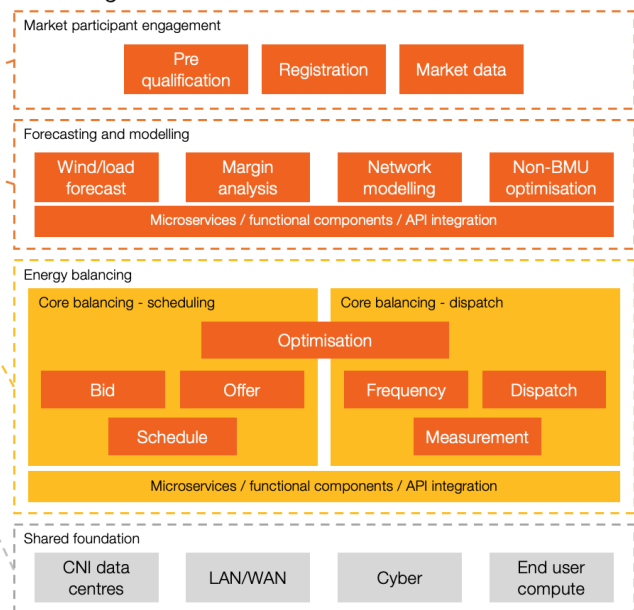


Figure 41 – Conceptual balancing reference architecture

We have taken a modular approach to our balancing services (Dispatch) architecture.

The existing balancing system and major functional areas is shown below. The legacy dispatch advice (LDA) drives the selection of generation supply to meet demand, within economical, safety and operational constraints.

The modern dispatch advice algorithm is the first functional area that we will develop in our roadmap to modernise the balancing services (MDA). This component will be developed to run in parallel with the

existing balancing service to test in parallel in the live environment, with the existing algorithm being decommissioned when appropriate.

Further functional areas will be developed in this way, aligned to the modular design and application functional design outlined in the work breakdown structure.

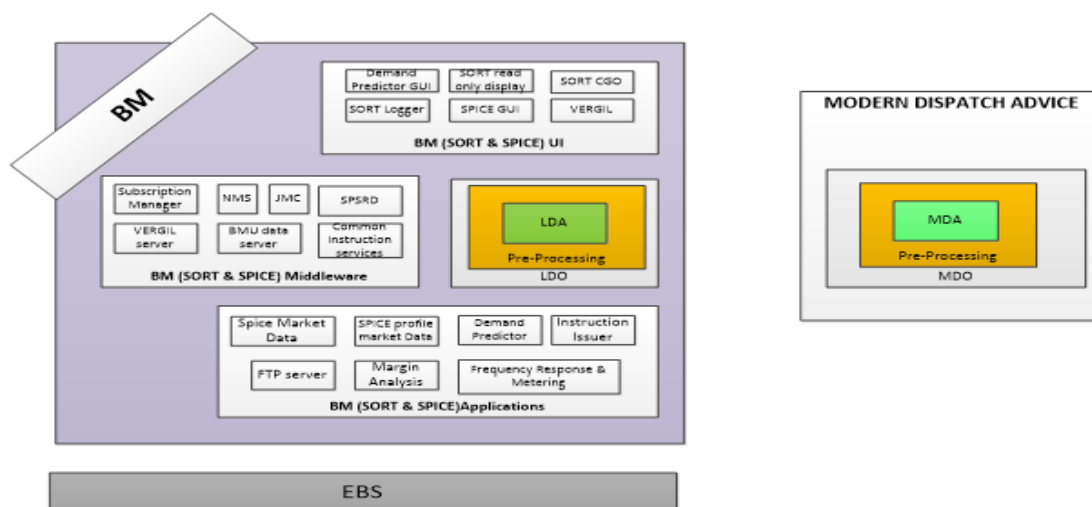


Figure 42 - Our modular approach to balancing services (dispatch)

The MDA logical design and its integration to the existing balancing service is outlined below. We are using a consistent integration capability based on application programming interfaces (API) and service oriented architecture (SOA) to link the existing balancing service and the MDA.

The MDA is de-composed into a network model/solver component for definition of network assets and constraints. A calculation engine (using the Gurobi product) takes the network model and real-time variables to calculate dispatch advice. A visualisation component provides a control room operator interface.

This provides:

- Better quality (economic) balancing decisions.
- Runs in parallel with current optimiser.
- Adaptable to developing market rules as RIIO-2 progresses.
- Modern software development operating model.
- Uses python, C#.NET, Javascript.
- Modern supported operating platform.

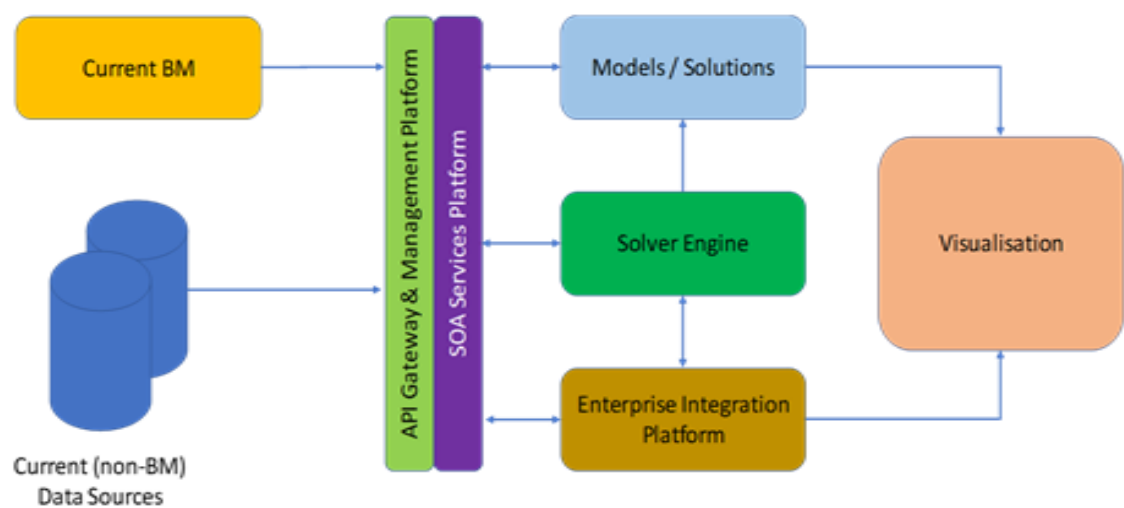


Figure 43 – Component view of the modern dispatch algorithm architecture



Work breakdown structure

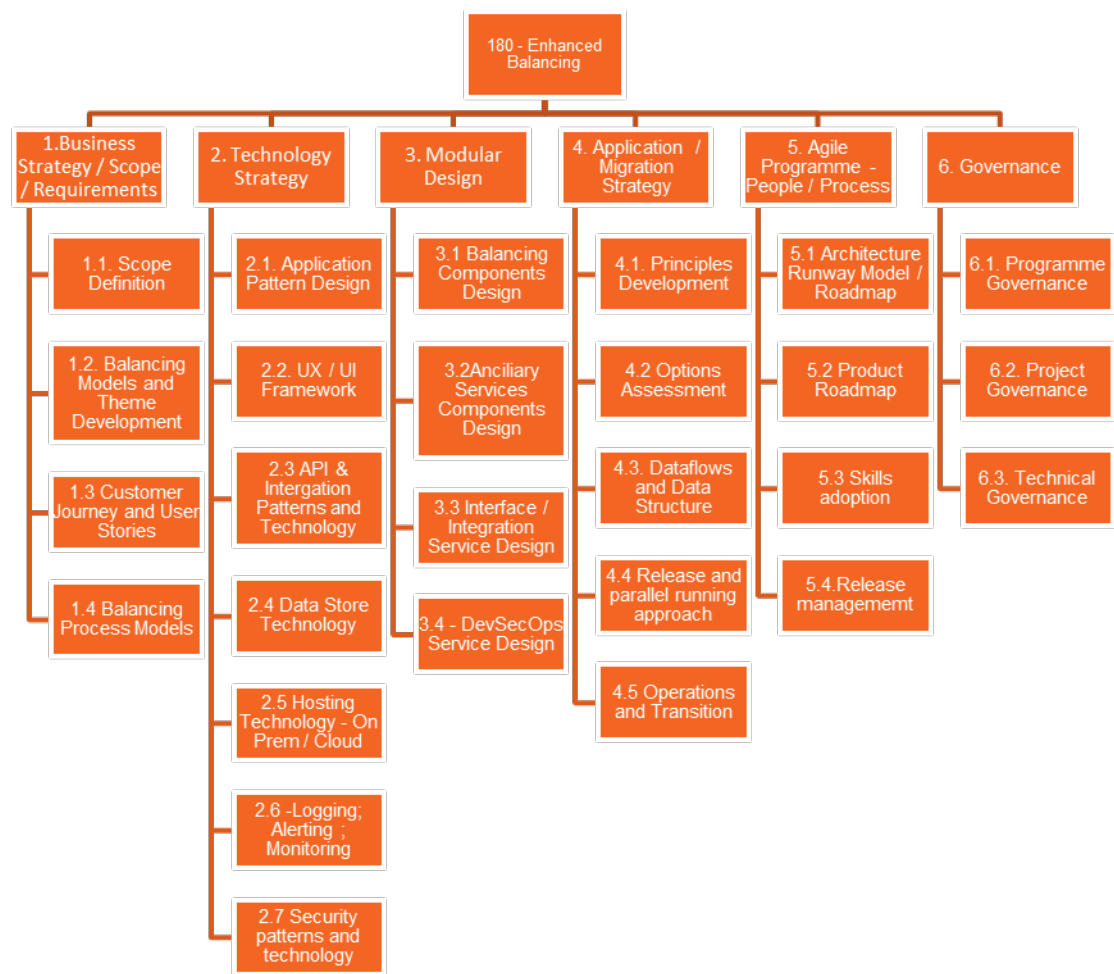


Figure 44 – Work breakdown structure

Resource plan

The current project team is represented in the diagram below. This team will be expanded at the end of the foundational phase to allow for the delivery work to be conducted.

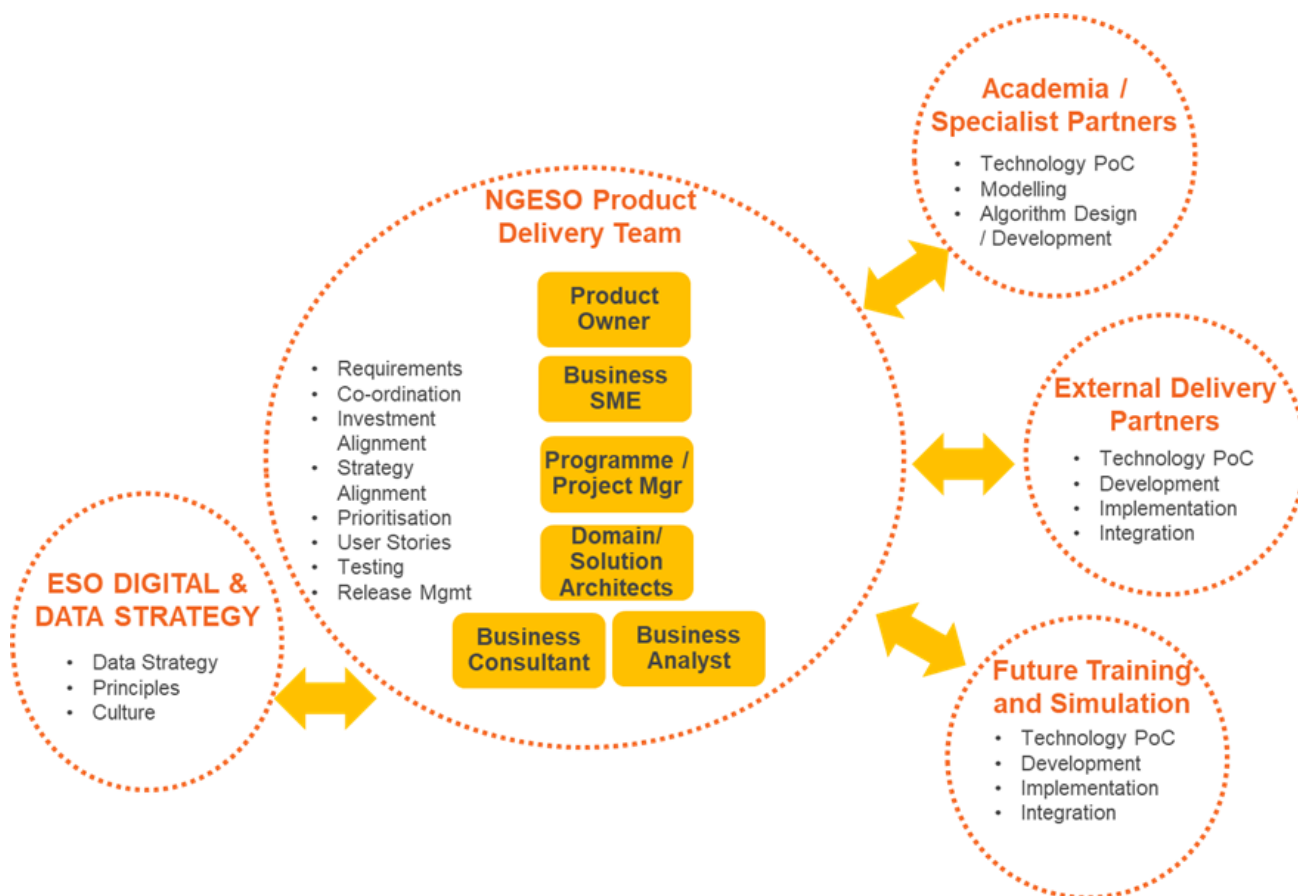


Figure 45 - Resource plan

Task	Resource type										
	Programme Manager	Product Mgr./ Owner	Project Manager	Business Analyst	Enterprise/solution Architect	Product Subject Matter Experts	Implementation Subject Matter Experts	Integration Partner	Tester	Service Transition	Procurement specialist
1 Business Strategy Scope and Requirements											
1.1 Scope Definition	L	L	L	M	M	M	M	L	L	L	L
1.2 Balancing Models and Theme Development	L	M	M	L	M	M	M	L	L	L	L
1.3 Customer Journeys and User Stories	L	M	M	L	M	L	M	L	L	L	L
1.4 Balancing Process Models	L	M	M	M	L	M	M	L	L	L	L
2 Technology Strategy											
2.1 Application Pattern Design	L	M	M	L	H	M	H	-	-	-	-
2.2 UX / UI Framework	L	M	M	M	H	M	H	-	-	-	-

Task	Resource type										
	Programme Manager	Product Mgr./ Owner	Project Manager	Business Analyst	Enterprise/solution Architect	Product Subject Matter Experts	Implementation Subject Matter Experts	Integration Partner	Tester	Service Transition	Procurement specialist
2.3 API & Integration patterns & Technology	L	M	M	L	H	M	H	M	L	L	-
2.4 Data Store Technology	L	M	M	M	H	M	H	L	L	L	L
2.5 Hosting Technology – On Prem / Cloud	L	M	M	L	H	L	H	M	M	M	M
2.6 Logging; Alerting; Monitoring Technology	L	M	M	L	H	L	H	M	M	M	M
2.7 Security Patterns and Technology	L	M	M	M	H	M	H	M	M	M	M
3 Modular Design											
3.1 Balancing Components Design	L	M	M	H	M	M	M	M	L	L	L
3.2 Ancillary Services Components Design	L	M	M	H	M	M	M	M	L	L	L
3.3 Integration / Interface Service Design	L	M	M	L	M	L	M	H	M	M	L
3.4 DevSecOps Service Design	L	M	M	L	M	M	M	M	M	M	L
4 Application / Migration Strategy											
4.1 Principles Development	L	M	M	M	M	M	M	M	L	L	L
4.2 Options Assessment	L	M	M	M	M	M	M	M	L	L	L
4.3 Data Flows and Data Structure	L	M	M	H	H	M	H	L	L	L	L
4.4 Release and Parallel Running Approach	L	M	M	H	H	H	H	M	M	M	L
4.5 Operations and Transition	L	M	M	M	M	M	M	M	H	H	L
5 Agile Programme – People / Process											
5.1 Architecture Runway Model / Roadmap	M	M	M	M	H	L	H	M	L	L	L
5.2 Product Roadmap	M	M	M	H	H	M	M	M	L	L	L
5.3 Skills Adoption	M	M	M	M	M	M	M	M	M	M	L
5.4 Release Management	L	M	M	M	M	M	L	L	L	M	L
6 Governance											
6.1 Programme Governance	M	M	M	L	L	M	L	L	L	L	L
6.2 Project Governance	M	M	M	L	L	M	L	L	L	L	L
6.3 Technical Governance	M	M	M	L	M	M	L	L	L	L	L

Low, medium, and high define the expected volume of resource relative to others for this activity.

- Highly specialised or difficult to source resources. Would require new frameworks or mitigation plans.
- Channels available but resources are hard to source, channels not currently available or market-wide constraints
- Established resource available or channels available to recruit,

### 9.3.7 Dependencies

The key investments that are interdependent with this investment are listed in the orange box below. These will form an overarching programme that will ensure that these dependencies are managed effectively.

The grey area depicts other investments that may interact with this one. These will be managed as external dependencies to the programme.

In practice, many of these will run in parallel rather than consecutively as the chart could imply. It is intended to show the interconnected nature of the investments rather than a time bound roadmap.

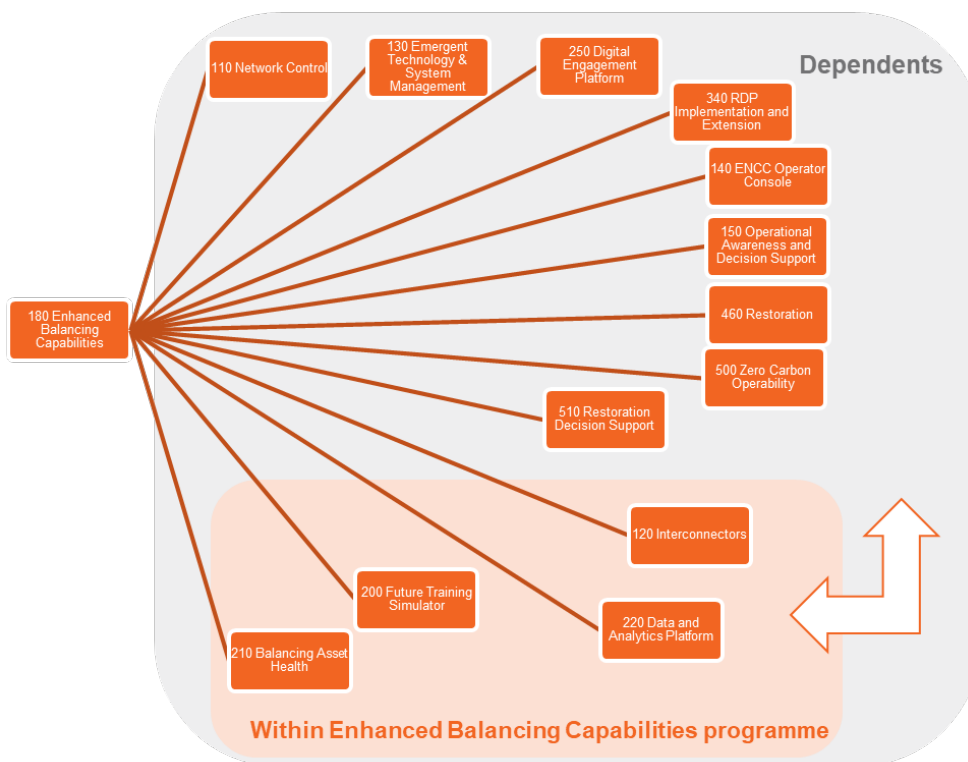


Figure 46 – Dependencies

### 9.3.8 Costs

Investment (£m)	2021/22	2022/23	2023/24	2024/25	2025/26	Total
Capex	8.1	10.1	12.2	6.1	4.1	40.5
Opex	0.9	1.1	1.4	0.7	0.5	4.5
<b>Total</b>	<b>9.0</b>	<b>11.3</b>	<b>13.5</b>	<b>6.8</b>	<b>4.5</b>	<b>45.0</b>
Cumulative RTB* increase	0.2	0.2	0.3	0.4	0.4	1.5

\*RTB - run-the-business on-going opex



Figure 47 - investment costs

Our proposal is just above Gartner's higher range. In this instance, Gartner's range is broad as they have limited comparative data for our specific requirements. Given the critical nature, ambition and complex level of change around this area we decided to keep our proposal.

### 9.3.9 Risks

Risks specific to this investment are listed below. Generic portfolio level risks and a description of the scoring method for likelihood and impact can be found in our December 2019 Business Plan, Annex 4 - Technology investment report, Appendix C.

Risk	Mitigation(s)	Likelihood	Impact
High impact market and regulatory (EU and GB) changes do not enable the new tool development to progress as intended. This could lead to key resources and attention being deviated to handle short term compliance implementation delaying strategic tool delivery.	<ul style="list-style-type: none"> <li>Develop new tool offline and with different resources than the ones delivering short term compliance changes.</li> <li>Engage all stakeholders via design authority to try and keep the level of high impact changes to the minimum necessary in initial stages of the project.</li> </ul>	1	
System complexity leads to long development and implementation periods.	<ul style="list-style-type: none"> <li>Apply lessons learnt from previous projects, both positive and negative.</li> <li>Adopt agile delivery methodologies to give the market as much value as early as possible.</li> <li>Adopt modular approach to development of new capabilities.</li> <li>Develop system offline so that critical market changes can still go ahead in legacy systems and new system development can also progress as planned.</li> </ul>	2	

### 9.3.10 Options

Option(s)	Pros	Cons
Not invest in this area		<ul style="list-style-type: none"> <li>Creates operational risk, staff overheads and technical debt as it addresses balancing</li> </ul>

Option(s)	Pros	Cons
		<p>problems with inefficient processes and workarounds.</p> <ul style="list-style-type: none"> <li>Increases cyber security risk.</li> <li>Does not support transparency of our operational actions.</li> <li>Does not support investment scalability and flexibility.</li> <li>Puts at risk 2025 ambition to be able to operate a carbon free electricity system.</li> <li>Leaves critical tools unsupported.</li> <li>Puts responding to regulatory changes at risk.</li> </ul>
Invest in legacy tools		<ul style="list-style-type: none"> <li>Requires refresh of current tools.</li> <li>Does not support investment scalability and flexibility.</li> <li>Restricts pace of to align to industry changes.</li> <li>Increases risk of delivering changes timely and efficiently.</li> <li>Risk of not being able to retain or attract legacy skill resourcing/SME.</li> </ul>
Update tools and integrate with data platform, network control and markets platform	<ul style="list-style-type: none"> <li>Enables introduction of flexible and scalable tools aligned with industry changes.</li> <li>Supports transparency of our operational actions.</li> <li>Introduces delivery efficiencies.</li> <li>Supports easy and economic data sharing with our customers.</li> <li>Enables 2025 ambition to be able to operate a carbon free electricity system.</li> </ul>	



## 9.4. 220 Data and analytics platform

Ofgem/Atkins assessment	RAG/£m	Supplementary information
Justification for project	G	<ul style="list-style-type: none"> <li>No change.</li> </ul>
Project definition incl. timing, scale, and dependencies	R	<ul style="list-style-type: none"> <li>Architectural approach.</li> <li>Expanded roadmap and WBS.</li> <li>Foundation data and analytics services and frameworks.</li> <li>Dependencies to other strategic initiatives.</li> </ul>
Definition of required resources	R	<ul style="list-style-type: none"> <li>Rationale added on partner-based implementation approach.</li> <li>Differentiation between common industry standard data services and business specific services.</li> </ul>
Cost confidence	A	<ul style="list-style-type: none"> <li>See above for additional supporting content.</li> </ul>
Requested capex Requested opex	£8.9m £2.2m	<ul style="list-style-type: none"> <li>No change.</li> </ul>
Ofgem view of capex	n/a	<ul style="list-style-type: none"> <li>Not previously included in the ex-ante steer.</li> </ul>

### Investment stage

Scoping	Start up	Requirements and design	Development and testing	Implementation
---------	----------	-------------------------	-------------------------	----------------

	RIIO-2 December 2019 Business Plan stage
	Consultation response stage (or if same stage)

#### 9.4.1 Overview

This is foundational work to unlock the value of the data we hold. It will be the key technology underpinning all our internal and external data management, pulling together data from a variety of sources and ensuring there is only one source of the truth. This includes critical national infrastructure (CNI) and non-CNI data and analytics platforms as well as their associated integration platforms.

Cloud-based data management and analytics are now universal and essential for modern data analysis approaches and even more so for artificial intelligence implementations. This investment will evolve ESO's traditional data management and analytics to the cloud. It is indispensable for much of the RIIO-2 change programme, including unlocking the value of our digital twin technology investments and hosting data from the asset register, fundamental for our single markets platform.

#### 9.4.2 Current state

We have multiple systems to store data for analysis and reporting. These are being upgraded to handle more data that will result from the changing regulatory frameworks and the increase in market participants.

We also have a system to distribute incoming regulatory reporting files.

During RIIO-1, a core set of integration systems have been implemented on non-CNI infrastructure to enhance our flexibility. We are now using a service-oriented architecture (SOA) approach for system interfaces which is reducing complexity and streamlining the data transfer between systems.

The ESO has started to offer application programming interface (API) access to data and services (such as the carbon intensity API) which allows partners and customers to access information or unlock value by building on existing services. It also offers fast and secure access to data, allowing seamless expansion of business capabilities into the cloud and coordinating in house with external solutions.

### 9.4.3 Case for change

The ESO has regulatory obligations to report on balancing activities, both to the GB and European markets. We need to maintain the appropriate systems and expand them to accommodate the increased number of participants. Accurate and timely information is vital to the market for customers to manage their positions.

We anticipate that the volumes of data managed by the ESO will continue to increase significantly in a short timescale because of greater market participation, from both a European and GB regional perspective. Closer coordination with Distributed System Operators (DSOs) will also increase the volume and types of data. We need solutions that can increase in scale.

To achieve this, we plan to replace our current storage and reporting systems with solutions integrated within a data and analytics platform. This also leads to a need for master data management tools and analytics packages that allow users to unlock the real value of our data.

This same increase in complex interactions drives the need to use digital twin technology (enabled through this investment) of each new strategic system during RIIO-2 to enable a quick analysis of ways to manage new challenges and avoid unnecessary spend, as explained under Theme 1.

#### By end of RIIO-1, I will manage ...

- Various sources and versions of same data leading to manual work to merge them
- Data at a team/department level
- Transmission network data
- Having to wait for key people to be in the office to understand data reasons

#### By end of RIIO-1, I will operate with ...

- Data that is hard and takes long to find
- Many sources of truth
- Data created in systems not logged in central master data repository



#### IT Investment in ...

- Integration Services
- Master Data Management
- Analytics capabilities
- API Management

will enable me in RIIO-2 to manage ...

will enable me in RIIO-2 to operate with ...

Data at a company level

Data from DSOs

Metadata that allows for data to be understood by anyone

Data from key spreadsheet tools being centrally stored

One single source of truth

Readily available data for internal and external consumption

Data that can easily be shaped and reformatted to meet business needs

Figure 48 - Use case, investment and outcome expectation

### 9.4.4 Roadmap

Our immediate focus in year one of RIIO-2 will be to build the foundations of our data and analytics platform and share as much data as possible in machine readable format. We will work through our data, following on from work during RIIO-1, making the highest priority data available first.

This work will be integrated with the digital engagement investment to ensure we present all data in consistent and efficient formats across the whole of the ESO to meet our RIIO-2 ambitions.

Our SOA approach will continue to be enhanced in RIIO-2 and will be extended into the CNI area, as new tools are delivered.

The significant increase in the volume and complexity of data will require a master data management system in place early in RIIO-2, with asset refresh at the end of the period.

## Draft determinations update

The investment 220 - data and analytics platform supports most other initiatives delivering a set of foundation data and analytical services and frameworks for other programmes to build on.

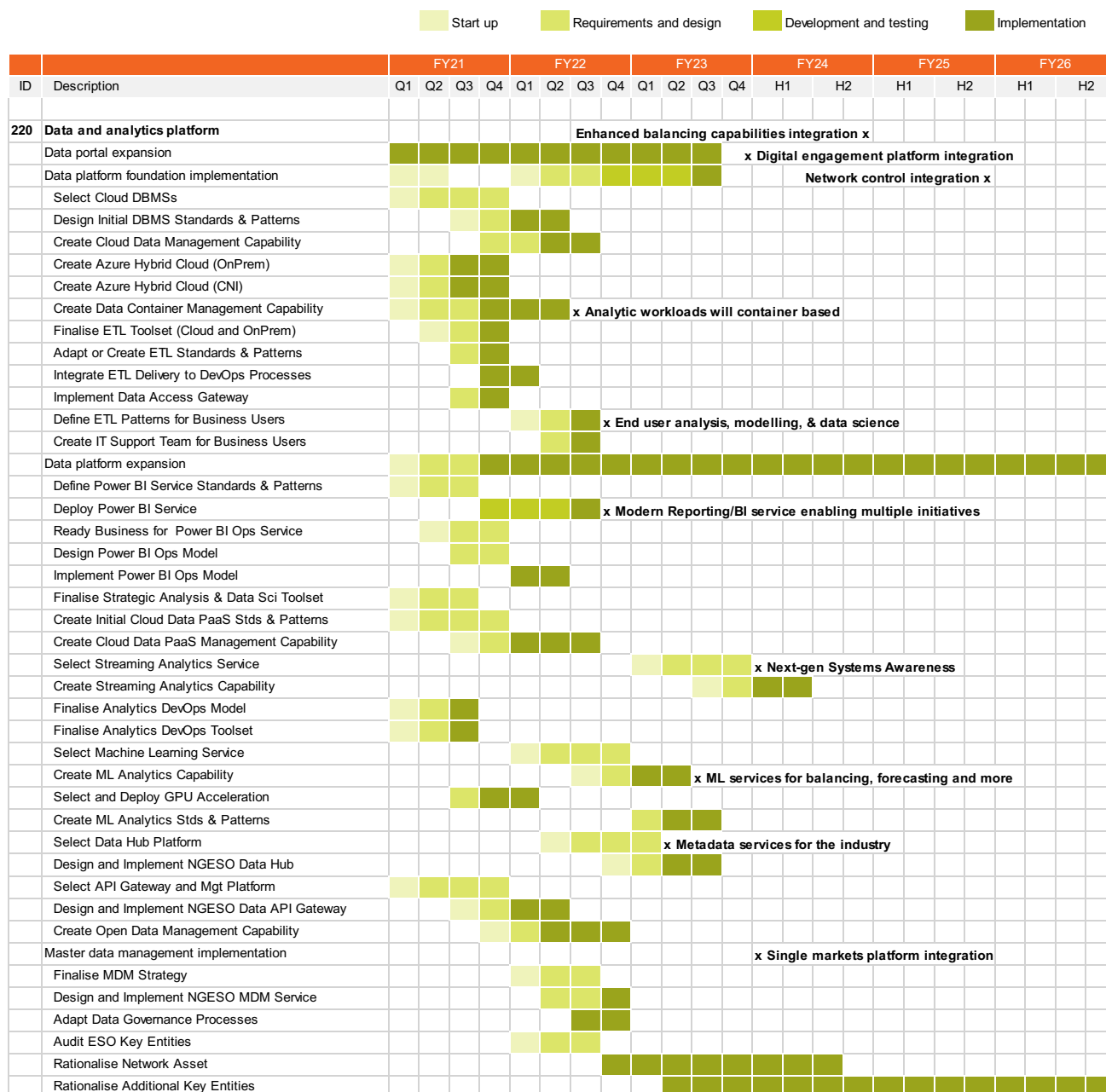


Figure 49 – Delivery plan

#### 9.4.5 Future state

This investment line will move all ESO data to a single platform and allow users to access it in the timescales they need.

Externally, we will make available for consultation agreed sets of data. This will allow ESO customers to make quicker and more accurate decisions. They will be able to extract and feed the data into their own analytics tools.

This single source of data approach requires a rigorous and well managed process and culture. It also requires our infrastructure investment to support this increase in capability.

To make the data accessible across the whole ESO we will invest in the required integration layer and associated APIs.

The data and analytics platform will retire many of our legacy data systems. It will include analytics capability, so we can access, share and shape any type of data we store. This is critical to allow quicker, accurate operational decisions and give our customers value added information.

## **Draft determinations update**

The new platform provides the agility and elasticity to scale to emergent data requirements as new market structures and rules emerge.

### **9.4.6 Approach**

We will progressively develop the new data and analytics platform to meet the needs of the RIIO-2 programme, delivering common capabilities for the component projects of the programme.

By default, the data and analytics platform will use low cost, open source, commodity building blocks and standards and give maximum flexibility for participants.

We will choose new solution components only after careful consideration and appropriate selection processes. We will modernise existing data management and analytical capabilities that are still fit for purpose.

We will institute a pragmatic data architecture and governance regime, supported by the right tools. Participants will have access to our metadata to provide reliable integration with ESO systems.

We will draw on external partners' capability and capacity during implementation of the data and analytics platform, and we will develop deep in-house capabilities for the RIIO-2 programme and beyond. The data science and analytical skills enabled by the data and analytics platform (and attendant capabilities, notably multiple forms of artificial intelligence) are core to the ESO role.

## **Draft determinations update**

The building blocks of the data and analytics platform are generic and common practice elsewhere in industry allowing their implementation to be outsourced to partners with low delivery risk.

The platform will be primarily cloud-based with deployment to CNI-compliant hybrid cloud as well as public cloud for less critical workloads. Public cloud opens further options for participants to ESO datasets.

Major component technologies will be subject to detailed selection processes to ensure that all requirements are met reliably. Careful selection will avoid unnecessary duplication of capabilities and reduce build and run cost.

The data and analytics platform will sit in the ESO SOA to standardise and automate access for the RIIO-2 business service. We will extend the ESO SOA to participants as managed APIs permitting access to ESO (tightly controlled) data and analytics services in the most cost-efficient way that meets industry standards.

## Architecture

The architecture of the ESO data and analytics platform follows the model defined by the NG Enterprise Data Platform (EDP) Reference Architecture:

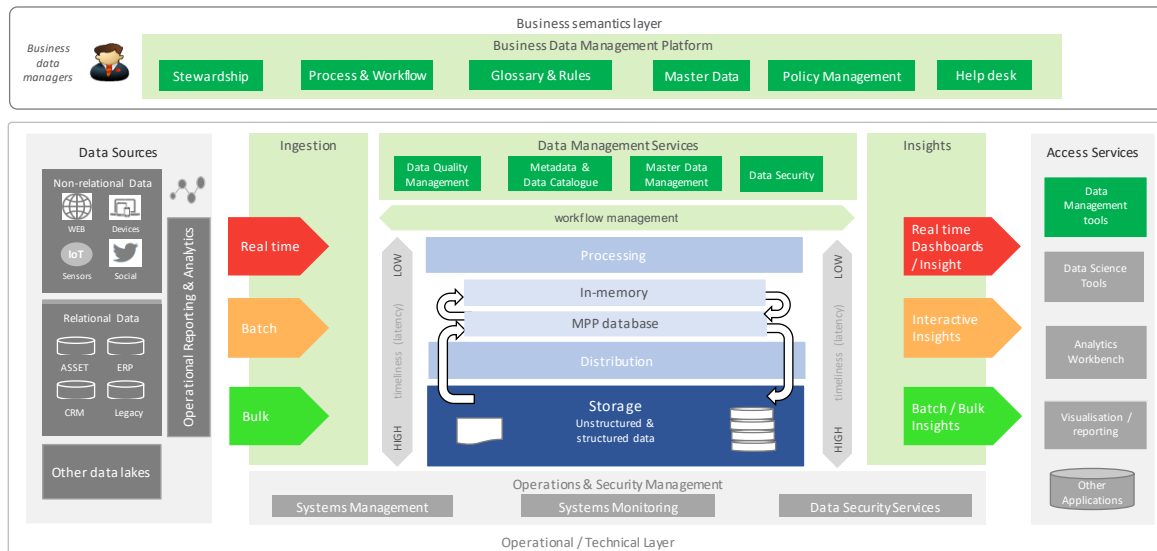


Figure 50 - Data and analytics platform reference architecture

Specifically, the data and analytics platform will consist of the components in the following target conceptual architecture.

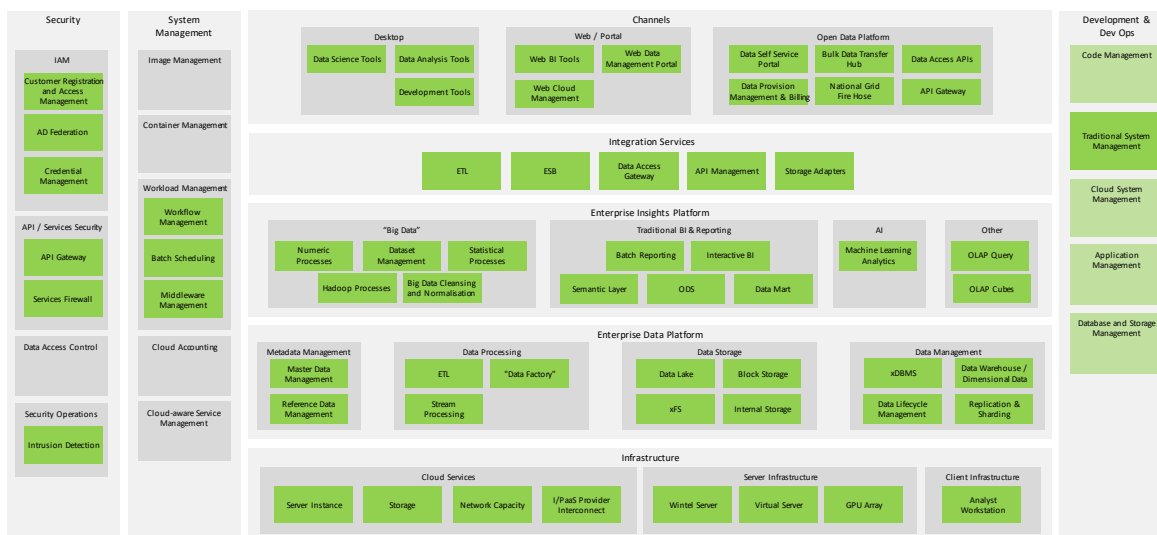
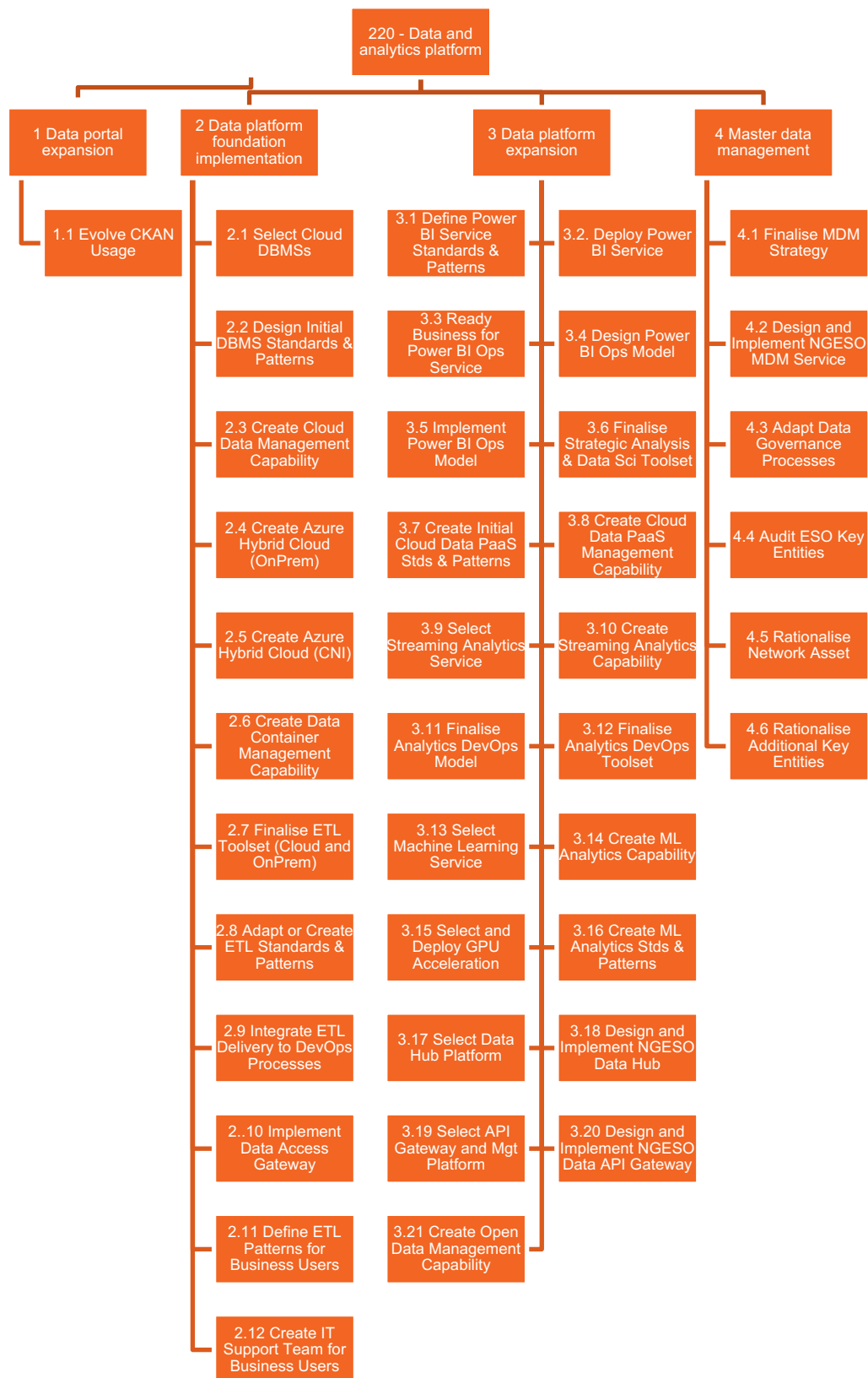


Figure 51 - Data and analytics platform target conceptual architecture

## Work Breakdown Structure (WBS)





## Resource plan

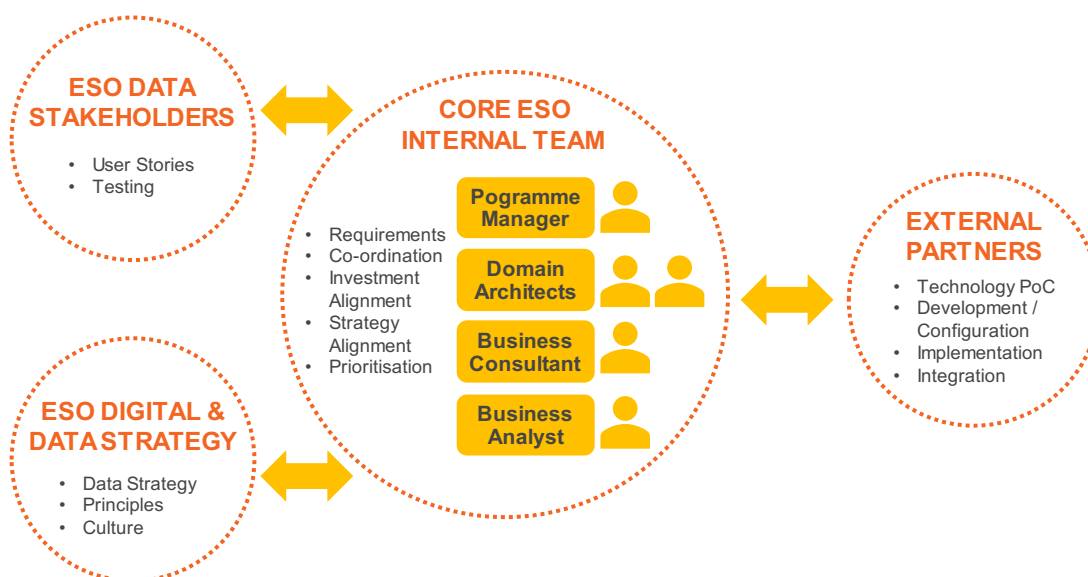


Figure 52 - Resource plan

Platform delivery will for the most part be carried out by external partners interfacing into a core ESO project team co-ordinating and prioritising the backlog of requirements developed with stakeholders and with dependant investment streams.

Table 2 - Resources required for work breakdown structure tasks

Task	Resource Type													
	Programme Mgr.	Product Owner	PM / Scrum Master	Business Analyst	Enterprise/solution Architect	Solution Development Mgr.	Ext Stakeholders	Business SMEs	IT SMEs	Integration Partner	Specialist IT Partner	Testers	Service Transition	Procurement SME
1 Data Portal Expansion	M	M	M	M	L	M	M	H	M	H	M	M	M	L
<b>2 Data Platform Foundation Implementation</b>														
2.1 Select Cloud DBMSs	L	L	L	L	L	L	L	L	M	L	L	L	L	L
2.2 Design Initial DBMS Standards and Patterns	L	L	L	L	L	L	L	L	M	M	L	L	L	L
2.3 Create Cloud Data Management Capability	M	L	L	L	L	L	L	L	M	M	M	L	M	L
2.4 Create Azure Hybrid Cloud (OnPrem)	M	L	L	L	L	L	L	L	M	M	M	L	M	L
2.5 Create Azure Hybrid Cloud (CNI)	M	L	L	L	L	L	L	L	M	M	M	L	M	L
2.6 Create Data Container Management Capability	M	L	L	L	L	L	L	L	M	M	M	L	M	L
2.7 Finalise ETL Toolset (Cloud and OnPrem)	M	L	L	L	L	L	L	L	M	L	L	L	L	L

Task	Resource Type													
	Programme Mgr.	Product Owner	PM / Scrum Master	Business Analyst	Enterprise/solution Architect	Solution Development Mgr.	Ext Stakeholders	Business SMEs	IT SMEs	Integration Partner	Specialist IT Partner	Testers	Service Transition	Procurement SME
2.8 Adapt or Create ETL Standards and Patterns	L	L	L	L	L	L	L	L	M	M	L	L	L	L
2.9 Integrate ETL Delivery to DevOps Processes	M	L	L	L	L	L	L	L	M	M	M	L	M	L
2.10 Implement Data Access Gateway	L	L	L	L	L	L	L	L	M	L	M	L	M	L
2.11 Define ETL Patterns for Business Users	L	L	L	L	L	L	L	M	L	L	M	L	M	L
2.12 Create IT Support Team for Business Users	L	L	L	L	L	L	L	M	L	L	M	L	M	L
<b>3 Data Platform Expansion</b>														
3.1 Define Power BI Service Standards and Patterns	L	L	L	L	L	L	L	L	M	L	L	L	L	L
3.2 Deploy Power BI Service	L	L	L	L	L	L	L	L	M	M	L	L	L	L
3.3 Ready Business for Power BI Ops Service	L	L	L	L	L	L	L	M	L	L	M	L	M	L
3.4 Design Power BI Ops Model	L	L	L	L	L	L	L	L	M	M	L	L	L	L
3.5 Implement Power BI Ops Model	M	L	L	L	L	L	L	M	L	L	M	L	M	L
3.6 Finalise Strategic Analysis and Data Sci Toolset	L	L	L	L	L	L	L	L	M	L	L	L	L	L
3.7 Create Initial Cloud Data PaaS Stds and Patterns	L	L	L	L	L	L	L	L	M	M	M	L	L	L
3.8 Create Cloud Data PaaS Management Capability	M	L	L	L	L	L	L	L	M	M	M	L	M	L
3.9 Select Streaming Analytics Service	L	L	L	L	L	L	L	L	M	L	L	L	L	M
3.10 Create Streaming Analytics Capability	M	L	L	L	L	L	L	L	M	M	M	L	M	L
3.11 Finalise Analytics DevOps Model	L	L	L	L	L	L	L	M	L	L	M	L	M	L
3.12 Finalise Analytics DevOps Toolset	L	L	L	L	L	L	L	M	L	L	M	L	M	M
3.13 Select Machine Learning Service	L	L	L	L	L	L	L	L	M	L	L	L	L	M
3.14 Create ML Analytics Capability	M	L	L	L	L	L	L	L	M	M	M	L	M	L
3.15 Select and Deploy GPU Acceleration	L	L	L	L	L	L	L	L	M	L	M	L	M	L
3.16 Create ML Analytics Stds and Patterns	L	L	L	L	L	L	L	L	M	M	L	L	L	L
3.17 Select Data Hub Platform	L	L	L	L	L	L	L	L	M	L	L	L	L	M
3.18 Design and Implement NGESO Data Hub	M	L	L	L	L	L	L	M	M	M	L	L	M	M
3.19 Select API Gateway and Mgt. Platform	L	L	L	L	L	L	L	L	M	L	L	L	L	M

Task	Resource Type													
	Programme Mgr.	Product Owner	PM / Scrum Master	Business Analyst	Enterprise/solution Architect	Solution Development Mgr.	Ext Stakeholders	Business SMEs	IT SMEs	Integration Partner	Specialist IT Partner	Testers	Service Transition	Procurement SME
3.20 Design and Implement NGESO Data API Gateway	M	L	L	L	L	L	L	L	M	M	M	L	L	L
3.21 Create Open Data Management Capability	M	L	L	L	L	L	L	L	M	M	M	L	M	L
<b>4 Master Data Management Implementation</b>														
4.1 Finalise MDM Strategy	M	M	M	H	M	L	L	L	M	M	M	L	M	M
4.2 Design and Implement NGESO MDM Service	M	L	L	M	L	L	L	M	M	M	M	L	L	L
4.3 Adapt Data Governance Processes	M	L	L	M	L	L	L	L	M	M	M	L	L	L
4.4 Audit ESO Key Entities	M	M	M	H	M	M	M	H	H	M	M	L	L	L
4.5 Rationalise Network Asset	H	M	M	H	M	M	M	H	H	H	M	H	H	L
5.6 Rationalise Additional Key Entities	H	M	M	H	M	M	M	H	H	H	M	H	H	L

Low, medium, and high define the expected volume of resource relative to others for this activity.

- Highly specialised or difficult to source resources. Would require new frameworks or mitigation plans.
- Channels available but resources are hard to source, channels not currently available or market-wide constraints
- Established resource available or channels available to recruit,

### 9.4.7 Dependencies

The ESO can only transform into an open data organisation if all investments contribute to the data platform growth consistently and with efficiency of scale in mind. Dependent investments are shown below.

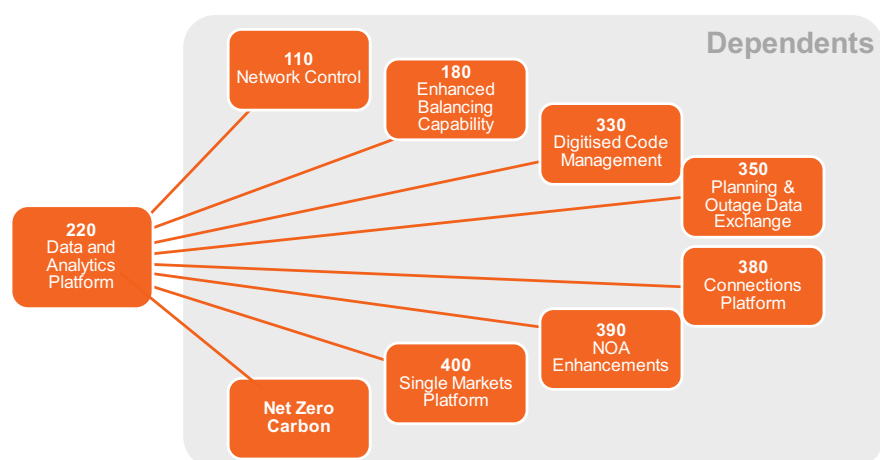


Figure 53 - Dependencies

Every data item managed on the data platform will have a role to play in securely capturing, recording, processing, analysing and reporting on our ability to operate a net zero system.

### 9.4.8 Costs

Investment (£m)	2021/22	2022/23	2023/24	2024/25	2025/26	Total
Capex	3.1	5.8	5.8	3.1	2.2	20.0
Opex	0.8	1.5	1.5	0.8	0.5	5.0
<b>Total</b>	<b>3.8</b>	<b>7.3</b>	<b>7.3</b>	<b>3.8</b>	<b>2.7</b>	<b>25.0</b>
Cumulative RTB* increase	0.0	0.1	0.3	0.5	0.6	1.4

#### Gartner benchmark range

Low	23.0
High	27.6

\*RTB - run-the-business on-going opex

Figure 54 - investment costs

220 Data and analytics platform		TotEx £m GBP					
		FY22	FY23	FY24	FY25	FY26	Total
Resource (Scoping, training)	10%	0.4	0.7	0.7	0.4	0.3	2.5
Resource (Dev., testing)	15%	0.6	1.1	1.1	0.6	0.4	3.7
Software	20%	0.8	1.5	1.5	0.8	0.5	5.0
Hardware	10%	0.4	0.7	0.7	0.4	0.3	2.5
Consulting	0%	-	-	-	-	-	-
Supplier	35%	1.3	2.6	2.6	1.3	0.9	8.7
Cyber	10%	0.4	0.7	0.7	0.4	0.3	2.5
Contingency	0%	-	-	-	-	-	-
<b>Total</b>	<b>25.0</b>	<b>3.8</b>	<b>7.3</b>	<b>7.3</b>	<b>3.8</b>	<b>2.7</b>	<b>25.0</b>

Figure 55 - parametric cost model provided within ESO\_SQ\_CA\_1

Expectations of costs for this investment line fall within Gartner's range and provide synergies for other RIIO-2 investments.

### 9.4.9 Risks

Risks specific to this investment are listed below. Generic portfolio level risks and a description of the scoring method for likelihood and impact can be found in our December 2019 Business Plan, Annex 4 – Technology investment report, Appendix C.

Risk	Mitigation(s)	Likelihood	Impact
It may prove difficult to achieve a common dataset for all modelling requirements, leading to increase cost due to more complex implementation.	Have data stewards and a data centric culture supported by data management tools in data and analytics platform.	2	2

### 9.4.10 Options

Option(s)	Pros	Cons
Not invest in this area		<p>Prevents easy and economic data sharing with our customers.</p> <p>Creates operational risk, staff overheads and technical debt as it addresses data problems with inefficient processes and workarounds.</p> <p>Requires higher level of investment in other areas to make up for data inefficiencies.</p> <p>Does not allow for Theme 1 and 2 proposals to be delivered.</p> <p>Does not enable transparency of our actions.</p> <p>Prevents reacting to new customer data needs in a timely way.</p>
Invest in legacy tools		<p>Does not enable easy and economic data sharing with our customers.</p> <p>Does not allow for scalability of investment.</p> <p>Duplicates investment in other areas to make up for lack of data standards.</p> <p>Does not allow for Theme 1 and 2 proposals to be delivered.</p> <p>Introduces inefficiencies as different standards get used to address data problems.</p> <p>Does not support transparency of our actions.</p> <p>Prevents reacting to and meeting new customer data needs in a timely way.</p>
Update tools and integrate with data platform, network control, digital engagement platform and enhanced balancing capabilities	<p>Enables transparency of our actions.</p> <p>Enables easy and economic data sharing with our customers.</p> <p>Allows for scalability of investment.</p> <p>Supports objectives of other prioritised customer value areas in RIIO-2 plan.</p> <p>Introduces data standards and efficient management.</p> <p>Enables quicker and better operational decisions.</p>	

## 9.5. 250 Digital engagement platform

### Current stage:

Scoping	Start up	Requirements and design	Development and testing	Implementation
---------	----------	-------------------------	-------------------------	----------------

#### 9.5.1 Overview

This investment, mentioned in the chapter 8, Digitalisation and open data unlocking zero carbon system operation and markets, will enable a single point of access for all ESO data and services, including the markets, connections, digitalised Grid Code management and data and analytics platform. It sits at the heart of our vision for digital capability across all our themes, providing a common engagement experience for stakeholders.

#### 9.5.2 Current state

We started investing in this area during RIIO-1, developing pockets of functionality through customer relationship management (CRM) capabilities. We will also be allowing customers access to more of our data via ESO websites which are not currently part of the core ng.com platform.

We identified demand from our customers for this service across most of our market and operational areas such as network charging and access, customer connections, contract management, commercial operations and others. Ease of access and user experience are key requirements.

#### 9.5.3 Case for change

Data access and submission is expected to increase for both our critical and supporting processes. This will result in a corresponding increase in data sources, volumes and update frequency. Enabling this increase in stakeholder engagement (incorporating smaller GB and European market participants and DNOs / DSOs) and ensuring quality and security of data, will require a significant investment across the RIIO-2 period.

To enable efficiencies across similar functionalities, we need to investment in application consistency during RIIO-2. This will also improve our customers' user experience and our own productivity in this area. Some potential benefits are shown in Figure 56 - Use case, investment and outcome expectation and Figure 57 - Use case, investment and outcome expectation.

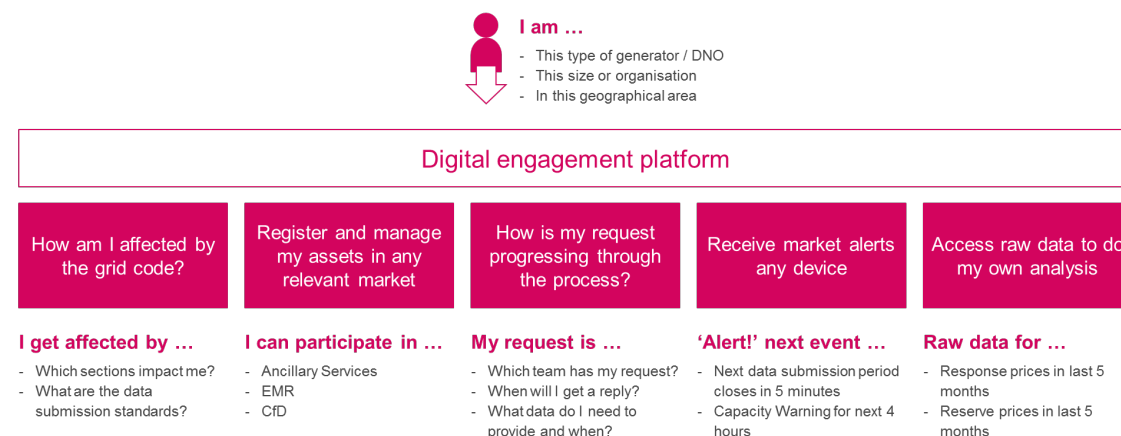


Figure 56 - Use case, investment and outcome expectation

**By end of RIIO-1, I will do my work based on ...**

- Accessing stand-alone applications & processes for each service
- Spreadsheet and email based processes
- Updating the same information in various internal and external communication channels



## IT Investment in ...

- Web presence tools
- Workflow capabilities
- APIs
- Multi channel management
- Artificial Intelligence

will enable my work in RIIO-2 to be based on ...

### Accessing a single, integrated platform for all markets

### Web based processes

**A single area for internal and external communications**

Figure 57 - Use case, investment and outcome expectation

### 9.5.4 Roadmap

The data portal investment from RII0-1 will be integrated with our CRM and operational systems. We will build supporting tools for ensuring data quality, and to provide search and knowledge management. With the large increase in participation and data, investment will also be needed to provide more responsive data access management, and to meet publication policy.

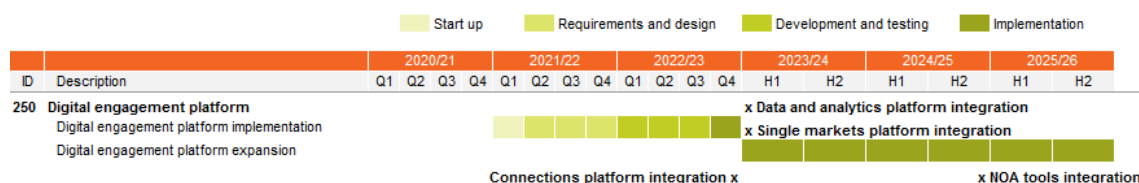


Figure 58 – Delivery plan

### 9.5.5 Future state

Here, investment centres on technologies to support digital market engagement. A range of approaches are required, from enhanced publication of raw data, through to publication of insights.

We propose a single point of access into the ESO systems and external-facing processes, providing secure, open access to data, compliant with data classification policies and standards. We will consolidate our ESO data publication and reporting channels, offering stakeholders access to our data, including multi device capability and industry standard APIs.

New tools will be introduced to support document management, collaboration, digital rights management, version management and workflow planning, providing clarity on areas including code modifications and connection contracts. This investment will ensure all external processes can be driven and updated from this platform, connecting seamlessly to our internal critical systems, making use of our IT investment 220 Data and analytics platform.

As mentioned, this investment will ensure efficiencies across otherwise overlapping investments as shown in next table:

Use Case	API / Multi-channel	Alerts	Doc. Mgt.	AI targeted content	Policy Enforcement	Data Quality Tools	Identity and Access Mgt.	Workflow Mgt.
Data and analytics platform	Y	Y	Y	N	Y	Y	Y	N



Single markets platform	Y	Y	Y	Y	Y	Y	Y	Y
Connections	Y	Y	Y	N	Y	Y	Y	Y
Outages	Y	Y	Y	Y	Y	Y	Y	Y
Codes management	N	Y	Y	Y	Y	Y	Y	Y

Figure 59 – Investment efficiency opportunities

### 9.5.6 Approach

We will develop a new digital engagement platform to meet the needs of the RIIO-2 programme, delivering common presentation capabilities for the component projects of the programme.

By default, the digital engagement platform will use low cost, open source, commodity building blocks and standards to control cost and give maximum flexibility.

New solution components will be chosen after careful research and appropriate formal selection processes.

First, we will identify a suitable web development framework and portal server (often called a digital experience platform or DXP - DXP is used here to avoid confusion with the wider digital engagement platform). This enables the development and management of modularised web UIs that can be combined into the sophisticated web UIs for operational use.

We will buy an API manager package to control the many service APIs we will present externally and internally.

We will draw on external partners' capability during implementation of the digital engagement platform, but we will develop deep in-house capabilities for the RIIO-2 programme and beyond.

The digital experience platform will be primarily cloud-based with deployment to CNI compliant hybrid cloud as well as public cloud for less critical workloads.

The digital engagement platform will sit in the ESO SOA to standardise and automate access for the RIIO-2 business service.

### 9.5.7 Costs

Investment (£m)	2021/22	2022/23	2023/24	2024/25	2025/26	Total
Capex	1.3	1.3	1.1	0.6	0.0	4.2
Opex	0.8	0.8	0.7	0.4	0.0	2.8
<b>Total</b>	<b>2.1</b>	<b>2.1</b>	<b>1.8</b>	<b>1.1</b>	<b>0.0</b>	<b>7.0</b>
Cumulative RTB* increase	0.0	0.1	0.2	0.3	0.3	0.9

\*RTB - run-the-business on-going opex



Figure 60 - investment costs

Our costs reflect synergies between investments required for IT investments 400 single markets platform, 330 Digitalised code management, 380 Connections platform and 320 EMR and CfD improvements. These synergies allow us to estimate lower costs than otherwise, that is if we were to address all the use cases individually.

### 9.5.8 Risks

Risks specific to this investment are listed below. Generic portfolio level risks and a description of the scoring method for likelihood and impact can be found in Appendix C.

Risk	Mitigation(s)	Likelihood	Impact
Requirements from market participants are unclear or conflicting.	<ul style="list-style-type: none"> <li>Engage market participants regularly via design authority and show and tells.</li> </ul>	3	1

### 9.5.9 Options

Option(s)	Pros	Cons
Not invest in this area	<ul style="list-style-type: none"> <li></li> </ul>	<ul style="list-style-type: none"> <li>Does not enable easy and economic data sharing with our customers.</li> <li>Creates staff overheads and technical debt as it addresses engagement problems with inefficient processes and workarounds.</li> <li>Requires higher level of investment in other areas to make up for engagement inefficiencies.</li> <li>Puts other prioritised customer value areas in RIIO-2 plan at risk.</li> <li>Does not enable transparency.</li> <li>Does not meet new customer data needs in a timely way.</li> <li>Maintains low customer experience.</li> <li>Increases cyber security risk.</li> </ul>
Invest in legacy tools	<ul style="list-style-type: none"> <li></li> </ul>	<ul style="list-style-type: none"> <li>Does not support easy and economic data sharing with our customers.</li> <li>Creates staff overheads and technical debt as it addresses engagement problems with inefficient solutions and processes.</li> <li>Duplicates investment in other areas to make up for lack of engagement standard solutions.</li> <li>Puts other prioritised customer value areas in RIIO-2 plan at risk.</li> <li>Does not enable transparency.</li> <li>Does not enable meeting new customer data needs in a timely way.</li> <li>Maintains low customer experience.</li> <li>Increases cyber security risk.</li> </ul>
Update tools and integrate with data platform, network control and enhanced balancing capabilities	<ul style="list-style-type: none"> <li>Enables transparency.</li> <li>Enables easy and economic data sharing with our customers.</li> </ul>	<ul style="list-style-type: none"> <li></li> </ul>

Option(s)	Pros	Cons
	<ul style="list-style-type: none"><li>• Allows for scalability of investment.</li><li>• Enables objectives of other prioritised costumer value areas in RIIO-2 plan.</li><li>• Introduces engagement standards.</li><li>• Enables high and consistent costumer experience.</li><li>• Enables introduction of efficient processes.</li><li>• Enables quicker response to market needs.</li></ul>	

## 9.6. 260 Forecasting enhancements

### Current stage:

Scoping	Start-up	Requirements and design	Development and testing	Implementation
---------	----------	-------------------------	-------------------------	----------------

### 9.6.1. Overview

Continuing with the investment made under RIIO-1, to enhance our mathematical forecasting models and refresh the forecasting system in line with our policies.

### 9.6.2. Current state

We are currently implementing new enhanced forecasting capabilities via the inflight platform for energy forecasting (PEF) project.

This is replacing our legacy energy forecasting system (EFS) through the delivery of a new IT system with scalability as a core principle, built on ESO cloud infrastructure capabilities.

### 9.6.3. Case for change

We expect new energy technologies and consumer patterns will continue to evolve rapidly during RIIO-2.

As such we will need to revise our models and implement new ones through advanced statistical and machine learning utilising new data feeds and cloud environments.

### 9.6.4. Roadmap

		Start up				Requirements and design				Development and testing				Implementation			
		FY21				FY22				FY23				FY24			
ID	Description	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	H1	H2	H1	H2
260	Forecasting enhancements																
	Platform for Energy Forecasting																
	Platform for Energy Forecasting enhancements																
	Platform for Energy Forecasting asset refresh																

Figure 61 –

Delivery plan

### 9.6.5. Future state

We will ensure our models remain accurate and enhance our data feeds to enable new technology models to be added to PEF.

Towards the end of RIIO-2 we will refresh PEF as per our asset health plans.

### 9.6.6. Approach

The introduction of new data feeds and the creation of new forecasting models will follow a similar approach to the one being applied currently to PEF, relying on advanced statistical and machine learning.

### 9.6.7. Costs

Investment (£m)	2021/22	2022/23	2023/24	2024/25	2025/26	Total
Capex	0.0	0.3	0.0	0.3	1.4	2.0
Opex	0.0	0.2	0.0	0.2	0.9	1.3
<b>Total</b>	<b>0.0</b>	<b>0.5</b>	<b>0.0</b>	<b>0.5</b>	<b>2.3</b>	<b>3.3</b>
Cumulative RTB* increase	0.1	0.1	0.1	0.1	0.1	0.4

\*RTB - run-the-business on-going opex



Figure 62 -

investment costs

Within ESO, there are systems or activities that are niche to our industry. As such we kept our cost estimates as they are based on historical costs.

### 9.6.8. Risks

Risks specific to this investment are listed below. Generic portfolio level risks and a description of the scoring method for likelihood and impact can be found in Appendix C of Annex 4 – Technology investment report.

Risk	Mitigation(s)	Likelihood	Impact
Evolution of energy technologies and consumer patterns are bigger than expected.	1. Monitor forecasting needs closely as the industry evolves in next few years and reprioritise investment plans if required.	2	1

### 9.6.9. Options

Option(s)	Pros	Cons
Do not invest in this area	•	<ul style="list-style-type: none"> <li>• Puts our capability to maintain grid system security at risk.</li> <li>• Puts our ability to exchange real time data with other parties at risk.</li> <li>• Increases cyber security risk.</li> </ul>
Invest in maintaining these tools	<ul style="list-style-type: none"> <li>• Addresses grid system security, real time data exchange and cyber security risks.</li> </ul>	•

## 9.7. 330 Digitalised code management

### Current stage:

Scoping	Start up	Requirements and design	Development and testing	Implementation
---------	----------	-------------------------	-------------------------	----------------

### 9.7.1. Overview

Investment to transform the stakeholder experience of the code management process through artificial intelligence enabled navigation, and document and workflow management tools.

### 9.7.2. Current state

ESO is responsible for administering the Grid Code, SO/TO code (STC) and Connection and Use of System Charging code (CUSC).

These codes, and their supporting documents, consist of thousands of pages of text and are perceived by stakeholders to be difficult to navigate and understand. In the future, the codes process will need to work for hundreds of participants rather than the tens the current process was devised for.

### 9.7.3. Case for change

#### Code Management User Journey



**By the end of RIIO-1, the code administration process is :**

Manual  
Designed for tens of participants  
Perceived to be too slow by stakeholders  
Difficult to navigate

**The codes:**

Consist of thousands of pages of text & supporting documents  
Are separate for T&D (Grid Code)

**IT Investment in ...**

- AI enabled guided navigation and search capability
- web based document workflow

**Will enable me in RIIO-2, as an external participant, to:**

Have easy access to information that I can trust	View a harmonised Transmission & Distribution Grid Code	See all the elements that are relevant to me
See which areas are subject to change, and receive targeted alerts.	Access FAQs that are relevant to me.	Be directed to the relevant sections when I register an asset (could have)

**Will enable me in RIIO-2, as an internal user, to:**

Operate the process with hundreds of participants	Make the digital version the legal document	Automatically publish changes when they are approved (and undo)
Find out which areas participants are interested in.	Have a secure system	Have full version control, access control, and signoff capability

Figure 63 - Use case, investment and outcome expectation

### 9.7.4. Roadmap

		Start up				Requirements and design				Development and testing				Implementation			
ID	Description	FY21	FY22	FY23	FY24	FY25	FY26										
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	H1	H2	H1	H2
330	Digitalised Code Management																
	Whole System Grid Code																
	Extension & enhancement																

Figure 64 - Delivery plan

### 9.7.5. Future state

This investment will digitalise and transform the external user experience through artificial intelligence enabled guided navigation and search capability, which will mean stakeholders are guided to the provisions that apply to them, based on their characteristics.

This will be provided for the whole system Grid Code and will be scalable to other codes in an agile phased manner. It will build on our investments in open data and digital engagement. We believe this investment will use a cloud infrastructure to make it easy to extend. The IT architecture build will take place in parallel with the restructuring of the codes.

The code modification process will also be enhanced by the provision of web-based document workflow, to make the change process more efficient and accessible to stakeholders.

This investment will support the digitalisation of the energy system, as recommended by the Energy Data Taskforce (EDTF).

### 9.7.6. Approach

We will build an enhanced code management hub using the digital engagement platform for customers, giving a consistent user experience and a set of APIs for business-to-business (B2B) integration.

Artificial intelligence will increase the level of automation and self-service. Natural language processing techniques will help participants (and ESO staff) search, interpret and better understand market codes with much less intervention.

### 9.7.7. Costs

Investment (£m)	2021/22	2022/23	2023/24	2024/25	2025/26	Total
Capex	0.0	0.0	0.3	0.8	0.5	1.6
Opex	0.0	0.0	0.2	0.5	0.3	1.0
<b>Total</b>	<b>0.0</b>	<b>0.0</b>	<b>0.5</b>	<b>1.3</b>	<b>0.8</b>	<b>2.6</b>
Cumulative RTB* increase	0.0	0.0	0.0	0.0	0.1	0.1

\*RTB - run-the-business on-going opex

Figure 65 - investment costs



Costs are at the high end of the Gartner benchmark due to the complexity of a whole system grid code which covers both transmission and distribution. A transmission only code would fall just below the centre of the range, due to synergies with IT investment 250 Digital engagement platform.

### 9.7.8. Risks

No specific risks have been associated to this investment. Generic portfolio level risks and a description of the scoring method for likelihood and impact can be found in Appendix C.

### 9.7.9. Options

Option(s)	Pros	Cons
Not invest in this area	•	<ul style="list-style-type: none"> <li>Does not enable the ambition to create a fully digitalised whole system Grid Code.</li> <li>Does not enable the digitalisation of the energy system.</li> <li>Does not provide a more user-friendly, tailored experience for customers.</li> <li>Does not increase the pace of decision making.</li> </ul>



Option(s)	Pros	Cons
		<ul style="list-style-type: none"> <li>• Process would remain manual.</li> <li>• New participants would continue to find it difficult to understand the Grid Code, potentially creating a barrier to entry.</li> <li>• Additional resource would be required to manage the process.</li> </ul>
Invest in new standalone tools	<ul style="list-style-type: none"> <li>• Enables the ambition to create a fully digitalised whole system Grid Code.</li> <li>• Provides a more user-friendly and tailored experience for customers.</li> <li>• Enables quicker decision-making.</li> <li>• Enables automation of processes</li> <li>• New participants would find it easier to understand the Grid Code, and a barrier to entry would be removed.</li> <li>• No need for additional resource to manage the process.</li> </ul>	<ul style="list-style-type: none"> <li>• Inconsistent user experience.</li> <li>• Lack of scalability.</li> <li>• Increased implementation cost due to lack of reuse of enabling technologies.</li> </ul>
Invest in new tools and integrate with digital engagement platform	<ul style="list-style-type: none"> <li>• Enables the ambition to create a fully digitalised whole system Grid Code.</li> <li>• Supports the digitalisation of the energy system, as recommended by the EDTF.</li> <li>• Provides a more user-friendly and tailored experience for customers.</li> <li>• Enables quicker decision-making.</li> <li>• Enables automation of processes.</li> <li>• New participants find it easier to understand the Grid Code, and a barrier to entry would be removed.</li> <li>• No need for additional resource to manage the process.</li> <li>• Enables high and consistent customer experience.</li> <li>• Allows for scalability of investment.</li> <li>• Reduced cost from reuse of enabling technologies.</li> </ul>	<ul style="list-style-type: none"> <li>•</li> </ul>

## 9.8. 350 Planning and outage data exchange

### Current stage:

Scoping	Start up	Requirements and design	Development and testing	Implementation
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#### 9.8.1. Overview

Enhancement of outage planning and data exchange systems to enable a whole system approach to access networks, manage significantly increased data volumes, and provide interactive stakeholder engagement.

#### 9.8.2. Current state

Exchange of outage planning data is currently handled by the Transmission Outage and Generator Availability (TOGA) system. Stakeholders have told us that manual processes are inconsistent, that communications are poor, and that the user experience could be enhanced. This feedback informs the scope of the TOGA replacement project, due to deliver in April 2020. We have developed specifications and begun agile delivery.

Submission of transmission and distribution system network data and models uses a system called External Data Exchange (EDE). This is designed for annual one-way submission of data to the ESO and will not be fit for purpose for the anticipated increase in data volumes and frequency of updates needed future coordination with DNOs. EDE will be due for replacement early in the RIIO-2 period and will need enhancements to cover other forms of customer data submission, implement process improvements and handle increasing data volumes.

At present, a lot of data validation is carried out manually. In RIIO-1 we have increased efficiency through automation of selected processes, and we will continue to build on this in RIIO-2.

#### 9.8.3. Case for change

### Planning & Outage Data Exchange



**By the end of RIIO-1, I manage outages...**

- With a new outage notification and planning tool to provide better service to customers.
- With manual data validation
- With systems designed to interact with a limited number of external stakeholders
- With DNO network data that is submitted to the ESO once a year.

**IT Investment in ...**

- More frequent exchange of network data with DNOs and TOs.
- DNO access to the outage planning tools.
- Outage Visualisation
- Tools to optimise system access in the long and short term.
- Machine learning for outage planning.
- CIM compliant outage data.
- Cloud based database which can interact with different tools
- Automated data validation

**will enable my outage management in RIIO-2 to ...**

Support 2 way data exchange of network & generation information with DNOs	Take better account of planned DNO network changes.	Have greater visibility of DNO outages that impact the transmission network (and vice versa)	Provide whole system stakeholder notifications of outages
Allow distributed parties to provide services to facilitate outages.	Give customers visibility of outages affecting them	Support short notice outage requests	Handle significantly increased types, volumes & frequency of data

Figure 66 - Use case, investment and outcome expectation

## 9.8.4. Roadmap

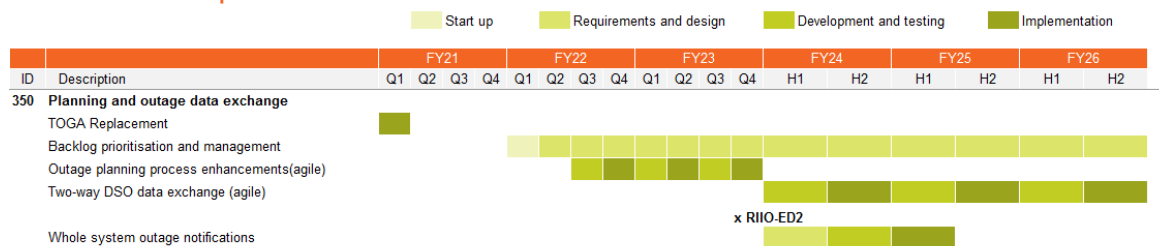


Figure 67 – Delivery plan

## 9.8.5. Future state

We expect a significant increase in the frequency, complexity and volumes of data exchanged between the ESO, DSOs and TOs as the need for whole electricity system coordination increases, and competition emerges in transmission. We will move from simply collecting winter peak data to exchanging data more frequently. We will need greater volumes of information about distributed energy resources, for example their capacity, location and type.

The way network data, regional models and outage planning data is exchanged will need to be transformed. The legacy methods of file transfer and faxing are not fit for the future and will be replaced with new flexible digital channels. Access to systems will be extended to a wider range of stakeholders with differing business models and needs.

To manage the greatly increased future workload, we will continue to build on the replacement for the TOGA system and further improve the outage planning process. Proposed enhancements in the RIIIO-2 period include:

- outage visualisation capability
- tools to optimise system access in the long and short term
- machine learning for outage planning
- implementation of common information model (CIM) compliant outage data.

We need to transform how we keep stakeholders informed of outages. We will introduce better digital communication with customers, stakeholders and the market, for example by using mobile apps, alerts, social media feeds and new digital enabler technologies. We will integrate with IT investment 250 Digital engagement platform to provide a seamless experience to customers and stakeholders.

The EDE system will be replaced with a system that can handle much greater volumes of data and more frequent updates. We will also enable two-way data exchange with DSOs, including full network models for their areas, and likely system flows. We will integrate our data exchange capabilities with IT investment 220 Data and analytics platform. This will provide a seamless exchange of data between tools.

Investing in this area aligns with the EDTF key finding around infrastructure and asset visibility, identifying system assets and infrastructure, where they are located and their capabilities, to inform system planning and management.

## 9.8.6. Approach

Building on the replacement TOGA system, we will develop new interchange services for other industry parties. These will support two-way exchange of data in formats suitable for a range of data flows.

These services will utilise the capabilities provided by the IT investment 250 Digital engagement platform. They will be developed to meet the needs of the RIIIO-2 programme and provide for the widest range of application and data integration styles. These will be used to exchange situational data with participants, DSOs, the TOs and Ofgem.

We will also build upon IT Investment 220 Data and analytics platform to enable an interchangeable suite of tools to utilise a common dataset. Artificial intelligence will be used to automate parts of the outage planning process, where appropriate.

As elsewhere, we will outsource much of the development and integration work to our partners, while building our in-house capabilities in data science, big data and artificial intelligence.

### 9.8.7. Costs

Investment (£m)	2021/22	2022/23	2023/24	2024/25	2025/26	Total
Capex	0.4	0.4	1.2	1.4	1.4	4.8
Opex	0.1	0.1	0.3	0.4	0.4	1.2
<b>Total</b>	<b>0.5</b>	<b>0.5</b>	<b>1.5</b>	<b>1.8</b>	<b>1.8</b>	<b>6.0</b>
Cumulative RTB* increase	0.0	0.0	0.0	0.1	0.1	0.2

\*RTB - run-the-business on-going opex



Figure 68 - investment costs

The costs are at the higher end of the Gartner range due to the need for continual enhancement to manage a significant increase in the frequency, complexity and volumes of data exchanged between the ESO, DSOs and TOs as the need for whole system coordination increases and competition emerges in transmission.

### 9.8.8. Risks

Risks specific to this investment are listed below. Generic portfolio level risks and a description of the scoring method for likelihood and impact can be found in Appendix C.

Risk	Mitigation(s)	Likelihood	Impact
Level of investment required in planning and outage data exchange will depend on the nature of the ESO / DSO relationship, which is still evolving.	<ul style="list-style-type: none"> <li>Engage closely with the business and monitor development of the whole system approach.</li> </ul>	2	1
Our working assumption is that the relationship will align least regrets with the coordinated and collaborative approach described by the future worlds 'world B'.			
Each DSO may have separate systems for logging outage plans, so there may be difficulties interfacing and sharing data.	<ul style="list-style-type: none"> <li>Work closely with DNOs in design phase to ensure common design standards. Share/promote use of the new TOGA.</li> </ul>	5	1

### 9.8.9. Options

Option(s)	Pros	Cons
Not invest in this area	<ul style="list-style-type: none"> <li>•</li> </ul>	<ul style="list-style-type: none"> <li>• Does not facilitate a whole system approach to outage planning.</li> <li>• Does not facilitate the ambition to work more closely with DNOs and DERs to facilitate network access.</li> <li>• Does not support infrastructure and asset visibility.</li> <li>• Leaves operational tools unsupported.</li> <li>• Increases cyber security risk.</li> <li>• Legacy models of data exchange will be unable to manage increased volumes of data.</li> </ul>
Invest in stand-alone tools.	<ul style="list-style-type: none"> <li>• Facilitates a whole system approach to outage planning.</li> <li>• Facilitates the ambition to work more closely with DNOs and DERs to facilitate network access.</li> <li>• Maintains reliability of operational tools.</li> <li>• Reduces cyber security risk.</li> <li>• Facilitates exchange of greatly increased volumes of data.</li> </ul>	<ul style="list-style-type: none"> <li>• Does not support infrastructure and asset visibility.</li> <li>• Tools would continue to operate with separate data sources, making dealing with an increasing workload more difficult.</li> <li>• Inconsistent user experience.</li> <li>• Lack of scalability.</li> <li>• Increased implementation cost due to lack of reuse of enabling technologies.</li> </ul>
Update tools and integrate with digital engagement platform and data & analytics platform	<ul style="list-style-type: none"> <li>• Supports infrastructure and asset visibility in line with the key findings of the EDTF.</li> <li>• Facilitates a whole system approach to outage planning.</li> <li>• Facilitates the ambition to work more closely with DNOs and DERs to facilitate network access.</li> <li>• Maintains reliability of operational tools.</li> <li>• Reduces cyber security risk.</li> <li>• Facilitates exchange of greatly increased volumes of data.</li> <li>• Modelling tools would operate with the same data sources, mitigating an increasing workload.</li> <li>• Enables high and consistent customer experience.</li> <li>• Allows for scalability of investment.</li> <li>• Reduced cost from reuse of enabling technologies.</li> </ul>	<ul style="list-style-type: none"> <li>•</li> </ul>

## 9.9. 360 Offline network modelling

### Current stage:

Scoping	Start up	Requirements and design	Development and testing	Implementation
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### 9.9.1. Overview

Transmission analysis is carried out from ten years ahead through to real-time and post event to help design and run the network as securely and economically as possible. The offline network modelling tools deliver the day-to-day analysis required to operate the transmission system in a safe and secure manner, as well as deliver the Electricity Ten Year Statement (ETYS) and ENTSO-E reporting

### 9.9.2. Current state

Offline network modelling currently uses tools and datasets for different purposes, including:

- Offline Transmission Analysis (OLTA): based around the Digsilent Powerfactory analysis tool.
- Offline Stability Analysis (OFSA): based around the Powertech analysis tool.
- Probabilistic Boundary Analysis Tool (PBAT): an experimental tool that could either be productionised or the capability included within one of the existing modelling tools.
- PSSE: an alternative transmission analysis package used for ENTSO-E reporting.
- BID3: used for NOA modelling (see IT investment 390 NOA enhancements).

The increasing complexity and frequency of analysis means continual investment is needed in the infrastructure and software to maintain and improve performance. Significant investment has been made in RIIO-1 to enhance the capabilities of the tools and this trend is anticipated to continue in RIIO-2.

A lot of data validation is carried out manually. In RIIO-1 we have increased efficiency through automation of selected processes, and we will continue to build on this in RIIO-2.

### 9.9.3. Case for change

#### Network Modelling



#### By the end of RIIO-1 I do my analysis ...

- Based on discrete and historical events
- For few specific scenarios
- Mostly considering transmission investment
- Not considering increasing system complexity
- Primarily for internal purposes
- Using different tools and datasets for different purposes

#### IT Investment in ...

- New and more complex modelling tools (for example, short circuit levels, virtual powerplants)
- Comparison tools for multi-scenario analysis
- Integration of economic analysis & network modelling.
- Regular asset health investment to handle greater data volumes and the increased performance needs of more complex modelling.
- Regular modelling tool upgrades to leverage international and GB best practice.
- User-developed models & algorithms
- Agile and iterative enhancements.
- Automation & simplification for efficiency & enablement. Machine learning for network modelling. Robotic process automation

#### will enable my analysis in RIIO-2 to ...

Deal with more complex models arising from new operability issues	Be run quickly for multiple scenarios	Understand the operating envelope at more time points	Use an interchangeable suite of tools on a common dataset, exchange data seamlessly between tools	Consider market & transmission investments
Adjust granularity of analysis dependent on need & timeframe	Model deeper into the DNO networks	Carry out probabilistic modelling	Support increased regional coordination (CACM/ENTSO-E/CORES0)	Enable external stakeholder access

Figure 69 - Use case, investment and outcome expectation

We will integrate IT investments 390 NOA enhancements and 360 Offline network modelling tools to give a suite of tools using a common dataset. This user journey covers both areas.

### 9.9.4. Roadmap

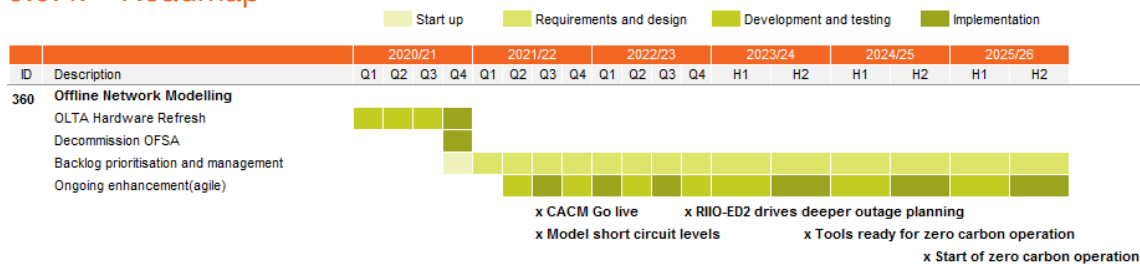


Figure 70 – Delivery plan

### 9.9.5. Future state

The offline network modelling tools will require enhancement throughout the RIIO-2 period to provide deeper outage planning and optimisation of transmission and distribution assets.

We plan to integrate our offline modelling tools with IT investment 220 Data and analytics platform. This will give an interchangeable suite of tools using a common dataset, and seamless exchange of data between tools, including the analysis tools described in IT investment 390 NOA enhancements. This will allow us to adjust the level of analysis as required.

Better performance will be needed to handle increased data volumes, more frequent modelling closer to real time and instant analysis of multiple scenarios. We will continue to invest in infrastructure and software upgrades to facilitate this. This will also allow us to use international best practice included in new releases.

We will use enhanced or new tools to allow more complex modelling arising from operability challenges (for example short circuit levels, virtual powerplants, probabilistic modelling, multi scenario analysis) and to support development of a regime for an integrated offshore grid. This will also include user-developed models and algorithms. We will continue to invest in automation and simplification for efficiency and data validation and will consider the use of machine learning to improve modelling. We will use an agile and iterative development approach where possible.

### 9.9.6. Approach

This investment line is related to NOA enhancements in network modelling and analysis.

We will follow a similar best of breed approach, combining commercial software and in-house developed analytic software using the same set of data science tools supplied by the data and analysis platform.

We will build upon IT Investment 220 Data and analytics platform to enable an interchangeable suite of tools to utilise a common dataset.

### 9.9.7. Costs



Investment (£m)	2021/22	2022/23	2023/24	2024/25	2025/26	Total
Capex	1.2	0.8	0.8	2.0	0.8	5.6
Opex	0.3	0.2	0.2	0.5	0.2	1.4
<b>Total</b>	<b>1.5</b>	<b>1.0</b>	<b>1.0</b>	<b>2.5</b>	<b>1.0</b>	<b>7.0</b>
Cumulative RTB* increase	0.0	0.0	0.1	0.1	0.2	0.3

\*RTB - run-the-business on-going opex

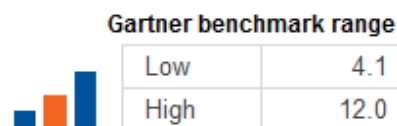


Figure 71 - investment costs

Expectations of costs for this investment line fall slightly below the centre of Gartner's range due to synergies with IT investment 220 Data and analytics platform.

### 9.9.8. Risks

Risks specific to this investment are listed below. Generic portfolio level risks and a description of the scoring method for likelihood and impact can be found in Appendix C.

Risk	Mitigation(s)	Likelihood	Impact
High level of uncertainty about how modelling tools will need to evolve in future due to changing needs and increased understanding of issues.	<ul style="list-style-type: none"> <li>Ensure regular review of requirements throughout RIIO-2 period.</li> <li>Deploy proof of concept tools as early as possible to gain understanding of modelling needs.</li> <li>Employ agile delivery principles and flexible, modular applications.</li> <li>Monitor international practice and engage with other network utilities.</li> </ul>	2	1
It is assumed that NGET will continue to use the OLTA system. If this changes, ESO running costs will increase.	<ul style="list-style-type: none"> <li>Engage with NGET on future plans.</li> </ul>	2	1
It is assumed that Scottish Power Transmission (SPT) will continue to use the Digsilent Powerfactory product. If this changes, interfacing costs may increase.	<ul style="list-style-type: none"> <li>Engage with SPT on future plans.</li> </ul>	2	1
It may prove difficult to achieve a common dataset for all modelling requirements. If so, costs may increase due to more complex implementation	<ul style="list-style-type: none"> <li>Understand data needs early in project life,</li> <li>Have data stewards and a data centric culture supported by data management tools in data and analytics platform</li> </ul>	3	1

Risk	Mitigation(s)	Likelihood	Impact
It may not be possible to achieve the appropriate balance of accuracy, complexity and commercial viability in respect of third party models.	<ul style="list-style-type: none"> <li>• Monitor international practice and engage with other network utilities.</li> <li>• Engage with other network utilities and network customers.</li> </ul>	3	1

### 9.9.9. Options

Option(s)	Pros	Cons
Not invest in this area	<ul style="list-style-type: none"> <li>•</li> </ul>	<ul style="list-style-type: none"> <li>• Puts at risk 2025 ambition to be able to operate a carbon free electricity system.</li> <li>• Does not enable modelling of the increasing complexity of the power system.</li> <li>• Modelling tools would continue to operate with separate data sources, making dealing with an increasing workload more difficult.</li> <li>• Leaves operational tools unsupported.</li> <li>• Increases cyber security risk.</li> </ul>
Invest in standalone tools.	<ul style="list-style-type: none"> <li>• Supports the 2025 ambition to be able to operate a carbon free electricity system.</li> <li>• Enables modelling of the increasing complexity of the power system.</li> <li>• Maintains reliability of operational tools.</li> <li>• Reduces cyber security risk.</li> </ul>	<ul style="list-style-type: none"> <li>• Modelling tools would continue to operate with separate data sources, making dealing with an increasing workload more difficult.</li> <li>• Does not enable holistic decision-making.</li> <li>• Does not enable adjustment of the level of analysis.</li> </ul>
Invest in tools and integrate with data & analytics platform	<ul style="list-style-type: none"> <li>• Supports the 2025 ambition to be able to operate a carbon free electricity system.</li> <li>• Enables modelling of the increasingly complex power system.</li> <li>• Maintains reliability of operational tools.</li> <li>• Reduces cyber security risk.</li> <li>• Modelling tools would operate with the same data sources, thus mitigating an increasing workload.</li> <li>• Enables holistic decision-making.</li> <li>• Enables adjustment of the level of analysis.</li> </ul>	<ul style="list-style-type: none"> <li>•</li> </ul>

## 9.10. 380 Connections platform

Ofgem/Atkins assessment	RAG/£m	Supplementary information
Justification for project	R	<ul style="list-style-type: none"> <li>Overview: Information added on how this will transform the user experience for customers</li> <li>Current state &amp; Case for change: Further information added on stakeholder support for our proposals.</li> </ul>
Project definition incl. timing, scale, & dependencies	R	<ul style="list-style-type: none"> <li>Future State: More clarity added on what will be delivered in the first 2 years.</li> <li>Roadmap updated based on revised delivery schedule.</li> <li>Approach: Initial architecture overview diagram and WBS added.</li> </ul>
Definition of required resources	A	<ul style="list-style-type: none"> <li>Approach: Parametric cost model and resource matrix added.</li> </ul>
Cost confidence	A	<ul style="list-style-type: none"> <li>n/a</li> </ul>
Requested capex Requested opex	£1.4m £1.0m	<ul style="list-style-type: none"> <li>No change</li> </ul>
Ofgem view of capex	£0m	

## Investment stage

Scoping	Start up	Requirements and design	Development and testing	Implementation
---------	----------	-------------------------	-------------------------	----------------

	<i>RIIO-2 December 2019 Business Plan stage</i>
	<i>Consultation response stage (or if same stage)</i>

## 9.10.1. Overview

We propose building a customer connections hub, providing a single point of contact for connections to electricity networks that will guide customers through the connection process. The hub will advise customers of capacity opportunities on both the distribution and transmission networks.

## Draft Determinations Update

We propose building a customer connections hub that will transform the connection journey and account management for all customers. The hub will provide a single point of contact for connections to electricity networks it will guide customers through the connection process, it will provide account management functionality and will help customers identify where capacity opportunities exist on both the distribution and transmission networks.

The changes in UK Government environmental targets have meant that over the last few years we have seen significant changes in the types of generation technology seeking connection to the electricity networks in GB. These changes have also brought many new participants to the energy market with experience in other markets and these developers require a different level of service than traditional industry participants.

The new technologies have allowed faster connections and greater volumes of smaller units, in many cases their project design and funding arrangements require developers to have increased day to day contact with

us and the network companies to understand more about connection progress and ongoing cost implications, this is often driven by more active funding regimes and increased focus on project risk.

Providing regular construction progress updates on a site by site basis and more dynamic cost reports for increasing volumes on connections requires a change in our existing account management functionality. Stakeholders and Customers have informed us that online availability of such information would provide more flexible access to the information they need.

To facilitate this, we propose building a customer connections hub, providing a single point of contact for connections to electricity networks that will guide customers through the connection process and provide online account management functionality for all live projects. The hub will enable customers to see regular updates on the progress of their applications to connect as well as information on those projects under construction, providing information directly from the relevant network companies to ensure regular and accurate information on build time and cost. The platform will also facilitate enduring contract management during the operational phase of the project as well as providing a source of information for customers who are researching opportunities for connection and wish to understand more about capacity opportunities on both the distribution and transmission networks.

The connections hub will transform the user experience for stakeholders. It will provide an electronic platform to take customers through the connections journey and will be the interface with us regarding the projects we are working on. It is planned to provide the following capabilities:

- Communications and online account management.
- Booking meetings with account managers.
- Online application form.
- Information portal about progress of applications.
- Ability for customers to see their portfolio and drill in to the detail of each project.
- Compliance process monitoring.
- Online question and answer capability.
- Integration with other network companies as required.
- Heatmaps of capacity and relevant connection path.

### 9.10.2. Current state

The process is carried out manually and is perceived as confusing by smaller parties that wish to connect.

#### **Draft Determinations Update**

The current processes for connection to the electricity networks do not benefit from any automation or online account management functionality. Experience from working with customers in both the transmission connected and DNO Embedded environments identified a need to research whether such a facility would provide a better service for customers. Throughout 2019 the ESO consulted customers and stakeholders to gather their views. Whilst some network owners felt this was not necessary, the feedback from customers was clear that they would benefit from this type of service.

### 9.10.3. Case for change

## Customer Connections User Journey



By the end of RIIO-1, the process

- Uses manual processes
- Only covers Transmission connections
- Is confusing to smaller players wishing to connect

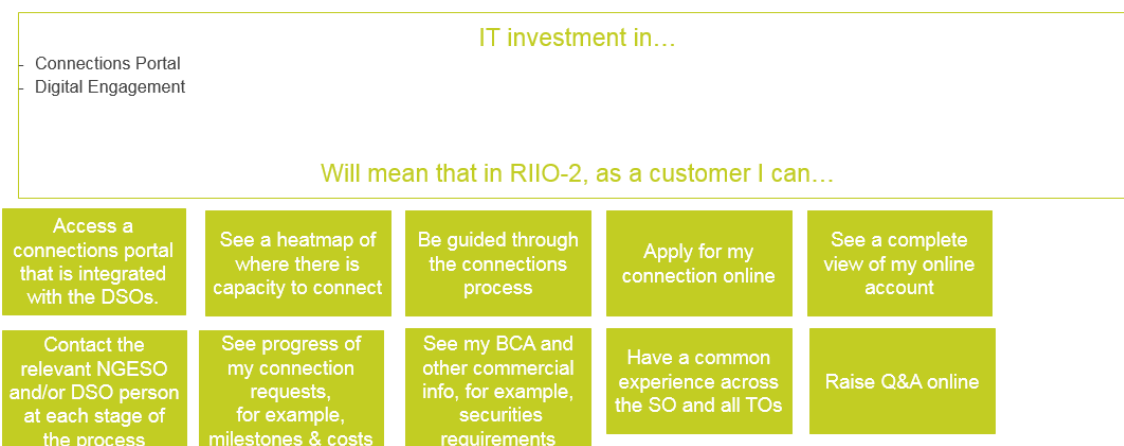


Figure 72 - Use case, investment and outcome expectation

### Draft determinations update

As a result of implementing the Connections platform, the connection process will run more smoothly and efficiently for customers. It will improve developer's understanding of the progress of their projects, this will improve the developer's risk profile. It will also speed up the journey through the connections process by making information visible to all the industry. It may help speed up transition to net zero by making the connections journey more transparent and easier to navigate.

Further information on stakeholder support for our proposals is summarised below:

We hosted round table sessions at our customer seminars to seek stakeholder views on our connections hub proposal (See our December 2019 Business Plan, activity A14.4) and how we should work together with TOs to deliver online portals in a coordinated way. Stakeholder views were:

- Customers were positive about our proposals and could see merit in the Great Britain connections landing page.
- The question was raised by three renewables customers at separate sessions as to why the TOs were building portals given that we are the contractual counterparty and whether we should be the only online interface with the customer ("a one stop shop"). Customers were keen that if we and the TOs are all building portals, they need to look and feel consistent, and be able to interface with each other.
- We also talked about what functionality customers would want from our portal/the connections hub landing page and we received suggestions including charging information, termination amounts, current contracts.
- Customers thought that when we start to build our portal, we could test functionality with a customer focus group and two generator customers offered to be part of such a group.

Generally, the stakeholders we engaged with on our connections hub proposals (including generators, DNOs, developers, smaller embedded customers) were supportive of moving the process to online. One generator fed back that the online connections portal was a nice to have and that if the connection experience is positive, they are not concerned if it is online. This was a minority view and we engaged with many stakeholders across a number of events.

### 9.10.4. Roadmap

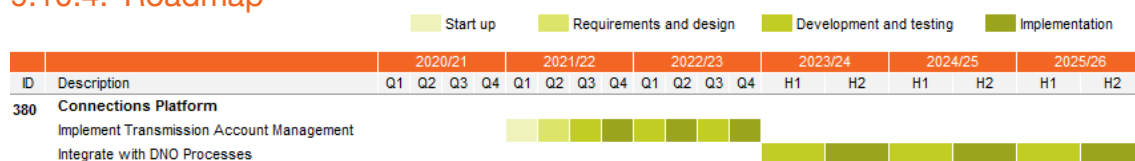


Figure 73 – Delivery plan

### Draft determinations update

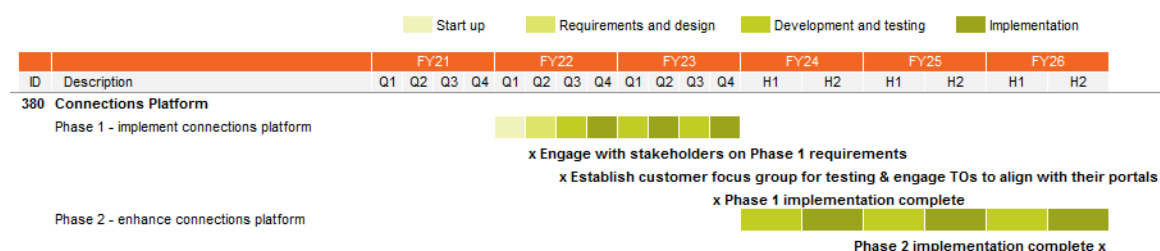


Figure 74 - Updated delivery plan

### 9.10.5. Future state

The hub will provide consistency in applying for connection across Great Britain, with standard data requirements, costs and technical requirements. Through RIIO-2 we will work with stakeholders to develop this tool so that it provides a one stop shop for all connection-related information, such as signed agreements, charges, and operational notifications. It will be fully integrated with our digital engagement and customer relationship management tools to provide a seamless experience to customers and stakeholders.

We will work collaboratively with TOs to create a consistent and transparent solution, reusing what we can.

We propose building this incrementally, between 2021/22 and 2022/23. Initially, it will provide a central repository of information about the connections process and in time give customers information on available capacity at each grid supply point (GSP). This will take the form of a heatmap indicating where there is capacity. It could be extended to show the need for balancing services.

The hub will also allow customers to access their account information online, access information about their connection agreements, and track the progress of their connections.

From 2023/24, we will also add the capability to integrate with other network organisations' websites and tools.

Investing in this also aligns with the EDTF key finding in the area of infrastructure and asset visibility, identifying the location of system assets and infrastructure and their capabilities, to inform system planning and management.

### Draft determinations update

We plan to deliver the connections hub in an agile incremental manner. However, to provide clarity on what we intend to deliver in the first 2 years of RIIO-2, we have divided the investment in to two phases.

Phase 1 of the connection hub will complete in Q4 2022/23, enabling Transmission customers to view and manage their connection contracts online and providing central point for the GB connections process; The

functionality planned to be delivered in Phase 1, subject to further stakeholder engagement on scope, includes:

- Ability to book meetings with account managers.
- Online application form and explanation of fees process.
- Ability to track the progress of an application through the process.
- Ability to view a portfolio of projects and apply for modification applications.
- Compliance process monitoring.
- In addition, we will consider interfacing requirements as the TOs develop their own customer portals.

In parallel with Phase 1 we will hold initial discussions with DNOs on our proposals and how we might need to collaborate in the ED-2 period to integrate systems as required.

Phase 2 of the connection hub will complete in Q4 2025/26, helping customers to navigate and providing a seamless connection process to transmission and distribution electricity networks across GB. The functionality planned to be delivered in Phase 2 subject to further stakeholder engagement on scope, includes:

- Integration with other network company customer portals as required, providing guidance on where to connect across GB.
- Heatmaps – indicating capacity and relevant connection path.
- Incremental enhancements to the user experience as required.

#### 9.10.6. Approach

We will build a new connections hub utilising IT investment 250 Digital engagement platform, providing a single user experience. The connections platform will provide a consistent set of Application Programming Interfaces (APIs), allowing customers to integrate with their own internal processes.

The connections platform will be based on a master connections database built on the IT investment 220 Data and analytics platform.

Artificial intelligence will increase the level of automation and self-service. Natural language processing techniques will help participants interpret and understand the various connection specification standards without intervention.

We anticipate that the connections platform will be primarily cloud-based, inherited from the underlying platforms.

#### **Draft determinations update**

##### **Architecture**

Our initial view of the capability architecture of the connections platform is depicted below, recognising that the services we deliver on the platform will evolve over the RII0-2 period. We have also assumed that data exchange between DSOs and TOs will be handled via our integration with the data platform.



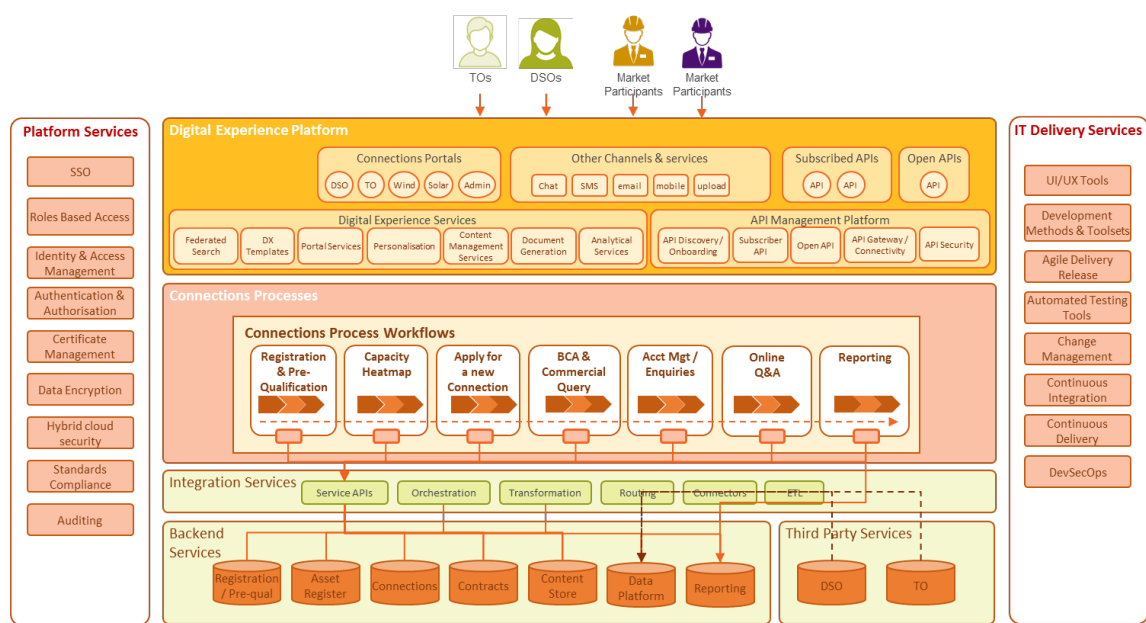


Figure 75 - Connections platform reference architecture

### Work Breakdown Structure

The Sprint Zero activities will confirm the work breakdown structure (WBS) depending on the chosen solution and delivery approach, however initial thoughts on the WBS for an agile delivery are included below.

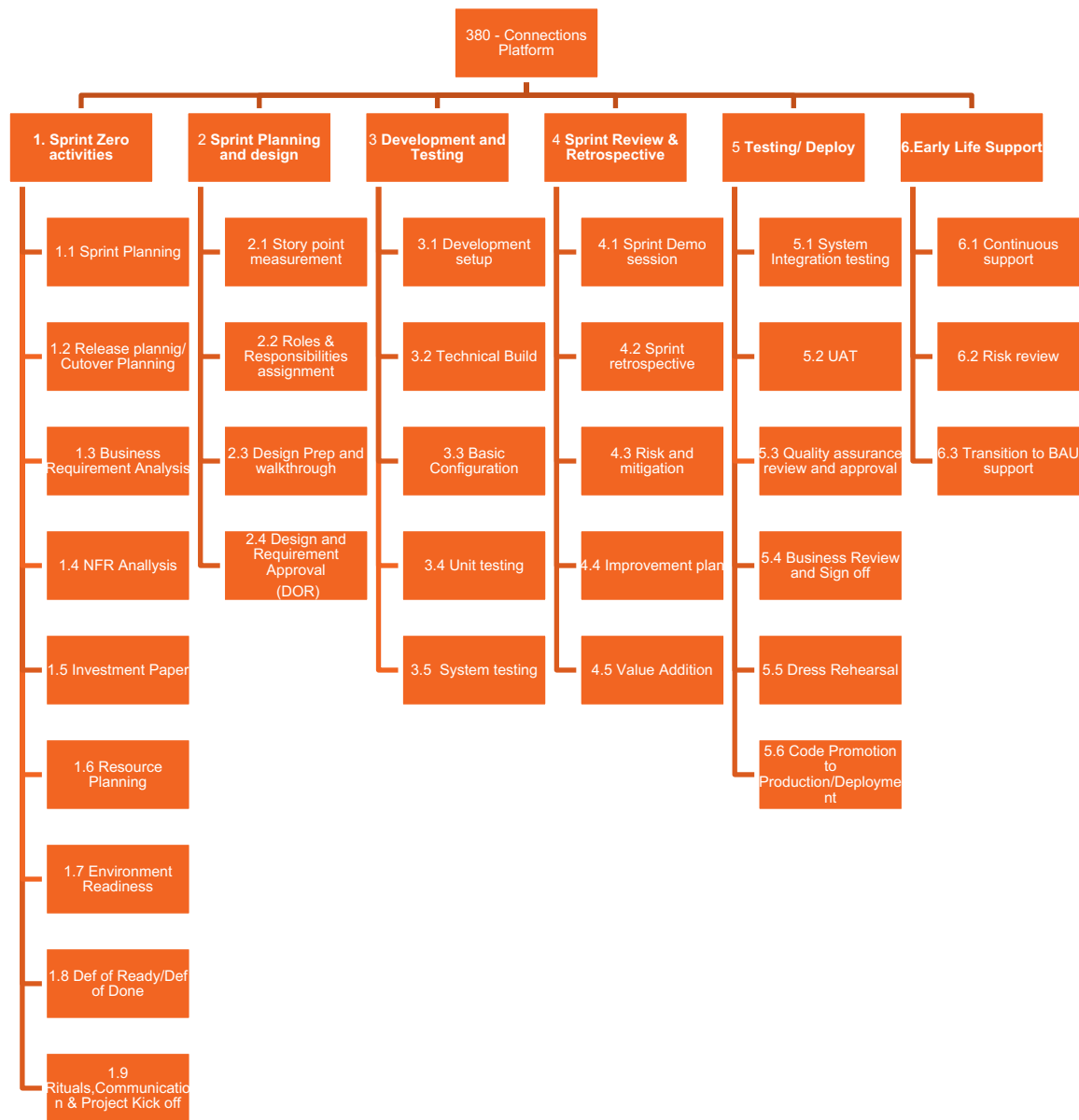


Figure 76 - Work breakdown structure

## Resource plan

Sprint zero activities will confirm the resource requirements depending on the chosen solution and delivery approach, however initial thoughts on the resource requirements are included below.

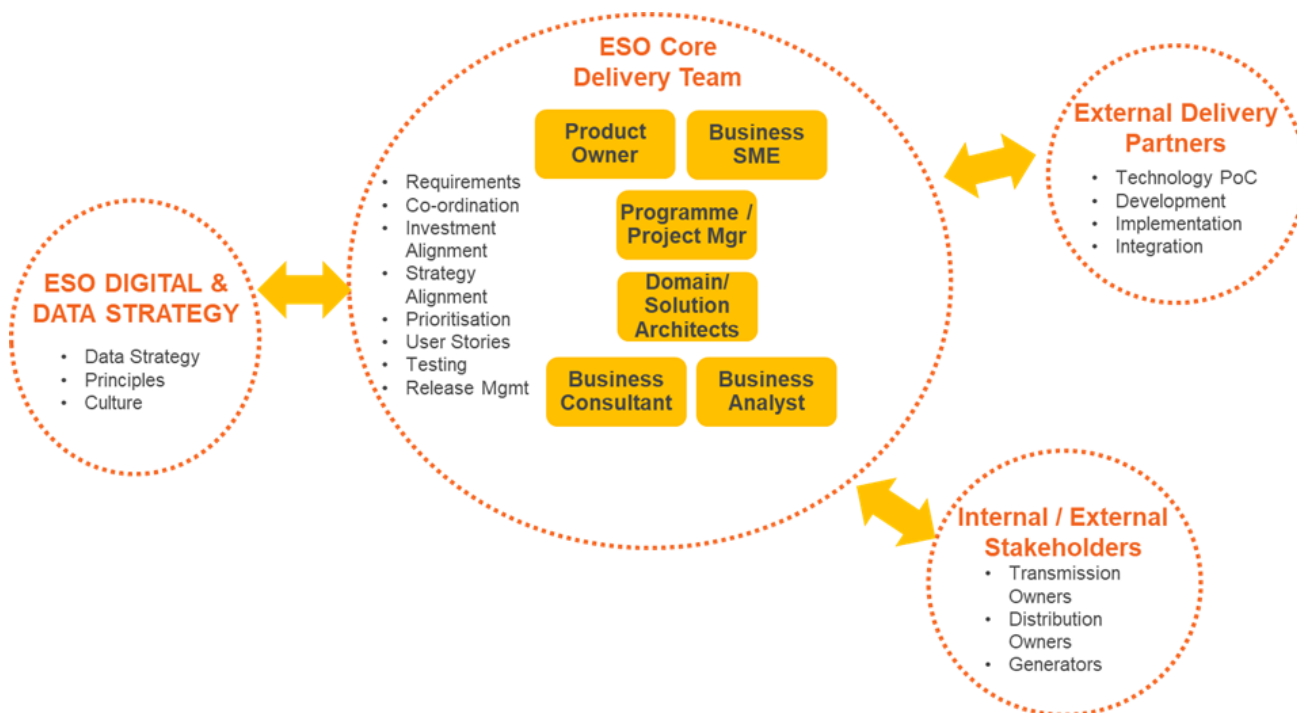


Figure 77 - Resource plan

Task	Resource type												
	Sponsor	Product Mgr. / Owners	Business SMEs	Business Consultant	Programme Manager	Scrum Master	Solution Architect	Business Analyst	Developer	System integration	Testing	Service Transition	Security / Compliance
1 Sprint Zero activities													
1.1 Sprint Planning		L	L			L							
1.2 Release planning/ Cutover Planning						L	L				L	L	L
1.3 Business Requirement Analysis		L	M	L		L		L					
1.4 NFR Analysis			L	L		L	L					L	L
1.5 Investment paper	L	L	L	L	L			L					
1.6 Resource Planning		L	L		L	L							
1.7 Environment Readiness					L		L				L		
1.8 Def of Ready/Def of Done		L	L		L	L							
1.9 Rituals, Communication & Kick off		L	L		L	L	L	L	L				

Task	Resource type												
	Sponsor	Product Mgr. / Owners	Business SMEs	Business Consultant	Programme Manager	Scrum Master	Solution Architect	Business Analyst	Developer	System integration	Testing	Service Transition	Security / Compliance
2 Sprint Planning and design													
2.1 Story point measurement						L							
2.2 Roles & Responsibilities assignment	L	L			L	L							
2.3 Design Prep and walkthrough		L	L			L	L	L	L	L			
2.4 Design and Requirement Approval		L	L			L	L	L	L	L			
3 Development and Testing													
3.1 Development setup											L		
3.2 Technical Build							L	L	M	L			L
3.3 Basic Configuration							L	L	M	M			L
3.4 Unit testing							L	L	M	L	M		L
3.5 System testing			M				L	L	M	L	M		L
4 Sprint Review & Retrospective													
4.1 Sprint Demo session		L	L	L		L	L	L	L	L			L
4.2 Sprint retrospective		L				L							
4.3 Risk and mitigation		L			L	L							L
4.4 Improvement plan		L			L	L							
4.5 Value Addition		L				L							
5 Testing/ Deploy													
5.1 System Integration testing										L	M		
5.2 UAT		L	M								M		
5.3 Quality assurance review and approval		L	L										
5.4 Business Review and Sign off	L	L	L										
5.5 Dress Rehearsal							L	L	L	L		L	
5.6 Code Promotion to Production/Deployment							L	L	L	L		L	
6 Early Life Support													
6.1 Continuous support							L	L	L	L		L	

Task	Resource type												
	Sponsor	Product Mgr. / Owners	Business SMEs	Business Consultant	Programme Manager	Scrum Master	Solution Architect	Business Analyst	Developer	System integration	Testing	Service Transition	Security / Compliance
6.2 Risk review					L	L	L	L	L	L		L	L
6.3 Transition to BAU support					L	L	L	L	L	L		L	

Low, medium, and high define the expected volume of resource relative to others for this activity.

	Highly specialised or difficult to source resources. Would require new frameworks or mitigation plans.
	Channels available but resources are hard to source, channels not currently available or market-wide constraints
	Established resource available or channels available to recruit,

### 9.10.7. Dependencies

Included below is a view of investments which have interactions with the Connections Platform. In practice, many of these will run in parallel rather than consecutively as the chart could imply. It is intended to show the interconnected nature of the investments rather than a time bound roadmap.

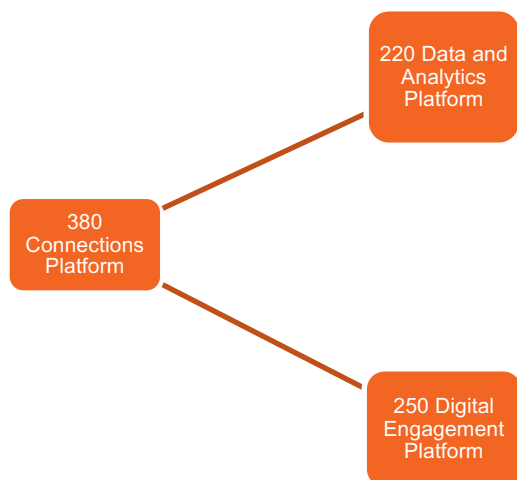


Figure 78 - Dependencies

### 9.10.8. Costs

Investment (£m)	2021/22	2022/23	2023/24	2024/25	2025/26	Total
Capex	0.7	0.7	0.2	0.1	0.1	1.8
Opex	0.5	0.5	0.1	0.1	0.1	1.2
<b>Total</b>	<b>1.2</b>	<b>1.2</b>	<b>0.3</b>	<b>0.2</b>	<b>0.2</b>	<b>3.0</b>
Cumulative RTB* increase	0.0	0.1	0.1	0.1	0.1	0.4

\*RTB - run-the-business on-going opex



Figure 79 - investment costs

Expectations of costs for this investment line fall slightly below the centre of Gartner's range due to synergies with IT investment 250 Digital engagement platform.

## Draft determinations update

A further breakdown of the costs based on our parametric model is shown below.

380 Connections platform		TotEx £m GBP						
		Tl risk						
		FY21	FY22	FY23	FY24	FY25	FY26	Total
Total	3.0		1.20	1.20	0.30	0.15	0.15	3.00
Resource (Scoping, training)		10%	-	0.12	0.12	0.03	0.02	0.30
Resource (Dev., testing)		15%	-	0.18	0.18	0.05	0.02	0.45
Software		20%	-	0.24	0.24	0.06	0.03	0.60
Hardware		10%	-	0.12	0.12	0.03	0.02	0.30
Consulting		0%	-	-	-	-	-	-
Supplier		35%	-	0.42	0.42	0.11	0.05	1.05
Cyber		10%	-	0.12	0.12	0.03	0.02	0.30
Contingency		0%	-	-	-	-	-	-
Total	3.0		-	1.2	1.2	0.3	0.2	3.0

Figure 80 - parametric cost model

### 9.10.9. Risks

Risks specific to this investment are listed below. Generic portfolio level risks and a description of the scoring method for likelihood and impact can be found in our December 2019 Business Plan, Annex 4 - Technology investment report, Appendix C.

Risk	Mitigation(s)	Likelihood	Impact
That there are many industry initiatives seeking to develop portals simultaneously and that this is an inefficient and uncoordinated approach (e.g. EDTF, BEIS code governance reform review, BEIS/Ofgem work on smart systems and flexibility). This may mean a delay to something being built for the whole industry plus potentially confusing and substandard product due to lack of coordination.	<ul style="list-style-type: none"> <li>We will work collaboratively with TOs to create a consistent and transparent solution, reusing what we can.</li> <li>Engage with industry via customer seminars.</li> </ul>	3	1

### 9.10.10. Options

Option(s)	Pros	Cons
Not invest in this area		<ul style="list-style-type: none"> <li>Does not enable the ambition to transform the connections process.</li> <li>Does not enable the digitalisation of the energy system.</li> <li>Does not provide a more user-friendly, inclusive and tailored experience for customers.</li> <li>Does not enable achievement of efficiencies in the pace of decision making.</li> <li>Process would remain manual and require additional resources.</li> <li>New participants would continue to find it difficult to connect, driving up workload and potentially creating a barrier to entry.</li> </ul>



Option(s)	Pros	Cons
		<ul style="list-style-type: none"> <li>Does not support infrastructure and asset visibility.</li> </ul>
Invest in new stand-alone tools	<ul style="list-style-type: none"> <li>Enables the ambition to transform the connections process.</li> <li>Supports the digitalisation of the energy system, as recommended by the EDTF.</li> <li>Provides a more user-friendly and tailored experience for customers.</li> <li>Enables efficiencies in the pace of decision-making.</li> <li>Enables automation of processes.</li> <li>New participants would find it easier to connect and a barrier to entry would be removed.</li> <li>Need for additional resource to manage the process would be mitigated.</li> <li>Supports infrastructure and asset visibility.</li> </ul>	<ul style="list-style-type: none"> <li>Inconsistent user experience.</li> <li>Lack of scalability.</li> <li>Increased implementation cost due to lack of reuse of enabling technologies.</li> </ul>
Invest in new tools and integrate with digital engagement platform	<ul style="list-style-type: none"> <li>Enables the ambition to transform the connections process.</li> <li>Supports the digitalisation of the energy system, as recommended by the EDTF.</li> <li>Provides a more user-friendly and tailored experience for customers.</li> <li>Enables efficiencies in the pace of decision-making.</li> <li>Enables automation of processes</li> <li>New participants would find it easier to connect and a barrier to entry would be removed.</li> <li>Need for additional resource to manage the process would be mitigated.</li> <li>Enables high and consistent customer experience.</li> <li>Allows for scalability of investment.</li> <li>Reduced cost from reuse of enabling technologies.</li> </ul>	

Option(s)	Pros	Cons
	<ul style="list-style-type: none"> <li>• Supports infrastructure and asset visibility in line with the key findings of the EDTF.</li> </ul>	

## 9.11. 400 Single markets platform

Ofgem/Atkins assessment	RAG/£m	Supplementary information
Justification for project	G	<ul style="list-style-type: none"> <li>n/a</li> </ul>
Project definition incl. timing, scale, & dependencies	A	<ul style="list-style-type: none"> <li>Included architectural approach.</li> <li>Expanded roadmap and included WBS.</li> <li>Included more detailed delivery plan.</li> <li>Included dependencies to other strategic initiatives.</li> </ul>
Definition of required resources	A	<ul style="list-style-type: none"> <li>Included more detailed breakdown of resources aligned to WBS.</li> </ul>
Cost confidence	A	<ul style="list-style-type: none"> <li>Included further details of costs breakdown.</li> </ul>
Requested capex Requested opex	£6.2m £4.2m	<ul style="list-style-type: none"> <li>No change.</li> </ul>
Benchmark capex	£4.7m	

### Current stage:

Scoping	Start up	Requirements and design	Development and testing	Implementation
---------	----------	-------------------------	-------------------------	----------------

#### 9.11.1. Overview

The single markets platform will provide a single route for providers to participate in our market and a full end-to-end customer journey allowing market participants to access the data relating to: how to become a provider (obligations, sign up, test, application progression), contract tender (see contracts status and manage contracts), unit management (see what units are registered for, see and change aggregation configurations), dispatch (access instructions), performance monitoring (see how units behaved under instructions), payment. This will include all ancillary service products plus EMR and CfD.

This investment includes a market sandbox to enable faster and more efficient trial of new products through the ability to integrate with the core systems.

#### 9.11.2. Current state

When a new market, or substantial changes to existing markets, are required, we need to change many production systems. These are usually hard to change, translating into costly and time-consuming exercises.

We also have different systems to manage diverse types of participants, i.e. BMUs or non-BMUs.

Smaller distribution-connected providers are currently managed using a variety of legacy systems. We will replace these in the RIIO-1 period with a new Ancillary Service Dispatch Platform (ASDP) system under the Platform for Ancillary Services (PAS) programme. This is designed to be adaptable to new provider types and services.

#### 9.11.3. Case for change

To make our markets work, we must be sure customers can access all the data they need in a convenient way. Given the expected overlaps and interactions between products at transmission and distribution level, having one place to view and manage all market related data is crucial.

With the removal of barriers to entry, new business models, configurations and technologies have started to develop. These in turn bring opportunities and challenges at operational level. We need to capitalise on the opportunities by trialling new ways of managing system balancing needs whilst ensuring we meet security operational needs. We need to have realistic testing capabilities, where market participants can connect and send test data to, validating individual and industry benefits under development conditions.

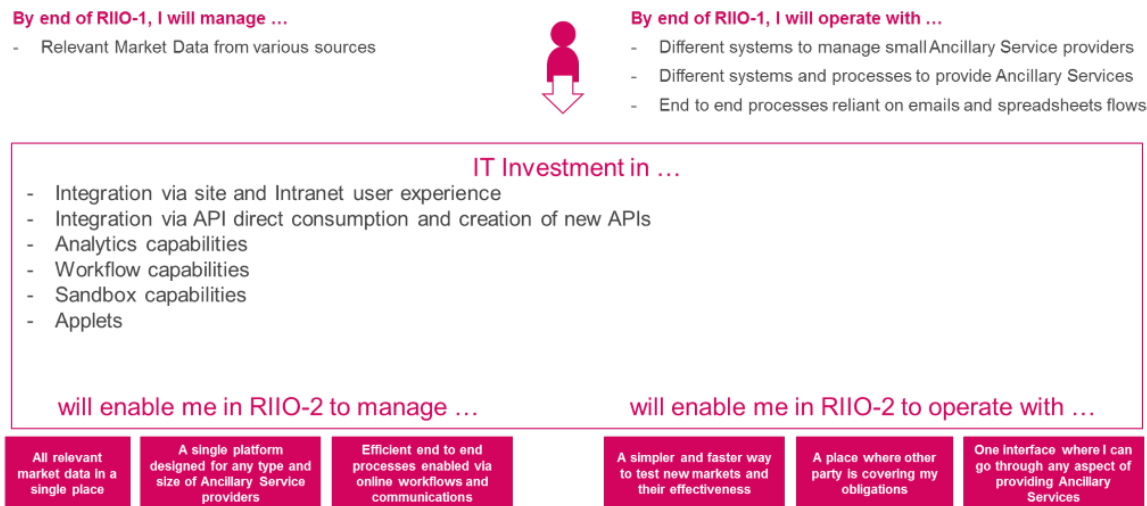


Figure 81 - Use case, investment and outcome expectation

#### 9.11.4. Roadmap

The platform will be based on an asset registry which identifies all characteristics of each unique asset on the transmission or distribution system. This will enable market participants to check their status in the various markets and make appropriate business and investment decisions.

During the first years of RIIO-2, we will create the workflow capabilities for the identified user experience. We will also make the required data available. We will evolve the PAS Customer Relationship Manager (CRM) capabilities in a modular fashion, starting with one product then adding markets in line with stakeholder and operational priorities.

As the single markets platform develops, we will add relevant products and services (existing or new) until all products are accessible, end-to-end.

#### Draft determinations update

The roadmap set out our plans for the sequence of delivering a single market platform for all our services. We have already embarked on this journey implementing some standardisation to our service suite and began our weekly Frequency Response Auction Trial.

The program will follow a phased approach. As the capabilities composing the single market platform are delivered the reformed services will be migrated over. Until we achieve a full migration where all markets and services are using the single market platform.

An outline of our delivery milestones to 2023/24 is shown in the roadmap below:

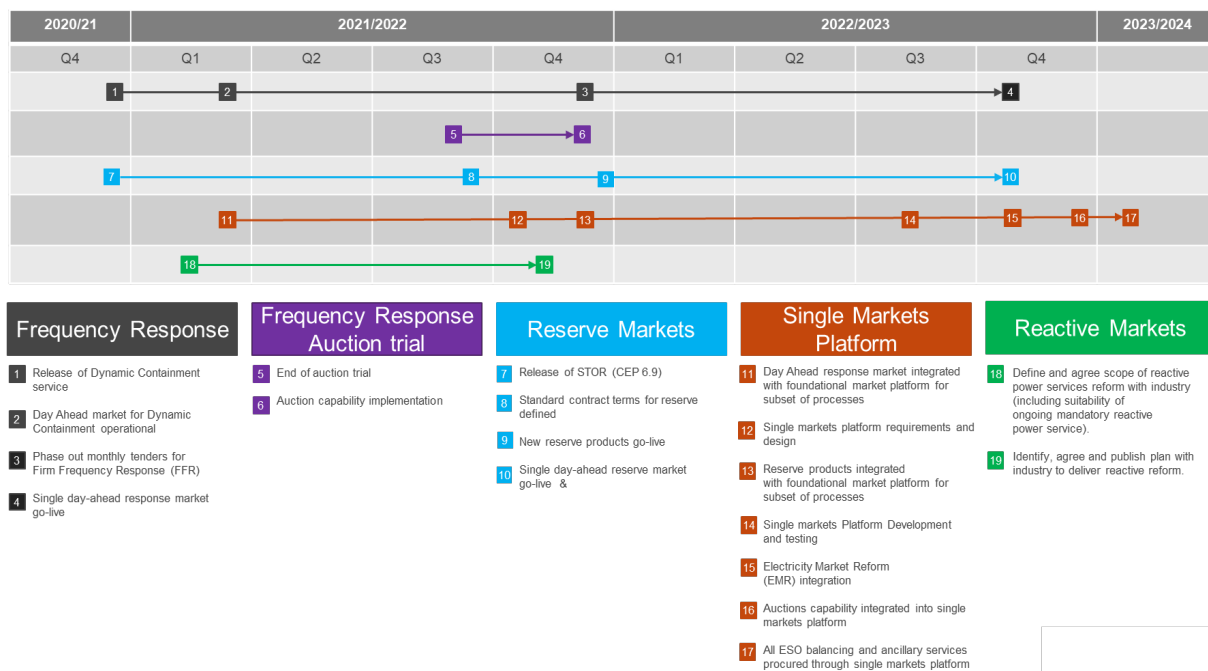


Figure 82 - Single markets platform roadmap

Note: The milestones documented in this plan are subject to change. For 2020/21, the regularly updated Forward Plan Tracker, or its equivalent in RIIO-2, should be considered the master document.

A detailed view of the delivery plan is shown below.

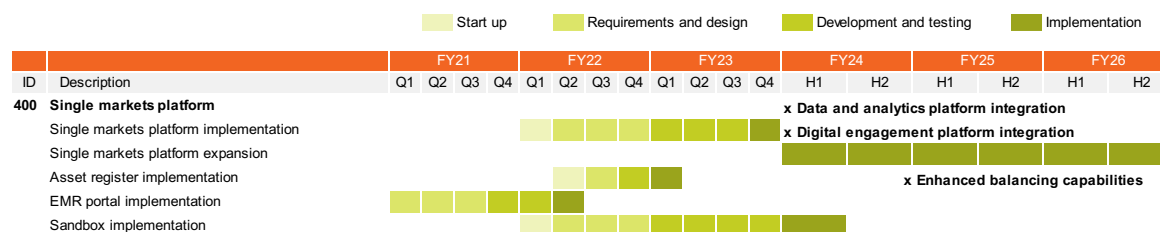


Figure 83 - Delivery plan

## Draft determinations update

An updated, more detailed view of the delivery plan is shown below.



Figure 84 - Revised delivery plan

### 9.11.5. Future state

The single markets platform will be a one stop shop for participation in our markets, integrating with the data and analytics platform, providing access to both historical and forecast data and supporting investment cases and decision-making. The single markets platform will enable providers to use the same portal to sign up for all their products registration, pre- qualification, procurement, contract management, and reporting dashboards. It will use our enhanced balancing capabilities, including ancillary services dispatch functionalities, and settlement systems. It will also receive and utilise data from DSOs markets when live, allowing clarity on which assets are running in which markets. This will provide a seamless user experience across all markets. Participants will be able to manage their portfolio and have a comprehensive end-to-end view of the whole participation process.

Having the single markets platform will also mean fewer human errors and increased data security.

The investment in a market sandbox will allow us to test new products and services, reducing the time and cost to deploy them into market whilst ensuring they meet both commercial and operational needs. Effectiveness of this model will also depend on the maturity of our balancing and settlements capabilities, increasing as they become more flexible and capable of coping with the pace of change.

### 9.11.6. Approach

We will implement the single markets platform progressively using solution components and platforms provided by RIIO-1 and other RIIO-2 investments. It will deliver our services to participants from a single location, while greatly increasing the level of automation to meet the much higher demand expected during RIIO-2. From the participants' viewpoint, the single markets platform will provide a higher degree of self-service and B2B access (for automation with their own systems).

We will automate market participant processes to meet the increased volume and types of participants, using Salesforce CRM as the main foundation for participant processes. These processes will give a much higher degree of self-service and B2B API access using the digital engagement platform. Artificial intelligence will increase the level of automation and self-service. We will draw on external partners for these implementations.

The single markets platform will be primarily cloud-based, inherited from the underlying platforms.

Implementation of single markets platform will feature industry consultation up front to get the presentation of services right and industry proving/pre-live trials to ensure smooth transitions to live. It is expected that much of the development and integration will be outsourced to our integration partners.

#### **Draft determinations update**

##### Single markets platform architecture

The architecture of our single markets platform will leverage a number of capabilities to deliver a seamless end to end user journey for market participants. The core elements of these include:

- 250 Digital engagement platform to deliver a suite of portal services, personalisation and templated user journeys.
- An API management platform that will be used to integrate modular backend systems and to publish subscribed and open APIs for use by our stakeholders.
- A core suite of adaptable but generic process workflows which will be used by all market participants to interact with the products and services they use (such as pre-qualification and registration, auctions, contracts and account management and reporting).
- These core services will integrate with our response and reserve, reactive and EMR (CM and CfD) services.
- A suite of underlying capabilities that will be used to deliver our service offerings, including for instance business process management, content management and integration services to orchestrate business processes.
- Using our investment 220 Data and analytics platform to provide data visualisation, analytics and reporting capabilities for historical and forecast data to support investment cases and decision-making.
- Integrating with our investment 420 Auctions capability, which will deliver day ahead/weekly auctions for response and reserve services. We will look to harmonise our auctions capability across these services to ensure a consistent experience across product and service offerings.

In short, the single markets platform will bring together a number of capabilities to deliver a seamless user experience for our customers and stakeholders across a range of market services. The capabilities reference architecture below depicts the core and product specific services that will form the basis for the single markets platform.

#### **Architecture**

Our initial view of the capability architecture of the single markets platform is depicted below, recognising that the services will deliver on the platform will evolve over the RIIO-2 period.



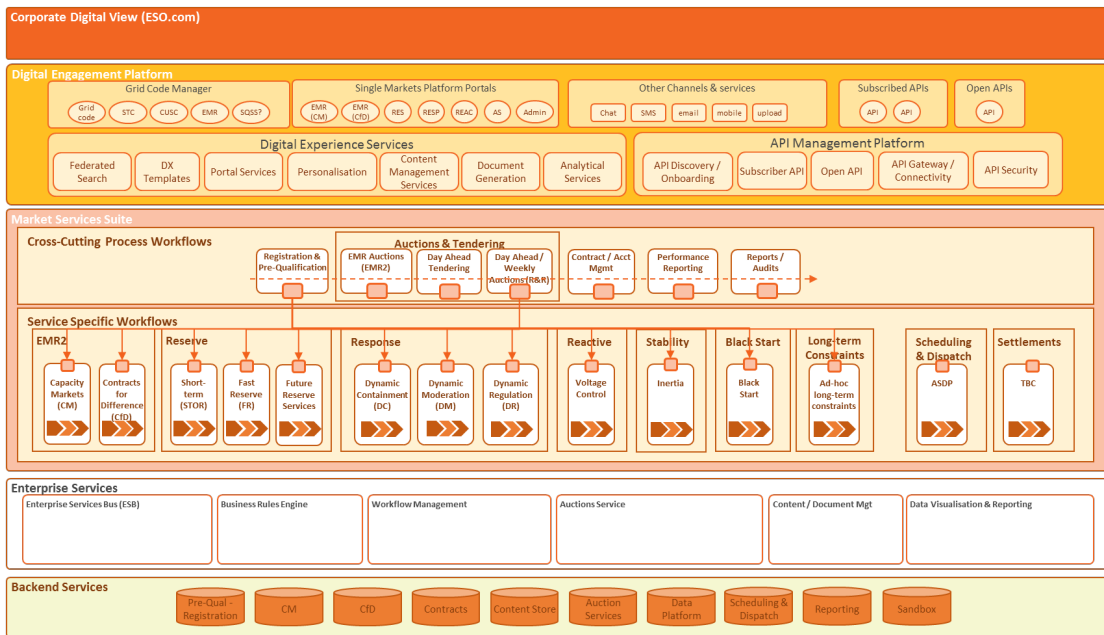


Figure 85 - Single markets platform capability architecture

## Work Breakdown Structure (WBS)

Our work breakdown structure incorporates delivery of the asset register, the foundational capabilities of the single markets platform, extensions of the platform to incorporate new reformed response and reserve services and integration of existing services such as the EMR portal into the platform. It also covers the delivery of the sandbox capability delivery. Our regulatory driven changes are covered separately in 270 EU regulation and 280 GB regulation.



Figure 86 - Work breakdown structure

The migration / integration of the reformed services into the single markets platform will be delivered in line with the business delivery schedule but are not explicitly shown in the WBS as the timing of the migrations are approximate at this stage.

### Draft determinations update

### Resource plan

Platform delivery for each underline module will for the most part be carried out by external partners interfacing into a core ESO project team co-ordinating and prioritising the backlog of requirements developed with stakeholders and with dependant investment streams.

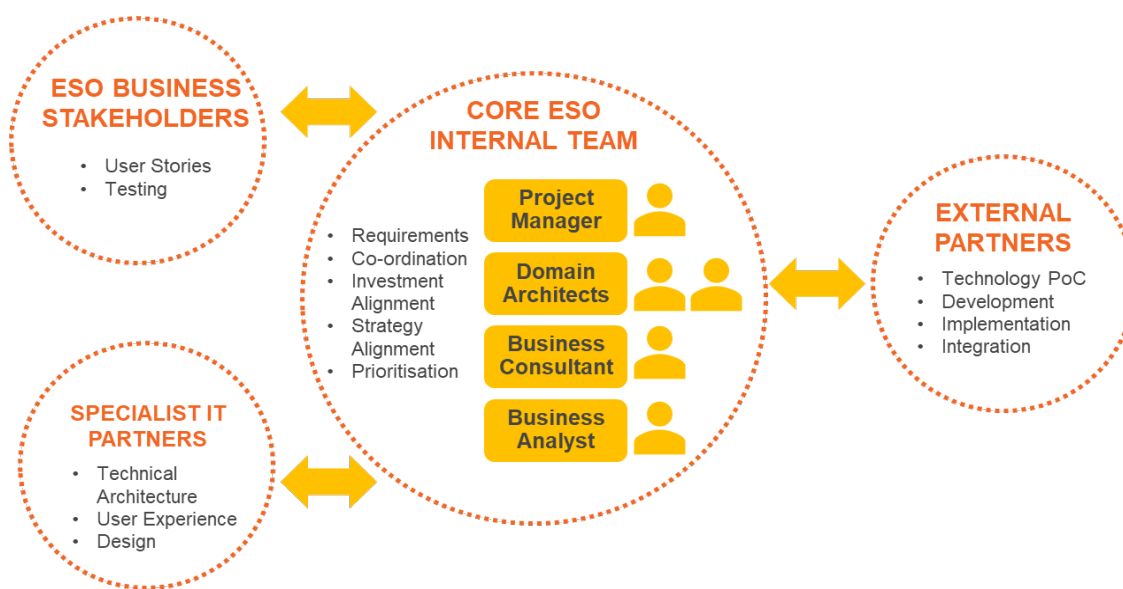


Figure 87 - Resource plan

A more detailed view of resourcing is shown in the table below.

Task	Resource Type											
	Programme Mgr.	Product Owner	PM / Scrum Master	Business Analyst	Enterprise/solution Architect	Business SMEs	IT SMEs	Integration Partner	Specialist IT Partner	Testers	Service Transition	Procurement SME
<b>Single markets platform</b>												
<b>1. Confirm SMP capabilities</b>												
1.1 Stakeholder engagement feedback	L	L	L	M	L	M	L	-	-	-	-	-
1.2 Validate Vision & capabilities for SMP	L	H	M	M	H	M	M	L	-	-	-	-
1.3 Create E2E stakeholder user journeys	L	M	M	M	M	M	M	M	M	-	L	-
1.4 Create Solution Vision	L	M	M	M	M	M	M	M	M	L	L	L
1.5 Select SMP platform components	M	M	M	M	H	M	M	M	M	-	M	H

Task	Resource Type											
	Programme Mgr.	Product Owner	PM / Scrum Master	Business Analyst	Enterprise/solution Architect	Business SMEs	IT SMEs	Integration Partner	Specialist IT Partner	Testers	Service Transition	Procurement SME
1.6 Develop detailed architecture	L	M	M	H	H	M	M	M	M	L	M	-
1.7 Create detailed integrated delivery & release plan	M	M	M	M	M	M	M	M	L	M	L	L
1.8 Confirm commercials	M	L	M	L	M	L	L	L	L	L	L	H
<b>2. Delivery SMP Foundation &amp; First Use Case</b>												
2.1 Develop Foundation stage EPIC and sprint plan	M	H	M	M	M	M	M	M	M	L	L	-
2.2 Develop product backlog	M	M	H	M	M	M	M	M	M	L	L	-
2.3 Develop user stories for use case 1	L	H	M	M	M	M	M	L	M	L	L	-
2.4 Develop service design	L	L	M	M	M	M	M	L	L	L	H	-
2.5 Deliver foundational infrastructure	L	L	M	L	M	-	M	H	H	L	L	L
2.6 Deliver foundational software configuration & development	L	L	M	L	M	-	M	H	H	L	L	L
2.7 Integrate with digital engagement platform	L	L	M	M	M	L	M	H	H	M	L	L
2.8 Integrate with Auctions capability	L	L	M	M	M	L	M	H	H	M	L	L
2.9 Integrate with data platform & build foundation reporting	L	L	M	M	M	L	M	H	H	M	L	L
2.10 Integrate with CSOC	L	L	M	L	H	L	M	M	M	M	L	L
2.11 SIT/PT/UAT	M	M	M	M	M	M	L	M	M	H	M	L
2.12 Pen testing	L	L	L	L	M	L	L	L	M	M	M	L
2.13 Cutover / Go-Live	M	M	M	M	M	M	M	H	H	M	H	L
2.14 PGLS	M	M	M	M	L	M	M	M	M	M	M	L
<b>Single markets platform expansion (iterative)</b>												
3.1 SMP technical extensions	M	M	M	M	M	M	M	M	M	M	M	L
3.1.1. Integrate Asset register	M	M	M	M	M	M	M	M	M	M	M	L
3.2 SMP functional extensions	L	H	H	M	M	M	M	M	M	M	M	L
3.3 Sprint plan & Backlog for use case 2&3	M	H	H	M	M	M	M	M	M	L	L	-
3.4 Create user stories & requirements	L	H	H	M	M	M	M	L	H	L	L	-
3.5 Business rules	L	M	M	M	M	M	L	M	M	L	L	-
3.6 Process & data modelling	L	M	M	M	M	M	L	M	M	L	L	-
3.7 Solution & UI design	L	M	M	M	M	M	M	H	H	L	M	-

Task	Resource Type											
	Programme Mgr.	Product Owner	PM / Scrum Master	Business Analyst	Enterprise/solution Architect	Business SMEs	IT SMEs	Integration Partner	Specialist IT Partner	Testers	Service Transition	Procurement SME
3.8 Configuration and custom enhancements	L	L	M	L	M	-	M	H	H	L	L	L
3.9 Testing (SIT/UAT/PT/Pen)	M	H	M	M	M	M	L	M	M	H	M	L
3.10 Pre-cutover activities	M	M	H	M	L	M	M	M	M	M	M	L
3.11 Release into production	M	M	H	M	M	M	M	H	H	M	H	L
3.12 PGLS	M	M	M	M	L	M	M	M	M	M	M	L
<b>Asset register implementation</b>												
4.1 Define Asset Register processes	L	M	M	H	L	H	L	L	M	L	L	-
4.2 Define Asset Register data model	L	M	M	M	L	M	L	L	M	L	L	-
4.3 Define Asset Register standards and design patterns	L	M	M	M	H	M	M	M	M	L	M	-
4.4 Configuration and custom enhancements	L	L	M	L	M	L	M	H	H	L	L	L
4.5 Deploy Asset register using data platform	M	M	M	M	M	M	M	H	H	M	M	-
4.6. Integrate into SMP	L	L	M	M	L	L	M	M	M	M	L	L
4.7 Testing (SIT/UAT/PT/Pen)	M	M	M	M	M	M	M	M	M	H	M	L
4.8 Pre-cut over activities	M	M	H	M	L	M	M	M	M	M	M	L
4.9 Release into production	M	M	H	M	M	M	M	H	H	M	H	L
4.10 PGLS	M	M	M	M	L	M	M	M	M	M	M	L
<b>EMR portal implementation</b>												
5.1 Integrate EMR Portal into single markets platform	L	M	M	M	M	M	M	M	H	M	M	L
<b>Sandbox implementation</b>												
6.1 Define sandbox requirements	L	H	M	H	M	M	M	L	L	L	L	-
6.2 Deploy Sandbox environments	L	M	M	L	L	L	M	M	M	M	L	-
6.3 Handover to business	L	M	L	L	L	M	L	L	L	L	L	-

Low, medium, and high define the expected volume of resource relative to others for this activity.

- Highly specialised or difficult to source resources. Would require new frameworks or mitigation plans.
- Channels available but resources are hard to source, channels not currently available or market-wide constraints
- Established resource available or channels available to recruit,

### 9.11.7. Dependencies

The delivery of the single markets platform is dependent upon:

- 220 Data and analytics platform to host the asset register and to provide the foundations and ongoing capability for our analytics and reporting requirements.
- 250 Digital experience platform to provide the consistent digital user experience across all ancillary services and EMR services.
- 270 and 280 EU and GB regulations may have a dependency on key elements of the functionality required for ancillary services across response, reserve and reactive services. EMR is also subject to regulatory changes.
- 330 EMR and CfD improvements – the anticipated increase in changes required to the EMR portals will also need to be aligned to the single markets platform.
- 420 Auctions capability will deliver the single day ahead auctions capability for response and reserve services which will need to be integrated to the end to end user journey for these services in the single markets platform.



Figure 88 - Single markets platform dependencies

### 9.11.8. Costs

Investment (£m)	2021/22	2022/23	2023/24	2024/25	2025/26	Total
Capex	3.1	3.1	2.2	1.2	1.3	11.0
Opex	2.1	2.1	1.5	0.8	0.9	7.3
<b>Total</b>	<b>5.2</b>	<b>5.2</b>	<b>3.6</b>	<b>2.1</b>	<b>2.2</b>	<b>18.3</b>
Cumulative RTB* increase	0.0	0.6	1.1	1.5	1.8	5.0

#### Gartner benchmark range

Low	14.0
High	20.0

\*RTB - run-the-business on-going opex

Figure 89 - investment costs

This investment falls close to Gartner's high range given the high level of change expected in all markets included under this platform.

### Draft determinations update

A further breakdown of the costs based on our parametric model is shown below.

400 Single markets platform		TotEx £m GBP					
		FY22	FY23	FY24	FY25	FY26	Total
Resource (Scoping, training)	10%	0.5	0.5	0.4	0.2	0.2	1.8
Resource (Dev., testing)	15%	0.8	0.8	0.5	0.3	0.3	2.7
Software	20%	1.0	1.0	0.7	0.4	0.4	3.7
Hardware	10%	0.5	0.5	0.4	0.2	0.2	1.8
Consulting	0%	-	-	-	-	-	-
Supplier	35%	1.8	1.8	1.3	0.7	0.8	6.4
Cyber	10%	0.5	0.5	0.4	0.2	0.2	1.8
Contingency	0%	-	-	-	-	-	-
<b>Total</b>		<b>5.2</b>	<b>5.2</b>	<b>3.6</b>	<b>2.1</b>	<b>2.2</b>	<b>18.3</b>

Figure 90 - parametric cost model

### 9.11.9. Risks

Risks specific to this investment are listed below. Generic portfolio level risks and a description of the scoring method for likelihood and impact can be found in our December 2019 Business Plan, Annex 4 - Technology investment report, Appendix C.

Risk	Mitigation(s)	Likelihood	Impact
That there are many industry initiatives seeking to develop portals simultaneously and that this is an inefficient and uncoordinated approach (e.g. EDTF, BEIS code governance reform review, BEIS/Ofgem work on smart systems and flexibility)	<ul style="list-style-type: none"> <li>Continue to actively participate with many of these activities and continue to coordinate with all relevant parties, including providing feedback to TOs' business plans.</li> </ul>	2	1
Requirements from market participants are unclear or conflicting.	<ul style="list-style-type: none"> <li>Engage market participants regularly via the design authority and show and tells.</li> </ul>	2	

### Draft determinations update

An updated view on risks is included below.

Risk	Mitigation(s)	Likelihood	Impact
That there are many industry initiatives seeking to develop portals simultaneously and that this is an inefficient and uncoordinated approach (e.g. EDTF, BEIS code governance reform review, BEIS/Ofgem work on smart systems and flexibility)	<ul style="list-style-type: none"> <li>Continue to actively participate with many of these activities and continue to coordinate with all relevant parties, including providing feedback to TOs' business plans.</li> </ul>	2	1
Requirements from market participants to define their user journey are unclear or conflicting.	<ul style="list-style-type: none"> <li>Engage market participants early in the programme via the design authority and show and tells.</li> </ul>	2	2



High impact regulatory changes do not enable migration activities to progress as intended. This could lead to key resources and attention being diverted to handle short-term compliance implementation delaying strategic solution delivery.	<ul style="list-style-type: none"> <li>Ongoing engagement with Ofgem and industry to prioritise requirements and minimise the level of high impact changes during the initial stages of the project.</li> </ul>	2	1
Reform of reserve, response and reactive services might take longer which will impact the agreed migration timeline of the ancillary services into the single market platform	<ul style="list-style-type: none"> <li>Early stakeholder engagements<sup>3</sup> to determine detailed delivery schedule, notwithstanding uncertainty over Covid-19 restrictions</li> <li>Develop integrated business plan with critical dependencies for proactive resolution</li> </ul>		1
Delay in delivery of constituent capabilities via other investments lines may have a consequential impact on timescales for delivering the integrated single markets platform as planned	<ul style="list-style-type: none"> <li>Develop integrated tech delivery plan to incorporate interdependencies with other platform deliveries</li> <li>Ongoing monitoring and control of coordinated delivery plan</li> </ul>	3	2

#### 9.11.10. Options

Option(s)	Pros	Cons
Not invest in this area		<ul style="list-style-type: none"> <li>No new markets or products will be created.</li> <li>Does not enable easy and economic data sharing with our customers.</li> <li>Creates staff overhead and technical debt as it addresses market procurement problems with inefficient processes and workarounds.</li> <li>Requires higher level of investment in other areas to make up for market procurement inefficiencies.</li> <li>Puts 2025 ambition to be able to operate a carbon free electricity system at risk.</li> <li>Does not enable transparency of our actions.</li> <li>Does not react to or meet new customer data needs in a timely way.</li> <li>Increases operational risk.</li> <li>Maintains low customer experience.</li> <li>Increases cyber security risk.</li> </ul>

Option(s)	Pros	Cons
Invest in legacy tools		<ul style="list-style-type: none"> <li>• Does not support easy and economic data sharing with our customers.</li> <li>• Creates staff overheads and technical debt as it addresses engagement problems with inefficient solutions and processes.</li> <li>• Duplicates investment in other areas to make up for lack of market procurement standard solutions.</li> <li>• Puts at risk 2025 ambition to be able to operate a carbon free electricity system.</li> <li>• Does not enable transparency.</li> <li>• Does not react to or meet new customer data needs in a timely way.</li> <li>• Maintains low customer experience.</li> <li>• Increases cyber security risk.</li> </ul>
Update tools and integrate with digital engagement platform, data platform, network control and enhanced balancing capabilities	<ul style="list-style-type: none"> <li>• Enables 2025 ambition to be able to operate a carbon free electricity system.</li> <li>• Enables transparency.</li> <li>• Enables easy and economic data sharing with our customers.</li> <li>• Allows for scalability of investment.</li> <li>• Introduces market procurement standards.</li> <li>• Enables high and consistent customer experience.</li> <li>• Enables introduction of efficient processes.</li> <li>• Enables quicker response to market needs.</li> </ul>	

## 9.12. 410 Ancillary service settlements refresh

### Current stage:

Scoping	Start up	Requirements and design	Development and testing	Implementation
---------	----------	-------------------------	-------------------------	----------------

### 9.12.1. Overview

Replacement of, and ongoing investment in, the ancillary services settlement system, to manage the increased number of market participants and increasing rates of change.

### 9.12.2. Current state

The ancillary services settlement system calculates payments for services provided to the ESO. Whilst the system can manage these in current environment, it does not have sufficient flexibility to cope with the expected increase in the number of new services and participants. The settlements process also needs significant manual intervention.

A project to replace the system is currently in the requirements stage and is expected to complete early in the RIIO-2 period.

### 9.12.3. Case for change

#### Ancillary Service Settlements



#### By the end of RIIO-1, I work with ...

- Manageable customer base from suppliers, generators, interconnectors and new transmission connections.
- An Ancillary Services Settlement system that requires significant manual intervention.

#### IT Investment to ...

- Complete the implementation of the flexible Ancillary Services Settlement System, started under PAS in RIIO-1.
- Integrate with the new Single Markets Platform and the Ancillary Services Despatch Platform.
- Continue to invest in the addition of new Ancillary Services products to the settlement system
- Maintain the asset health of the AS Settlement system.

#### will enable me in RIIO-2 to ...

Transform the Ancillary Services.

Introduce new Ancillary Services.

Settle Ancillary Services more efficiently and accurately

Improve the customer experience

Manage an increasing customer base including new types (DSO, DERs, storage)

Implement an increasing rate of change more quickly and cheaply.

Manage a greater number of parties down to 1MW.

Figure 91 - Use case, investment and outcome expectation

### 9.12.4. Roadmap

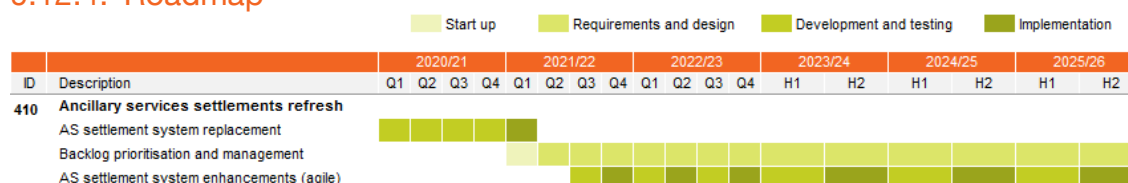


Figure 92 - Delivery plan

### 9.12.5. Future state

This system is being replaced by the platform for ancillary services (PAS) project, which is under way in RIIO-1 and is expected to complete in 2021. The new system will enable settlement of ancillary services to be

carried out more efficiently and accurately, and will more easily manage the increasing number of market participants (down to 1 MW) and changes in ancillary services. It will also include automated online account management. Ongoing investment will enable addition of new ancillary services as required and integration with the single markets platform.

This investment, along with the digital engagement investment in open data, will enable access to historical, current and forecast billing information, which is a key requirement as part of the customer journey.

#### 9.12.6. Approach

We will use the tools and capabilities of the digital experience, data and analytics platform to further enhance, automate, and integrate the new settlement system.

We will integrate it into our customer portal to give a seamless user experience for customers cf. IT investment 250 Digital engagement platform above.

We will provide customers with API and dataset access to our settlement services and data to allow them to integrate (automate) our settlement processes into their own business processes.

We will integrate ancillary services dispatch and other operational systems into the settlements solution using our SOA and the data platform.

#### 9.12.7. Costs

Investment (£m)	2021/22	2022/23	2023/24	2024/25	2025/26	Total
Capex	2.1	0.2	0.2	0.2	0.2	2.8
Opex	1.4	0.1	0.1	0.1	0.1	1.9
<b>Total</b>	<b>3.5</b>	<b>0.3</b>	<b>0.3</b>	<b>0.3</b>	<b>0.3</b>	<b>4.7</b>
Cumulative RTB* increase	0.1	0.2	0.2	0.2	0.3	1.1

\*RTB - run-the-business on-going opex



Figure 93 - investment costs

Our estimate is higher than Gartner benchmark, as we plan to implement a new system in 2021/22, then continually enhance it to add new services in response to evolving market requirements throughout the RIIO-2 period.

#### 9.12.8. Risks

Risks specific to this investment are listed below. Generic portfolio level risks and a description of the scoring method for likelihood and impact can be found in Appendix C.

Risk	Mitigation(s)	Likelihood	Impact
Levels of market participation are higher than anticipated, leading to additional investment being required.	<ul style="list-style-type: none"> <li>System is being designed to be flexible and extendable.</li> </ul>	1	1
Extended parallel run of the old and new Ancillary Services Settlements systems may be required in the transition period, increasing IT running costs.	<ul style="list-style-type: none"> <li>Plan to minimise parallel run period.</li> </ul>	2	1

### 9.12.9. Options

Option(s)	Pros	Cons
Not invest in this area	<ul style="list-style-type: none"> <li>•</li> </ul>	<ul style="list-style-type: none"> <li>• Puts our ability to manage the settlements process at risk.</li> <li>• Leaves tools unsupported and at increasing risk of failure.</li> <li>• Planned improvements in agility and flexibility would not be achieved, making it more difficult to introduce new ancillary services and manage increasing numbers of participants.</li> <li>• Puts ambition to transform the customer experience at risk.</li> <li>• Prolongs manual processes and increases inefficiencies.</li> <li>• Increases cyber security risk.</li> </ul>
Carry on investing in our legacy tools	<ul style="list-style-type: none"> <li>• Mitigates risk to settlements process.</li> <li>• Brings tools into support and reduces risk of failure.</li> <li>• Mitigates cyber security risk.</li> </ul>	<ul style="list-style-type: none"> <li>• Planned improvements in agility and flexibility would not be achieved, making it more difficult to introduce new ancillary services and manage increasing numbers of participants.</li> <li>• Puts ambition to transform the customer experience at risk.</li> <li>• Prolongs manual processes and increases inefficiencies.</li> </ul>
Update our tools	<ul style="list-style-type: none"> <li>• Facilitates ambition to transform the customer experience.</li> <li>• Improves agility and flexibility.</li> <li>• Reduces cost and time to implement future changes.</li> <li>• Removes manual processes and reduces inefficiencies.</li> <li>• Mitigates risk to settlements process.</li> <li>• Brings tools into support and reduces risk of failure.</li> <li>• Mitigates cyber security risk.</li> </ul>	<ul style="list-style-type: none"> <li>•</li> </ul>

## 9.13. 420 Auction capability

Ofgem/Atkins assessment	RAG/£m	Supplementary information
Justification for project	A	<ul style="list-style-type: none"> <li>No update to December 2019 Business Plan</li> </ul>
Project definition incl. timing, scale, & dependencies	A	<ul style="list-style-type: none"> <li>No update to December 2019 Business Plan</li> </ul>
Definition of required resources	A	<ul style="list-style-type: none"> <li>No update to December 2019 Business Plan</li> </ul>
Cost confidence	A	<ul style="list-style-type: none"> <li>No update to December 2019 Business Plan</li> </ul>
Requested capex	£0m	No additional information has been provided. This investment is opex only and despite having no red RAG assessments, was not included in the ex-ante steer. We request that this investment is included within the ex-ante steer.
Requested opex	£6m	
Benchmark capex	-	

## Current stage:

Scoping	Start-up	Requirements and design	Development and testing	Implementation
---------	----------	-------------------------	-------------------------	----------------

## 9.13.1. Overview

We will invest in common auction capability and apply economies of scale for more efficient action-based procurement activities. This capability will be expandable to all types of auctions and allow for appropriate running frequency, including Electricity Market Reform (EMR), Contracts for Difference (CfD), reserve, response, reserve and response, and reactive power.

Where possible, efficiency benefits from auctions will also be implemented in tender-based service procurements.

## 9.13.2. Current state

Medium term procurement of ancillary services is currently carried out via a tender process, on a monthly to triannual basis. This is mainly underpinned by user written spreadsheets. The firm frequency response (FFR) trial innovation project is currently under way to explore the feasibility of using an auction platform to procure balancing services closer to real time (e.g. weekly or day ahead). One of this project's learnings is that it takes a long time to implement given the peripheral legacy systems affected.

EMR and CfD function, which was implemented in RIIO-1, operates in isolation in the IT architecture. Its development and support are now offshore to gain better value for money. All development is done in an agile manner to best enable all the changes deemed necessary by Ofgem and BEIS. The tool is hard to change, and some development is risky, with assumptions that can only be validated closer to go live date given the time it takes to implement the full change. In other cases, bigger changes raised closer to auction running are deemed impossible to implement and get postponed to later auctions.

### 9.13.3. Case for change

Current quarterly to annual tender, and even monthly, processes are not flexible enough for our customers, and a barrier to market entry. Intermittent generation finds it difficult to predict output in the long term and is excluded from many services.

We anticipate the desire for closer to real-time procurement of ancillary services will continue, as it unlocks further market participation and competition, so we plan to develop a common auction capability. This will build on the learnings of the RIIO-1 auction innovation project, extending the capability to all other services being auctioned over the RIIO-2 period.

This investment also allows us to address customer feedback that the ESO EMR systems are difficult to change. We will implement a new solution built around customer requirements and that is agile, flexible and future proof.

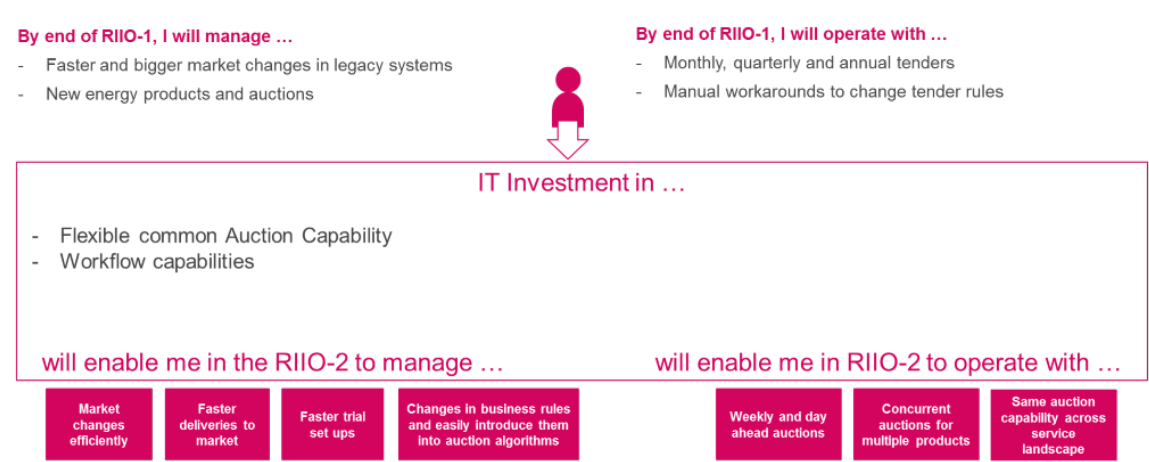


Figure 94 - Use case, investment and outcome expectation

### 9.13.4. Roadmap

We will use the current innovation project to test if capabilities can be expanded to all other relevant services, exploring in RIIO-1 which options are viable for implementation of the wider auction capability.

Our assumption is that we will start RIIO-2 with a view on an auction capability that is flexible and efficient to scale and expand to all possible new and existing auctioned services. We will implement this tool in the first year, allowing the various auctions’ algorithms to be developed in parallel in subsequent years.

In the later years of RIIO-2, we will implement capabilities that account for impact from DSOs, such as constraints or market players already participating in DSO markets.

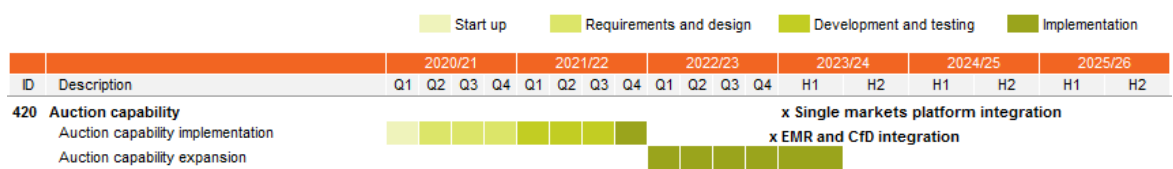


Figure 95 - Delivery plan

### 9.13.5. Future state

Our auction capability will be scalable to new services and products, with multiple algorithms for auctions at different frequencies, spanning from yearly to day ahead. This will include algorithms for co-optimised response and reserve day-ahead auction which also considers impact on DSOs.



It will use the asset register in our IT investment 220 Data and analytics platform to ensure market participants can provide declared volumes. This will require standardisation or mapping of similar concepts across markets.

The auction capability will be integrated with IT investment 180 Enhanced balancing capability and the IT investment 410 Ancillary service settlement system for faster trials or new balancing services auctions. The full cost and implementation reduction benefits will not be realised until all these capabilities are integrated.

We anticipate towards the end of RII0-2 between six to eight services, each running one auction with variable frequencies, requiring the same amount of parallel auction algorithms. This capability is expected to be bought from a third party as it is not deemed CNI.

### 9.13.6. Approach

We will select a provider of energy markets for the base auction capability.

The existing footprint with UK energy markets and participants will be an important factor in the selection process and we will consider integration (user interface and business to business) between the participant community and the provider.

The auction markets will be integrated into the single markets platform to provide a common participant experience across common processes such as market registration, settlement and billing.

The auction markets will be hosted and provided as a software as a service (SaaS) solution by the provider.

Implementation will be owned and managed by the ESO. The ESO will consult with the industry to roll out services in the right way. Industry proving/pre-live trials will ensure smooth transitions to go live. We expect much of the development and integration will be outsourced to our integration partners.

### 9.13.7. Costs

Investment (£m)	2021/22	2022/23	2023/24	2024/25	2025/26	Total
Capex	0.0	0.0	0.0	0.0	0.0	0.0
Opex	4.0	2.0	2.0	0.0	0.0	8.0
<b>Total</b>	<b>4.0</b>	<b>2.0</b>	<b>2.0</b>	<b>0.0</b>	<b>0.0</b>	<b>8.0</b>
Cumulative RTB* increase	0.1	0.5	0.8	1.0	1.0	3.4

\*RTB - run-the-business on-going opex



Figure 96 - investment costs

This investment falls close to Gartner's high range given the high level of change expected in services included under this capability.

### 9.13.8. Risks

Risks specific to this investment are listed below. Generic portfolio level risks and a description of the scoring method for likelihood and impact can be found in our December 2019 Business Plan, Annex 4 – Technology investment report, Appendix C.

Risk	Mitigation(s)	Likelihood	Impact
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A single auction supplier may not be able to create and support all future auctions, leading to the need to contract with multiple auction suppliers.

- Ensure chosen supplier can meet all current and future ESO needs as part of the tender process.

2

1

### 9.13.9. Options

Option(s)	Pros	Cons
Not invest in this area		<ul style="list-style-type: none"> <li>• No new auctions or tenders will be created.</li> <li>• Increases operational risk.</li> <li>• Puts at risk 2025 ambition to be able to operate a carbon free electricity system.</li> <li>• Puts single markets platform costumer value at risk.</li> <li>• Maintains low customer experience.</li> <li>• Increases cyber security risk.</li> <li>• Leaves tools unsupported and underperforming.</li> <li>• Does not enable transparency.</li> </ul>
Individual auction data energy package	<ul style="list-style-type: none"> <li>• Enables transparency.</li> </ul>	<ul style="list-style-type: none"> <li>• Does not provide single user experience.</li> <li>• Duplicates investment in other areas to make up for lack of auction standard solutions.</li> <li>• Prevents efficiencies through economies of scale.</li> <li>• Puts single markets platform costumer value at risk.</li> </ul>
All auctions in a single capability	<ul style="list-style-type: none"> <li>• Enables single markets platform costumer value.</li> <li>• Supports 2025 ambition to be able to operate a carbon free electricity system.</li> <li>• Enables transparency.</li> <li>• Allows for economies of scale.</li> <li>• Introduces market procurement standards.</li> <li>• Enables high and consistent customer experience.</li> <li>• Enables introduction of efficient processes.</li> </ul>	<ul style="list-style-type: none"> <li>• Creates dependency on single auction solution.</li> </ul>

## 10. Appendix C – Delivery schedule

On 9 October 2020, we submitted our delivery schedule for the roles and activities (see ESO RIIO-2 Updated Delivery Schedule 091020 attached). For ease of reference, the activities and deliverables referenced in this document are listed below.

Table 3 - Activities and deliverables relating to our digitalisation action plan

Activity	Deliverable
A1.1 Ongoing activities	D1.1.7 Detailed forecasts and analysis
A1.2 Enhanced Balancing Capability	D1.2.1 Enhanced balancing tool
A1.3 Transform Network Control	D1.3.1 Situational awareness tool
	D1.3.2 Network modelling
A1.4 Control Centre Architecture	D1.4.1 Data and analytics platform
A4.4 Deliver a single, integrated platform for ESO Markets	D4.4.1 Market platform
	D4.4.2 Common standards
A5.3 Improve our security of supply modelling capability	D5.3 Enhanced modelling/data sets
A6.5 Work with all stakeholders to create a fully digitalised, whole system Grid Code by 2025	D6.5 Digitalised grid code
A11.1 Refresh and integrate economic assessment tools to support future network modelling needs	D11.1 Improved investment assessment
A11.2 Implement probabilistic modelling	D11.2 Identification of network needs
A13.1 Carry out analysis and scenario modelling on future energy demand & supply	D13.1 Future energy scenarios (FES)
A13.2 Conduct mathematical and modelling and market research on local and wider geographic demand information	D13.2 Energy demand models
A14.4 Facilitate development of the customer connections hub	D14.4.1 Connections hub phase 1
A15.6 Transform our capability in modelling and data management	D15.6.1 Phase 1 data mgt. scope
	D15.6.2 Grid code modifications
	D15.6.3 Phase 2 modelling scope
	D15.6.4 Data analytics platform
	D15.6.5 Data platform extension
	D15.6.7 Outage planning
A16.4 TOGA / Whole system outage notification	D16.4.1 Outage notification scope
	D16.4.2 Outage notification delivery
A17 Transparency and Open Data	D17.1 Open data portal w/ limited data sets
	D17.2 All published ESO data in machine readable format

# ESO RIIO-2 Updated Delivery Schedule

We welcome the opportunity to be able to provide an updated Delivery Schedule now that we have a better understanding of how it is to be used. The detailed feedback provided by Ofgem in Draft Determinations has been very useful and we strongly believe we have substantively addressed it in the areas identified for improvement.

Key areas in which we have significantly enhanced our Delivery Schedule include:

- Providing greater clarity on how our BP1 proposals drive us towards our 2025 ambitions for: An electricity system that can operate carbon free; Competition Everywhere; A whole system strategy that supports net zero by 2050; and The Electricity System Operator (ESO) is a trusted partner.
- Where major IT programmes are being delivered through an agile methodology, we have provided much greater clarity on what we expect to deliver in each year.
- New deliverables have been added to better articulate how we are working to align flexibility markets across transmission and distribution and develop new markets for reactive power and stability services.
- Where there is significant uncertainty, we have provided examples of what we expect to deliver in each year of the BP1 period.
- We have provided several supplementary documents: Balancing and Network Control Roadmaps; DSO-ESO alignment-Delivery Schedule view; and updated Role 3 aims. The intention of the additional material is intended to support better understanding of our Delivery Schedule and should not be treated as additional commitments.
- Whilst not included in this Delivery Schedule, significant further information on the IT investments referenced below can be found in documents submitted either as part of the December 2019 Business Plan submission or the ESO RIIO-2 consultation response – Technology Investment detail parts 1-3 submitted in September 2020. A table signposting further information for each of these investments can be found at the end of this document.

When reviewing the below updated Delivery Schedule there are a number of key points, we would like Ofgem and stakeholders to keep in mind:

- For a wide variety of reasons, it is very likely that some milestones will change over time. The milestones documented in the Delivery Schedule are our best current view. The Forward Plan Tracker, or its RIIO-2 equivalent, should always be considered the master document.
- In all areas, we have articulated very ambitious proposals for the BP1 period that we consider to “exceed expectations” and failure to deliver every one of them to the letter, should not be considered that the ESO has not “met expectations”.
- In some areas there is significant uncertainty on specific future developments, such as specific codes changes or IT system module delivery. In these cases, we have sought to make our proposals more tangible through clear articulation of the strategic purpose, alignment with end goals, and providing examples of changes that may be delivered in the BP1 period. It should not be expected that all the examples of change will be delivered exactly as articulated.
- A large proportion of deliverables in the ESO Delivery Schedule are dependent on the actions of other parties. It has been widely acknowledged that through the development of our RIIO-2 Business Plan we have built very strong alignment across industry on our strategic goals. However, it should be noted that delivery and timescales are often not within the full control of the ESO.
- The ESO’s IT delivery model is currently under review with significant implications for the delivery of ESO IT investments and associated activities in RIIO-2. Numerous deliverables and milestones in this schedule may need to be revisited depending on the timing and scope of separation determined.
- The original ESO RIIO-2 Business Plan was submitted almost one year ago. The updated Delivery Schedule contains both new deliverables and updated timelines for some deliverables to reflect our latest thinking and Ofgem’s feedback. Where there are implications for additional resource or investment that were not captured in the original submission, these have been signposted alongside the relevant deliverable. It is intended that detail on these additional requirements should be communicated through ongoing regulatory engagement.

We firmly believe that this ambitious Delivery Schedule should exceed the expectations of Ofgem and other stakeholders. We would welcome the opportunity to discuss further in advance of Final Determinations if this would be helpful.

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## Role 1 – Control centre operations

### A1 Control Centre architecture and systems

Our proposals for A1 Control Centre architecture and systems help deliver our **zero carbon operation ambition** giving us the control centre systems and processes to analyse, optimise, schedule and dispatch the zero carbon energy market of the future.

To enable this, we will build and develop a new control centre architecture (A1.4) that our new balancing and control centre tools (A1.2 and A1.3) integrate with in a modular fashion. Such a fundamental reconfiguration of our control centre environment will be challenging to deliver, but it will enable: a more “plug and play” or “app-like” approach to system developing, promoting flexibility; a central location for all data, providing accessibility and transparency; and, a consolidated graphical user interface for our control centre engineers.

**A1.1 Ongoing activities** allows us to continue running the electricity system safely, efficiently and economically. D1.1.5 will provide the necessary legacy asset upgrades whilst we deliver our transformational capability. D1.1.7 will upgrade our forecasting capability, allowing us to provide more frequent better-quality forecasts, helping the market self-balance and operate efficiently.

**A1.2 Enhanced Balancing Capability** will enable us to schedule and dispatch a far greater number of market participants than we can today. This is crucial to our ambition because a zero carbon system will have higher numbers and more diverse market participants than today.

By the end of BP1 we will have:

- A clear roadmap for prioritised pipeline of developments, developed through stakeholder engagement including the Technology Advisory Council (TAC).
- Made incremental improvements to system balancing capability based on priority modules delivered.
- Determined the future balancing architecture for future modular development of new systems development.
- Developed a sandbox environment for developing and testing new balancing modules.

This helps ensure our 2025 zero carbon operation ambition is on track by:

- Finalising the balancing architecture for zero carbon operation, providing the foundations for balancing modules to integrate into.
- Establishing the production environment for future tool development.

**A1.3 Transform Network Control** will enable us to safely and efficiently operate the network by providing enhanced situational awareness – real-time visibility of the status of the network. Our current tools will not be able to manage the increased levels of data coming into the control room from the network from a zero carbon system due to the increased numbers of market participants and associated data points. Look ahead functionality and the ability to simulate what is about to happen is vital to manage a system with more renewable generation, due to its variable output and consequential network volatility.

By the end of BP1 we will have:

- Started, and be continuing with, the integrated energy management system (IEMS) life extension work to ensure we maintain our existing situational awareness tool while the new tool is being built.
- Delivered the core system of our new situational awareness tool (although it will not be operational).

This helps ensure our 2025 zero carbon operation ambition is on track by:

- Providing the core situational awareness tool that additional modules then integrate with to build the complete tool.

**A1.4 Data and Analytics Platform** will develop the architecture for our future systems and market to integrate with. This will provide a single, central location for all data sent between the market and the control room (either directly or by hosting other external facing modules such as the data platform and single markets platform) and a single source of all data used by our new control centre tools to operate the electricity system. This will lead to more efficient system balancing and facilitating greater data sharing with industry.

By the end of BP1, we will have:

- Delivered the data platform foundation.
- Integrated the single markets platform and digital engagement platform with the data platform, providing a single point of access for participation in ESO balancing services.
- A master data management system completed.

## ESO RII0-2 Delivery Schedule

This helps ensure our 2025 zero-carbon operation ambition is on track by:

- Providing the foundation architecture that future systems and markets that are necessary for zero-carbon operation can integrate with.

Sub activity	Deliverable	Related IT investment	Project or continuous	RIIO-1 end point	2021/2022 Milestones	2022/2023 Milestones	First year success	Second year success	Expected final delivery date and what success looks like.	Notes on changes to Dec 2019 Business Plan
A1.1 Ongoing activities	D1.1.1 Balance Great Britain's (GB) demand for energy with supply from generators around the clock.	None	Continuous	N/A	N/A	N/A	Meeting agreed metrics on balancing costs and security of supply.	Meeting agreed metrics on balancing costs and security of supply.	Meeting agreed metrics on balancing costs and security of supply.	Success criteria added.
A1.1 Ongoing activities	D1.1.2 Maintain security of supply in real time and the ability to restart the system in the event of a partial or total loss of power.	None	Continuous	N/A	N/A	N/A	Meeting agreed metrics on balancing costs and security of supply.  Carry out necessary work to meet GB restoration standard as described in A3.2.	Meeting agreed metrics on balancing costs and security of supply.  Carry out necessary work to meet GB restoration standard as described in A3.2.	Meeting agreed metrics on balancing costs and security of supply.  Carry out necessary work to meet GB restoration standard as described in A3.2.	Success criteria added.
A1.1 Ongoing activities	D1.1.3 Maintain the integrity of the transmission network, while manage the economical operation of the system.	None	Continuous	N/A	N/A	N/A	Meeting agreed metrics on balancing costs and security of supply.	Meeting agreed metrics on balancing costs and security of supply.	Meeting agreed metrics on balancing costs and security of supply.	Success criteria added.
A1.1 Ongoing activities	D1.1.4 Liaise with ENTSO-E (European Network for Transmission System Operators – Electricity) and Co-Ordination of Electricity System Operators (CORESO) on the ESO's European operations.  Strategic relationships with European institutions are covered in Activity A6.2 European Union (EU) code change and relationships.	None	Continuous	Active participation with ENTSO-E, including membership of: <ul style="list-style-type: none"><li>• Assembly (ESO Director);</li><li>• Board (ESO Director);</li><li>• 3 main Committees reporting to Board (ESO Exec / Senior Management);</li><li>• 4 other groups reporting to Board (wider ESO leadership);</li><li>• 18 Steering Groups; (D2CF, DACF, IDCF)</li><li>• 100+ work groups.</li></ul> Daily liaison with CORESO in operational timescales to support their role as Regional Security Coordinator.	Q2 – Common Grid Model Stage 3 (bespoke CORESO web reporting tool modifications fit for the NGENSO control room) complete.  Q2 – become compliant with Common Grid Model requirements - Establishment of two-day ahead, day-ahead and intra-day congestion forecast (D2CF, DACF, IDCF) processes (depending on future trading relationship).	N/A	DACF Stage 3 completed.  Compliant with Common Grid Model requirements.  Stage 4 – Inter RSC Coordination between CORESO and Nordic RSC defining a system operating region whilst expanding CORESO study capabilities (TBC on interconnector go-live).	Common Grid Model Stage 4 (establishing system operation regions and expanding CORESO study capabilities) (TBC on interconnector go-live).	N/A	Milestones and success criteria added.  Note that this only provides a small snapshot of the work we are doing.  Note also that many of the deliverables are dependent on the UK's future trading relationship with the EU.
				Work focusing on:						

ESO RfO-2 Delivery Schedule

Sub activity	Deliverable	Related IT Investment	Project or continuous	RfO-1 end point	2021/2022 Milestones	2022/2023 Milestones	First year success	Second year success	Expected final delivery date and what success looks like.	Notes on changes to Dec 2019 Business Plan
				<ul style="list-style-type: none"> <li>Future trading relationship with EU;</li> <li>TERRE (Trans European Replacement Reserve Exchange) and MARI (Manually Activated Reserve Initiative)</li> <li>Day Ahead Congestion Forecast (DA CF) and Capacity Allocation and Congestion Management (CACM);</li> <li>Codes and frameworks.</li> </ul>						
A1.1 Ongoing activities	D1.1.5 Upgraded legacy balancing and situational awareness tools to deliver continued service levels whilst new tools are being development.	<b>210</b> Balancing Asset Health Along with building the enhanced balancing capabilities we need to ensure we continue providing at least the same level of service as now. We will need to carry on with lifecycle upgrades, enhancement for near term requirements and transition to new capabilities. Once we have implemented new systems and tools it will be necessary to invest periodically throughout their life cycle in order to maintain their reliability and usability, and to keep them up to date and minimise cyber security risks.	Continuous	Access to the Application Programming Interface (API) widened to allow use across all market participant routes subject to the communication standards ( <i>Forward Plan</i> ).  Dispatch facility expanded to handle a large number of small Balancing Mechanism Units (subject to market take up) ( <i>Forward Plan</i> ).  Work started to re-platform our existing multi-dispatch tool delivery which will fully integrate the current interim process for bulk dispatch of Balancing Mechanism Units (BMUs) into control room systems. This will reduce our manual processes and make it easier for the ENCC to dispatch many small BMUs at once. ( <i>Forward Plan</i> ).	TBC (dependent on Impact assessment) - State of Energy signal defined and implemented for limited energy assets (such as batteries).	N/A	State of Energy signal from limited-energy assets (such as batteries) provides control engineers with visibility of the remaining energy.	Incremental targets for Metric 2 CNI system health met.	Ongoing maintenance and incremental upgrades have been completed to maintain our legacy balancing tools while we develop new ones including improving our systems and processes to handle greater levels of interconnection.	Updated to provide more clarity on what will be delivered in BP1.
		<b>240</b> Electricity National Control Centre (ENCC) Asset Health To operate the grid system, and to handle unforeseen events and emergency situations,								



ESO RIIQ-2 Delivery Schedule

Sub activity	Deliverable	Related IT Investment	Project or continuous	RIIQ-1 end point	2021/2022 Milestones	2022/2023 Milestones	First year success	Second year success	Expected final delivery date and what success looks like.	Notes on changes to Dec 2019 Business Plan
		we need to invest in maintaining our stand-alone specific tools and resilient bespoke communication links.		<p>Interconnector systems delivered for IF A2 and also system updates to align processes between interconnectors, aiding intraday markets, enabling new commercial services and streamlining our existing IT systems (<i>Forward Plan</i>).</p> <p>Existing IT systems upgraded to prepare for European Network Codes (<i>Forward Plan</i>).</p> <p>Published outcome of the reserve from storage in the Balancing Mechanism trial (<i>Forward Plan</i>).</p> <p>State of Energy – impact assessment complete with firm delivery date for 2021/22 (<i>Forward Plan</i>).</p> <p>Dynamic Stable Import Limit (SIL)/Stable Export Limit (SEL) impact assessment complete (<i>Forward Plan</i>).</p>						
<b>A1.1</b> Ongoing activities	<b>D1.1.6</b> Assessment of future operability challenges communicated through the <i>Operability Strategy Report</i> . Published annually.	None	Continuous	<p>The report explains the future challenges we face in maintaining an operable electricity system and what we are doing about them. Opportunities for engagement are highlighted, as well as where to look for more information. This allows potential service providers to engage with us and help develop services to meet future system needs.</p> <p>The challenges outlined in the report also form the needs case for developing new systems and markets. Our RIIQ-1 work has focused on</p>	Q3 – publish <i>Operability Strategy Report</i> . Undertake improvements to these publications in accordance with stakeholder feedback and/or ESO internal publication review.	Q3 – publish <i>Operability Strategy Report</i> . Undertake improvements to these publications in accordance with stakeholder feedback and/or ESO internal publication review.	Market participants have a clear view of the future operability challenges, and where to engage to help develop new solutions. <i>Operability Strategy Report</i> developed in line with stakeholders' feedback and published.	Market participants have a clear view of the future operability challenges, and where to engage to help develop new solutions. <i>Operability Strategy Report</i> developed in line with stakeholders' feedback and published.	<p><i>Operability Strategy Report</i> will:</p> <ul style="list-style-type: none"> <li>Continue to pull out the most significant or new system challenges.</li> <li>Ensure the market understands those challenges (in so far as they want to).</li> <li>Link to potential solutions (e.g. Pathfinder and product roadmaps) to market participants know how to engage.</li> <li>Be used as the needs case for developing control centre tools that are integrated with our</li> </ul>	<p>Overview on how the <i>Operability Strategy Report</i> will be used and potential future developments in line with stakeholder feedback.</p>



# ESO R10-2 Delivery Schedule

Sub activity	Deliverable	Related IT Investment	Project or continuous	R10-1 end point	2021/2022 Milestones	2022/2023 Milestones	First year success	Se cond year success	Expe ct ed final delivery date and what success looks like.	Notes on changes to Dec 2019 Business Plan
<b>A1.1</b> Ongoing activities	<b>D1.1.7</b> Produce and publish detailed forecasts and analysis, for both demand and generation, published at day-ahead and other timescales. Forecasts will be enhanced using detailed statistical and machine learning approaches.	<b>260</b> Forecasting Enhancements Continuing with the investment made under R10-1, to enhance our mathematical forecasting models and refresh the forecasting system in line with our policies.	Continuous	Approach to Platform for Energy Forecasting (PEF) developed with early benefits realisation, including: <ul style="list-style-type: none"> <li>Improved quality of ESO forecasts through continuous development and implementation of ESO's new forecasting capability on an agile and advanced platform</li> <li>Improved and more frequent energy forecasts delivered by PEF available to market participants and the control room (24 solar, 8 embedded wind, 8 BMU wind and 24 national demand forecasts per day)</li> </ul>	Implementation of forecasting products and sharing outputs from mature products externally where possible: <ul style="list-style-type: none"> <li>Implementation of core forecasting capability (demand, wind and solar power generation forecasts at national and GSP levels) in PEF</li> <li>Embed additional input data into internal forecasting processes – embedded generation metering data, weather data</li> </ul>	Complete integration of grid supply point (GSP) level demand, solar and wind power forecasts into transmission analysis study and balancing tools (where possible): <ul style="list-style-type: none"> <li>Make GSP level demand, solar and wind power forecasts available for market participants</li> <li>Make additional improved, granular and frequent forecasting data available in machine readable format for market participants to improve decision making ahead of real time.</li> </ul>	Improvement in core energy forecasting KPI - Mean Absolute percentage error (MAPE) as per benchmark for metric 3. <ul style="list-style-type: none"> <li>With a better use of technology and advanced computing power on the new platform, we aim to deliver a step change improvement in large data processing, model training and forecast prediction time.</li> </ul>	Maintain or improve (where possible) Energy forecasting core KPI - Mean Absolute percentage error (MAPE) as per benchmark for metric 3 <ul style="list-style-type: none"> <li>Integration of GSP level demand, solar and wind power forecasts into transmission analysis study and balancing tools (where possible).</li> <li>Positive market participant feedback on usage of published forecasts and data.</li> </ul>	transformational balancing capability (D1.2.2). <ul style="list-style-type: none"> <li>Reflect stakeholder feedback.</li> </ul>	Updated to provide more clarity on what will be delivered in BP1.
<b>A1.1</b> Ongoing activities	<b>D1.1.8</b> Our forecasting enhancements will provide the control room with better quality, more frequent forecasts, allowing them to make better operational decisions. This helps minimise balancing costs and reduce carbon emissions.		Continuous	Trade on up to four interconnectors (FA, IF A2, BritNed, NEMO) for system and energy reasons.	New interconnectors online, as per interconnector register <sup>1</sup> (subject to change).	New interconnectors online, as per interconnector register (subject to change).	Managing increased trading volumes as: <ul style="list-style-type: none"> <li>New interconnectors come online.</li> </ul>	Managing increased trading volumes as: <ul style="list-style-type: none"> <li>New interconnectors come online.</li> <li>Greater renewable generation increases</li> </ul>	Successfully managed increased trading volumes due to new interconnectors coming online.	Success criteria updated in relation to new interconnectors coming online.

<sup>1</sup> <https://www.nationalgrid.co.uk/connections/registers-reports-and-guidance>

ESO RII0-2 Delivery Schedule

Sub activity	Deliverable	Related IT Investment	Project or continuous	RIIO-1 end point	2021/2022 Milestones	2022/2023 Milestones	First year success	Se cond year success	Expe cted final delivery date and what success looks like.	Notes on changes to Dec 2019 Business Plan
							<ul style="list-style-type: none"><li>Greater renewable generation increases the operability challenges we face.</li></ul>	the operability challenges we face.	Trading transparency increased.	
							Estimate interconnector trading volumes increase by 25% from previous year.	Estimate interconnector trading volumes increase by 25% from previous year.		
							Explore ways to increase trading transparency.	Explore ways to increase trading transparency.		
A1.2 Enhanced Balancing Capability	D1.2.1 Enhanced balancing tool built and developed in a modular fashion that will incorporate machine learning and artificial intelligence. It will enable us to schedule and dispatch a greater number of market participants than today.	180 Enhanced balancing capability We will develop our core balancing systems and processes in a modular fashion to deliver dispatch and scheduling improvements. Our scheduling solution will be in line with the market gate closure, greater flexibility to respond to market changes, including a new suite of ancillary services, and close to real time auction markets.	Project	Balancing Roadmap developed with Technology Advisory Council (TAC) and published. It will contain a high-level view of: <ul style="list-style-type: none"><li>Key drivers and priority user requirements.</li><li>User stories and user journeys, including how participants will interact with our systems.</li><li>Backlog and when the first items will be delivered, focusing on 2021/22 and 2022/23, based on the user requirements and asset health.</li><li>Outputs and outcomes.</li><li>Dependencies.</li><li>Progress updates (for later revisions).</li></ul> Early technology proof of concept working completed to: <ul style="list-style-type: none"><li>Inform technology is appropriate</li><li>Inform programme structure, resourcing and ways of working</li><li>Inform future system architecture work</li></ul>	Q1 – start developing foundational infrastructure and tooling to support applications: <ul style="list-style-type: none"><li>Testing and automation tools</li><li>Capacity management tools</li><li>Alarm and event management</li><li>Monitoring tools</li><li>Incident management</li><li>Coding tools</li><li>Change management tools</li><li>Containment tools</li><li>Cyber security tools</li></ul>	Q1 - Migration roadmap development started, providing a view of when new systems will come online, and legacy ones switched off.  Q2 – updated Roadmap agreed with TAC and published.	Sandbox environment developed for testing components to prove components work, giving industry confidence.  Key decisions on architectural design made incorporating feedback from the TAC.  Priority technology identified and sourcing decisions made.	Production environment developed.  Technology sourcing decisions for further application development completed.  Scaled agile approach to development underway and on track against roadmap.	By March 2024 Control Centre engineers can schedule and dispatch a far greater number of market participants at once than they can in 2020, which is a key enabler of our ability to operate the network carbon free.  Using increased automation provides market participants with greater confidence in our decision-making.	Updated to provide more clarity on what will be delivered in BP1.
		480 Ancillary Services Dispatch Continue integration of the ancillary services dispatch platform (ASDP) capabilities developed in RIIO-1 into the core balancing capabilities and processes and expanding it to cover any new ancillary services. This will also be integrated with the single market platform so new ancillary services can be			Q2 – complete foundational infrastructure tooling work.  Q2 – updated Roadmap agreed with TAC and published.	<ul style="list-style-type: none"><li>Build the production environment to safely and securely develop code for 24/7 systems</li><li>Testing in sandbox environment.</li></ul>	Incremental targets for Metric 2 – CNI system reliability met.  Updated programme costs to feed efficient cost benchmark review.	Incremental targets for Metric 2 – CNI system reliability met.  Updated programme costs to feed efficient cost benchmark review.	The practical improvements to system operation are: <ul style="list-style-type: none"><li>Ability to operate the electricity system carbon-free</li><li>Ability to efficiently and transparently schedule and dispatch significantly more market</li></ul>	

ESO RII0-2 Delivery Schedule

Sub activity	Deliverable	Related IT investment	Project or continuous	RIIO-1 end point	2021/2022 Milestones	2022/2023 Milestones	First year success	Se cond year success	Ex pected final delivery date and what success looks like.	Notes on changes to Dec 2019 Business Plan
		consistently managed and dispatched.		(see 2021/22 milestone).  Included in the above is reviewing the approach taken to develop the Modern Dispatch Optimiser, which is a trial for our RIIO-2 ways of working.	Q4 – future system architecture defined, including in-scope modules for future development.  Q4 - updated Roadmap agreed with TAC and published	components, using production environment and sandbox (will be determined by Roadmap at end of RIIO-1).	Incremental benefits identified in cost-benefit analysis realised.		participants than today <ul style="list-style-type: none"><li>Stakeholder confidence in our control room decision making.</li></ul> This helps our zero-carbon operation because: <ul style="list-style-type: none"><li>We will have the control centre tools to be able to operate the system carbon-free.</li></ul>	
				Internal baseline roadmap for technology delivery (for iterative ongoing development), taking outputs of proof-of concept work and combining with known technologies. This provides an overview of what technology is available to us for future system development.	Sandbox testing environment developed (timescale TBC): <ul style="list-style-type: none"><li>Define data inputs and data sets to test components</li><li>Define expected outputs to compare test against</li></ul> <ul style="list-style-type: none"><li>Start testing priority components (to be determined).</li></ul>					
				Internal baseline roadmap for functional capability being delivered for key processes including scheduling and dispatch, based on current known requirements. This provides an overview of what the key system issues to solve are.						
				Identify opportunities for end-to-end balancing process rationalisation, to inform future operating model and system architecture.						
				Programme structure defined and resourcing strategy confirmed reflecting previously described FTE numbers).						
				Clear governance structure defined, including TAC and internal sign-off processes.						

ESO RfIO-2 Delivery Schedule

Sub activity	Deliverable	Related IT Investment	Project or continuous	RfIO-1 end point	2021/2022 Milestones	2022/2023 Milestones	First year success	Se cond year success	Expe cted final delivery date and what success looks like.	Notes on changes to Dec 2019 Business Plan
<b>A1.2</b> Enhanced Balancing Capability	<b>D1.2.2</b> Develop inertia monitoring capabilities and other tools to address emerging technology and system management issues (as required), as outlined in future Operability Strategy Reports.	<b>130</b> Emergent Technology and System Management  This investment will allow us to tackle new operational challenges more quickly and efficiently through our RfIO-2. It will use our foundation work, such as the IT investment <b>220</b> Data and analytics platform, being built on a modular basis like IT investment <b>180</b>  Enhanced balancing capability to allow its integration with any other required tool.	Project	<b>Operability Strategy Report</b>  Regular (likely annual) publication of reports, providing transparency to stakeholders and outlining challenges that new tools should respond to.	<b>Operability Strategy Report</b>  Q3 – publish <i>Operability Strategy Report</i> (D1.1.6).	<b>Operability Strategy Report</b>  Q3 – publish <i>Operability Strategy Report</i> (D1.1.6).	Stability Pathfinder phase 1, Constraint Management Pathfinder and inertia monitoring delivered, with some tools being used.  Work ongoing in other areas.	Stability Pathfinder phase 2 and Mersey Pathfinder delivered.  Pennines Pathfinder on track.  Inertia tools being used.  Business processes developed to fully utilise monitoring tool outputs in control centre.	By March 2024: Pennines Pathfinder IT enabling works complete  User developed tools integrated with enhanced balancing capability during development.  By March 2026: User developed tools integrated with network control tool.	The <i>Operability Strategy Report</i> is likely to be an annual publication, rather than twice yearly as previously articulated.  We have provided clarification on what this deliverable is, how it builds on previous work and how it links to <b>D1.2.1</b> .
	Depending on their urgency, impact and complexity, solutions can range from user-developed tools to real-time data feed tools integrated with our IT estate. These will eventually be integrated with the Enhanced Balancing Capability.  System conditions can quickly change, often surfacing challenges that need to be tackled at short notice. One example is inertia, now a key operational constraint leading to significant increase in balancing costs if not managed properly. During RfIO-1, we had to invest in real-time system data for its monitoring and forecasting. We also had to focus on system stability (through the Stability Pathfinder) and control centre visibility (through Power Available) and Voltage (through the Mersey Pathfinder).	It will enable control centre users to manage changes to the system in real time, securely and economically.		<b>Inertia</b>  First supplier's inertia monitoring tool delivered ( <i>Forward Plan</i> ).  <b>Stability</b>  Stability Pathfinder phase 1 and 2, work ongoing (see Role 3).  Interim IT solution for phase 1 complete.	(Exact challenges and tools are TBC).  <b>Inertia</b>  Ongoing – ESO uses first supplier's monitoring tool.  Q1-2 - Deliver first supplier inertia forecasting.  Q2 – Second supplier delivers inertia monitoring tool.	(Exact challenges and tools are TBC).  <b>Inertia</b>  Ongoing use of tools and work with TOS to improve data quality.  Q1-3 – development and testing for Phase 2.  Q4 - Deliver Stability Pathfinder phase 2, including enduring IT solution.	Lessons learned from development and operation of monitoring tool used to inform design of inertia forecasting tool.  Ability to rapidly respond to changing operational environment.  (Any new market-procured services will be developed in line with our competitive procurement ambitions in Role 2).	Ability to rapidly respond to changing operational environment.  (Any new market-procured services will be developed in line with our competitive procurement ambitions in Role 2).		Inertia forecasting tool delivery has been brought forward one year to July 2021 Further work on data quality from Transmission Owners will be required for full operational use to be achieved.
				<b>Visibility</b>  Phase 2b of Power Available delivered enabling greater use of wind for Mandatory Frequency Response (MFR). This will improve wind forecasting and response optimisation by blending PA with weather forecasts to provide a real time measure of output for wind units.	Q2 – Second supplier delivers inertia monitoring tool.  <b>Stability</b>  Q2 - Deliver Stability Pathfinder phase 1, including enduring IT solution.  Q1-2 – requirements and design work for Phase 2.	Q4 - Deliver Stability Pathfinder phase 2, including enduring IT solution.  <b>Voltage</b>  Q1 – Mersey Pathfinder IT work complete.  Q1 – start work on Pennines Pathfinder.	(Any new market-procured services will be developed in line with our competitive procurement ambitions in Role 2).			Second supplier inertia monitoring tool has revised delivery dates of Summer 2021.
				Published outcome of the reserve from storage in the Balancing Mechanism trial ( <i>Forward Plan</i> ).  State of Energy – impact assessment complete with firm delivery date for 2021/22 ( <i>Forward Plan</i> ).  (Any new market-procured services will be developed in line with our competitive procurement ambitions in Role 2).	Q3-4 – development and testing work for Phase 2.  <b>Visibility</b>  TBC (dependent on impact assessment) - State of Energy' signal defined and implemented for limited energy assets (such as batteries).  <b>Voltage</b>	Q2-4 Pennines Pathfinder requirements and design work.  Q3 – Mersey Pathfinder go-live.				
	Future challenges will be determined via the <i>Operability Strategy Report</i> , so we cannot say									

ESO RIO-2 Delivery Schedule

Sub activity	Deliverable	Related IT investment	Project or continuous	RIO-1 end point	2021/2022 Milestones	2022/2023 Milestones	First year success	Second year success	Expected final delivery date and what success looks like.	Notes on changes to Dec 2019 Business Plan
	<p>exactly what issues we will need to respond to or the tools we will need to develop.</p> <p>The deliverables in this section relate to the IT and system investments required. Other changes (e.g. markets) are in other Roles.</p>			<p><b>Voltage</b> Mersey Pathfinder work ongoing.</p> <p><b>Constraints</b> Constraint management pathfinder impact assessment complete to determine if any IT solutions are required.</p>	<p>Q1 – finish requirement and design work for Mersey Pathfinder.</p> <p>Q2-4 – development and testing for Mersey Pathfinder.</p> <p><b>Constraints</b> (This is TBC on the impact assessment).</p>					
					<p>Q1-2 – development and testing for Constraints Management Pathfinder.</p> <p>Q3 – implement Constraints Management Pathfinder.</p>					
A1.2 Enhanced Balancing Capability	D1.2.3 Projects running, using innovation funding, to consider how greater automation, machine learning and use of artificial intelligence can be used across our activities to handles increases in the amount of data and the number of expected actions.	450 Future Innovation Productionisation This investment covers future Network Innovation Allowance (NIA) projects only. This funding is needed to enable us to respond to challenges as they appear. The ongoing nature of the NIA pipeline requires funding to be available for NIA productionisation. We are evaluating several projects that would mature towards the end of the RIO-1 period and may require funding early in RIO-2. This investment also includes an opex element to cover IT support for new innovation projects. Known NIA and Network Innovation Competition (NIC)	Continuous	N/A	N/A	N/A	N/A	N/A	N/A	



## ESO R110-2 Delivery Schedule

Sub activity	Deliverable	Related IT Investment	Project or continuous	RIO-1 end point	2021/2022 Milestones	2022/2023 Milestones	First year success	Second year success	Expected final delivery date and what success looks like.	Notes on changes to Dec 2019 Business Plan
		projects are covered by their own investment lines, included elsewhere in the RIO-2 submission.								
A1.3 Transform Network Control	D1.3.1 Develop and deliver new real-time situational awareness tool, so Control Centre engineers can better understand changing network limitations, leading to a more efficient risk-based operation of the system.	110 Network Control The new capabilities will integrate with IT investment 220 Data and analytics platform, ensuring a single network model for Control Centre operators. Although not switching or moving transmission equipment, i.e. no large-scale asset control, the new tool will still need to send signals to ask for services (e.g. sending instructions to the DSOs' automated network management (ANM) systems). In a similar way, we will still need to see substitution configurations even if we do not need to receive all the detailed alarms.	Project	<p><b>IEMS Life Extension</b></p> <p>Detailed asset health assessment undertaken. Technical approach with stakeholders and vendors agreed.</p> <p>In-depth technical options analysis developed.</p> <p>Asset risk mitigation options determined.</p> <p><b>Network Control Strategy</b></p> <p>Forward Plan - Control capability development, including life extension of current system, capability requirements work ongoing between SO-TO in prep for separation of systems, user stories for new product.</p>	<p><b>IEMS Life Extension</b></p> <p>Q1 &amp; Q2 - Vendor negotiations to support life extension.</p> <p>Q3 &amp; Q4 - Deliver high priority software and hardware life extension projects.</p> <p><b>Network Control Strategy</b></p> <p>Q1 - validate scope and transition strategy, based on Roadmap.</p> <p>Q1 - start procurement activity for core system.</p> <p>Q1 - commence proof of concept work.</p> <p>Q1 - determine core system "to be" architecture and options</p> <p>Q1 - commence core system requirements.</p>	<p><b>IEMS Life Extension</b></p> <p>Q1 &amp; Q2 - Deliver medium priority software and hardware life extension projects.</p> <p>Q3 &amp; Q4 - Deliver low priority software and hardware life extension projects.</p> <p><b>Network Control Strategy</b></p> <p>Q1.4 - build of core situational awareness system.</p> <p>Q2 - roadmap updated with input from TAC.</p> <p>Q4 - finish proof of concept work.</p>	<p><b>IEMS Life Extension</b></p> <p>Design work completed.</p> <p>Agile delivery starting.</p> <p>Life extension of current systems continued including development work where necessary to manage changing network.</p> <p>Incremental targets for CNI system reliability metric met.</p> <p><b>Network Control Strategy</b></p> <p>Supplier engagement and sourcing strategy in action.</p>	<p><b>IEMS Life Extension</b></p> <p>Life extension of current systems continued including development work where necessary to manage changing network.</p> <p>Voltage stability analysis capability implemented</p> <p>Improved fault level analysis implemented</p> <p>Delivery continuing in an agile manner.</p> <p>Incremental targets for Metric 2 - CNI system reliability met.</p> <p><b>Network Control Strategy</b></p> <p>Core situational awareness tool delivered (but not yet in operation). This will be the core system, that links to the control centre architecture (Activity A1.4), including the data and analytics platform, and other modules.</p>	<p><b>IEMS Life Extension</b></p> <p>Final delivery in March 2026 with the decommissioning of IEMS</p> <p><b>Network Control Strategy</b></p> <p>By March 2025 Business process implemented ensuring Control Centre engineers can manage and visualise far greater volumes of data than in 2020 which is a key enabler of our ability to operate the network carbon free. This information is used to better understand the operating envelope, allowing Control Centre engineers to run a more efficient system safely and at lower cost to consumers.</p> <p>Specific deliverables include:</p> <ul style="list-style-type: none"> <li>Integration with new NGET SCADA system complete</li> <li>Enhanced situational awareness capability delivered</li> <li>Enhanced real-time modelling tools and look-ahead capability delivered</li> <li>Enhanced control room visualisation delivered</li> <li>Full training simulator integration (D2.3.1 / IT investment ref 200)</li> <li>Shadow control room live.</li> </ul>	<p>There are no significant changes. However, we have provided further detail, breaking the project down into two components:</p> <ul style="list-style-type: none"> <li>IEMS Life Extension - maintenance of legacy system.</li> <li>Network Control Strategy - transformation investment in the new situational awareness tool to replace IEMS.</li> </ul>

ESO R10-2 Delivery Schedule

Sub activity	Deliverable	Related IT Investment	Project or continuous	R10-1 end point	2021/2022 Milestones	2022/2023 Milestones	First year success	Se cond year success	Expe cted final delivery date and what success looks like.	Notes on changes to Dec 2019 Business Plan
					Q4 – finish core system design work. Q4 – finish procurement activity. Procurement approach confirmed. Q4 – roadmap updated with input from TAC.		<ul style="list-style-type: none"> <li>Timeline agreed with codes team.</li> <li>Incremental benefits identified in cost-benefit analysis realised.</li> </ul>	<ul style="list-style-type: none"> <li>State estimator</li> <li>Basic alarm management.</li> <li>Other potential in-scope items delivered at this stage (subject to change):</li> <li>Display capability</li> <li>Contingency analysis.</li> </ul>	Benefits identified in cost-benefit analysis realised.  iEMS decommissioned (for ESO use).	
							Updated roadmap agreed with TAC and published.	Incremental benefits identified in cost-benefit analysis realised.		
							Core system initially running in a non-operational sandbox alongside iEMS, allowing for testing and tuning of modules.			
							Project scope and prioritisation for development of new tools developed through stakeholder engagement (e.g. TAC) and finalised.	Progress on track against previous roadmap with first set of tools delivered and integrated with data platform.	By March 2026: we will have enhanced network modelling capabilities delivering consistent and accurate outputs which support better operational decision making across all time scales.	Updated to provide more clarity on what will be delivered in BP1.
<b>A1.3</b> Transform Network Control	<b>D1.3.2</b> Enhanced network modelling capabilities with online analysis of voltage and power flow profiles closer to real time.	<b>150</b> Operational Awareness and Decision Support Enhanced look ahead capability will be required to predict transmission problems in a more volatile operating environment.	Project	Restructured internally to bring modelling into more efficient structure and processes.  Lessons learned from investigation into system events such as 9 August 2019.	<ul style="list-style-type: none"> <li>Ongoing: Engagement with the TAC on required tools. Scoping and development work.</li> <li>Agile build.</li> <li>Tool delivery.</li> </ul>	<ul style="list-style-type: none"> <li>Ongoing: Engagement with the TAC on required tools. Scoping and development work.</li> <li>Agile build.</li> <li>Tool delivery.</li> </ul>	<ul style="list-style-type: none"> <li>Project scope and prioritisation for development of new tools developed through stakeholder engagement (e.g. TAC) and finalised.</li> <li>Roadmap produced for priority tools.</li> </ul>	<ul style="list-style-type: none"> <li>Project scope and prioritisation for development of new tools developed through stakeholder engagement (e.g. TAC) and finalised.</li> <li>Updated roadmap produced for named priority tools.</li> <li>First tools integrated with new Network Control tool core system (<b>D1.3.1</b>).</li> </ul>	Our modelling systems will have the option to be interoperable with DNO/DSO systems, allowing two-way data exchange to enhance whole system decision making.	

ESO R10-2 Delivery Schedule

Sub activity	Deliverable	Related IT Investment	Project or continuous	R10-1 end point	2021/2022 Milestones	2022/2023 Milestones	First year success	Se cond year success	Expe cted final delivery date and what success looks like.	Notes on changes to Dec 2019 Business Plan
<b>A1.3</b> Transform Network Control	<b>D1.3.3</b> Upgraded Control Centre video walls and operator consoles, with a single interface giving an overall state of the power system. This will allow Control Centre engineers make better and quicker decisions.	<b>140</b> ENCC Operator Console This will also give an overall view of the state of the power system in one place enabling Control Centre managers to make better and quicker informed decisions. In emergency cases, the silver command team will also be able to have faster reaction times and give the most up to date and relevant information to external stakeholders. Control Centre users will get all data from our IT investment <b>220</b> Data and analytics platform. Critical modules and applications will be delivered by IT investments <b>180</b> Enhanced balancing capability and <b>110</b> Network control.	Project	Current Control Centre facilities maintained.	N/A	Q1 – start user experience (desks and graphical user interface) project. Q2 – scope requirements. Q3 - begin design work. Q4 – continue design work.	Current Control Centre facilities maintained.	Current Control Centre facilities maintained. Requirements for new Control Centre visualisation tools understood and scope agreed. Understand technology required to enable IEMS tool to drive the video wall. Delivery timeline agreed and progress tracked.	By March 2026 Our enhanced Control Centre video walls and operator consoles will integrate all of the tools developed to ensure Control Centre engineers can visualise the real-time state of the network. Using these tools, they will be able to understand and analyse the increased data coming into the Control Centre and use it to make optimal decisions.	
<b>A1.3</b> Transform Network Control	<b>D1.3.4</b> Increased Operational Ilation with DNOs.  The Regional Development Programmes (RDPs) will highlight new ways of working with a range of network companies across time horizons. This deliverable relates to the incorporation of these new ways of working into our operational processes.  Due to the "learn by doing" approach to RDPs, we cannot say at this stage exactly what the changes will be.	N/A	Continuous	Learnings from Optional Downward Flexibility Management (ODFM) learning; rudimentary work on managing voltages, learning from DNOs, information sharing.	Q1-Q2 - Engage DNOs to develop view of further information to support service coordination. This may include identifying services covered, granularity of information to be shared in both directions and timescales.  Ongoing – learnings and new ways of working from RDPs incorporated into operational processes and ways of working.	Engage DNOs to develop process to share further information to support service coordination. This may include identifying services covered, granularity of information to be shared in both directions and timescales.  Ongoing – learnings and new ways of working from RDPs incorporated into operational processes and ways of working.	View of further information to support service coordination, to be shared with DNOs complete (building on ODFM learnings and delivered in coordination with ENA Open Networks Project).	Process in place to share further information to support service coordination (building on ODFM learnings and delivered in coordination with ENA Open Networks Project).  Key concepts from RDPs identified and utilised to demonstrate better ways for whole network to work together in real-time.	Key concepts from RDPs identified and utilised to demonstrate better ways for whole network to work together in real-time.	Further clarity added on this deliverable.



ESO RLO-2 Delivery Schedule

Sub activity	Deliverable	Related IT investment	Project or continuous	RLO-1 end point	2021/2022 Milestones	2022/2023 Milestones	First year success	Se cond year success	Expe cted final delivery date and what success looks like.	Notes on changes to Dec 2019 Business Plan
	This deliverable will also help facilitate enhanced coordination in network access planning by ensuring liaison in operational timescales.									
A1.4 Control Centre Architecture	D1.4.1 Creation of a data and analytics platform that will act as the foundation for our new Control Centre architecture. It will house all ESO internal data, including from the Control Centre systems, and allow users to access it in the timescales they need. External stakeholders will be able to access it through the data portal.	220 Data and Analytics Platform The data and analytics platform will retire many of our data legacy systems. It will include analytics capability, so we can access, share and shape any type of data we store. This is critical to allow quicker, accurate operational decisions and give our customers value added information.	Project	Data portal in operation with application program interfaces (APIs) available.  Learning captured from data portal use of APIs and data management for use with data platform work.	(The work-breakdown structure associated with this deliverable is complex. We have provided a summary here. For full details please see IT ref 220 Data & analytics platform).	(The work-breakdown structure associated with this deliverable is complex. We have provided a summary here. For full details please see IT ref 220 Data & analytics platform).	Evidence of ongoing, constructive, planned engagement with stakeholders ensuring their requirements are fully considered.  Code changes identified and roadmap of activity for next 12 months agreed. Data platform foundation build on target.	Master data management system completed.  Data platform foundation delivered including successful testing of plug-and-play approach with modules in development/delivery phase.  Stakeholder able to submit and access single version of the truth data for an agreed subset of data.	By March 2023 Data is available in a common environment accessible via APIs. All parties can use and harvest data.  The completed communications architecture allows new systems to be integrated seamlessly in a 'plug-and-play' or 'app-like' way. This allows our plan, and future system upgrades, to flex with the need to meet the challenges of facilitating the transition to net zero.	Updated to provide more clarity on what will be delivered in BP1.
					Q1-4 – build data platform foundation.  Q1-4 – develop master data management strategy.  Q2 - phase 1 data management scoping complete for modelling and data management for Operability (Role 3, A15.6.1).  Regular progress updates with the TAC.	Q1-3 – continue building data platform foundation.  Q3 – deliver machine learning for balancing and forecasting.  Q4 – integrate data platform with digital engagement platform  Q4 – integrate data platform with single markets platform.  Regular progress updates with the TAC.  Q1-Q4 - Explore opportunities for Data and Analytics Platform to support real-time operational data exchange in support of Regional Development Programmes.	Master data management strategy developed and implemented.  Digital engagement platform and single markets platform migrated to data platform, providing a single point of access for participation in ESO balancing services.  Planned code change activity completed. Further code changes identified and roadmap of activity for next 12 months agreed.	Evidence of ongoing, constructive, planned engagement with stakeholders ensuring their requirements are fully considered.  Incremental benefits identified in cost-benefit analysis realised.	Benefits identified in cost-benefit analysis realised.	

ESO R10-2 Delivery Schedule

Sub activity	Deliverable	Related IT Investment	Project or continuous	R10-1 end point	2021/2022 Milestones	2022/2023 Milestones	First year success	Second year success	Expected final delivery date and what success looks like.	Notes on changes to Dec 2019 Business Plan
<b>A1.4</b> Control Centre Architecture	<b>D1.4.2</b> Creation of the ESO Technology Advisory Council (TAC), open to external stakeholders, who we will work with on the development of new balancing and control tools.	none	Continuous	TAC set up to inform the overall direction and provide input into the design, development and testing phases of our solution development.	Ongoing – regular meetings with the TAC (likely to be at least quarterly).	Ongoing – regular meetings with the TAC, (likely to be at least quarterly).	Positive feedback from the TAC and wider stakeholders on ESO transparency, accountability and engagement.	Positive feedback from the TAC and wider stakeholders on ESO transparency, accountability and engagement.	From April 2021: The ESO will work with a cross-sector TAC to guide the digital and technological transformation. The TAC will provide stakeholder input, transparency and accountability into the development of new systems and markets.	Updated to provide more clarity on what will be delivered in BP1.

## A2 Control Centre training and simulation

Our proposals for A2 Control Centre Training and Simulation help deliver our **zero carbon operation ambition** giving us the training and simulation capability to be able to operate the zero carbon system of the future. We expect this to be a step-change in complexity from today, with more market participants and greater volumes of embedded, weather dependent and asynchronous generation.

**A2.1 Ongoing activities** ensures that the control centre is appropriately resourced to continue operating the system safely, efficiently and economically. We will have the appropriate policies and carry out technical investigations as necessary.

**A2.2 Enhanced training material** will ensure we develop a pipeline of talent and skills into the control centre by forging deep relationships with universities and wider industry to train students and our colleagues across the industry in system operation.

By the end of BP-1 we will have:

- Strengthened relationships with existing universities and built relationships with new ones to start delivering new modules and courses in system operation.
- Laid the foundations for partnering with universities, DNOs and other industry participants to ensure the skills identified for development industry wide are those required to operate a zero carbon system by 2025.

This helps ensure our 2025 zero carbon operation ambition is on track by:

- Delivering modules in system operation that, based on feedback, we can update and iterate, including building into longer (e.g. one-year long) courses.
- Providing the enhanced training we need for future control centre engineers to manage the operational landscape of the future. For modules starting in September 2022, we may see some flow into the ESO for 2023/24.
- Developing relationships that will equip staff and organisations across the energy industry with the knowledge and skills that we need to achieve our 2025 aims and attract them to a career in the ESO.

**A2.3 Training simulation and technology** will mean our control centre engineers will be better equipped in BP1 to manage the operating environment associated with a zero carbon system.

By the end of BP-1 we will have:

- Control engineer training based on up to date scenario snapshots that reflect the increase in balancing services providers and opportunities to operate the system in a less-carbon intensive way.
- Delivered practical improvements to system operation as control centre engineers have better training on how to use key systems and how to manage the changing operational environment. This will help improve their decision making, leading to safer and more efficient system operation. It also means that experienced control engineers do not have to be released from operational duties to directly support training and allows training to focus on the power system being developed in addition to the power system of today.

This helps ensure our 2025 zero carbon operation ambition is on track by:

- Ensuring that our new training and simulation technology that we will deliver in subsequent years reflects industry best practice.

**A2.4 Workforce and change management** will mean the control centre reflects (where possible) modern, flexible working and training practices. Control engineers are better supported in delivering the complex requirements of carbon-free system operation by ensuring we have the correct processes for maintaining staff wellbeing and providing them with the latest updates in easy to digest formats.

Sub activity	Deliverable	Related IT investment	Project or continuous	RIIO-1 end point	2021/2022 Milestones	2022/2023 Milestones	First year success	Second year success	Expected final delivery date and what success looks like.	Notes on changes to Dec 2019 Business Plan
<b>A2.1 Ongoing activities</b>	<b>D2.1.1</b> Develop and drive control centre strategic resource planning, scheduling and training.	None	Continuous	N/A	N/A	N/A	N/A	N/A	N/A	
<b>A2.1 Ongoing activities</b>	<b>D2.1.2</b> Incident analysis and investigations of abnormal events, implementing	None	Continuous	N/A	N/A	N/A	Sustained or improved investigation quality and to 75%. investigation actions	Sustained or improved investigation quality and to 85%. investigation actions	Sustained or improved investigation quality and investigation actions closed on time from 2022/23.	Updated to provide more clarity on what success will be in BP1.

ESO RII0-2 Delivery Schedule

Sub activity	Deliverable	Related IT investment	Project or continuous	RIIO-1 end point	2021/2022 Milestones	2022/2023 Milestones	First year success	Second year success	Expected final delivery date and what success looks like.	Notes on changes to Dec 2019 Business Plan
	improvements where needed.						closed on time from 2020/21 to 95%.	closed on time from 2021/22 to 97%.		
A2.1 Ongoing activities	D2.1.3 Monitoring and reporting of system performance to regulatory bodies and ENTSO-E.	None	Continuous	N/A	N/A	N/A	N/A	N/A	N/A	
A2.1 Ongoing activities	D2.1.4 Guidance on operational policies for use in the control centre produced.	None	Continuous	N/A	N/A	N/A	N/A	N/A	N/A	
A2.2 Enhanced training material	D2.2.1 Development of new modules and (based on feedback) new qualifications in system operation formed via an enhanced partnership with academic institutions.	None	Project	Building relationship with selected universities to understand what is possible and plan how best to encourage development and inclusion of course content on electricity system operation.	Q1 – develop plan for engaging academia, including detail of the institutions to talk to, how we can work together, understanding the process for creating modules and the skillset for future power system operation. Q2-4 – work with industry to define skillset for future power system operation. Q3-4 – work with institutions to develop new module(s), for delivery in September 2022.	Q1-2 – work with institutions to develop new module(s), for delivery in September 2022. Q3 – run new university modules. Q4 – run new university modules.	Skillset for future power system operation agreed across industry. Plan for engaging with universities, including the topics we want content developed on and an understanding of which institutions we can partner with. Details of partnership agreed with selected universities to design and deliver optional electricity system operation modules for existing university courses which provides an overview of all elements of system operation, including power system engineering, market operation and commercial and regulatory frameworks.	ESO supports delivery of new module content delivered within university courses during academic year 22/23. Evaluation of new module content. More academic partnerships built to deliver new module content. Support the dissertation process of existing university courses, allowing candidates to work on an ESO-relevant project and gain experience of the ESO as part of the development of their project. This work lays the foundation for partnering with universities to ensure the right skills are developed that are required to operate a zero-carbon system. For modules starting in September 2022, we may see some flow into the ESO for 2023/24.	By March 2023 See Second Year success. By March 2026 UK institutions that already offer courses in relevant subjects such as power system engineering, data science and energy systems have been given the option partner with the ESO to ensure that existing qualifications remain relevant. Exploring potential for use of future training simulators in support of university projects and courses. Regular recruitment from graduates of these courses supports workforce planning by providing a secure pipeline of high-quality talent joining the ESO (and wider industry) who are ready to be developed through a recognised career track to fill business critical roles.	One-year delay due to covid-19, meaning preparatory work with academia in 2020/21 has not been possible.

ESO RII0-2 Delivery Schedule

Sub activity	Deliverable	Related IT investment	Project or continuous	RII0-1 end point	2021/2022 Milestones	2022/2023 Milestones	First year success	Second year success	Expected final delivery date and what success looks like.	Notes on changes to Dec 2019 Business Plan
								The first suite of modules will have been run that, if successful, will form the basis of future partnerships between institutions and the ESO (see March 2026 aims).		
<b>A2.2</b> Enhanced training material	<b>D2.2.2</b> Enhanced training and simulation with DNOs and wider industry.	None	Project	Engage with cross ESO high level planning for engagement with energy industry stakeholders during RII0-2 to ensure coordinated approach makes effective use of stakeholder time and resources.	Q2 – develop plan for engaging with energy industry, including detail of the organisations to talk to, how we can work together.  Q2 – develop plan for engaging with energy industry, including detail of the organisations to talk to, how we can work together.	Q1.4 – explore requirements with industry on possible training using enhanced ESO simulators. Engage DNOs on sharing data, what their interest is and how we can help each other.	Team set up and liaising with external parties to understand DNO needs and appetite to work together on wider industry training in ED2.  Team set up and liaising with external parties to understand DNO needs and appetite to work together on wider industry training in ED2.	Cross industry development initiatives for individuals (up to and including secondments) are now normal, with best practice being regularly shared.  Positive engagement with industry on partnerships to develop whole electricity system training. An understanding of the appetite of DNO's and other industry participants to develop future opportunities for training and development initiatives which reflect and are in response to wider energy industry needs.  Practical improvements to system operation will be delivered through the sharing of best practice across the industry.	By March 2026, whole electricity system training and joint exercises will be standard across industry.  ESO capable of providing training to meet the needs of other parties reflects the needs, in particular working together to enable the DNO to DSO transition.	One-year delay due to covid-19, meaning preparatory work with academia in 2020/21 has not been possible.  Due to covid-19, secondments are likely to be more ad-hoc and based on bilateral relationships rather than a more structured programme.
					Q2 – understand the requirements for cross-industry secondments including post-COVID-19 safeguards.  Q3.4 – work with industry to define skillset for future power system operation and understand potential opportunities for wider industry/whole system training in RII0-2/ED2.	Q1 – Implement cross industry development initiatives for individuals (up to and including secondments where possible).				
<b>A2.3</b> Training simulation and technology	<b>D2.3.1</b> Upgrades to current simulators, including annual scenario snapshot refreshes, ahead of developing new training simulation capability, including end-to-end bespoke	<b>200</b> Future training simulator. We will use our new simulation capabilities to deliver a training suite that includes end-to-end	Project	Annual refreshment of existing simulator snapshot scenario completed to reflect key changes to the energy landscape.	Q1 – Develop plan to explore best practice training and simulation technology including understanding requirements for post-COVID-19 safeguards.	Q1 – continue exploring best practice training and simulation technology.	Annual refreshment of existing simulator snapshot scenario completed to reflect key changes to the energy landscape.	Annual refreshment of existing simulator snapshot scenario completed to reflect key changes to the energy landscape.	By March 2025 Control Centre engineers will be using training simulators which accurately reflect the changing energy landscape. This will allow them to learn	Prioritisation of IT portfolio due to COVID-19, meant development of Balancing Mechanism training simulator to support energy and strategy training for Control



ESO RII-2 Delivery Schedule

Sub activity	Deliverable	Related IT investment	Project or continuous	RIIO-1 end point	2021/2022 Milestones	2022/2023 Milestones	First year success	Second year success	Expected final delivery date and what success looks like.	Notes on changes to Dec 2019 Business Plan
	training scenarios and simulated operational systems using live data.  This functionality will be delivered as a training capability through <b>D1.2.1</b> Enhanced Balancing Capability and D1.3.1 Transform Network Control to ensure training environment is able to duplicate real time operations.	scenario simulations. The training simulator will also integrate capabilities from IT investment <b>400</b> single markets platform to easily create complex scenarios.  The same capabilities can be used to use different data sets and train DSOs and other industry stakeholders, if such need arises, as well as our own teams.		Current status of energy and strategy training for control engineers understood and improvements for Balancing Mechanism training simulator planned to support training in managing the changing energy markets.	Q2 – begin exploring best practice training and simulation technology.  Q3 – update existing simulators with scenario snapshots. – continue exploring best practice training and simulation technology.	practice training and simulation technology.  Q3 – update existing simulators with scenario snapshots. – continue exploring best practice training and simulation technology.  Q4 – continue exploring best practice training and simulation technology.	Balancing Mechanism training simulator improved and started supporting energy and strategy training for control centre engineers.  Findings from best practice training and simulation technology shared with <b>D1.2.1</b> and <b>D1.3.1</b> project teams.  Control engineer training is based on up to date scenario snapshots which reflect the increase in balancing services providers and reflect the increasing opportunities to operate the system in a less-carbon intensive way.  Control Centre engineer training is based on up to date scenario snapshots which reflect the increase in balancing services providers and reflect the increasing opportunities to operate the system in a less-carbon intensive way.	Balancing Mechanism training simulator supports energy and strategy training for control centre engineers.  Findings from best practice training and simulation technology shared with <b>D1.2.1</b> and <b>D1.3.1</b> project teams are being incorporated into development of training capability.  Control engineer training is based on up to date scenario snapshots which reflect the increase in balancing services providers and reflect the increasing opportunities to operate the system in a less-carbon intensive way.  Potential for use of future training simulators in support of university courses and whole electricity system training is being explored, enabling the DNO to DSO transition.	from a range of past and future scenarios, including using real-time data as opposed to the current snapshots used in 2020.  Our training capabilities will be fully aligned with the new balancing and network control tools, and any future updates, providing fully integrated training and simulation capability on energy and transmission.	Centre engineers in 2020/21 has not been possible.
<b>A2.3</b> Training simulation and technology	<b>D2.3.2</b> New training methods and platforms, including online and e-learning, introduced to support training and new starters and continued development of existing staff.	None	Project	Training for some roles moved into classroom and becomes less reliant upon shadowing Control Centre colleagues and learning "on the job".  Potential alternative options explored, initially video and E-learning including costs and timelines	Q1 – understand lessons learnt from Project TERRE E-learning trial including cost considerations and effectiveness of training delivery.  Q1 – identify and evaluate other opportunities to deploy E-learning and develop plan.	Q1.4 - use new video and e-learning training enhancements.  Q3.4 – incorporate use of new video and e-learning training enhancements into design of new academic modules, due to start in September 2022.	Delivery via video and e-learning evaluated against success criteria including student experience.  Continued exploration of ways to reduce reliance upon shadowing Control Centre colleagues and learning "on-the-job" with different options	Delivery via video and e-learning evaluated against success criteria including student experience.  Continued development and implementation of training materials and approaches which reduce reliance upon shadowing Control Centre colleagues	By March 2023 Control Centre engineers will be trained on a variety of platforms to meet individual and organisation training needs, reducing the specialised resource needed to support each individual.	Use of the new video and e-learning enhancements in new academic modules to start from September 2022 rather than September 2021, due to delay in starting new modules.

ESO RII0-2 Delivery Schedule

Sub activity	Deliverable	Related IT investment	Project or continuous	RII0-1 end point	2021/2022 Milestones	2022/2023 Milestones	First year success	Second year success	Expected final delivery date and what success looks like.	Notes on changes to Dec 2019 Business Plan
				E-Learning trialled for Project TERRE.	Q2-Q4 –develop and deploy of new E-learning modules as required.		such as classroom, video, E-learning, etc including NG Academy platform. Next steps identified and planned.	and learning "on-the-job".  New training methods become part of the new academic modules, providing deeper and more flexible training.		
<b>A2.4</b> Workforce and change management	<b>D2.4.1</b> Personalised updates and automated shift logins, allowing for learning and operational investments to made available on different platforms and updated to a user's profile, giving better training and operational decision making.	<b>190</b> workforce and change management tools. We will integrate these management tools with our IT investments <b>180</b> E enhanced balancing capability and 110 Network control tools to enable personalised updates. They will be linked to the rota and change management tools to allow for relevant updates to be given as required, for example, when a Control Centre user returns from a day off to perform a specific role.	Project	Review of rotas to ensure protection of staff wellbeing while providing efficient Control Centre staffing levels.  Rota management automation project Phases 1 and 2 completed providing better management of the authorisation database containing details of which individual control engineers are qualified for which duties.	Q1-Q2 – evaluate Phase 1 and 2 of Rota management automation project implementation and operation with users.  Q2 – understand capabilities of underlying systems and understand opportunities for enhancement in Phase 3.  Q3 – agree Phase 3 requirements.  Q4 – define high-level scope for Phase 3 with IT provider.	Q1 – start work on Phase 3 of Rota management automation project.  Q1 - start work on document management (e.g. control centre policy) improvements project.  Q2 - Scope requirements for document management improvements.  Q3 – start design work for document management improvements.  Q4 - Continue design work for document management improvements.	High level scope for Rota management automation enhancements work (Phase 3).	Rota management process reviewed, improvements identified and specified.  Design work for automation of workforce related processes including development of personalised updates and automated shift logins underway.	By March 2025 Control Centre engineers' wellbeing and development is supported using greater automation in producing rotas and personalised training packages. The enhanced user experience will provide flexibility to both the trainee and the trainers through their authorisations and training needs.	
<b>A2.4</b> Workforce and change management	<b>D2.4.2</b> Content and infrastructure for personalised training plans designed, developed and delivered.	See D2.3.1	Continuous	Generic assessment used to identify candidates with aptitude for control engineer role. Current simulator technology does not support more refined assessment which would enable standard training programmes to be adjusted to fit	N/A	N/A	N/A	N/A	By March 2025 Potential control centre engineers will be assessed using training simulators which can support identification of individual aptitude for control engineer roles and inform adjustment of the standard training programme to ensure	



ESO R10-2 Delivery Schedule

Sub activity	Deliverable	Related IT investment	Project or continuous	R10-1 end point	2021/2022 Milestones	2022/2023 Milestones	First year success	Second year success	Expected final delivery date and what success looks like.	Notes on changes to Dec 2019 Business Plan
				Individual requirements.					each suitable candidate receives training tailored to their existing knowledge and skills set which results in more effective preparation for Control Centre roles in a shorter time.	

### A3 Restoration

Our proposals for restoration are fundamental to delivering our **zero-carbon operation ambition** and **competition everywhere ambition** in the services we procure.

Details of the specific activities are provided below. It is important to understand the relationships between the different elements.

- **D1.3.5** Fully competitive Black Start procurement process will establish and test approaches to competitive procurement for black start.
- **A3.3** Innovation project in restoration will establish a proof of concept for the provision of black start services from Distribute Energy Resources (DER). If the project establishes that DER can deliver this service, the competitive procurement process can be evolved to establish a route to market for DER to provide black start.
- **A3.2** Restoration standard includes **D3.2.4** Restoration decision making support tool. The requirements and design for this tool are heavily dependent on the outcomes of **A3.3** Innovation project in restoration and subsequently cannot start until the conclusions of the innovation project are known.

Sub activity	Deliverable	Related IT investment	Project or continuous	RIIO-1 end point	2021/2022 Milestones	2022/2023 Milestones	First year success	Second year success	Expected final delivery date and what success looks like.	Notes on changes to Dec 2019 Business Plan
<b>A3.1</b> Ongoing activities	<b>D3.1.1</b> Control Centre has fully tested skills, processes, plans and tools to support incident management and disaster recovery.	None	Continuous	N/A	Control Centre staff trained to fulfil their role under new licence condition imposed following publication of Restoration Standard.	Ongoing training of Control Centre staff to ensure all are aware of their roles under restoration.	Planning for 60% of demand restored within 24 hours, on a zonal basis if economic, as per Black Start procurement methodology <sup>2</sup> .	Planning for 60% of demand restored within 24 hours on a zonal basis, if economic, as per Black Start Strategy and Procurement Methodology.	TBC – will be based upon new restoration standard.	The Restoration Standard is now anticipated to be in place (i.e. in ESO's licence) from April 2021. Milestones have been adjusted accordingly.
<b>A3.1</b> Ongoing activities	<b>D3.1.2</b> Restoration plans for GB with the necessary stakeholders, developed, maintained and validated.	None	Continuous	N/A	Review and update of plans as required on individual review dates. 2021/22 Black Start Strategy and Procurement Methodology consulted and published.	2022/23 Black Start Strategy and Procurement Methodology published and System Restoration Plan reviewed and consulted.	Restoration Plans reviewed in line with ESO's review criteria (minimum of every 3 years). Black Start Strategy and Procurement Methodology accepted by Ofgem.	Restoration Plans reviewed in line with ESO's review criteria (minimum of every 3 years). Black Start Strategy and Procurement Methodology accepted by Ofgem.	Relevant restoration plans aligning with Black Start Strategy restoration approach.	Annual publication of Black Start Strategy and Procurement Methodology as per licence obligation.
<b>A3.1</b> Ongoing activities	<b>D3.1.3</b> Engage and collaborate with industry to plan and develop the new GB restoration standard, including the annual assurance framework, consistent with our licence obligations.	None	Continuous	N/A	N/A	N/A	N/A	N/A	N/A	
<b>A3.1</b> Ongoing activities	<b>D3.1.4</b> Advice and oversight of Black Start and restoration strategy for the future provided.	None	Continuous	N/A	N/A	N/A	N/A	N/A	N/A	
<b>A3.1</b> Ongoing activities	<b>D3.1.5</b> Fully competitive Black Start procurement process with	None	Project		As per Section 8 of procurement methodology.	As per section 8 of procurement methodology.	Contracts awarded to successful parties for the South West / Midlands and Northern Tenders with	By March 2022 We will have delivered the first of these tenders enabling the transition	Final delivery of this activity will be a fully implemented competitive process for Black Start.	This activity has been reclassified from "continuous" to "project" to

<sup>2</sup> <https://www.nationalgrid.co.uk/document/173826/download>

ESO RIL0-2 Delivery Schedule

Sub activity	Deliverable	Related IT investment	Project or continuous	RIL0-1 end point	2021/2022 Milestones	2022/2023 Milestones	First year success	Second year success	Expected final delivery date and what success looks like.	Notes on changes to Dec 2019 Business Plan
	submissions from a wide range of technologies connected at different voltage levels on the network, with DNOs playing a more active role in the restoration approach.				Q1-Q2 Deliver competitively tendered Black Start contracts from the South West / Midlands and Northern tenders.	Q1-Q2 Deliver competitively tendered Black Start contracts from the South East tenders. Q3 contract award and service commences.	support provided to parties through the process before they start delivering the contracts.  Preparatory work for future tender opportunities in South East complete.	of Black Start from a service which is bilaterally procured to one with a more open and transparent procurement approach.	Opportunities for engagement will be published with clear technical requirements to enable participation from the whole market and all service providers who meet these.	reflect its transformational nature  COVID-19 impact: The tendering process for Black Start contracts has had revised timescales due to provider delays in completing feasibility or commercial studies due to lack of resource during COVID19.
					Q1-2 Carry out preparatory work for future tender opportunities in South East, in preparation for future tender event.		Publication of an updated restoration roadmap to highlight future opportunities for Black Start services – including integration of the findings from Distributed ReStart project	Contracts awarded to successful parties for the South East  Tenders with support provided to parties through the process before they start delivering the contracts.  Something about a plan/updated roadmap for next stages?		
A3.2 Restoration standard	D3.2.1 Facilitate and complete, on behalf of the GB industry, the annual assurance process for GB Black Start.	None	Project		[These timescales are based on the GB standard go-live in April 20210, with ESO have 12 months to implement].  Q1 – Restoration Standard in ESO's licence conditions.  Q2 – External plan for licence implementation consulted on.  Q4 P publication of Assurance Framework for consultation.  Q2-4 – Continue implementing GB restoration standard licence conditions.	Q1 – Restoration Standard in place.  Q2 – Complete annual assurance framework data collection and validation  - use outputs to recommend improvements.  Q3 - Implement improvements.  Publication of Assurance Framework.	Detailed plans in place to complete implementation within 12 months after licence condition, including training, industry agreements, code modifications, and changes to processes and systems required.  A communicated implementation plan, with code changes identified to support the annual assurance process under a Restoration standard.	Control centre engineers, ESO leaders and staff and wider industry fully prepared to deliver GB restoration standard supported by necessary industry agreements, code modifications, code processes and systems.  First annual assurance framework data collection and validation successfully completed and identified improvements implemented.	By December 2022 GB industry has successfully completed the first annual assurance process for GB Black Start readiness, including agreeing and implementing improvements.	The Restoration Standard is now anticipated to be in place (i.e. in ESO's licence) from April 2021. Milestones have been adjusted accordingly.

ESO RIL0-2 Delivery Schedule

Sub activity	Deliverable	Related IT investment	Project or continuous	RIO-1 end point	2021/2022 Milestones	2022/2023 Milestones	First year success	Second year success	Expected final delivery date and what success looks like.	Notes on changes to Dec 2019 Business Plan
A3.2 Restoration standard	D3.2.2 Validate restoration timelines for GB using the assurance data.	None	Project	See D3.2.1	[These timescales are based on the GB standard go-live in April 2021, with ESO having 12 months to implement]. Q1 Produce statement of restoration timescales. Q2 – Implementation of restoration standard (in line with D3.2.1). Q3 – restoration standard in place (12 months after licence condition).	Q1 -Q2 – continue implementing GB restoration standard licence conditions. Q1 – restoration standard in place (12 months after licence condition). Q3 – begin validation of restoration timelines using output from first annual assurance process (D3.2.1).	Statement of restoration timescales (i.e. what restoration times are nationally & zonally) to be produced for restricted review to establish the current status in 2021 of restoration timescales and to enable future monitoring of standard effectiveness.	Confirmation provided new restoration timescales can be met across the industry, leading to faster system restoration (should the need ever arise). Statement of restoration timescales to demonstrate that restoration timescales are decreasing (if all industry codes & supporting measures in place).	ESO have produced a standard statement of restoration to demonstrate the year on year improvement to the Restoration Standard. This uses results from the assurance framework to update model variables in line with reported assurance areas.	The Restoration Standard is now anticipated to be in place (i.e. in ESO's licence) from April 2021. Milestones have been adjusted accordingly.
A3.2 Restoration standard	D3.2.3 Maintain obligations and requirements against the new standard for Black Start capability provision.	None	Project	Compliance with current Black Start obligations.	These timescales are based on the GB standard go-live in April 2021, with ESO have 12 months to implement. Q1 – Restoration Standard in ESO's licence conditions. Q2 – External plan for licence implementation shared and consulted. Q3&4—Continue implementation of GB Restoration standard through code and or contractual means.	Q1 & Q2 Continue to implement GB Restoration Standard Licence conditions to meet new obligations.	ESO has maintained its license and code obligations whilst designing the necessary frameworks to implement a GB Restoration Standard, including design and training towards application of the Assurance Framework.	ESO has maintained its license and code obligations whilst facilitating the annual validation of the GB standard via the Assurance Framework.	Obligations under the standard become BAU compliance obligations once in force, and implementation period across the industry is completed.	The Restoration Standard is now anticipated to be in place (i.e. in ESO's licence) from April 2021. Milestones have been adjusted accordingly.
A3.2 Restoration standard	D3.2.4 Restoration decision making support tool designed and developed to aid faster restoration times in line with stakeholder expectations.	510 Restoration decision support tool.	Project	N/A	Q3 – Develop high level scope and requirements. Q4 – Restoration decision support	Design, build and delivery activities during 2022/23 aligned to our Solution Delivery Framework.	Engagement with stakeholders on the requirements and design for the restoration decision support tool (e.g. input data needed from across industry).	By March 2024 Control Centre engineers have the ability to have a dynamic tool with current advice on the best route to restoration and are enabled to manage potentially hundreds of	In response to Ofgem's feedback we have reviewed the timescales for the Restoration Decision Making Tool. We do not believe it is possible to articulate further	

ESO RILIO-2 Delivery Schedule

Sub activity	Deliverable	Related IT investment	Project or continuous	RILIO-1 end point	2021/2022 Milestones	2022/2023 Milestones	First year success	Second year success	Expected final delivery date and what success looks like.	Notes on changes to Dec 2019 Business Plan
		route to restoration. It will change its output every time the network configuration changes and update live in a restoration situation if the initial recommendation is overruled.  It will be flexible to accommodate learnings from restoration innovation project and meet Government restoration standards, including user defined scenarios for multiple restoration strategies.			tool project start up.	Q1 - Finalise restoration decision support tool project start up. - Engage with TAC on project requirements.  Q2 - Scope requirements.  Q3 – Engage with design authority on design. - Commence design work.  Q4 – Commence development work on restoration decision support tool.		Tool design and development underway.	restoration providers. Plans can respond immediately to changes in the restoration situation.	system changes that will be made in BP1 due to: <ul style="list-style-type: none"> <li>Requirements and design for the Decision Support Tool are dependent on the conclusions of A3.3 Distributed ReStart (Innovation project in restoration)</li> </ul> Expert restoration business resources will be deployed in delivery of the new restoration standard as well as the innovation project in this period. In addition to the previous point we consider attempting to bring this investment forward would undermine the deliverability of the restoration activities as a whole.
A3.3 Innovation project in restoration	D3.3.1 Trial case studies based on different technology types.  Innovation project in restoration will establish a proof of concept for the provision of black start services from Distributed Energy Resources (DER).	None	Project	Innovation project: ReStart ongoing: <ul style="list-style-type: none"> <li>With process for restoration defined;</li> <li>control systems design and power engineering live trials have begun.</li> </ul>	Q1 – Project progress report.  Q2 – implement 2 or 3 proof of concept case studies to confirm feasibility and cost.	N/A	Case studies selected, implemented and concluded.  Control systems designed.  Power Engineering Live trials complete.  End to end procurement design complete.  Telecommunications functional specification complete.	N/A	By March 2022 (see First year success), we will have established proof of concept for distributed restant, including an understanding of the challenges to implementation.	Updated to provide more clarity on what will be delivered in BP1.
					Q3 – Demonstration of Black Start for DER.  Q3 - Final version of generic procurement terms.  Q3 – Project progress report.  Q4 – Final proposals for functional and		Relevant learning gathered and used to determine distributed restant feasibility and go/no go decision for D3.3.2.			

ESO RII0-2 Delivery Schedule

Sub activity	Deliverable	Related IT investment	Project or continuous	RIIO-1 end point	2021/2022 Milestones	2022/2023 Milestones	First year success	Second year success	Expected final delivery date and what success looks like.	Notes on changes to Dec 2019 Business Plan
					testing requirements.					
<b>A3.3</b> Innovation project in restoration	<b>D3.3.2</b> (Subject to project findings) Proof of concept findings implemented and new system and communication methods implemented.	<b>460</b> Restoration We will support for the innovation project for technological solutions and procurement recommendations. From these, put in place changes ranging from secure communication links to distributed energy resources (DERs), to creating auctions for restoration services.	Project	See D3.3.1 above.	See D3.3.1 above.	Q1 – Q2 –assess learning from innovation project, working with stakeholders across the industry.  Q3 - engage with industry on productionisation.  Q4 - produce roadmap for productionisation.	See <b>D3.3.1</b> above.	Roadmap published for delivery of the collaborative and comprehensive solution developed jointly by the ESO and DNOs to allow DER to participate in the restoration market.	By March 2026 (subject to proof of concept findings), distributed resources are able to participate fully in restoration services. This will include completion of necessary framework, market, system and infrastructure work.	

## A17 Transparency and open data

Our proposals for Transparency and Open data drive progress towards our Trusted Partner ambition as well as our ambition to be able to operate a zero carbon system. Through transparency of our actions, stakeholder and market participants will be able to understand, and have greater confidence in, the decisions that we take to balance the system in real-time. In addition, by providing far greater diversity and volumes of operational and market data we anticipate that we will stimulate a fresh wave of innovation in low carbon and whole electricity system operation solutions. These solutions may mature into tools that will help us to operate the zero carbon system of the future.

Sub activity	Deliverable	Related IT investment	Project or continuous	RIIO-1 end point	2021/2022 Milestones	2022/2023 Milestones	First year success	Second year success	Expected final delivery date and what success looks like.	Notes on changes to Dec 2019 Business Plan
<b>A17 Transparency and Open Data</b>	<b>Transparency Roadmap</b>  This new deliverable defines the outcomes, timescales and steps to achieve the ESO's ambition to provide the highest level of transparency possible.  Further detail on the specific elements contained within the Roadmap are shown in the rest of the Transparency and Open data section below.  Note that whilst Energy Forecasting publications are in scope of the Transparency Roadmap, the details on publication updates for forecasting are covered in section A1.1 (D1.1.7) above.	<b>220 - Data and analytics platform:</b> It will be the key technology underpinning all our internal and external data management, pulling together data from a variety of sources and ensuring there is only one source of the truth.  <b>250 - Digital engagement platform:</b> This investment will offer a single point of access into the ESO systems and external-facing processes, providing secure, open access to data, compliant with data classification policies and standards. We will consolidate our ESO data publication and reporting channels, offering stakeholders access to our data, including multi device capability and Application Programming Interfaces (API) functionality.	Continuous	Initial <i>Transparency Roadmap</i> published with feedback on scope and methodology received.	Q1 – Publish <i>Transparency Roadmap</i> refresh.  Q3 – Publish <i>Transparency Roadmap</i> refresh.	Q1 – Publish <i>Transparency Roadmap</i> refresh.  Q3 – Publish <i>Transparency Roadmap</i> refresh.	ESO <i>Transparency Roadmap</i> refresh published informed by stakeholder feedback.  This will provide clarity on information that we share and future developments.  Positive stakeholder feedback received.	ESO <i>Transparency Roadmap</i> refresh published informed by stakeholder feedback.  This will provide clarity on information that we share and future developments.  Positive stakeholder feedback received.	N/A	This is a new deliverable, not included in December 2019 Business Plan.
<b>A17 Transparency and Open Data</b>	Transparency of operational decision making.  Provision of enhanced data to provide greater clarity and consistent		Continuous	Transparency of operational decision-making actions delivered including: <ul style="list-style-type: none"> <li>N-BM STOR (non-Balancing Mechanism Short</li> </ul>	Engage stakeholders to review and refine scope and quality of information shared.	Engage stakeholders to review and refine scope and quality of information shared.	Transparency of operational decision making will be further enhanced, for example through sharing data sets on operational decisions	Transparency of operational decision making will be further enhanced with information on operational decisions		This is a new deliverable, not included in December 2019 Business Plan.



ESO RII0-2 Delivery Schedule

Sub activity	Deliverable	Related IT investment	Project or continuous	RII0-1 end point	2021/2022 Milestones	2022/2023 Milestones	First year success	Second year success	Expected final delivery date and what success looks like.	Notes on changes to Dec 2019 Business Plan
	information about the individual actions taken in the Balancing Mechanism (BM). Sitting alongside this data will be a methodology statement which sets out the data provided and how it can be interpreted.  Data to be published includes: <ul style="list-style-type: none"> <li>All Bid Offer Acceptances (BOAs) including reasons</li> <li>potential alternative actions.</li> </ul> For actions not accepted reason codes which explain the operational need which is not resolved by the available actions not accepted. These actions when assessed on price comparison alone might be perceived as more optimal.			<ul style="list-style-type: none"> <li>Term Operating Reserve) instructions &amp; system operator plan</li> <li>Machine readable system operator plan</li> </ul> Initial publication on BM decision making	Rolling delivery of improvements identified.	Rolling delivery of improvements identified.	for a wider range of services and ancillary service contracts publication.  Positive stakeholder feedback received.	shared for a wider range of services.  Positive stakeholder feedback received.		
<b>A17 Transparency and Open Data</b>	Trading transparency  This deliverable aims to provide industry with greater transparency of our trading decisions. It will be driven by the feedback we get from engaging with our stakeholders on what information is most helpful to them and how it should be prioritised.		Continuous	<ul style="list-style-type: none"> <li>Trading transparency engagement complete and action plan published.</li> <li>Transparency actions delivered including: <ul style="list-style-type: none"> <li>Publishing Super -SEL</li> <li>Enactments</li> <li>Publication of additional trading information based on a prioritized action plan in line with stakeholder feedback.</li> </ul> </li> </ul>	Q1 -Q4 - Engage stakeholders (through the TAC and surveys at the Transparency Forums) to review and refine scope and quality of information shared.	Engage stakeholders (through TAC?) to review and refine scope and quality of information shared.  Rolling delivery of improvements identified.	Transparency of trading actions will be further enhanced, through sharing data sets that are identified and prioritised through stakeholder engagement and surveys. This may include information such as the Balancing Mechanism Unit (IDs (or other identifier) and names of trading counter-parties, migrating trade publications to the data portal, presenting the information in a more	Transparency of trading actions will be further enhanced, through sharing additional data sets that are identified through stakeholder engagement.		This is a new deliverable, not included in December 2019 Business Plan.

ESO RIIO-2 Delivery Schedule

Sub activity	Deliverable	Related IT investment	Project or continuous	RIIO-1 end point	2021/2022 Milestones	2022/2023 Milestones	First year success	Second year success	Expected final delivery date and what success looks like.	Notes on changes to Dec 2019 Business Plan
							usable format, providing historic trade information, providing more information on the use of balancing services contracts.			
<b>A17 Transparency and Open Data</b>	ESO Transparency Forum  During the Covid-19 pandemic, NGESO establish weekly preparedness webinars with industry. We received great feedback that these webinars were helping industry to understand our operational decisions.		Continuous	ESO Transparency Forum delivered regularly.	Transparency Forum delivered regularly.	Transparency Forum delivered regularly.	Stakeholders are able to better operate their assets through improved understanding of the operational decisions that we make.	Stakeholders can better operate their assets through improved understanding of the operational decisions that we make.		This is a new deliverable, not included in December 2019 Business Plan.
	The webinars have been rebranded as Transparency forums, with a renewed focus on answering transparency questions and helping industry to understand the operational decisions that we make.						Continued positive stakeholder feedback received.	Continued positive stakeholder feedback received.		
<b>A17 Transparency and Open Data</b>	<b>D17.1</b> Open data portal with limited data sets (initial go live 2019)  This deliverable refers to the foundational data portal acting as a proof of concept for the RIIO-2 data portal which will be powered by the Data and analytics platform and utilise the user interface of the Digital	<b>220</b> - Data and analytics platform: It will be the key technology underpinning all our internal and external data management, pulling together data from a variety of sources and ensuring there is only one source of the truth.	Project	We will have developed a detailed strategy for our data and analytics platform, understanding the business requirements across ESO. This will have been translated into an IT architecture for implementation in RIIO-2.	Q2-Q3 – Data and analytics platform requirements and design.	Q1-Q2 – Data and analytics platform foundation development and testing.	An increasing number of data sets will be shared with stakeholders through the foundational data portal.	Integration of the data platform into the digital engagement platform will enable the acceleration of data upload automation and make publishing new datasets more efficient.	2024-25 All published data automated reducing publishing times ( <b>D17.4</b> ).  All ESO data accessible through the single interface of the digital engagement platform.	This content has been moved to sit alongside the Data and analytics platform and new <i>Transparency Roadmap</i> .
		<b>250</b> - Digital engagement platform. This investment will offer a single point of			Q4 - Master data management implementation.	Q1-Q3 – Digital engagement platform development and testing.	Requirements of the enduring data portal will have been considered in the development of the enabling IT investments: <b>220</b> - Data and analytics platform and <b>250</b> - Digital engagement platform.	Agile approach to adding new data sets, prioritising by overall benefit, accelerated due to data and analytics platform capabilities.	All published data available through an API.	

ESO RII0-2 Delivery Schedule

Sub activity	Deliverable	Related IT Investment	Project or continuous	RII0-1 end point	2021/2022 Milestones	2022/2023 Milestones	First year success	Second year success	Expected final delivery date and what success looks like.	Notes on changes to Dec 2019 Business Plan
	engagement platform.  Milestones for the foundational data portal and enabling IT investments are included in this row with specific points captured in the deliverables below.	access into the ESO systems and external-facing processes, providing secure, open access to data, compliant with data classification policies and standards. We will consolidate our ESO data publication and reporting channels, offering stakeholders access to our data, including multi device capability and Application Programming Interfaces (API) functionality.				Q4 - Digital engagement platform implementation.  Q4 - Digital engagement platform integration with data and analytics platform.		As new data sets are published, they are automatically in machine readable format.	Additional functionality driven by user requirements (such as subscriptions and notifications).	
<b>A17 Transparency and Open Data</b>	<b>D17.2</b> All published ESO data in machine readable format.	<b>220 - Data and analytics platform:</b> It will be the key technology underpinning all our internal and external data management, pulling together data from a variety of sources and ensuring there is only one source of the truth.  <b>250 - Digital engagement platform:</b> This investment will a single point of access into the ESO systems and external-facing processes, providing secure, open access to data, compliant with data classification policies and standards. We will consolidate our ESO data publication and reporting channels, offering stakeholders access to our data, including multi device capability and	Project	All published ESO data available via the ESO data portal with limited exceptions (e.g. data published through Balancing Service Report Service (BMRS)).  Subset of ESO published data is machine readable.	Q2 All published ESO data in machine readable format.	Q1-Q4 – Further data sets released. Q1-Q4 – Further data sets automated. Q1-Q2 – Data and analytics platform foundation development and testing. Q3 - Data and analytics platform foundation implementation. Q1-Q3 – Digital engagement platform development and testing. Q4 - Digital engagement platform implementation. Q4 - Digital engagement platform integration with data and analytics platform.	All of the data published by the ESO is machine readable.  Data is available to download manually or through an API, which will allow consumers of ESO data to integrate published data into their systems and models programmatically.	As new data sets are published, they are automatically in machine readable format.	2024-25 All published data automated reducing publishing times (D17.4)	This content has been moved into Role 1 consistent with Ofgem's organisation of feedback.

ESO RIO-2 Delivery Schedule

Sub activity	Deliverable	Related IT investment	Project or continuous	RIO-1 end point	2021/2022 Milestones	2022/2023 Milestones	First year success	Second year success	Expected final delivery date and what success looks like.	Notes on changes to Dec 2019 Business Plan
		Industry standard APIs.								

## Role 2 - Market development and transactions

### A4 Build the future balancing service markets

Our plans for future balancing markets will see us make significant steps towards our ambition for **Competition Everywhere** in the BP1 period. Where competition already exists, we are focusing on removing barriers to entry by moving procurement closer to real time and making it much easier to provide us services through the Single Markets Platform. In support of our ambition to be able to operate an electricity system carbon free we are also developing competitive approaches for system services such as stability and reactive power.

Alongside these new markets we are also delivering **Competition Everywhere** through the removal of barriers in our activities to transform industry codes and frameworks in our proposals in the codes and charging section of this document. Competitive approaches are also being developed in our Restoration activities in Role 1.

Sub activity	Deliverable	Related IT investment	Project or continuous	R10-1 end point	2021/2022 Milestones	2022/2023 Milestones	First year success	Second year success	Expected final delivery date and what success looks like.	Notes on changes to Dec 2019 Business Plan
<b>A4.1</b> Manage existing balancing services markets	<b>D4.1</b> Balancing and ancillary services efficiently procured to deliver security of supply at optimal cost  We manage an end-to-end process to ensure that balancing services are procured to deliver security of supply at lowest cost to consumers. We manage relationships and contracts with the growing volume and diversity of service providers.	<b>410</b> Ancillary services refresh: required to ensure we have the capability to perform settlements for much higher volumes of market participants.	Continuous	N/A	N/A	N/A	N/A	N/A	N/A	
<b>A4.2</b> Power Responsive	<b>D4.2.1</b> Regular and specific metrics and publications across Distribution System Operator (DSO) development and co-development	N/A	Continuous	Power Responsive will have raised awareness of Demand Side Response (DSR) opportunities and shaped the growth of the DSR market through extensive engagement with businesses including, regular Flexibility Forums and the annual publication of <i>Power Responsive Annual Report</i> . We will have extended our engagement to provide a	N/A	N/A	N/A	N/A	N/A	

ESO RIIQ-2 Delivery Schedule

Sub activity	Deliverable	Related IT investment	Project or continuous	RIIQ-1 end point	2021/2022 Milestones	2022/2023 Milestones	First year success	Second year success	Expected final delivery date and what success looks like.	Notes on changes to Dec 2019 Business Plan
	of local flexibility markets through a variety of innovation projects			direct route for dialogue between the demand side community and the ESO subject matter experts. This will ensure that the views of the demand side community are reflected in the development of new products and markets.						
<b>AA.2 Power Responsive</b>	<b>D4.2.2</b> Regular and specific metrics, and publications for multi sector approaches focusing on opportunities for household, community energy, small business participation, zero carbon technologies, and electrification of heat in Demand Side Flexibility (DSF).	N/A	Continuous	Power Responsive will have raised awareness of DSR opportunities and shaped the growth of the DSR market through extensive engagement with businesses including regular Flexibility Forums and the annual publication of <i>Power Responsive Annual Report</i> . We will have extended our engagement to provide a direct route for dialogue between the demand side community and the ESO subject matter experts. This will ensure that the views of the demand side community are reflected in the development of new products and markets.	N/A	N/A	N/A	N/A	N/A	
Alignment of ESO-DSO flexibility markets	ESO-DSO flexibility services contract alignment.		Project	We are supporting Open Networks' Workstream 1A, Product 4 Contract alignment. Simplifying service terms and aligning where possible will provide increased market confidence and help improve market liquidity. RIIQ-1 end point for this product is expected to be defined in Q3 2020/21.	Commence implementation of agreed contract alignment	Complete implementation of ESO-DSO Contract alignment	Review current commercial arrangements adopted by DNOs and the ESO in the contracting of flexibility services and agree the areas where contract alignment will be considered valuable. The success of this activity is dependent on the coordinated actions of the ESO with the ENA and 6 DNOs.	ESO-DSO flexibility services Contract alignment delivered as appropriate. The success of this activity is dependent on the coordinated actions of the ESO with the ENA and 6 DNOs.	Success will be reduced barriers and enhanced liquidity for ESO and DSO procured ancillary services.	This is a new activity, not previously included in the December 2019 Business Plan.
Alignment of ESO-DSO flexibility markets	ESO-DSO flexibility services tendering and procurement		Project	We are leading Open Networks' Workstream 1A, Product 2 tendering and procurement timescales alignment. RIIQ-1 end point	Commence implementation of ESO-DSO flexibility services tendering and	Complete implementation of ESO-DSO flexibility services tendering and	Agreed approach and end-state for implementation of ESO-DSO flexibility services tendering and procurement timescales alignment.	ESO-DSO flexibility services tendering and procurement timescales alignment delivered as appropriate.		This is a new activity, not previously included in the December 2019 Business Plan.

ESO RIIO-2 Delivery Schedule

Sub activity	Deliverable	Related IT investment	Project or continuous	RIIO-1 end point	2021/2022 Milestones	2022/2023 Milestones	First year success	Second year success	Expected final delivery date and what success looks like.	Notes on changes to Dec 2019 Business Plan
	timescales alignment.			for this product is expected to be defined in Q3 2020/21.	procurement timescales alignment.	procurement timescales alignment.	The success of this activity is dependent on the coordinated actions of the ESO with the ENA and 6 DNOs.	The success of this activity is dependent on the coordinated actions of the ESO with the ENA and 6 DNOs.		
<b>A4.3</b> Deliver a single day-ahead response and reserve market	<b>D4.3.1</b> We will work with stakeholders, including DNOs, to ensure that ESO market design decisions are future-proofed for the establishment of DSO markets.	<b>400</b> Single markets platform. Will ultimately provide a platform providing a full end-to-end customer journey, allowing market participants to access the data relating to: how to become a provider (obligations, sign up, test, application progression), contract tender (to see contracts status and manage contracts), unit management (to see what units are registered for, see and change aggregation configuration s), dispatch (to access instructions), performance	Project	Some initial alignment of distribution and transmission flexibility markets will have been agreed including completion of relevant ENA Open Networks WS1A activities to promote coordination and cooperation.	Q1 – Day Ahead market for frequency response. Q2 - Control and dispatch solutions for reserve. Q3 – Provide input into RIIO-ED2 business plans to promote alignment of ESO and DSO markets. Q3 - Standard contract terms for reserve. Q4 - New reserve products go live.	Q4 - Single day-ahead response and reserve market go live.	Alignment of ESO and DSO services as appropriate to the maturity level of DSO service procurement.	Alignment of ESO and DSO services as appropriate to the maturity level of DSO service procurement.	As per year 2	This deliverable has been replaced by two more specific deliverables in the two columns above.



ESO RfIO-2 Delivery Schedule

Sub activity	Deliverable	Related IT investment	Project or continuous	RfIO-1 end point	2021/2022 Milestones	2022/2023 Milestones	First year success	Second year success	Expected final delivery date and what success looks like.	Notes on changes to Dec 2019 Business Plan
		monitoring (to see how units behaved under instructions), payment.								
		<b>420</b> - Auction capability: This investment will provide extension of the auction capability developed for frequency response in RfIO-1 to all relevant services.								
<b>A4.3</b> Deliver a single day-ahead response and reserve market	<b>D4.3.2</b> Day ahead market for frequency response.	<b>410</b> Ancillary services settlements refresh: required to ensure we have the capability to perform settlements for much higher volumes of market participants.	Project	Full functionality of frequency response weekly auction trial deployed, and learnings shared with market.	Q1 – Day ahead market for frequency response operational.  Q1 - Day ahead response market integrated with foundational market platform (the foundational market platform comprises the automation of a subset of key processes, allowing users to set own parameters).	<b>D4.3.2</b> Day ahead market for frequency response evolves into <b>D4.3.4</b> Full co-optimised auction for response and reserve at day ahead or even closer to real time. Please see <b>D4.3.4</b> for further frequency response developments beyond year 1.	Auction trial complete with learnings applied to day ahead market for response. Day ahead market for response operational and we are procuring volumes for use in the control room.	<b>D4.3.2</b> Day ahead market for frequency response evolves into <b>D4.3.4</b> Full co-optimised auction for response and reserve at day ahead or even closer to real time. Please see <b>D4.3.4</b> for further frequency response developments beyond year 1.	As per year 1	
		<b>420</b> Auction capability: This investment will provide extension of the auction capability developed for frequency response in RfIO-1 to all relevant services.								
		<b>400</b> Single markets								

ESO RII0-2 Delivery Schedule

Sub activity	Deliverable	Related IT investment	Project or continuous	RIIO-1 end point	2021/2022 Milestones	2022/2023 Milestones	First year success	Second year success	Expected final delivery date and what success looks like.	Notes on changes to Dec 2019 Business Plan
		platform: Experience of participation in frequency response markets will be enhanced by the capabilities of the single market platform.			2. should be considered the master document.					
<b>A4.3</b> Deliver a single day-ahead response and reserve market	<b>D4.3.3</b> New Reserve Products Development and introduction of a new suite of products to provide reserve to the control room.	<b>410</b> Ancillary services settlements refresh: required to ensure we have the capability to perform settlements for much higher volumes of market participants.	Project	Market design for reformed reserve products published. ( <i>Forward Plan</i> )	Q2 - Control and dispatch solutions for reserve. Q3 - Standard contract terms for reserve. Q4 - New reserve products go live.  The milestones documented in this Delivery Schedule were correct as of December 2019 and are subject to change. For 2020/21, the regularly updated <a href="#">Forward Plan Tracker</a> , or its equivalent in RII0-2, should be considered the master document.	<b>D4.3.3</b> New Reserve products evolve into <b>D4.3.4</b> Full co-optimised auction for Response and Reserve at day ahead, or even closer to real time. Please see <b>D4.3.4</b> for further frequency response developments beyond year 1.	New reserve products are operational and we are procuring volumes for use in the control room.	<b>D4.3.3</b> New Reserve products evolve into <b>D4.3.4</b> Full co-optimised auction for Response and Reserve at day ahead, or even closer to real time. Please see <b>D4.3.4</b> for further frequency response developments beyond year 1.	As per year 1	
		<b>420</b> Auction capability: This investment will provide extension of the auction capability developed for frequency response in RII0-1 to all relevant services.								
		<b>400</b> – Single markets platform: Experience of participation in reserve markets will be enhanced by the capabilities of the single								

ESO R10-2 Delivery Schedule

Sub activity	Deliverable	Related IT investment	Project or continuous	R10-1 end point	2021/2022 Milestones	2022/2023 Milestones	First year success	Second year success	Expected final delivery date and what success looks like.	Notes on changes to Dec 2019 Business Plan
		market platform.								
<b>A4.3</b> Deliver a single day-ahead response and reserve market	<b>D4.3.4</b> Full co-optimised auction for Response and Reserve at day ahead or even closer to real time	<b>410</b> Ancillary services settlements refresh: required to ensure we have the capability to perform settlements for much higher volumes of market participants.	Project	See <b>D4.3.1</b> and <b>D4.3.2</b> for relevant R10-1 deliverables and milestones end state.	<b>D4.3.4</b> Full co-optimised auction for Response and Reserve at day ahead or even closer to real time evolves from <b>D4.3.1</b> and <b>D4.3.2</b> . Please see <b>D4.3.1</b> and <b>D4.3.2</b> for relevant year 1 deliverables and milestones.	Q4 - Single day ahead response and reserve market go live.	<b>D4.3.4</b> Full co-optimised auction for Response and Reserve at day ahead or even closer to real time evolves from <b>D4.3.1</b> and <b>D4.3.2</b> . Please see <b>D4.3.1</b> and <b>D4.3.2</b> for relevant year 1 successes.	Market participants will be able to participate in a day ahead co-optimised Response and Reserve Market; Business processes for Response and Reserve products integrated through single markets platform. (see <b>D4.4.1</b> below for more detail).	Auction capability integration with Single markets platform will be in early 2023-24. Market participants able to participate in market auctions through interface of Single markets platform (alongside other processes such as contracts and settlements).	
		<b>420</b> Auction capability: This investment will provide extension of the auction capability developed for frequency response in R10-1 to all relevant services. This will include algorithms for co-optimised response and reserve day-ahead auction which also considers impact on DSOs.								
		<b>400</b> Single markets platform: Will ultimately provide a platform providing a full end-to-end customer								

ESO R10-2 Delivery Schedule

Sub activity	Deliverable	Related IT investment	Project or continuous	R10-1 end point	2021/2022 Milestones	2022/2023 Milestones	First year success	Second year success	Expected final delivery date and what success looks like.	Notes on changes to Dec 2019 Business Plan
		journey, allowing market participants to access the data relating to: how to become a provider (obligations, sign up, test, application progression), contract tender (to see contracts status and manage contracts), unit management (to see what units are registered for, see and change aggregation configuration s), dispatch (to access instructions), performance monitoring (to see how units behaved under instructions), payment.								
<b>A4.3</b> Deliver a single day-ahead response and reserve market	<b>D4.3.5</b> Auction capability	<b>A4.20</b> - Auction capability: This investment will provide extension of the auction capability developed for frequency response in R10-1 to all relevant services. This will include algorithms	Project	Auction capability tested for weekly frequency response. Understanding of options available for wider implementation of auction capability in R10-2.	Q1-Q3 - Auction capability development and testing. Q4 - Auction capability implementation.	Q4 – Electricity Market Reform (EMR) and Contracts for Difference (CFD) integration.	Auction capability implemented supporting Day Ahead frequency response procurement. Market participants will access all ESO auctions through one single auction platform.	Auction capability implemented supporting co-optimised day ahead response and reserve procurement.	Auction capability integration with Single markets platform will be in early 2023-24. Market participants able to participate in market auctions through interface of Single markets platform (alongside other processes such as contracts and settlements).	

ESO RIIO-2 Delivery Schedule

Sub activity	Deliverable	Related IT investment	Project or continuous	RIIO-1 end point	2021/2022 Milestones	2022/2023 Milestones	First year success	Second year success	Expected final delivery date and what success looks like.	Notes on changes to Dec 2019 Business Plan
		for co-optimised response and reserve day-ahead auction.								
<b>A4.4</b> Deliver a single, integrated platform for ESO Markets	<b>D4.4.1</b> (shared with <b>D5.2</b> ) A platform through which participants will be able to participate in balancing and capacity markets. The markets platform will cover the end to end process for market participation including: communications, data input and management, messaging and validation	<b>400</b> Single markets platform. Will provide a platform providing a full end-to-end customer journey, allowing market participants to access the data relating to: how to become a provider (obligations, sign up, test, application progression), contract tender (to see contracts status and manage contracts), unit management (to see what units are registered for, see and change aggregation configurations), dispatch (to access instructions), performance monitoring (to see how units behaved under instructions), payment, inclusion of sandbox	Project	This project will not have started in RIIO-1.	Q1 - Day Ahead response market integrated with foundational market platform for subset of processes. Q4 – Single markets platform requirements and design. Q4 Reserve products integrated with foundational market platform for subset of processes.  Q3 - Asset register requirements and design. Q4 - Asset register development and testing.	Q3 – Single markets Platform Development and testing. Q4 - Procurement of all ESO balancing and ancillary services through single markets platform for full range of processes.  Q1 - Asset register implementation	Market participants will be able to manage upstream processes for participation in frequency response markets integrated through foundational market platform. Asset register requirements and design and development and testing phases complete.	Market participants will be able to access all ESO balancing services through Single markets platform. Business processes for all ESO balancing services products integrated through single markets platform. Asset register implemented providing one place for market participants to register for ESO markets, accessed through Single markets platform.	Auction capability integration with Single markets platform will be in early 2023-24. Market participants able to participate in market auctions through interface of Single markets platform (alongside other processes such as contracts and settlements).	

ESO RIIO-2 Delivery Schedule

Sub activity	Deliverable	Related IT investment	Project or continuous	RIIO-1 end point	2021/2022 Milestones	2022/2023 Milestones	First year success	Second year success	Expected final delivery date and what success looks like.	Notes on changes to Dec 2019 Business Plan
		functionality will allow us to test new products and services, reducing the time and cost to deploy them into market whilst ensuring they meet both commercial and operational needs.								
<b>A4.4</b> Deliver a single, integrated platform for ESO Markets	<b>D4.4.2</b> Common standards, including interoperable systems, a common data model and shared minimum specifications between ESO and other flexibility platforms as well as at the distribution level.	<b>400 – Single markets platform:</b> Development of this investment should be aligned with DSO services procurement platforms where possible.	Project	This project will not have started in RIIO-1.	Q1 - Day Ahead response market integrated with foundational market platform for subset of processes. Q3 – Provide input into RIIO-ED2 business plans to promote alignment of ESO and DSO markets and platforms. Q4 – Single markets platform requirements and design. Q4 - Reserve products integrated with foundational market platform for subset of processes.	Q3 – Single markets platform development and testing. Q4 - Procurement of all ESO balancing and ancillary services through single markets platform for full range of processes. Q1 - Asset register implementation	Single markets platform requirements and design aligned with developments of other platforms including those for DSO markets as appropriate to maturity of distribution level markets. Asset register design aligned with developments of other markets including DSO as appropriate to maturity of distribution level markets.	Single market platform implemented with common standards. Platform coordinated with DSO platforms development as appropriate to maturity of distribution level markets.	As per year 2.	

Q3 - Asset register requirements and design.  
Q4 - Asset register development and testing.

The milestones documented in this Delivery Schedule were correct as of December 2019 and are subject to change. For 2020/21, the regularly updated [Forward Plan Tracker](#), or its equivalent in RIIO-

ESO RfO-2 Delivery Schedule

Sub activity	Deliverable	Related IT investment	Project or continuous	RfO-1 end point	2021/2022 Milestones	2022/2023 Milestones	First year success	Second year success	Expected final delivery date and what success looks like.	Notes on changes to Dec 2019 Business Plan
New services market development	Development of competitive approaches to procurement of stability.  <b>Networks Option Assessment (NOA) stability pathfinder<sup>3</sup> phase 1</b> – Procurement of proven technologies focusing on Great Britain national inertia requirement	<b>130</b> Emergent technology and system management  Development of IT solutions for phase 1 and 2 to register, instruct, settle and report new services	Project	Stability pathfinder phase 1 tenders awarded.  Early stability pathfinder phase 1 contracts deliver.  Stability pathfinder phase 2 feasibility study in progress.	Q2 - Award contacts for stability pathfinder phase 2.  Q2 - Implement enduring IT solution for phase 1 (IT investment 130).  Q3 - Complete design of IT solution for phase 2 (IT investment 130). Q1-4 - as required review Great Britain wide requirements at a regional level for stability.	Q1-4 - as required Complete implementation of IT solutions for phase 2 (IT investment 130) Emergent technology and system management).	Stability pathfinder phase 2 tender assessment complete, contracts awarded, and outcome published.  Phase 1 enduring IT solution implemented  Remaining stability phase 1 contracts deliver.	Early stability pathfinder phase 2 contracts deliver.  IT solutions for phase 2 complete.  Detailed implementation plan for stability market published.		This is a new activity not in our December 2019 Business Plan. Implications for additional resourcing will be communicated through ongoing regulatory engagement.
	<b>NOA stability pathfinder phase 2</b> – Procurement of broader range of solutions focusing on regional short circuit level requirement in Scotland				Expand pathfinder process to further region(s) and align with voltage requirements.  Define scope of stability market development and start engagement with industry.  Develop plan to deliver stability market.					
	<b>Stability market</b> – enduring market structure for procurement of stability services  Activities in A8 (Role 3) and A4 (Role 2) share common milestones. This is because the									

<sup>3</sup> Our pathfinder projects look to work with stakeholders to establish methods to identify the most cost effective approach to addressing system issues - <https://www.nationalgrid.co.uk/research-publications/network-options-assessment-noa/network-development-roadmap>



Sub activity	Deliverable	Related IT investment	Projector continuous	RIO-1 end point	2021/2022 Milestones	2022/2023 Milestones	First year success	Second year success	Expected final delivery date and what success looks like.	Notes on changes to Dec 2019 Business Plan
	activities are being delivered both as part of our work to ensure a level playing field for all technology types to be able to provide solutions to network challenges (Role 3) and develop competitive means to procure those new system services (Role 2). Pathfinder projects deploy virtual teams of cross-functional resource bringing together world-leading technical and economic analysis skills and tools (Role 3) alongside innovative commercial approaches to procurement and market design (Role 2). Both activities and skilsets are required to deliver the milestones outlined for the Pathfinder projects and the enduring markets solutions that will build on those learnings.									

ESO R10-2 Delivery Schedule

Sub activity	Deliverable	Related IT investment	Project or continuous	R10-1 end point	2021/2022 Milestones	2022/2023 Milestones	First year success	Second year success	Expected final delivery date and what success looks like.	Notes on changes to Dec 2019 Business Plan
New services market development	Development of competitive approaches to procurement of reactive power.	<b>130</b> Emergent technology and system management : Development of IT solutions to register, instruct, settle and report new services	Project	Publish strategic approach for reactive review and reform. Contracts awarded for Mersey pathfinder.	Q3: Define and agree scope of reactive power services reform with industry (including suitability of ongoing mandatory reactive power service).	Initiate delivery of enduring plan for reactive reform as required. <sup>6</sup> Q1 - Deliver IT changes for Mersey pathfinder.	Industry agreed plan for enduring reactive services reform published. Pennines Pathfinder contract awarded. Deliver pathfinder tender process to one further region with tender issued.	Delivery of enduring plan agreed with industry initiated. Delivery of new reactive service from Mersey pathfinder.	End state is expected to be reformed procurement of reactive power services with supporting code and technical arrangements in place including control room systems.	This is a new activity, not in Dec 2019 Business Plan. Implications for additional resourcing will be communicated through ongoing regulatory engagement.
	Pathfinders are pilot projects to explore innovative approaches to the procurement system services.	Mersey Pathfinder: discrete geographical area with small requirement (all new build assets) <sup>4</sup> .		Tender published for Pennines pathfinder.	Q4: Identify, agree and publish plan with industry to deliver reactive reform.	Q3 latest - Go-live of new Mersey pathfinder reactive service.	Way forward with Ofgem and industry agreed for how 'OMW' connections should be treated and exposure to certain costs (level playing field between commercial providers and network owners).		Pennines Pathfinder service delivery in 2024	
	Pennines pathfinder: much larger geographical area and larger requirement than for Mersey <sup>5</sup> .				Award contract for Pennines Pathfinder.					
	Further regions: interaction with stability on setting requirements				Expand pathfinder process to further region(s) and issue tender (aligned with stability requirements).					
	Activities in A8 (Role 3) and									

<sup>4</sup> Quarterly milestones available as no dependency on direction of travel for zero MW connections

<sup>5</sup> Quarterly milestones not available as dependent on direction of travel for zero MW connections

<sup>6</sup> Dependent on expected approval/ rejection of way forward for CMP 304 Improving the Enhanced Reactive Power Service or CMP305 Removal of the Enhanced Reactive Power Service - any delivery requirements will be planned as necessary.

<https://www.nationalgrid.co.uk/industry-information/codes/connection-and-use-system-code-cusc-old/modifications/cmp304-improving>

<https://www.nationalgrid.co.uk/industry-information/codes/connection-and-use-system-code-cusc-old/modifications/cmp305-removal>

Sub activity	Deliverable	Related IT investment	Projector continuous	RIO-1 end point	2021/2022 Milestones	2022/2023 Milestones	First year success	Second year success	Expected final delivery date and what success looks like.	Notes on changes to Dec 2019 Business Plan
	<b>A4 (Role 2)</b> share common milestones. This is because the activities are being delivered both as part of our work to ensure a level playing field for all technology types to be able to provide solutions to network challenges (Role 3) and develop competitive means to procure those new system services (Role 2). Pathfinder projects deploy virtual teams of cross-functional resource bringing together world-leading technical and economic analysis skills and tools (Role 3) alongside innovative commercial approaches to procurement and market design (Role 2). Both activities and skilsets are required to deliver the milestones outlined for the Pathfinder projects and the enduring markets									

Sub activity	Deliverable	Related IT investment	Project or continuous	RIIO-1 end point	2021/2022 Milestones	2022/2023 Milestones	First year success	Second year success	Expected final delivery date and what success looks like.	Notes on changes to Dec 2019 Business Plan
	solutions that will build on those learnings.									

### A5 Transform access to the Capacity Market

Our business plan for Transforming access to the Capacity Market (CM) is focused on driving changes required to achieve our goal of Competition Everywhere. Our plans under **A5.1** Electricity Market Reform (EMR) Delivery Body focus on driving improvements to the customer experience through enhanced guidance, stakeholder engagement and a new change prioritisation process. **A5.2** Deliver an enhanced platform for the CM within the single, integrated ESO markets platform focuses on reducing barriers and improving the customer experience through transformation of the EMR portal. **A5.3** Improve our security of supply modelling capability focuses on enabling the effective consideration of new energy technologies in our calculations and delivery of consumer value through enhancing our use of tools and data to ensure we are procuring optimal volumes of capacity.

Sub activity	Deliverable	Related IT investment	Project or continuous	RIIO-1 end point	2021/2022 Milestones	2022/2023 Milestones	First year success	Second year success	Expected final delivery date and what success looks like.	Notes on changes to Dec 2019 Business Plan
<b>A5.1</b> Electricity Market Reform (EMR) Delivery Body	<b>D5.1</b> Continuation of EMR Delivery Body obligations.  As EMR Delivery Body, we will deliver the prequalification and auction processes for the Capacity Market (CM) and Contracts for Difference (CfD). We will also deliver our agreement management obligations for the CM. We will also ensure our processes and system comply with regulatory changes and communicate these to industry.	Forms part of the portal update in deliverable in D5.2	Continuous	We provide updated guidance as soon as practicable after rule changes have occurred. We use the lessons learnt from previous auctions rotation to inform the planning for, and delivery of, subsequent auction rounds, including improvements to guidance. We expect to work with Ofgem/BEIS on rule changes at the end of RIIO-1 period which will come into force at the start of the RIIO-2 period.	Q1 Publish a co-created guidance document covering 2021 rule changes (in collaboration with Ofgem, BEIS and industry) open within 4 weeks of the rules being laid.  Q1 - Publish a co-created guidance document covering 2021 rule changes (in collaboration with Ofgem, BEIS and industry) open within 4 weeks of the rules being laid.  Q1.4 - Use previous Customer Relationship Management (CRM) tool data to upskill front desk and feed any frequently asked questions into guidance documentation.	Q1 - Guidance to rule changes are incorporated into Portal  Q2/3 - EMR portal will allow disputes to be attached to applications, reducing the burden to appeal.	Improved guidance leads to improved level of understanding of the rule changes across industry, contributing to an increase in first-time passes at Prequalification, ultimately removing a barrier to entry for the Auctions.  Use of CRM data allows us to better anticipate and respond to customer needs, leading to improved customer service, as reflected in customer feedback.  Customers will know we have used real query data to ensure guidance reflects user needs.	Rule guidance and interpretation becomes part of the portal. This will improve the customer journey for Prequalification and reduce the number of administrative rejections at application stage.  Dispute process easier to follow and less burden on the applicants as reflected in customer feedback.	Guidance to be incorporated into single markets platform as part of integration in 2022/23.	Updated to reflect deliverables that will enhance the customer experience.
<b>A5.1</b> EMR Delivery Body	An improved prioritisation process in how we implement change in the EMR Delivery Body. This is about embedding the process and not the	N/A	Continuous	By the end of RIIO-1 a high level at Regulatory Change Advisory Board (RCAB) and at an annual process to determine which changes can be	Q1 - EMR Delivery Body delivers full assessments of the backlog of changes with estimated impacts of implementation	Q1 - EMR Delivery Body runs informal consultation with industry to refine the improved prioritisation process for changes that are deliverable and ensure transparency of those that are not.	Delivery Partners address the backlog of change.	The prioritisation process is broadened out to include input from external stakeholders.	As year two but with an annual process to gain feedback on the approach to allow improvements.	This is a new deliverable, not reflected in December 2019 Business Plan.

ESO RIIQ-2 Delivery Schedule

Sub activity	Deliverable	Related IT investment	Project or continuous	RIIQ-1 end point	2021/2022 Milestones	2022/2023 Milestones	First year success	Second year success	Expected final delivery date and what success looks like.	Notes on changes to Dec 2019 Business Plan
	delivery of specific changes for each year.			delivered for the following delivery cycle.	Q2 – Backlog of change is prioritised at RCAB to understand changes for next delivery cycle.  Q3 – Delivery Body implements a robust estimation process for assessing future changes using robust and transparent criteria including: Whether there are any unintended consequences of the change, anticipating the impact on all stakeholders (ESO, applicants, Delivery Partners etc), the anticipated impact on the Delivery Body Portal and IT and ultimately the overall cost to consumer.  Q4 – outputs shared with wider industry	Q2 – Improved change prioritisation process is published by EMR Delivery Body.  Q3 Industry take part in prioritisation process.	occurs on an ongoing basis by assessing each change.  The prioritisation process is broadened out to include external stakeholders to enhance transparency. This will allow market participants to understand the prioritisation of rules and system changes.	All key processes will be fully supported by the system by the end of year 2, enabling customer self-service.	We anticipate that by March 2026, the EMR Delivery Body will: <ul style="list-style-type: none"><li>Have integrated the EMR service into our IT investment <b>400</b> Single Markets Platform by 2022/23, enabling existing customers and new entrants to participate in CM and CFD alongside other ancillary services.</li><li>Have implemented self-service, process automation and optimised any remaining manual processes and controls.</li><li>Run a customer-centric query</li></ul>	The investment has been updated to reflect the significant changes in the policy and regulatory framework for EMR since the ESO Business Plan was drafted in December 2019 and the implications for EMR portal development.
<b>A5.2</b> Deliver an enhanced platform for the Capacity Market within the single, integrated ESO markets platform	<b>D5.2</b> (shared with <b>D4.4</b> ) IT system to allow all participants in ESO markets (including CM and CFD) a single point of access for services and data	IT investment <b>320</b> EMR Portal Improvements (Capacity Market and Contracts for Difference) Will deliver a 'new' EMR solution which will be flexible, scalable and adaptable to respond to customer and regulatory requirements faster and at a lower cost than currently experienced. It will offer a step change in the current user experience, implementing self-service and improved automation and optimise any remaining manual processes and controls.	Project	Completion of EMR Portal Roadmap to confirm the design, requirements, timescales and costs to deliver a new EMR Portal solution.  Solution and system integrator identified through competitive process.  Mobilisation and design activities for new EMR portal commenced.  Prioritised requirements will deliver improvements in process efficiency, customer experience and reporting along with Capacity Market Restoration changes	Q1 - Essential regulatory changes delivered on existing EMR portal.  Q1-4 - First elements of the new EMR Portal delivered via agile delivery.	Q1-4 - Additional elements of the new EMR Portal delivered through prioritised agile delivery.	Migration to new portal delivered for subset of capabilities depending on prioritisation.  Subject to prioritisation, capabilities for year 1 are expected to include optimised user journeys and on-line user guidance for application process. This will reduce the amount of time applicants need to spend following the process (as reflected in customer feedback and satisfaction scores).	Integration of new EMR portal with Single Markets platform		

ESO RIL0-2 Delivery Schedule

Sub activity	Deliverable	Related IT investment	Project or continuous	RIL0-1 end point	2021/2022 Milestones	2022/2023 Milestones	First year success	Second year success	Expected final delivery date and what success looks like.	Notes on changes to Dec 2019 Business Plan
		<b>400</b> Single markets platform: A platform providing a full end-to-end customer journey allowing market participants to access the data relating to: how to become a provider (obligations, sign up, test, application progression), contract tender (to see contracts status and manage contracts), unit management (to see what units are registered for, see and change aggregation configurations), dispatch (to access instructions), performance monitoring (to see how units behaved under instructions), payment.		on the existing EMR portal.  Reporting capabilities will leverage one of the first use cases of the reporting and analytics capabilities from the new ESO data and analytics platform (IT investment <b>220</b> ).			compliance with all BEIS and Ofgem requirements.  Only essential investment will be made in the existing portal to deliver regulatory compliance. Cost and timescale to deliver change on existing portal will be reduced.	We will have ensured that the portal continues to comply with changing regulatory requirements.	management process that resolves queries efficiently and effectively within agreed Service Level Agreements (SLAs).  We will continue to have systems and processes that ensure regulatory compliance.	
<b>A5.3</b> Improve our security of supply modelling capability	<b>D5.3</b> Use of enhanced modelling and more granular data sets to improve security of supply modelling.  In a world of rapidly evolving energy systems, we will need to deploy the latest modelling techniques to ensure we can keep pace with these changes.  We will need to develop new data sets, models and methods to correctly model the growing interactions of new generation and the demand side. This will ensure their contributions to security of supply remain appropriate and help to ensure the 'Great Britain reliability standard' is met.	<b>220</b> Data and analytics platform: It will be the key technology underpinning all our internal and external data management, pulling together data from a variety of sources and ensuring there is only one source of the truth. It will underpin our advanced data analytics capability that is critical for the data capture and modelling required to improve our security of supply modelling.	Project	Modelling methodology to calculate available capacity for cross-border participation in capacity markets on a consistent basis across Europe will have been developed in conjunction with European Network Transmission System Operators-Electricity (ENTSO-E).  The various sources of technology type and capacity data that would enable a robust method to be developed and implemented into the future will have been investigated.  In particular, information available on embedded generation from implemented Distribution Connection and System Use Agreement (DCUSA)	Q1 - Production of the Electricity Capacity Report Q4 – In line with the prioritisation agreed with the Panel of Technical Experts (PTE), BEIS and Ofgem enhancements will be made to our modelling. Following the production of the Electricity Capacity Report in Q1 we will agree with the PTE, BEIS and Ofgem and begin to work through, the prioritised list of enhancements. It is not possible to provide a more granular timescale for this activity.  Priorities are expected to include: enhancements to the modelling for distributed generation, duration-limited storage and demand response, maximising the use of	Q1 - Production of the Electricity Capacity Report Q4 – In line with the prioritisation agreed with the PTE, BEIS and Ofgem enhancements will be made to our modelling. Following the production of the Electricity Capacity Report in Q1 we will agree with the PTE, BEIS and Ofgem and begin to work through, the prioritised list of enhancements. It is not possible to provide a more granular timescale for this activity.  Priorities are expected to include: <ul style="list-style-type: none"> <li>improved modelling of security of supply for intermittent technology and Demand Side Response (DSR);</li> <li>support modelling changes to the review of the reliability standards, in particular around the implementation of the</li> </ul>	The PTE continue to endorse our analysis in response to the changing energy landscape in their published reports.  Subject to agreement with PTE, BEIS and Ofgem we currently believe that successes could include the following: <ul style="list-style-type: none"> <li>Refined approach to calculating the de-rating factors for embedded generation technologies to improve the data quality and categorisation of embedded assets. (Using data from the DCUSA mod and working with DNOs)</li> </ul> Modelling demand assumptions reviewed,	The PTE continue to endorse our analysis in response to the changing energy landscape in their published reports.  Subject to agreement with PTE, BEIS and Ofgem we currently believe that successes could include the following: <ul style="list-style-type: none"> <li>Better understanding of the economics of embedded generation and whether it is contributing to over-delivery in the CM.</li> <li>Review of how we construct our generation distribution assumptions complete (we currently assume generators are fully</li> </ul>	We will continue to deliver ongoing improvement projects in line with the prioritisation of the PTE, BEIS and Ofgem.	Updated to provide more clarity on successes and milestones.



## ESO RIIO-2 Delivery Schedule

Sub activity	Deliverable	Related IT investment	Project or continuous	RIIO-1 end point	2021/2022 Milestones	2022/2023 Milestones	First year success	Second year success	Expected final delivery date and what success looks like.	Notes on changes to Dec 2019 Business Plan
	With growing interconnection across Europe and between Great Britain and other countries, our pan-European modelling needs to be able to better model different markets. We will improve our pan-European modelling in 2021 and 2022. This will include participation of interconnectors and/or European generators in the CM.			modification is expected be in use by the end of the period. This data will allow us to assess whether it is more appropriate to calculate de-rating factors for embedded generation technologies directly from distribution data.	the data from the DCUSA modification in RIIO-1; and enhancements of European market modelling, as level of interconnection increases over RIIO-2 period. This includes supporting a methodology for cross-border participation in the CM.	clean energy package; and review and continued enhancements of European market modelling, as level of interconnection increases over RIIO-2 period.	to assess viability and develop hourly timeseries of historic underlying demand, which could improve the robustness and self-consistency of our modelling.	on / fully off in our modelling and that units are independent).		
	It will require significant development of the model and data collection to correctly model the interactions of future plant mixes within Europe. It will have to factor in the different operating regimes and security of supply standards across the various European capacity markets.						Plan developed for further modelling improvements of DSR, and in particular, new demand-side technologies that could participate in the CM and whether the performance of this DSR is duration-limited.	Models further developed to ensure we are compliant with the Clean Energy Package legislation (Building on the work to support ENTSO-E in developing a methodology for cross-border participation in the CM)		

## A6 Develop code and charging arrangements that are fit for the future

Our plans to develop code and charging arrangements that are fit for the future are key to achieving our strategic goals for Competition Everywhere, an electricity system that can operate Carbon free and whole energy system solutions. Our code change activities (A6. 1 and A6.2) enhance competition and progress towards net zero thorough changes that remove barriers to market participation for the broadest set of organisations. Our plans for a whole system Grid code and SQSS review will also remove barriers to entry and help to align industry arrangements across transmission and distribution.

Sub activity	Deliverable	Related IT investment	Project or continuous	RIIO-1 end point	2021/2022 Milestones	2022/2023 Milestones	First year success	Second year success	Expected final delivery date and what success looks like.	Notes on changes to Dec 2019 Business Plan
<b>A6.1</b> Code management / management of market	<b>D6.1</b> Continued facilitation of industry changes to the Grid Code, Connection and Use of System Code	<b>280</b> - GB regulation: This investment allows us to deliver mandatory GB	Continuous	Targeted Charging Review <sup>9</sup> (TCR) process has completed including Ogem decisions to	Q1 - GC0137 <sup>13</sup> /139 <sup>14</sup> /145 <sup>15</sup> code change process completed.	Q2 Submit Access and Forward Looking Charges Modification Proposals to Authority.	While modifications are dependent on external factors such as industry participation and governance, we currently	While modifications are dependent on external factors such as industry participation and		Greater articulation of likely areas of focus provided.

<sup>9</sup> <https://www.ofgem.gov.uk/electricity/transmission-networks/charging/targeted-charging-review-significant-code-review>

<sup>13</sup> <https://www.nationalgrideso.com/industry-information/codes/grid-code-old/modifications/gc0137-minimum-specification-required>

<sup>14</sup> <https://www.nationalgrideso.com/industry-information/codes/grid-code-old/modifications/gc0139-enhanced-planning-data-exchange>

<sup>15</sup> <https://www.nationalgrideso.com/industry-information/codes/grid-code-old/modifications/gc0145-updating-grid-code-include-manually>



# ESO RfIO-2 Delivery Schedule

Sub activity	Deliverable	Related IT investment	Project or continuous	RfIO-1 end point	2021/2022 Milestones	2022/2023 Milestones	First year success	Second year success	Expected final delivery date and what success looks like.	Notes on changes to Dec 2019 Business Plan
development and change	(CUSC), System Operator Transmission Owner Code (STC) and Security and Quality of Supply Standards (SQSS). Also, delivery of Great Britain driven regulatory change through the open governance process. We will facilitate the code change required for Great Britain markets to adopt recommendations from Significant Code Reviews (SCRs) and to ensure that they remain compliant with European regulations where necessary. Examples include Balancing Services Use of System (BSUoS) Taskforce outcomes and Access and Forward Looking Charges <sup>8</sup> modifications.	regulatory and market-driven change which impacts across ESO systems, particularly market operation.		allow post TCR processes to occur.	Post TCR modification proposals identified. Q3 - Raise Access and Forward Looking Charges Modification Proposals. Clean Energy Package non-BM imbalance correction proposal submitted to Authority Management of any further modifications received through open governance for which the resource requirement can vary considerably.	Q3 – Manually Activated Reserve Initiative (MARi) Go-Live Management of any further modifications received through open governance for which the resource requirement can vary considerably.	expect to progress modifications in the following areas in year 1: <ul style="list-style-type: none"><li>Stability and restoration of a decarbonising system: GC0137 (facilitating new commercial service contributing to grid stability) and CMP326<sup>16</sup> (introducing a 'Turbine Availability Factor' for use in Frequency Response Capacity Calculation for Power Park Modules.</li></ul> Facilitating access for new and smaller market participants: GC0134 (Removing telephony requirements for small, distributed and aggregated BM participants), GC0140 (Grid Code Sandbox for innovative propositions), CIMP316 (co-location proposal approved), and supporting P415 (extending wholesale market access to VLPs).	governance, we currently expect to progress modifications in the following areas in year 2: <ul style="list-style-type: none"><li>Access and Forward Looking Charges Modification Proposals submitted to and approved by the Authority delivering on changes as Directed.</li><li>Clean Energy package non-BM imbalance correction proposal implemented.</li><li>Post TCR modification proposals approved</li></ul>		
	We will work with market participants to ensure that codes evolve to reflect the changing market environment, ensuring that market codes and charging is equitable, efficient and accessible for all participants.  Support significant IT system changes across the ESO and with industry participants to ensure that code changes are embedded into ongoing activities with minimal disruption.						Facilitating progress towards whole electricity system: GC0139 (coordinated network planning between NGEESO & DNOs), GC0117 (improving consistency of access arrangements across GB, and raising modification proposals from the Access and Forward Looking Charges SCR.). Implementation of European regulatory and code changes: GC0145 (MARi) and P410 (Imbalance harmonisation).			

<sup>8</sup> <https://www.ofgem.gov.uk/electricity/transmission-networks/charging/reform-network-access-and-forward-looking-charges>

<sup>10</sup> [https://www.acer.europa.eu/Official\\_documents/Acts\\_of\\_the\\_Agency/Individual%20decisions/A-CER%20Decision%2018-2020%20on%20the%20harmonisation%20of%20the%20main%20features%20of%20the%20imbalance%20settlement%20\(SHP\).pdf](https://www.acer.europa.eu/Official_documents/Acts_of_the_Agency/Individual%20decisions/A-CER%20Decision%2018-2020%20on%20the%20harmonisation%20of%20the%20main%20features%20of%20the%20imbalance%20settlement%20(SHP).pdf)

<sup>11</sup> <https://www.nationalgrideso.com/industry-information/codes/gnd-code-oid/modifications/gc0130-oc2-change-simplifying-output-useable>

<sup>12</sup> <https://www.elexon.co.uk/mod-proposal/p408/>

<sup>16</sup> <https://www.nationalgrideso.com/industry-information/codes/connection-and-use-system-code-cusc-oid/modifications/cmp326-introducing>

ESO RIIO-2 Delivery Schedule

Sub activity	Deliverable	Related IT investment	Project or continuous	RIIO-1 end point	2021/2022 Milestones	2022/2023 Milestones	First year success	Second year success	Expected final delivery date and what success looks like.	Notes on changes to Dec 2019 Business Plan
	Technical support delivered to this activity through <b>A15.3</b> in Role 3.						Agreed plan of work established through Charging Futures for 21/22 and 22/23 for transmission charging reform linking to wider market reforms/development where necessary  Support of IT system changes driven by Targeted Charging Review, MARI, TE RRE, and the introduction of the Common Information Model under GC0139.			
<b>A6.2</b> European Union (EU) code change and relationships	<b>D6.2</b> Continued facilitation of EU driven code changes into Great Britain market.  Over RIIO-2, we will increase the size of the team supporting this area to step up our presence in the key working groups and ensure we respond to consultations where we can influence on behalf of Great Britain's consumers. This activity is highly dependent on our overall European strategy which will impact our approach and its delivery.  Specifically, in BP1 we will work to ensure the most efficient progression of EU exit arrangements. Code changes that are necessary to support EU exit arrangement will be implemented as directed by Ofgem and BEIS. Support significant IT system changes across the ESO and with industry participants to ensure that code changes are embedded	<b>D6.2</b> Continued facilitation of EU driven code changes into Great Britain market.  Over RIIO-2, we will increase the size of the team supporting this area to step up our presence in the key working groups and ensure we respond to consultations where we can influence on behalf of Great Britain's consumers. This activity is highly dependent on our overall European strategy which will impact our approach and its delivery.  Specifically, in BP1 we will work to ensure the most efficient progression of EU exit arrangements. Code changes that are necessary to support EU exit arrangement will be implemented as directed by Ofgem and BEIS. Support significant IT system changes across the ESO and with industry participants to ensure that code changes are embedded	Continuous	Planned Trans European Reserves Replacement Exchange (TERRE) go-live (subject to legal status after EU withdrawal).  Submission of data files for Short Term Adequacy" (STA).	Q2 MARI Grid Code and BSC modifications complete.  Q3 MARI implementation project – definitions of system changes.  Q2 Clean Energy Package – changes for Short Term Operating Reserve (STOR) ready for new auctions.  Q4 Implementation of Coordinated Security Analysis.  Q2 Grid code and BSC change for Emergency and Restoration (Supporting activity <b>A3</b> in Role 1).	Q3 IT investment <b>270</b> clean energy package development and testing.  Q2 Delivery of MARI.  Q2 Implement harmonised Re-dispatching and Countertrading.  Q4 Coordinated calculation of Interconnector capacity.  Q2 Full compliance with Article 6 of the Clean Energy Package.	Cost benefits for GB consumers from use of TERRE.  Enhanced cooperation with other TSOs increasing operational security.  Compliance with Clean Energy Package supports our already stated aims (see A4.3) for markets closer to real-time.	Use of the Capacity Calculation platform allows ESO to coordinate with other Transmission System Operators (TSOs) on the calculation of maximum capacity over interconnectors in both long-term, Day Ahead and Intra day timescales.  Use of Re-dispatching and Countertrading provides tool for controlling flows.	Cost benefits for GB consumers through use of MARI.  Cooperation with other EU TSOs further enhanced through the coordinated use of remedial actions to solve operational security issues.	Greater articulation of likely areas of focus provided.

ESO RIIO-2 Delivery Schedule

Sub activity	Deliverable	Related IT investment	Project or continuous	RIIO-1 end point	2021/2022 Milestones	2022/2023 Milestones	First year success	Second year success	Expected final delivery date and what success looks like.	Notes on changes to Dec 2019 Business Plan
	into BAU with minimal disruption.									
<b>A6.3</b> Industry revenue management	<b>D6.3</b> Continued managing, collecting and disbursing charges relating to the operation of the transmission system. Also delivering a refresh of charging and billing IT system and changes to the charging regime for CUSC.	<b>290</b> The Charging and Billing (CAB) system manages transmission Network Use of System (TNUs) charges, BSUs charges and connection charges. It calculates the charges for market participants to pay the ESO. TNUs charges go to the TOs, BSUs charges to ESO, and connection charges are shared.  This investment completes the re-engineering of the charging and billing system, making it much more flexible than the current system, reducing the lead time and cost for change to manage and accommodating the increased number of market participants.  <b>300</b> Charging regime and CUSC changes: This investment enables mandatory market-driven change to the CUSC and/or the charging regime. There are two Ofgem Significant Code Reviews (SCRs) in progress: the Targeted Charging Review and the Access and Forward Looking Charges Review which are expected to drive system changes.	Continuous	Roadmap on enduring CAB solution complete confirming the high-level design, timescales, resource requirements and costs to deliver a new solution.  Delivery of Targeted Charging Review BSUs, connection charge, TNUs generation re-zoning and BSUs charging methodology for storage generators onto the existing CAB solution.	Investment <b>290</b> Charging and Billing Asset Health Deliver critical system changes necessary to improve/ sustain the foundation of the CAB system in order to deliver the regulatory changes (investment <b>300</b> ) up to April 2022. Asset health improvements will be delivered quarterly throughout the year.  Change delivery for Investment <b>300</b> Charging Regime and CUSC Changes include: <ul style="list-style-type: none"> <li>Transmission Demand allocation (CMP343 - TCR TNUs);</li> <li>Enabling reform of residual network charging as directed by the TCR (P402);</li> <li>Q1 - Requirements and design</li> <li>Q2/Q3 – Development and Testing</li> <li>Q4 Implementation</li> </ul>	Investment <b>290</b> Charging and Billing Asset Health Minimum Viable Product for an enduring solution which will enable delivery of regulatory changes under investment <b>300</b> - Charging regime and CUSC changes, including Access & Forward Looking Charges: <ul style="list-style-type: none"> <li>Q1 - Start up</li> <li>Q2 – Requirements and design</li> <li>Q3 Development and Testing</li> <li>Q4 Implementation.</li> </ul>	Implementation of Transmission Demand Residual Bandings and allocation (CMP343 - TCR TNUs); and Enabling reform of residual network charging as directed by the TCR (P402) onto the existing CAB solution.	Delivery of a Minimum Viable Product for the enduring solution, including successful delivery of: Changes to the BSUs charging methodology driven by the BSUs Taskforce, due in 2023; and Changes to the TNUs methodology driven by the Significant Code Review for Access Forward Looking Charges	Continued timely collection of revenue on behalf of the industry, in line with the evolving charging framework.  All processes migrated to the new solution by the end of 2023/24 and human error risk is sufficiently mitigated by bringing the offline processes into the new solution.  Customer charging experience enhanced with the more customer centric IT solution.  A scalable and configurable solution allowing the introduction of changes faster to the market to accommodate the addition of customers, increasing data requirements and regulatory changes.  Flexible solution allowing changes to existing and new regulatory changes without standing up an IT project for small and medium complexity changes.  Sarbanes-Oxley compliance requirements fully	New content provided to reflect updated view of frameworks change and supporting systems development.

ESO RfIO-2 Delivery Schedule

Sub activity	Deliverable	Related IT investment	Project or continuous	RfIO-1 end point	2021/2022 Milestones	2022/2023 Milestones	First year success	Second year success	Expected final delivery date and what success looks like.	Notes on changes to Dec 2019 Business Plan
<b>A6.4</b> Transform the process to amend our codes	<b>D6.4</b> Change from a code administrator to a code manager.  Create and own a strategic and incremental industry change plan for our codes.  Seek more explicit powers to assess and prioritise code change to ensure the delivery of more strategic change which is expected to be of benefit to consumers.  Seek more explicit powers for managing the change process. This will help ensure change is delivered at pace, relevant modelling is undertaken if not available, and we have more ownership of change development and delivery throughout the process.  . Place more emphasis on engagement with wider stakeholders outside our standard working groups.  Make better use of technology through initiatives such as code digitalisation, a more customer-friendly and accessible website, and better information management and communication channels.  Provide better user guidance and supporting documents that support	N/A	Project	Improvements to code administration implemented including: <ul style="list-style-type: none"> <li>Easier to read industry emails and processes allowing users to better manage their communication preferences.</li> <li>Updated onboarding documentation for new industry parties for ease of access and use.</li> </ul> Web pages refreshed with plain English content.	Q1 - Dedicated ESO legal support for code changes. Q2 - Recruit people and set up new teams and investigate the methods to transform the process to amend our codes. Q3 - Stakeholder engagement and consultation on the process to amend our codes. Q4 - Investigate licence changes required to transform the process to amend our codes. Q4 – Create plan to deliver the transformed codes process. Q4 – Consult stakeholders on plan to deliver the transformed codes process.	Q1 – Initiate licence change to support transform the process to amend our codes. Q2 – Begin detailed scoping and prioritising work for new process go live. Q4 – An ambitious go live in Q4 of Transform the process to amend our codes (subject to outcome of Energy Codes Review and scope of change required). Q4 Strategic and incremental industry change plan implemented. Q4 Greater emphasis on larger and more coordinated programmes of work for our codes.	Resource in place to deliver transform the process to amend our codes. Stakeholder supported plan for transformed codes process in place. Discussion with Ofgem and BEIS initiated on how to deliver change.	Prioritisation of strategic change has begun with a new process in place. ESO has created and owns a strategic and incremental industry change plan for our codes. ESO has more explicit powers to assess and prioritise code change and seek necessary amendments to the management of the change process. Clarity on objectives for remaining years	Strategic change is systematically being prioritised and delivered by year 3 Q1.  By year 2 we will not have reached our vision for code manager. In the BP1 period, in parallel with leading the strategic code change activities detailed in A6.1 and A6.2, we will be building capability and putting tools and processes in place to enables us to; place extra emphasis on larger and more proactive programmes of work for our codes, and; give more focus to other industry change, which is less directly relevant to ESO but where we feel we could add value to the process.	Further clarity provided on progress to be made against long term aims in the BP1 period.

ESO RII0-2 Delivery Schedule

Sub activity	Deliverable	Related IT investment	Project or continuous	RIIO-1 end point	2021/2022 Milestones	2022/2023 Milestones	First year success	Second year success	Expected final delivery date and what success looks like.	Notes on changes to Dec 2019 Business Plan
	self-service, but also have a service-focused and well-resourced team available to be a great critical friend where stakeholders require.									
	Take on additional responsibilities for developing code modification and directing incremental improvements for our own codes. For example, analysing and modelling change proposals, engaging stakeholders on proposals and developing options.									
A6.5 Work with all stakeholders to create a fully digitalised, whole system Grid Code by 2025	D6.5 The Grid code combines transmission and distribution codes in an IT system with AI-enabled navigation and, document and workflow management tools.	330 - Digitalised code management: Investment to transform the stakeholder experience of the code management process through artificial intelligence enabled navigation, and document and workflow management tools.	Project	The Grid Code at the transmission level and Distribution code at the distribution level are separate and static documents from a user-experience perspective. No work is proposed on this initiative in the RII0-1 period.	Q1 - Recruit people and set up project team. Q2 - Scope detailed project work plan. Q4 - Engage and consult industry to refine scope, in particular distribution stakeholders, on whole system Grid Code and digitalised capability.	Q1 – First code modifications and licence changes initiated. Q2-Q4 – Continue to deliver against detailed stakeholder-backed plan by raising and progressing code modifications and licence changes, and digitalising codes.	Scope, objectives and capabilities for digitalised whole system Grid Code agreed with stakeholders. Clear outline for whole system Grid Code structure and governance published. Detailed project work plan and resourcing plan in place. IT requirements defined.	Code modifications and licence changes initiated as required to facilitate whole system Grid Code.	Go live of digitalised whole system Grid Code in Year 5, 2025/26. The whole system Grid Code will focus on providing minimum standards to allow safe and secure operation of the electricity systems. The latest data technologies will support navigation of the codes, tailored to each code user's individual needs. Supporting documents will provide examples of how the requirements might be met. The digitalised, whole system Grid Code will provide users with a more user-friendly, inclusive and tailored experience.	Year 1 and Year 2 milestones and success factors updated to drive an extremely challenging timeline.

ESO RIIO-2 Delivery Schedule

Sub activity	Deliverable	Related IT investment	Project or continuous	RIIO-1 end point	2021/2022 Milestones	2022/2023 Milestones	First year success	Second year success	Expected final delivery date and what success looks like.	Notes on changes to Dec 2019 Business Plan
<p><b>A6.6</b> Look at fully or partially fixing one or more components of Balancing Services Use of System (BSUoS) charges</p>	<p><b>D6.6</b> Delivery of the recommendation from the BSUoS taskforce around reducing the volatility of BSUoS forecasting.</p> <p>This requires the collection of BSUoS to change from an arrangement in which charges are set after the costs have been incurred, to one whereby charges are set on the basis of an ESO forecast.</p> <p>This, in effect, transfers forecasting risk from industry to the ESO. It also fixes the charge in a given period, with any under or over-recovery being accounted for in a subsequent chargeable period.</p>	<p>It is envisaged that the BSUoS taskforce decision will require significant system changes and hence would be implemented on a new Charging and Billing solution.</p>	<p>Project</p>	<p>This deliverable is highly dependent on the outcome of the Balancing Services Charges Task Force.</p> <p>In November 2019 the first Task Force concluded that Balancing Services Charges should be treated as cost-recovery charges. In order to develop this work further, Ofgem requested a second Balancing Services Task Force, led by National Grid ESO.</p> <p>By the end of RIIO-1 the Task Force is expected to have answered the following questions: Who should be liable for Balancing Services Charges, and how should these charges be recovered?</p> <p>Further progress is dependent on Ofgem direction following the conclusion of this work.</p>	<p>Q1-Q4 – Continue the process to modify industry codes to allow for a fixed BSUoS price – including industry engagement, project implementation and ESO financing arrangements.</p>		<p>Code modifications raised and approved to implement fixed BSUoS with ESO licence changes providing for funding arrangements, risk mitigation and appropriate reward to do so.</p>		<p>April 2023 expected implementation of fixed BSUoS product into the new Charging and Billing solution.</p>	<p>Updated to reflect current situation.</p>



## Role 3 – System insight, planning and network development

### A7 – A11 Network Development

Our plans for Network Development will see us make significant steps towards our ambition for **Competition Everywhere** in the BP1 period. They will enable us to take the learning from the RfIO-1 period, to continue to 'learn by doing', and to identify and address the blockers (with Ofgem and wider industry).

Key outcomes in this area for the BP1 period are:

- NOA and NOA pathfinders projects will remain separate processes but be brought together under the NOA umbrella; with learning from the NOA pathfinder projects incorporated into the NOA methodology on an ongoing basis.
- We will take steps to widen the NOA to study more of the network and give more recommendations generating more consumer value. We will work with DNOs and TOs to identify and seek resolution to regulatory funding challenges associated with broadening participation in our NOA and NOA pathfinder work.
- We will start to engage with DNOs, providing bespoke support to help them implement their own NOA-type activity.
- And lastly, develop new tools that will enable the above to come together. By March 2023, we will have retendered our Economic Assessment tool, the core tool for the NOA, and implemented Probabilistic Modelling. The new Voltage Optimisation tool will be at the testing phase and the Stability Assessment tool will be ready to go into the testing phase.

### A7 Network Development

Sub activity	Deliverable	Related IT investment	Project or continuous	RfIO-1 end point	2021/2022 Milestones	2022/2023 Milestones	First year success	Second year success	Expected final delivery date and what success looks like.	Notes on changes to Dec 2019 Business Plan
A7.1 Analyse and communicate future network needs	D7.1 Electricity Ten Year Statement (ETYS)	Relies on Network Options Assessment (NOA) tools with no direct IT investments. Once implemented, this activity will benefit from improvements introduced via the IT investment 390 NOA enhancements. (Described under A11 Enhance analytical capabilities).	Continuous	Undertake a fundamental review across our suite of ESO publications to determine the best way to represent the information we publish.  A redesigned ETYS web page that contains more interactive content to engage a broader stakeholder base.  Initiate developments to integrate pre and post-fault actions within our probabilistic analysis.	Q1 / Q2 Review usefulness of System Requirements Form (SRF) for interested options submission process and work with industry to improve the needs information.  Q2 Proof of Concept for a bespoke joint network and market tool for probabilistic thermal analysis.  Q2 Proof of Concept for integration of probabilistic network analysis into the NOA process.	Q2 Show a greater integration of all types of system needs within the ETYS publication.  Q2 / Q3 Review how ETYS can help signal needs considering the Whole system across Transmission / Distribution interface.	Ofgem approved enhancements to ETYS following the annual ETYS consultation process that results in an increased number of stakeholders engaging with this process. These enhancements will be stakeholder-led and dependent on the feedback received through the annual consultation process.  Slimmed down ETYS publications with traditional chapters available on our website and results visualised through interactive website content  Improved System Requirements Form process which encourages more interested Persons to enter options into the NOA.	Ofgem approved enhancements to ETYS following the annual ETYS consultation process that results in an increased number of stakeholders engaging with this process. These enhancements will be stakeholder-led and dependent on the feedback received through the annual consultation process.  Greater integration of all types of system needs within the ETYS publication.  ETYS can help signal needs considering the Whole system across Transmission / Distribution interface.	Continuous deliverable  Measurement of consumer value realised as a result of the related NOA process.	More detailed milestones and successes added for Years 1 and 2 of RfIO-2 as to how ETYS will be developed.



ESO RfIO-2 Delivery Schedule

Sub activity	Deliverable	Related IT Investment	Project or continuous	RfIO-1 end point	2021/2022 Milestones	2022/2023 Milestones	First year success	Second year success	Expected final delivery date and what success looks like.	Notes on changes to Dec 2019 Business Plan
					Visualised through interactive website content.		Proof of Concept for integration of probabilistic network analysis into the NOA process.	NOA methodology evolution.		
<b>A7.2</b> Advise on economic efficient ways to address networks needs	<b>D7.2</b> NOA Annual Report	Relies on NOA tools. No direct IT investment.  Once implemented, this activity will benefit from improvements introduced via the IT investment <b>390</b> NOA enhancements.  (Described under <b>A11</b> Enhance analytical capabilities).	Continuous	Undertake a fundamental review across our suite of ESO publications to determine the best way to represent the information we publish in NOA.  A redesign of our Network Development roadmap website with dedicated pages for each NOA Pathfinder project. This will help ensure our stakeholders have a strong understanding of our NOA Pathfinder projects and how they can get involved.  Undertake assessment of some simple Offshore Wider Works proposals in the 2020/21 NOA in order to incrementally improve the process.  Undertake evaluation of extending Least Worst Regrets to Least Worst Weighted Regret approach (LWWR).  A redesigned NOA webpage that contains more interactive content to engage a broader stakeholder base  Work with the early competition project (ECP) team seeking to ensure that any agreed output can be implemented taking due consideration of the NOA process.	Q1 Review outputs from our Offshore Wider Works assessment in NOA 20/21 and devise the process and tool requirements to fully evaluate the benefit of OWW options.  Q1. Review outputs from NOA 20/21 and consider extension of Least Worst Regret approach to Least Worst Weighted Regret (LWWR) to explore sensitivities to different scenarios, to inform NOA 2021/22 methodology.  Q3/Q4 Create slimmed down NOA publication with traditional chapters available on our website and results visualised through interactive website content.	Q1 Undertake enhancements to the NOA Annual Report in response to stakeholder feedback.  Q2 Review and consolidation of NOA methodology, including learning from the LWWR investigation.  Q4 Establish a process to assess the benefits of OWW including the wider social benefits alongside onshore transmission reinforcement plans [this milestone is dependent upon the outcome of preceding development work and on developments made as part of the BEIS Offshore Transmission Network Review].	NOA methodology evolution.  Approved enhancements to the NOA methodology which result in more participants involved in the NOA process.  The NOA process document is examined by stakeholders and approved by Ofgem which determines how we will do network options assessment and outlines which recommendations or investments will be taken over the next twelve months.  Multiple complex OWW options assessed with a recommendation(s) of which OWW projects should be progressed in the best interest of GB consumers and how they could impact the latest/future NOA recommendations if delivered.  Understanding the LWWR approach to inform future direction.	NOA methodology evolution.  Approved enhancements to the NOA methodology which results in more participants involved in the NOA process.  NOA methodology slimmed down improving accessibility for stakeholders.  Tools developed to enable a strategic approach to optimising both OWW and onshore transmission reinforcements.  Depending on the outcome of the LWWR investigation, an updated NOA methodology further enhancing understanding of sensitivity to scenarios.	Continuous  Measurement of consumer value realised because of the NOA process.	More detailed milestones and successes added for Years 1 and 2 of RfIO-2.
<b>A7.3</b> Undertake ad hoc analysis in response to external requests	<b>D7.3</b> Strategic Wider Works (SWW) (or Large Onshore Transmission Projects	Relies on NOA tools. No direct IT investment.	Continuous	Continued support for ongoing SWW/LOTT (including Eastern HVDC,	Q1 Finalise processes to facilitate LOTT requirements in	Ad hoc support as required.	Ad hoc support of LOTT projects, and successfully take projects through the	Ad hoc support of LOTT projects, and successfully take projects through the	Continuous  Measurement of consumer value	Updated to include reference to the new LOTT process; We anticipate that

ESO RfIO-2 Delivery Schedule

Sub activity	Deliverable	Related IT Investment	Project or continuous	RfIO-1 end point	2021/2022 Milestones	2022/2023 Milestones	First year success	Second year success	Expected final delivery date and what success looks like.	Notes on changes to Dec 2019 Business Plan
	(LOTT) for RfIO-2) projects, Connections and Infrastructure Options Note (CION) and Cost Benefit Analysis (CBA) for small schemes.	Once implemented, this activity will benefit from improvements introduced via the IT investment <b>390</b> NOA enhancements.		and Isle of Skye) and CIONs.  Developing processes to facilitate LOTT requirements, particularly relating to Eastern HVDC Final Needs Case.	collaboration with TDS and Ofgem.		initial and final needs case in collaboration with the TDS and Ofgem.  Ad hoc support of other CBAs and CIONs when required.	Initial and final needs case in collaboration with the TDS and Ofgem.  Ad hoc support of other CBAs and CIONs.	realised because of the NOA process.	the new threshold for LOTT will result in increased workload for the team who will have to conduct cost-benefit analyses and assess a greater number of projects. This is therefore a change in scope to our December Business Plan and will require additional resource.  Implications for additional resourcing will be communicated through ongoing regulatory engagement.
		(Described under <b>A11</b> Enhance analytical capabilities).								

A8 Enable all solution types to compete to meet transmission needs

Sub activity	Deliverable	Related IT Investment	Project or continuous	RfIO-1 end point	2021/2022 Milestones	2022/2023 Milestones	First year success	Second year success	Expected final delivery date and what success looks like.	Notes on changes to Dec 2019 Business Plan
<b>A8.1</b> Rollout of pathfinder approach and optimise assessment and communication of future needs	<b>D8.1</b> New areas of need identified, and 3-6 tenders run.  Activities in <b>A8</b> (Role 3) and <b>A4</b> (Role 2) share common milestones.	<b>130</b> Emergent technology and system management: Development of IT solutions for phase 1 and 2 to register, model, instruct, settle and report new services	Project	Stability Phase 1 pathfinder outputs have been incorporated into the NOA methodology. Pennines voltage pathfinder Request for Information (RFI) has been issued, followed by a tender.	Annual assessment undertaken to identify system needs / next priority area  Pennines voltage pathfinder outputs /recommendation is available.	Annual assessment undertaken to identify system needs.  Review of constraint management pathfinder success.	First year success will result in Stability phase 2, Pennines voltage and constraint management pathfinder phase 1 tender being complete.	Up to 3 additional tenders completed which may include new areas of need identified. This will be driven by the needs identification process and will determine size and scope of the tender processes and whether there will be continuations of previous pathfinders or new areas.	The measure of success is that we tender for solutions. Also, that we are able to evaluate if cheaper solutions exist than if the tender was not run.	Updated to include details of known tenders (also reflected in new activities in Role 2, Activity group reference <b>A4</b> ).
(As described under A4.4 New services market development in Role 2).	This is because the activities are being delivered both as part of our work to ensure a level playing field for all technology types to be able to provide solutions to network challenges (Role 3) and develop competitive means to procure those new			Constraints management pathfinder - Stakeholder engagement and commercial aspects are communicated.	Q2 Conclusion (contracts awarded) of Stability Phase 2 tender.  Q4 Conclusion (contracts awarded) of Pennines voltage tender.	Constraint management pathfinder phase 1 year 2 tenders concluded.	Pathfinder lessons learned and developments are incorporated into the NOA methodology. We will ensure our pathfinders adopt a co-ordinated approach where there is a clear benefit in doing so such as where there needs to be overlap.	Pathfinder lessons learned and developments are incorporated into the NOA methodology. We will ensure our	Success is having a broader range of options to assess considering that we may use existing solutions if these were the most optimal after further evaluation.	

ESO RfIO-2 Delivery Schedule

Sub activity	Deliverable	Related IT Investment	Project or continuous	RfIO-1 end point	2021/2022 Milestones	2022/2023 Milestones	First year success	Second year success	Expected final delivery date and what success looks like.	Notes on changes to Dec 2019 Business Plan
	system services (Role 2). Pathfinder projects deploy virtual teams of cross-functional resource bringing together world-leading technical and economic analysis skills and tools (Role 3) alongside innovative commercial approaches to procurement and market design (Role 2). Both activities and skillsets are required to deliver the milestones outlined for the Pathfinder projects and the enduring markets solutions that will build on those learnings.				pathfinder outputs are incorporated into the MOA methodology.  Constraint management pathfinder phase 1 year 1 tender concluded.  Constraint management pathfinder phase 1 year 2 tenders communicated.			pathfinders adopt a co-ordinated approach where there is a clear benefit in doing so such as where there needs to be overlap.	Measured by the appropriate counterfactual costs compared to actual contract costs.  This facilitates finding solutions to transmission problems from sources other than transmission owners. I.e. Market solution or Distributed Network Operator (DNO) solutions in line with introducing competition into the market and enabling market participants.	
<b>A8.2</b> Enhance tendering models	<b>D8.2</b> Improved tender approaches that enable more participants to enter the market. Activities in <b>A8</b> (Role 3) and <b>A4</b> (Role 2) share common milestones.  This is because the activities are being delivered both as part of our work to ensure a level playing field for all technology types to be able to provide solutions to network challenges (Role 3) and develop competitive means to procure those new system services (Role 2). Pathfinder projects deploy virtual teams of cross-functional resource bringing together world-leading technical and	None	Project	Lessons learned exercise from Stability Phase 1 results in additional time in the process and the introduction of a feasibility study stage. Following the Voltage pathfinder, we have conducted an internal and then external Lessons Learned exercise. Following the Voltage pathfinder, we have conducted an internal and then external lessons learned exercise. Changes we will be looking to implement for future events to be fed back to participants. Categories for review were communication, pre-equal and compliant bids, assessment including transparency, participation and "level playing field", and process timeline.	<b>Q4:</b> New areas of need identified that will be tendered.  Through lessons learned on earlier tender exercises undertaken in consultation with tender participants and wider industry, we will strive to improve the tendering experience.  We will seek to broaden the market by reducing barriers to entry, increasing the scope of participants where possible (see <b>D8.3</b> below).  Specific timing of the lessons learned process is dependent upon tender timescales.	<b>Q4:</b> Tenders prepared and run on 2021-22 work (which are currently not known)	Improvements to tender processes result in new and varied tender participants. Improvements to tender processes are in line with stakeholder feedback. For example, for the voltage pathfinders we will look to remove ambiguity on what we expect to receive in a tender.	Improvements to tender processes result in new and varied tender participants; lessons learned from 2021/22 applied to tender processes in 2022/23.	<b>D8.2.3</b> RfIO-2, year 3: year 2023-24: Improved tender approaches that enable more participants to enter the market.  Successfully attracted more participants and / or the tender process is more efficient for participants.  We have received feedback that more people are aware of the process and are considering participation.	Further information added to RfIO-1 end point, milestones and success measures.

ESO RIIO-2 Delivery Schedule

Sub activity	Deliverable	Related IT Investment	Project or continuous	RIIO-1 end point	2021/2022 Milestones	2022/2023 Milestones	First year success	Second year success	Expected final delivery date and what success looks like.	Notes on changes to Dec 2019 Business Plan
	economic analysis skills and tools (Role 3) alongside innovative commercial approaches to procurement and market design (Role 2).  Both activities and skillsets are required to deliver the milestones outlined for the Pathfinder projects and the enduring markets solutions that will build on those learnings.									
<b>A8.3</b> Support Ofgem to establish enabling regulatory and funding frameworks	<b>D8.3</b> Frameworks based on competitive regime not monopoly regime.  Activities in <b>A8</b> (Role 3) and <b>A4</b> (Role 2) share common milestones.  This is because the activities are being delivered both as part of our work to ensure a level playing field for all technology types to be able to provide solutions to network challenges (Role 3) and develop competitive means to procure those new system services (Role 2).  Pathfinder projects deploy virtual teams of cross-functional resource bringing together world-leading technical and economic analysis skills and tools (Role 3) alongside innovative commercial approaches to procurement and market design (Role 2).	None	Project	<b>Q4:</b> Support Ofgem and TOs to consider RIIO-2 TO funding implications of competition.  Start discussions with DNOs on their RIIO-ED2 business plans and how any applicable funding arrangement proposals work with the MOA process.  Initiate policy intent for wider level playing field via Ofgem approval of CMP334 WACM1 to remove voltage support sites from paying TNUoS demand residual charge.	<b>Q1</b> Identify further possible changes to CUSC to remove blockers to competition depending on the outcome of CMP334.  <b>Q4:</b> Assess and adapt processes to accommodate any new regulatory funding arrangements.  Establish, through stakeholder engagement following each phase, a prioritised list of actions required to remove or reduce blockers to tender participation (level playing field discussions to be facilitated through 'learning by doing').	<b>Q1-Q4:</b> Work with industry and BEIS (for wider policy aspects) to identify and implement any other framework changes that may be needed: support Ofgem to consider RIIO-ED2 funding implications.	Depending upon outcome of CMP334, changes to charging arrangements are implemented.	Relevant modifications raised in response to any blockers identified.	Engagement with OfGEM and industry on specific aspects of funding and level playing field so that frameworks are taken forward to be modified to assist creating a more level playing field.  Be able to recommend funding solutions.  Enable a more levelled playing field for all participants in tender process.	Changes to RIIO-1 end point and milestones in year 1. Reference added to specific ongoing work (with Ofgem) to promote competition and a level playing field via framework changes.

Sub activity	Deliverable	Related IT Investment	Project or continuous	RIIO-1 end point	2021/2022 Milestones	2022/2023 Milestones	First year success	Second year success	Expected final delivery date and what success looks like.	Notes on changes to Dec 2019 Business Plan
	Both activities and skillsets are required to deliver the milestones outlined for the Pathfinder projects and the enduring markets solutions that will build on those learnings.									

### A9. Extend NOA approach to end of life asset replacement decisions and connections wider works

Sub activity	Deliverable	Related IT Investment	Project or continuous	RIIO-1 end point	2021/2022 Milestones	2022/2023 Milestones	First year success	Second year success	Expected final delivery date and what success looks like.	Notes on changes to Dec 2019 Business Plan
<b>A9.1</b> Expand network planning processes to enable more connections wider works to be assessed	<b>D9.1</b> Developed and trialled connection wider works (CWW) processes with TOs.	Relies on NOA enhancements investment <b>390</b> .  Once implemented, this activity will benefit from improvements introduced via the IT investment <b>390</b> NOA enhancements (Described under <b>A11</b> Enhance analytical capabilities).	Project	Most connections wider works are subject to NOA assessment, but some are not. Most connections wider works are subject to NOA assessment, but some are not.	Q3 Review existing network planning processes and identify where and how to extend.	Q2 Undertake initial conversations with TOs and Ofgem, and explore initial technical feasibility, and potential exchange processes.	Initial proposals for extending the existing processes prepared.	TOs engaged on the CWW trial. More of the transmission network will be evaluated under NOA processes resulting in reaping the benefits identified in the cost benefit analysis.	This deliverable is scheduled to complete in Q3. RIIO-2 year 2.  The overall final deliverable is defined below in <b>D9.3</b> in 2026. Overall objective is to yield benefits for consumers.	More information added to the milestones and successes.
<b>A9.2</b> Trial assessment of all connection wider works in one region	<b>D9.2</b> Completed and published connection wider works trials, in selected geographic regions, in NOA.	Relies on NOA enhancements investment <b>390</b>  Once implemented, this activity will benefit from improvements introduced via the IT investment <b>390</b> NOA enhancements (Described under <b>A11</b> Enhance analytical capabilities).	Project	Most connections wider works are subject to NOA assessment, but some are not. Most connections wider works are subject to NOA assessment.	Q3 Review existing network planning processes and identify where and how to extend.	Q4: Complete and publish outputs from connection wider works trials, based on the study work and trial undertaken in <b>A9.1</b> .	Initial proposals for extending the existing processes prepared.	Connection wider works trials in selected geographic zones have been included in NOA. Trials allow for stakeholder engagement on the outcomes and process employed.	This deliverable is scheduled to complete in Q4. RIIO-2 year 2  The overall final deliverable is defined below in <b>D9.3</b> in 2026.	



ESO RII0-2 Delivery Schedule

Sub activity	Deliverable	Related IT Investment	Project or continuous	RIIO-1 end point	2021/2022 Milestones	2022/2023 Milestones	First year success	Second year success	Expected final delivery date and what success looks like.	Notes on changes to Dec 2019 Business Plan
<b>A9.3</b> Expand to all Connections Wider Works (CWW)	<b>D9.3</b> Incremental expansion of the process (following trials) which results in making recommendations on all connections wider works in NOA 2026.	Relies on NOA enhancements investment <b>390</b>  Once implemented, this activity will benefit from improvements introduced via the IT investment <b>390</b> NOA enhancements.  (Described under <b>A11</b> Enhance analytical capabilities).	Project	N/A See <b>D9.1</b> and <b>D9.2</b> for deliverables which enable this deliverable.	N/A. See <b>D9.1</b> and <b>D9.2</b> for deliverables which enable this deliverable.	N/A. See <b>D9.1</b> and <b>D9.2</b> for deliverables which enable this deliverable.	N/A. See <b>D9.1</b> and <b>D9.2</b> for deliverables which enable this deliverable.	N/A. See <b>D9.1</b> and <b>D9.2</b> for deliverables which enable this deliverable.	Following completion of the trials in <b>D9.2</b> (2022/23) there will be an incremental expansion of the process leading to full implementation in NOA 2026. This enables us to manage the scale of change to the NOA and smooth the resulting impact for all industry parties.  Recommendation of network solutions which are outside of historic defined boundaries.  Larger portion of the GB network being assessed through NOA.  Extending NOA and increasing the defined set of boundaries or moving to a nodal assessment of the network (depending on the technical and computational feasibility delivered in IT investment 390).	
<b>A9.4</b> Develop process with TOS to input into ESO analysis of end of life asset replacement decisions	<b>D9.4</b> Efficient planning process agreed with TOS  NOA 2024 makes recommendation on future end of life asset replacement	Relies on NOA enhancements investment <b>390</b>  Once implemented, this activity will benefit from improvements introduced via the IT investment <b>390</b> NOA enhancements (Described under <b>A11</b> Enhance analytical capabilities)	Project	End-of-life asset replacement decisions do not form part of the NOA assessment. End-of-life asset replacement decisions do not form part of the NOA assessment.	N/A – activity to start in year 2.	Q1 We will start to engage with TOS to determine, evaluate and agree the eligible set of criteria: <ul style="list-style-type: none"> <li>Identify equipment categories to be evaluated</li> <li>Undertake investigatory runs using the NOA tools to understand if feasible and sensible to do so.</li> </ul>	N/A	RIIO-2 year 2 we will explore developing the process and understanding the criteria we will use for defining which equipment will go through the process with TOS.  The network development team will facilitate and establish the criteria list, and undertake exploratory technical work The network development team will facilitate and establish the criteria list and undertake	NOA 2024 will make recommendations on future end of life asset replacement.  Measurement will take place at the end of the RIIO-2 period.  New options will go through a cost benefit analysis and be included in NOA. This will increase the range and type of options that can be optimised to deliver the optimal solution for consumers. The NOA CBA will establish the	Milestones clarified and successes updated to reflect when we would engage with TOS.

Sub activity	Deliverable	Related IT Investment	Project or continuous	RIIO-1 end point	2021/2022 Milestones	2022/2023 Milestones	First year success	Second year success	Expected final delivery date and what success looks like.	Notes on changes to Dec 2019 Business Plan
								exploratory technical work	Value of this process and the scope and nature of future iterations will be kept under review based on this output. Establish criteria and agreement with TOs on scope of this activity.	

### A10. Support decision making for investment at distribution level

Sub activity	Deliverable	Related IT Investment	Project or continuous	RIIO-1 end point	2021/2022 Milestones	2022/2023 Milestones	First year success	Second year success	Expected final delivery date and what success looks like.	Notes on changes to Dec 2019 Business Plan
A10.1 Support DNOs to develop NOA type assessment processes	D10.1 NOA expertise shared with DNOs	None	Project	Initial engagement with DNOs on the requirements for NOA type assessments and where support may be required (to feed into RIIO-ED2 plans)	Engage with ENA Open Networks work stream, to continue discussions with DNOs.  Q1 Engage with DNOs to support them to develop NOA type proposals for the RIIO-ED2 business plans.	Q1 Engage with DNOs on what support they want to develop NOA type proposals, develop support materials for DNOs as required on the existing NOA methodology.  Q2-Q4 Continue to provide support to DNOs heading into the RIIO-ED2 period.	DNOs are engaged with the ESO on this topic and we have jointly scoped where support is required and when with each DNO.	DNOs continue to be engaged with the ESO on this topic and we have jointly scoped where support is required where support is required and when with each DNO.	Support DNOs to establish consistent methodologies and processes by providing information on our existing NOA processes should they want or need it.	Updated milestones to reflect earlier engagement with DNOs prior to submission of RIIO-ED2 Business Plans. Updated success measures.

### A11 Enhance analytical capabilities

Sub activity	Deliverable	Related IT Investment	Project or continuous	RIIO-1 end point	2021/2022 Milestones	2022/2023 Milestones	First year success	Second year success	Expected final delivery date and what success looks like.	Notes on changes to Dec 2019 Business Plan
A11.1 Refresh and integrate economic assessment tools to support future network modelling needs	D11.1 Improved identification of when is the most economical time to invest and the most efficient solution	NOA Enhancements investment <b>390</b> Data and analytics platform investment <b>220</b> . The data and analytics platform will provide the foundational architecture to enable the development of an interchangeable suite of tools with a	Project	Informal engagement with potential tool providers and understanding limitations of current tool.	Q1: Start Economic Assessment (EA) tool refresh.  Q2-3: Gather requirements and design / procure future EA tool.  Q4: Commence development and testing of EA tool.	Q3: Continue development and testing of EA tool, including parallel working with existing tool. Given the complexity of the tool, seek independent analysis to provide assurance of the new model.	Procurement exercise for new EA tool completed, with design decisions made to design the right tool for the future.	A new EA tool, which reflects the latest modelling approach and technologies, and therefore enables: <ul style="list-style-type: none"> <li>Quicker evaluations and issues identification</li> <li>At lower cost.</li> <li>More network being evaluated</li> </ul>	RIIO-2 year 4: 24/25: Started cyclical EA tool refresh (D11.1.5)  RIIO-2 year 5 25/26: Full integration with Data and analytics platform complete, enabling a joined-up analysis process that allows us to stack different network needs and adjust the	More detail added to the milestones and successes.



ESO R10-2 Delivery Schedule

Sub activity	Deliverable	Related IT Investment	Project or continuous	R10-1 end point	2021/2022 Milestones	2022/2023 Milestones	First year success	Second year success	Expected final delivery date and what success looks like.	Notes on changes to Dec 2019 Business Plan
		common dataset, and seamless exchange of data between tools.  The data and analytics platform will be delivered under <b>D1.4.1</b> Creation of a data and analytics platform.				Data and analytics platform foundational architecture in place.  Q4: Implement EA tool.		<ul style="list-style-type: none"> <li>Evaluation of additional quantities, and/or on additional boundaries.</li> </ul>	level of detail in the analysis, to deliver the most economic decision.  This can be measured by measuring savings or efficiencies from NOA that is comparing costs, network coverage, speed of evaluation before and after implementation of each tool enhancement.	
A11.2 Implement probabilistic modelling	D11.2 Improved identification of network needs	NO4 Enhancements Investment <b>390</b>  We need to manage the increasing number of scenarios and modelling complexity driven by the growing interaction between different network needs. The better we understand likely needs, the better we can identify where and when to invest most efficiently.  Data and analytics platform investment <b>220</b> . The data and analytics platform will provide the foundational architecture to enable the development of an interchangeable suite of tools with a common dataset, and seamless exchange of data between tools.  The data and analytics platform will be delivered under <b>D1.4.1</b> Creation of a data and analytics platform.	Project	Proof of concept to demonstrate how to integrate pre and post-fault actions within our probabilistic analysis in line with our commitments within our Network Development Roadmap and ETYS.	Q1: Gather requirements and design Probabilistic Model (PM).  Q2: Develop and test PM; Proof of Concept for a bespoke joint network and market tool for probabilistic thermal analysis.  Proof of concept for integrating probabilistic network analysis into the NOA process.  [These milestones are in line with our commitments within our Network Development Roadmap and ETYS].	Q3: Data and analytics platform foundational architecture in place.  Q4: Implement PM.	Model that enables Year-round assessment of Thermal needs. Needs identified across the year rather than single winter peak snapshot.  Analysis completed across all available FES scenarios and not just focussed on one.  Proof of Concept for a bespoke joint network and market tool for probabilistic thermal analysis.  Proof of Concept for integration of probabilistic network analysis into the NOA process.	Year-round analysis completed on all solution types: Asset reinforcements, reduced build, commercial solutions.  Year-round analysis completed on solution types submitted by multiple parties: TOs, ESO and Interested Persons.  Probabilistic modelling integrated within NOA process.	R10-2 year 4: 24/25: Developed and implemented online portal ( <b>D11.2.4</b> )  The online portal will provide an interactive platform to allow stakeholders to view network needs and see the impact selected generic options will have on addressing those needs from a technical perspective.  R10-2 year 5 25/26: Full integration with Data and analytics platform complete, enabling a joined- up analysis process that allows us to stack different network needs and adjust the level of detail in the analysis, to deliver the most economic decision.  This can be measured by measuring savings or efficiencies from NOA that is comparing costs, network coverage, speed of evaluation before and after implementation of each tool enhancement.	More detail added to milestones and successes.

ESO RfIO-2 Delivery Schedule

Sub activity	Deliverable	Related IT Investment	Project or continuous	RfIO-1 end point	2021/2022 Milestones	2022/2023 Milestones	First year success	Second year success	Expected final delivery date and what success looks like.	Notes on changes to Dec 2019 Business Plan
A11.3 Build voltage assessment techniques into an optimisation tool	D11.3 Improved assessment of voltage requirements, and ability to look across a range of network needs at the same time	NOA enhancements investment <b>390</b>  Data and analytics platform investment <b>220</b> . The data and analytics platform will provide the foundational architecture to enable the development of an interchangeable suite of tools with a common dataset, and seamless exchange of data between tools.  The data and analytics platform will be delivered under <b>D14.1</b> Creation of a data and analytics platform.	Project	Completion of the innovation project: "Application of Connext Optimisation to Enhance the NOA Process".	Q4: Start full Voltage Optimisation (VO) tool development. Dependent on the success of the innovation project we would look to start this work earlier.	Q1-Q2: Gather requirements and design VO tool.  Q3: Data and analytics platform foundational architecture in place.  Q3-Q4: Develop and test VO tool.  Q4: Proof of concept for integrating year-round voltage analysis into the NOA process.	Taken outputs and learnings from the innovation project. "Application of Connext Optimisation to enhance the NOA process" and completed the initial Proof of Concept work to understand which optimisation model and algorithm will be best suited to the NOA process for voltage assessment.	Completed development and testing of the VO model.  Model that enables a national assessment as well as a local assessment of needs. Proof of concept for integrating year-round voltage analysis into the NOA process.	RfIO-2 year 3: 23/24: Implemented VO tool and identified further enhancements.  RfIO-2 year 5 25/26: Full integration with Data and analytics platform complete, enabling a joined-up analysis process that allows us to stack different network needs and adjust the level of detail in the analysis, to deliver the most economic decision.	More detail added to successes in BP 1 and linking to the innovation work that is supporting model development.
A11.4 Build stability assessment techniques into an optimisation tool	D11.4 Improved assessment of stability requirements across the network.	NOA enhancements investment <b>390</b>  We need to manage the increasing number of scenarios and modelling complexity driven by the growing interaction between different network needs.  The better we understand likely needs, the better we can identify where and when to invest most efficiently.	Project	12 months completed of 18-month innovation project with TNEI. Probabilistic Planning for Stability Constraints.  Work Package 1 complete: Initiation and Review.  Work Package 2 complete: Development and Reduced-scale Testing.	Q1: Work Package 3 completed. Trialling on Full GB Model.  Q2: Work Package 4 completed. Future Roadmap and Plan for implementation.	Q2: Start-up phase for full Stability Assessment (SA) tool development.  Q3: Data and analytics platform foundational architecture in place.  Q3-Q4: Gather requirements and design SA tool.	Completion of the innovation project with TNEI: Probabilistic Planning for Stability Constraints.  Successful trials of the initial concept developed in the innovation project on full GB model which shows comparable accuracy to our current process. This is dependent on the success of the innovation project.	Proof of Concept for new stability assessment tool that can be used in the NOA process.	RfIO-2 year 4: 2024-25: Implemented SA tool (D11.4.4).  RfIO-2 year 5 25/26: Full integration with Data and analytics platform complete, enabling a joined-up analysis process that allows us to stack different network needs and adjust the level of detail in the analysis, to deliver the most economic decision.	Further detail added to the milestones and Year 1 and 2 successes.

Sub activity	Deliverable	Related IT Investment	Project or continuous	RIIO-1 end point	2021/2022 Milestones	2022/2023 Milestones	First year success	Second year success	Expected final delivery date and what success looks like.	Notes on changes to Dec 2019 Business Plan
		These investments are necessary to support delivery of all the MOA activities. Data and analytics platform investment <b>220</b> . The data and analytics platform will provide the foundational architecture to enable the development of an interchangeable suite of tools with a common dataset, and seamless exchange of data between tools. The data and analytics platform will be delivered under <b>D1.4.1</b> Creation of a data and analytics platform.					A plan for the implementation of the findings from the innovation project has been developed		Enable efficiencies, greater insights into the future network requirements and how to meet them. This can be measured by measuring savings or efficiencies from MOA that is comparing costs, network coverage, speed of evaluation before and after implementation of each tool enhancement.	

## A12 SQSS Review

Our plans to review the SQSS will remove barriers to entry to ensure that it enables decarbonisation of the electricity system and help to align industry arrangements across transmission and distribution. We have updated this deliverable to drive a very challenging timeline, thereby implementing 'quick win' amendments to the SQSS by March 2023.

Sub activity	Deliverable	Related IT Investment	Project or continuous	RIIO-1 end point	2021/2022 Milestones	2022/2023 Milestones	First year success	Second year success	Expected final delivery date and what success looks like.	Notes on changes to Dec 2019 Business Plan
<b>A12.1</b> Scope project, building on the BEIS recommendations	SQSS updated to ensure it is designed to enable decarbonisation of the electricity system	N/A	Project	Evaluation of recommendations from BEIS review of technical standards (depending on publication timescale).	Q1: Engage key stakeholders and initiate scope review. Q2: Consult on SQSS Review scope, issues and options.	Milestones on delivery of quick wins and initiation of actions on broader topics are dependent on the outputs delivered in 2021/2022.	Key issues identified and prioritised with industry stakeholders including the SQSS Panel. Clear understanding of impact of key strategic projects on SQSS including Energy Standards Review, Offshore coordination and implications of extending competition in the MOA process to meet transmission system needs.	Quick wins implemented. Broader changes on strategic topics such as Energy Standards Review. Offshore coordination and implications of extending competition in the MOA process to meet transmission system needs initiated.	Strategic changes implemented by end of 2025/26 to ensure that SQSS is designed to enable decarbonisation of the electricity system.	Year 1 and Year 2 milestones and success factors updated to drive an extremely challenging timeline.
<b>A12.2</b> Identify solutions										
<b>A12.3</b> Implement changes to the SQSS					Q2-3 Engage stakeholders (including network companies) to co-create prioritised list of issues and action plan.					Three sub-activities

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					Q4 Publish prioritised list of issues to be addressed and action plan. Engage stakeholders. Q4: Publish plan for quick wins and initiate action if appropriate.		Published report including horizon scanning and potential code modifications identified. Quick wins identified and action initiated if appropriate.		merged into one overall deliverable.
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## A13 Leading the Debate

We will continue to build on the valued insights we already produce through our Future Energy Scenarios (FES) and associated documents thereby underpinning our 'Whole system strategy that supports net zero by 2050' ambition. By the end of BP1 we will have developed and implemented our proposed energy and electricity demand models which will be more robust and allow for greater interrogation of the scenarios. Through our proposal to Bridge the Gap to Net Zero, we will create an environment for debate and additional thinking with industry stakeholders to explore and present thinking on subject areas without necessarily having a fully formed or 'right' answer. Given the stakeholder-driven nature of this activity we therefore currently do not know what insights will be provided and how extensive they will be until we engage with stakeholders.

Sub activity	Deliverable	Related IT investment	Project or continuous	RIIO-1 end point	2021/2022 Milestones	2022/2023 Milestones	First year success	Second year success	Expected final delivery date and what success looks like.	Notes on changes to Dec 2019 Business Plan
A13.1 Carry out analysis and scenario modelling on future energy demand & supply	D13.1 Published <i>Future Energy Scenarios (FES)</i> , <i>Winter Outlook</i> and <i>Summer Outlook</i> , and other regular external commentary such as blogs from ESO employees on our website.	Investment 220. Data and analytics platform. The data and analytics platform will store the data and provide analytical capabilities to support the FES modelling.	Continuous	Undertake a review of ESO publications, including FES, to ensure they work together as a suite of documents for stakeholders.	Q1: <i>Winter Review</i> Q2: FES Call for Evidence Q2: FES Launch Q2-Q3: FES Network Forum (this is a new initiative) Q3: FES Stakeholder Feedback Document Q3: <i>Winter Outlook</i> Q4: <i>Summer Outlook</i>	Q1: <i>Winter Review</i> Q2: FES Call for Evidence Q2: FES Launch Q2-Q3: FES Network Forum (new) Q3: FES Stakeholder Feedback Document Q3: <i>Winter Outlook</i> Q4: <i>Summer Outlook</i>	Ongoing success of the delivery of FES as set out in the 'Final delivery date and what success looks like' column. We adjust our bottom up process outputs each year to system actuals to keep them as close to output as possible. Using our bottom up processes, we include as much actual data as possible, where this does not behave as we expect we investigate and engage to understand this to reflect our scenarios. We begin with the scenario framework, assessing its suitability each year. The process is documented in our scenario framework document giving reason for changes and how this will be	Ongoing success of the delivery of FES as set out in the 'Final delivery date and what success looks like' column. We adjust our bottom up process outputs each year to system actuals to keep them as close to output as possible. Using our bottom up processes, we include as much actual data as possible, where this does not behave as we expect we investigate and engage to understand this to reflect our scenarios. We begin with the scenario framework, assessing its suitability each year. The process is documented in our scenario framework document giving reason for changes and how this will be	The FES will continue to be one of our flagship documents. Performance is subjective and qualitative in many areas. We aim for the FES to remain relevant and reflect changes in the market/policy/technology. It will continue to be built on stakeholder engagement and research but not just reflect the scenarios and thinking already published. It will continue to show a stretching but credible range of scenarios. It will focus on key aspects to whole energy and net zero. It will not be a handle turning exercise but one where our expertise and capacity is spent on the most integral aspects of the scenarios taking a lead from the Bridging The Gap outputs (A13.4).	Updated successes to reflect the current FES development process.

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Sub activity	Deliverable	Related IT investment	Project or continuous	RII-1 end point	2021/2022 Milestones	2022/2023 Milestones	First year success	Second year success	Expected final delivery date and what success looks like.	Notes on changes to Dec 2019 Business Plan
<b>A13.2</b> Conduct mathematical and modelling and market research on local and wider geographic demand information	<b>D13.2</b> Created pan-European and country level electricity and energy demand models	<b>Investment 220</b> Data and analytics platform. The data and analytics platform will store the data and provide analytical capabilities to support the FES modelling.	Continuous	Introduction of the pan-European power dispatch model - a market model that attempts to replicate the power dispatch model including trades on the interconnectors (used for FES development but also for MOA). We have expanded the data that we put in to this from an initial small set of directly connected countries, to a much wider geography of European countries (data sourced from ENTSO-E and TSOs).	Work with ENTSO-E to collate the latest European "Ten Year Network Development Plan" (TYNDP) 2020 scenarios, cleanse the data, and incorporate the resulting data in to our pan-European dispatch model.	As the TYNDP is only published every 2 years, we would use this year to gather updates from key neighbouring TSOs and to update these in our pan-European dispatch model. This will help us keep in sync with any net zero policy changes occurring in the EU without having to wait for the next TYNDP cycle.	Each year we make modelling improvements as well as collate new information. For demand including embedded generation and demand side response we report on the changes to our modelling methodology and the performance of the recent outturn winter peak demand to Ofgem as part of the Capacity Mechanism process.	Each year we make modelling improvements as well as collate new information. For demand including embedded generation and demand side response we report on the changes to our modelling methodology and the performance of the recent outturn winter peak demand to Ofgem as part of the Capacity Mechanism process.	N/A	RII-1 end point and milestones updated to reflect current processes and specific reference to European model and data development.
<b>A13.3</b> Maintain external communication channels with consumers and stakeholders	<b>D13.3</b> Shared insights on future energy expectations and requirements	N/A	Continuous	We have implemented the Network Forum and are using this as a forum to discuss our modelling assumptions and outputs on a national basis with the regional network experts who engage with local authorities etc on a more detailed basis. This is then reflected in our FES.	Q1: Develop a communication strategy aligned to target audiences. Create future energy insights content to share through selected channels. Q2: <i>Future Energy Scenarios</i> Publication and Launch Events; Introduce Bridging the gap topic and invite core stakeholders to co-creation events. Q3: <i>Future Energy Scenarios</i> Call for evidence, workshops and bilateral meetings. Bridging the gap stakeholder events Q4: <i>Future Energy Scenarios</i> Bilateral meetings. Bridging the gap report launch Annual FES activities comprise continuous engagement with stakeholders throughout the year. Communication is	Q2: Publication and Launch Events Q3: Call for evidence, workshops and bilateral meetings Q4: Bilateral meetings Annual FES activities comprise continuous engagement with stakeholders throughout the year. Communication is managed via various communication channels such as: email, FES newsletter, social media, FES website and the ESO website.	See final success column	See final success column	Continued positive scores from our stakeholders following targeted surveys. Performance will not be measured on the number of people we engage with but the value and breadth of the engagement. Good performance will demonstrate that engagement is beyond the traditional energy industry. A range of methods will be used to engage. This is relevant not only to the <i>Future Energy Scenarios</i> but also Bridging the Gap to Net Zero.	Updated milestones and success measure to reflect our engagement process for FES.



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Sub activity	Deliverable	Related IT investment	Project or continuous	RIIO-1 end point	2021/2022 Milestones	2022/2023 Milestones	First year success	Second year success	Expected final delivery date and what success looks like.	Notes on changes to Dec 2019 Business Plan
					managed via various communication channels such as: email, <i>FES</i> newsletter, Social media, <i>FES</i> website and the ESO website.					
<b>A13.4 FES: Bridging the gap to net zero</b>	<b>D13.4</b> This work draws from each annual <i>FES</i> publication, and the engagement activity referenced in <b>A13.3</b> above, to provide insights and analysis beyond <i>FES</i> . We look to ensure that we are examining topics of relevance to our stakeholders which can inform energy policy development and the strategic thinking of our customers and stakeholders.	N/A	Project This work will require a project to mobilise and embed the new changes into the existing process, however there are no specific deliverables related to this project besides enabling the existing process.	Support BEIS and industry in developing a strategy for clean heat. Shared and tested thinking on Clean Heat pathways with networks and industry.	Q3: Establish broad industry engagement and interactive collaborative spaces. Q4: Publish focused and extensive whole energy system report.	Q3: Establish broad industry engagement and interactive collaborative spaces. Q4: Publish extensive whole energy system report.	We create environment for debate and additional thinking and explore and present thinking on subject areas without necessarily having a fully formed or 'right' answer. We currently do not know what insights will be provided and how extensive they will be until we engage with stakeholders.	We create environment for debate and additional thinking and explore and present thinking on subject areas without necessarily having a fully formed or 'right' answer. We currently do not know what insights will be provided and how extensive they will be until we engage with stakeholders.	Success can be measured via stakeholder feedback (see above) which can evidence the value this work brings to other external parties. Conclusions and findings from Bridging the Gap are also fed onwards into the following annual <i>FES</i> publication. Our work therefore supports a closer loop across our ongoing work to Lead the Debate.	Updates made to the deliverable, the milestones and successes to demonstrate that the specific outputs from this deliverable are unknown until we have engaged stakeholders.
<b>A13.5</b> <i>FES</i> : Integrating with other networks and supporting DNOs to develop their own <i>DFES</i> processes - This project will require a cross organisation project group at a senior stakeholder and working level with the national and regional network companies. <i>FES</i> : Integrating with other networks and supporting DNOs to develop their own <i>DFES</i> (Distribution <i>FES</i> ) processes - This project will require a cross organisation project group at a senior stakeholder and working level with the national and regional network companies.	<b>D13.5.1</b> Working with DNOs to understand what information we need to share to support development of <i>DFES</i> and ED-2 submissions Working with DNOs to understand what information we need to share to support development of <i>DFES</i> and RIIO - ED2 submissions The data and analytics platform will store the data and provide analytical capabilities to support the <i>FES</i> modelling. The data and analytics platform will be delivered under <b>D1.4.1</b> Creation of a data and analytics platform. Key milestones relevant to this deliverable are: Data platform foundation delivered including	Investment <b>220</b> . Data and analytics platform. Investment <b>220</b> . Data and analytics platform. The data and analytics platform will store the data and provide analytical capabilities to support the <i>FES</i> modelling. The data and analytics platform will be delivered under <b>D1.4.1</b> Creation of a data and analytics platform. Key milestones relevant to this deliverable are: Data platform foundation delivered including	Project	The RIIO-1 end point has been where we have defined the first set of building block data to be shared which has been trialled in <i>FES</i> 20 and used once in full in <i>FES</i> 21. <i>FES</i> Network Forum established to enable organisations to input into <i>FES</i> on a more regular and timely manner. Initiate engagement with DNOs on development of regional <i>FES</i> and development of RIIO-ED2 business plans.	Q2: Completed ESO electricity demand modelling requirements gathering and design work. Bring DNO data into the process (enhanced building blocks information as a result of a DCUSA modification) to compare with national data in order to inform discussions on how we can support DNOs to develop their own regional <i>DFES</i> (and inform ESO <i>FES</i> each year). Q3 Engage with DNOs and provide input to RIIO-ED2 business plans.	Q2 Share <i>FES</i> building block data with industry parties and engage with stakeholders; Develop and share data reports and insights (with DNOs) to further develop our regional assumptions.	Electricity demand modelling requirements compiled and well understood by stakeholders. Positive engagement with DNOs on supporting their <i>DFES</i> processes.	Positive engagement with DNOs on supporting their <i>DFES</i> processes.	ESO working closely with DNOs to share relevant and timely data to support development of <i>FES</i> and <i>DFES</i> for the benefit of stakeholders.	Further detail added to the deliverable description, the RIIO-1 end point and successes. Reference also made to engagement activity with DNOs.

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Sub activity	Deliverable	Related IT investment	Project or continuous	RII0-1 end point	2021/2022 Milestones	2022/2023 Milestones	First year success	Second year success	Expected final delivery date and what success looks like.	Notes on changes to Dec 2019 Business Plan
It is dependent on a clearly aligned strategy between parties and collaboration with Oigem. There may also be code change requirements. It is dependent on the engagement and resource available from the other companies and as such we cannot define a plan of work. The first step will be to define the project scope and set a strategy.		successful testing of plug-and-play approach with modules in development/ delivery phase.								
<b>A13.5 FES:</b> Integrating with other networks	<b>D13.5.2</b> Developed new energy demand model – this brings together all energy demand data in one place	Investment <b>220</b> . Data and analytics platform. The data and analytics platform will store the data and provide analytical capabilities to support the FES modelling. The associated IT investment <b>250</b> Digital Engagement Platform will provide the ability to share the data with 3rd parties. The data and analytics platform will be delivered under <b>D1.4.1</b> Creation of a data and analytics platform.	Project	We have defined the first set of building block data to be shared with DNOs which has been trialled in FES 20 and used once in full in FES 21.	Q3: Completed review of available energy data and established stakeholder modelling requirements.	Q1: Developed energy demand model plan, including pilots and full-scale development.  Q3: Built, tested and validated model.  Q4: Implemented model.	Energy Data availability and sources understood. Relevant stakeholders engaged on modelling requirements with their requirements documented and agreed.	Developed energy demand model plan, including pilots and full-scale development.  Built, tested and validated model. Implemented model.	Provides longer term forecasting by incorporating annual profiles and vectors while integrating currently separate models such as transport.	Detail added on the additional functionality delivered by the new model.
							The functionality of the data platform will allow for better sharing of data into and out of the ESO and analysis of a greater level of granularity and volume (to enable us to support the development of Regional FES). The ability to use consistent formats and inputs/outputs will gain efficiency savings internally and externally allowing us to manage the increasing levels of data we need to share between organisations.			



### A14 Take a whole electricity system approach to connections

Our Connections proposals ensure that we continue to support the ongoing increase in numbers and variety of market participants looking to connect to the network, contributing to wards our Trusted Partner ambition and facilitating whole system outcomes. This will be supported by our connections hub proposal to help customers engage through the connections process along with additional customer service and contract management for smaller and distributed connected parties. The connections hub will be developed in co-ordination with network organisations to ensure efficient delivery and an experience that is seamless for the customer wherever they may be looking to connect. Phase 1 of the portal will be delivered by the end of March 2023, enabling customers to arrange meetings with Account Managers, apply to connect and track the progress of their application.

Sub activity	Deliverable	Related IT investment	Project or continuous	R10-1 end point	2021/2022 Milestones	2022/2023 Milestones	First year success	Second year success	Expected final delivery date and what success looks like.	Notes on changes to Dec 2019 Business Plan
<b>A14.1</b> Provide contractual expertise and management of connection offers to customers	<b>D14.1.1</b> Managing an increasing volume of connection offers for customers (with technical support provided via activity A15.	N/A	Continuous	N/A	As required	As required	N/A	N/A	Ongoing activity – ongoing success measured by positive customer feedback on our service.	
provision of connection offers to customers	<b>D14.1.2</b> Contract management of connection agreements									
<b>A14.2</b> Ensure Grid Code compliance of new connections	<b>D14.2.1</b> Compliance monitoring of new connections in accordance with Grid Code provisions	N/A	Continuous	N/A	As required	As required	N/A	N/A	Ongoing activity – ongoing success measured by positive customer feedback on our service; Grid Code compliant connections.	
<b>A14.3</b> Further enhance the customer connection experience, including broader support for smaller parties	<b>D14.3.1</b> Establish dedicated Distributed Energy Resource (DER) account management function – this is to support smaller parties, who are not our direct customers and who may have transmission-related issues with their connection applications. The type of support we can provide includes information about system charges and securities, commercial opportunities in system services, contractual / code arrangements and the works required to facilitate their connection.	N/A	Project (becomes continuous once implemented)	An example of where we have sought to develop processes to enhance the connections process for DER customers to-date is the Appendix G process which provides greater control to the DNOs while providing visibility to ESO of what is connecting to the DNO networks, thus facilitating connection of DER more efficiently. Engage with DNOs on the scope of the new DER function and start to foster closer working relationships.	Q1: Review DER internal processes; develop customer engagement and foster closer working relationships with DNOs on the scope of the new proposed DER function. Q2: Establish DER management function (through appropriate training); engage with customers on the new function and identify any additional areas of potential support required. Q4: Request feedback from customers and DNOs.	Continue to deliver the DER function and make improvements to the service delivered in line with customer feedback.	New DER function established and closer working relationships with DNOs established. Positive feedback from DER customers and DNOs on our service provision.	Demonstrable changes in line with customer feedback. Further positive feedback from DER customers and DNOs on our service.	Function established in 2021/22 with ongoing improvement. Positive feedback from DER customers and DNOs on our service provision; ESO has provided DER customers with information about system charges and securities; commercial opportunities in system services; contractual / code arrangements and the works required to facilitate their connection.	Updated to include support areas for DER customers and earlier engagement with DNOs on the new function.
<b>A14.3</b> Further enhance the customer connection experience, including	<b>D14.3.2</b> Deliver first whole electricity system connections seminar – these seminars will incorporate DNO input in addition to existing	N/A	Project	Deliver customer seminars using current approach.	Q4: Engage with DNOs on new approach to forthcoming seminar.	Q1: Prepare and plan for whole system seminar; engage DNOs and TOs on approach and content.	DNOs engaged and willing to participate in in whole system seminars.	Positive feedback from customers who attend the seminar and DNOs on the development and preparation process.	Success measured by positive feedback from customers on the first whole electricity system seminar and extent to which DNOs have	First year success added to deliverable

ESO R10-2 Delivery Schedule

Sub activity	Deliverable	Related IT investment	Project or continuous	R10-1 end point	2021/2022 Milestones	2022/2023 Milestones	First year success	Second year success	Expected final delivery date and what success looks like.	Notes on changes to Dec 2019 Business Plan
broader support for smaller parties.	Involvement from the TOS to the customer seminars that we already offer to customers.					Q2: Engage TOS and DNOs on seminar preparation and content; deliver first whole system seminar. Q3: Gather and process feedback on seminar.			engaged with seminar delivery.	
<b>A14.3</b> Further enhance the customer connection experience, including broader support for smaller parties.	<b>D14.3.3</b> Whole electricity system connection seminars on an ongoing basis having delivered the first one in the previous deliverable.	N/A	Continuous	N/A	Q4: engage with DNOs on new approach to the first whole system seminar; Q4: Engage with DNOs on new approach to the first whole system seminar.	Q4: Refine seminar planning and engagement process from first seminar; deliver second whole system seminar.	DNOs engaged and willing to participate in in whole system seminars. DNOs willing to participate in whole system seminars.	Demonstrable changes to seminars in line with customer feedback. Further positive feedback from customers who attend the seminar.	Ongoing: success measured by demonstrable changes in line with customer feedback and ongoing positive feedback from customers on the seminars and attendance rates.	Updated to reflect content in related deliverables
<b>A14.4</b> Facilitate development of the customer connections hub	<b>D14.4.1</b> Implement first phase of the ESO connections hub, including online account management and integration with other network organisation websites	IT Investment ref 380 – Connections Portal – this is the IT investment that will enable delivery of the connections hub and electronic management of the connections contracting process, providing an interface for customers, TOS and (ultimately) DNOs.	Project	Agreed way forward with TOS (on their respective portal proposals) on coordinated delivery of portal functionality, including outline plan for delivery.	Q1: Commence project start up; engage the TOS on their portal proposals. Q2: Conduct work on requirements & design; engage with key stakeholders, the ENA and TOS on scope of Phase 1. Q3: Develop & test NGESO portal; establish a customer focus group for testing & engage TOS to align with their portals. Q4: Implementation; check in with key stakeholders.	Q4: Implementing agile developments of the portal. Q1: Further development & testing; engage with customer focus group and TOS. Q2: Implementation of updates to NGESO portal. Q3: Further development & testing; engage with customer focus group and TOS to further align with their portals. Q4: Implementation of phase 1 of the connections hub.	We are aligned with TOS on our respective proposed portal solutions. We have engaged with customers to develop and test key outward-facing aspects of the portal. We have reached the first implementation phase of agile development. Q1: Further development & testing; engage with customer focus group and TOS. Q2: Implementation of updates to NGESO portal. Q3: Further development & testing; engage with customer focus group and TOS to further align with their portals. Q4: Implementation of phase 1 of the connections hub.	Phase 1 of connection hub complete, enabling Transmission customers to view and manage their connection contracts online and providing central point for the GB connections process. The functionality to be delivered in Phase 1, subject to further stakeholder engagement on scope, includes: <ul style="list-style-type: none"> <li>Ability to book meetings with account managers</li> <li>Online application form process and fee information</li> <li>Ability to track the progress of an application through the process</li> <li>Ability to view a portfolio of projects and apply for modification applications</li> <li>Compliance process monitoring</li> <li>A GB connections landing page which can point customers</li> </ul>	Phase 2 of the connections hub to be complete in Q4 2025 / 2026, helping to navigate customers and providing a seamless connection process to transmission & distribution electricity networks across GB. The system will be integrated with other network company customer portals as required, providing guidance on where to connect across GB. Success to be demonstrated through positive customer feedback.	Successes updated to include functionality delivered by Phase 1 of the portal.

# ESO RIIO-2 Delivery Schedule

Sub activity	Deliverable	Related IT investment	Project or continuous	RIIO-1 end point	2021/2022 Milestones	2022/2023 Milestones	First year success	Second year success	Expected final delivery date and what success looks like.	Notes on changes to Dec 2019 Business Plan
<b>A14.4</b> Facilitate development of the customer connections hub	<b>D14.4.2</b> Phase 2 of the connections hub concluded	IT investment ref <b>380</b> Connections Portal – this is the IT investment that will enable delivery of the connections hub and electronic management of the connections contracting process, providing an interface for customers, TOs and (ultimately) DNOs.	Project	Agreed way forward with TOs (on their respective portal proposals) on coordinated delivery of portal functionality, including outline plan for delivery.  Initial discussions with DNOs on our connections hub proposals and how we might need to collaborate in the RIIO-ED2 period to integrate systems as required.	N/A – activity does not commence until BP2.	N/A – activity does not commence until BP2.	N/A – activity does not commence until BP2.	N/A – activity does not commence until BP2.  to the various Network Companies' own connection processes. As a result, the Connection process runs more smoothly and efficiently for customers. In addition, we will consider interfacing requirements as the TOs develop their own customer portals.	Phase 2 of connection hub to be complete in Q4 2025 / 2026, helping to navigate customers and providing a seamless connection process to transmission & distribution electricity networks across GB.  Specific functionality may be impacted by final implementation of Phase 1 and the developments of other network company's systems as required. It is envisaged that functionality delivered by this Phase could include: <ul style="list-style-type: none"> <li>• Delivery of an industry wide tool, providing access to existing heat maps from TOs, showing where capacity is and the relevant connection path to take</li> <li>• Integration with DNO systems requirements.</li> </ul>	Expanded to include reference to early engagement with DNOs regarding Phase 2.
									Success of Phase 2 to be demonstrated through positive customer feedback	

## A15.5 Regional Development Plans (and A15.8)

Our RDP proposals are key to achieving our strategic goals of an electricity system that can operate Carbon free and whole energy system solutions. As we capture learning from our ongoing work on aligned and consistent markets for flexibility, we will be increasingly looking in RIIO-2 at how we can efficiently scale our RDPs for broader roll-out across each DNO area. We believe this is a step change from the approach in RIIO-1, where we set out to develop initial projects to test new ways of working. In RIIO-2, building on this, and also the 2020 work in the Open Networks project, work will further evolve to deliver standardised markets for flexibility services which embed operational co-ordination with DNOs. This is a significant and new piece of work for the industry. Through efficient scaling we will minimise the overall cost of IT infrastructure and impact on both transmission and distribution control centres. We will also be using RDPs to trial new use cases, for example market development across DNO licence areas and they provide the first step to exchanging operational data between the ESO and DNOs. It should also be noted that RDPs are a collaboration vehicle between us and potentially a number of network parties for any one RDP. Progress of these is therefore heavily reliant on all parties involved driving them forward.

ESO RLO-2 Delivery Schedule

Sub activity	Deliverable	Related IT Investment	Project or continuous	RLO-1 end point	2021/2022 Milestones	2022/2023 Milestones	First year success	Se cond year success	Expected final delivery date and what success looks like.	Notes on changes to Dec 2019 Business Plan
<b>A15.5</b> Develop Regional Development Programmes (RDPs)	<b>Forward Plan 2020-21 RDP – N-3</b>	IT investment reference <b>340</b> RDP Implementation and Extension - This investment will provide the ESO with greater visibility and control of parties connected to distribution networks. IT investment reference <b>340</b> RDP Implementation and Extension.  This investment will provide the ESO with greater visibility and control of parties connected to distribution networks. It will provide an integrated real-time data exchange, situational awareness and dispatch capability with DNOs thereby facilitating the RDP process. We will look to implement common processes where possible across the RDPs. However, each DNO / TO will have different control systems and interfacing requirements. A separate IT design stage for each RDP will therefore assess requirements to achieve a co-created design.	Project	Delivery of N-3 inter- tripping of DER with UK Power Networks (UKPN).  Delivery of communication link between NGEESO and Western Power Distribution (WPD).  Delivery of communication link between NGEESO and Scottish and Southern Electricity Networks (SSE-N).	Q3 Completion (subject to obtaining NGE T outage availability)	N/A – RDP complete in 2021/22	Facilitation of efficient access to transmission assets on south coast of England. N-3 intertrip scheme will create additional transmission headroom allowing the connection of additional DER.	N/A – RDP complete in 2021/22	Project will conclude in Q2 2021/22 resulting in integrated DER intertripping solution with south coast DNOs and NGET. This will maintain system operability of the south coast system facilitating the connection of new DER.	Addition of RDPs from the 2020/21 Forward Plan that are due for completion in BP1.
<b>A15.5</b> Develop Regional Development Programmes (RDPs)	<b>Forward Plan 2020-21 RDP - Generation Export Management Scheme (GEMS)</b>	IT investment reference <b>340</b> RDP Implementation and Extension - This investment will provide the ESO with greater visibility and control of parties connected to distribution networks. IT investment reference <b>340</b> RDP Implementation and Extension  This investment will provide the ESO with greater visibility and control of parties connected to distribution networks. It will provide an integrated real-time data exchange, situational awareness and dispatch capability with DNOs thereby facilitating the RDP process.  We will look to implement common processes where possible across the RDPs. However, each DNO / TO will have different control systems and interfacing requirements. A separate IT design stage for each RDP will therefore assess requirements to achieve a co-created design.	Project	Integrate Scottish Power Energy Networks (SPEN) Active Networks Management (ANM) of local constraints with NGEESO management of wider transmission constraints.  Detailed design of NGEESO commercial systems to interface with GEMS.	Q3 Detailed design & development of IT solution complete. Q4 IT installation complete.	Q3 IT commissioning complete and GEMS go-live.	IT solution is fully developed and installed.	GEMS system will be complete by Q3 2022/23.	Project will conclude in Q3 2022/23 with jointly developed IT solution with Scottish Power Transmission (SPT). This will enable the continued operability of Dumfries and Galloway through an integrated congestion market.	Addition of RDPs from the 2020/21 Forward Plan that are due for completion in BP1.
<b>A15.5</b> Develop Regional Development Programmes (RDPs)	<b>D15.5.1</b> Start RDP1 of RLO-2 – Regional development plans provide a means to working with other network parties to facilitate connection of low carbon energy sources in capacity constrained areas. We plan to	IT investment reference <b>340</b> RDP Implementation and Extension.  This investment will provide the ESO with greater visibility and control of parties connected to distribution networks. It will provide an integrated real-time data exchange, situational awareness and dispatch capability with DNOs thereby facilitating the RDP process. We will look to implement common processes where possible across the RDPs. However, each DNO / TO will have different control systems and interfacing requirements. A separate IT design stage for each RDP will therefore assess requirements to achieve a co-created design.	Project	2020 / 2021 South West (WPD), MW dispatch RDP detailed development (Commercial and technical) complete.	Q1: Start RDP1 IT requirements and design stage. Q3: IT Requirements & design stage complete. Q4: IT Development & testing phase commences.	Q4: IT implementation phase complete.	RDP1 IT commenced. Requirements and design stage for investment 340 complete.	RDP1 established; Positive feedback received from RDP partner(s) on progress and IT development. IT investment 340 progressed to the first implementation phase.	RDP1 completed in Q4 2022-23 with learnings feeding into why there is a design phase for development of future RDPs.	Detail added to explain why there is a design phase for each RDP for IT investment 340. DNO area now specified

**ESO RLO-2 Delivery Schedule**

<b>Sub activity</b>	<b>Deliverable</b>	<b>Related IT Investment</b>	<b>Project or continuous</b>	<b>RLO-1 end point</b>	<b>2021/2022 Milestones</b>	<b>2022/2023 Milestones</b>	<b>First year success</b>	<b>Second year success</b>	<b>Expected final delivery date and what success looks like.</b>	<b>Notes on changes to Dec 2019 Business Plan</b>
	undertake 6 RDPs in RLO-2	therefore, assess requirements to achieve a co-created design.							markets for local and national system needs. RDPs provide the first step to exchanging operational data between the ESO and DNOs.  Standardisation, where possible, in dispatch procedures across MW dispatch RDPs.	against the RDP. Success measures updated.
<b>A15.5</b> Develop Regional Development Programmes (RDPs)	<b>D15.5.2</b> Start RDP2 of RLO-2 - Regional development plans provide a means to working with other network parties to facilitate connection of low carbon energy sources in capacity constrained areas. We plan to undertake 6 RDPs in RLO-2	IT investment reference <b>340</b> RDP Implementation and Extension - This investment will provide the ESO with greater visibility and control of parties connected to distribution networks. IT investment reference <b>340</b> RDP Implementation and Extension. This investment will provide the ESO with greater visibility and control of parties connected to distribution networks. It will provide an integrated real-time data exchange, situational awareness and dispatch capability with DSOs thereby facilitating the RDP process. We will look to implement common processes where possible across the RDPs. However, each DNO / TO will have different control systems and interfacing requirements. A separate IT design stage for each RDP will therefore assess requirements to achieve a co-created design.	Project	Q4 2020 / 2021 South East (UKPN) MW dispatch RDP detailed development (Commercial and technical) complete.	Q1: detailed RDP IT development commences.  Q2: detailed RDP IT development complete.  Q3: Start RDP2 IT requirements and design phase.	Q1: IT Requirements & design stage complete.  Q2: IT development & testing commences.	RDP2 detailed solution scoping complete.	RDP2 IT commenced with Requirements and Design stage complete. Positive feedback received from RDP partner(s) on progress and IT development.	RDP2 completed in 2023-24 with learnings feeding into ENA Open Networks project and the development of future RDPs.  RDPs provide the first step to exchanging operational data between the ESO and DNOs.  Standardisation, where possible, in dispatch procedures across MW dispatch RDPs.	Detail added to explain why there is a design phase for each RDP for IT investment <b>340</b> . DNO area now specified against the RDP. Success measures updated.
<b>A15.5</b> Develop Regional Development Programmes (RDPs)	<b>D15.5.3</b> Start RDP3 of RLO-2 Regional development plans provide a means to working with other network parties to facilitate connection of low carbon	IT investment reference <b>340</b> RDP Implementation and Extension This investment will provide the ESO with greater visibility and control of parties connected to distribution networks. It will provide an integrated real-time data exchange, situational awareness and dispatch capability with DSOs thereby facilitating the RDP process.	Project	Q4 2020 / 2021 Midlands Storage (WPD) MW dispatch RDP detailed development (Commercial and technical) complete.	Q2: Viability of market solution confirmed.  Q3: Detailed RDP development starts.  Q4: Detailed RDP development complete.	Q1: Start RDP3 IT requirements and design phase.  Q3: IT Requirements & design stage complete.	Outline need for RDP 3 identified, detailed RDP solution scoping complete.	RDP3 IT commenced. Positive feedback received from RDP partner(s) on progress and IT development. Requirements and design stage for	RDP3 completed in 2023-24 with learnings feeding into ENA Open Networks project and the development of future RDPs.	Detail added to explain why there is a design phase for each RDP for IT investment <b>340</b> .



ESO RILO-2 Delivery Schedule

Sub activity	Deliverable	Related IT Investment	Project or continuous	RILO-1 end point	2021/2022 Milestones	2022/2023 Milestones	First year success	Second year success	Expected final delivery date and what success looks like.	Notes on changes to what success looks like Business Plan
	energy sources in capacity constrained areas. We plan to undertake 6 RDPs in RILO-2	We will look to implement common processes where possible across the RDPs. However, each DNO / TO will have different control systems and interfacing requirements. A separate IT design stage for each RDP will therefore assess requirements to achieve a co-created design.				Q4: IT development & testing commences.		investment <b>340</b> complete.	RDPs provide the first step to exchanging operational data between the ESO and DNOs. Standardisation, where possible, in dispatch procedures across MW dispatch RDPs. This will result in the connection of new zero carbon DER and the development of aligned flexibility markets for local and national system needs.	DNO area now specified against the RDP. Success measures updated.
<b>A15.5</b> Develop Regional Development Programmes (RDPs)	<b>D15.5.4</b> Start RDP4 of RILO-2  Regional development plans provide a means to working with other network parties to facilitate connection of low carbon energy sources in capacity constrained areas. We plan to undertake 6 RDPs in RILO-2	IT investment reference 340 RDP Implementation and Extension. This investment will provide the ESO with greater visibility and control of parties connected to distribution networks. It will provide an integrated real-time data exchange, situational awareness and dispatch capability with DSOs thereby facilitating the RDP process. We will look to implement common processes where possible across the RDPs. However, each DNO / TO will have different control systems and interfacing requirements. A separate IT design stage for each RDP will therefore assess requirements to achieve a co-created design.	Project	RDP4 not yet initiated – future need for RDPs identified through discussions with TOs and DNOs via the connections process and via DNO network development plan processes when available (as required by the Clean Energy Package).	Q4: Identify outline need for RDP 4.	Q1: Detailed RDP development starts.  Q3: Detailed RDP development complete.  Q4: Start RDP4 IT requirements and design phase.	Outline need for RDP 4 identified.	Detailed RDP solution scoping complete.	RDP4 completed in 2024-25 with learnings feeding into ENA Open Networks project and development of future RDPs. This will result in the connection of new zero carbon DER and the development of aligned flexibility markets for local and national system needs.	Detail added to explain why there is a design phase for each RDP for IT investment 340. DNO area now specified against the RDP. Success measures updated.
<b>A15.5</b> Develop Regional Development Programmes (RDPs)	<b>New deliverable</b>  Development of roadmap to deliver GB rollout of functionality (visibility & control of DER) developed through initial RDPs. i	As set out above, IT investment 340 RDP implementation and extension provides the initial operational data linkages with DNOs through each project. This project would understand how this investment can be rolled out most efficiently and consistently across GB.	Project	Not started.	Q1-Q3 DNO & TO engagement to understand determine needs case for greater visibility & control of DER.  Q4 Review of RDP projects to date to understand potential learnings and synergies.	Q1-Q3 Development of aligned proposals for GB wide rollout. Q4 Publication of roadmap for national rollout.	Common agreement of the needs case for GB roll out. Current position of RDPs understood and factored into strategy development.	A common, standard plan for national roll-out is agreed with DNOs and TOs.	A national roadmap to deliver greater visibility & control of DER will be published by Q4 2022/23.	New deliverable added to provide clarity on broader rollout of RDPs
<b>A15.8</b> Provide technical support to DSO and whole	<b>D15.8.1</b> Completion of any DSO associated code changes ahead of	N/A	Continuous	Active engagement in the development of DSO and aligned national and local	Q1-Q4 Work with Open Networks, to identify, scope and	Q1-Q4 Provide input to relevant DSO associated	DSO associated Code changes initiated in	The ESO has been actively engaged in the Open Networks	2023/24 Policy changes developed through Open Networks and	Further detail added to milestones

#### ESO RIO-2 Delivery Schedule

Sub activity	Deliverable	Related IT Investment	Project or continuous	RIO-1 end point	2021/2022 Milestones	2022/2023 Milestones	First year success	Second year success	Expected final delivery date and what success looks like.	Notes on changes to Dec 2019 Business Plan
electricity system alignment	RIO-ED2 to facilitate system operation activities.			markets, including Open Networks DSO Implementation Plan (and ongoing updates thereto).  Engage with the DNOs on DSO transition topic areas as they develop their RIO-ED2 plans.  Offer opportunities for workshops to discuss alignment of business plans.	submit relevant DSO associated Code mods ahead of RIO-ED2. This is to include active engagement in Ogem work on DSO policy.  Q1-Q4 Undertake active engagement in the Open Networks project to support ongoing developments and lead 4 Whole Energy Systems.	Code mods ahead of RIO-ED2.  Q1-Q4 Undertake active engagement in the Open Networks project to support ongoing developments and lead 4 Whole Energy Systems.	The ESO has been actively engaged in the Open Networks Project and work stream 4.  The ESO has been actively involved in the RIO-ED2 development and DNO plans are appropriately aligned with the ESO business plan.	The ESO has been actively involved in the RIO-ED2 development process and DNO final business plans are appropriately aligned with the ESO business plan.  Positive feedback on our engagement approach and timeliness.  DSO associated Code changes completed in readiness for RIO-ED2.	progressed through codes are in place to enable DSO in RIO-ED2.  Our business activities are aligned with those of DNOs facilitating efficient whole system processes, including those associated with flexibility services.	and successes.
A.15.8 Provide technical support to DSO and whole electricity system alignment	D15.8.2 Review of aligned technical standards – this review will be led by BEIS and requires active engagement from industry participants.	N/A	Project	N/A	Q2 Engage with the review scoping process  Q3: Business plan alignment discussions with DNOs conclude ahead of final RIO-ED2 business plan submissions.	Q1-Q4 provide ongoing technical expertise and engagement with the technical standards review	Active engagement on the review	Active engagement on the review.	2023 / 2024 Outcome of review expected to be published and the ESO has provided technical input.	Removed as a discrete deliverable with the milestones from here added to A12 SQSS Review.

#### A15 Taking a whole energy system approach to promote zero carbon operability

These proposals underpin and enable our zero-carbon system operation ambition through the development of data exchange, offline modelling capability and system operation tools. It is under this activity that we signal the longer-term requirements for system operation through, for example, our System Operability Framework publications. Through activity **A15.6** we will transform our capability in data and modelling ensuring also that regulatory frameworks are in place to support appropriate exchange and use of data by the ESO, network companies and other stakeholders through our data and analytics platform. Activity **A15.7**, the development of a wide area monitoring and control system (MCS), can facilitate zero carbon operation by 2025. By March 2023 Phase 3 of the MCS (an Operational demo) will be halfway through and therefore testing of the system will be underway. Activities proposed in **A15.9** will bring a whole system focus to some of our existing activities including RDPs and System Operability Framework publications during the latter years of the RIO-2 period.



ESO RII-0-2 Delivery Schedule

Sub activity	Deliverable	Related IT Investment	Project or continuous	RIIO-1 end point	2021/2022 Milestones	2022/2023 Milestones	First year success	Second year success	Expected final delivery date and what success looks like.	Notes on changes to Dec 2019 Business Plan
<b>A15.1</b> Develop the <i>System Operability Framework (SOF)</i> and provide solutions up to real time of network related operability issues.	<b>D15.1.1</b> System <i>Operability Framework (SOF)</i> documentation – to identify and quantify operability needs in short and long-term planning timescales, encouraging the development of market-based solutions wherever possible  <b>D15.1.2</b> Innovation projects developing new operability solutions – undertake innovation projects, as appropriate, to test operability solutions	N/A	Continuous	Publication of the Operability Strategy report.  Undertake a review of publications looking at how the ESO publications work together for stakeholders.	Deliver System Operability publications to a schedule in response to real time system operation events or other system developments. These currently include: <ul style="list-style-type: none"> <li>Low Demand-Lessons from COVID19 and implications for future operability</li> <li>Impact of future system trends on Power Quality</li> <li>National System Performance Trend and Insights</li> </ul>	Deliver system operability publications to a schedule in response to real time system operation events or other system developments.  Topics are under development with wider industry stakeholders including key operability issues to reach zero carbon system operation ambition and what's next including whole energy system issues.	Positive Stakeholder feedback on clarity of future requirements.  Linkage between the requirements published and solutions in deployment.	Positive Stakeholder feedback on clarity of future requirements.  Linkage between the requirements published and solutions in development or deployed.  Clear view of further whole energy system issues which may need to be resolved.	Ongoing: Our operability strategy ensures future system operability. It will improve network safety and reliability by ensuring that future operational challenges can be addressed securely. It will drive lower bills by changing the way we operate and seek better solutions, tested through innovation projects where relevant  SOF publications work together with the <i>Operability Strategy Report</i> to provide clear requirements to stakeholders. Plans and associated frameworks / funding arrangements are in place to facilitate operability outcomes.	Detail added to milestones on topics and approach.
<b>A15.2</b> Provide technical support to the connections process	<b>D15.2.1</b> Updates to customer offers and agreements – provide technical support to the connection offer process (as set out in activity <b>A14.1</b> ) and assess offers to determine future operability need	N/A	Continuous	N/A	As required and provide technical support to delivery of the connections hub in activity group <b>A14</b> .	As required and provide technical support to delivery of the connections hub in activity group <b>A14</b> .	Content for agreements issued within licence deadline.	Content for agreements issued within licence deadline.	Ongoing: Future system operability strategy accounts for technical capabilities of future connections.	
<b>A15.3</b> Assess the technical implications of framework developments and implement changes into business procedures and systems.	<b>D15.3.1</b> Changes to business procedures and processes following framework developments – provide technical expertise to development of Codes and Standards and assess impact of	N/A	Continuous	N/A	Q1 - GC0137/139/145 code change process completed; Provide ongoing technical support to modifications as required (including those raised through open governance) –	Provide ongoing technical support to modifications as required (including those raised through open governance) –	Change delivered in line with Modification Implementation.	Change delivered in line with Modification Implementation.	Ongoing: amendments to technical codes and standards are appropriate; and any consequential change to ESO internal processes (and, where appropriate, external industry processes)	Linkage provided to <b>A6.1</b> in Role 2 and milestones clarified.

ESO RII0-2 Delivery Schedule

Sub activity	Deliverable	Related IT Investment	Project or continuous	RIIO-1 end point	2021/2022 Milestones	2022/2023 Milestones	First year success	Second year success	Expected final delivery date and what success looks like.	Notes on changes to Dec 2019 Business Plan
	change to operability processes. This activity provides technical support to modifications managed by frameworks teams in activity <b>A6.1</b> , Role 2.				the level of resource required can vary hugely from one modification to the next.	modification to the next.			are made in a timely and efficient way.	
<b>A15.4</b> Manage operational data and modelling requirements for the ESO	<b>D15.4.1</b> Data transfers between network organisations in accordance with current Grid Code and STC requirements – managing operational data flows across network companies to underpin offline network analysis in the ESO.	N/A	Continuous	N/A	As required.	As required.	Data received and delivered in line with Grid Code and STC Requirements.	Data received and delivered in line with Grid Code and STC Requirements.	Ongoing: Data transfers occur in accordance with Grid Code provisions and fed into internal models / processes as appropriate.	
<b>A15.4</b> Manage current operational data and modelling requirements for the ESO	<b>D15.4.2</b> Technical modelling for use across the ESO – ongoing development and support of system data and models used to analyse future network needs and operability solutions by different teams in the ESO.	N/A	Continuous	N/A	Q3 Deliver ETYS and NOA models.	Q3 Deliver ETYS and NOA models.	All ETYS and NOA models delivered to time and quality.	All ETYS and NOA models delivered to time and quality.	Ongoing: Teams within the ESO have latest offline model developments and data.	Updated milestones to refer to delivery of models to feed current processes
<b>A15.6</b> Transform our capability in modelling and data management	<b>D15.6.1</b> Phase 1 data management scoping complete to feed into data & analytics platform (see Role 1 <b>D1.4.1</b> ) – modelling and data expertise will be used to scope planning data requirements for the data & analytics platform	IT investment reference 220 Data & Analytics platform - This platform is foundational work to unlock the value of the data we hold and will be the key technology underpinning all our internal and external data management. IT investment reference 220 Data & Analytics platform	Project	Q4 2020 / 2021: Initial O/N Grid Code mod (GC0139) progressed to facilitate Transmission-Distribution data exchange. Progression of Code modification GC0138 Compliance process technical improvement.	Q2 Phase 1 modelling scoping complete to feed into requirements and design stage of the data & analytics platform (foundation implementation).	Q2: Modelling scoping complete to feed into platform extension requirements phase ( <b>D15.6.3</b> ). Q3 Data & analytics platform foundation complete. ( <b>D15.6.4</b> ).	Outcomes from Grid Code modifications work informs the scoping exercise for the Data & Analytics platform in terms of frequency of planning data exchange (DSO, TO and user data exchange) and level of granularity / complexity.	Data platform foundation delivered in line with scope including successful testing of plug-and-play approach with modules in development/delivery phase. Extension scoping work enables timely progression of the platform extension implementation; key stakeholders have been engaged on the scope.	Clear Code requirements have been developed, agreed and implemented to support appropriate exchange and use of data; customers can access data on the	Reference added to the ongoing Grid Code modification GC0139. Deliverables <b>D15.6.3</b> and <b>D15.6.4</b> and corresponding successes now included here.

ESO RII0-2 Delivery Schedule

Sub activity	Deliverable	Related IT Investment	Project or continuous	RIIO-1 end point	2021/2022 Milestones	2022/2023 Milestones	First year success	Second year success	Expected final delivery date and what success looks like.	Notes on changes to Dec 2019 Business Plan
		Internal and external data management. The data and analytics platform will provide the foundational architecture to enable the development of an interchangeable suite of tools with a common dataset, and seamless exchange of data between tools. This deliverable supports the delivery of the IT investment. The data and analytics platform will be delivered under <b>D1.4.1</b> Creation of a platform.							platform via APIs, for their own analysis.	
<b>A15.6</b> Transform our capability in modelling and data management	<b>D15.6.2</b> Further Grid Code mods (arising, for example, from O/N 2020 work programme, discussions with industry participants and/or in response to Ofgem's Call For Evidence on Distributed Generation visibility)	IT investment reference 220 Data & Analytics platform This platform is foundational work to unlock the value of the data we hold and will be the key technology underpinning all our internal and external data management. The data and analytics platform will provide the foundational architecture to enable the development of an interchangeable suite of tools with a common dataset, and seamless exchange of data between tools. This deliverable supports the delivery of the IT investment. The data and analytics platform will be delivered under <b>D1.4.1</b> . Creation of a platform.	Project	Q4 2020/21: Any additional requirements identified from GCO138, Open Networks 2020 work programme for imminent code progression. Outputs from Ofgem's Call for Evidence on Distributed Generation visibility understood and ESO actively involved in next steps.	Q1: Determine what data is required, from which parties and any associated issues with obtaining the data. Any further data-driven Grid Code mods scoped and raised as required. Engage with DNOs on any specific requirements as they develop their RIIO-ED2 plans. Q2-Q3: Code mods or agreements to obtain new data progressed in accordance with governance requirements as required. Q4: Grid Code mods submitted for approval / agreements progressed to facilitate transmission-	Provide ongoing technical support and input to the Code modification process as required. Provide ongoing technical support and input to the code modification process as required.	Code modifications and / or agreements are developed with parties to facilitate data requirements for new processes and support connections, design and operability requirements). Relevant stakeholders engaged in the process.	Code modifications are implemented such that any required changes to systems, models and processes are aligned to any new requirements (depending upon timescales of the code modification process).	Frameworks are in place to support appropriate exchange and use of data by the ESO, network companies and other stakeholders through the data and analytics platform.	Addition of milestones to engage with DNOs and reference to Ofgem's Call for Evidence on Distributed Generation visibility.

ESO RLO-2 Delivery Schedule

Sub activity	Deliverable	Related IT Investment	Project or continuous	RLO-1 end point	2021/2022 Milestones	2022/2023 Milestones	First year success	Second year success	Expected final delivery date and what success looks like.	Notes on changes to Dec 2019 Business Plan
<b>A15.6</b> Transform our capability in modelling and data management	<b>D15.6.3</b> Phase 2 modelling scoping complete to feed into data & analytics platform extensions (see Theme 1)	IT investment reference <b>D20</b> Data & Analytics platform - This platform is foundational work to unlock the value of the data we hold and will be the key technology underpinning all our internal and external data management. This deliverable supports the delivery of the IT investment.	Project	Q4 2020-21: Initial O/N Grid Code mods (GCO139) progressed on Transmission-Distribution data exchange	N/A	Q2: modelling scoping complete to feed into platform extension requirements phase	N/A	Scoping work enables timely progression of the platform extension implementation; key stakeholders have been engaged on the scope	RLO-2 year 5 25/26: Full integration with Data and analytics platform complete, enabling a joined-up analysis process that allows us to stack different network needs and adjust the level of detail in the analysis, to deliver the most economic decision.	This deliverable has been removed for clarity. <b>D15.6.3</b> has been added to <b>D15.6.1</b> where scoping work is done for data and analytics platform foundation (this is just the milestone for delivering the platform extension which happens in Role 1).
		The data and analytics platform will provide the foundational architecture to enable the development of an interchangeable suite of tools with a common dataset, and seamless exchange of data between tools. The data and analytics platform will be delivered under <b>D1.4.1</b> Creation of a data and analytics platform.							The platform allows ESO customers to make quicker and more accurate decisions. Customers are able to extract and feed the data into their own analytics tools.	
<b>A15.6</b> Transform our capability in modelling and data management	<b>D15.6.4</b> Data analytics platform foundation in place (see Theme 1)	IT investment reference <b>D20</b> Data & Analytics platform - This platform is foundational work to unlock the value of the data we hold and will be the key technology underpinning all our internal and external data management. This deliverable supports the delivery of the IT investment.	Project	Q4 2020-21 Initial O/N Grid Code mods complete on Transmission-Distribution data exchange	N/A	Q3 Data & analytics platform foundation complete.	N/A	Data platform foundation delivered including successful testing of plug-and-play approach with modules in development/delivery phase	RLO-2 year 5 25/26: Full integration with Data and analytics platform complete, enabling a joined-up analysis process that allows us to stack different network needs and adjust the level of detail in the analysis, to deliver the most economic decision. The platform allows ESO customers to make quicker and more accurate	This deliverable has been removed for clarity. <b>D15.6.4</b> has been added to <b>D15.6.1</b> where scoping work is done (this is just the milestone for delivering the platform which happens in Role 1).

ESO RfIO-2 Delivery Schedule

Sub activity	Deliverable	Related IT Investment	Project or continuous	RfIO-1 end point	2021/2022 Milestones	2022/2023 Milestones	First year success	Second year success	Expected final delivery date and what success looks like.	Notes on changes to Dec 2019 Business Plan
		The data and analytics platform will provide the foundational architecture to enable the development of an interchangeable suite of tools with a common dataset, and seamless exchange of data between tools. The data and analytics platform will be delivered under <b>D1.4.1</b> Creation of a data and analytics platform.							decisions: Customers are able to extract and feed the data into their own analytics tools.	
<b>A15.6</b> Transform our capability in modelling and data management	<b>D15.6.5</b> Data platform extension complete (please see deliverable <b>D1.4.1</b> for further details) – once the data & analytics platform foundation is complete, an extension will be developed as new tools are delivered.	IT investment reference <b>220</b> Data & Analytics platform - This platform is foundational work to unlock the value of the data we hold and will be the key technology underpinning all our internal and external data management. This deliverable supports the delivery of the IT investment.  The data and analytics platform will provide the foundational architecture to enable the development of an interchangeable suite of tools with a common dataset, and seamless exchange of data between tools. The data and analytics platform will be delivered under <b>D1.4.1</b> Creation of a data and analytics platform.	Project	Q4 2020-21 Initial O/N Grid Code mods complete on Transmission-Distribution data exchange.	N/A	Q2 modelling scoping complete to feed into platform extension phase.	N/A	Modelling scoping complete and sufficient to inform timely progression of platform extension.	RfIO-2 year 5 25/26: Full integration with Data and analytics platform complete, enabling a joined-up analysis process that allows us to stack different network needs and adjust the level of detail in the analysis, to deliver the most economic decision.  The platform allows ESO customers to make quicker and more accurate decisions. Customers are able to extract and feed the data into their own analytics tools.	This deliverable has been removed for clarity. This deliverable was simply the milestone for data platform extension completion (occurs in Role 1).

ESO RII0-2 Delivery Schedule

Sub activity	Deliverable	Related IT Investment	Project or continuous	RIIO-1 end point	2021/2022 Milestones	2022/2023 Milestones	First year success	Second year success	Expected final delivery date and what success looks like.	Notes on changes to Dec 2019 Business Plan
<b>A15.6</b> Transform our capability in modelling and data management	<b>D15.6.6</b> Deliver major upgrades to our offline modelling tools, which will allow us to model a more complex system. This upgrade will include tactical enhancements, for example, compliance with Capacity Allocation and Congestion Management (CA CM), as well as establishing the development roadmap for the multi-layered off-line modelling capability needed to facilitate operation of a zero carbon system.	IT investment ref <b>360</b> Offline network modelling. This investment is required to enhance network modelling tools to enable larger volumes of data, and a greater number of scenarios to be modelled. These modelling tools will be integrated with the Data & Analytics platform.  IT investment ref <b>270</b> EU Regulation This investment enables the mandatory European Union (EU) regulatory driven change which impacts across ESO systems, particularly market operation.	Project	Offline Transmission Assessment (OLTA) hardware refresh. decommission Offline Stability Analysis (OFSA) tool Offline Transmission Assessment (OLTA) hardware refresh. Decommission Offline Stability Analysis (OFSA) tool	Q1, Q2 Engagement with TOs on CACM requirements.  Q3 CACM and short circuit go-live in offline network modelling.	Q2 Produce Offline modelling development roadmap. Q2 Produce Offline modelling development roadmap. Q2-Q3 Engage stakeholders on further iteration of the development roadmap.  Q4 Offline modelling development roadmap finalised.	Modelling tools upgraded to support CACM capacity validation process as required.  Work commenced on the Offline modelling development roadmap.	Increased efficiency through automation of selected modelling processes. Use of enhanced tools to allow more complex modelling arising from operability challenges (for example short circuit levels, virtual powerplants, probabilistic modelling, multi scenario analysis) and to support development of a regime for an integrated offshore grid, as required. Through scoping work in activity <b>A15.6.1</b> , ensure integration of our offline modelling tools with IT investment 220 Data and analytics platform. Increased efficiency through automation of selected modelling processes. Use of enhanced tools to allow more complex modelling arising from operability challenges (for example short circuit levels, virtual powerplants, probabilistic modelling, multi scenario analysis) and to support development of a regime for an integrated offshore grid, as required.	Integration of our offline modelling tools with IT investment 220 Data and analytics platform. This will facilitate an interchangeable suite of tools using a common dataset, and seamless exchange of data between tools, including the analysis tools described in IT investment 390 NOA enhancements. This will allow us to adjust the level of analysis as required depending on the issue that needs to be assessed whilst ensuring that consistent data and assumptions are applied.	Deliverable broadened out to cover general upgrades to offline modelling capability in line with business plan with updated successes.
<b>A15.6</b> Transform our capability in modelling and data management	<b>D15.6.7</b> Deeper Outage Planning go live in Offline Network Modelling - this will enable higher volumes of network data, regional models and outage planning data to be exchanged, used and shared by network companies. <b>D15.6.7</b> Deeper	IT investment ref 360 Offline network modelling - required to enhance network modelling tools to enable larger volumes of data, and a greater number of scenarios to be modelled. These modelling tools will be integrated with	Project	Complete the Offline Transmission Assessment (OLTA) hardware refresh to facilitate enhanced modelling capability. Progression of Grid Code modifications GCO138 and GCO139.	Q4 feed findings from deliverable <b>A16.3.2</b> and any relevant Grid code modifications into future modelling scoping and development.	Q3 Data and analytics platform foundational architecture complete.  Q4 feed findings from deeper access work into offline network modelling development.	Findings and recommendations outputs from deliverable <b>A16.3.2</b> are accurately reflected into model functionality development.	Offline network models are developed in accordance with learning from deeper access planning trials and implementation roll out plan. Key stakeholders engaged in the model development process.	2023-24 Deeper access planning processes and models go-live. Increased co-ordination between parties resulting in optimisation of flows across the networks and network access. First phase of agile IT enhancements to	Updated with reference to relevant Grid Code modifications.



Sub activity	Deliverable	Related IT Investment	Project or continuous	RfIO-1 end point	2021/2022 Milestones	2022/2023 Milestones	First year success	Second year success	Expected final delivery date and what success looks like.	Notes on changes to Dec 2019 Business Plan
	Outage Planning go live in Offline Network Modelling  Enables higher volumes of network data, regional models and outage planning data to be exchanged, used and shared by network companies. This activity enables the network access planning activity A16.3.	the Data & Analytics platform.  IT investment ref 350 Planning & outage data exchange will enable a whole system approach to access networks, manage significantly increased data volumes, and provide interactive stakeholder engagement.				Work with DNOs to develop IT requirements for deeper outage planning.			enable deeper outage planning complete.	
		IT investment ref 220 Data and analytics platform will provide the foundational architecture to replace the existing External Data Exchange system, allowing greater volumes of data and more frequent updates.  The data and analytics platform will be delivered under D14.1 Creation of a data and analytics platform.								
A15.7 Deliver an operable zero carbon system by 2025	D15.7.1 Commence System State Targeted Monitoring and Control System (MCS) stage roll out. This activity seeks to roll out a system that has been tested on a small scale via the Enhanced Frequency Control Capability (EFC2) Innovation project and is comprised of 5 phases.	IT investment ref 500 – this investment is for a wide area monitoring and control system (MCS). It enables coordinated, fast frequency response, allowing a wide range of technologies to participate in managing system frequency to keep the system stable. It can therefore facilitate zero carbon operation by 2025.	Project	N/A	Q1 Start-up for Phases 1 and 2: Identify industry parties to participate in the Phase 1 non-operational demonstration.  Q2 Phase 1 and Phase 2 Requirements and design.  Q3 Phase 1 Development and testing: Engage with key stakeholders.  Q4 Commence implementation of	Q1-Q2 Phase 2 (Develop operational demonstration) Development and testing.  Q3-Q4 Phase 3 (Operational Demonstration) Implementation.  Q1-Q2 Phase 4 (First stage rollout) Start-up.  Q3-Q4 Phase 4 Requirements.	Completed a non-operational demonstration and therefore proof of concept to installing on a wider scale.  Development of an operational demonstration is underway.	Phase 3 (Operational demonstration) is halfway through and therefore testing of the system is underway. Phase 4 of the roll out commenced and at the Requirements and Design stage.  The system's algorithm will be in place, with required equipment installed on the system. Basic integration with existing control systems achieved in order to run the operational demonstration in Phase 3.	2025-26 Roll out of Stage 1 of the MCS complete and facilitates, along with other Theme 1 investments, our ability to operate a zero carbon system. Stage 2 roll out of the MCS commenced.  The work undertaken on non-operational and operational demonstrations and staged rollout up to March 2023 will facilitate a checkpoint to determine, in accordance with stakeholders, whether	Timescales adjusted to account for changes to Phases 1 and 2 timescales. Further detail added to success measures.



ESO RfIO-2 Delivery Schedule

Sub activity	Deliverable	Related IT investment	Project or continuous	RfIO-1 end point	2021/2022 Milestones	2022/2023 Milestones	First year success	Second year success	Expected final delivery date and what success looks like.	Notes on changes to Dec 2019 Business Plan
					Phase 1 non-operational demonstration.	Q4 Engage with key stakeholders on the progress of rollout.			to continue the rollout of the MCS as a means to achieving zero carbon operation by 2025.	
<b>A15.9</b> Identify Future operability needs across whole energy system	<b>D15.9.1</b> Trial new innovation projects for whole energy system operability	N/A	Continuous	Q4 Support ESO open innovation event with focus on whole system problem statement.	Q1-Q4 Evolve existing approach to identifying innovation projects to give a broader cross-vector view.	Q1-Q4 seek innovation project opportunities to trial whole energy system operability tools in response to operability requirements identified in SOF publications. Provide technical support to further ESO innovation events such as Open Innovation days and to initiatives driven by external stakeholders.	Ongoing proactive external engagement, for example, through Open Networks WS4	Ongoing proactive external engagement, for example, through Open Networks WS4. Innovation projects progressed as appropriate and in line with any future requirements identified via activity <b>A15.1</b> .	Innovation projects result in increased understanding and potential tools to address future operability challenges. Findings from innovation projects published to industry, along with progression plans as appropriate.	RfIO-1 end point added
<b>A15.9</b> Identify Future operability needs across whole energy system	<b>D15.9.2</b> Commence RDP approach to whole energy system challenges – build on the RDP approach used in the electricity sector to develop cross sector operability solutions	N/A	Project	N/A	N/A – initial scoping for this activity to take place in 2023/24 so no milestones applicable here	N/A – initial scoping for this activity to take place in 2023/24 so no milestones applicable here	N/A	N/A	2024-25 RDP approach to whole energy system challenges commenced (hence no milestones detailed here), working closely with stakeholders (for example via Open Networks WS4/Whole Energy System work plan). Scope and undertake first whole system/cross-vector RDP alongside key industry stakeholders.	Updated to reflect that this activity starts in BP2
<b>A15.9</b> Identify Future operability needs across whole energy system	<b>D15.9.3</b> Second whole energy system RDP launched	N/A	Project	N/A	N/A – work to commence on this activity in 2024/25	N/A – work to commence on this activity in 2024/25	N/A	N/A	2025-26 Take emerging learnings from the first whole system/cross-vector RDP to develop the second project. 2025-26 Whole system operability framework published ( <b>D15.9.4</b> ) with key industry stakeholders having been engaged in the process. Positive feedback received on framework.	Updated to reflect that this activity starts in BP2

ESO RILIO-2 Delivery Schedule

Sub activity	Deliverable	Related IT Investment	Project or continuous	RILIO-1 end point	2021/2022 Milestones	2022/2023 Milestones	First year success	Second year success	Expected final delivery date and what success looks like.	Notes on changes to Dec 2019 Business Plan
<b>A15.9</b> Identify Future operability needs across whole energy system	<b>D15.9.4</b> Whole system operability framework published – this extends the ethos of the current system operability reports to cover a wider range of parties and challenges	N/A	Project	N/A	N/A	N/A	N/A	N/A	2025-26 Whole system operability framework published with key industry stakeholders having been engaged in the process; positive feedback received on framework	Deliverable removed. Deliverable reference added to deliverable D15.9.3 which occurs post BP1.
<b>A15.10</b> Develop a regime for an integrated offshore grid	<b>D15.10.1</b> Initial scoping report published	Network analysis implications going forward.	Project	Q2 - Gap analysis and scope of Phase 2; Q3 - Phase 1: Complete technical analysis and Cost Benefit Analysis (CBA), including system analysis on conceptual offshore designs (Note 1); Q4 - Deliver Phase 2	This work may result in a new ongoing role for the ESO, pending its outcome.	Ongoing	Ongoing	Ongoing	Initial report delivered in RILIO-1 Q4 potentially with an ongoing role into the RILIO-2 period, depending on the outcome of the project.  Allows us to progress with best approach to connecting offshore projects for consumers and coastal communities.	Deliverable removed Additional information to be provided on the integrated offshore grid deliverables by 15 October as agreed with Ofgem.

## A16 Delivering consumer benefits from improved network access planning

These proposals will enable roll out of best practice access planning processes developed in Scotland in RILIO-1 across the whole Great Britain transmission system. We will support increased levels of co-ordination across the transmission-distribution interface to deliver significant consumer benefits, facilitating the connection of low carbon generation and the development of new flexibility market opportunities. By March 2023 we will have developed and implemented the processes, frameworks and infrastructure to facilitate deeper access planning from 2023/24, in line with RILIO ED-2 timescales.

Sub activity	Deliverable	Related IT Investment	Project or continuous	RILIO-1 end point	2021/2022 Milestones	2022/2023 Milestones	First year success	Second year success	Expected final delivery date and what success looks like.	Notes on changes to Dec 2019 Business Plan
<b>A16.1</b> Manage access to the system to enable the TDOs to undertake work on their assets.	<b>D16.1.1</b> Year ahead regional outage programmes developed in liaison with network parties.	IT investment ref 350 Planning and outage data exchange.	Continuous	Transmission Outage and Generation Availability (TOGA) system replacement complete.	Q4 deliver regional outage programmes.	Q4 deliver regional outage programmes.	N/A	N/A	N/A	

ESO RII0-2 Delivery Schedule

Sub activity	Deliverable	Related IT investment	Project or continuous	RII0-1 end point	2021/2022 Milestones	2022/2023 Milestones	First year success	Second year success	Expected final delivery date and what success looks like.	Notes on changes to Dec 2019 Business Plan
liaising with customers where access arrangements impact them.		(Ongoing agile process enhancements)								
<b>A16.1</b> Manage access to the system to enable the TOs to undertake work on their assets, liaising with customers where access arrangements impact them.	<b>D16.1.2</b> Detailed week and day ahead operational documentation produced for National Control	IT investment ref 350 Planning and outage data exchange (Ongoing agile process enhancements)	Continuous	TOGA system replacement complete.	Weekly / Day ahead outage plans	Weekly / Day ahead outage plans	N/A	N/A	N/A.	
<b>A16.2</b> Enhance the Network Access Policy (NAP) process with TOs	<b>D16.2.1</b> Great Britain (GB) wide NAP process goes live including extension of the existing SO-TO payment mechanism to the whole of GB. Investigate, with TOs, any further mechanisms that will drive consumer value in this area ahead of RII0-2.	N/A	Project (becoming continuous upon implementation).	Work with the GB TOs in quarterly meetings to develop NAP proposals. Development of proposals to extend SO-TO mechanism to whole of GB, including trial use of STCP 11-3 with NGET, and explore other mechanisms that might drive further value.	Q1 GB wide NAP process go-live (and any further mechanisms progressed as appropriate). Draft revised process for STCP 11-4 following engagement with the TOs.	GB NAP Becomes continuous process. Q2 Output from innovation informs new change to outage cost visibility process.	NAP process and cost go-live in Q1 with positive relationships with TOs.	Process reviewed and discussed at TO meetings. TOs receive cost visibility that is useful for their own decision making and reduces costs to the consumer.	Ongoing success is the value created through more efficient access planning and working with network parties. Greater visibility of outage change costs allow network parties to assess the possible impact of their actions.	Updates to RII0-1 end point and milestones.
				Develop and approve current methodology for providing a cost forecast for outage change projects identified under STCP 11-4 to incorporate potential boundary reductions for outages that have not been included in the outage plan but we would reasonably expect to have.	Q4 Provide increased visibility of outage change cost - provide more visibility on an ad hoc basis.					
				Commence development for increasing outage change cost visibility via an innovation project. Code changes submitted to authority for approval and licence changes						

ESO RIIO-2 Delivery Schedule

Sub activity	Deliverable	Related IT Investment	Project or continuous	RIIO-1 end point	2021/2022 Milestones	2022/2023 Milestones	First year success	Second year success	Expected final delivery date and what success looks like.	Notes on changes to Dec 2019 Business Plan
				agreed with Ofgem to facilitate go-live.						
<b>A16.3</b> Work more closely with DNOs and DER to facilitate network access	<b>D16.3.1</b> Conclude trials on closer working relationships with DNOs and DER to enhance co-ordination of system access and development of flexibility markets (commenced in 2019-21 <i>Forward Plan</i> ).  The RIIO-2 deliverables in this area look to broaden the application of deeper access planning and apply trials in different more complex parts of the network. These trials will facilitate a more formal implementation of deeper access.	N/A	Project	Trial for closer working relationships established and underway. Initial learning points documented from trials, via the RDP projects, with WPD-SW, UKPN-SE, SSE-S (N-3 intertripping) WPD-SW, UKPN-SE (MW dispatch) SPD, SPT (GEMS) with an understanding that these projects will be at differing stages of completion. Expand further trial(s) currently in the early stages (SSE-N) and look for further interested trial partners.	Q1-Q2 Ongoing engagement with trial partner(s).  Engage and update DNOs on trial progress to inform their RIIO-ED2 plan development. Explore the principle of introducing Network Access Policy-type frameworks with DNOs for coordinating distribution and transmission outage planning.  Q2 Completion of trials.  Q3 Trials concluded.	N/A for this deliverable – activity progressed further via D16.3.2 and D16.3.3 below.	Enhanced working relationship reflecting joint desire of trial participants to improve network access.  Lessons learned by all parties.  Interest gained from non-trial parties to be involved.	N/A – trials concluded in year 1.	Q4 2023 / 2024 Deeper access planning processes go-live. Increased co-ordination between parties resulting in optimisation of flows across the networks and network access. We will have set out arrangements for efficient coordination of DER services with the DNOs (DSOs) such that we are able to make pre-operational timescale decisions which consider the impact on both the transmission and distribution networks. We will have the IS, communication and modelling tools available to ensure that there is not conflict between ESO and DSO when decisions over service provision (constraint management, voltage management, margin, reserve, response etc) are made.	Expansion of how the deliverable is a step change to work undertake in RIIO-1 in sub-activity column.
<b>A16.3</b> Work more closely with DNOs and DER to facilitate network access	<b>D16.3.2</b> Learnings from trials shared alongside recommendations for GB roll out such that best practice is applied to ongoing processes	N/A	Project	DNOs engaged in the lead up to submission of their RIIO-ED2 business plans on the aims of deeper access. Ensure that the ESO has clearly articulated that the aims of deeper access are to create value for the end consumer by developing a range of services which span the transmission-distribution interface. DNOs to be informed and consulted on the risk and rewards of any such scheme developments with reference to and	Q1-3 Engage relevant parties on ongoing conclusions and learnings from trials. Feed findings into RIIO ED-2 business planning processes.  Q4 Develop and share learnings and recommendations for GB roll out, including whether to introduce NAP-type frameworks with DNOs for coordinating distribution and transmission outages.	Progress recommendations in accordance with GB roll out recommendations. Engage with relevant parties to support successful delivery	Agreed published statement on trial learnings and recommendations for broader process improvements.	Implementation of any relevant recommendations. Positive stakeholder feedback and increased co-ordination between parties.	Q4 2023 / 2024 Deeper access planning processes go-live. Increased co-ordination between parties resulting in optimisation of flows across the networks and network access. We will have set out arrangements for efficient coordination of DER services with the DNOs (DSOs) such that we are able to make pre-operational timescale decisions which consider the impact on both the transmission and distribution network. We will have	Update to RIIO-1 end point and successes

ESO RII0-2 Delivery Schedule

Sub activity	Deliverable	Related IT Investment	Project or continuous	RII0-1 end point	2021/2022 Milestones	2022/2023 Milestones	First year success	Second year success	Expected final delivery date and what success looks like.	Notes on changes to Dec 2019 Business Plan
				'conflict of service' lessons learned from trials or analysis.					the IS, communication and modelling tools available to ensure that there is no conflict between ESO and DSO when decisions over service provision (constraint management, voltage management, margin, reserve, response etc) are made.	
<b>A16.3</b> Work more closely with DNOs and DER to facilitate network access	<b>D16.3.3</b> Finalise new processes in readiness for approval of code modifications to facilitate closer working relationships and data exchange/modelling. This will ensure that frameworks support any new enduring processes developed in <b>A16.3.1</b> and <b>A16.3.2</b>	N/A	Project	DNOs engaged in the lead up to submission of their RII0-ED2 business plans on the aims of deeper access. Ensure that the ESO has clearly articulated that the aims of deeper access are to create value for the end consumer by developing a range of services which span the transmission-distribution interface. DNOs to be informed and consulted on the risk and rewards of any such scheme developments with reference to and 'conflict of service' lessons learned from trials or analysis.	Q1-4 feed findings from deliverable A16.3.2 into preliminary code modification discussions. Instances of conflict of service evidenced from the trials to be a key consideration.	Q1 Code modification requirements assessed, scoped and raised as required.  Q2-Q4 Modifications progressed through governance.	Key learnings from deeper access trials are fed through into scoping phase for Code modifications with relevant parties engaged.	Relevant modifications are scoped and raised in line with outcomes from trials.  Frameworks ultimately support and facilitate new best practice processes, determined as a result of trials, between parties.	Q4 2023 / 2024 Deeper access planning processes go-live. Increased co-ordination between parties resulting in optimisation of flows across the networks and network access. We will have set out arrangements for efficient coordination of DER services with the DNOs (DSOs) such that we are able to make pre-operational timescale decisions which consider the impact on both the transmission and distribution network. We will have the IS, communication and modelling tools available to ensure that there is no conflict between ESO and DSO when decisions over service provision (constraint management, voltage management, margin, reserve, response etc) are made.	Update to RII0-1 end point and successes
<b>A16.3</b> Work more closely with DNOs and DER to facilitate network access	<b>D16.3.4</b> Deeper access planning go-live – frameworks, processes and models are in place to facilitate deeper access planning with network parties	IT investment refs <b>350</b> Planning and outage data exchange, and <b>360</b> Offline network modelling	Project	Processes in place to model the impact of the most advanced of the schemes in IEMS and OLTA. Currently in-train. TOGA system replacement complete.	Q1-4 feed findings from deliverable <b>A16.3.2</b> into future modelling scoping and development.	Q3 Data and analytics platform foundational architecture complete.	Offline network models are developed in accordance with learning from deeper access planning trials and implementation roll out plan. Key stakeholders, including DNOs,	Continued development of Offline models. Developments are made to facilitate any code modification outcomes. DNOs engaged in discussions on IT and model development.	Q4 2023 / 2024 Deeper access planning processes go-live. Increased co-ordination between parties resulting in optimisation of flows across the networks and network access. We will have set out arrangements	Updated to include engagement with DNOs, updated final success column on the benefits of

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Sub activity	Deliverable	Related IT Investment	Project or continuous	R10-1 end point	2021/2022 Milestones	2022/2023 Milestones	First year success	Second year success	Expected final delivery date and what success looks like.	Notes on changes to Dec 2019 Business Plan
		(including for DER) and models with stakeholders, and enhance our modelling tools to enable deeper outage planning.  IT Investment ref <b>220</b> Data and analytics platform will provide the foundational architecture to replace the existing External Data Exchange system, allowing greater volumes of data and more frequent updates.  The data and analytics platform will be delivered under <b>D1.4.1</b> Creation of a data and analytics platform.		Preliminary discussion with other interested DNO parties around data and model exchange.  DNOs engaged in the lead up to submission of their R10-ED2 business plans on the aims of deeper access.  Offline Transmission Assessment (OLTA) Hardware Refresh Complete.	R10-ED2 business plans on the aims of deeper access.	modelling development, assess IT impact of any code modifications to facilitate deeper access planning.  Work with DNOs to develop IT requirements for deeper outage planning.	engaged in the model development process.		for efficient coordination of DER services with the DNOs (DSOs) such that we are able to make pre-operational timescale decisions which consider the impact on both the transmission and distribution network. We will have the IS, communication and modelling tools available to ensure that there is not conflict between ESO and DSO when decisions over service provision (constraint management, voltage management, margin, reserve, response etc) are made.  First phase of agile IT enhancements to enable deeper outage planning complete.  IT investment enables a step change to a more efficient exchange of information and models to facilitate more efficient management of transmission and distribution outages.	deeper access planning.
<b>A16.4</b> TOGA / Whole system outage notification	<b>D16.4.1</b> Scoping exercise concluded for delivery of enhancements to outage notifications  <b>D16.4.2</b> Delivery of enhancements to outage notifications, to stimulate flexibility markets as an additional tool for efficient outage management - we will develop the TOGA system to become a more interactive experience for customers, stakeholders and the market.	IT investment ref <b>350</b> Planning and outage data exchange.  This investment includes development of TOGA to provide digital communications to customers on the status of outages.	Project	TOGA system replacement complete.	Q3 Commence scoping activity and engage with key stakeholders. Align model development and requirements with output from deliverable A16.3.2 (recommendations for roll out of deeper access planning)	Q2 scoping exercise concluded and published.  Q3 commence IT project start-up phase.	Industry stakeholders, particularly DNOs and DER, are engaged with the project and scoping is underway.	Agreement and publication of scope for enhancements to outage notification processes, including technology roadmap. Scope adequately informs the design and requirements stage of the system development.	Q4 2024 / 2025 Delivery of whole system outage notification enhancement to support potential flexibility markets which in turn should give additional tools for managing outages.	



## Sources of further information on IT investments referenced in the Delivery Schedule tables

IT Investment	Source for further information
110 Network control	For further information on this investment please see the ESO RIIQ-2 consultation response – Technology Investment detail parts 1-3 submitted in September 2020.
120 Interconnectors	For further information on this investment please see Annex 4 of the ESO RIIQ-2 Business Plan submitted in December 2019.
130 Emergent technology and system management	For further information on this investment please see the ESO RIIQ-2 consultation response – Technology Investment detail parts 1-3 submitted in September 2020.
140 ENCC operator console	For further information on this investment please see Annex 4 of the ESO RIIQ-2 Business Plan submitted in December 2019.
150 Operational awareness and decision support	For further information on this investment please see Annex 4 of the ESO RIIQ-2 Business Plan submitted in December 2019.
170 Frequency visibility	For further information on this investment please see Annex 4 of the ESO RIIQ-2 Business Plan submitted in December 2019.
180 Enhanced balancing capability	For further information on this investment please see the ESO RIIQ-2 consultation response – Technology Investment detail parts 1-3 submitted in September 2020.
190 Workforce and change management tools	For further information on this investment please see the ESO RIIQ-2 consultation response – Technology Investment detail parts 1-3 submitted in September 2020.
200 Future training simulator and tools	For further information on this investment please see Annex 4 of the ESO RIIQ-2 Business Plan submitted in December 2019.
210 Balancing asset health	For further information on this investment please see Annex 4 of the ESO RIIQ-2 Business Plan submitted in December 2019.
220 Data and analytics platform	For further information on this investment please see the ESO RIIQ-2 consultation response – Technology Investment detail parts 1-3 submitted in September 2020.
240 ENCC asset health	For further information on this investment please see Annex 4 of the ESO RIIQ-2 Business Plan submitted in December 2019.
250 Digital engagement platform	For further information on this investment please see Annex 4 of the ESO RIIQ-2 Business Plan submitted in December 2019.
260 Forecasting enhancements	For further information on this investment please see Annex 4 of the ESO RIIQ-2 Business Plan submitted in December 2019.
270 EU regulation	For further information on this investment please see the ESO RIIQ-2 consultation response – Technology Investment detail parts 1-3 submitted in September 2020.
280 GB regulation	For further information on this investment please see Annex 4 of the ESO RIIQ-2 Business Plan submitted in December 2019.
290 Charging and billing asset health	For further information on this investment please see the ESO RIIQ-2 consultation response – Technology Investment detail parts 1-3 submitted in September 2020.
300 Charging regime and CUSC changes	For further information on this investment please see Annex 4 of the ESO RIIQ-2 Business Plan submitted in December 2019.
320 EMR and CID Improvements	For further information on this investment please see the ESO RIIQ-2 consultation response – Technology Investment detail parts 1-3 submitted in September 2020.
330 Digitalised code management	For further information on this investment please see Annex 4 of the ESO RIIQ-2 Business Plan submitted in December 2019.
340 RDP implementation and extension	For further information on this investment please see the ESO RIIQ-2 consultation response – Technology Investment detail parts 1-3 submitted in September 2020.
350 Planning and outage data exchange	For further information on this investment please see the ESO RIIQ-2 consultation response – Technology Investment detail parts 1-3 submitted in September 2020.
360 Offline network modelling	For further information on this investment please see the ESO RIIQ-2 consultation response – Technology Investment detail parts 1-3 submitted in September 2020.
380 Connections platform	For further information on this investment please see the ESO RIIQ-2 consultation response – Technology Investment detail parts 1-3 submitted in September 2020.
390 NOA enhancements	For further information on this investment please see the ESO RIIQ-2 consultation response – Technology Investment detail parts 1-3 submitted in September 2020.
400 Single markets platform	For further information on this investment please see the ESO RIIQ-2 consultation response – Technology Investment detail parts 1-3 submitted in September 2020.
410 Ancillary services settlements refresh	For further information on this investment please see Annex 4 of the ESO RIIQ-2 Business Plan submitted in December 2019.
420 Auction capability	For further information on this investment please see the ESO RIIQ-2 consultation response – Technology Investment detail parts 1-3 submitted in September 2020.



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<b>IT investment</b>	<b>Source for further information</b>
450 Future innovation productionisation	For further information on this investment please see the ESO R10-2 consultation response – Technology Investment detail parts 1-3 submitted in September 2020.
460 Restoration	For further information on this investment please see Annex 4 of the ESO R10-2 Business Plan submitted in December 2019.
480 Ancillary services dispatch	For further information on this investment please see the ESO R10-2 consultation response – Technology Investment detail parts 1-3 submitted in September 2020.
500 Zero carbon operability	For further information on this investment please see the ESO R10-2 consultation response – Technology Investment detail parts 1-3 submitted in September 2020.
510 Restoration decision support	For further information on this investment please see the ESO R10-2 consultation response – Technology Investment detail parts 1-3 submitted in September 2020.