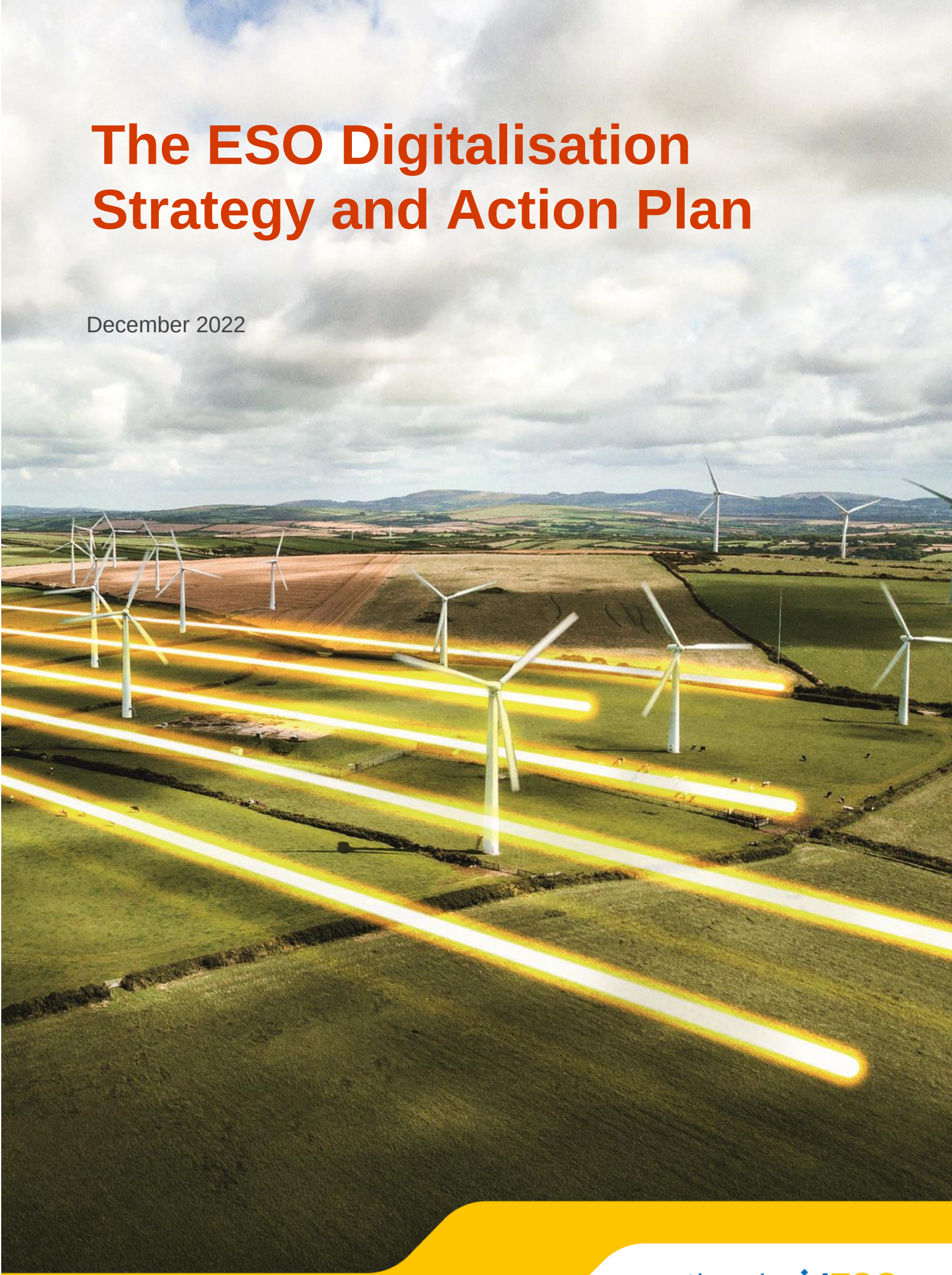
The ESO Digitalisation Strategy and Action Plan

December 2022



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Foreword

Our mission as the Electricity System Operator (ESO) is to drive the transformation to a fully decarbonised electricity system by 2035 which is reliable, affordable, and fair for all.

The ESO has a unique opportunity to shape the way we use and consume energy for generations to come. We have committed to be able to operate a zero-carbon system by 2025, which supports the UK's plan to achieve net zero greenhouse gas emissions by 2050. This is an exciting and challenging time for the energy sector as we all work together towards a decarbonised and decentralised energy system.

We will reduce our reliance on traditional energy sources and move to a more inclusive energy system with hundreds of connected generation, storage, and consumption assets. Over 600,000 heat pumps could be installed per year by 2028; and with all new cars and vans required to be zero emissions from 2035, the number of electric vehicles connected to the energy network will soar.

Pivotal to the successful delivery of these initiatives is ensuring we have a robust digitalisation strategy and action plan that outlines our approach and details a roadmap of how we will deliver to plan. The ESO's digital transformation is not just an enabler, but a core component of our transition as we progress on our journey to reach zero carbon operability. Our digitalisation strategy and related action plan will be periodically refreshed and maintained to align with changing consumer expectation and as we move forward in our thinking on Future System Operator (FSO).

Digitalisation and data will underpin the transition to net zero through better monitoring and management of the system, improved sharing of large quantities of high-quality data and the analytics this enables, as well as the developing customer-centric digital capabilities.

We're excited and proud of the role we are playing in the decarbonisation of the energy system to help mitigate climate change and the opportunity to bring about greater value for consumers through digitalisation.

Shubhi Rajnish
ESO Chief Information Officer

Submission Overview

Since our last strategic update in June 2022, we have submitted our RIIO-2 Business Plan 2 (BP2) which provides more detail on our plans until 2025. As part of the BP2 submission process we are currently developing our consultation response to Ofgem's Draft Determinations. We will continue to work with Ofgem as we seek to move towards Final Determinations which are expected to conclude in early 2023.

As a result of the ongoing Draft Determinations work, only an action plan update is provided in this DSAP publication. Our intention is to review the accompanying strategic content upon completion of the BP2 Final Determinations, where a broader strategic update will be detailed as part of the next DSAP update due to be published in June 2023.

We have received Ofgem's new Role Guidance covering the period of 2023 to 2025 which highlights several additional information requirements, including the creation of a digital dashboard, provision of further information on our code modifications, as well as the incorporation of greater feedback on our DSAP from our wider stakeholders. We are currently impact assessing these requirements which we expect will require further Ofgem discussion and alignment over the coming months.

In parallel to our BP2 delivery we also continue to progress our transition to the Future Systems Operator (FSO). FSO presents an exciting opportunity for our organisation and will be key to unlocking additional value for consumers and driving towards net zero. As we close out 2022, we can confirm that the transition programme has been established and will continue to define the separation scope whilst understanding the impact of moving away from National Grid PLC. As we progress our delivery, we will continue to assess the separation impact on our digitalisation plans.

Digitalisation Action Plan

Conceptualising our digitalisation strategy and tracking our delivery

Success in achieving our digitalisation strategy is closely linked to the successful delivery of our overarching Business Plan. To help conceptualise the relationship between these elements we have developed a 'Digitalisation matrix' (see Figure 2). This seeks to demonstrate how our investments, activities and deliverables are aligned to a primary ESO role, whilst also acknowledging that all investments, activities, and deliverables will be cross-cutting to a degree, and collectively contribute to the ESO's overall digital transformation.

This seeks to illustrate how our transformation activities and associated investments will collectively support our ongoing transformation towards a sustainable energy system. Broken down across our three core ESO delivery roles (see Figure 1), we have highlighted how our change activities link back to improvements across our core business services.

Using the power of data is fundamental to our transformation, as will a cultural shift towards more digital ways of working and associated delivery structures. These two items are the foundation of our matrix, collectively underpinning our overall transformation journey across all business areas.

To provide visibility of our digital transformation progress, Figures 3-5 show a plan view of our transformation activities, deliverables, and milestones. We have updated our action plan to more readily demonstrate our ongoing delivery progress and successes to date.

We report against these activities, deliverables, milestones, and investments on a quarterly basis through the RIIO-2 deliverables tracker1. This tracker contains detail about each milestone, and these are linked back in our business plan to agreed performance measures that have been tested with stakeholders and regulatory bodies. The successful delivery of our DSAP is intrinsically linked to the successful delivery of our Business Plan.

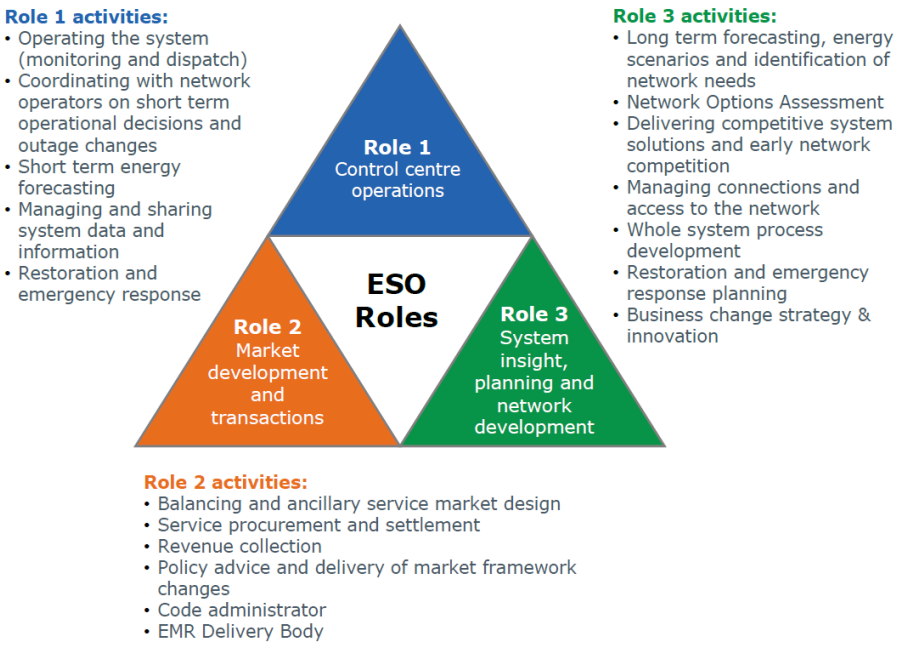

Figure 1 – ESO Roles.

[1] Our deliverables tracker can be found here https://www.nationalgrideso.com/document/266141/download

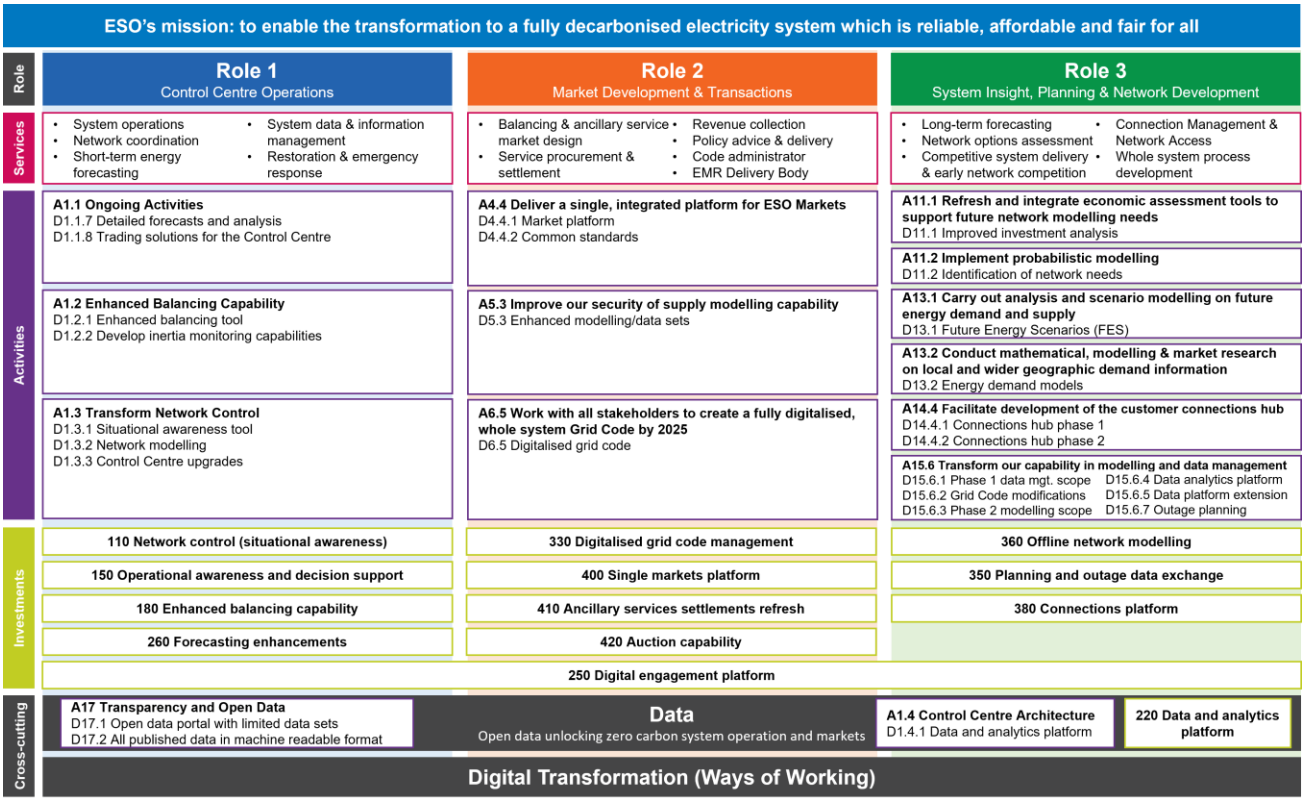

Figure 2 – ESO digitalisation matrix.

Figures 3,4 and 5 below show the high-level timeline for the IT investments that support our activities and deliverables. Given the importance of these enabling investments, we have provided a progress update in Tables 3, 4, and 5.

Role 1 activities, deliverables, and investments

Role 1 – Control Centre Operations
We will keep the lights on and get energy to people when they need it, maintaining today's reliability levels in a rapidly decarbonising and decentralising world. We will ensure our control centres are resilient, flexible, and agile, with the ability to keep pace with the changing energy landscape. We will confidently and regularly operate periods of zero carbon electricity with high levels of renewable output and dynamic demand. The number of market participants will have increased significantly, as a result of growth in distributed energy resources, electric vehicles, and energy storage. We will have invested and adapted ahead of need, to continue to operate securely and reliably through extensive automation, greater use of artificial intelligence and enhanced training and simulation, to deal with the vast amount of data needed to run the electricity system. There will be alignment with distribution system operation (DSO) to enable seamless planning and operational coordination to realise the benefits for consumers of a decarbonised energy system.

Figure 3 below shows a plan view of our transformation activities, deliverables, and milestones corresponding to Role 1 – Control Centre Operations.

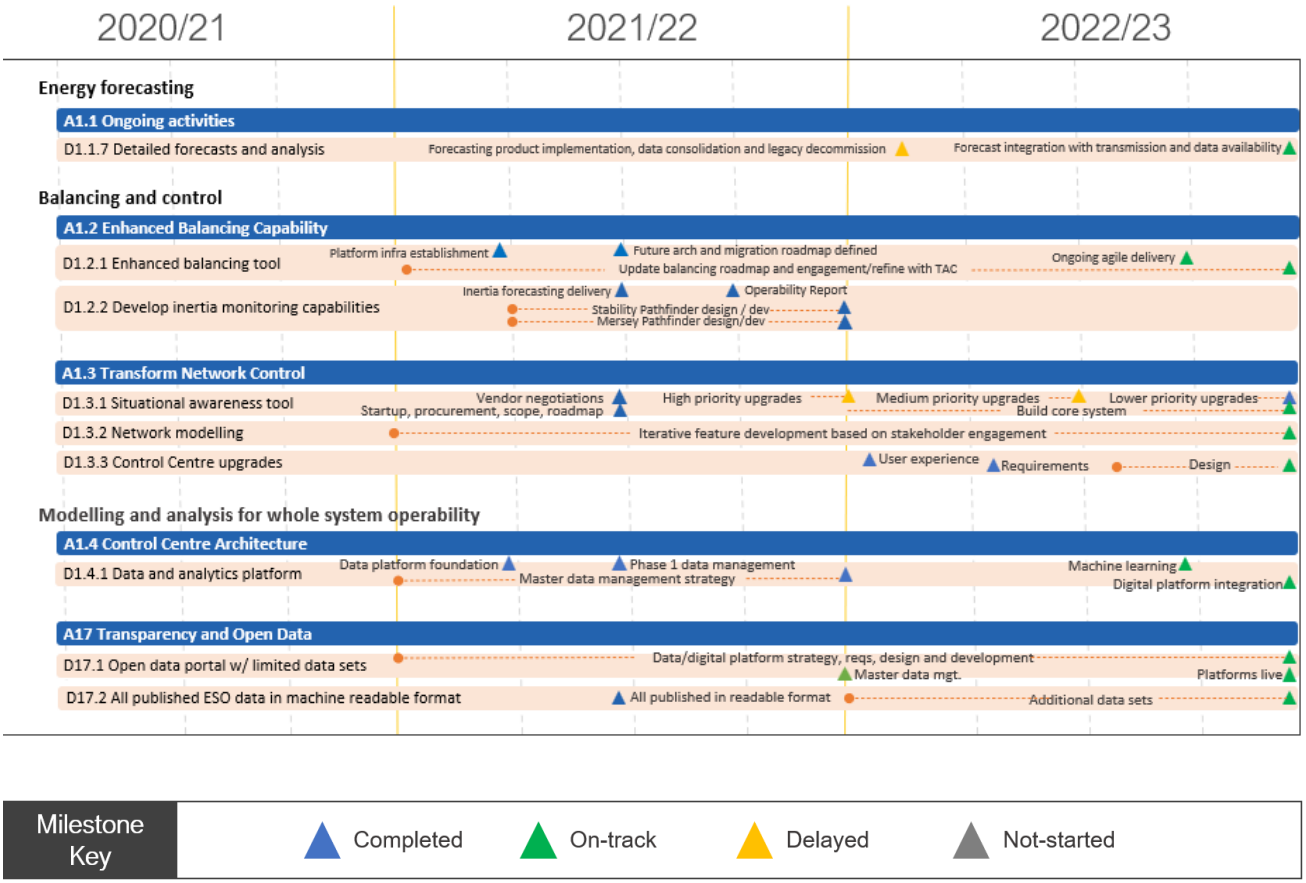

Figure 3 – Our Role 1 digitalisation strategy activities, deliverables, and associated delivery statuses. Data is as per the April 2022 Incentives Report.

Role 1 activities and deliverables

Table 1 – Activities and deliverables that support Role 1 – Control Centre Operations (as reflected in the April 2022 Incentives Report).

Activity/Deliverables	Related Investment	Status	Update
A1.1. Ongoing activities			
D1.1.7 Detailed forecasts and analysis *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.*	260 Forecasting Enhancements	Delayed	• PEF is a continuous improvement project to develop and implement ESO's new forecasting capability. We have already developed and implemented national solar power generation, national demand and GSP net demand forecast products • We have now partially implemented this milestone (GSP Forecasts) , we aim to implement remaining GSP level forecasting product (PV & Wind) in FY24 • GSP demand machine learning model outputs are now consumed with in operational planning and decision-making timescales. Output from this model is estimated to be ~20% better than legacy energy forecasting system. • Model are re-training automatically at least 3 times a week to capture most recent demand patterns and provide accurate possible forecasts to transmission analysis study setups and real time decision making in control room. PEF products also use most recent and weather data inputs • During the next phases of the project and in BP2, we are adopting new way of working and start delivering forecasting as a product. We are exploring options to further enhance and implement newly developed forecasting products into operational use and share it with market (where possible)
A1.2 Enhanced Balancing Capability			
D1.2.1 Enhanced balancing tool *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 Enhancing balancing capability	Delayed	• The programme is now in the Core Phase. • This is where we begin to build out the core of the new platform. • For the "build a platform environment" milestone, we are setting up the Development environment to begin building the new platform in February 2022. The "foundational infrastructure tooling work" deliverable also forms part of this activity, and has been re-planned to be delivered just ahead of the first go-live in 2023. • Updated roadmap has been shared with TAC as part of ongoing engagement

Activity/Deliverables	Related Investment	Status	Update
A1.3 Transform Network Control			
D1.3.1 Situational awareness tool *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.*	110 Network control	On track	• Work on a Voltage Stability Analysis Tool (VSAT) is continuing and we have completed an upgrade to Industrial Defender Software. However some projects such as Fault Level Enhancements have been delayed due to other projects blocking build deployment paths. • Work has completed on a proof of concept for using SSD hard drives. We also remain on track to deliver remediation work following security penetration tests. The enhancements to our Control Training Unit (CTU) are delayed slightly because of external resource constraints with the supplier. • Core system functions and environments have been scoped, final system design to be agreed with winning vendor. Work with data centres underway for initial deployment by mid 2022-23. • Roadmap updated to focus on breaking down silod working between the future balancing programme and the Data Analytics Platform • Regular touch points with Data Analytics Platform team to ensure both programmes are aligned and stressing the role of data and its flow into the NCMS & other systems
D1.3.2 Network modelling *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).*	150 Operational awareness and decision support	On track	• This is an ongoing activity with scoping being completed, we are now working with the vendors to ensure the Network Control Management System can deliver the functionality and integration levels required as per our requirements

Activity/Deliverables	Related Investment	Status	Update
A17 Transparency and Open Data	220 Data and analytics platform	On track	• Platform Build & Configuration work inflight, predominantly being delivered by the strategic partner (Avanade). On track to complete on schedule. • DAP go-live scheduled for Dec-22, with "Inertia Monitoring" as the lead MVP project for Production release • Data sets identified to be ingested onto DAP, to publish through CKAN, for transition through to DEP. Integration planned for MVP delivery in Q3 • SMP Data requirements to be finalised in Q3 2022-23. • Initial engagement complete to understand RDP objectives & deliverables - prior to exploring formal requirements
D17.1 Open data portal with limited data sets *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.*	220 Data and analytics platform	On track	• We have completed the Digital Engagement Platform strategic definition phase and design system development activity is under way. • Our procurement exercise for identifying a main digital experience platform has commenced and will elicit requirements and high-level design documents. A vendor is due to be appointed in Q4 2022-2023.
D17.2 All published ESO data in machine readable format *All published ESO data in machine readable format.*	250 Digital engagement platform	On track	• We achieved our Q2 2021/22 target for all ESO data to be in machine-readable format and have published over 80 data sets. • We continue to inform new data sets via engagement with the OTF and are on track for releasing and automating further data sets.

Role 2 activities, deliverables, and investments

Role 2 – Market Development and Transactions
We continue to drive to deliver efficient outcomes for consumers and are always conscious that everything we do has an impact on consumer energy bills. A key focus will be enabling whole system flexibility through the markets we operate. Our balancing markets will be decarbonised and distributed, to help achieve the UK's commitment to net zero emissions. We will maximise consumer benefit by facilitating competitive markets and managing system costs, attracting high volumes of flexible energy, such as demand-side response and storage.

Error! Reference source not found.4 below shows a plan view of our transformation activities, deliverables, a nd milestones corresponding to Role 2 – Market Development and Transactions.

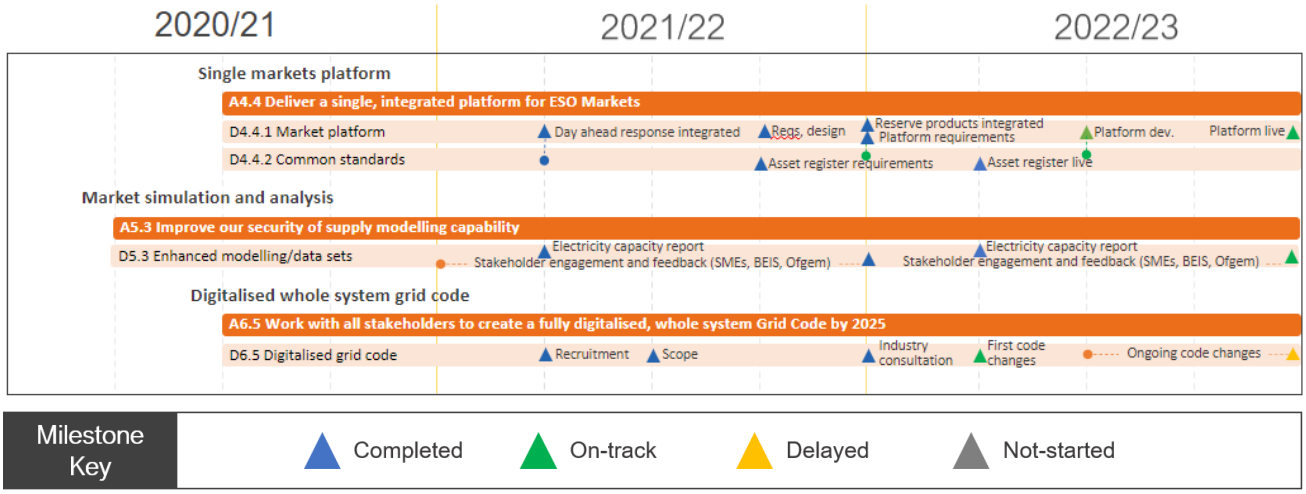

Figure 4 – Our Role 2 digitalisation strategy activities, deliverables, and associated delivery statuses. Data is as per the April 2022 Incentives Report.

Role 2 activities and deliverables

Table 2 – Activities and deliverables that support Role 2 – Market Development and Transactions (as reflected in the April 2022 Incentives Report).

Activity/Deliverables	Related Investment	Status	Update
A4.4 Deliver a single, integrated platform for ESO Markets			
D4.4.1 Market platform *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.*	400 Single markets platform	On Track	• The Single Market Platform (SMP) will evolve over time. Different elements of functionality will be deployed for different markets and services at different times in a co-ordinated release train. • The first successful release for SMP was on 10 February 2022 and supports the onboarding of the new DR and DM frequency response products that go live in March / April 2022. Accounts and data for DC providers were also created proactively. • Additional functionality and more balancing services will then be released in stages in subsequent releases. • Based on the backlog of requirements it is now expected that the procurement of all appropriate balancing services through SMP will extend into BP2 timescales. This will ensure that we are able to focus on the development of value adding functionality for new and existing Day Ahead markets over simply integrating all services
D4.4.2 Common standards *Common standards, including interoperable systems, a common data model and shared minimum specifications between the ESO and other flexibility platforms as well as at the distribution level.*	400 Single markets platform	On Track	• See D4.4.1 Markets platform.

Activity/Deliverables	Related Investment	Status	Update
A5.3 Improve our security of supply modelling capability			
D5.3 Enhanced modelling/data sets *Use of enhanced modelling and more granular data sets to improve security of supply modelling.*	220 Data and analytics platform	On track	• Development projects for 2022/23 will be prioritised following completion of the 2022 Electricity Capacity Report
A6.5 Work with all stakeholders to create a fully digitalised, whole system Grid Code by 2025			
D6.5 Digitalised grid code *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	Delayed	• Scoping documents include creation of workgroups to initiate this process in May 2022. • Next steps are for the steering group to develop and publish the project scope, objective and approach through the scoping documents. Due to the approach adopted by the steering group and the focus on digitalisation this may not lead to mods as first envisaged as part of the original plan as consolidation will not take place at this point.

Role 3 activities, deliverables, and investments

Role 3 – System Insight, Planning and Network Development
We seek the best whole electricity system solutions, working collaboratively with Transmission Owners (TOs) and Distribution Network Operators (DNOs) across transmission and distribution to deliver electricity to Great Britain's homes and businesses as efficiently as possible. We will use our unique position in the industry to help Great Britain meet net zero through driving debate and collaborative action across the energy sector. This means stepping up and playing a crucial part in the transition to net zero – using our insights to identify and accelerate no regrets strategies that deliver consumer value over the long term. By taking a whole energy system view we will facilitate the transition to clean heat by helping prepare the energy networks and optimising between them. In doing so, we can drive the transition to a low-carbon energy system in a way that maximises benefits to consumers.

5 below shows a plan view of our transformation activities, deliverables, and milestones corresponding to Role 3 – System Insight, Planning and Network Development.

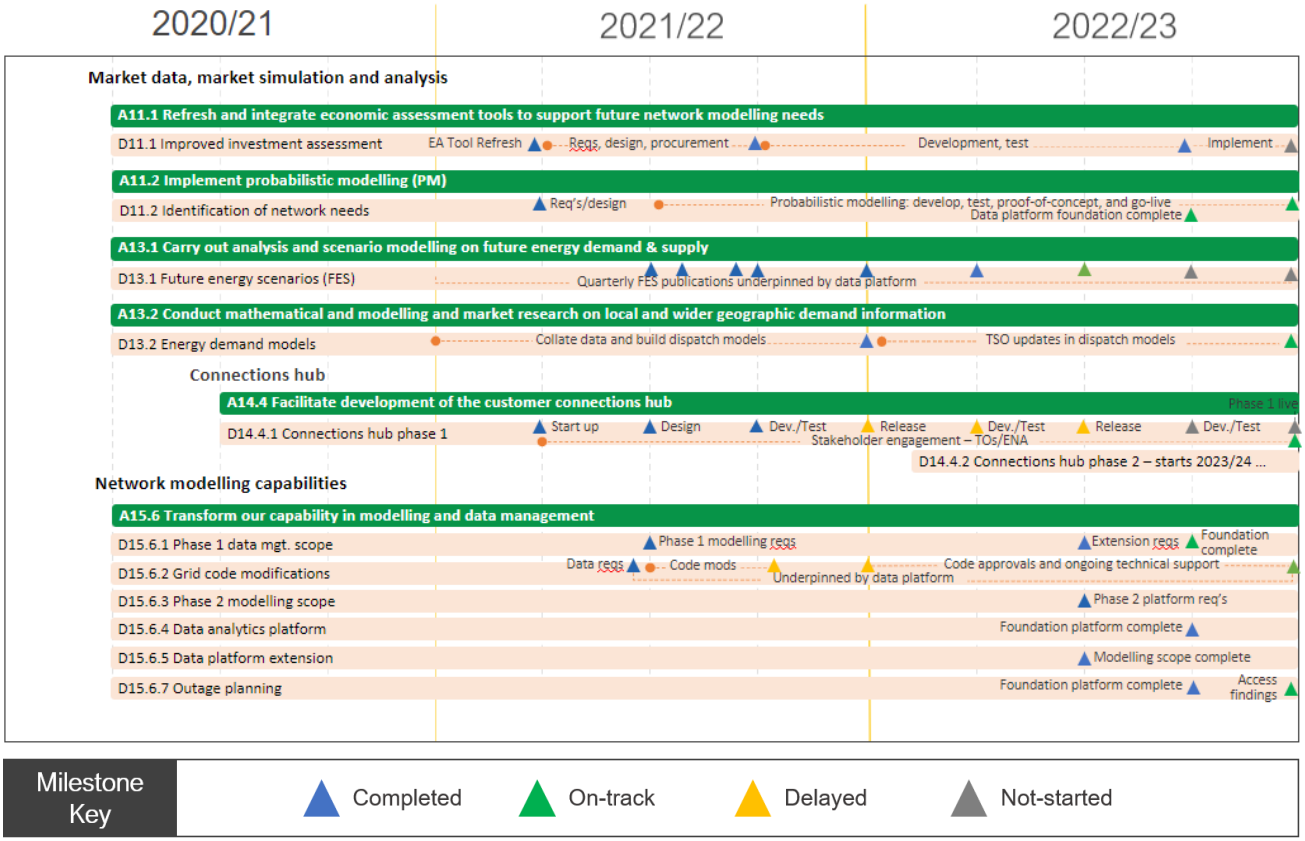

Figure 5 – Our Role 3 digitalisation strategy activities, deliverables, and associated delivery statuses. Data is as per the April 2022 Incentives Report.

Role 3 activities and deliverables

Table 3 – Activities and deliverables that support Role 3 – System Insight, Planning and Network Development (as reflected in the April 2022 Incentives Report).

Activity/Deliverables	Related Investment	Status	Update
A11.1 Refresh and integrate economic assessment tools to support future network modelling needs			
D11.1 Improved investment analysis *Improved identification of when is the most economical time to invest and the most efficient solution.*	390 Network options assessment	On track	• Work initiated to implement new model, PLEXOS, for Enterprise Architecture after tender exercise. Plans in place for parallel work, including User Acceptance Testing, until March 2023.
A11.2 Implement probabilistic modelling			
D11.2 Identification of network needs *Improved identification of network needs.*	390 Network options assessment	On track	• Pouya architecture development ongoing to support future DAP integration. • Probabilistic planning tool, Pouya, is on track and we are working with IT to build the necessary systems to host it for business use.
A13.1 Carry out analysis and scenario modelling on future energy demand and supply			
D13.1 Future Energy Scenarios (FES) *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*.	220 Data and analytics platform	On track	• Network forum continues to meet regularly. • Stakeholder Feedback Document due in January 2023 in line with the licence requirement

Activity/Deliverables	Related Investment	Status	Update
A13.2 Conduct mathematical, modelling and market research on local and wider geographic demand information			
D13.2 Energy demand models *Update pan-European and country level electricity and energy demand models*	220 Data and analytics platform	On track	• The tender process is complete and we are changing our dispatch model from BID 3 to PLEXOS. • This project will include an update to our European assumptions.
A14.4 Facilitate development of the customer connections hub			
D14.4.1 Connections hub phase 1 *Implement first phase of the ESO connections hub, including online account management and integration with other network organisation websites*	380 Connections portal	Delayed	• Workshop sessions have been held with customers and TOs to obtain insight on their needs and requirements, which has been factored into the design assumptions. • During the design and development phase, we learned that the build of the new portal was more complex than originally anticipated, and reviewed its level of functionality to ensure that the final product will meet our customers' needs and expectations. This had an impact on the delivery date for the phase 1 of the Customer Portal. • Development and testing is currently underway, with the initial release of the portal now anticipated in January and March 2023. • The customer focus group and overall stakeholder engagement will take place continuously between now and the planned release date. Following this, any updates identified by stakeholders post implementation will be reviewed and implemented where possible, using an Agile process. • Customer focus group has been established, engagement will be continuous throughout project delivery. Functional areas will be reviewed and tested by the focus group with comments fed back into the development process. Development, testing and engagement will be an ongoing activity into FY22/23. • Dates for future releases of the portal past March 2023 have yet to be identified. The plan is to continually build on the base functionality with numerous further releases in FY 2023/24. Stakeholder comments will feed in heavily to the additional functionality within these releases.
D14.4.2 Connections hub phase 2 *Phase 2 of the connections hub concluded.*	380 Connections portal	Not started	• This activity does not commence until BP2.

Activity/Deliverables	Related Investment	Status	Update
A15.6 Transform our capability in modelling and data management			
D15.6.1 Phase 1 data mgt. scope *Phase 1 data management scoping complete to feed into data and analytics platform (see D1.4.1) – modelling and data expertise will be used to scope planning data requirements for the data and analytics platform*	220 Data and analytics platform	On track	• This activity depends on D1.4.1 Phase 1 modelling scope
D15.6.2 Grid Code modifications *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)*	220 Data and analytics platform	On track	• "Work depends on D15.8.1. • GC0139 (Enhanced Planning-Data Exchange to Facilitate Whole System Planning) is currently at Working Group stage "
D15.6.3 Phase 2 modelling scope *Phase 2 modelling scoping complete to feed into data and analytics platform extension*	220 Data and analytics platform	n/a	• See D1.4.1 Data and analytics platform.
D15.6.4 Data analytics platform *Data analytics platform foundation in place*	220 Data and analytics platform	n/a	• See D1.4.1 Data and analytics platform.
D15.6.5 Data platform extension *Data platform extension complete (please see deliverable D1.4.1 for further details) – once the data and analytics platform foundation are complete, an extension will be developed as new tools are delivered.*	220 Data and analytics platform	n/a	• See D1.4.1 Data and analytics platform.
D15.6.7 Outage planning *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.*	360 Offline network modelling	On track	• Work on this deliverable is planned to start later in the BP2 period.