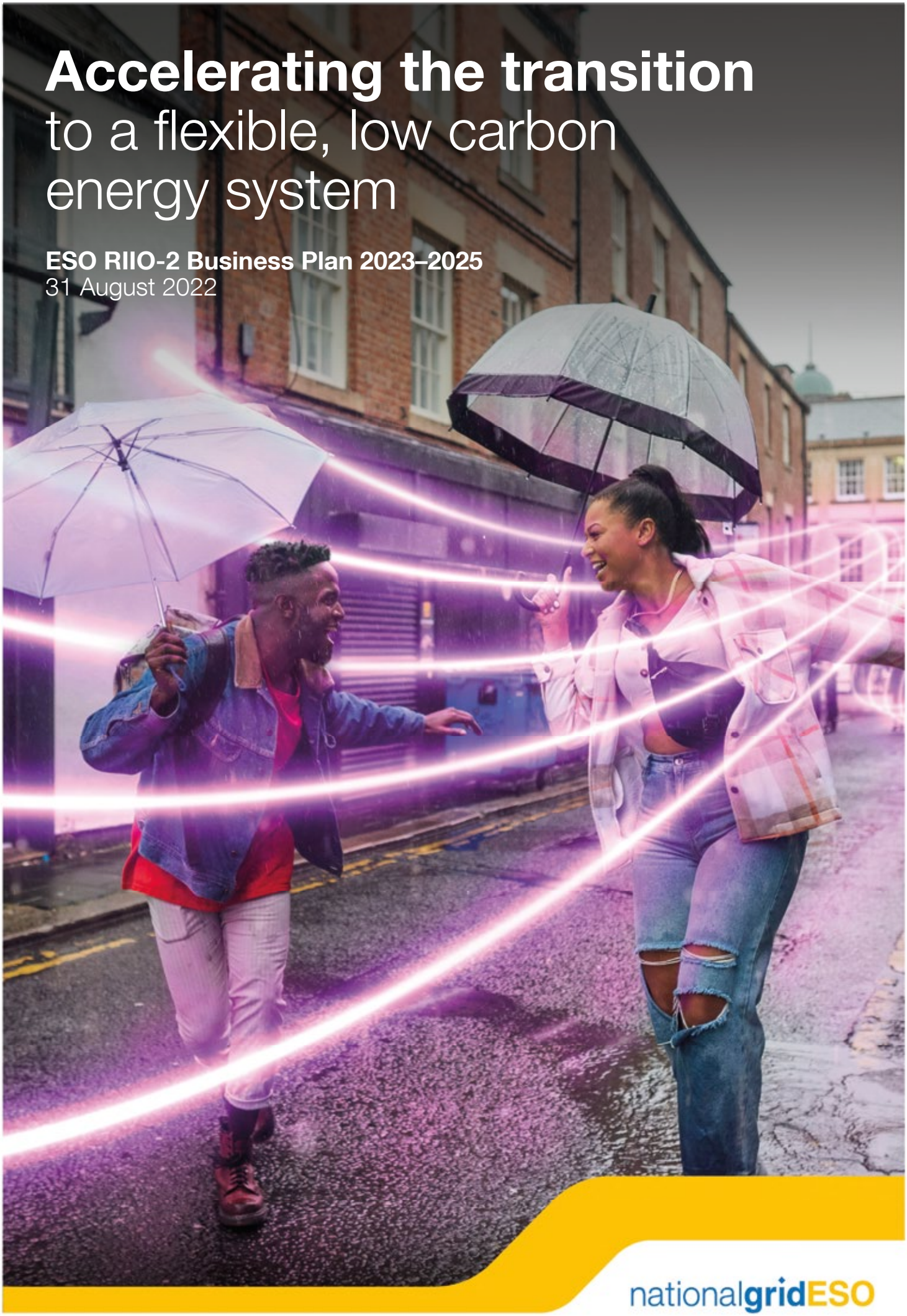
Accelerating the transition to a flexible, low carbon energy system

ESO RIIO-2 Business Plan 2023–2025

31 August 2022



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Part A
Our Summary Business Plan

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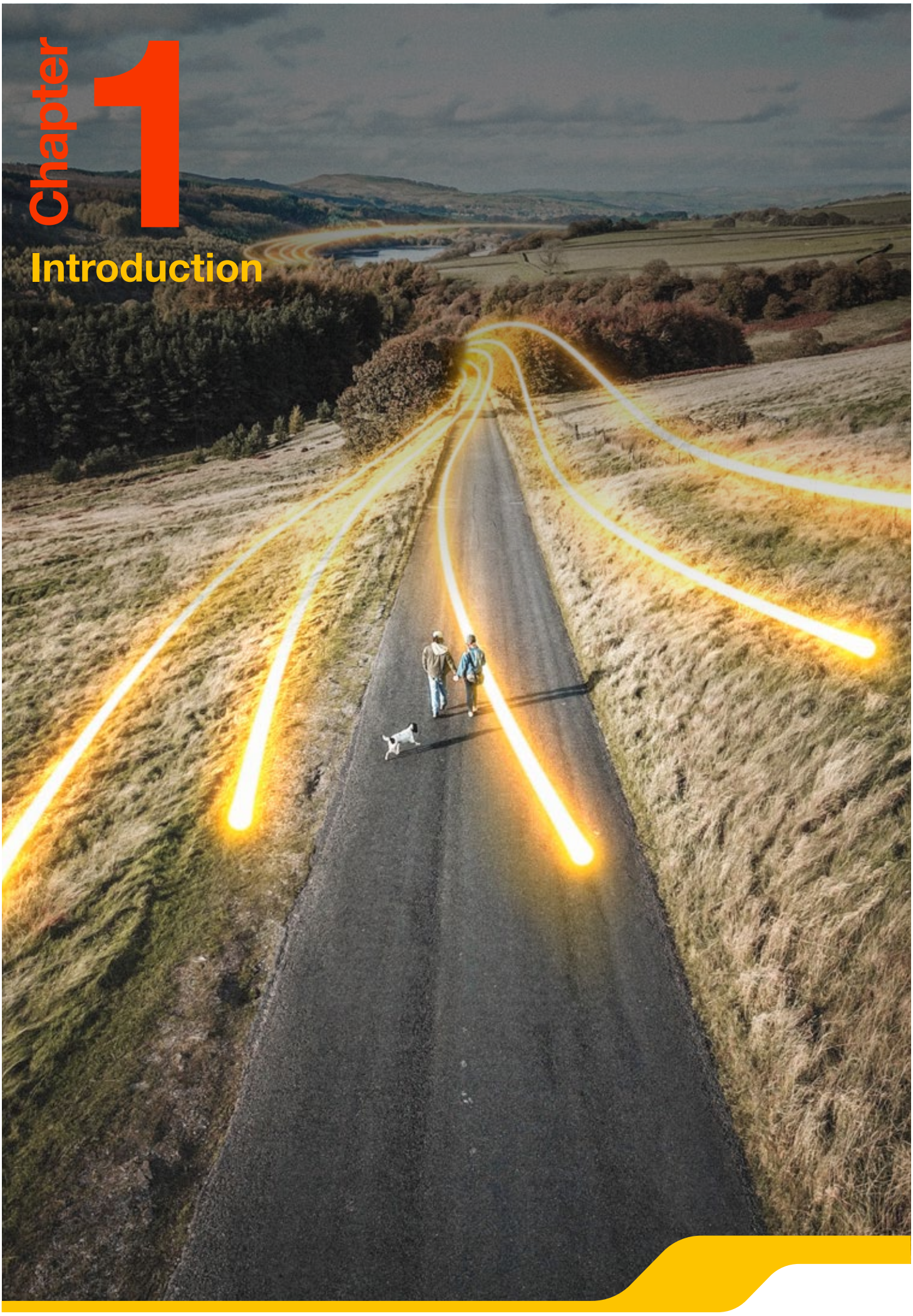
Introduction



Foreword

We are delighted to present our ESO RIIO-2 Business Plan for the period April 2023 to March 2025 (BP2); a plan which will drive over £2.8bn of benefits for consumers, support a reduction in consumer bills and accelerate Great Britain's journey to net zero.

Great Britain is at a critical point on the path to net zero and the Government target of a fully de-carbonised electricity system by 2035 puts energy at the heart of the journey. We are also in the midst of an energy price crisis and must do everything we can to manage overall costs to consumers, while ensuring safe, reliable electricity supply and staying the course on net zero to protect future generations. Now, more than ever, our strategy and plans must go further and faster. We have a critical role to play in managing through the current challenges and delivering on the energy transition. It is against this backdrop that we present our Final Business Plan.

Our mission is to drive the transformation to a fully decarbonised electricity system by 2035 which is reliable, affordable and fair for all.

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We have co-created our BP2 plan with customers and stakeholders and we are proud to set out an ambitious suite of prioritised deliverables to ensure we can effectively fulfil our evolving role as electricity system operator, and enable current and future industry participants to play their part. We have set clear priorities to deliver the outcomes our stakeholders need from us over the next two years – delivering excellence in system operation, building efficient and effective markets, driving clarity in our path to net zero and enabling our organisation to perform.

The scale of change we need to deliver will demand a step change in our own business. Stakeholders agree that we must adapt to further embed digital, data and technology capability, become the net zero employer of choice, drive rigour in our delivery approach and maintain the agility and flexibility to adapt as the energy system continues to change at pace.

A big part of this step change will be our growth into the Future System Operator (FSO) for GB, transitioning out of National Grid plc, accelerating the evolution and expansion of our role within the industry, and establishing a new relationship with Government. We are hugely excited about the contribution we can make through BP2 and as we transition to the FSO.

I am grateful to our stakeholders and customers for providing the challenge and support to develop our BP2 plans and look forward to continuing to work with you as we accelerate the transition to a sustainable, secure and affordable electricity system for the future.

Fintan Slye

Fintan Slye
ESO Executive Director

How to read this plan

Our BP2 submission sets out detailed proposals for years three and four (2023/24 and 2024/25) of the five-year RIIO-2 period. It reflects our review and refresh of the plans we originally set out at the start of BP1, builds on the draft plan we published in April 2022 and incorporates extensive feedback from our stakeholders.

Our final BP2 Business Plan is set out in two parts:

Summary Business Plan: Sets out the high-level context we are operating in, the outcomes and priorities we have defined for the business in BP2, our key areas of focus in delivering on those priorities, and a summary of the benefits and costs of our plans. We also provide a high-level overview of our Future System Operator (FSO) transition plans.

Part A can be read as a standalone document, for stakeholders whose primary focus is on understanding the key outcomes we are seeking to deliver for stakeholders and our overarching priorities in BP2.

Delivery Plan: Follows the Regulatory framework structure of Roles 1, 2 and 3 and provides the detailed view on our activities and milestone plans, as well as highlighting those outputs that cut across all parts of the business, including the transition to the FSO. In each Role chapter, you will find information about the costs and benefits of our proposed new and materially changed activities, as well as stakeholder views on our proposals. This section also covers our performance measures and a regulatory finance summary.

Parts B provides granular detail for stakeholders who are interested in actions, timelines and costs for specific teams or areas of work, and for Ofgem and the Performance Panel to help inform their assessment of the level of ambition, value for money and deliverability of our proposals.

Supporting information can be found in the following annexes:

Annex 1 – Supporting information, which includes delivery roadmaps, an overview of how content has changed since our draft plan and more detail for activities that have completed in BP1 or have no material change.

Annex 2 – Cost benefit analysis (CBA) report, which details how we calculated the net present values (NPVs) used in this Business Plan and determined which proposals to take forward. This report also includes our cost summary tables, which you can review as you read through the relevant chapters.

Annex 3 – Stakeholder engagement, which highlights the feedback we have received through our extensive stakeholder engagement programme and how we have used it to develop our plan.

Annex 4 – Digital, data and technology, which supplements the technology chapter in Part B. It sets out the IT investment references and includes benchmarking information.

Annex 5 – Glossary, which has definitions of the terms used in this Business Plan.

Other things to note when reading our Business Plan:
The benefits and costs in this document are all in 2018/19 prices. The costs and full-time equivalent (FTE) employee numbers presented in this plan have been rounded to the nearest £100,000 and nearest whole FTE.

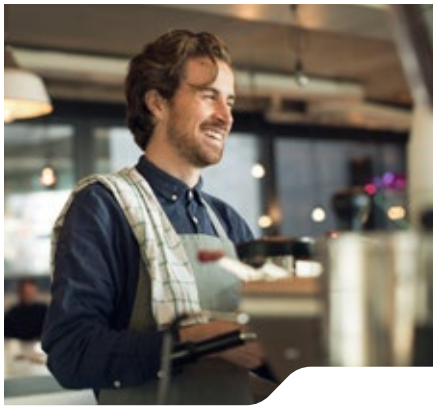
In this plan we have submitted updated direct opex, direct capex, property, and IT opex costs. The BP1 comparators relate to costs submitted in our first RIIO-2 plan.

BP1 is our first detailed Business Plan covering the RIIO-2 price control framework. Published in 2019 and covering the period from April 2021 to end of March 2023. Delivery of BP1 is now underway.

BP2 is our second Business Plan covering the RIIO-2 price control period. We have updated our plans to set out the detail of what we will deliver between 1 April 2023 to 31 March 2025.

A stakeholder-led submission

Extensive engagement to develop our plans



It is very important to us that our Business Plan is stakeholder led; we have therefore engaged extensively with them throughout the development of BP2.

Building on the extensive engagement we had with our customers and stakeholders during the development of our original RIIO-2 plans, which has continued throughout the BP1 period, we have approached the development of BP2 with an emphasis on customer and stakeholder insight. This stakeholder-led approach helps shape the future of the energy market and allows us to understand how we can best deliver value.

Stakeholder priorities, defined for our RIIO-2 BP1 plan, remain unchanged and, throughout the development of BP2, we have continued to listen and take on board feedback from stakeholders. We have:

- Tested with stakeholders that our proposals are well justified, particularly those undergoing significant change from BP1, using existing events where possible to minimise stakeholder fatigue.
- Clearly communicated our proposals and demonstrated how these have been shaped by stakeholder feedback.
- Continued to run our ESO RIIO2 Stakeholder Group (ERSG) – which provides feedback on our BP2 proposals and scrutinises our stakeholder engagement and delivery capabilities.

Figure 1: Consumer and stakeholder priorities

Consumer priorities

- We want an affordable energy bill
- We want a decarbonised energy system, fit for the future
- We want energy to be available when we need it
- We want a safe and secure energy system

Stakeholder priorities

- I want transparent and forecastable charges
- I want to provide more balancing and anciliary services
- I want efficient whole energy system operation
- I want to connect to the electricity network in a timely manner
- I want you to enable the smart, flexible and low carbon energy system of the future
- I want you to facilitate active markets for a wide range of products and services
- I want you to protect the system from cyber and external threats
- I want you to be open, engaging and easy to work with
- I want you to be adaptable and innovative
- I want access to comprehensive, accurate and user-friendly information

A stakeholder-led submission

Evolution of our plan between draft and final

Since we published our draft plan in April, we have gathered stakeholder thoughts on the content and structure of our plan via consultation responses, webinars, forums, and through our ESO RIIO-2 Stakeholder Engagement Group (ERSG).

From a structural perspective, stakeholders asked us to ensure our plan provides the following:

- Clarity on how we will prioritise the activity planned for BP2.
- Assurance that we can deliver everything that we have committed to.
- A clearer view of the benefits our activities will deliver.
- An easier to read document that draws out our priorities in BP2 and why they are important to us and to industry.

Since publishing our draft plan in April, we have also made material updates in three key areas of content:

1
Enhancing our balancing capability

We set out the outcome of our strategic review into the balancing capabilities that our Control Centre need to deliver reliable and secure system operation.

Our final submission sets out our stakeholder-endorsed roadmap, proposing an investment of £152 million[1] across existing and new systems. This is by far the biggest change to our plan. (This includes investments 180 Enhanced Balancing Capability, 210 Balancing asset health, 260 Forecasting enhancements and 480 Ancillary services dispatch.)

2
Balancing costs

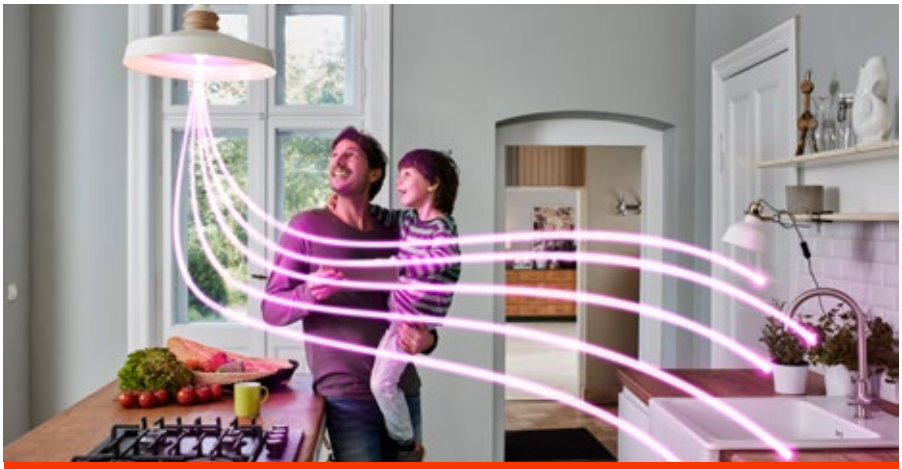
We continually take action to reduce balancing costs. Our final plan provides more information on the specific actions we are taking across the organisation to reduce balancing costs in all timescales.

3
Reforming the connections process

The efficient management of connection processes is important to our customers and stakeholders, and a key enabler for the connection of low carbon technologies to meet the UK's net zero target. Stakeholders have asked that we do more to reform the connections process and so our plans have been revised to set out how we will help drive wider connections reform.

ERSG, a group of senior leaders across the wider industry, scrutinised our proposals focusing on:

- Our stakeholder and consumer approach
- The strategic context and ambition for BP2
- Our ability to deliver on our plans.



£152m

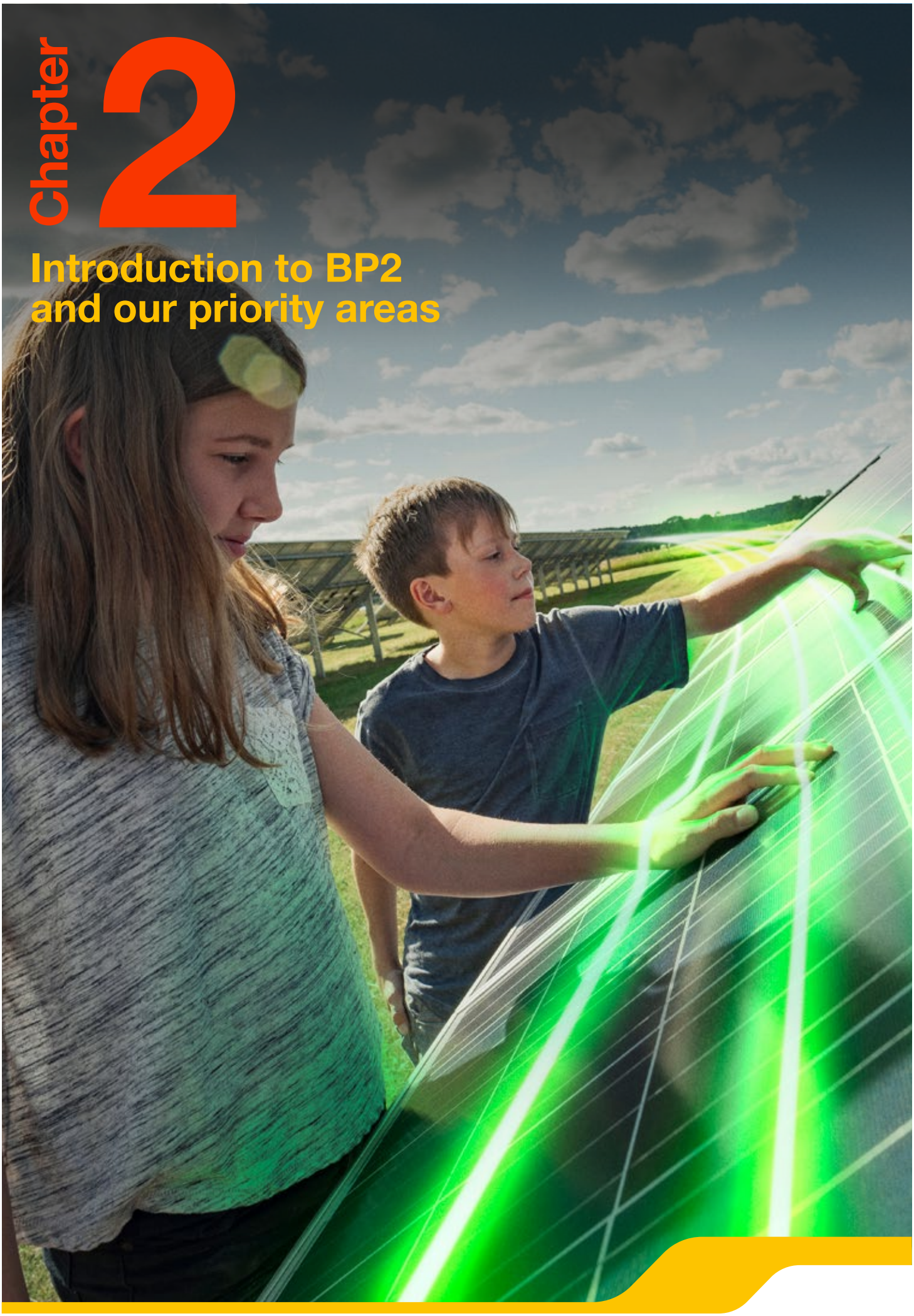
Proposed investment across existing and new systems.

For detailed stakeholder consultation responses, information on how we engaged with different groups and our 'you said, we did' overview please see Annex 3 – Stakeholder engagement

[1] National Grid ESO, 2019. Electricity Operational Forum:

Chapter 2

Introduction to BP2 and our priority areas



The value of net zero to Great Britain

Climate change is the challenge of a generation and action is needed urgently to make sure our world remains safe for generations to come. But tackling climate change also comes with the potential of unlocking significant opportunities and benefits for GB.

The opportunity for Great Britain in the transition to net zero is significant – attracting inward investment, creating regional growth and jobs, growing our economic productivity as well as benefits to society and the environment. But to access those benefits we will need to act together, across industries to ensure the transition is fair and affordable for all.

An unparalleled change is required in consumer behaviour and in technological progress to achieve net zero carbon in less than 30 years. Recent geo-political events and the associated impact on gas prices have compounded the importance of energy security to our nation, and the impact that the cost of energy has on every citizen.

The Great Britain energy system is the cornerstone of the net zero transition; the UK government's Ten Point Plan[4] puts one measure of the global investment opportunity at c. $11 trillion in zero carbon technologies for electricity systems by 2050. To help drive this investment, the UK government set out an ambitious vision in its 2022 Energy Security Bill. Within this, it prioritises an affordable, reliable, home-grown energy system with investment in clean technologies, ensuring the safety, security and resilience of the energy system, protecting consumers from volatile energy prices, and enabling export opportunities.

In 2021, the UK government confirmed its ambition to fully decarbonise the electricity system by 2035. Given our role at the heart of the energy industry, we have a unique opportunity to work with government and industry to solve some of the biggest challenges facing our nation. This is a journey and our plans in BP2 build further on the significant progress we have made in BP1. As the pace of change accelerates, we are looking further ahead, ensuring that as we deliver safe, reliable, efficient system operation today we are putting the foundations in place for key milestones in 2025, 2035 and beyond.

1.7m
Jobs created in net zero roles by 2030[2]

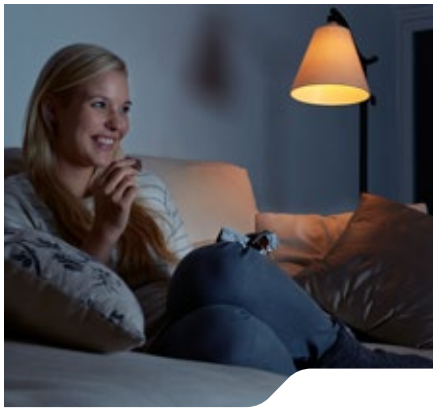
£53bn
Export and domestic contribution to the UK economy through net zero[3]

£35bn
Clean air benefit from a transition to net zero[3]

[2] Greening the Giants (ukonward.com)
[3] NZR – Final_Report – Published_version.pdf (publishing.service.gov.uk)
[4] The Ten Point Plan for a Green Industrial Revolution (publishing.service.gov.uk)
[5] bsi_nzb_report_2022-final.pdf (bsigroup.com)

2. Introduction to BP2

ESO stepping up to the challenge



Zero carbon operation of the electricity system means a fundamental change to how our system was designed to operate; integrating newer technologies across the system – from large-scale offshore wind to domestic scale solar panels – and increasing demand-side participation, using new smart digital systems to manage and control the system in real time.

Fintan Slye,
ESO Executive Director

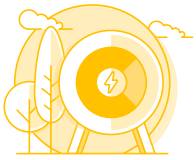
We are stepping up to face the challenges of decarbonisation, working with stakeholders and industry to establish innovative ways to manage the system we operate. And as the electricity system changes, so must the policy, markets and infrastructure that support it.

We play a central role in driving Great Britain's path to net zero and in supporting our stakeholders to make critical decisions along the pathway. We have refreshed our 2019 mission and ambitions to reflect the evolving needs of our stakeholders. We have tested our refreshed mission with stakeholders, including with the ERSG, to make sure we have the right focus for our BP2 commitments.

Our mission

To drive the transformation to a fully decarbonised electricity system by 2035 which is reliable, affordable, and fair for all.

Our refreshed ambitions



Ensuring the electricity system can operate carbon free by 2025
Our 'headline' focus – a clear and ambitious goal that we set ourselves in 2019 that is unchanged in its intent, and against which we are making good progress.

Driving competition for the benefit of consumers
We will maximise innovation and consumer benefit by driving value through competition in current and emerging markets. By bringing insight and encouraging collaboration, we will drive the transformation of markets, so they are fit for the future.

Being the net zero employer of choice
Building a talented and diverse workforce to overcome challenges on the path to net zero. We recognise the need to attract, retain and develop a purpose-driven, innovative and delivery-focused workforce if we are to achieve our mission.

Engaging as a trusted partner
We must work in partnership with our customers and stakeholders, leading efforts on the industry's most difficult challenges. We will be reliable in our approach, credible in our expertise, and use our impartial position to build on our established and trusted role as a key partner to others in the industry.

Being innovative, digital and data driven
IT and data are fundamental to our role and will have greater importance as the system becomes increasingly complex. Successful digitalisation of products, services and applications will further unlock innovation, flexibility, and transparency.

Our refreshed mission not only reflects the commitments we are making, but also aligns our focus more closely with that of the UK government, creating a shared goal for us to all strive towards.

Specifically, our mission recognises the imperative of a 'just transition' and the need to deliver benefits across the whole of society, being 'fair for all'.

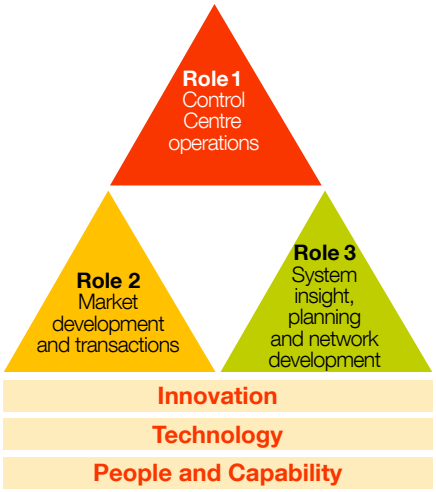
Our role has evolved through RIIO-2

Our RIIO-2 framework centres on three core Roles, as defined in Ofgem's role guidance:

Role 1 – Control Centre operations
Role 2 – Market development and transactions
Role 3 – System insight, planning and network development

Our activity in these three Roles is supported by a number of cross-cutting areas of focus.

Figure 2: ESO RIIO-2 Roles



The three Roles provide a useful and relatively simple framework for the breadth of our activities, and from a business planning and regulatory reporting perspective all of our activities and associated deliverables are captured under one of these three areas as a cross-cutting area of focus.

While the definition of the three Roles remains consistent as we move from BP1 to BP2, the scope of what each Role covers in practice is expanding. We are continuously understanding and responding to the changing needs of our stakeholders and building this into our plans.

In the BP1 period, we have already used the flexibility in our regulatory framework to invest in new activities (that were not included in BP1) across all three of our Roles.

Examples of these new activities include:

Role 1

Market Monitoring:
This new function monitors and reports to Ofgem on potential breaches of REMIT (including insider trading and market manipulation) and the Grid Code in balancing services including in the Balancing Market.

Our role has evolved through RIIO-2

Continued

Role 2

Net Zero Market Reform: creating the analytical basis and evidence to evaluate markets needed for net zero. This work will feed BEIS' Review of Energy Market Arrangements (REMA) project and will continue through BP2 as we further unpack the challenges and potential solutions.

Role 3

Offshore Coordination and Network Planning Review: creating clarity in the infrastructure needed to support 50 GW of offshore wind by 2030. We launched the first wave of this in the summer of 2022 and we are developing a forward-looking network planning and development process to support net zero.

You can read more about the benefits that these investments bring in Chapter 5: Benefits and investment in our plan.

The flexibility that is built into our regulatory framework has been critical to ensuring we can respond in an agile way to the evolving needs of our stakeholders and unlock new consumer value; we will continue to look for opportunities to better support our stakeholders and unlock additional value through BP2 in collaboration with Ofgem.

As we transition to the FSO, we expect a more fundamental review of our formal Roles will be required to ensure that our regulatory framework accurately reflects the evolution of our organisational and strategic objectives. We look forward to engaging with Ofgem and stakeholders on this.

Clarity on the outcomes we are seeking

Against the backdrop of a cost of living crisis, the impacts of the war in Ukraine on security of supply and the huge strides still required to achieve net zero by 2050, the competing demands of the trilemma are evident.

Our stakeholders have consistently told us that they see us at the heart of driving towards a fair, affordable and secure net zero energy system, and in today's context it is more important than ever that we carefully consider how we can best deploy our focus and resources to ensure successful outcomes for consumers.

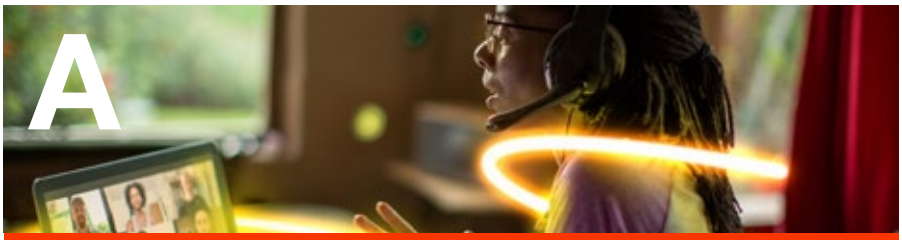
Every part of our business has a role in delivering across all elements of the trilemma. Therefore in defining the overarching outcomes we are seeking for consumers and for stakeholders we have initially stepped away from the regulatory construct of the three ESO Roles. (Note: we return to the Role structure in Part B, where our activities and deliverables are mapped to our three Roles).

In service of our mission, and considering the competing demands of the trilemma, the overarching outcomes we are seeking are as follows:

Figure 3: Framing our key outcomes through BP2

Our priorities in BP2

With clarity on the outcomes we are seeking, we have identified 11 priorities for BP2. Again, delivery of these priorities requires input from across the business, meaning that the activities and deliverables underpinning them are spread throughout the Business Plan – often touching all three Roles. In this Summary Business Plan, as we describe at a high level what we will deliver in BP2, we have provided signposts to the relevant chapters of Part B: Our BP2 Delivery Plan – where the supporting detail can be found.



Ensuring excellence in system operations

As we transition to a fully decarbonised energy system, the volume and characteristics of the assets on the electricity system will change significantly. Alongside changes in how consumers use energy, our system will require closer management as we progress towards net zero. For us, that means a big shift in how we manage the system, control costs and plan to protect Great Britain in emergency conditions.

Priorities

1 — Keeping the lights on
2 — Managing balancing costs
3 — Maintaining resilient and secure operations

Building efficient and effective markets

A key part of our role is to create the environment required to stimulate the necessary investment in technology and infrastructure to operate a secure and affordable zero carbon system. While the role we play differs across markets, we are driven by the belief that competition is key to fostering innovation, encouraging investment and securing the lowest cost to the consumer.

Priorities

4 — Reforming our balancing and ancillary service markets
5 — Supporting wider market reform

Our priorities in BP2

Continued

Driving to net zero

Ensuring all parts of the energy ecosystem – networks, markets, consumers – show up with the right solutions, at the right time, is critical to achieving net zero. Increasingly, our role in driving evidence-based decisions is fundamental to creating clarity and confidence across government, industry and investors.

Priorities

6 — Holistic planning and development for net zero

7 — Driving towards a whole energy system approach

Enabling our organisation to perform

To deliver on the outcomes and priorities we have set out, we will also need to evolve as an organisation to enable us to: deliver a scaled technology programme at pace, attract and retain the industry's best talent, and respond to changing stakeholder needs with agility and flexibility. Our remit will expand as we transition and transform to become the FSO.

Priorities

8 — Innovation and change through digital, data and technology

9 — Developing our people, capability and culture

10 — Focusing on our stakeholders

11 — Transitioning to the FSO

Our 11 priorities in BP2 will support the delivery of our outcomes, and in doing so help tackle the trilemma challenge. We are also clear on how these priorities individually and collectively support delivery of our mission and ambitions. For each of the 11 priorities, we have identified a 'primary' link to the ambition where we see delivery of the priority having the greatest impact, but we also call out significant secondary links, where a priority contributes more broadly to our success. We have limited these connections somewhat in the chart below, but note that all of the priorities could in some way be considered to support achievement of almost all of our ambitions.

Effectively prioritising our portfolio of work

The scale of delivery we are proposing in BP2 represents a step change from BP1, with an increase in average spend per year to £303m. This is an increase over the five-year RIIO-2 period of £135m capex and £89m opex compared to our BP1.

To achieve the £2.8 billion benefits linked to that investment we must continually assure ourselves of our ability to deliver, while maintaining the flexibility needed to respond to the changing needs of our stakeholders and the broader energy market. In planning for the BP2 period, we have thought carefully about our 11 priorities and the detailed deliverables we are committing to.

However, we are acutely aware that a rapidly evolving energy landscape, and an ambitious delivery plan, means we will need to continually reassess where we are directing our resources to ensure we optimise overall benefit for the consumer. In particular, we are mindful of the level of transformational change required to deliver the ambitious proposals in BP2 while at the same time separating from National Grid plc and establishing the FSO. We have assessed – at a high level – the deliverability of FSO and BP2 and, based on the assumptions in our indicative plan for FSO, we have not identified any red flags. However, we are currently working with National Grid, BEIS and Ofgem to create a shared blueprint for separation – refining our assumptions, working towards detailed design, and setting out an updated delivery plan. Through this process we will reassess deliverability of the FSO and BP2 plans and will provide feedback to Ofgem, BEIS and stakeholders.

Our approach to prioritisation

Throughout BP1 we have continuously prioritised our efforts, however stakeholders have told us that they would like more transparency around our prioritisation process and how we adapt our plans over time. Work is under way to review and strengthen our process to provide greater external transparency of the decisions we make. Below we have set out the guiding principles that inform our decision-making, and the practical approach we take considering and making changes to the plan.

Our prioritisation principles and approach

Deprioritisation is not always the default: with sufficient time/notice, our regulatory framework allows us to expand our resources to take on new activity, without sacrificing plan deliverables, if we are confident of consumer benefit. Recent examples include our Offshore Coordination activities, which were not part of our original plan.

Assessing how we react to events outside our control

Where we have to accommodate unplanned urgent activities or internal constraints, we use a prioritisation approach based on benefits, external/internal dependencies, alignment with delivery priorities and the capability we need to deliver the requirement. Keeping the lights on and safety will always be our top priorities.

Effectively prioritising our portfolio of work

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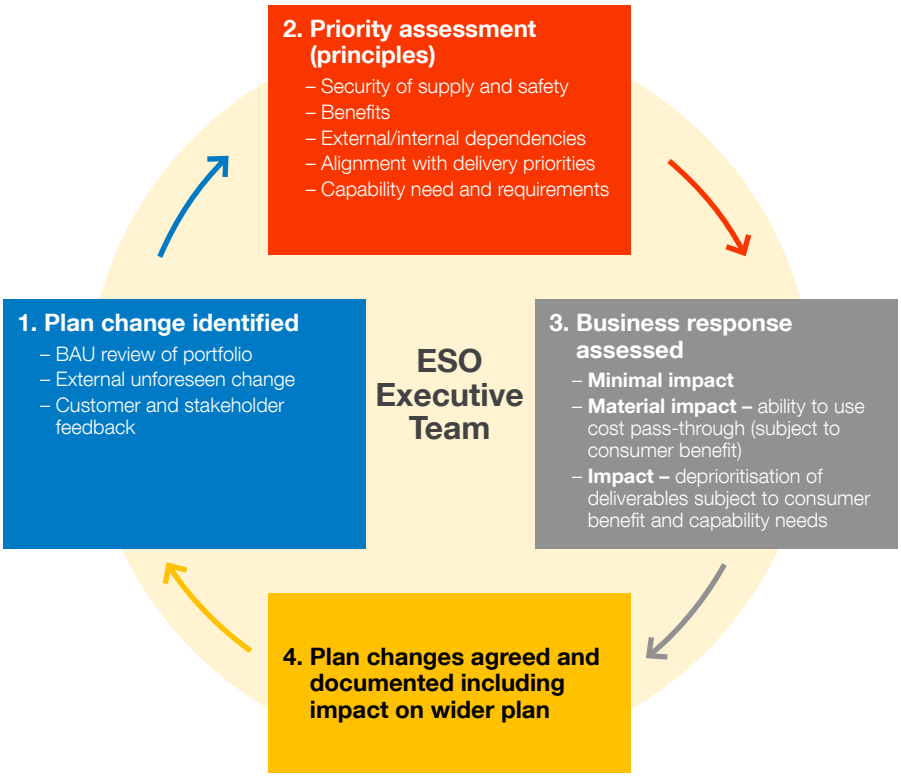
Figure 4: Prioritisation principles and approach



Our prioritisation decisions will not always align to deliverables that deliver the highest consumer benefit:
Our skills and capabilities are finite. Our prioritisation decisions will factor in available capabilities, which may mean that urgent tasks requiring specialist skill sets result in high priority deliverables are delayed.

We will use our best judgement and continue to review our decisions to seek to reduce any long-term impact on our transformation programmes.

We will more explicitly highlight the impact prioritisation has on our delivery plans:
We will seek to provide greater transparency of our decisions through our regular incentives reporting.

Figure 5: Key components of delivery assurance

Read more about our prioritisation approach in chapter 3 of our Summary Business Plan.

Understanding the impact of dependencies on prioritisation

Understanding our dependencies

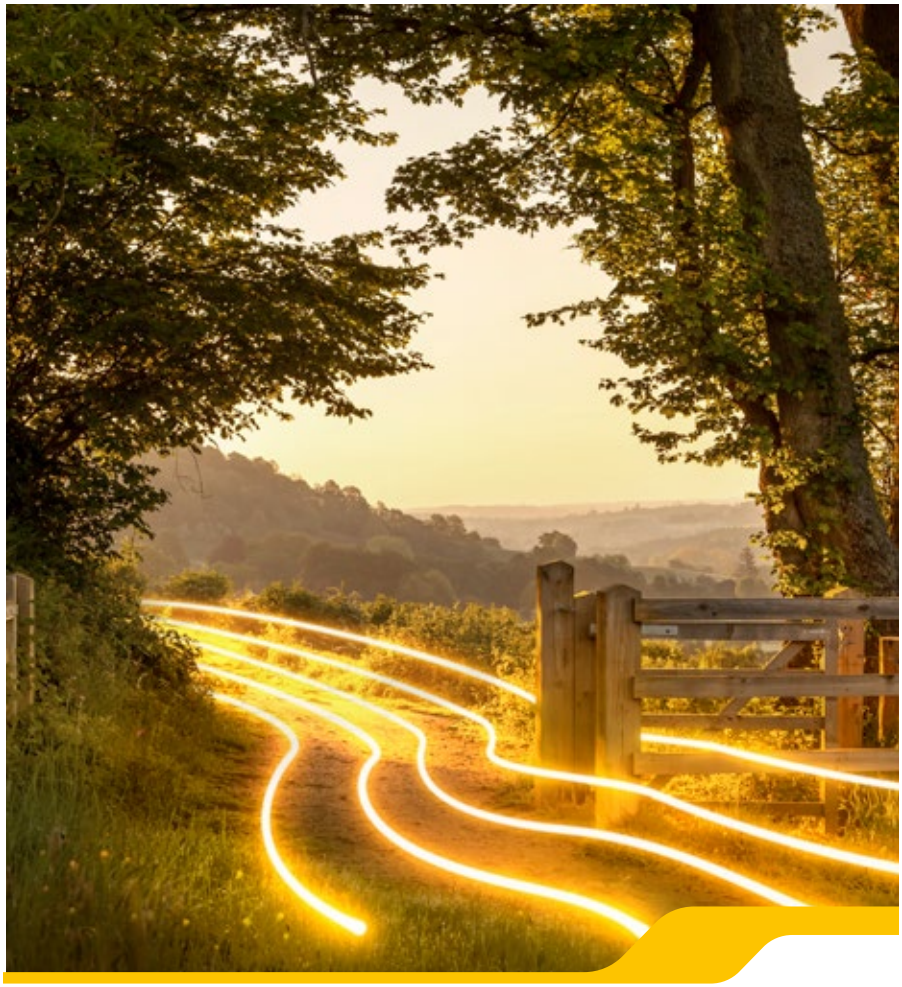
The most complex element of prioritisation is in understanding how activities in our plan are interconnected. The level of interdependency in BP2 is significant. Our interdependency mapping, as seen in Figure 6 on the following page, helps us understand where changes to one activity could eliminate, or materially erode, consumer value in another. We cannot consider the value of any one activity in isolation as part of our prioritisation; we need to fully understand the wider contribution of each activity across all deliverables.

To support our ongoing prioritisation, we have mapped the external dependencies that may impact our plan, as well as the internal interdependencies of each activity within our plan.

The mapping identifies the value of each activity as well as the contribution of each dependent activity to value creation. It is this detail that is fundamental to our prioritisation.

To deliver the value set out in our plan, there are a number of key external dependencies over which we may have some influence but ultimately we do not control.

It is equally critical that we understand and communicate these dependencies to support a more holistic understanding and approach to industry-wide prioritisation.



Understanding the impact of dependencies on prioritisation

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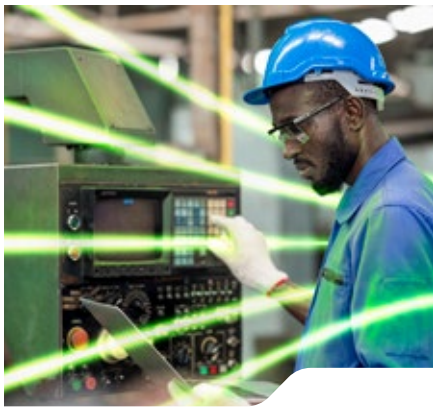
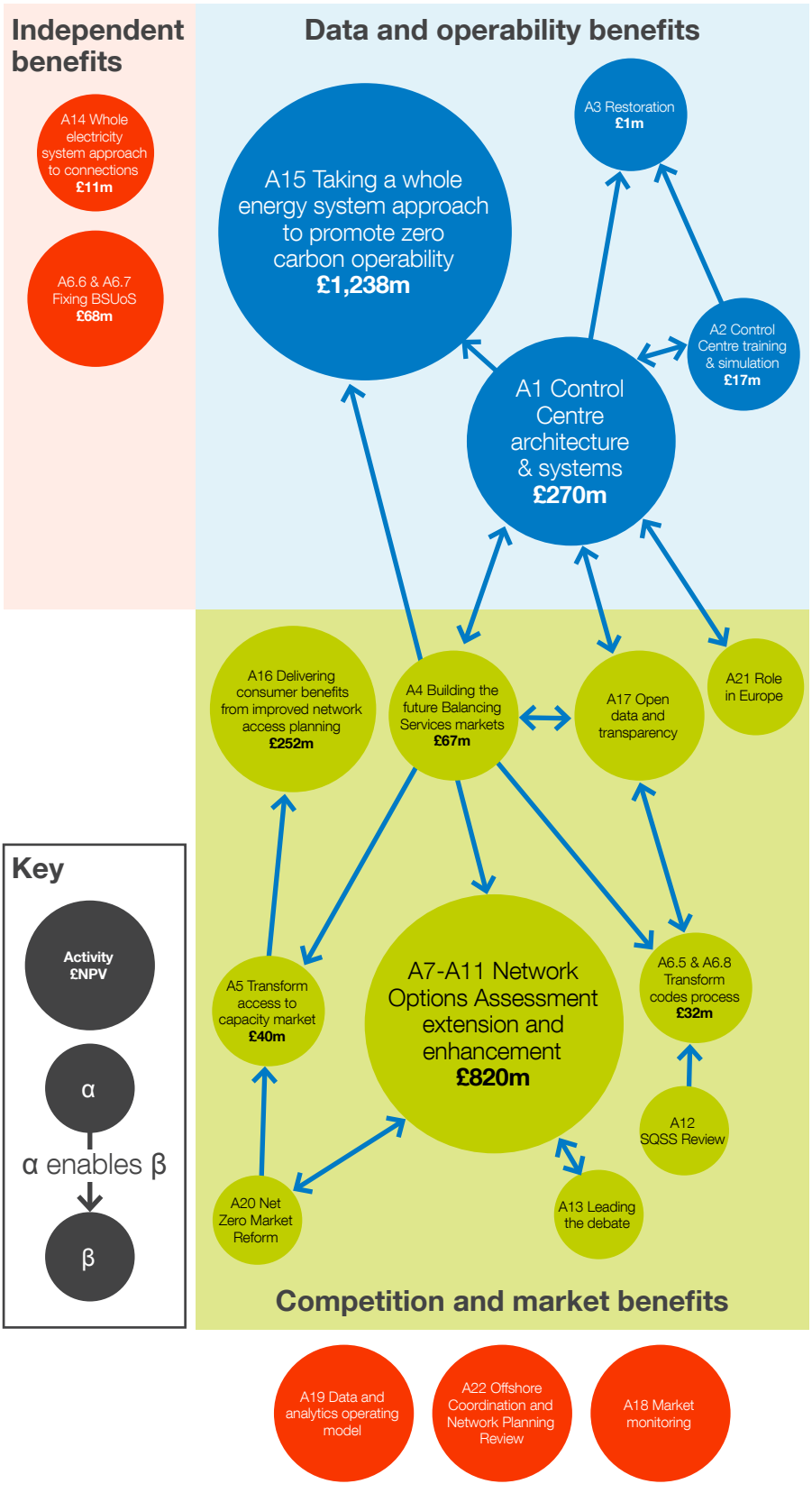


Figure 6: Internal activities interdependency mapping



Understanding the impact of dependencies on prioritisation

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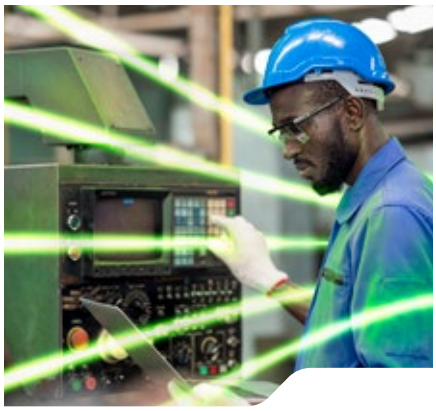
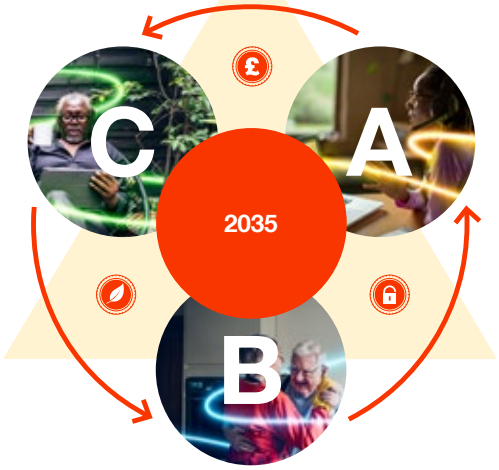


Examples of critical dependencies during BP2

External
Policy decisions are our biggest external dependency. Key decisions in BP2 include:

- **BEIS' Review of Electricity Market Arrangements:**[6] potentially impacts our market reform roadmaps, our balancing system design and our EMR delivery body roles.
- **Outputs of the data and digitalisation taskforce:** potentially impacts the scope of our role in this space and our data and analytics investments.
- **The outcome of Ofgem's call for input considering the future of local energy institutions and governance:** potentially impacts how we engage and work with distribution system operators (DSOs) and other local and regional energy institutions.
- **Further decisions on the roles of the FSO:** potentially impacts on the scale of our capability build, within our existing national control, markets and networks functions, as well as across other sectors and energy vectors e.g. heat, hydrogen and transportation.

Confidence in the regulatory framework: Our regulatory framework is also a key external dependency. We need confidence in the regulatory framework to support investment in complex, multi-year plan deliverables and to allow us to respond flexibly to new opportunities to add value for consumers.



Internal
Key dependencies on two of our largest benefit areas in BP2:

Whole system zero carbon operability – dependent on:

- **Network control technology investments:** to support faster decision-making across larger volumes of assets.
- **DER (Distributed Energy Resources) visibility investments:** to widen participation and create the tools needed for future network balancing.
- **Future waves of Network Services Procurement:** to create the flexibility needed for net zero operability.

Whole system network architecture – dependent on:

- Continued advancement of **Network Options Assessment (NOA),** to provide the principles and mechanisms developed through NOA.
- Taking a **whole electricity system approach** to connections to consider future participants on the grid.
- Development of the **Network Planning Review** to provide a holistic view of the network.

[6] BEIS and Ofgem, 2022. Future System Operator Government and Ofgem's response to consultation

Our plan in numbers

By or in

2024

FSO established

£3bn

reduction in future electricity system costs through FSO[7]

£135-£185m

One-off cost for transition to the FSO

£2.8bn

in benefits delivered to consumers over the RIIO-2 period

£8m

continued ESO internal efficiencies delivered per year compared to RIIO-1

£556m

IT portfolio capex and opex investment over RIIO-2

£50m

innovation funding needed across RIIO-2

314 FTE

Total increase from the final RIIO-2 BP1 Plan (by 2024)

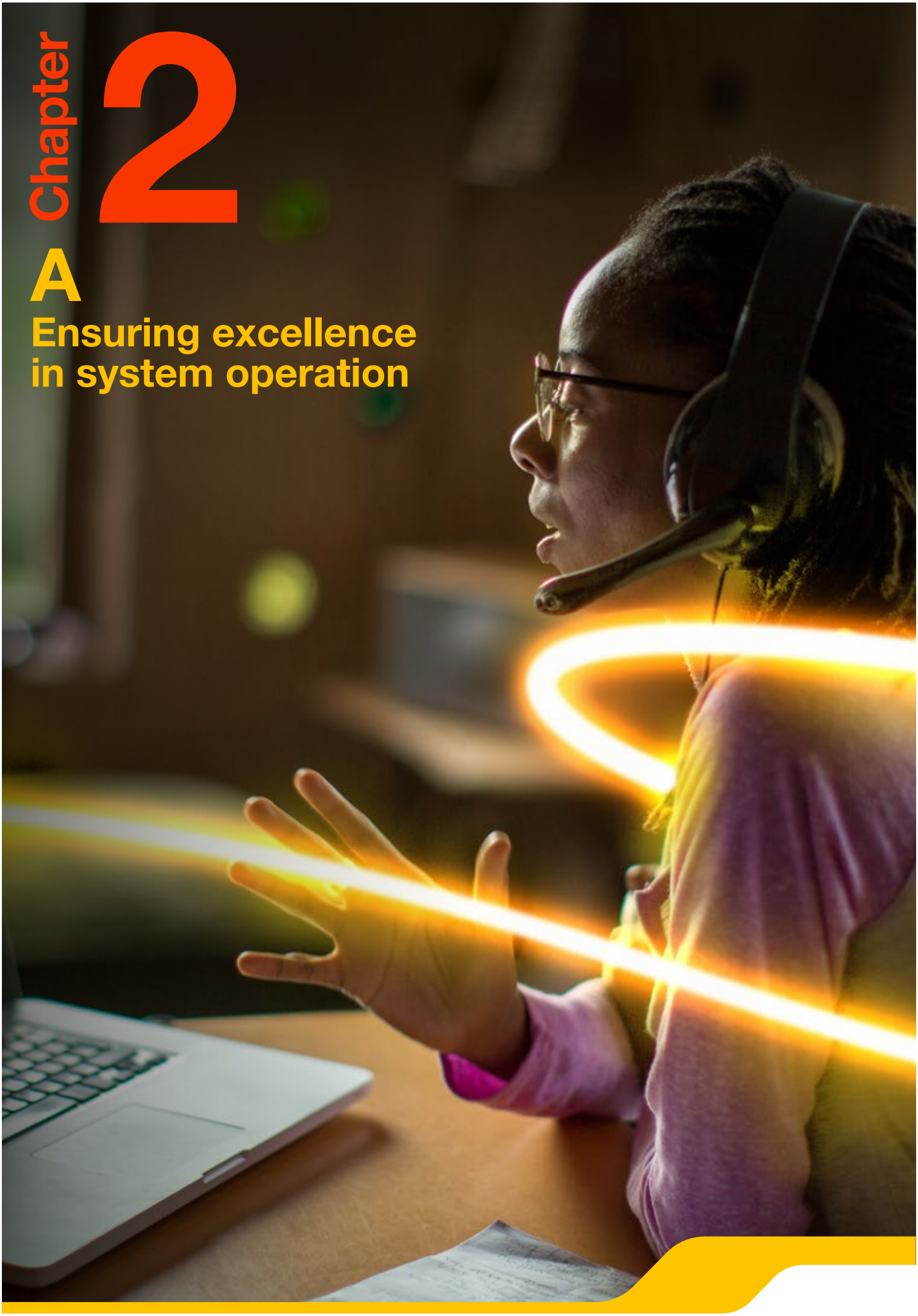
£3.90/bill

net reduction per year from the level it would have been without our actions

[7] BEIS, 2021. Future System Operator Consultation Impact Assessment

Chapter 2

A Ensuring excellence in system operation



2. Ensuring excellence in system operation

Why is 'Ensuring excellence in system operation' important for us and the industry?

50GW

Facilitated by Pathway to 2030 and the Holistic Network Design[8]

2.3m

Electric heat pumps by 2025[9]

GB has one of the fastest decarbonising electricity systems in the world.

The government has set a clear target to fully decarbonise our energy system by 2035 and set out enabling policy positions such as the target of reaching 50GW offshore wind by 2030.[10] This will need a significant change in operational capability, from the 13.1GW installed capacity we have today.

The way we consume electricity will change too. As we decarbonise the nation's heat and transport infrastructure, the rapid uptake of heat humps and rise in electric vehicle (EV) ownership expected through the 2020s and 2030s will further shift the intensity and timing of energy consumption away from the more predictable patterns we have always known.

In the control room we are already experiencing and responding to high growth in renewable generation and many smaller units coming onto the system. Impacts on system operability will continue and further intensify, as we overlay changes on the supply side with more significant shifts on the demand side.

Right across the organisation we are already taking action to understand and address changing operability needs in the key areas of frequency, stability, voltage, thermal and restoration. We know that the growing number of assets on the system, and their changing characteristics, means we need greater visibility and control than we have ever had before – requiring a significant investment in our people and system capabilities.

Through our BP1 and BP2 proposals we are taking action to get ahead. We track our progress towards enabling a zero carbon grid through our Zero Carbon Operability (ZCO) metric, a measure of the proportion of zero carbon generation of the total generating capacity at any given time. Through the operability work we have done in BP1, for example in the procurement of inertia, we can already manage a system of ZCO 80 per cent. In BP2 we are proposing further investments to meet our stated ambition to be able to operate the system at zero carbon for short periods by 2025[11], en route to achieving the government target of a fully decarbonised system by 2035.

Of course 'Ensuring excellence in system operation' goes beyond our own system operability needs. It is equally important for our stakeholders and consumers. We must ensure we are an enabler to the new technologies and business models that will be required for a decarbonised energy system by 2035 and net zero by 2050; we must focus on managing the significant upward pressure on balancing costs; and we must consider the resilience and security of our operations.

[8] National Grid ESO, 2022. The Pathway to 2030 Holistic Network Design
[9] National Grid ESO, 2022. A Day in the Life 2035
[10] BEIS, 2022. British Energy Security Strategy
[11] National Grid ESO, 2022. Operability Strategy Report

Priority 1: Keeping the lights on

How does this link to our ambitions?

£46m
Investment in network control technology (Role 1)

We have defined three priorities that are central to our ability to deliver a fully decarbonised electricity system by 2035 while ensuring excellence in system operation:

1
Keeping the lights on

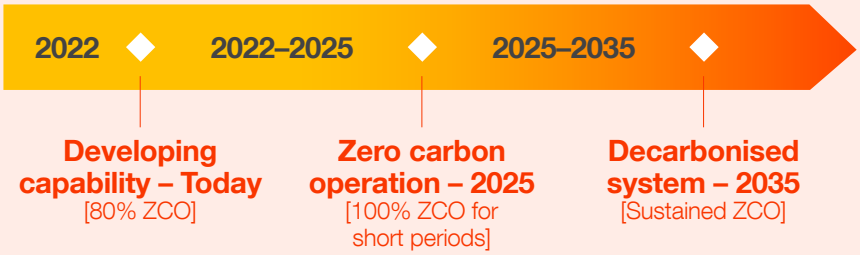
2
Managing balancing costs

3
Maintaining resilient and secure operations

The ESO is responsible for co-ordinating and directing the flow of electricity onto and over the national electricity transmission system in an efficient and co-ordinated manner. The Secretary of State has a principal objective which includes protecting the interests of consumers with regard to security of supply. We consistently hear from our stakeholders that 'keeping the lights on' must continue to be our highest priority. To do so while transitioning to net zero will demand significant capability and capacity build within our Control Centre. An important focus for us in BP2 will be delivering significant IT change against a backdrop of wider organisational change including the transition to the FSO.

Throughout BP2 we will maintain and ultimately decommission various legacy IT systems while, in parallel, investing in and developing new technology within our control centre. Underpinning this, we will also grow the capabilities of our people.

Our decarbonisation journey will be delivered in phases. We will not get to zero carbon operation in one step and will need to continue to improve our ability to support a fully decarbonised grid for longer and longer periods of time.



Priority 1: Keeping the lights on

Continued

How does this link to our ambitions?

Read more about our activities in in the Balancing Programme (A1) and Control Centre operations (A1, A2 and A3) in our BP2 Delivery Plan.

People and capability

As we transform our technology capability to meet the changing requirements of the electricity system, we must also invest to ensure we have the right people, capability and capacity to deliver. Investment in our people is a key focus for us in BP2.

The complexity of managing the electricity system has increased – technology has a critical role to play in enabling faster decision-making in the Control Centre. We are already working to enhance our approach to training through digitalising much of our training and building partnerships with academic institutions and schools' STEM programmes. A key part of our Control Centre training and simulation activity will be to introduce a new training simulator for our Control Centre staff. This simulator will be the first use-case of our digital twin product, and will enable controllers to simulate their response to various net zero scenarios in real time.

We must also look beyond the traditional skill sets we associate with electricity system operation to the skills that will enable us to operate in a fully digital world. Investing now to build our skillset in data science, analytics, modelling and automation will be critical to building a flexible and agile workforce to lead our future system operation. We are doing this through innovative new recruitment campaigns, targeted recruitment through appropriate channels and ultimately through building an employee value proposition that will enable us to attract and retain these skills in a very competitive market.

The Balancing Programme

The Balancing Programme is a key IT programme, designed to develop the balancing capabilities that the Electricity National Control Centre needs to deliver reliable and secure system operation, facilitate competition and meet our ambition for net zero carbon operability. Our current IT systems cannot accommodate the level of change required in the energy system to achieve full decarbonisation, therefore significant investment is required to develop new capabilities to meet changing requirements and market conditions.

The Balancing Programme will modernise and transform our balancing capabilities and associated platforms; this is a key enabler to the £2.8 billion in benefits delivered by our overall BP2 plan. Given the scale, complexity, and importance of this programme we have engaged in detail with internal and external stakeholders through a comprehensive 6-month review and updated our programme plans and costs in response. At the conclusion of our review, in May 2022, we were clear that the revised Balancing Programme will deliver significant net benefits of £200m–£650m over an increased cost to deliver (up from £58m totex in BP1 to £152m totex in BP2). We are now delivering in line with a co-created, industry-endorsed roadmap, and have committed to ongoing detailed engagement with stakeholders throughout the life of the programme.

This investment will ensure that we have the vital flexibility to facilitate expected and emerging changes across the industry. We have assessed what is required to deliver the Balancing Programme while maintaining our existing systems for the interim period and enabling market changes to continue. We have a robust understanding of the complexity of change required, the large number of dependencies involved in transitioning from old to new systems, and how we will manage them.

Network control

Critical to our ability to take more actions, more quickly in the control room is to upgrade our Network Control Management System (NCMS), which will replace our current real time situational awareness tool, the Integrated Energy Management System (IEMS). By the end of RIIO-2, this £46m investment will deliver a fully operational NCMS suite that is integrated into our new Critical National Infrastructure (CNI) data centres.

Once complete, it will provide a more agile tool that will be able to adapt to the changing system requirements and ensure continued cyber resilience in a rapidly changing landscape. Over the longer term, the NCMS solution will form the basis of the wider IT system landscape to support whole system operation, enabling greater interoperability with the distribution system operators.

Priority 1: Keeping the lights on

Continued

How does this link to our ambitions?

Alongside NCMS we are also investing to build our visibility and understanding of the electricity system. For example, we are investing in tools to support greater DER visibility across the distribution network, improved network scenario modelling capabilities, and a better understanding of the level of inertia we carry on the system at any time. Each of these will help us to keep the system secure while transitioning to net zero.

It is important to note that these are complex IT programmes, involving mission-critical systems and significant dependencies (for example, IEMS is currently a shared IT system with National Grid Electricity Transmission). As we transition to new control room IT systems, we must continue to mitigate and manage the electricity system operability risk. We talk more about our approach to IT delivery in Priority 8.

Growth in DER and our interaction with DSOs: As we transition to net zero, we will develop new tools to facilitate whole electricity system market access for DER and to facilitate the DSO transition, through advancement of decentralised local markets, and the functions and services needed to run these future markets.

By 2025, we believe that DER could make up a larger slice of the energy mix, both for the balancing of energy and also for the provision of other system services. There will likely be a greater need for operational coordination between us and the DSOs. Underpinning this will be a significant increase in the volume of real-time data exchanged between Control Centres. Through transforming our capabilities in real-time operations and longer-term planning in BP2, we will develop consistent approaches, enabling efficient dispatch and better support for consumers.

Resource Adequacy: Policy decisions by government on the resource mix we seek as a nation will be critical in determining our path to net zero. Alongside the right markets and networks for net zero we must ensure that we have adequate capacity through a resource mix that is secure, reliable and flexible. We already support government policy through providing insight and data and, as BEIS considers the future of the Capacity Market (CM) and Contracts for Difference (CfD) regimes, we see our role growing to support confidence in energy security, affordability and progress towards net zero over the longer term.

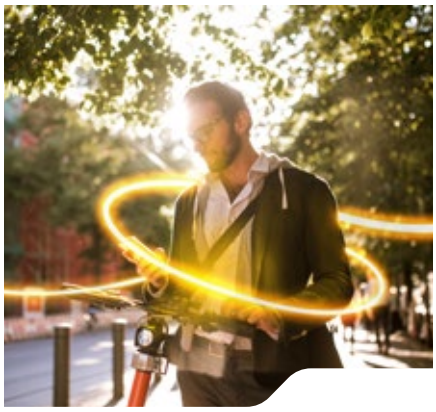
In BP2 we will focus on two areas with respect to resource adequacy:

Enhancing our adequacy studies, building on the work we have recently concluded with Afry on a study of potential resource mixes in 2035. In BP2 we will further build on this important work, undertaking stakeholder engagement and modelling enhancements, to develop a second capacity adequacy study in the first half of 2024/5. This will explore options for the capacity mix to deliver adequacy through the 2030s and support policy development to meet net zero.

Improving our security of supply modelling capability as agreed with BEIS, Ofgem and BEIS's Panel of Technical Experts (PTE), through the use of enhanced modelling and more granular data sets. Our 2023 and 2024 Electricity Capacity Reports (ECRs) will reflect our updated supply-side modelling and CM recommendations, enabling more informed and timely supply-side decisions e.g. through the inclusion of renewables and the volume of capacity to be procured internationally.

Read more about our activities in adequacy (A5) in our BP2 Delivery Plan.

Priority 2: Managing balancing costs



How does this link to our ambitions?

To demonstrate excellence in system operation we must deliver on our role in managing balancing costs, using all the levers available to us as system operator, and supporting Ofgem, BEIS and industry more broadly to play their part. We do not control all the drivers of balancing costs, but we recognise and take very seriously our role in doing everything we can to reduce them over the short, medium, and long term.

Balancing Costs have significantly increased over last two years, from £1.3 billion in 2019/20 to £3.1 billion in 2021/22. The main drivers of the increased costs in 2021/22 were:

- Correlation between the high cost of gas feeding through to electricity prices and balancing costs.
- Gas and coal generator market strategies e.g., coal generators setting the marginal price at £4,000/MWh, coupled with some scarcity pricing leading to high costs on low margin days.
- Constraints costs, mainly the cost of replacement energy when wind generation is constrained in Scotland and the North of England.

However, balancing costs are lower than they otherwise would have been without our action in BP1, and will be mitigated further in BP2 by actions that are already in train:

Delivery of the Five Point Plan to manage constraints[12]: i) Providing clearer Balancing Service Use of System (BSUoS) cost forecasts, ii) developing new intertrip capability, iii) working with regional networks on a whole electricity system approach to constraint management, iv) exploiting storage potential in a heavily constrained network, and v) continuing to improve the current network.

The Frequency Risk and Control Report[13] (FRCR), and Dynamic Containment Low service: This implemented a risk-based approach to our frequency policy in 2021, and was a significant driver of the reduced volume of actions. It has already saved an estimated £435m in balancing costs when combined with the recently introduced Dynamic Containment Low service and will be further reviewed on a regular basis.

Outage optimisation activities: In collaboration with our customers and stakeholders our outage optimisation activity has released around 24,600 GWh of constrained generation capacity, saving an estimated £1.8 billion in balancing costs over the past year.[14]

Read more about our activities in Managing balancing costs (A1, A4, A15) in our BP2 Delivery Plan.

[12] National Grid ESO, 2021. Our 5-point plan to manage constraints on the system
[13] National Grid ESO, 2022. Frequency Risk and Control Report
[14] https://www.nationalgrideso.com/document/259971/download

Priority 2: Managing balancing costs

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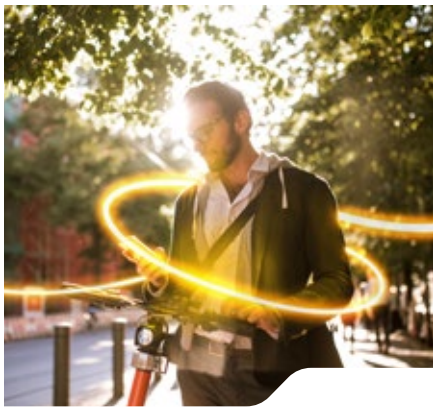


While we have demonstrated that our current actions are already serving to mitigate rising costs, we are redoubling our efforts in light of the energy price crisis. Accordingly, an end-to-end review of the real-time drivers of balancing costs will be undertaken; using this insight, we will increase our focus on driving operational efficiency in our actions, cost transparency in markets and cost effectiveness in new or enhanced activities.

We have identified a significant number of improvement ideas across the business, some of which are already being trialled and implemented.

We are also undertaking broader activities which will also reduce these costs, including:

- Taking a holistic view of the network through the first Holistic Network Design (HND), which will be developed further through transitional phases of the Central Strategic Network Plan (CSNP).

This will ensure the costs of connecting and transporting power across the transmission network are minimised, keeping constraint costs down:

- Optimising and reforming our ancillary services, products and markets to improve our approach to balancing demand and supply, expanding supplier options and keeping costs down for consumers.
- Improving monitoring and measuring activities, to ensure improvement activities are tracked, and benefits measured, for example through Regional Development Programmes (RDPs), where we are working with DNOs to deliver coordinated real-time constraint management systems.

How does this link to our ambitions?

£1.8bn

Of savings in balancing costs due to outage optimisation in 2021/22.

Read more about our activities in Managing balancing costs (A1, A4, A15) in our BP2 Delivery Plan.

Priority 3: Maintaining resilient and secure operations

How does this link to our ambitions?

Cyber secure operations

Our role in the Great Britain energy ecosystem means that the protection of our assets, people and technology has long been a priority for our business. As the nature of the threat and the needs of our stakeholders change, our response must continually evolve, enabling us to meet a new set of challenges head on.

Energy has become a strategic target. The geo-political context has changed, with cyber threats becoming increasingly complex. Heavily funded Foreign State driven cyber attacks have focused on disrupting critical infrastructure, industrial control networks and utilities.

With our vision for increased interconnectivity and transparency across a broader virtual system, our vulnerability also increases with the potential for a broader attack footprint.

Over the last decade, we have seen attacks on the energy sector increase in frequency and magnitude. Three common methods of attack have been identified; Big game ransomware, Attacks on operational technology, and Supply chain attacks, with the goal of disrupting and harming the environment, the economy and society. Maintaining secure control of our systems is central to all that we do. Cyber security is a priority for us, and we work hard to ensure that we have strong, fit-for-purpose system defences that evolve with the external threat.

Cyber security is at the heart of ensuring excellence in system operation. Our cyber services are currently delivered by National Grid Security, and together we will invest heavily to continue to enhance our cyber capabilities as follows:

- **Systems:** we will enhance our existing Endpoint Protection, Vulnerability Management, and Access Management tools to meet the evolving threat landscape.
- **Processes:** we will evolve our cyber processes including Risk, Incident, Response, and Assurance, to ensure they align with the NIS-D standard and future cyber security standards.
- **People:** we will review and enhance our cyber training protocols to continuously improve cyber awareness within our organisation, and those of our key partners.
- **Partners:** we will deepen and improve our relationships with key cyber partners in industry and government, including key service providers, regulatory bodies, government, and the National Cyber Security Centre (NCSC).

Priority 3: Maintaining resilient and secure operations

How does this link to our ambitions?

£11m

additional benefits from Restoration activities in BP2, compared to BP1.

Restoration

A key part of maintaining resilience and security is ensuring we are ready for restoration in a fully decarbonised system; i.e. the process used to restore power in the event of a total or partial shutdown of the national electricity system.

To date, our ability to do this has relied on traditional thermal plant. However, as we transition to operating in an environment with a higher penetration of renewables, we need to identify and implement contingency arrangements as part of our operability strategy.

The UK government's new Electricity System Restoration Standard (ESRS) is the revised arrangement which reflects the changing generation mix. Working with industry, the devolved administrations and Ofgem, the UK government has undertaken a review of the current regulatory framework for dealing with widespread electricity failure. The new standard intends to strengthen the current regulatory framework by introducing a legally binding target for the restoration of electricity supplies in the event of a nationwide electricity failure.

To comply with this, we are reviewing our restoration plans and the obligations we place on the electricity industry, and considering the procurement of additional restoration services from traditional and non-traditional sources. In doing so, we are providing continued energy security to our consumers and society.

Additionally, as our restoration services mature, we will further open up our markets to enable a wider variety of providers, such as interconnectors and DER, to provide us with additional options to restore the system.

Addressing this challenge is our world-first initiative, Project Distributed ReStart, which is exploring how DER, such as solar, wind and hydro, can be used to restore power to the transmission network in the unlikely event of a total or partial shutdown of the National Electricity Transmission System. This project has been awarded £10.3m of Network Innovation Competition (NIC) funding, demonstrating the industry-aligned view of the criticality of exploring radically different approaches to system restoration.

Emergency Management

Security of supply challenges in recent years have shone a spotlight on cross-vector interdependencies and their criticality in ensuring a successful emergency response. Whether in the form of control room to control room engagement during the 'Beast from the East', transmission/distribution interactions, when managing periods of low demand during the Covid-19 pandemic, or the impact of gas supplies on electricity security of supply during the unlawful invasion of Ukraine by Russia, it is increasingly evident that, in an emergency scenario, we must have the ability to take a whole system approach.

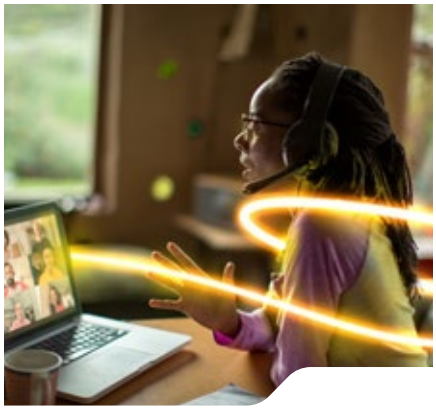
The proposed statutory duties for the FSO recognise this interaction, requiring the FSO to manage the trade-offs and synergies between:

- achieving net zero;
- ensuring security of supply of electricity and gas; and
- ensuring an efficient, coordinated and economical electricity and gas system.

As part of our transition to the FSO, we propose to establish an Office of Energy Resilience and Emergency Management, enabling a step change in our ability to strategically manage emergencies. The Office will be responsible for cross-vector energy resilience, emergency preparedness and emergency response. It will engage extensively across governing bodies and industry, taking a whole system approach to emergency planning, training, scenario planning and testing. This will therefore enable us to help adopt a whole energy system response across energy vectors.

Read more about our activities in supporting restoration (A3, A6) in our BP2 Delivery Plan.

2. Linking to our BP2 Delivery Plan



This chapter has provided an overview of the outcome – ensuring excellence in system operation.

Below we summarise the breakdown of priorities in this area and the activities in BP2 that relate to each. These are further explained in Part B: Our BP2 Delivery Plan.

Priority Area	Priority (Part A)		Activities (Part B)
Ensuring excellence in system operation	1	Keeping the lights on	– **A1** (Role 1) Control Centre architecture and systems – **A2** (Role 1) Control Centre training and simulation – **A3** (Role 1) Restoration – **A5** (Role 2) Transform access to the Capacity Market and Contracts for Difference
	2	Managing balancing costs	– **A1** (Role 1) Control Centre architecture and systems – **A4** (Role 2) Building the future Balancing Services markets – **A15** (Role 3) Taking a whole energy system approach to promote zero carbon operability
	3	Maintaining resilient and secure operations	– **A3** (Role 1) Restoration – **A6** (Role 2) Develop code and charging arrangements that are fit for the future

Chapter 2

B Building efficient and effective markets

2. Building efficient and effective markets

Why is 'Building efficient and effective markets' important for us and the industry?

To enable delivery of net zero, government, Ofgem and industry must work together.

Delivery of a decarbonised electricity system by 2035 will require significant investment across all parts of the energy sector, and in generation capacity and network infrastructure in particular. Creating the right signals and vehicles to encourage efficient investment is central to an affordable transition to net zero.

We believe there is value in driving this investment through competitive markets, to secure innovative solutions and investor confidence at the lowest cost to the consumer.

The current suite of electricity markets were not designed for net zero and, if left unchanged, will have wide-ranging impacts on the future cost and operability of the system. Examples include imposing excessive constraint costs and inefficiencies in balancing the network, delaying or preventing full decarbonisation of the system and inhibiting the potentially significant and currently largely untapped contribution of demand-side flexibility.

To enable delivery of net zero, government, Ofgem and industry must work together to evolve, adapt and reform electricity markets and industry frameworks. If we get this right, we can widen market participation, lower costs and drive even further innovation into how we operate.

We have a direct role to play, in ensuring timely and effective reforms to the markets we manage today. Our Markets Roadmap[16] sets out how we plan to adapt our balancing and ancillary services markets to ensure providers can develop and offer the full range of products and services we need to manage the systems in real time.

This is a journey that runs across the whole of RIIO-2, requiring the design and delivery of a new suite of products and the ramp-down and removal of the products they have replaced. The transition must be carefully managed to ensure continued safe and efficient system operation, while encouraging innovation and enabling investor confidence.

Looking beyond the markets we operate, wholesale and capacity markets must also be reformed to account for the significant portion of generation capacity operating at near zero marginal cost, in a system where network and constraint costs will have a material impact on the economics of delivered power. Creating markets that signal and reward the need for efficient investment across our system is central to our journey to net zero.

Beyond electricity, as we transition to the FSO, we will also need to think more expansively about the markets we support. With the government's ambition to create a hydrogen and carbon economy by 2030[17], we stand ready to support them in creating the right markets to support delivery.

£130m

Increase in benefits compared to BP1, from embedding Pathfinder projects[15]

[15] https://www.nationalgrideso.com/document/249951/download – incentives report page 14
[16] download (nationalgrideso.com)
[17] UK Hydrogen Strategy (publishing.service.gov.uk)

Priority 4: Reforming our balancing and ancillary service markets

How does this link to our ambitions?

To build efficient and effective markets, we have identified two priorities to unlock the opportunities of a low-cost and low carbon electricity system of the future.

4

Reforming our balancing and ancillary service markets

5

Supporting wider market reform

Through our balancing and ancillary service markets, we procure the services we need to operate the system today and into the future, in the most cost efficient manner. Our markets are a key driver for technology innovation and investment, providing the signals for industry to invest and deliver a zero carbon energy system. We recognise that, in the uncertain and changing context in which we operate, we need a sharp focus on how we go about reforming our markets. We need to engage early and often with our stakeholders, be transparent in our decision-making and ensure that overall our markets remain efficient and effective as we navigate the transition.

Markets Roadmap
Through our Markets Roadmap, we detail how and why we are reforming our balancing and ancillary services markets, to maximise their ability to deliver the clear and efficient investment and dispatch signals needed to operate a zero carbon system. This is essential to provide early visibility of our direction of travel to our market participants, so that they can make the critical investment decisions required to help transition to net zero.

The reform we are undertaking throughout BP1 and BP2 is far reaching – touching systems, processes and teams from across the business. Much of this reform is underpinned by significant technology transformation, both in new market platforms and auction systems, and in control room investment to accommodate new balancing products and ancillary services. With this in mind we have put in place a number of mechanisms to ensure a robust, well tested and holistic approach to designing and implementing market change.

Priority 4: Reforming our balancing and ancillary service markets

Continued

How does this link to our ambitions?

£39m

In benefits from RDPs over the RIIO-2 period

Read more about our activities to reform our markets in section (A4, A8, A15) of our BP2 Delivery Plan.

These include:

– Establishing an independently chaired Markets Advisory Council (MAC) to inform our approach to strategic market design and delivery, based on robust evidence, international best practice, and the needs of, and impacts on, wider industry.
– Implementing market reform objectives and principles that will drive market design decisions that are robust, well-evidenced and justifiable. As we continue to reform our markets throughout BP2 we will be transparent in how we use this framework, giving our stakeholders confidence in how and why we are making reform decisions. This framework will also enable us to assess the effectiveness of our current market designs, and identify where they can be improved.
– Implementing a cross-ESO steering committee for market reform, bringing together colleagues from across our Markets, National Control, Networks and IT teams to ensure that internally we are collaborative and holistic in our approach to designing and implementing reform.

These relatively new mechanisms will all add considerable value during BP2 and will complement the extensive collaboration and co-creation we already undertake with current and future market participants.

Our Pathfinder approach to long-term procurement

We also recognise that we need to attract the right participants in the market to achieve this reform. Pathfinder is a procurement approach that explores and tests a long-term procurement strategy – establishing requirements and launching procurement events with long enough lead times to deliver strong investment signals for development of new services. (This is in comparison to other services we procure in markets which are already sufficiently deep and liquid to operate in close to real time).

Throughout RIIO-2 we have used Pathfinder projects to introduce new technologies and business models that deliver services into our markets. For example, our approach to long-term procurement of voltage (though our voltage Pathfinder) compares market-based solutions against transmission owner solutions, and has driven competition into a sector where there has not traditionally been competitive pressures. Through implementing this approach an Offshore Transmission Owner's asset will – for the first time in 2024 – provide reactive power to the Great Britain energy, with forecast savings to the consumer of over £10m[18].

Where appropriate, we will continue with our long-term procurement approach as we move to increasingly complex operability requirements on the path to net zero. As part of our plans in this area, we will stop using the Pathfinder label and instead use the name Network Services Procurement to reflect the mainstream application and wider scope.

Regional Development Programmes (RDPs)

As we transition to a whole energy system, we need to look across a broader landscape, to resolve problems in key regional areas of the network in need of development. RDPs support the reform of our markets by unlocking network capacity, reducing constraints and developing new revenue streams for market participants. For example, to manage thermal constraints more efficiently, we need to ensure that our markets are accessible to different types of technologies by removing barriers to entry. We are increasing participation of DER through our RDPs, as well as our future Local Constraints Market (LCM).

Through our in-flight RDP projects and the roll-out of RDP functionality with partner DNOs, we will ensure solutions are quickly scalable to other areas, while enabling enhancements across existing functionality. Also, through the Open Networks Project, we are exploring how products can be stacked across DSO and ESO markets. Clarity on which products can be stacked should incentivise more DERs to provide transmission constraint management via initiatives such as RDPs.

Capacity Market (CM) and Contracts for Difference (CfD)

As part of reforming our markets, we need to make sure that the right investment signals are made available to the market, either through the CM and CfD auctions or targeted changes to charging methodologies or other codes. Specifically, we are transforming access to the CM and CfD through supporting the development of policy and rules for the CM and enable the transition to annual CfD auctions, helping deliver 50 GW of offshore wind by 2030, and managing the end-to-end process for all CM participants. In doing so, we are building the capacity of our current markets, to support the increase in demand on the grid.

[18] National Grid ESO, 2022. ESO Voltage Pathfinder Results

Priority 5: Supporting wider market reform

22%

Increase in the volume of code modifications that we have facilitated over the last year.

Great Britain's electricity market will need to be substantially reformed and will be critical to deliver a future system that is affordable, secure and clean.

Ensuring the right market reforms to achieve net zero efficiently is a hugely complex challenge, with many interdependencies and a raft of future uncertainties. We are well positioned at the heart of the energy system, to lead and inform the debate on establishing the right packages of reforms to maximise value for consumers.

We will do this by bringing our own analysis, evidence and insight to drive early momentum on the challenge and opportunity and engaging deeply in associated programmes of work led by government as policy maker, and Ofgem. In BP2 we will build on our Net Zero Market Reform (NZMR) programme of work through:

Analysis and trials: our NZMR work to date has found that a nodal pricing market with central dispatch has the potential to deliver significant consumer benefits by facilitating efficient dispatch of generation, demand and flexible assets, and optimising siting decisions across the whole electricity system. These findings will continue to be refined with a need for greater technical and economic assessment, to further assess the potential of this possible reform.

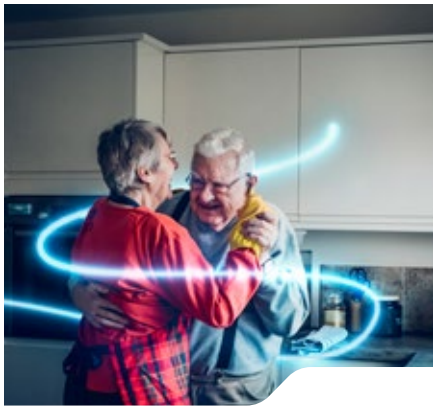
Stakeholder engagement: our work has leveraged vast domestic and international knowledge and experience on this critically important topic. Over Phases 1 (Scoping), 2 (Analysing the 'Case for Change' and identifying options) and 3 (Assessing operational elements and sharing conclusions), we have engaged with over 1,000 stakeholders through 15 workshops and events, and dozens of in-depth bilateral meetings with market players, academics, think tanks and trade associations. We expect this level of engagement to increase over BP2 as our work intensifies and our stakeholder community grows.

We will also be working closely with our new Markets Advisory Council (MAC) to set the strategic direction for NZMR, embed stakeholder perspectives and international best practice, provide transparency, certainty and confidence to stakeholders around our decision-making in the areas of designing, delivering and optimising our markets, and to provide input on our strategic priorities and plans.

Working alongside BEIS and Ofgem: we have worked closely with BEIS and Ofgem over the first three phases of NZMR and we expect this to continue through FY22/23 and BP2. We are currently supporting Ofgem in their technical feasibility study of nodal wholesale markets, and supporting BEIS, as a trusted strategic partner, in their Review of Electricity Market Arrangements (REMA). Within this, as part of Phase 4 of the NZMR programme, we will continue to engage and input our views on the future direction of market reform, as we seek to support creation of a path to bring about the required reform in a timely, efficient, and effective way.

Facilitating codes and charging rules: it is crucial that we continue to reform the codes and frameworks that govern our market to ensure they are fit for future use. These will need to evolve to keep pace with technological change, allowing access for all potential market participants. In BP2, this means we need to build on the reforms delivered in BP1 by working with industry to progress transmission-level charging reform and setting new Balancing Services Use of System (BSUoS) tariffs. We will also respond to BEIS and Ofgem's work on Energy Code Reform, which looks at optimal ways to accommodate a growing number of market participants.

Read more about our activities to support wider market reform (A4, A6, A20) in our BP2 Delivery Plan.



This chapter has provided an overview of the outcome – Building efficient and effective markets.

Below we summarise the breakdown of priorities in this area and the activities in BP2 that relate to each. These are further explained in Part B.

Priority Area	Priority (Part A)		Activities (Part B)
Building efficient and effective markets	4	Reforming our balancing and ancillary service markets	– **A4** (Role 2) Building the future Balancing Services markets – **A8** (Role 3) Enable all solution types to compete to meet transmission needs – **A15** (Role 3) Taking a whole energy system approach to promote zero carbon operability
	5	Supporting wider market reform	– **A4** (Role 2) Building the future Balancing Services markets – **A6** (Role 2) Develop code and charging arrangements that are fit for the future – **A20** (Role 2) Net Zero Market Reform

Chapter 2

Driving to net zero

Why is 'Driving to net zero' important for us and the industry?

50%
Increase in total electricity demand by 2035[19]

£54bn
Of investment required in Great Britain network infrastructure[20]

There is no template for a fully decarbonised energy ecosystem; the pace of Great Britain's decarbonisation means we are leading the way globally. We are laying the foundations now for short periods of zero carbon operation in 2025, and a transition to 100 per cent zero carbon operation by 2035.

To get to 2035 we will need to transform the system we have today, enabling the right resource mix, markets, and networks to support a fully decarbonised system. We will do this through global collaboration, embracing new technologies and enabling the industry to innovate to provide the outcomes we need, and all at least cost to the consumer.

Increasingly, our role in driving evidence-based decisions is fundamental to creating clarity and confidence across government, industry, and investors. Ensuring accuracy and reliability of data on which to evidence our decisions is critical; we must strike the right balance between our commitment to achieve net zero at pace, while maintaining security and affordability for consumers.

As we look to net zero by 2035, we recognise the complex landscape and associated challenges:

Ensuring the right networks: pace and coordination are critical

As we transition to net zero, the location of where energy is produced will start to look very different from today, with much of it originating offshore. Making sure we have the right infrastructure in place to move energy from where it is produced to where it is consumed will be critical through the energy transition.

While there is value in maintaining optionality in the infrastructure we deploy to support a future generation landscape, we must balance that with the significant lead times associated with the building of new infrastructure. Providing certainty to the developers of network infrastructures, or providers of 'network alternatives' on what is required, is a critical enabler to the energy transition and is a driver behind the Centralised Strategic Network Plan (CSNP) work.

Ensuring a simple connections process for our customers

To deliver on our net zero ambition, we will need to connect new generation faster than we have to date. Simplifying and streamlining the connections process is a key part of accelerating the integration of new generation customers.

Ensuring consumers are at the heart of a just transition

We will not achieve net zero without doing more to engage consumers. To operate a zero carbon system, we will rely on consumers being more flexible in how and when they use energy, as well as a shift in the way consumers interact with the energy ecosystem of tomorrow through, for example, in supplying energy back to the system in times of high demand. This transition needs to be carefully managed, through policy development to implementation. Engaging the consumer and putting them at the heart of a just transition is fundamental to our success. We discuss this topic in more detail within our Consumer Strategy.

Ensuring a smart, flexible system through digitalisation and data

Finally, as we transition to a whole energy system, we need to make choices about how we utilise digitalisation and data across gas and electricity, transmission and distribution, and even across consumer technologies such as heat pumps and electric vehicles. In short, we must understand the integrated landscape, and associated challenges of a digital world to optimise consumer interaction and benefits. To achieve this, a major digital transformation is required, for us and the industry as a whole. We will use new technologies to manage a decarbonising grid, and our activities must be coordinated across different voltage levels, vectors and sectors. With digitalisation comes greater accessibility to a broader set of data from across the sector, which must be leveraged carefully to understand and forecast overall generation and demand.

[19] download (nationalgrideso.com)
[20] National Grid ESO, 2022. The Pathway to 2030 Holistic Network Design

Priority 6: Holistic planning and development for net zero

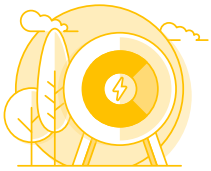
How does this link to our ambitions?

To address these challenges, we have defined two priorities needed to deliver a fully decarbonised electricity system by 2035.

6

Holistic planning and development for net zero

7



Driving towards a whole energy system approach

Creating greater certainty on network needs will be key to ensuring the right infrastructure is in place, at the right time, to support growing renewable deployment at a transmission and distribution level.

Centralised Strategic Network Plan (CSNP)
Central to our success in driving for net zero will be coordinated offshore and onshore network planning across GB. The development of the right infrastructure, at the right time, is essential for the connection of generation, decarbonisation of our energy system and secure operation of the system. We must also look towards whole energy system solutions and provide strategic and anticipatory investment recommendations so that infrastructure is an enabler of the transition to net zero.

Our approach to the development of the CSNP will bring together key players in the industry, with specific inputs from Ofgem (Electricity Transmission Network Planning Review (ETNPR)), and BEIS (Offshore Transmission Network Review (OTNR)). We share Ofgem's vision that the CSNP will deliver a more holistic and strategic approach to energy system planning which ensures we deliver net zero in the most efficient way, through a new, coordinated approach to system planning.

As the CSNP is developed, we remain committed to enhancing our network planning tools, and continuing to provide clear recommendations on which network reinforcement projects need to take place to support decarbonisation. As we move towards an energy landscape that is dominated by renewable and zero carbon electricity, our commitment to improving and enhancing the network planning process will be ever more critical in achieving a more strategic and coordinated approach to transmitting large volumes of power to demand centres across GB.

Reform of the connections process
The efficient management of connection processes is important to our customers and stakeholders, and a key enabler for the connection of low carbon technologies to meet the UK's net zero target. Over the BP1 period we have managed an increasing number of connections, with a 67 per cent increase in licenced connection applications in FY22 and 47 per cent YTD, which are also becoming more diverse and complex due to varied technologies and an increase in the volume of smaller distributed energy resources looking to connect to distribution and transmission networks.

Central to our success in driving to net zero will be strong offshore and onshore network planning across GB.

Priority 6: Holistic planning and development for net zero

Continued

How does this link to our ambitions?

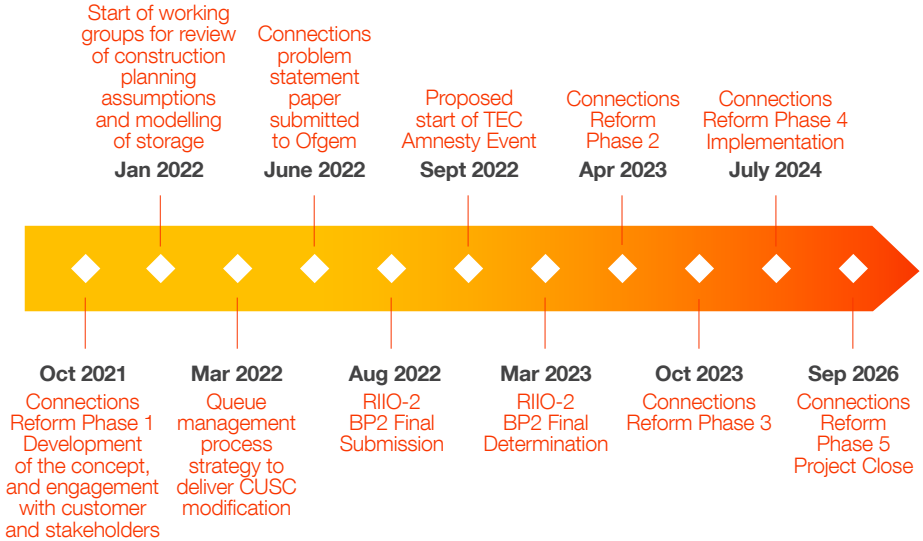
The current connections process was designed for a small number of large connections and is not fit for purpose to facilitate the growth in low carbon technology needed to meet government targets.

Our BP2 Plans, therefore, set out a programme of reform to enable the Great Britain energy system to have a Connections process that supports the delivery of its future ambitions, where integration of renewable and low carbon technology is successfully achieved along with maintaining reliability, longevity, resilience and value to end consumers.

This will enable us to work with Ofgem, Transmission Owners (TOs), DNOs, key industry stakeholders and customers, to reshape the Transmission Connections process for the benefit of the industry.

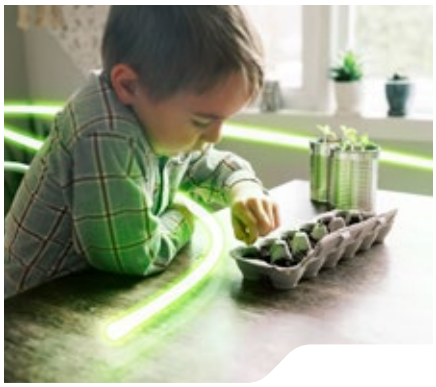
The development of RDPs will play a central role in undertaking this reform, as these unlock network capacity, reduce constraints, and develop new revenue streams for market participants. In 2022, the number of RDPs increased significantly and we expect a maximum of 30 to run at any one time, demonstrating the scale and ambition of new connections across the network.

Figure 7: Holistic planning and design approach



Read more about our activities in holistic planning and development for net zero (A7, A8, A14, A22) in our BP2 Delivery Plan.

Priority 7: Driving towards a whole energy system approach



How does this link to our ambitions?

Accelerating whole electricity flexibility
As the trend towards decentralised generation continues, and increasing volumes of DERs connect to the grid, we must continue to open our markets and services to new entrants that will play a critical role in delivering a secure, fair, and affordable net zero system for GB.

Current market arrangements and frameworks do not currently provide the access that smaller distributed assets require – we are working with industry to address these barriers and to facilitate whole electricity system outcomes. We are already making good progress, for example through our RDPs and introduction of LCMs which enable revenue opportunities for DER. However, to achieve the level of DER participation that we require to achieve our net zero ambitions, we must accelerate progress.

In BP2 we are focusing on four areas of activity across the whole business:

Facilitating market access for whole electricity flexibility: We will investigate how our markets can be designed and implemented to unlock the potential of distributed flexibility, for example through removing barriers for aggregators and energy suppliers, thereby facilitating DER assets in our markets.

Service coordination between markets: We will develop and embed processes and systems to coordinate markets across the whole electricity system. This will reduce the overall cost of managing electricity networks, ensure consumer value is realised and maintain continued security of supply. Moreover, this will support service providers' access to markets.

Improved DER visibility: We require increased visibility of DER, as this will enable us to facilitate greater aggregation of DER services and enhance situational awareness, to allow better management of system events. To achieve this, we will work with industry and DSOs to deliver real-time visibility of DER, improve our processes for managing data relating to service providers, and expand the use of contractual arrangements.

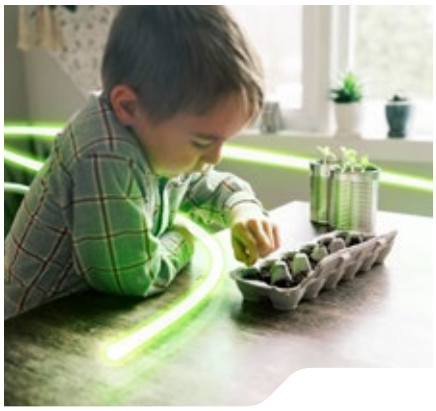
Facilitating DSO: ESO/DSO coordination will be critical to achieve whole system operations and ensure a coordinated approach to operating in a highly decentralised sector. In BP2, we will build on the policies and procedures implemented in BP1, to further accelerate whole electricity flexibility. Additionally, from an operational perspective, we will focus on learning from real-time use of flexibility services.

£150m
Annual benefit from improving DER visibility

Read more about our activities in Driving towards a whole energy system (A1, A4, A13, A15) approach in our BP2 Delivery Plan.

Priority 7: Driving towards a whole energy system approach

Continued



How does this link to our ambitions?

80%

of Great Britain power from renewables in 2035[21]

Looking beyond 'whole electricity' to 'whole energy'
The work we have described on managing growth in DER, our interaction with DSOs and investment in RDPs and LCMs will support the immediate need for a 'whole electricity' approach to system operation. As growth in these zero carbon technologies continues, and markets become increasingly deep and liquid, clear investment signals will usefully provide confidence for investors as they consider the trade-off between electricity, gas and hydrogen in seeking to solve the net zero challenge through a broader whole system lens.

In BP2, our focus will be on flexibility, under these three key activities:

Ensuring operability of a zero carbon energy system: Our Operability Strategy Report sets out the challenges we face today in operating a rapidly changing electricity system and the capabilities and system requirements needed to resolve these. In BP2, as we work towards operating a zero carbon grid by 2035, we are taking a broader look, through a whole energy system perspective, by undertaking a rigorous and longer-term view of the requirements to meet the operational challenges as we decarbonise.

Transforming our capability in modelling and data management: We must transform our capability in modelling and data management to cater for a more complex system and facilitate zero carbon operation. We will do this in two parts: improving quality of system data and models through automation, and more broadly upgrading our modelling and tools for a more complex system.

To be most effective in enabling a whole energy system approach, we must focus on foundational architecture for an interchangeable suite of tools – delivering a seamless data exchange for common data sets, and enabling more data and models to be shared. We will work closely with DNOs and other industry players to ensure we maximise the value of our work in this space.

Supporting whole system policy decisions: We will work with policy makers, regulators, and industry to develop the evolving future energy strategy, markets, and system needed for net zero. In our advisory role as FSO we will work with government on broader policy developments for example in relation to CCUS, hydrogen, long duration electricity storage and EVs. Additionally, we will continue to advise Ofgem and BEIS on the evolution of the network planning regime, for example working to optimise the connection of offshore wind farms and introduce competition to onshore transmission.

Stakeholder engagement will be central to achieving this, for example on the integration of new technologies needed for effective zero carbon operation. We will bring our knowledge, insights and capabilities into decision-making forums and cross-industry working groups to help ensure that new technologies develop in line with system needs, thereby reinforcing our role as a trusted partner.

Read more about our activities in Driving towards a whole energy system (A1, A4, A13, A15) approach in our BP2 Delivery Plan.

[21] download (nationalgrideso.com)

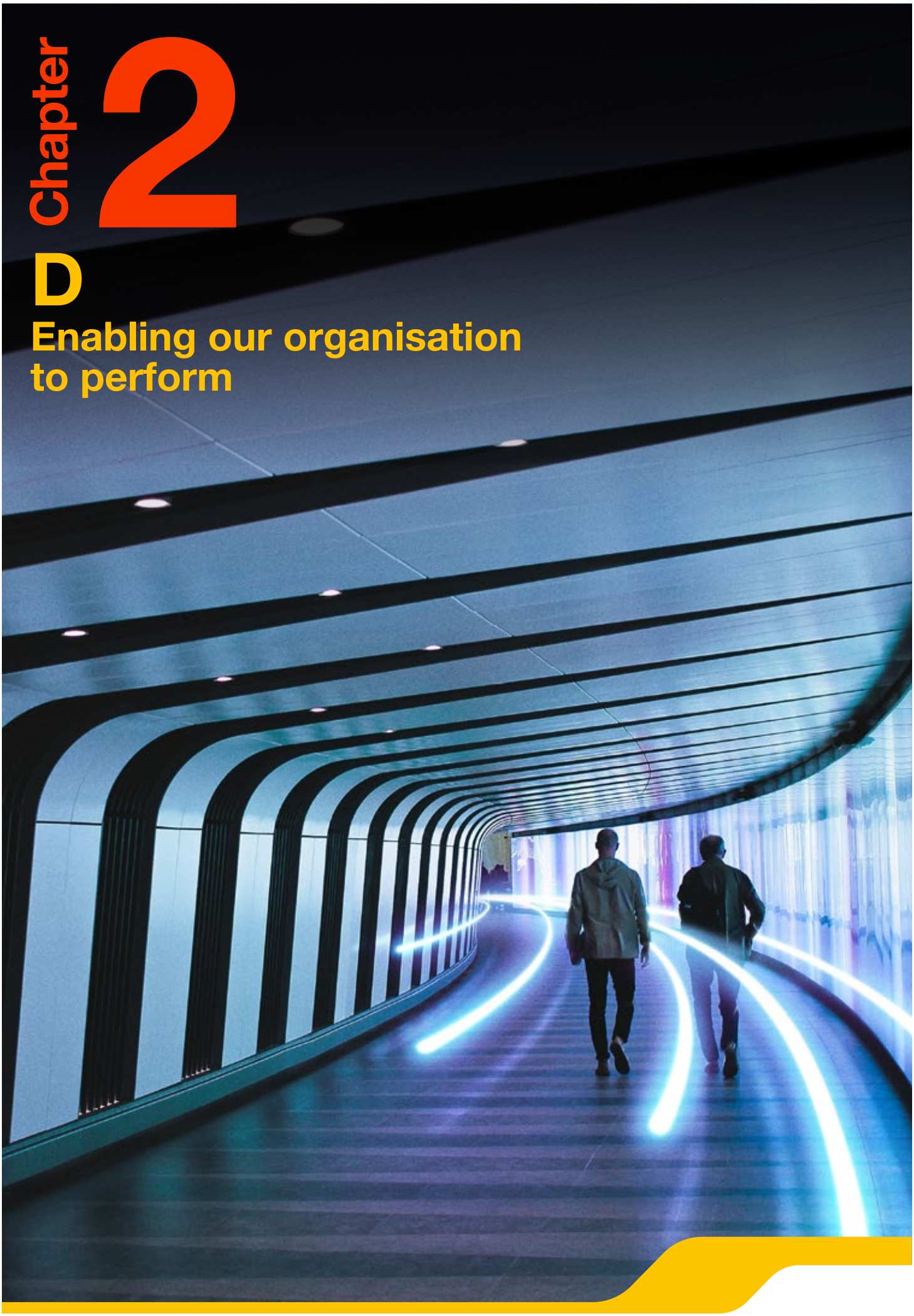
This chapter has provided an overview of the outcome – Driving to net zero.

Below we summarise the breakdown of priorities in this area and the activities in BP2 that relate to each. These are further explained in Part B.

Priority Area	Priority (Part A)		Activities (Part B)
Driving to net zero	6	Holistic planning and development for net zero	– **A7** (Role 3) Network development – **A8** (Role 3) Enable all solution types to compete to meet transmission needs – **A14** (Role 3) Take a whole electricity system approach to connections – **A22** (Role 3) Offshore Coordination and Network Planning Review
	7	Driving towards a whole energy system approach	– **A1** (Role 1) Control Centre architecture and systems – **A4** Role 2) Building the future Balancing Services markets – **A13** (Role 3) Leading the debate – **A15** (Role 3) Taking a whole energy system approach to promote zero carbon operability

Chapter 2

D Enabling our organisation to perform



Why is 'Enabling our organisation to perform' important for us and the industry?

Our operating context is changing rapidly and becoming increasingly complex. In parallel, we are growing our role significantly to respond to our evolving stakeholder needs.

To deliver on the seven priorities we have set out above, we will need to evolve as an organisation: delivering a scaled technology programme at pace, attracting and retaining the industry's best talent, and responding to changing stakeholder needs with agility and flexibility. And we need to do all of this while transitioning from National Grid plc and transforming our organisation to become the FSO. In this chapter we describe the four 'enabling' priorities that will facilitate the successful delivery of our BP2 submission.

8

Innovation and change through digital, data and technology

Our role in enabling the transition to net zero will rely heavily on the definition and execution of our digital, data and technology strategy. Better monitoring and management of the system, improved sharing of large quantities of high-quality data and the analytics this enables, and the development of customer-centric digital capabilities are at heart of our plans. Investment in innovation, technology, and collaboration with industry are key to allowing us to deliver at pace, as we shift towards having a 'product mindset', focused on operating with agility, flexibility, and security at the core of our business.

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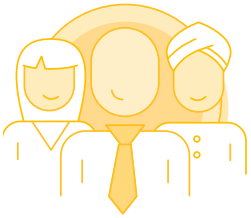


Developing our people, capability and culture

People are at the heart of our organisation and achieving our mission will require us to build on our already talented and diverse workforce. Our business is growing and in BP2, we must retain a strong focus on developing capability and capacity in key skills areas that reflect the evolving needs of our business. We will continue to build a culture of innovation, learning and growth in order to ensure we have the capability we require now and as our role in industry grows and evolves. To do all of this successfully, we are clear that we must become the net zero employer of choice.

Why is 'Enabling our organisation to perform' important for us and the industry?

10

Focusing on our stakeholders

We have a central role in driving the decarbonisation of electricity, and as we transition to the FSO will increasingly fulfil an advisory role to government and Ofgem. We will have increasing responsibility to remain neutral and independent in order to ensure the trust of our stakeholders, as we make decisions that will define the way that the industry operates. We will ensure that we are responsive to the needs of our stakeholders, transparent in our decisions, and continuing to listen and evolve as our supply chain broadens. We will continue to engage with our existing stakeholders, recognise new stakeholder groups and demonstrate the influence they have on the way we will operate in future.

11

Transitioning to the FSO

A joint announcement was made by BEIS and Ofgem in April 2022 of the decision to create a FSO that builds on our skills and capabilities, with enhanced roles and responsibilities to unlock additional value for consumers and drive towards net zero. Our role in working with industry to deliver a clean, reliable and cost-effective energy transition for all underpins our transition to the FSO.

Priority 8: Innovation and change through digital, data and technology

How does this link to our ambitions?

In prior chapters, we have outlined how we are responding to the unprecedented level of change taking place within our industry: delivering excellence in system operation, creating and maintaining competitive markets, driving towards net zero and delivering a step change in our own business to ensure we are enabled to perform. Delivery of our digital, data and technology strategy is fundamental to our ability to rise to this challenge.

Delivering our digitalisation strategy
A common theme across all of these areas is how we innovate, use technology and share data better to drive operational efficiency. Across priorities 1-7 we have interwoven components of continued digitalisation of our processes, insights through our data and upgrade of our analytical and control capabilities. We see digital and data at the heart of the cultural, innovation and technical shift we need to drive across our business, continuing to build practices and models that will deliver greater pace, integration, and security of systems.

We have already made great progress in this shift during BP1, ramping up our talent and building capabilities in technology and business operations (TechOps), data and cyber. While further investment will be required as we transition to an independent FSO, having the right capability and frameworks in place is critical to our £555m IT investment portfolio over the RIIO-2 period.

This is further set out in our Digitalisation Strategy[22] which focuses across three pillars:

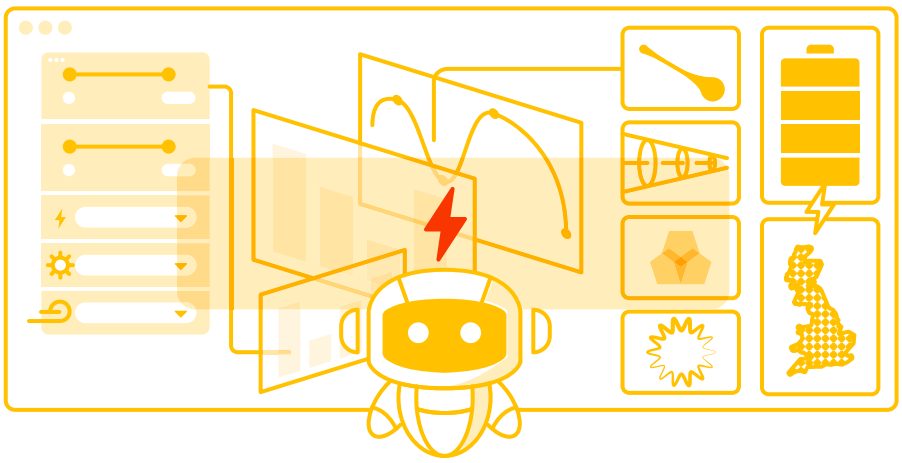
1
Digital mindset (customers first, culture, behaviours, and innovation)

2
Product model (customer-centric products, integrated portfolio backlog, ways of working, multidisciplinary teams, digitalisation and data)

3
Agile (agile methodology and flexible technology)

While we strive for certainty in our technology delivery, we recognise that in a fast-changing market both the scope and requirements of our portfolio will need to flex over time.

For us, managing change and service introduction into our operational and customer-facing environments is critical. We manage these risks through future-proofing our solutions by building modularity into our design, continually prioritising the benefits of our technology portfolio and adopting industry-leading processes for the testing and cutover of new systems into live operation.



[22] https://www.nationalgrideso.com/document/262371/download

Priority 8: Innovation and change through digital, data and technology

Continued

How does this link to our ambitions?

£24.3m

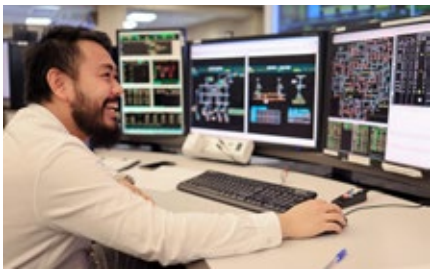
Additional NIA funding required for years three to five of the RIIO-2 period.

Transforming through innovation

In order to transform our business and successfully meet the challenges facing our industry, it is imperative that we can rapidly innovate to match the pace of change taking place. Proactively taking opportunities to innovate, and adopting different approaches to solving industry challenges, is also necessary to deliver net zero at an affordable cost for consumers.

The Network Innovation Allowance (NIA) is the funding route that we access to deliver our innovation projects over the RIIO-2 period. We continually refresh our strategic priorities for innovation[23] to ensure that we are focused on the projects that deliver maximum value to our consumers. For the first two years of RIIO-2, we were awarded NIA innovation funding by Ofgem of £23m (including 10 per cent pass-through costs contribution). We believe an additional £24.3m is required for the remaining RIIO-2[24] period to enable us to deliver the innovation priorities needed to facilitate the energy transition.

We consider innovation through two lenses:



Innovation at the heart of how we think as a business

We are dedicated to the delivery of a series of ambitious innovation programmes, focused on helping us to become the flexible, agile, whole energy system business of the future. Innovative digital solutions are a key part of our evolution towards becoming a more digitally-enabled business, as we develop the tools and capabilities to innovate faster and stay ahead of the energy transition.

Over the BP1 period, we embedded our ESO Labs team within the innovation team, leveraging their data science capabilities to identify new and emerging technologies. In BP2, we are focusing this capability into two key areas. Firstly, we will establish a centre of excellence that shares demand forecasting and analytical methods internally and with the energy industry. Secondly, we will scan the external horizon to source intelligence on emerging and disruptive technologies, and how they can be used to support our own transition and that of the wider energy system.

Another example of our innovative response to the changing landscape is in monitoring demand. Demand forecasting has become more complex as new demand comes onto our networks. Our development of the Machine Learning (ML) model is essential to us forecasting demand accurately. In January 2022, this model out-predicted the nearest competitor model, resulting in reduced balancing costs. We estimate that this event alone saved consumers c. £600k.[25]

Innovation at the heart of our role in the energy ecosystem

Externally, we collaborate with industry to find and develop innovation projects, by facilitating the incubation of innovative solutions and technology.

With the Virtual Energy System, for example, a world-first, real-time replica of our entire energy landscape, we will bring stakeholders together to form an ecosystem of connected digital twins for the entire Great Britain energy system. This will facilitate secure and resilient energy data sharing across organisational and sector boundaries, enable scenario modelling and whole system decision-making, which will result in better outcomes for society, the economy, and environment.

[23] National Grid ESO, 2022. ESO Innovation Strategy
[24] Part B: Chapter 10 – Innovation
[25] State of AI Report 2022

Priority 8: Innovation and change through digital, data and technology

Continued

How does this link to our ambitions?

Unlocking the value of data

We are committed to becoming a fully data-enabled system operator, continuing to put insights-driven decision-making at the heart of how we do business. We will provide the highest level of transparency possible, by ensuring that the data we hold is open and accessible, and will enhance the transparency of our decision-making processes. We look to continuously improve our data governance and data technology, and will value data as an asset through creating advanced analytics and insights.

Data and Analytics Platform (DAP)

Our open Data and Analytics Platform (DAP) will provide real-time access to our operational data, enabling automated data publishing and efficient adding of new data sets. This will unlock the value of the data we hold, allow transparent decision-making, and form a foundational component of the RIIO-2 change programme. Specifically, the DAP will:

1. Unlock the value of our digital twin technology investments, revolutionising operation and delivery.
2. Host data from the asset register, which is fundamental to our Single Market Platform objective of creating a single point of access to optimise markets.

In BP2, we will focus on removing technical complexity for users, enabling greater value to be derived from our data through broader integration across systems and tools. For example, the Digital Engagement Platform will allow a single point of contact for our stakeholders to access our data and services.

Enhanced Balancing Capability

We will also harness the real-time value of data through an Enhanced Balancing Capability, a series of core systems that will balance electricity demand and supply. Balancing our systems, especially in the context of our expanding energy sources, is essential for safe, secure, and economic operation.

Within BP2, we will widen market participation and encourage innovation. This will increase competition and allow new technologies and services to access balancing markets, adapting to the significant change needed to transition to a zero carbon future and ultimately driving greater consumer value.

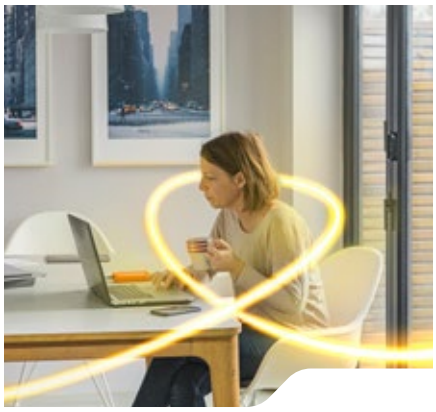
Our open Data and Analytics Platform (DAP) will provide real-time access to our operational data.

Lower costs for consumers

Read more about our activities in Innovation and change through digital, data and technology (A11, A17, A19) in our BP2 Delivery Plan.

2. Enabling our organisation to perform

Priority 9: Developing our people, capability and culture



How does this link to our ambitions?

People are at the heart of our organisation and achieving our ESO mission will require us to build upon our already talented and diverse workforce, evolving and growing the organisation so we can play our part in the delivery of net zero. This is reflected in a new ambition to be the net zero employer of choice.

We need to attract, retain, develop, motivate and engage our people to successfully tackle the challenges and maximise the opportunities presented by the energy transition. At the same time, we will further develop the culture of our organisation to be ever more purpose driven, where our people relate to our goals and are passionate about achieving them because they align with their own beliefs and aspirations for a clean energy future.

As the net zero employer of choice, we will appeal to those committed to our mission, and to the overall energy transition. Driven by a strong purpose, we will also need our people to:

- Solve complex problems: we will collaborate widely, share with and learn from others, including technology forums, industry, and academia.
- Grow new skills: as we transition into the FSO and adopt a whole energy system perspective, the skills required to operate our business will evolve. We need to invest in skills now to stay ahead of the changes to come, for example continued development of digital and technology skills, and the skills required to operate the system in real time, as well as new skills in sectors and vectors where we currently do not have expertise.
- Work differently: we need an agile and flexible workforce. For some roles, different resourcing models may give us, the employer, and the candidate, the flexibility needed. To complement our existing workforce we will leverage and partner with our supply chain to bring in particular expertise, and consider contingent resourcing in sector-specific skills.
- Grow the next generation of talent: we need to invest in equipping future generations with the skills and knowledge to continue solving the industry's greatest challenges. For example, we will focus on growing technology skills through partnerships with schools and academia on STEM programmes and training development. We will also implement targeted recruitment, increasing headcount by 50 FTE by the end of the BP2 period to support the increased IT investments over the BP2 period. Additionally, through investing in simulation training tools, we are seeking new ways of training talent.
- Maximise the benefits of diversity: we need a workforce and an environment that fosters inclusivity and a sense of belonging, represents the communities we serve and enables creativity and problem solving.
- Our BP2 plans set out proposals to bring around 300 additional FTE into the business over the full RIIO-2 period, focused heavily on five core capabilities:
- **Power system engineering:** to meet the challenges of whole electricity system operation
- **Data and analytics:** to maintain system security and stability, and drive innovation
- **Commerciality:** to ensure the needs of the power system can be sourced through competitive processes
- **Leading the debate:** to articulate the wider energy market needs and engage stakeholders
- **Technology:** to digitalise our operations, while increasing cyber security and interacting with our customers as a technology-enabled business This list of capabilities will be revisited during BP2, through our strategic workforce plan.

We will keep these capabilities under review throughout BP2, ensuring we continually understand our future resource needs. We will source the required capabilities through a variety of routes and, importantly, will continue to recognise and work hard to retain our current employees.

Read more about our activities in Developing people, capability and culture – Chapter 11 of our BP2 Delivery Plan.

Priority 10 Focusing on our stakeholders

How does this link to our ambitions?

In a constantly changing market, where the actions, insights and decisions of the system operator are increasingly impacting and enabling others, maintaining the confidence of our stakeholders is critical to our success. Therefore our engagement objective for BP1, to be a 'trusted partner', continues to be a priority and indeed grows in importance as our role expands in BP2.

We are committed to working with our customers and stakeholders to help shape the future of the energy market and understand how we can best deliver this value. This has been, and will continue to be, critical to the evolution of our role as we transform into the FSO.

Being transparent in our engagement with stakeholders

As we evolve into the FSO, we will take an increasingly influential role in informing policy direction. As we build our 'trusted partner' role with all stakeholders, we recognise the need to be neutral and transparent by continuing to provide platforms for engagement. Industry stakeholders' input to the development of our NZMR work, for example, enabled engagement with over 1,000 stakeholders across 15 workshops and events.

Throughout BP2, we will continue to seek input and feedback on how we are delivering against our BP2 commitments, and ensure we remain agile and flexible in responding to stakeholder needs and unlocking value for consumers.

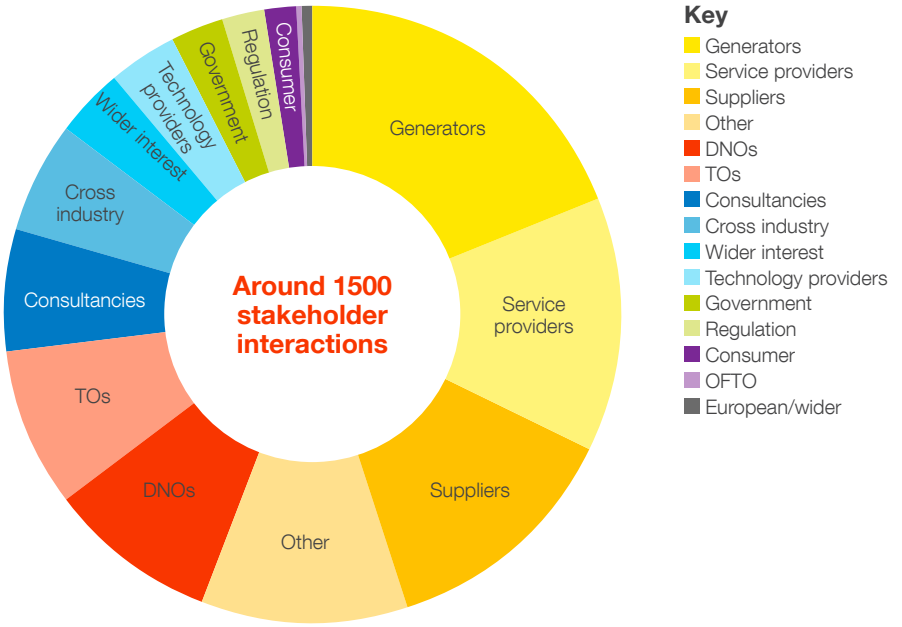
Being flexible in our changing landscape, recognising the evolving nature of our stakeholders

In order to manage, plan and deliver effective stakeholder engagement, we segment our stakeholders into groups, which we then analyse to understand how we can appropriately engage them on specific topics. We currently have nine groups, which include, for example, the Energy Industry, UK Networks, Regulators and Consumers, with a total of 38 sub-groups within these. However, our engagement reaches an even broader range of stakeholders, including those beyond current industry participants. For example, the 'other' category in Figure 8 below includes non-domestic consumers, construction companies, automotive companies and charities.

1,000

Stakeholders engaged with during the Net Zero Market Reform.[26]

Figure 8: Stakeholders we have engaged with on RIIO-2 by sector



[26] https://www.nationalgrideso.com/document/249511/download

Priority 10 Focusing on our stakeholders

Continued

How does this link to our ambitions?

As we transition to the FSO and our own role evolves, so too will our stakeholder groups – both who we engage with and the topics we engage on. We recognise, for example, that our relationship with DNOs/DSOs will further deepen and evolve and we will build new relationships with those introducing innovative new technologies (CCS, Hydrogen, EVs).

As we develop projects in new sectors, our Customer and Stakeholder team will work closely with relevant project teams to undertake in-depth impact assessments, to identify the range of affected stakeholders, and continue to develop our collaborative approach to operating the future energy system.

Making it easier for our stakeholders to engage and do business with us

We have conducted in-depth user research with a range of people who use our digital services to understand how we can improve their experience. This has allowed us to develop and refine the features and services that we are delivering through a new major IT investment called the Digital Engagement Platform (DEP).

Building on work already done in BP1, in BP2 we will introduce further releases of the new platform, ultimately enabling single sign-on, personalisation to make it easier for stakeholders to find what they are looking for on our digital channels, and to stay up-to-date and manage their interactions with us. As we have an increasing number and mix of stakeholders on the grid, providing a seamless user experience for our customers will help us to form and strengthen our relationships.

Priority 11: Transitioning to the FSO

Delivering a 'net zero ready' energy system requires an entity capable of addressing challenges from a whole energy system perspective.

There is a need for coordination across the energy system, and an organisation that can translate decarbonisation policy into immediate strategy. It is against this backdrop that BEIS and Ofgem consulted on setting up an expert, independent Future System Operator with responsibilities across both the electricity and gas systems initially, and the mandate to expand its remit to additional energy vectors. This organisation will be able to drive progress towards net zero, deliver value for consumers by enabling potential cost reductions of up to £3bn[27] through improved whole energy system decision-making, and support energy security. Following the laying of the Energy Security Bill in July 2022 and subject to the Bill receiving Royal Assent, a key priority in BP2 will be establishing our organisation as the Future System Operator by, or in, 2024. Working with BEIS, Ofgem and industry stakeholders we will establish ourselves at the core of a standalone organisation under the ownership of the UK government, with new and enhanced industry roles and appropriately designed back-office functions to support these expanded responsibilities.

Our goal for the Future System Operator is to create an innovative, world-leading organisation at the heart of Great Britain's energy system and the delivery of net zero. Our BP2 commitments are at the core of how we achieve this, critical to demonstrating our commitment to act as a trusted partner and advisor, and to unlocking increasing value across the whole energy ecosystem.

How does this link to our ambitions?

Our focus during the BP2 period will be:

Whole energy system transformation

- Define a new mandate for the Future System Operator and our build transformation roadmap.
- Engage our stakeholders to inform the purpose of the Future System Operator and the value the new organisation creates.
- Define and deploy the culture change required to deliver the Future System Operator outcomes.
- Define and design new industry roles to deliver our stakeholder needs.

Standalone capability

- Define the transition plan, future operating model and transitional arrangements with National Grid plc.
- Work with National Grid plc to build the initial capability required to operate as a standalone organisation from the point of separation (with support of transitional service agreements (TSAs) where needed).
- Develop and implement the broader capability required fully separate from National Grid plc. (i.e. without the requirements for TSAs).
- Establishing the Future System Operator as a technology and digitally-enabled business means that transforming our IT capability forms a large and ambitious part of our plan.
- The IT activities for both BP2 and the Future System Operator transformation have been designed with each other in mind to make sure they can be delivered in parallel.

[27] BEIS, 2021. Future System Operator Consultation Impact Assessment

Priority 11: Transitioning to the FSO

Continued

How does this link to our ambitions?

Our focus during the BP2 period will be:

Our People

- Build new capabilities that complement our existing strengths in power system engineering, customer and stakeholder engagement, and commerciality.
- Develop a people strategy that considers how to deliver in an increasingly technology and data-enabled organisation.
- Attract, build and develop our current and future talent.

Programme

- Establish a delivery programme that sets the tone for the new business – leading with energy, excitement, and confidence.
- Ensure alignment across National Grid plc, Ofgem and BEIS to stabilise the transition.

Our goal for the Future System Operator is to be an innovative, world-leading organisation at the heart of Great Britain's energy system and the delivery of net zero.

At the heart of the energy system

Priority 11: Transitioning to the FSO

Continued

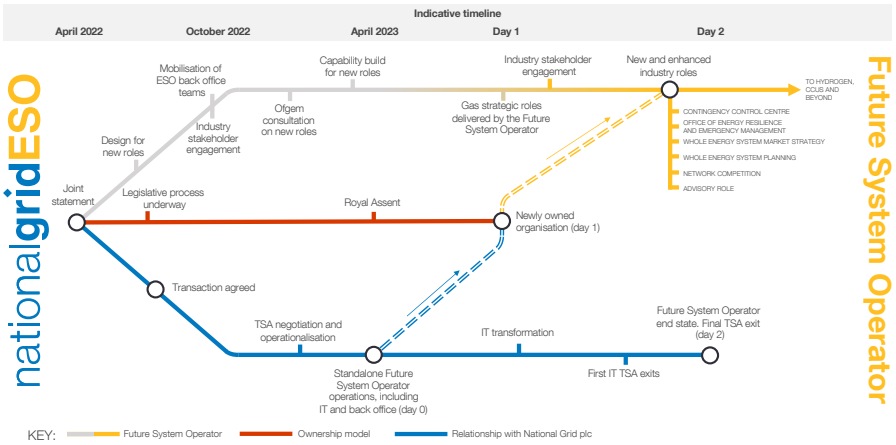
The creation of the Future System Operator will require a significant transformation programme that must be delivered alongside other significant industry change, without compromising security of supply or the continued delivery of our BP2 commitments.

We have taken a pragmatic, yet ambitious approach, with a plan that is both deliverable and affordable but can move at pace. Taking a phased approach enables us to safely plan to expand its remit to take on the new industry roles of the FSO, while moving swiftly reduces uncertainty for our people and stakeholders, prevents delay in action on net zero and unlocks consumer value as early as possible.

The transition plan includes assumed dates for illustrative purposes to provide a view on a possible pathway to implementation. Actual dates will be subject to joint discussion and agreement with BEIS, Ofgem and National Grid plc. Elements outside of our direct control that could affect timings include licence changes, transaction process, the legislative timetable, and activities to be completed by National Grid plc. Figure 9 outlines the indicative high-level transition timeline, highlighting some of the key ESO transformation activities.

How does this link to our ambitions?

Figure 9: Indicative high-level transition timeline



We have taken a pragmatic yet ambitious approach, with a plan that is both deliverable and affordable but can move at pace.

This chapter has provided an overview of the outcome – Enabling our organisation to perform

Below we summarise the breakdown of priorities in this area and the activities in our BP2 submission that relate to each. These are further explained in our BP2 Delivery Plan.

Priority Area	Priority (Part A)		Activities (Part B)
Enabling our organisation to perform	9	Innovation and change through digital, data and technology	– **A11** (Role 3) Enhance analytical capabilities – **A17** (Role 1) Transparency and open data – **A19** (Role 1) Data and analytics operating model – Annex 4 – Technology Investment
	10	Developing our people, capability and culture	– Chapter 11 – People, capability and culture – **A2** (Role 1) Control Centre training and simulation
	11	Focusing on our stakeholders	– Annex 3 – Stakeholder Engagement
	12	Transitioning to the FSO	– Chapter 15 – Future System Operator


Chapter 3
Delivery of our plan

Reflecting on BP1 and our operating context in BP2

As we reflect on our journey throughout BP1, flexibility and agility in our approach to delivery have been fundamental to our success. In BP2, we expect our operating context to be even more demanding, with the following key features necessitating a robust delivery framework:

Scope and scale of change

We have a central role to play in driving towards net zero. Our plan sets out an ambitious set of change proposals for BP2 including technology delivery, market reform and capability build. Overlaid with the transition to the FSO, the scope and scale of change in this period is significant.

Interdependency and concurrency

Our plan includes significant internal and external interdependencies. Notably, the delivery of new technology underpins many of our commitments and we must manage this while establishing our own internal back-office capability for the FSO.

People at the heart of the change

BP2 sees growth in the size of the organisation, with new skills and capabilities needed both for BP2 delivery and as we transition to the FSO. Our approach to delivering change for our people will be key to our success.

Pace

Industry is already demanding answers to many of the questions we will tackle through BP2. Accelerating the pace of our delivery is critical. As we transition to the FSO, our stakeholder network will expand and we will be exposed to new and equally pressing challenges.

Uncertainty

With the rate of change in the industry, and remaining policy questions, the level of uncertainty facing the industry is significant. In BP2, our delivery will need to be agile to respond to shifts in policy as well as the evolving needs of stakeholders.

Reflecting on BP1 and our operating context in BP2

Continued

Learning lessons from BP1

We are proud of the progress we have made in supporting a more secure, decarbonised and affordable energy system through the BP1 period. Highlights include managing the system effectively through unprecedented low demands during the Covid-19 pandemic; making significant progress reforming the full suite of response products; establishing the new Market Monitoring function; delivering our Balancing Market (BM) Review in light of high balancing costs and delivering our emerging conclusions on Net Zero Market Reform.

BP1 has also provided some important learnings that will inform our approach to planning and delivery in BP2.

However, as we move into BP2 there are key lessons learnt that we will make central to how we deliver in BP2, underpinned by having trust in the regulatory regime.

Mobilisation

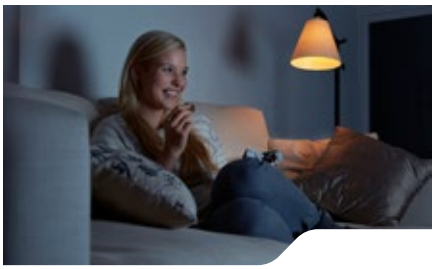
We were unable to meet our planned recruitment trajectory in the early part of BP1 and have continually evolved our approach to recruitment throughout the period to deliver the required increases in headcount. Our people and capability strategy now allows more time for recruitment, onboarding, and capability development.

Engagement

We made significant improvements in our approach to stakeholder engagement in BP1, focusing more on co-creation and collaboration and providing additional transparency through our weekly operational transparency forums. We will continue to engage broadly and deeply with our stakeholder base, flexing our approach to reflect the subject matter and specific context.

Innovate

With an increased understanding of the complexity and pace of IT change required, cost estimates have increased. During BP2 we will ensure transparency and increase engagement with industry and Ofgem for our major IT programmes.



Consumer benefit

Through BP1 we used the cost pass-through framework to initiate major new programmes of work, such as Offshore Coordination and Early Competition, which were not part of our original RIIO-2 plans. We will continue to use the agility of the framework during BP2 to maximise the consumer benefit we deliver.

Reflecting on BP1 and our operating context in BP2

Continued

Delivery, assurance and tracking

Given the scope and scale of change we are proposing and the backdrop of broader industry context and change, rigorous portfolio and project management, prioritisation, and assurance will continue to be important. Delivery of our BP2 ambitions will become increasingly complex, with interdependent elements across our portfolio of work. Further building our portfolio management capability will be critical to be able to respond to the pace and scale of change, while ensuring integration across our business. By enhancing our portfolio management capability and integrated assurance framework, we will ensure we have a stable, realistic, and achievable delivery plan for our stakeholders. We will prioritise our portfolio and ensure we have efficient and effective delivery of our Business Plan on schedule and to budget while reporting transparently to our stakeholders.

1. Portfolio governance structure and reporting system

- The **Adobe Workfront tool** will provide a robust view of portfolio content and live delivery status, tracking and management of risks and issues, dependency mapping, and reporting on progress against RIIO-2 Business Plan commitments.
- We have also set up a centralised **Portfolio Review Board (PRB)** with cross-role representatives from each business delivery function as well as IT, Finance and Assurance, along with a streamlined sanctioning paper format.

Figure 10: Key components of delivery assurance

Read more about our activities in supporting delivery, assurance and tracking in Part B, Chapter 13.

Reflecting on BP1 and our operating context in BP2

Continued

2. Portfolio Prioritisation

We will strengthen our prioritisation process to provide greater transparency for our stakeholders and deliver the best value for consumers. The most complex element of prioritisation is understanding the interdependencies between activities. We cannot consider the value of any one activity in isolation; we need to fully understand the wider contribution of each activity across all deliverables. We prioritise based on the assessment of two key areas:

Consumer value: the value activities will deliver to consumers over the BP2 period, value contributed to our mission (even in cases where the value is not directly attributable) and value established through interdependencies of activities.

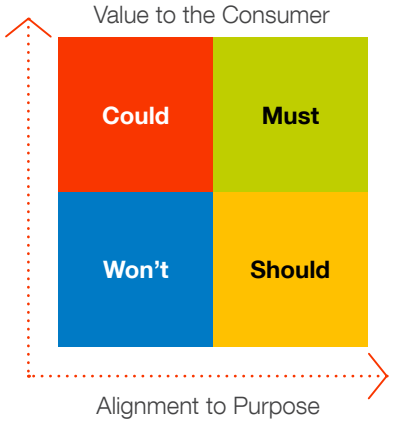
Cost and ability to deliver: the cost to consumers, the extent to which the organisation can absorb the changes being implemented across the business, and the ability to manage external dependencies.

Figure 11: Prioritisation principles and approach

3. ESO Assurance

ESO Assurance covers risk and controls, health, safety and wellbeing, compliance and audit, engineering assurance, and portfolio assurance. Our vision is to design an effective integrated assurance framework which provides a coordinated approach to all assurance activities, minimises waste, reduces duplication, and improves the collation of knowledge.

Figure 12: Example prioritisation framework



Read more about our activities in supporting delivery, assurance and tracking in Chapter 14 – Performance Measures in Part B.

Chapter 4

Linking to our BP2 Delivery Plan

4. Linking to our BP2 Delivery Plan

Part A has provided an introduction to our priority areas for BP2. In Part B we provide more detail on our BP2 activities and deliverables which support these priorities.

Priority Area	Priority (Part A)		Activities (Part B)
Ensuring excellence in system operation	1	Keeping the lights on	– **A1** (Role 1) Control Centre architecture and systems – **A2** (Role 1) Control Centre training and simulation – **A3** (Role 1) Restoration – **A5** (Role 2) Transform access to the Capacity Market and Contracts for Difference
	2	Managing balancing costs	– **A1** (Role 1) Control Centre architecture and systems – **A4** (Role 2) Building the future Balancing Services markets – **A15** (Role 3) Taking a whole energy system approach to promote zero carbon operability
	3	Maintaining resilient and secure operations	– **A3** (Role 1) Restoration – **A6** (Role 2) Develop code and charging arrangements that are fit for the future
Building efficient and effective markets	4	Reforming our balancing and ancillary service markets	– **A4** (Role 2) Building the future Balancing Services markets – **A8** (Role 3) Enable all solution types to compete to meet transmission needs – **A15** (Role 3) Taking a whole energy system approach to promote zero carbon operability
	5	Supporting wider market reform	– **A4** (Role 2) Building the future Balancing Services markets – **A6** (Role 2) Develop code and charging arrangements that are fit for the future – **A20** (Role 2) Net Zero Market Reform
Driving to net zero	6	Holistic planning and development for net zero	– **A7** (Role 3) Network development – **A8** (Role 3) Enable all solution types to compete to meet transmission needs – **A14** (Role 3) Take a whole electricity system approach to connections – **A22** (Role 3) Offshore Coordination and Network Planning Review
	7	Driving towards a whole energy system approach	– **A1** (Role 1) Control Centre architecture and systems – **A4** Role 2) Building the future Balancing Services markets – **A13** (Role 3) Leading the Debate – **A15** (Role 3) Taking a whole energy system approach to promote zero carbon operability
Enabling our organ-isation to perform	8	Innovation and change through digital, data and technology	– Chapter 10 – Innovation – **A11** (Role 3) Enhance analytical capabilities – **A17** (Role 1) Transparency and open data – **A19** (Role 1) Data and analytics operating model – Annex 4 – Technology Investment
	9	Developing our people, capability and culture	– Chapter 11 – People, culture, and capability – **A2** (Role 1) Control Centre training and simulation
	10	Focusing on our stakeholders	– Annex 3 – Stakeholder Engagement
	11	Transitioning to the FSO	– Chapter 15 - Future System Operator transition

Chapter 5

Benefits and investment in our plan

5. Benefits and investment in our plan

Cost-Benefit Analysis (CBA)

£2.8bn

In net benefits across the five-year RIIO-2 period.

£8m

Value of our efficiencies per year.

Our BP2 Delivery Plan sets out an ambitious set of priorities that will be core to the delivery of our mission:

To drive the transformation to a fully decarbonised electricity system by 2035 which is reliable, affordable, and fair for all.

We have explored the substantial value we will deliver for our customers, for example through developing the CSNP, a world-leading energy system planning methodology to achieve net zero in Great Britain in the most efficient way, expanding our thinking to encompass a whole energy system approach and providing a seamless user experience to connect customers to the grid and support us in our decarbonisation journey.

Our BP2 submission provides significant net benefits of around £2.8 billion across the five years of RIIO-2, on a proposed five-year spend of £1.5bn. This is a positive increase in net benefits of £0.8 billion (+43%) since the BP1 plan, which had a spend of £1.3 billion. Our BP2 submission reflects the new activities and sub-activities we will deliver in the period and the delivery of the significant and transformational IT investments that are key enablers of our RIIO-2 plan.

All our transformational RIIO-2 activities, subject to a CBA, have a positive five-year NPV. The positive increase of £0.8 billion in our five-year NPV has three main drivers:

1. Increase to our cost of carbon assumption
2. Increase to our constraint costs forecasts
3. New deliverables providing greater consumer benefit.

Cost-Benefit Analysis (CBA)

Continued

In our BP2 submission, of the total five-year CBA of £2.8bn:

Role 1 has an NPV of £0.3bn, up 32 per cent from £0.2 billion in BP1.

The benefit is predominantly driven by the significant investments in the Control Centre architecture and systems with the leading project being the IT transformation of the Balancing Mechanism. Role 1 also plays a significant part in delivering benefits from across our organisation in Roles 2 and 3, as new services are delivered into the Control Centre.

In **Role 2**, our BP2 submission has an NPV of £0.2bn, down 52 per cent from £0.4 billion in BP1. Key benefits in Role 2 result from building future balancing services markets, transforming access to the Capacity Market and fixing Balancing Service Use of System charges (BSUoS). The reduction in CBA since BP1 is due to lower benefits from fixing BSUoS, with information now available to calculate BSUoS industry risk premia, which has reduced significantly, and the industry delay of fixed BSUoS to April 2023.

In **Role 3**, our BP2 submission has an NPV of £2.3bn, up 74 per cent from £1.3bn in BP1. Benefits are predominantly driven by key investments in network development and dependent associated activities, taking a whole energy system approach to promote zero carbon operability and delivering consumer benefits from improved network access planning.

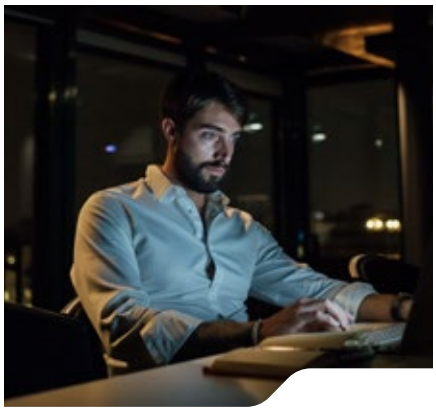
The significant increase since BP1 is driven by an increase in the benefits in 'Whole System Operability NOA-type Assessment' due to higher forecast constraint costs, and this demonstrates how vital we are in reducing costs to consumers. Since BP1, analysis has been undertaken on additional stability Network Services Procurement (Pathfinder) projects, which better estimates the scale of the operability challenges and corresponding benefits of this work. We have therefore changed the methodology to represent the most recent findings and present the best available view for consumers. A further increase in NPV is driven by the addition of a new benefits case for DER visibility savings to account for the new deliverables.

This BP2 submission proposed spend equates to an average cost of £303m per year, which is around £2.10 on a consumer's annual energy bill, and the proposed new and transformational outputs will save consumers around £6.09 per year. This equates to £3.90 more in savings than would have been the case without our actions.

Our ongoing activities also deliver consumer savings that have not been quantified, so overall savings are likely to be even greater.

Read more about our activities' CBAs in Annex 2 – Cost-Benefit Analysis.

Our overall financial view across BP2



The table below shows the £1.5 billion of proposed investment and the associated full-time equivalent (FTE) headcount across the periods within our RIIO-2 BP2 submission, as well as the variance to BP1. Over the five-year RIIO-2 period, to deliver the additional value, our proposed totex request is up by £224m, with an additional 321 FTE by the end of FY26.

TOTAL ESO		BP1			BP2			BP3	
		Actuals	Forecast		Forecast			Forecast	
		2021/22	2022/23	TOTAL (2 years)	2023/24	2024/25	TOTAL (2 years)	2025/26	TOTAL (5 years)
Capex (£m)	BP2 submission	99	120	219	132	131	263	102	583
	BP1	96	90	186	95	88	183	78	448
	Variance	**3**	**29**	**33**	**37**	**42**	**79**	**23**	**136**
Opex (£m)	BP2 submission	141	178	318	200	208	408	207	933
	BP1	163	165	328	170	173	343	174	845
	Variance	**(22)**	**13**	**(9)**	**30**	**35**	**65**	**33**	**88**
Totex (£m)	BP2 submission	240	297	537	332	339	670	309	1,516
	BP1	259	255	514	265	261	526	252	1,292
	Variance	**(19)**	**42**	**23**	**67**	**77**	**144**	**56**	**224**
FTE	BP2 submission	801	1,012		1,119	1,119		1,114	
	BP1	746	777		801	804		793	
	Variance	**55**	**235**		**318**	**314**		**321**	

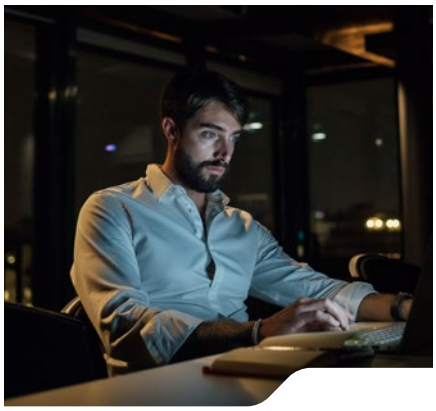
There are two key areas where our proposed costs have increased. Totex associated with investments in our IT systems has increased by £181m over the RIIO-2 period, which includes the cost of delivering the key IT systems underpinning our plan as well as the incremental IT support costs we expect to incur once our systems are live. Secondly, our direct opex costs have increased by £52m, with the biggest driver for increases being the new activities we are delivering now and into the future.

The cost of delivering our IT investment has increased by £148m compared to BP1, with an associated increase of £33m in future IT support costs. Most of this increase is driven by a small number of key IT investments.

Balancing Programme: proposed costs have increased by £110m, comprising £95m additional investment and £15m additional ongoing support costs. The Balancing Programme is a key enabler of our RIIO-2 plan benefits and will deliver new capabilities and associated platforms to ensure that we have the flexibility required to respond to expected and emerging changes in the industry. Since developing our original proposals we have a clearer view of the future needs of the balancing system, markets and industry, and have a much better understanding of the scale and complexity of the capability change required.

Our overall financial view across BP2

Continued



Settlements, charging and billing: our total proposed costs have increased by £23m, consisting of £16m in additional delivery costs and £7m in future IT support costs. This programme will deliver a full replacement of our charging and billing systems, rather than the system update that was planned in BP1 and is a key enabler of regulatory charging reform. The new solution will deliver a sustainable and adaptable long-term system that can easily be reconfigured to allow us to introduce new calculations at speed and at a lower cost to consumers.

Network control: total proposed costs have increased by £17m, which is due to additional delivery costs. This programme will replace our current real-time situational awareness tool, the Integrated Energy Management System (IEMS), with new products that include improved online and offline modelling capabilities, and whole electricity system simulation. The increase in costs compared to our original RIIO-2 business plan is due to additional investment in cyber security for the existing IEMS system in response to the latest cyber security intelligence for Critical National Infrastructure. There is also additional investment in a more modern virtualisation of our system architecture, which will unlock benefits such as improved cyber security, performance, and evergreen maintenance.

Single markets platform: total proposed costs have increased by £17m, which is due to additional delivery costs. The increased delivery cost reflects a greater understanding of requirements and how the system will integrate with downstream systems that provide the end-to-end user experience for market participants who engage in ancillary services.

Our direct opex costs have increased by £52m compared to our original RIIO-2 business plan with a corresponding increase of 321 FTE by the end of 2025/26. A key part of this increase is due to new activities which were not in BP1.

Offshore Coordination and Network Planning Review: our proposed opex costs have increased by £15m with an additional 50 FTE. Our role in offshore coordination will deliver significant cost, environmental and community benefits in taking a coordinated approach to the design of onshore and offshore transmission systems.

Early Competition: proposed opex costs are £9m over the RIIO-2 period, with 18 FTE in BP1 reducing down to 3 during BP2. Early Competition will introduce competition in the delivery of new transmission infrastructure investment and has a key role in delivering reliable and affordable green power for consumers.

Other new activities: other smaller activities of Market Monitoring, Net Zero Market Reform, and the expansion of innovation activities for the Virtual Energy Systems and Strategic Innovation Fund (SIF) projects are adding an additional 33 FTEs at a cost of £10m.

The other main drivers of cost and FTE increase are:

Control Centre operations: our BP2 submission includes an additional 19 FTE by the end of 2023, costing an additional £7m across the final three years of our Plan. This additional headcount will manage workloads which have increased substantially ahead of the deployment of our transformed network control and balancing capabilities. This will ensure the effective implementation of market reforms into real-time operations, processes, and systems.

IT delivery support: 37 additional FTEs will support delivery of our key IT programmes such as the balancing and network control programmes. This does not drive additional cost since costs are included within the relevant capex programme.

Customer connections: where our BP2 submission includes an additional 56 FTE at a cost of £6m. This is due to adapting to new requirements driven by the growth in complex, low carbon and decentralised technologies. A significant proportion of the cost of these additional heads will be recharged to connecting parties. These additions will also support the fundamental review and reform of industry-wide connections processes to better enable the low carbon transition.

Read more about our activities CBAs in Annex 2 – Cost-Benefit Analysis.

Proposed Regulatory Funding Framework

Ofgem's Final Determinations for BP1 set out a new fit-for-purpose funding framework taking into consideration our role in the energy industry and our unique asset light nature. Most of the parameters in the framework were set for the full RIIO-2 period, however there were a small number of areas of uncertainty to review for the BP2 submission.

For most areas we do not propose any changes for the BP2 submission period. This is either because we do not see a material change in risk, or because further time is needed to conclude whether certain risks, such as cost disallowance, are likely to materialise.

We see emerging risk in two areas, namely the cash flow risk associated with fixing BSUoS tariffs and the potential increase in risk from taking on new activities.

If BSUoS tariff fixing is implemented under current proposals, we will take on a significant and new proportion of the cash flow risk associated with underrecovery of BSUoS revenues. We would commit to additional credit facilities and be exposed to profit volatility, legal and reputational risks. Since there are no assets associated with our role in supporting fixed BSUoS tariffs, there is no opportunity to earn a return for the additional risks and the contingent equity associated with raising the additional credit facilities. We propose an extension to Ofgem's preferred ESO method of remunerating capital employed to provide funding for these additional risks. Based on us providing £300m of additional credit facilities, this equates to an additional £4.4m of funding.

We also have plans in BP2 for new activities which could, due to scale and complexity, present significant additional risks. We do not believe that any organisation would take on such additional activities with the prospect of, at best, only recovering their costs and, at worst, incurring fines, penalties, legal challenge, and reputational damage. We propose future discussions on adjustments to our Additional Funding, where we believe activities present additional material risk, which cannot be mitigated.

£4.4m

of additional funding, based on us providing £300m of additional credit facilities.

Part B
Our BP2 Delivery Plan

nationalgridESO

Delivering our BP2 priorities

As set out in Part A: Our Summary Business Plan, we have identified four key outcomes for the RIIO-2 period that are supported by our three Roles and enabling activities. They are:

- delivering excellence in system operation
- efficient and effective markets
- driving to net zero, and
- enabling our organisation to perform.

This section of the Business Plan, Part B: Our BP2 Delivery Plan, sets out the detailed activities and sub-activities that support delivery of these outcomes. Using the Role-based structure, it describes a variety of entirely new and materially changed activities which, together with those that haven't changed since our original RIIO-2 Plan (BP1), will achieve these overall outcomes. Successful delivery of this plan will result in very substantial benefits for consumers (c.£2.8bn), allow the creation of a new Future System Operator at the heart of the energy industry and accelerate the UK's path to net zero.

Our regulatory framework allows frequent changes to our plans so we can be flexible in responding to the pace and scale of the energy transition. Even between business planning cycles, we can use a 'pass-through' mechanism to respond to changes and opportunities as the industry decarbonises. This has already allowed us to take on additional roles not included in BP1, such as our work on Early Competition and Offshore Coordination.

For BP2, our three RIIO-2 Roles haven't changed. However, the four themes that sat beneath the Roles in BP1 have now been removed. Our three Roles, as defined in Ofgem's Roles guidance document, are:

1. Control Centre operations
2. Market development and transactions
3. System insight, planning and network development.

The five-year strategies for all three Roles are largely unchanged but, during BP1, we've developed a deeper understanding of the scale and complexity of our deliverables in each area. This has led to a significant number of new and changed activities for each Role. Across the three Roles, for BP2, we have:

- 5 new activities
- 16 new sub-activities
- material changes to 49 per cent of the existing sub-activities
- 3 sub-activities which will be completed by the start of BP2.

Enabling our organisation to perform

To deliver on the priorities we have set out in Part A, we will also need to evolve as an organisation; delivering a scaled technology programme at pace, attracting and retaining the industry's best talent, innovating to keep ahead of industry change and responding to changing stakeholder needs with agility and flexibility. We will also need to substantially grow our role as we transition to become the Future System Operator. This section of the Business Plan provides more detail on how we will achieve this.

How stakeholder feedback has influenced our delivery plans

Following stakeholder consultation on our April draft plan, we've included details of the feedback we received and highlighted any changes to what, or how, we are planning to deliver. This information is included in brief under relevant activities and in more detail in **Annex 3 – Stakeholder Engagement**.

We've also restructured this section in response to feedback asking us to provide:

- clarity on how we will prioritise the activity planned for BP2.
- assurance that we can deliver everything that we have committed to.
- a clearer view of the benefits our activities will deliver.
- an easier to read document that draws out our priorities in BP2 and why they are important to us, and to the industry. To do this, we have restructured how we present activities under each of our Roles.

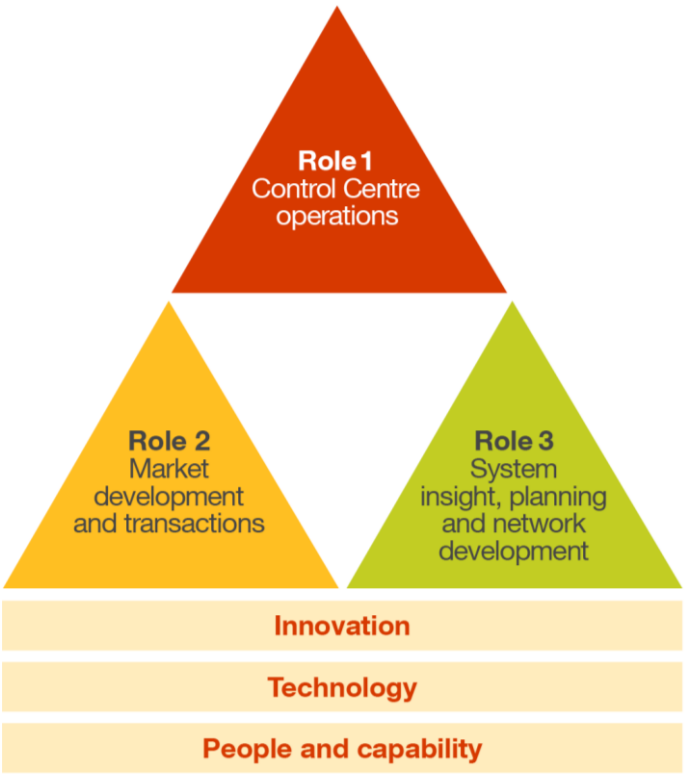


Figure13: Our three RIIO-2 Roles

Our definition of material change

We have defined an activity, sub-activity or deliverable to be materially changed if it meets any of the following criteria:

	Scope	Timescales	Costs
Activity	– New sub-activity – More than 25% of the sub-activities have materially changed	– More than 25% of the sub-activities have changed timescales	– Costs are 10% larger than at BP1 – Costs have increased by £25m
Sub-activity	– More than 25% of the deliverables have materially changed	– More than 25% of the deliverables have changed timescales	– Costs are 10% larger than at BP1 – Costs have increased by £10m
Deliverables	– Scope has reduced or expanded so considerably that the benefits case has clearly changed	– A BP1 milestone impacting stakeholders has slipped into BP2 – A BP2 milestone impacting stakeholders has slipped into BP3 – A key milestone for realising benefits has been delayed by more than 6 months	– Costs are 10% larger than at BP1 – Costs have increased by £2m

These criteria were introduced to create a consistent approach to the Cost Benefit Analysis (CBA) updates across our RIIO-2 activities. The scope of these CBAs is new and transformation activities, benefits from BAU activities are out of scope.

In addition, we also used our judgement to identify changes as “material” where they are likely to draw significant interest from stakeholders, customers, and consumers.

We have updated the BP1 CBAs in the areas of material change. CBA calculates a project’s net present value (NPV) from its financial and economic cashflow. This provides the direct and quantitative financial benefits to consumers.

Whereas new activities that have timescales of 5-10 years before the first benefits are delivered act to enable us to deliver other activities, or form part of wider commitments towards a net zero energy system, we have carried out a break-even analysis. This is where benefits are quantified but direct financial benefits are not defined.

In total:

- Ten CBAs have been updated to reflect material changes.
- Two break-even analyses have been updated to reflect material changes.
- Four new break-even analyses have been undertaken for new activities or sub-activities.

Delivering our BP2 priorities

Changes to how we present our activities in this plan

As mentioned above, since publishing our April draft plan we have changed the structure of our Role chapters and have reordered our enabling activity chapters. This has been in response to stakeholder feedback.

The following section of our plan covers:

- Chapter 6 – Role 1 Control Centre operations
- Chapter 7 – Role 2 Market development and transactions
- Chapter 8 – Role 3 System insight, planning and network development
- Chapter 9 - Digital, Data and Technology
- Chapter 10 – Innovation
- Chapter 11 – People, capability and culture
- Chapter 12 – Enabling activities
- Chapter 13 - Deliverability of BP2
- Chapter 14 Performance measures
- Chapter 15 - Indicative plan to establish Future System Operator
- Chapter 16 - Regulatory finance
- Chapter 17 Conclusion

Within our Role chapters (Chapters 6, 7 and 8) we provide an overview of the Role, the value it delivers, detail of new and materially changed activities as well as a detailed cost overview.

The table below describes how we have presented activities and sub-activities, depending on whether they are new, materially changed or have not changed from BP1 (or have been completed). We've highlighted throughout this document where you can find more information in **Annex 1 – Supporting Information.**

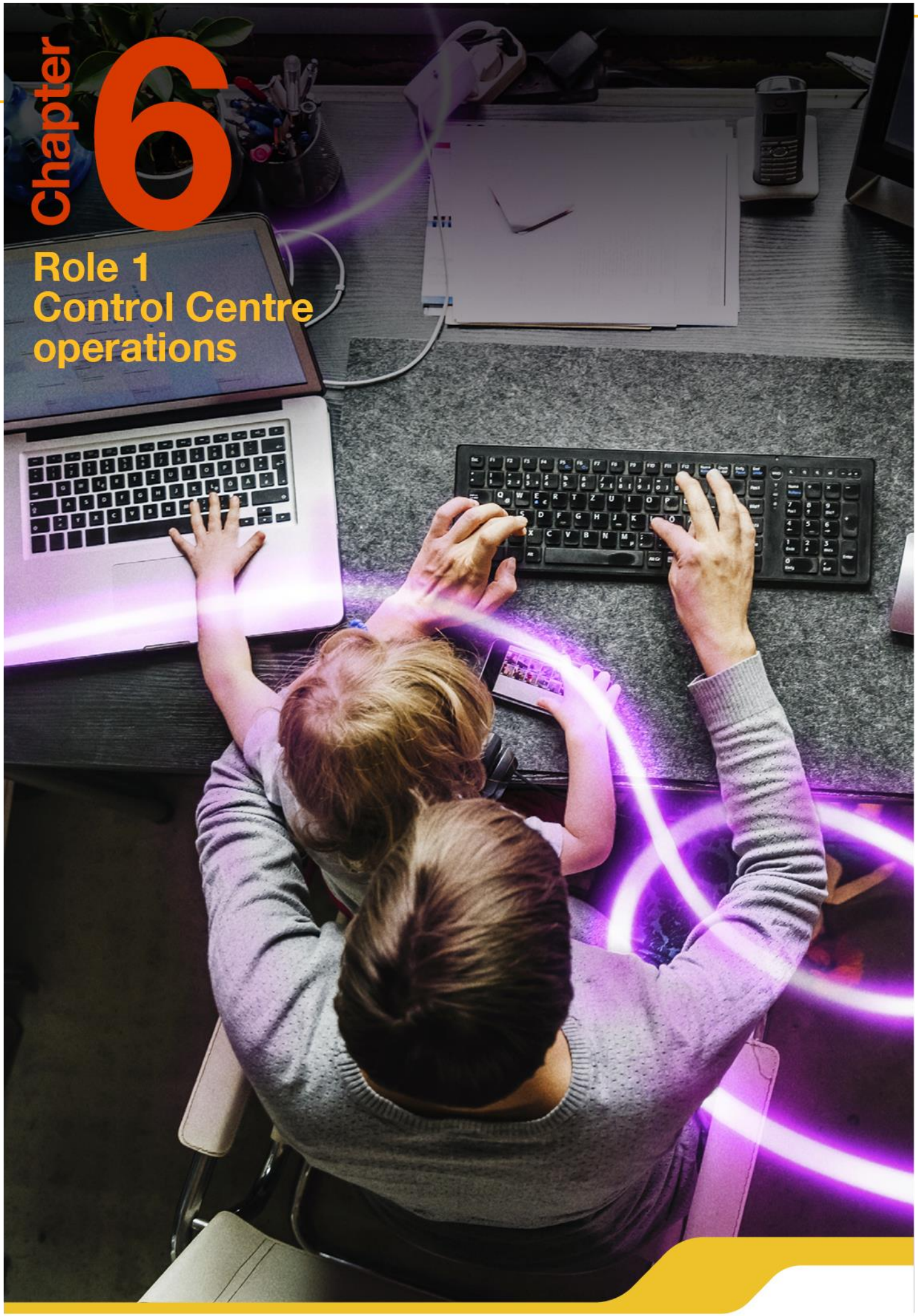
	New	**Materially changed**	**No change**
Activity	Since the draft plan, we have summarised the content to focus only on activity for the BP2 period. Additional information and context can be found in the **Annex 1 – Supporting Information** where indicated. Where there is new content since our April draft plan, we provide additional information in this document.	We provide an overview of the activity to set the context for the section.	We have moved narrative for activities that haven't changed since our BP1 Plan into **Annex 1 – Supporting Information**.
Sub-activity	As above.	Where the sub-activity has changed, we provide explanatory narrative. Where the sub-activity has not changed, content has been moved to **Annex 1 – Supporting Information**.	As above.

How have we assured our plan?

Our final BP2 submission has been overseen, reviewed and endorsed by our Executive team, ESO Board and ESO Committee. They have assured for accuracy, ambition and efficiency. The contents of our plan have been developed by subject matter experts, senior managers, and accountable business owners, and has been monitored by the ESO Assurance team to maintain quality and accuracy throughout the process.

Chapter 6

Role 1 Control Centre operations



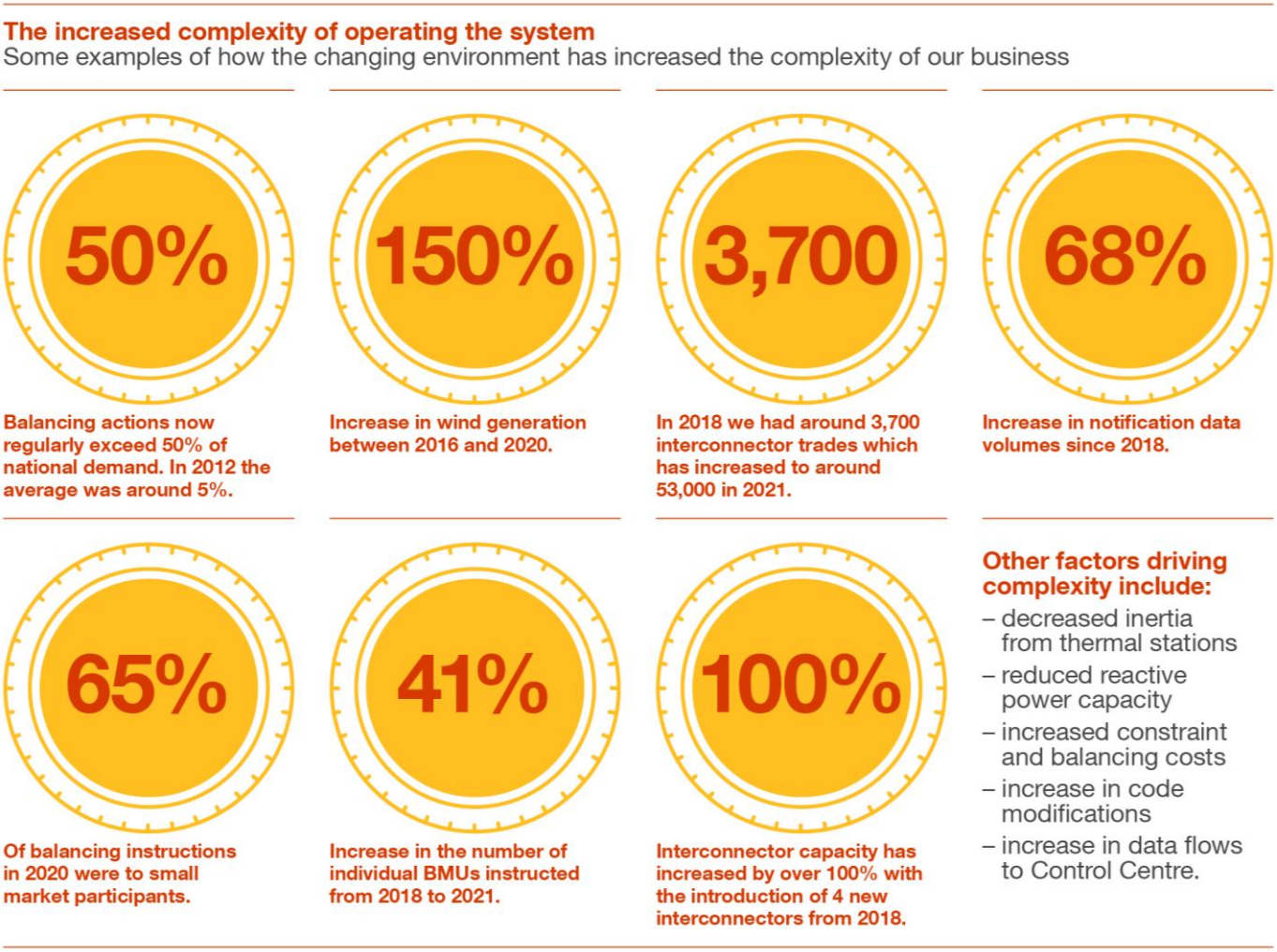
Chapter 6 – Role 1 Control Centre operations

6.1 Role 1 Control Centre operations

Role 1 covers our core function of balancing the National Electricity Transmission System (NETS) in an efficient, economic and coordinated way. We keep the lights on and get electricity to people whenever and wherever they need it. Our activities under this Role include contracting and trading with energy market participants and working with network owners to optimise the physical network in the short term. Other key functions under this Role include short-term energy forecasting, system restoration and emergency response, as well as managing and sharing system data and information. In combination with our other Roles, Role 1 also leads much of our activity to manage and reduce balancing costs.

In a fast-changing energy landscape, that is rapidly decarbonising, decentralising and digitalising, we need to be increasingly agile and flexible in how we operate the electricity system. The ability to anticipate and respond to change, while also managing operational risk, is not new to us. However, by any measure, the rate of change in the energy industry is accelerating fast as we strive to achieve a fully decarbonised electricity system by 2035 and net zero by 2050.

Figure 14 (below): The increased complexity of operating the systems



Chapter 6 – Role 1 Control Centre operations

Against this backdrop of rapid change, our RIIO-2 strategy for Role 1 remains focused on the safe, reliable and economic operation of today's electricity system whilst building the skills, systems and capabilities required for the operation of the carbon free system of tomorrow.

Examples of how our plans are responding to the changes taking place in our industry include:

- **An accelerated drive to net zero** – the urgent need to decarbonise the UK's energy mix can lead to operability challenges as we manage the system transition. For example, fault levels and inertia are declining due to a rapid reduction in traditional generation sources (coal and nuclear) and an equally rapid increase in new market participants and renewable generation. **To meet this accelerated drive to zero carbon operation, we are developing a range of new, competitive market services which will continue to support our operational needs.**
- **Transforming markets and changes in technology** – growth in market participation increases the diversity of technologies delivering Balancing Services. This breadth of technology brings new opportunities for innovation and cost reduction but, at the same time, leads to a significant increase in the volume and complexity of data used to inform our operational decisions. **As a result, we are developing a new suite of systems and tools to equip the Control Centre of the future. The centrepiece of this is our new Open Balancing Platform, part of our Balancing Programme.**
- **Ever higher energy prices contributing to a cost-of-living crisis –** the unprecedented increase in energy prices over the last 12 months, compounded by the war in Ukraine, has brought an even sharper focus on the cost of our activities and the cost of balancing the system. **We have therefore maintained an acute focus on the efficiency of our activities and redoubled our efforts to reduce balancing costs, including several entirely new initiatives described in this plan.**
- **Expectations of our stakeholders and consumers** – stakeholder expectations of us, and particularly of our Role 1 activities, are high when it comes to the transparency of our operational decisions. This, coupled with increasing energy costs, is driving an even greater focus on the cost effectiveness of our decision-making. **Understanding how important transparency is for our stakeholders, we have focused on giving clear and concise justifications for our actions, such as through the weekly Operational Transparency Forum.**

6.2 Role 1 activities during BP1

In BP1, we are delivering the foundations for a significantly enhanced Role 1 capability to keep pace with, and maximise the benefit from, the industry transition. For example, by the end of the BP1 period we will have:

- commissioned **two new interconnectors** (North Sea Link and Eleclink).
- successfully completed a first-for-Great Britain **Electricity System Restoration test**, linking two power islands across a geography of 320 miles.
- implemented the first ever **Frequency Risk and Control Report**, which has changed how we manage frequency and already saved consumers c.£435m in balancing costs.
- undertaken pioneering **domestic demand flexibility** trials, including testing the viability of Vehicle to Grid (V2G).
- delivered the **Balancing Capability Strategic Review,** inviting stakeholders to co-create our Transformation Roadmap for our enhanced balancing capability.
- delivered the **Balancing Costs Review;** a comprehensive internal review of our activities and strategy to minimise balancing costs, together with the delivery of quick-win actions.
- set up a fully functioning **Market Monitoring team**, to meet our new licence obligations to monitor and report on activity in Balancing Services markets, including undertaking a comprehensive review of Balancing Market activity during winter 2021.
- delivered the **Data and Analytics Platform** Minimum Viable Product (MVP), laying the foundation for our new data and analytics operating model.
- Completed our **Distributed ReStart** Network Innovation Competition (NIC) project and shared its recommendations with industry.

During the BP1 period, we have also successfully operated the system under some very challenging conditions, including dealing with the impacts of the COVID-19 pandemic, the war in Ukraine and storm Arwen.

Our BP2 submission builds on the foundational capabilities delivered during BP1 and take us closer towards the achievement of our ESO mission and ambitions.

6.3 How Role 1 supports our BP2 priorities

As set out in Part A, ensuring excellence in system operations is one of our priority areas for BP2, where **keeping the lights on**, **managing balancing costs** and **maintaining resilient and secure operations** are among our very highest priorities.

While contributing to many of the other BP2 priorities, the importance of **stakeholder participation** as the industry evolves and the need to continually invest in the **capability of our people** to stay ahead of market and system developments are paramount.

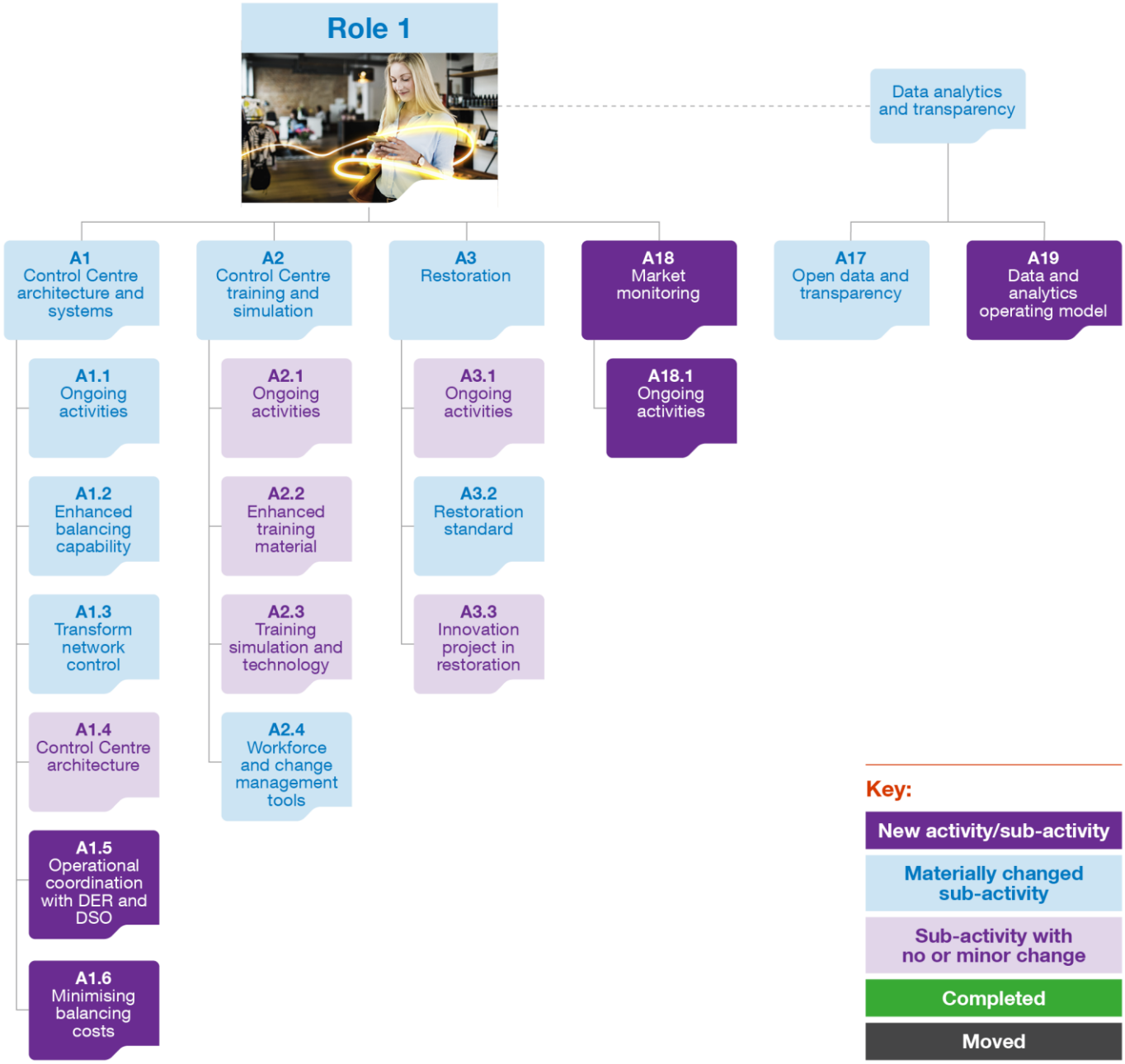
Chapter 6 – Role 1 Control Centre operations

6.4 What does this mean for BP2?

The accelerated drive to zero carbon operation, regulatory change, stakeholder feedback and the rapidly evolving external environment have driven a significant number of material changes to, and the inclusion of entirely new activities in, our BP2 submission (when compared to BP1). The following diagram identifies these changes and additions, which are described in more detail below:

Chapter 6 – Role 1 Control Centre operations

Figure 15: Role 1 activity level of change



Chapter 6 – Role 1 Control Centre operations

6.5 What is new and what has changed?

New activities and sub-activities in BP2

- **A18 Market Monitoring** – this is a new activity, established in BP1 but continuing in BP2, requiring us to monitor activity in Balancing Services markets to meet a new licence obligation.
- **A1.5 Operational coordination with DER and DSO** – this is a new sub-activity to support the DSO transition and improve DER visibility. This will allow us to implement, in real-time, the enhanced whole electricity system coordination proposed under Role 3.
- **A1.6 Minimising Balancing Costs** – this is a new sub-activity to coordinate and improve strategy and activities to minimise balancing costs across our organisation.
- **A19 Data and Analytics Operating Model** – this is a new sub-activity enabling a fully functional data and analytics operating model by the end of the BP2 period that moves us towards being an insight-driven organisation, will continue to build on our open data platform commitments and gives our stakeholders the opportunity to drive insights from the data.

Materially changed activities and sub-activities

- Increased system complexity is driving higher Control Centre workloads resulting in expanding scope and increasing costs for ongoing deliverables in the sub-activity **A1.1 Ongoing Activities.**
- Changes in our **A1.1** and **A1.2 Enhanced Balancing Capability** sub-activities have resulted from obtaining a full understanding of the technology and market requirements of our Balancing Programme, which we did not have at the time of the BP1.
- Evolving cyber-security requirements, an improved delivery approach and adoption of an enhanced IT architecture have significantly increased the costs of the transformational sub-activity **A1.3 Transform Network Control**.
- One deliverable in **A2.4 Workforce and Change Management Tools** is currently 12 months behind schedule due to unforeseen issues with the provider of a new system. However, we expect to recover this delay by the end of BP1.
- Additional requirements for sub-activity **A3.2 Restoration Standard** have been identified to implement the UK Government's Electricity System Restoration Standard (ESRS), following changes to our licence in October 2021.

Activities and sub-activities with no change, or minimal change

- **A1.4 Control Centre Architecture** – this covers the architecture, capabilities and governance needed to make changes to our Control Centre quicker and smarter.
- **A2.1 Ongoing Activities** – this represents the business-as-usual continuous activities within A2 Control Centre Training and Simulation, with a focus on resourcing the Control Centre, monitoring performance, investigating incidents, and making sure operational policy changes are adopted effectively.
- **A2.2 Enhanced Training Material** – this covers investment in materials for universities and industry, making sure we have continued access to a pool of new and future talent by educating and inspiring students.
- **A2.3 Training simulation and technology** – this covers investment in simulation and e-learning technologies, for training of Control Centre engineers. This includes use of Digital Twin Technology.
- **A3.1 Ongoing activities** – this represents the business-as-usual continuous activities within A3 Restoration, with a focus on making sure we have the right procedures in place to economically restore the system within acceptable timescales.
- **A3.3 Innovation project in restoration** – this covers potential investments to implement findings of the Network Innovation Competition project Distributed ReStart, which is a collaborative solution developed by the ESO and DNOs to enable DER to participate in the restoration market.

For activities and sub-activities identified as new or materially changed, we have included further details in the sections that follow in this chapter. For those activities and sub-activities which have not materially changed, further details can be found in **Annex 1 – Supporting Information**.

We have also included additional information in areas that were still in development at the time of the April draft plan, including details of the process and outcomes of the Balancing Programme Strategic Review.

Chapter 6 – Role 1 Control Centre operations

6.6 Role 1 benefits overview

Direct consumer benefits from the activities in Role 1 are mainly delivered through the transformation of our Control Centre systems, and through continuous improvement to our forecasts for demand and generation. Our Role 1 activities create benefits in reduced carbon emissions and lower system operation costs and they are essential to achieving zero carbon operation by 2025 and increasing competition.

What is in our RIIO-2 CBAs?

We have updated the RIIO-2 CBAs for transformational activities in A1, A2 and A3 in **Annex 2 – Cost-Benefit Analysis**. CBAs are not required for the BAU activities A18 and A19, and updates were not required to the break-even analysis for A17.

Activity	Name	NPV[1] BP1 (£m)	NPV BP2 (£m)	Change (£m)
A1	Control Centre architecture and systems	210	270	+60
A2	Control Centre training and simulation	16	17	+1
A3	Restoration	-8	1	+9
A18	Market Monitoring	No analysis required		
	Total	**218**	**288**	**+70**

Table 1: Role 1 NPV change

The largest gross benefits contained in our Role 1 CBAs are for the transformed Network Control and Balancing Systems in our Control Centre (A1) which:

- reduce carbon emissions by unlocking lower carbon intensity energy markets, leading to consumer benefits of around £226 million,
- improve situational awareness, allowing better management of the NETS and therefore savings of around £108 million in constraint costs,
- enable the use of new flexibility sources, reducing system operation costs by around £80 million.

Our Control Centre training and simulation activities (A2) will also lead to savings of around £25.9 million in response and reserve costs through improved decision-making.

How have the RIIO-2 CBAs evolved from BP1?

The total NPV of our transformational Role 1 activities has increased since BP1 mainly due to increases in the NPVs of A1 and A3, which are both driven by our updated assumption for the cost of carbon[2].

Benefits outside of the scope of the RIIO-2 CBAs

Direct consumer benefits are also delivered through our BAU activities in:

- Forecasting demand and generation (D1.1.7): by maintaining and improving our forecasting products and transitioning to a new strategic hosting platform, we estimate that we will deliver consumer benefits of around £1 billion in RIIO-2.
- Maintenance and upgrades to legacy systems (D1.1.5): upgrading our Balancing Mechanism system, whilst its replacement is being developed in RIIO-2, will save at least £22 million in avoided balancing costs.

Market Monitoring (A18): our new monitoring activities will deter market manipulation, leading to lower energy prices for consumers.

6.7 Role 1 costs overview

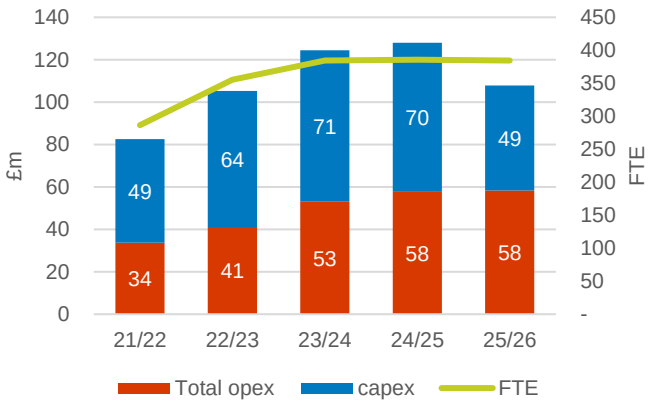


Figure 16: Role 1 costs

Over the five-year RIIO-2 period, our proposed spend has increased by £159m, with an additional 74 FTE by the end of FY26.

£120m of the Role 1 totex increase relates to our IT capex investments. The biggest component of this increase is our Balancing Programme, where we are forecasting an additional spend of £84m capex over the RIIO-2 period. We now have a clearer view of the future needs of balancing markets and the wider industry, and we have a much better understanding of the scale and complexity of capability change required. We have engaged with industry stakeholders extensively through our Balancing Capability Strategic Review to make sure that we work transparently and collaboratively to deliver the required systems transformation, which is a key enabler to delivering our BP1 benefits.

[1] The net present value (NPV) is a measure of the net benefits of an activity over the five-year RIIO-2 period, accounting for the time value of money. Our NPVs are calculated at an activity level, using the total activity costs and the total gross benefits of the benefits cases associated with the activity. A description of the largest benefits cases is provided below the table.

[2] Our updated cost of carbon assumption is based on the marginal abatement cost, rather than on the short-term traded value of carbon used in our BP1 submission. This update is recommended by BEIS: https://www.gov.uk/government/publications/valuing-greenhouse-gas-emissions-in-policy-appraisal

We also forecast to spend an additional £17m of capex on our Network Control programme. The additional investment is in cyber-security and Critical National Infrastructure (CNI) data centres which will enhance the security of our existing Integrated Energy Management System (IEMS) until it is replaced in 2026.

Our proposed totex spend over the BP1 period (FY22 and FY23 and excluding running costs) has increased compared to BP1 by £48m, with an additional 44 FTE. The increase is principally driven by additional investment required for our Balancing Programme (£44m), as set out above.

For the BP2 period (FY24 and FY25), our proposed totex spend has increased by £79m, with an additional 68 FTE by the end of FY25.

6.8 Role 1 interdependencies

Activities in Role 1 are enablers of many of our Role 2 and 3 deliverables and, in turn, are dependent on the delivery of other activities in this BP2 submission and, in some cases, a number of external factors. The most significant internal and external interdependencies for Role 1 activities are summarised below.

Internal factors:

Role 1: Some of our sub-activities have dependencies on other activities in Role 1. The following all feed into our balancing transformation:

- The Operability Strategy Report
- Restoration activities
- Balancing Programme.

Role 2:

- Balancing tools and our ways of working in the Control Centre will be impacted by ancillary services market reform.
- How we interact with Europe (e.g. trading and operating the system efficiently) will be shaped by our activities under A21 Role in Europe.

Role 3:

- Our balancing tools will need to evolve to meet the requirements of future Regional Development Programmes, Network Services Procurement and DER flexibility.

External factors:

- Changes in the number and types of market participants, regulatory, code and technology changes impact the costs and scope of our activities.
- Stakeholder engagement and feedback will inform the implementation of all of our activities including the Data and Analytics operating model (A19).
- We will need stakeholders to deliver changes to their own systems (e.g. to enable new Balancing Services) and develop their capabilities such as simulation capabilities.

Key IT investments:

- **180** Enhanced balancing capability and
- **110** Network control.

Across all of our sub-activities, we will seek to engage with external stakeholders where appropriate. We recognise that these interactions could mean that some of our BP2 deliverables are amended or that the scope, cost and time to implement them may change. However, it is important that our plans remain adaptable to meeting the current and evolving needs of the market in Great Britain.

6.9 Role 1 New activities

6.9.1 A18 Market Monitoring (new)

This is a new activity for BP2, created to fulfil a new ESO licence obligation.

In April 2021, Ofgem introduced a new ESO Licence obligation to monitor balancing services markets for potential breaches of the Grid Code[3]. This obligation sits alongside our role as a Person Professionally Arranging Transactions (PPAT) under the EU Regulation on Energy Market Integrity and Transparency (REMIT). As part of this new activity, we monitor Balancing Services markets for potential breaches of codes, investigating where necessary and raising concerns to Ofgem where appropriate. The intent of these activities is to deter market manipulation ensuring fair energy prices for consumers. In December 2021, we held an open workshop with market participants to discuss our new Market Monitoring role and seek stakeholder views. During the event we shared our proposed business processes, discussed how providers would submit any required data and addressed stakeholder concerns. Stakeholders told us they supported the creation of this function and felt it was appropriate given our position in the market.

[3] Electricity Transmission Standard Licence Conditions 01 04 2022 C28 4(j)

Stakeholder feedback (A18):

During BP1, we carried out initial engagement with stakeholders via the Operational Transparency Forum and followed up with an open workshop in December 2021 to support setting up of the Market Monitoring team and ensure our stakeholders understood this new role.

In response to the consultation on our draft plan, stakeholders were broadly supportive of our proposals and asked for further clarification around the data used to carry out the function, how to broaden engagement for DNO flexibility markets, and how we can share more information with the market. While these do not materially change our BP2 proposals, we have responded to these clarification requests in our full responses to the stakeholder feedback in **Annex 3 – Stakeholder Engagement**.

A18 sub-activities

This activity is made up of the following sub-activities:

Sub-activity #	Sub-activity name	Status
A18.1	Ongoing activities	New

6.9.1.1 A18.1 Ongoing activities (new)

What is this sub-activity and why is it important?

In BP1, we have set up the Market Monitoring team to focus on developing tools and processes to fulfil our new licence obligation. By the end of BP1 we expect to be able to monitor all balancing product groups, including Ancillary Services and bi-lateral and interconnector trades. This will be supported by governance processes and training to ensure we have the expertise to carry out these obligations.

What will we deliver in BP2?

The continuous deliverables of the Market Monitoring team in BP2 are:

- **D18.1.1 Daily analysis of market activity and transaction data** – a process for analysing data in a timely manner, to identify any suspicious behaviour both internally and externally.
- **D18.1.2 Detection of suspicious behaviour and submission of Suspicious Transaction Report (STR) to Ofgem** – forming evidence-based cases where suspicious activity is detected and submitting these to Ofgem via an STR in a timely manner.
- **D18.1.3 Undertake an independent review of our Market Monitoring compliance activities against our PPAT and licence obligations alongside emerging market services** – this includes a review of the original risk assessment and additional risk assessments of new market products and services. The review is planned to begin in April 2023.

Our plans will adapt and flex as new legal requirements arise, and to address evolving market behaviours.

What do we need to deliver this sub-activity?

- We will continue to openly engage with Ofgem, to enable escalation of suspicious activity where appropriate.
- A fully resourced team with effective succession, with training in place to ensure the team are qualified to perform core monitoring processes and continued tool development and improvement.
- Continue to deliver monitoring of new/additional services and products.
- We have a dependence on a successful and timely contracting process with the provider to undertake the independent review as part of D18.1.3.

6.10 Role 1 materially changed activities

6.10.1 A1 Control Centre architecture and systems (materially changed)

This activity describes the ongoing work in our Control Centre to improve our tools and systems so that we can meet our Business Plan objectives and support net zero operation.

The transformational investments proposed in BP1 were designed to:

- enhance our balancing capability to manage greater decentralisation of service providers and to accommodate closer to real-time markets.
- transform our network control tools to give Control Centre engineers a high degree of situational awareness and to manage an increasing amount of network data.
- build a data and analytics platform as a ‘single version of the truth’ for all our data.
- establish a Technology Advisory Council (TAC), formerly called the Design Authority, to give stakeholders a say in the design of new systems, delivering a step change in transparency and accountability.

We continue to deliver these investments as described in BP1. However, the scope and costs of several of these investments have changed significantly. There is also change to activity A1.1 due to the greater operational workload caused by the need to manage increasing system complexity. This is driven by the requirement to plan and support changes to the Control Centre introduced by IT investments, market reform products and a greater focus on whole system operation.

We have included two new sub-activities to **A1 Control Centre Architecture and Systems**:

- We will invest to accelerate whole electricity system flexibility, the DSO transition and DER visibility through the new transformational sub-activity **A1.5 Operational coordination with DSO and DER.**
- We highlight our continued focus on minimising balancing costs through the new ongoing sub-activity **A1.6 Minimising Balancing Costs.**

Our ambition for the greater use of automation, Machine Learning (ML) and Artificial Intelligence (AI) in the operation of a net zero power system is supported by the work of the ESO Labs. This is embedded within our Innovation function and considers how we can exploit new and emerging

technologies, feed ideas into innovation processes and support adoption. The ESO Labs resources are accounted for under activity **A1 Control Centre Architecture and Systems.**

Stakeholder feedback (A1):

As part of our stakeholder engagement for activities **A1.1–A1.4**, we have shared plans relating to our balancing and network control programmes with the TAC. We discussed the current technology suite, our goals for 2025, and the five-year delivery roadmaps. Their feedback, particularly on the importance of technology and operations collaboration within the organisation, has shaped how we have worked in BP1 and will continue to deliver in BP2. As a result of this feedback we are implementing a new way of working, involving the creation of joint technology and business operations teams (TechOps) focused on achieving outcomes for the needs of the customer.

During April and May 2022, we undertook a specific stakeholder engagement programme as part of the Balancing Capability Strategic Review (BCSR) (as described in **A1.2**: Enhanced Balancing Capability).

High-level stakeholder feedback themes raised during the BCSR, including how they have shaped our BP2 submission, are as follows:

- Skip rate in existing systems – stakeholders raised concerns that we are not dispatching smaller and aggregated assets efficiently. As part of our work, we are investigating if there are changes we can make to existing systems before we get new facilities in the Open Balancing Platform (OBP). We will engage with the industry on our findings once we have completed our investigation.
- Level playing field – stakeholders suggested that we should accommodate the integration of DNO requirements and sub-MW dispatch into our systems. We are addressing this by designing the systems in a flexible, modular way to ensure we can integrate across all energy resources and ensure we can dispatch across all types of assets consistently.
- Delivery approach – stakeholders highlighted that the lack of visibility, inability to input into the design and the significant timeframe to deliver IT projects, increased the risk of future systems being outdated when implemented. Throughout our engagement we emphasized the importance of transparency, and how we want to bring stakeholders into the discussions around the changes we are implementing. Therefore, we have committed to delivering monthly website updates and quarterly webinars or in-person events to maintain as much transparency as possible for stakeholders.
- Market frameworks and codes – requests for more time-based dynamic parameters, the ability to allow decreasing offer prices and increasing bid prices for additional volumes and changes to gate closure timescales were all suggested as areas for further consideration. These changes would need to be developed alongside relevant framework changes. Specifically, there is the capability to incorporate time varying dynamic parameters as part of release 6 of the OBP. In terms of other changes, we are building future capability in the OBP which will have the potential to allow for changing optimisation algorithms/market frameworks, without the need for wholesale, complex updates to our systems.
- Transparency – stakeholders requested more transparency around BM instructions and improved data access for DNOs and market participants. As a result, we are considering options on how to share outputs from the algorithms which will be implemented within the OBP. Furthermore, we have already started sharing more locational information on service providers through our data portal and will continue this work on new services. In BP2, we are planning to carry out significant work to improve operational co-ordination and DER visibility.
- Adopting new asset technologies – stakeholders told us that systems need to be developed to ensure they aren't a blocker to new providers and smaller participants joining. We can confirm that as part of release 5 of the OBP, we have put a focus on 'Sub MW Dispatch', meaning we will deliver systems that will be able to dispatch units below the current limits and therefore facilitate new asset types joining the market. In release 6, we have made the commitment of 'All assets can be part of all services', making sure that the systems we develop facilitate market change and increase accessibility to new asset types.

For further information, please see **Annex 3 – Stakeholder Engagement**, which describes in detail the stakeholder feedback themes we received through the BCSR, along with our corresponding responses.

A1 sub-activities

This activity is made up of the following sub-activities:

Sub-activity #	Sub-activity name	Status
A1.1	Ongoing activities	Materially changed
A1.2	Enhanced Balancing Capability	Materially changed
A1.3	Transform Network Control	Materially changed
A1.4	Control Centre architecture	No change (please see **Annex 1 – Supporting Information**)
A1.5	Operational coordination with DER and DSO	New
A1.6	Minimising Balancing Costs	New

6.10.1.1 A1.1 Ongoing activities (materially changed)

The transition to net zero requires us to understand and respond to changing system characteristics. Since submission of BP1, we have seen declining system fault levels and levels of inertia and increasing levels of intermittent and distributed generation. These have combined to increase the complexity of managing the NETS (**D1.1.1, D1.1.2, D1.1.3**). The rapid pace of change has resulted in our Control Centre workloads increasing substantially ahead of the deployment of our transformed network control and balancing capabilities. To date, this increased workload has been absorbed by our Control Centre staff, but we are now requesting additional resources for our Control Centre operations in BP2.

The scope of the support needed to Control Centre operations has also evolved since BP1. Deliverables **D1.1.5, D1.1.7** and **D1.1.8** are materially changed and therefore described below. For details of activities that have not materially changed, please see **Annex 1 – Supporting Information**.

What will we deliver in BP2 for European operations (D1.1.4)?

Please see **Annex 1 – Supporting Information.**

What will we deliver in BP2 for maintenance and upgrades to legacy systems (D1.1.5)?

Under this deliverable we maintain and upgrade our existing Control Centre systems while we develop an enhanced balancing capability and new network control tool. This work is crucial to continuing to operate the electricity system safely and economically. In BP2, we will:

- remove defects, improve system performance and stability, and introduce new functionality for the Control Centre to manage the system ahead of delivery of an enhanced balancing capability.
- deliver the changes needed in our existing balancing systems to support and enable other Role 1, Role 2 and Role 3 deliverables. These deliverables have a total net present value benefit of £2.46 billion[4] and include ancillary services reform, Networks Services Procurement (Pathfinders) and Regional Development Programmes.
- incorporate new services into our systems to meet the changing needs of our customers and stakeholders. We currently have around 600 Balancing Mechanism Units (BMUs) loaded into the system; we expect this to increase to around 10,000 through new market participants[5].
- replace our products for Dynamic System Monitoring (DSM) to address the changing generation profile[6]. This will enable connectivity to service providers, providing us with direct and timely access to data required following system events.

To maintain our existing balancing systems, we have established change capability teams, in addition to our support teams, which reliably deliver modifications, enhancements and new requirements, and are developing integrations with the future balancing systems. This work is crucial to ensuring effective management of the complex transition from existing to new systems. We will maintain this change capability during the balancing transformation period described under **A1.2 Enhanced Balancing Capability**, to ensure critical service levels continue. We continually reassess and reprioritise our backlog of changes for existing balancing systems, and we expect to significantly reduce resource requirements for the associated change capability teams over the BP2 period.

The benefits of this deliverable include:

- enabling the delivery of benefits for projects in Role 2 and 3 by making the necessary Control Centre system changes **(D1.2.1)**.
- avoiding the risk from a serious unplanned outage of our Control Centre systems. Such an outage costs approximately £700,000 per hour in additional response and reserve costs. For the period April 2022 to March 2023, we estimate that **D1.1.5** will deliver avoided balancing costs of at least £22.4m[7] via maintenance and upgrades to the Balancing Mechanism (BM).
- removal of manual workarounds in the Control Centre allows engineers to focus on higher value activities. For the period April 2022 to March 2023, we have estimated a corresponding £1m[8] saving in opex costs because of maintenance and upgrades to the BM
- a step change improvement in frequency monitoring data for system stability and dynamic monitoring and modelling.

We estimate that the replacement of our Dynamic System Monitoring products will reduce balancing costs by £650k[9] per annum through reducing the time generation is restricted.

The table below provides an overview of our activities under each IT investment line covered by D1.1.5 and their links to our transformational deliverables. More detail can be found in **Annex 4 – Digital, Data and Technology**.

[4] The is the sum of the net present values of all RIIO-2 activities dependent on A1, please see Annex 2 – Cost-Benefit Analysis for details. Some of these benefits will be enabled by the legacy systems and then migrated to new systems, other benefits will be enabled only in the new systems.
[5] Under a particular GC0117 scenario, we could see an additional 10,000 BMUs over the next four years. This cannot be accommodated in our current systems. The Balancing Mechanism system has been successfully tested and benchmarked with 900 BMUs, but testing at levels above this has identified performance issues.
[6] The growth in new and smaller providers requiring monitoring makes accessing the installed DSM equipment harder. The increase in installed power electronic based equipment also increases the likelihood of stability issues arising.
[7] These benefits are not included in the Cost Benefit Analysis for A1 presented in Annex 2 – Cost-Benefit Analysis, because our RIIO-2 Cost Benefit Analyses cover our transformational activities only. The sub-activity A1.1 describes business as usual activities.
[8] These benefits are not included in the Cost Benefit Analysis for A1 presented in Annex 2 – Cost-Benefit Analysis, because our RIIO-2 Cost Benefit Analyses cover our transformational activities only. The sub-activity A1.1 describes business as usual activities.
[9] These benefits are not included in the CBA for A1 presented in Annex 2 – Cost-Benefit Analysis, because our RIIO-2 CBAs cover our transformational activities only. The sub-activity A1.1 describes business-as-usual activities.

IT investment	Summary of BP2 activities	Link with transformational deliverables
170 Frequency Visibility	Decommission Frequency and Time Error (FATE) system.	This investment line includes transformational activities for updating and expanding the existing WAMS applications. These activities are required for our investments in Network Control (**A1.3),** Enhanced Frequency Control (**A15.7)** and Stability Assessment Techniques (**A11.4).**
	Enhancements to the Wide Area Monitoring System (WAMS) applications to improve stability monitoring.	
	Upgrade to Dynamic System Monitoring (DSM) data access to improve system stability and optimise generation tuning.	
210 Balancing Asset Health	**Electricity Balancing System (EBS):** the value of a four-hour ahead schedule has decreased significantly with the introduction of hourly gates on most of the interconnectors. Therefore, the costs of maintaining and developing EBS outweighs the value it provides. We plan to decommission it after transferring the required capabilities from EBS to the new systems. In parallel, we will make the decision on the optimum time to decommission EBS.	This investment is dependent on **D1.2.1 Future of Balancing** and is one of the Balancing Programme IT investments**.** Please see **A1.2 Enhanced Balancing Capability** for a description of the Balancing Programme plans in BP2.
	Balancing Mechanism (BM): we will continue to maintain and enhance the BM, allowing for growth in the number of BMUs and accommodating the changes needed by other RIIO-2 initiatives during the balancing capability transformation. Components will be decommissioned when no longer needed, being replaced by the capabilities delivered under **D1.2.1 Future of Balancing**.	
240 Electricity National Control Centre (ENCC) Asset Health	Maintenance updates to existing tools other than those covered by IT investments **170** and **210.**	Maintenance updates to systems being replaced are closely monitored to ensure least possible regret spend.

Table 2: D1.1.5 IT Investments

What will we deliver in BP2 for the Operability Strategy Report (D1.1.6)?

Please see **Annex 1 – Supporting Information.**

What will we deliver in BP2 for forecasting demand and generation (D.1.1.7)?

The scope of this deliverable has changed in line with our IT investment plans, as described below. However, we also see additional requirements to support data transparency, develop automation of forecasting-related processes and meet increasing regulatory reporting obligations. We plan to absorb these requirements within the current Role 1 business areas.

Our forecasting capabilities are a key enabler for the Control Centre and our zero carbon operation ambition. Our IT investments in forecasting have already delivered benefits of improved accuracy and greater transparency for market participants, ultimately leading to fewer balancing actions being taken in the Control Centre. Between April 2017 and December 2019, investments in our forecasting capabilities delivered a ~100MW improvement in the accuracy of our forecasts at the daily peaks and troughs. The table below provides an overview of the activities under each IT investment line covered by D1.1.7 and their links to our transformational deliverables.

IT investment	Forecasting products	Summary of BP2 activities	Link with transformational deliverables
260 Forecasting enhancements	Product 1: National demand	We will maintain and improve, where possible, the benefits already delivered in BP1 by these	This investment will enable development and integration of forecasting products within the data
	Product 2: Solar power generation		

IT investment	Forecasting products	Summary of BP2 activities	Link with transformational deliverables
	Product 3: Grid supply point demand	products. They are expected to deliver around £200m**Error! Bookmark not defined.** annual benefits for consumers by saving on balancing costs.	and analytics platform (**D1.4.1)** and the future balancing platform (**D1.2.1).**
	Product 4: Wind power generation		
670 Real-time predictions	Product 5: Real-time predictions	We will undertake the discovery work for this product in BP2. This will include an estimation of the consumer benefits to support investment decisions.	This product will replace the existing demand predictor in the Control Centre and deliver greater benefits from our future balancing tools (**D1.2.1)** than would be possible with the existing forecast predictor.

Table 3: D1.1.7 IT Investments

We have a well-established delivery capability for the first four forecasting products set out above, but the real-time predictions product presents us with new challenges. Real-time predictions mean delivering forecasts for each minute between real-time and six hours ahead, rather than half hourly. The real-time predictions forecasts are also expected to be updated at least every five minutes (preferably every minute) and to be available as soon as new outturn data is received. The complexity and scale of the effort required to deliver **670** will be developed during BP2. We will need to develop new data sources, mathematical models and machine learning algorithms, and implement them in a CNI IT solution.

Our cost forecasts for **260** Forecasting Enhancements have increased since BP1, from £3m to £16m. This is due to the transition to a new strategic cloud hosting platform with a sustainable, flexible and scalable infrastructure. This platform is required to deliver the benefits of our improved forecasting products via integration with the strategic platforms and applications being delivered by **220** Data and Analytics Platform and **110** Network Control. It is also required to deliver the forecasting requirements for our future balancing tools being delivered under **180** Enhanced Balancing Capability.

The forecasting IT investments **260** and **670** are dependent on **D1.2.1 Future of Balancing** and are both part of the Balancing Programme. Please see **A1.2 Enhanced Balancing Capability** for a description of the Balancing Programme plans in BP2. More detail about the IT investments can be found in **Annex 4 – Digital, Data and Technology**.

What will we deliver in BP2 for trading solutions (D1.1.8)?

The trading activity that we undertake reduces balancing costs. Greater automation of our trading processes mitigates against the risk of manual errors and makes sure we continue to meet our increasing need for energy trading actions. For example, new interconnection capacity has, as expected, increased the volumes of both preparatory and operational trading activities.

In 2019, we introduced the current trading processes for transacting with interconnector counterparties. In its first year, we estimate it saved £22.3m on balancing costs, as well as increasing counterparty participation.

Automation of our trading processes is supported by our IT investments. A business continuity solution, required for critical trading systems used for trade capture and trade notification, will be delivered under **240 ENCC Asset Health** in BP1. A loss of the systems used for logging and storing all trade details and for subsequent notification of energy contract volumes to Elexon would result in trading by the ESO being suspended. Between April 2021 and March 2022, we saved on average £410,000 per day, or around £150m per year, in balancing costs, as demonstrated in the chart below. A robust business continuity solution for our systems is therefore essential.

Total saving (£m) from trading activity from the start of the financial year

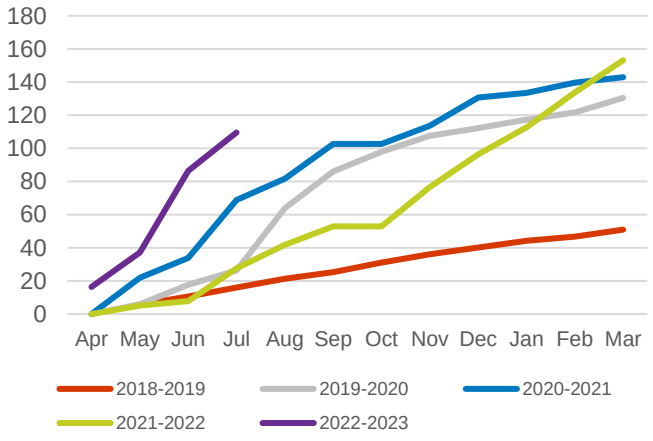


Figure 17: Annual cumulative benefit of trading

6.10.1.2 A1.2 Enhanced Balancing Capability (materially changed)

What is this sub-activity and why is it important?

This sub-activity covers the significant investment needed in our balancing systems to manage decentralisation of providers and to accommodate closer-to-real-time energy markets. The name of the deliverable **D1.2.1** has been updated to 'Future of Balancing'.

The Balancing Programme refers to our internal delivery programme which comprises the IT investments **180** Enhanced Balancing Capability, **480** Ancillary Services Dispatch, **210** Balancing Asset Health, **260** Forecasting Enhancements and the new investment **670** Real-time Predictions. These IT investments contain the suite of systems that underpin our current and future balancing capabilities. The systems are highly interdependent and must be planned, developed, tested and (in some cases) decommissioned in an integrated way. This coordinated approach will enable us to move functionality from existing to future systems in a cost-efficient manner, while delivering benefits at pace.

The capabilities and outcomes being delivered by the Balancing Programme are critical to achieving our mission and ambitions. This programme is integral to:

- ensuring the electricity system can operate carbon free by 2025.
- delivering gross consumer benefits of £191m over the RIIO-2 period in reduced carbon emissions and lower system operation costs than would otherwise be the case.
- realising the consumer benefits of many other RIIO-2 initiatives, such as new Balancing Services and Networks Services Procurement (Pathfinders). These have a total net present value of £2.15 billion[10].
- scaling participation in the balancing markets and providing a level playing field for all participants, regardless of technology type and size.
- delivering a step change in transparency for market participants, by explaining our balancing decisions.

Internal and external strategic reviews of our balancing capabilities and plans were undertaken between November 2021 and May 2022. The key outcomes of these strategic reviews were a roadmap co-created with industry, validated internal and external requirements, and a framework for quarterly reporting and engagement with industry. The strategic reviews have given us confidence that our BP2 submissions for the Balancing Programme are well supported by industry and are cost-effective.

The RIIO-2 cost forecasts for the Balancing Programme IT investments have increased since BP1, from £63.3m to £173m (including capex, opex and running costs). These increases in costs have resulted from obtaining a full understanding of the technology requirements of our balancing transformation, which we did not have at the time of BP1, and from market changes during BP1 which have necessitated a change in the scope of our future balancing capabilities. A detailed explanation of why our Balancing Programme costs have increased can be found in **Annex 1 – Supporting Information** and the cost drivers for each IT investment can be found in **Annex 4 – Digital, Data and Technology.**

The IT investments **210**, **260** and **670** are aligned to the deliverables **D1.1.5 Maintenance and upgrades to legacy systems** and **D1.1.7 Forecasting demand and generation**. Further information about these investments can be found under **A1.1 Ongoing activities**, as well as in **Annex 4 – Digital, Data and Technology**.

The Balancing Capability Strategic Review

Why did we carry out the review?

Since publishing our BP1 we have completed the foundation and blueprint phases for our enhanced balancing capability (**D1.2.1**). The foundation phase gathered detailed requirements from within our organisation and across wider industry. The blueprint phase delivered the high-level design of our future capability, including the associated technology and delivery team. We are now part way through the core phase where we are building the capabilities to deliver these investments. We have also been creating the delivery team and executing the delivery methodology.

> **"ADE encourages the ESO to … progress the IT reforms as fast as possible"**
>
> *BP2 consultation response from the Association for Decentralised Energy (ADE). Documentation*

Through the foundation and blueprint phases, we developed a much greater understanding of the scale and complexity involved in transforming our balancing capability. We need to optimise multiple services across thousands of units at the same time and incorporate more regulatory and market driven change. We also need to accommodate higher volumes of renewable generation and interconnector capacity and reflect their increased operating volatility. We therefore updated our plans and costs for the transformation to include:

- a delivery approach (described under **D1.2.1 Future of Balancing** below) which minimises risk and maximises value through implementing changes in small increments.
- functionality requirements for other RIIO-2 initiatives such as Regional Development Programmes (RDPs), Networks Services Procurement (Pathfinders) and new Balancing

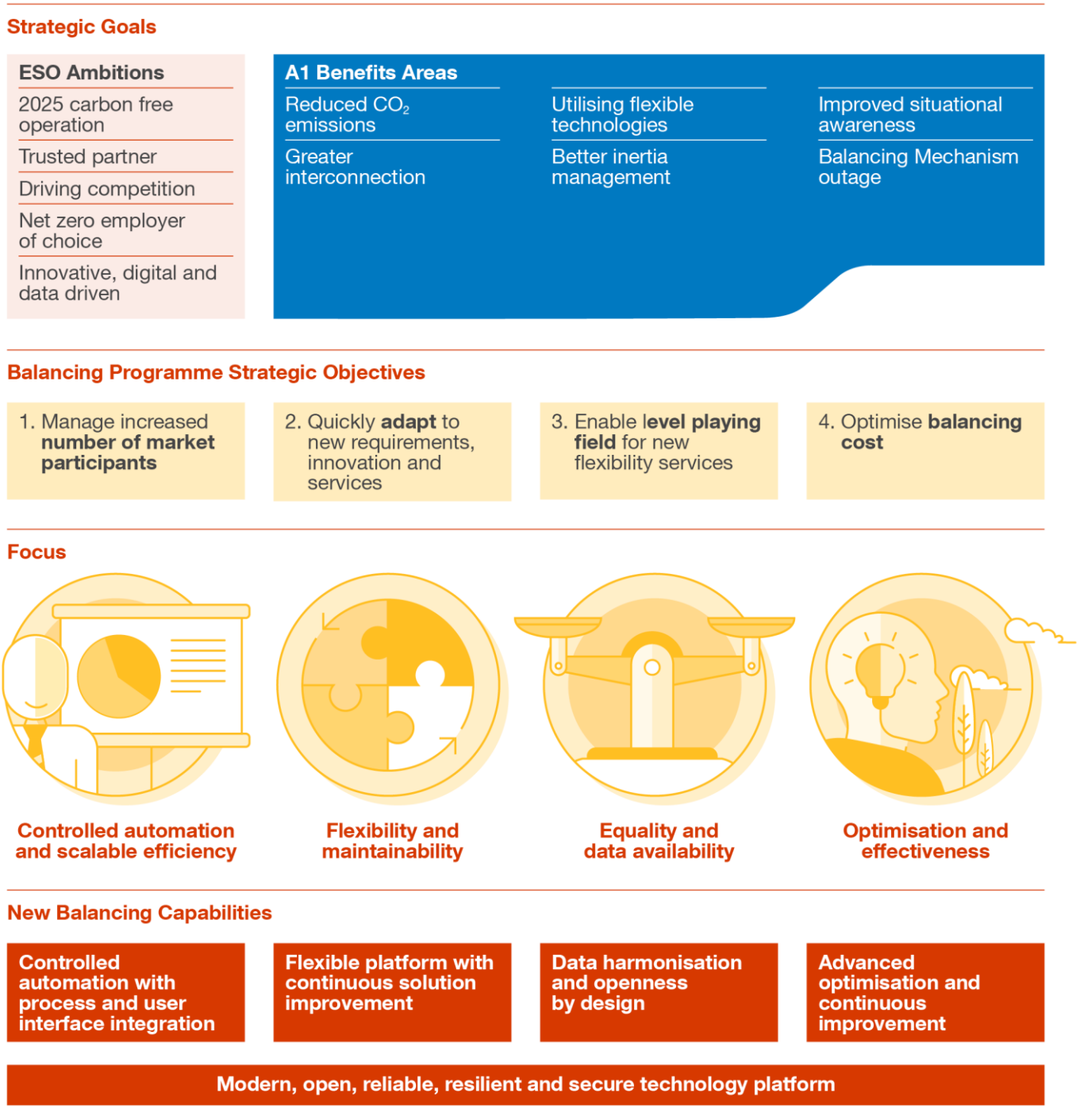
[10] The is the sum of the net present values of all RIIO-2 activities dependent on A1, please see Annex 2 – Cost-Benefit Analysis for details. Some of these benefits will be enabled by the legacy systems and then migrated to new systems, other benefits will be enabled only in the new systems.

Services such as Dynamic Containment, Dynamic Moderation and Dynamic Regulation.

- detail on the capabilities of the existing systems that we will need to maintain while we develop the new platforms.
- detail on the product and delivery capabilities required to deliver the outcomes of our Business Plan.
- a roadmap for transforming our balancing systems and for transitioning between our existing and future systems, supported by benefits cases aligned with the roadmap.

Our improved understanding of the scale and complexity of the balancing transformation prompted an internal strategic review of our balancing capabilities in November 2021, while we continued to deliver the core phase. The internal strategic review comprised of assessing the current and proposed balancing systems against our strategic objectives (see figure 18 below), engaging with all internal stakeholders to validate their requirements and making sure our delivery plan remained robust and cost-effective.

Figure 18: Alignment between our strategic goals and the Balancing Programme objectives and focus areas



Chapter 6 – Role 1 Control Centre operations

The strategic review concluded that:

- Our current balancing systems are limiting our ability to adapt at pace to a changing energy market and we cannot achieve the benefits of our RIIO-2 Business Plans without transforming them.
- The cost estimate for implementing the Open Balancing Platform (IT investment **180**) would increase from £45m in our BP1 to £103m in our BP2 submission. In addition, we would need to maintain existing balancing systems (IT investment **210**) for longer than anticipated in the final two years of RIIO-2.
- The scale and scope of the Balancing Transformation Roadmap needed to meet our strategic goals and objectives was too significant to commit to without first seeking support from industry.

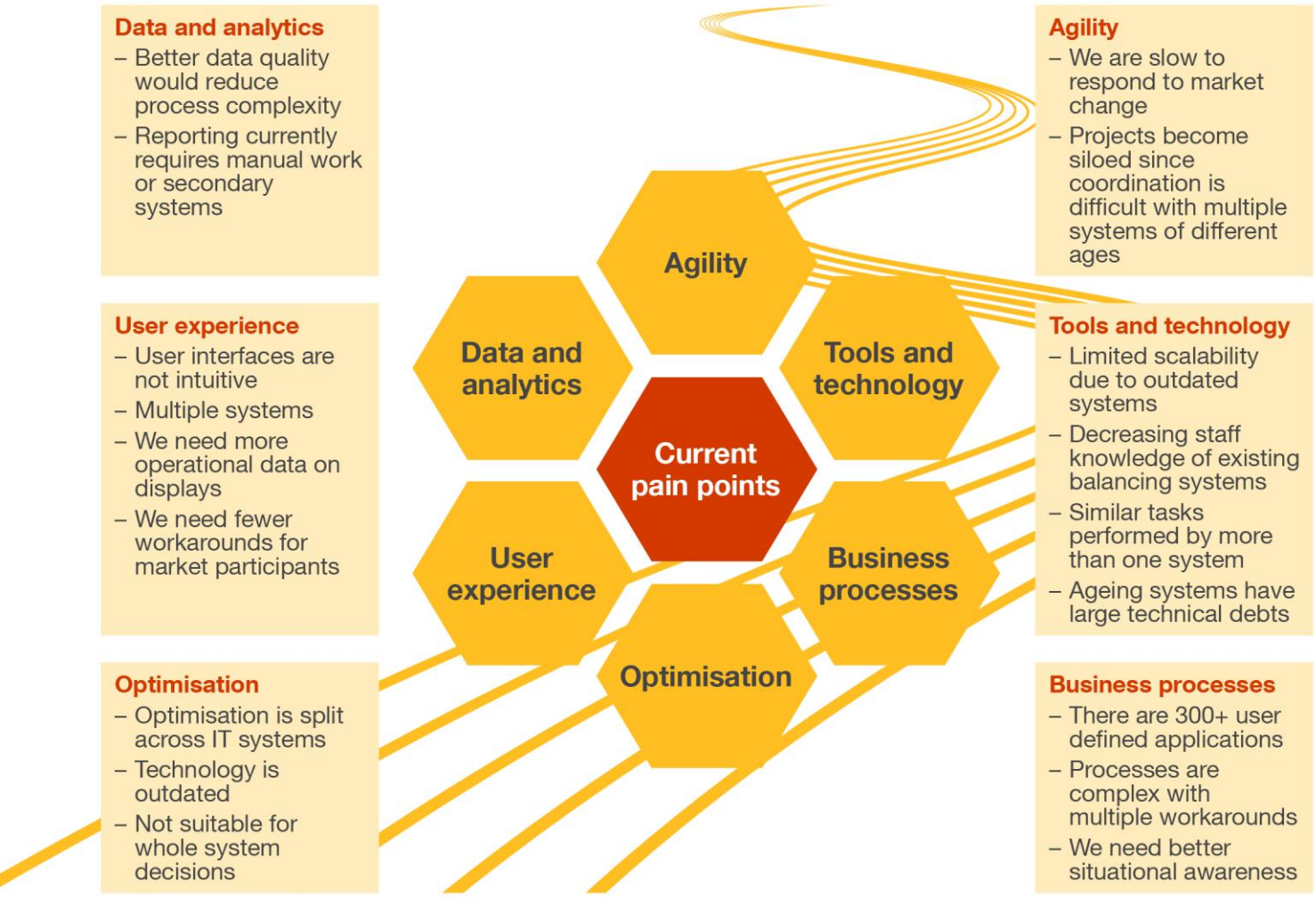
This led to the launch of intensive engagement with industry stakeholders in April and May 2022.

What were the objective and outcomes of the external review?

The objectives of our industry engagement in the Balancing Capability Strategic Review were to:

- provide an understanding of the current challenges in the Control Centre, as summarised in Figure 19;
- seek a common understanding of why we need to transform the balancing capabilities;
- understand all the benefits of the transformation;
- produce a co-created, industry endorsed roadmap;
- build support for our approach;
- create a framework for continued industry engagement while we transform.

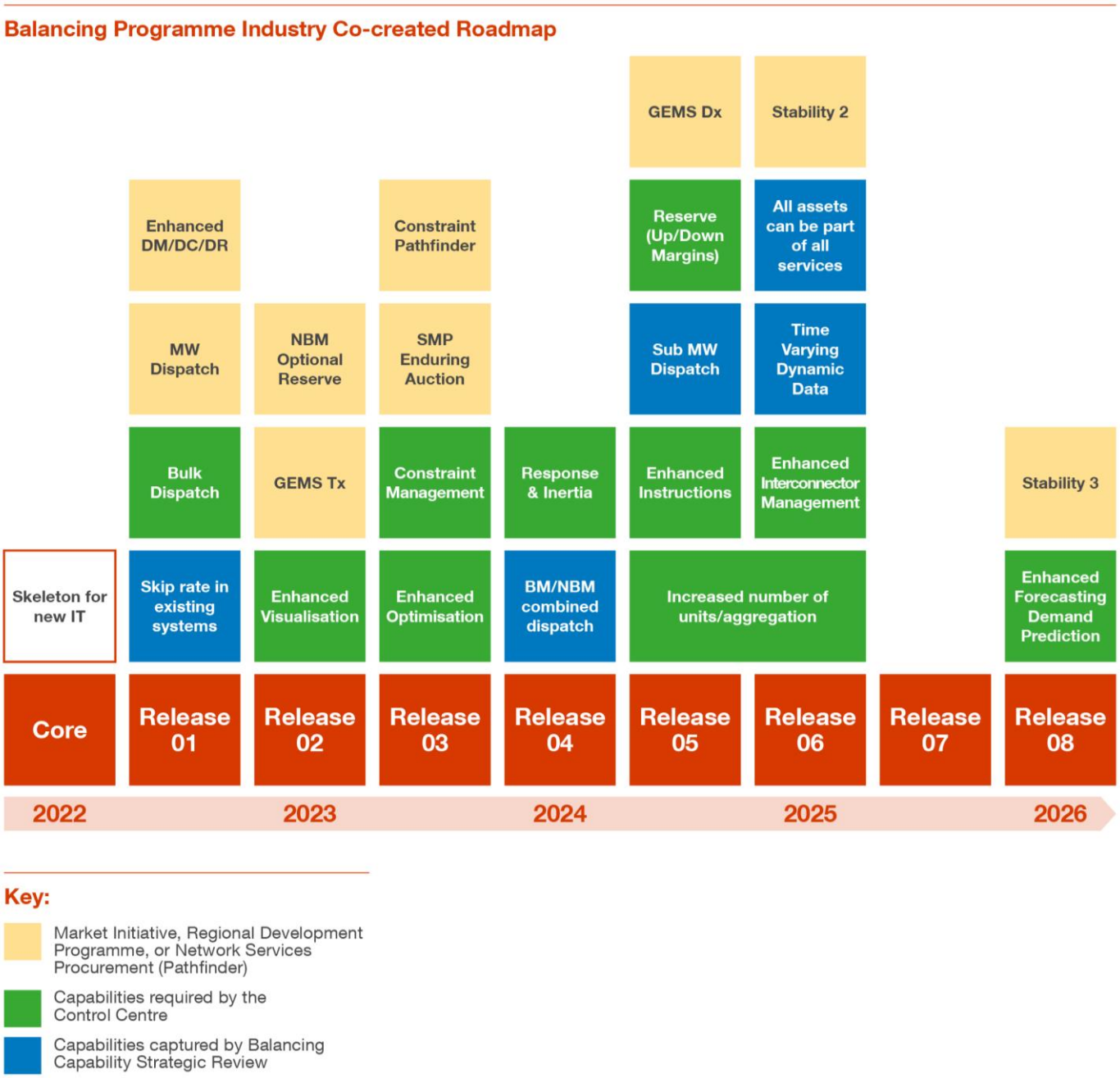
Figure 19 (below): Current challenges in the Control Centre



We engaged with industry through a series of transparent briefings, workshops and webinars[11] . The co-created roadmap for transformation summarised in Figure 20, aligns well with the roadmap we created internally, but also includes new and reprioritised capabilities based on stakeholder feedback.

Figure 20. The roadmap co-created with industry for balancing transformation; the release structure is explained under **D1.2.1** Future of Balancing.

Some capabilities suggested by our stakeholders were not included in the roadmap, as summarised in Table 4.



[11] The materials and recordings for these webinars are available on our website: https://www.nationalgrideso.com/industry-information/balancing-services/balancing-programme/strategic-capability-review

Capability suggestion	Reason for not including it in the roadmap
Carbon intensity as an input to decision-making	Not currently facilitated by our licence. Future balancing capabilities will enable us to make better use of all technologies, including low carbon.
Allowing decreasing prices in the Balancing Mechanism (BM)	This change is difficult to accommodate in our systems, but we will consider alternatives such as start-up prices.
Sharing BM prices outside of gate closure	This would require code change and agreement with Elexon; it has been added to our capability backlog and will be investigated.

Table 4: Balancing capabilities suggested by stakeholders that were not included in the Balancing Transformation Roadmap

Through the Balancing Capability Strategic Review we gained stakeholder support for our approach to transformation and we agreed a framework for continued engagement with our industry partners as we transform. The details of the stakeholder feedback received are in **Annex 3 – Stakeholder Engagement.**

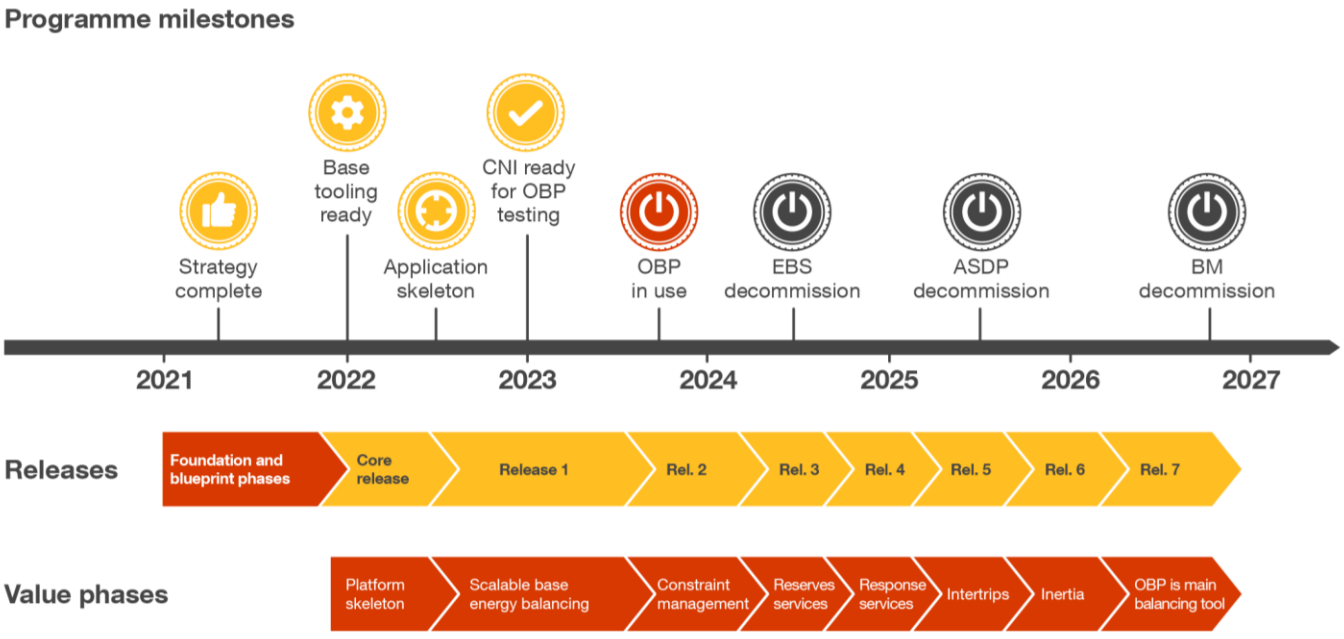
What will we deliver in BP2?

What will we deliver in BP2 for Future of Balancing (D1.2.1)?

By the start of BP2 we will have completed the foundation, blueprint and core phases of the Balancing Programme. Please see **Annex 1 – Supporting Information** for a detailed description of these phases. During BP2 we will be incrementally releasing capabilities onto the Open Balancing Platform (OBP) and gradually decommissioning existing capabilities, as described by the roadmap co-created with industry above. The OBP is the platform upon which we will build our future balancing capabilities and deliver our commitments under **D1.2.1**.

We are developing the OBP incrementally, aligned to the Scaled Agile Framework[12] delivery methodology. Each increment of development is referred to as a Programme Increment, which is a 12-week period consisting of five two-week development sprints and a two-week planning sprint. We plan to deploy the first production release of the OBP into the Control Centre in September 2023. Subsequent releases of capabilities into the OBP will occur after every two programme increments i.e. every six months. We will deploy capability releases over a four-year period, whilst also gradually decommissioning existing capabilities until 2027.

Figure 21: The high-level schedule for OBP milestones, releases and value phases



We have implemented several improvements in our ways of working to make sure that the delivery of our future balancing capabilities is flexible and can adapt to the evolving needs of our stakeholders.

[12] https://www.scaledagileframework.com/

- We have established a Balancing Product team who liaise with internal and external stakeholders to refine features and prioritise our backlog, delivering highest value outcomes as early as possible.
- We have fully adopted a Scaled Agile Framework[13] approach to delivery which enables us to deliver value to stakeholders earlier by:
  - demonstrating delivered value (at least) quarterly
  - leveraging the latest DevOps capabilities and containerised architecture to develop, test and integrate in the cloud, and deploy easily to CNI environments
  - aligning our development teams to product owners, who take features and refine them to deliver user stories.
- We align benefits and outcomes to releases, to demonstrate value to our internal and external stakeholders.
- We will increase confidence in our delivery capability as we progress, by being transparent with industry on what was delivered at the end of each Programme Increment.
- We will engage quarterly with external stakeholders. This will prepare industry for changes that they may need to make in their own systems to ensure that the OBP is effective.

What do we need to deliver Future of Balancing (D1.2.1)?

Our plans for the Future of Balancing (**D1.2.1**) have the following dependencies:

- The balancing transformation, and our approach to it, is supported by industry and Ofgem.
- CNI data centres will be ready to support Release 1, otherwise the benefits of this release may be delayed.
- We will need clarity on foreseeable market changes and initiatives (as described in this Business Plan).
- Other platforms will be available for integration with the OBP. This includes the Data and Analytics Platform, Single Markets Platform and Network Control tools described in **A1.4**, **A4.4** and **A1.3**.

This deliverable is aligned to the IT investments **180** Enhanced Balancing Capability and **480** Ancillary Services Dispatch. It is also dependent on the IT investments **210** Balancing Asset Health, **260** Forecasting Enhancements and new investment **670** Real-time Predictions which are aligned to **A1.1 Ongoing activities**. The detail behind these investments can be found in **Annex 4 – Digital, Data and Technology**.

What will we deliver in BP2 for inertia forecasting, emergent technology and system management (D1.2.2)?

Please see **Annex 1 – Supporting Information.** This deliverable is aligned to the IT investment **130** Emergent Technology.

What will we deliver in BP2 for greater use of automation, Machine Learning (ML) and Artificial Intelligence (AI) (D1.2.3)?

In our BP1 we committed to consider how innovation funding can support greater use of automation, ML and AI in the Control Centre. These became a key driver for our innovation priority 'Digital Transformation', as described in our 2020/21 Innovation Strategy, and projects have already been proposed to address Digital Transformation in the Control Centre within BP2. Given that the funding mechanisms for these will be through the Network Innovation Allowance (NIA) and the Strategic Innovation Fund, we are removing deliverable **D1.2.3** from the RIIO-2 delivery schedule. However, increased use of automation, ML and AI remains a key part of our strategy for activity **A1**, and this will be realised through the capability developed in **D1.2.1 Future of Balancing** and **A1.3** Transform Network Control, and through the work of ESO Labs.

6.10.1.3 A1.3 Transform network control (materially changed)

What is this sub-activity and why is it important?

This sub-activity covers the investment to enhance the situational awareness of our Control Centre engineers. In BP1, we committed to replace our current real-time situational awareness tool, the Integrated Energy Management System (IEMS), with our new Network Control Management System (NCMS). By the end of RIIO-2 we will deliver a fully operational NCMS suite into the Control Centre, integrated into our new Critical National Infrastructure (CNI) Data Centres, and will transition away from the IEMS tool which is currently shared with National Grid Electricity Transmission (NGET).

What will we deliver in BP2?

Our milestones for deliverables **D1.3.1, D1.3.2** and **D1.3.3** are on track and include new BP2 milestones for Shadow Control Centre establishment and integration of Network Control tools with the Data and Analytics Platform (DAP) and balancing systems. However, our scope of work has increased in the following areas.

- **Evolving cyber requirements –** as part of our commitment to replace our IEMS, we have reviewed our design against the latest cyber-security intelligence for CNI. This area is rapidly developing, and we have identified new resilience options to maximise the security in the design of the new NCMS tools. [redacted][14]
- **Enhanced IT architecture –** for our new NCMS product, we propose a more modern virtualisation of our architecture, in collaboration with our preferred supplier. This will be deployed in our new CNI Data Centres and offer improved cyber-security, performance, and better maintenance options. Owing to higher costs for hardware, due to the ongoing semiconductor shortage, a higher level of investment is required to ensure we deliver the most suitable foundations for future operation. This will also

[13] https://www.scaledagileframework.com/

[14] It has been necessary to redact this section from our Business Plan because it contains operationally sensitive information.

benefit future developments such as the Virtual Energy System programme described in the Innovation chapter.

– **Improved delivery approach** – the Programme team is moving to a 'TechOps' way of working, with an agile delivery model. Where we had previously allocated resource to remain in other business areas and provide expertise into the product team, we are now bringing this expertise into the Programme team. This is in response to stakeholder feedback (such as from the TAC).

The continuous deliverable **D1.3.4 Increased operational liaison with DNOs** has been removed from this sub-activity. Its associated milestones and benefits will now be delivered under the sub-activity **A1.5.**

What do we need to deliver this sub-activity?

Our plans must remain adaptable to meeting the current and evolving needs of the Control Centre end-users. For example, where legacy solutions such as video walls are causing issues, it may be efficient for the Network Control programme to reprioritise and reorder the sub-activity milestones. Requirements for enhanced cyber-security measures will evolve and could continue to impact the future costs and schedule for this sub-activity. Cyber-security is an area of increasing importance, and we will invest to ensure the appropriate level of security and resilience.

This sub-activity is aligned to IT investment lines: **110** Network Control**, 150** Operational Awareness and Decision Support and **140** ENCC Operator Console. These will eventually integrate with the **220** Data and analytics platform, and the investment **200** Future training simulator is dependent on its delivery. The detail behind these investments can be found in **Annex 4 – Digital, Data and Technology**.

6.10.1.4 A1.5 Operational coordination with DER and DSO (new)

This is a new sub-activity to address the impact of the interface between ESO, Distribution System Operators (DSOs) and Distributed Energy Resource (DER) on our real-time operations.

Due to the direct interdependencies of facilitating whole electricity flexibility activities, detailed deliverables for this sub-activity are found in the spotlight **Accelerating whole electricity flexibility** section.

6.10.1.5 A1.6 Minimising Balancing Costs (new)

Minimising balancing costs has always been a priority for us but, given their recent rapid increase, we have re-examined all areas of our business to see if there are further actions that we can take to keep costs down. We have, of course, also made this one of our key priority areas for BP2, as described in Part A of this document.

All our activities across the business have the potential to impact the scale of balancing costs. The costs materialise in Role 1, as we take actions to balance the network second-by-second in the Control Centre. However, Role 2 and Role 3 activities can affect both the size of the balancing requirements, as well as the options that the Control Centre has available to balance the system. This means we need to think holistically about the activities we can undertake to minimise these costs.

What are balancing costs and why is it important that we minimise them?

Balancing costs are incurred when we take actions in the Control Centre to secure and balance the electricity system. They make up the largest component of Balancing Services Use of System (BSUoS) charges, which recover the costs of day-to-day operation of the transmission system.

Balancing costs impact consumers' bills which is why it has always been important for us to take all the actions we can to minimise them. However, recently these costs have rapidly increased as the effects of the global energy crisis have driven gas prices to record levels. Consequently, this has increased electricity prices, and therefore the cost of balancing actions. We project balancing costs for this year (2022/23) to be c.£4.5bn, which is calculated by combining the incurred balancing costs to date and our BSUoS forecasts for the remaining months.

In the medium to longer term, there are trade-offs between network investment, balancing costs and operational complexity that we need to consider. For example, the level of network investment can impact how dynamic the system is, potentially leading to more options and scenarios that need to be optimised in shorter timescales. We forecast that the constraints element of balancing costs, which are incurred to manage bottlenecks on the system, will continue to increase to a peak of approximately £2.3bn in 2026. This peak is driven by the electricity system transitioning towards zero carbon operation[15] before the networks owners' investment plans have a significant impact.

How do we minimise balancing costs?

In addition to balancing actions in the Control Centre, ahead of real-time we manage and reduce balancing costs by proactive network planning, developing commercial services, expanding our markets and driving competition. Today, customers are benefitting from our market and network initiatives progressed over the last decade. Some examples of this work and associated savings are set out below. As a result of these activities, the volume of balancing actions we took last year was down to around 20TWh, from roughly 25TWh in 2019/20. However, despite the reduction in the volume of actions, balancing costs have risen significantly over the last two years, from £1.3bn in 2019/20 to £3.1bn in 2021/22. The main drivers of the increased costs in 2021/22 were:

– The effects of the high cost of gas feeding through to electricity prices, and therefore balancing costs.

– Gas and coal generator market strategies e.g. coal generators setting the marginal price at £4,000/MWh, coupled with some scarcity pricing leading to high costs on low margin days.

– Constraint costs, predominantly driven by the cost of replacement energy when wind generation is constrained in Scotland and the North of England.

[15] https://www.nationalgrideso.com/document/258871/download

Notwithstanding these increases, balancing costs are lower than they otherwise would have been without our actions. Examples of the actions we have taken to minimise costs include:

1. **Delivery of the 5-point plan**[16] to manage constraint costs. We have engaged with industry to enable immediate and future savings through:
   a. **Clearer forecasts on BSUoS costs** (short to medium term)
      i. We now publish rolling forecasts as well as a 24-month constraint forecast.
      ii. By the end of BP1, we will have developed a process to allow ranges of costs to be forecast with different wind scenarios.
   b. **Developed intertripping capability through our Pathfinder** (short to medium term)
      i. Early implementation of a generator intertrip service on the England/Scotland boundary (part of the Constraint Management Pathfinder[17]) saved **£29.792m** in its first four months of operation from April 2022 and continues to deliver savings under high wind conditions **(Activity A8.1).**
   c. **Working with regional networks on a whole system approach** (across all timescales)

      Our Regional Development Programmes (RDPs) involve us working with Distribution Network Operators (DNOs) to identify and solve localised network issues, including reducing constraints. Prior to the delivery of RDPs in Scotland, the Local Constraint Market (LCM) will provide an interim solution over the next three to four years to help manage the high and rising costs at the England/Scotland boundary. With industry and partners, we have been co-creating service terms for the LCM, which will be instructed ahead of BM actions. So far, requirements have been developed and procurement is underway for a platform to deliver the LCM, which is expected to be launched in Q4 2022.
   d. **Exploiting storage potential in a heavily constrained network (**medium term)
      i. We commissioned analysis on using storage effectively to reduce constraints.
      ii. We will continue to work with storage companies to understand and remove any barriers to allow them to compete with other technologies to provide constraint management services.
   e. **Continuing to improve our existing network** (medium to long term)
      i. Working with three Transmission Owners (TOs) we identified five schemes of work that could save £2.5bn if accelerated by 1 year (assessed by the *NOA7*[18]) Following the Holistic Network Design (HND), we will look to refine the expected benefits case.
2. The Frequency Risk and Control Report[19] (FRCR), underpinned by the Accelerated Loss of Mains programme, implemented a risk-based approach to our frequency policy in 2021. This was a significant driver of the reduced volume of actions. It also saved **£435m** in balancing costs when combined with the recently introduced Dynamic Containment Low service last year. **(Activity A4.1).**
3. Outage optimisation over the last year, in collaboration with our customers and stakeholders, released around 24,600 GWh of constrained generation capacity, saving **£1.87bn** in balancing costs (an increase from £1.4bn in 2020-2021), **(Activity A16.1).**
4. **End–to end review of balancing costs** processes, which included trials on closer to real-time constraint optimisation, delivered savings of **£6m** in 6 weeks. We forecast this could equate to over £50m per year over the BP2 period. These benefits will be realised by FY23/24.
5. **Enhanced Service Provisions STCP11.4 (TO Incentive)** was set up to encourage TOs to find ways to undertake outages in a way that reduces network restrictions, thereby minimising constraints and costs for consumers. Last year alone, we worked with TOs to achieve savings of around £42.5m. One example that delivered a large portion of this benefit was reaching agreement with a TO that they would have a temporary operating regime, for two weeks, that allowed enough time to take manual post-fault actions to secure the network. This included additional people to man multiple sites and the Transmission Network Control Centre, as well as enhanced mitigation checks and monitoring. This avoided running additional conventional generation for two weeks, saving £37.8m.

[16] https://www.nationalgrideso.com/news/our-5-point-plan-manage-constraints-system

[17] https://www.nationalgrideso.com/news/our-5-point-plan-manage-constraints-system

[18] https://www.nationalgrideso.com/research-publications/network-options-assessment-noa

[19] https://www.nationalgrideso.com/document/248151/download

Chapter 6 – Role 1 Control Centre operations

What will we deliver in BP2 to minimise balancing costs?

The Balancing Capability Strategic Review suggested that our current balancing systems are limiting our ability to adapt at pace to a changing energy market. To enable the benefits of our Business Plan and minimise balancing costs, we recognise we need to transform our balancing capability in the Control Centre. Doing so will drive competition by enabling access to an increased number of market participants. This will be particularly important in light of anticipated changes to Balancing Mechanism Units' (BMU) MW thresholds that could mean between 6,500 and 25,000 new BMUs participating over the next 5 years.

Our new balancing capability will be adaptable so when market rules change, or innovation brings new possible solutions, our systems will be agile and able to respond. It will also provide new flexibility services that contribute to creating a level playing field for market participants.

Before this enhanced capability is delivered, within BP1 timescales the recent significant rise in energy prices prompted us to undertake an end-to-end review of the processes that lead to balancing costs being incurred in real-time. The table below identifies the Business Plan activities that contribute towards minimising balancing costs, some of which were introduced or changed as a result of this review.

Timeframe	Role	Deliverables
Long term – more than 5 years ahead	**1**	– We are designing the Open Balancing Platform **(A1.2)** to be highly adaptable to the needs of the future energy system. This investment in flexibility will enable us to make the changes required to our balancing systems that will minimise balancing costs far beyond the RIIO-2 period.
	2	– Our Net Zero Market Reform (NZMR) programme **(A20)** aims to identify the optimal market design for Great Britain to achieve net zero cost efficiently. Phase 3 of this programme concluded that a nodal pricing wholesale market, enabled by central dispatch, should be the foundation of this enduring market design. This will deliver value by reducing constraint costs. We are currently supporting Ofgem in their technical assessment of nodal pricing, which should quantify this value. Phase 4 of the NZMR programme will investigate what other market design elements are needed to complement this wholesale market reform, as well as enable the scale and pace of investment needed in net zero assets.
	3	– We will optimise the development of the network to the lowest overall cost **(A7, A8, A9, A11, A12)**. – We have expanded the scope of network optimisation to include offshore and onshore networks together **(A22)**. – Our focus on promoting zero carbon operability (**A15**) will minimise balancing costs on network services by identifying where there are opportunities to deliver them more economically. These opportunities may be identified through Pathfinders, Regional Development Programmes and operational visibility of DER. – Also captured in Role 3 are **our 5 Point Plan** activities, as discussed above.
Medium term – 2 to 5 years ahead	**1**	– The Balancing Capability Strategic Review (**A1.2**) has created an industry-endorsed plan to transform our Control Centre capability to make sure we can minimise balancing costs and create a foundation for future market changes and reform.
	2	– We are reforming our suite of reserve products (A4.6). This includes exploring the creation of dedicated markets for stability and reactive power, which would enable emerging new technologies to participate and avoid inefficient redispatch in the BM. It is estimated that a stability market would save around £58m by 2023. Our Markets Roadmap will continue to assess where we can reform our markets to continue to drive down balancing costs.
Short term – in the next 2 years	**1**	– As more accurate forecasts allow for more efficient decision-making, we are developing and enhancing our forecasting systems for demand and generation. **(D1.1.7, A1.1).** – We are investigating options for greater automation of our trading facilities to enable us to trade reliably and efficiently, particularly as our interconnection with Europe increases in coming years **(D1.1.8, A1.1).** – **D1.6.1 Constraint Boundary Optimisation** allows for **additional engineers in the Control Centre**. This will improve closer to real-time optimisation of constraint boundaries. To begin with,

		this will be on an opportunity/value basis, targeting the largest potential cost savings. As more resource is recruited, and capability built, this activity will be fully deployed. – **D1.6.2 An agile programme of strategic and tactical balancing cost improvement** activities covering Roles 1, 2 and 3. These require clearly defined internal measures and controls, where the impact of our decisions in Roles 1, 2 and 3 on balancing costs are understood and prioritised. Measures we are taking include: – **focus on forecasting –** which includes any method for providing greater certainty on energy and BSUoS cost forecasts. Stakeholders have told us that this would reduce risk premia built into transactions across all marketplaces. – **provide more transparency** of our actions and the scenarios leading to high costs. – **programme of improvements** to enable closer to real-time optimisation of the system operation plan. – drive towards more certainty with **fixed BSUoS charging**. – **inform industry –** publication of greater details of market rules, which stakeholders have told us would remove confusion. – **D1.6.3** Set up an external **stakeholder engagement programme** on balancing costs and opportunities to enable savings. Our intention is to make this a regular channel of engagement where we will increase transparency on balancing costs and share our plans to reduce them.
	2	– We have designed and implemented a new suite of response products that have saved £1.6m of a £32m spend in FY 21/22. We expect a continued 5 per cent year on year saving from reformed response products **(A4.1).** We have also improved our procurement strategy and optimised our response products. – We are managing rising constraint costs through the introduction of a Local Constraints Market **(A15.5)** – We are making it easier for providers to access our markets through the development of the recently launched Single Markets Platform **(A4.4).** This will deliver more competition and drive down costs.
	3	– Pathfinders, now known as Network Services Procurement **(A8),** which will be delivered during the BP2 period that will reduce balancing costs, includes: – Constraint Management for the England/Scotland boundary – Stability Pathfinder phase 2 – Stability Pathfinder phase 3. – We are working with DNOs in the Regional Development Programmes **(A15.5)** to deliver co-ordinated real-time constraint management systems using the DNO distributed energy resources management system (DERMS) infrastructure. This will increase the options available to us to manage the system and reduce costs. – We recently published a paper[20] on the benefits of improved operational visibility of DER and our proposed roadmap to deliver greater visibility. We plan to initiate a project to deliver this work in BP2 **(A15.8)**. – Also captured in Role 3 are our **5 Point Plan** activities, as detailed above.

Stakeholder feedback

Stakeholders shared their thoughts with us on balancing costs at a listening session held in July 2022; 72 people participated, representing a broad spectrum of industry, to discuss BSUoS charges. We are working through the information and ideas shared and the questions raised. We will use this feedback to align our actions with what stakeholders and consumers value and to identify any gaps in our current plans. The main areas covered were:

– ESO forecasting – BSUoS and energy
– fixed BSUoS
– information transparency on ESO actions

[20] https://www.nationalgrideso.com/document/250251/download

– closer to real-time optimisation of the plan.

Please see **Annex 3 – Stakeholder Engagement** for further detail**.**

What do we need to deliver this?

Balancing costs are impacted by almost all our day-to-day and project activities and so this activity has dependencies across Roles 1, 2 and 3. Our IT delivery programme (**A1, A2**), which will enable new capability to control, monitor and balance the network in our Control Centre, also underpins our ability to deliver activities that minimise balancing costs. We will also look to the outputs of the ESO Balancing Market Review 2022[21] and ongoing stakeholder engagement to continue to shape our plans and delivery.

Dependencies for this activity also extend to ongoing work with Ofgem and BEIS, such as the Review of Electricity Market Arrangements (REMA). This review, together with Ofgem's consideration of locational marginal pricing, will underpin what we can do to reduce balancing costs in the medium to longer term**.**

6.10.2 A2 Control Centre Training and Simulation (materially changed)

In BP1, this activity described our resource planning and training, incident analysis and investigation, monitoring system performance and guidance on operational policy for the Control Centre.

It also contained transformational sub-activities to ensure our Control Centre engineers continue to have the right training to operate the energy system of the future. The specific deliverables included:

– enhanced training material through partnerships with academic institutions and through training collaborations with DNOs, as they look to develop their own capabilities in system operation.

– developing a new training simulator and additional online or e-learning options to reflect the changing energy landscape.

– greater automation in document management and personalised training plans, to provide an environment that supports the wellbeing and continued development of our Control Centre engineers.

This activity is categorised as materially changed because the delivery of greater automation in document management for Control Centre shift rotas (**D2.4.1**) is currently 12 months behind schedule, due to unforeseen issues with the provider of the new system. However, we expect to recover this delay by the end of BP1 and to deliver on our BP2 commitments on time. The delivery of the five other transformational deliverables in this activity is on track.

Stakeholder feedback (A2)

During BP1, we committed to being proactive and sharing learnings from across the industry on incident analysis and investigation of abnormal events. We used our Operational Transparency Forum (OTF) and other relevant industry forums to share learnings with stakeholders. For example, we shared details of an investigation into a major incident around Heysham on 22 July 2021.

Feedback received on our draft plan relating to our A2 activities was supportive. We will continue to use the OTF throughout BP2 and we will also use feedback from stakeholders during the development phase of our new training and simulation products (scheduled to take place between Q3 of 2023/24 and Q4 of 2024/25). This will make sure that products can be used for industry-wide training going forwards.

To see more detail on feedback for A2, please refer to **Annex 3 – Stakeholder Engagement**.

A2 sub-activities

This activity is made up of the following sub-activities:

Sub-activity #	Sub-activity name	Status
A2.1	Ongoing activities	No change (please see **Annex 1 – Supporting Information**)
A2.2	Enhanced training material	No change (please see **Annex 1 – Supporting Information**)
A2.3	Training simulation and technology	No change (please see **Annex 1 – Supporting Information**)
A2.4	Workforce and change management tools	Materially changed

[21] https://www.nationalgrideso.com/research-publications/eso-balancing-market-review-2022

6.10.2.1 A2.4 Workforce and change management tools (materially changed)

What is this sub-activity and why is it important?

This sub-activity covers investment in greater automation to produce personalised training packages for career development and enhancement (**D2.4.1**). Our ambition for 2026 is to create a training repository system which will automatically populate training options into personalised training plans.

What will we deliver in BP2?

Our plans remain as set out in our BP1. However, there has been a delay to the delivery of **D2.4.1** (currently thought to be 12 months) due to the technical challenges introduced by the complexities of our Control Centre rota and a change in ownership of the company we are working with. The mobile application we were intending to procure is no longer supported and an alternative is being launched, which will better suit our needs.

This delay only impacts timing of deliverables within our BP1, and we still expect to deliver our milestones by the end of the BP1 period. We remain on track for our BP2 milestones as originally set out, although we acknowledge that the delays in BP1 have created a delivery risk for BP2.

What do we need to deliver this sub-activity?

This sub-activity is aligned to IT investment line **190** Workforce and Change Management Tools. The detail behind this investment can be found in **Annex 4 – Digital, Data and Technology.**

6.10.3 A3 Restoration (materially changed)

In BP2 we will continue to extend restoration services to different technologies and to implement, and ensure compliance with, the Electricity System Restoration Standard (ESRS) which came into effect on 19 October 2021.

Our work with stakeholders has identified a need to deliver code changes earlier than expected, to allow time to implement the system changes needed to comply with the agreed restoration times. We had anticipated a need for additional resource to support ESRS compliance but had planned for this work to be supported by junior engineers or apprentices. As a result of the accelerated timescales, we now know that more experienced engineers will be required in the initial stages of ESRS implementation.

We will work with DNOs and industry stakeholders to incorporate recommendations from the Distributed ReStart project[22] into our restoration tenders in 2022. This is earlier than we had anticipated in BP1 and requires a significant increase in stakeholder engagement. Consequently, we will need to bring forward an increase in resource from 2023/24 to 2022/23.

Our Business Continuity team provides support for our Control Centre operations. During the COVID-19 pandemic, this team also provided support and expertise to our wider business to implement pandemic response plans to minimise disruption to our critical processes and coordinate reporting, as well as sharing best practice with external stakeholders. This has highlighted an increased need for additional resources to support a coordinated approach to emergency planning with both internal and external stakeholders.

Stakeholder feedback (A3):

We have undertaken significant stakeholder engagement during BP1 regarding implementing the ESRS. This includes hosting several webinars and establishing a Coordination Committee and a Steering Committee. Feedback has informed our development approach for ESRS.

We also consulted on several areas of ESRS implementation, including how codes and/or licence obligations will need to be changed, suggestions for how industry could demonstrate its capability to meet the ESRS, and how we can continue to deliver a secure and resilient communication infrastructure across the industry.

In response to the consultation on our draft plan, stakeholders were directly supportive of our plans for ESRS implementation, and the majority felt this should be a priority for us for BP2, with further clarity sought on the process.

We are continuing to progress commercial tendering developments and the code changes that are needed to implement ESRS through the relevant channels, to ensure we meet the 2026 timeframe. These include the code change working group, made up of representatives across industry looking at ESRS implementation, and from a commercial perspective, developing contracts for renewable providers and the ability to employ distributed generation for restoration services.

To see our full responses to the stakeholder feedback, please refer to **Annex 3 – Stakeholder Engagement**.

A3 sub-activities

This activity is made up of the following sub-activities:

Sub-activity #	Sub-activity name	Status
A3.1	Ongoing activities	No change (please see **Annex 1 – Supporting Information**)
A3.2	Restoration standard	Materially changed
A3.3	Innovation project in restoration	No change (please see **Annex 1 – Supporting Information**)

[22] https://www.nationalgrideso.com/future-energy/projects/distributed-restart

6.10.3.1 A3.2 Restoration Standard (materially changed)

What is this sub-activity and why is it important?

This sub-activity covers the investment to implement the ESRS using an evidence-based methodology, including socio-economic impacts and the likelihood of a shutdown event.

Following implementation of the ESRS, we were directed by the BEIS Secretary of State to maintain an electricity restoration capability and appropriate restoration timeframe. In accordance with Special Condition 2.2 of the ESO Transmission Licence, the timeframes defined are:

- 60 per cent of electricity demand restored within 24 hours in all regions;
- 100 per cent of electricity demand restored within five days nationally.

We must be fully compliant with this standard by no later than 31 December 2026.

What will we deliver in BP2?

By September 2023, we expect to have:

- concluded industry engagement to develop regulatory solutions.
- updated the regulatory frameworks to allow TOs, DNOs and restoration service providers to start network upgrades/investments for efficient network restoration in a partial or total network power outage.
- progressed development of the restoration decision support tool to incorporate requirements from across the industry to provide us with oversight and control of the restoration process.
- published the Annual Assurance Framework, with the first being published in spring 2022.
- incorporated findings from the Distributed ReStart project (described in A3.3 Innovation project in Restoration) into the implementation plans.

Our original timescales, set out in the BP1 delivery schedule, were based on the assumption that the new Restoration Standard would go live in April 2021. On 19 October 2021, BEIS issued the ESRS Direction confirming the new implementation deadline, which is reflected in our BP2 delivery schedule.

What do we need to deliver this sub-activity?

Compliance with the timescales set out in the ESRS is dependent on various industry stakeholders delivering changes to their systems and processes. We have set up working groups to engage key industry stakeholders and a cross-industry steering committee to ensure work is prioritised and timescales met. We are also regularly updating industry forums on progress and risks.

Compliance with the ESRS is dependent on delivery of the Restoration Decision Support Tool and associated Inter-Control Centre Communications Protocol (ICCP) Links (IT investments 510 and 460). These will support the decision-making of Control Centre engineers in a national power outage scenario by giving real-time visibility of the time expected to restore the network. This project is expected to start as planned in Q1 2022/23.

6.11 Transparency, data and analytics (materially changed)

Introduction

We believe we can deliver significant benefits to industry and consumers if our data is open and accessible, and we improve the transparency of our decision-making processes. Our recent strategy refresh includes a new ambition to be innovative, digital, and data-driven, reflecting the importance of data to achieving our mission. We will achieve this ambition through:

- **Our technology:** the **220** Data and Analytics Platform (DAP) investment will provide a single source of trusted data that is discoverable by, and accessible to, both internal and external stakeholders, and a self-serve platform for data product development. The **250** Digital Engagement Platform (DEP) investment will provide external stakeholders with a single point of access into our data, content and external-facing processes.
- **Our way of working:** business and technology teams will work together under a Hub and Spoke operating model[23] to develop and operate data products. This will be underpinned by embedded and robust data governance.
- **Our people**: we will upskill our teams through a focused programme of change management and training, with Communities of Practice driving and embedding best practice.

Building on the foundations laid in the BP1 period, in BP2 we will continue to:

- provide transparency on the relevant data that we hold through the publication and maintenance of an up-to-date **Open Data Catalogue.** We will operate a transparent and user-friendly process for customers and stakeholders to request access to data sets not yet published.
- operate a **Data Triage Process** to ensure that data is shared responsibly and aligned with the Data Best Practice Guidance published by Ofgem in November 2021[24]. We will actively manage the risk of sharing data and information that could be used in dangerous or inappropriate ways.
- engage stakeholders and signpost the delivery of our open data and transparency commitments through the **Transparency Roadmap** and **Operational Transparency Forum.**

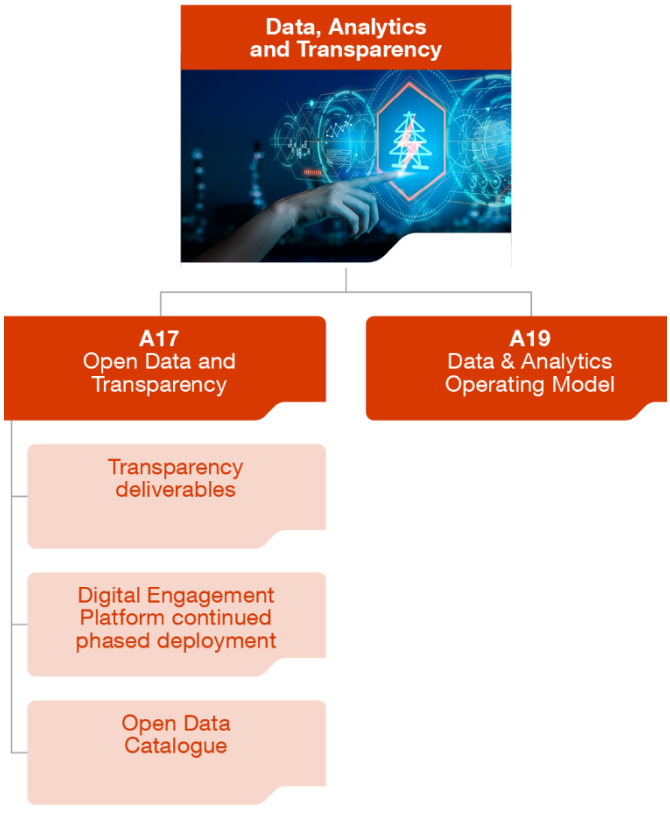
[23] The Hub and Spoke operating model is composed of a central 'Hub' team, which drives data governance and standardisation, and decentralised 'Spoke' teams, which are the creators of data products within business teams.

[24] https://www.ofgem.gov.uk/sites/default/files/2021-11/Data_Best_Practice_Guidance_v1.pdf

- deploy **DEP** in a phased manner to make the experience of engaging with us more intuitive and user-friendly by providing a consistent and personalised user experience. This will include access to information and data, codes, connections, and market participation.
- deliver the foundational capability in data governance, products, and services to meet both internal and external stakeholder needs through **DAP**. We will standardise our approach to model development to enable greater integration of our analytics and driving open-source analytics.
- work closely with other relevant **data sharing projects**, such as Icebreaker One's Open Energy Data Catalogue and the Energy Networks Association's whole system asset register.

Activity Structure

The updated structure of our RIIO-2 activities in transparency, data and analytics is summarised by the diagram below. This update does not reflect a significant change in the scope of our commitments. Rather, existing activities have been reframed to better describe the nature of our work as we move, in BP2, into enhancing and expanding the foundational IT investments made in BP1.



The activity **A17 Transparency and Open Data** was introduced in BP1 to deliver a foundational open data portal, to make available an ESO data list (which we now call the Open Data Catalogue) and to enhance the transparency of our decision-making processes. For BP2, we are introducing new continuous deliverables in this activity to describe how the foundational IT investments made in BP1 will transition into business as usual and to clarify the scope of our transparency activities. We have also added a new activity, **A19 Data and Analytics Operating Model**, to describe our plans for fully exploiting DAP.

Transparency, data and analytics are key enablers for all three of our Roles.

Stakeholder feedback

A17 Transparency and Open Data

As part of our BP2 development we shared our draft A17 proposals with the TAC who stressed the importance of not trying to build a perfect end-to-end solution that does many things poorly, but rather to work incrementally. For BP2, we will introduce the new continuous deliverable D17.8 Digital Engagement Platform with a continued phased deployment. We will deliver incremental build of the physical platform via a use-case-led approach. In this way, the deployment of new capabilities is always aligned with business priorities and value creation for stakeholders.

In response to our draft plan, stakeholders were supportive and keen for us to involve industry in the work on open data and transparency to ensure a joined-up approach. We confirmed we will be conducting user research to inform the decisions made around transparency and open data.

We were asked to provide more clarity on the dispatch of smaller generation units to increase confidence and transparency in our decision-making and enable industry to take better actions themselves. The Open Balancing Platform (OBP), described in **A1.2 Enhanced Balancing Capability**, will automate many decisions which are currently manual and will bring greater transparency to our decision-making. Specifically, data that can be used to explain our dispatch decisions will become available to stakeholders in our Dispatch Transparency data set.

A19 Data and Analytics Operating Model

The TAC also provided feedback which shaped our draft proposals for our **A19** activities on the Hub and Spoke operating model. For example, the TAC recommended to minimise the distance between decision-making and data producers. To address this, we will be embedding data stewards within business teams as part of our operating model.

In response to our draft BP2 consultation, the majority of stakeholders were supportive of our **A19** proposals and wanted to increase their understanding of the strategy/plan for the use of enhanced data analytics, AI and other improved IT tools. Stakeholders also wanted more explanation of how we are leading the way across the energy industry in the area of data and digitalisation, noting the need for cross-industry collaboration. In August 2022, we presented our approach and ambitions for data and digital to the ESO RIIO-2 Stakeholder Group (ERSG), which included our revised data strategy, along with the proposal to create specific TAC and ERSG sub-groups going forward, to ensure cross-industry collaboration.

We were asked by the ERSG for more detail about our plan for data and analytics upskilling/talent retention. We recognise technology and data and analytics skills as key capabilities required for BP2. As a result, we have developed a set of specific actions to ensure we can recruit the necessary IT, data and digital skills required. Please refer to

Chapter 11 - People, Capability and Culture for further information. To see our full responses to the stakeholder feedback across A17 and A19, please refer to **Annex 3 – Stakeholder Engagement**.

6.11.1 A17 Transparency and Open Data (materially changed)

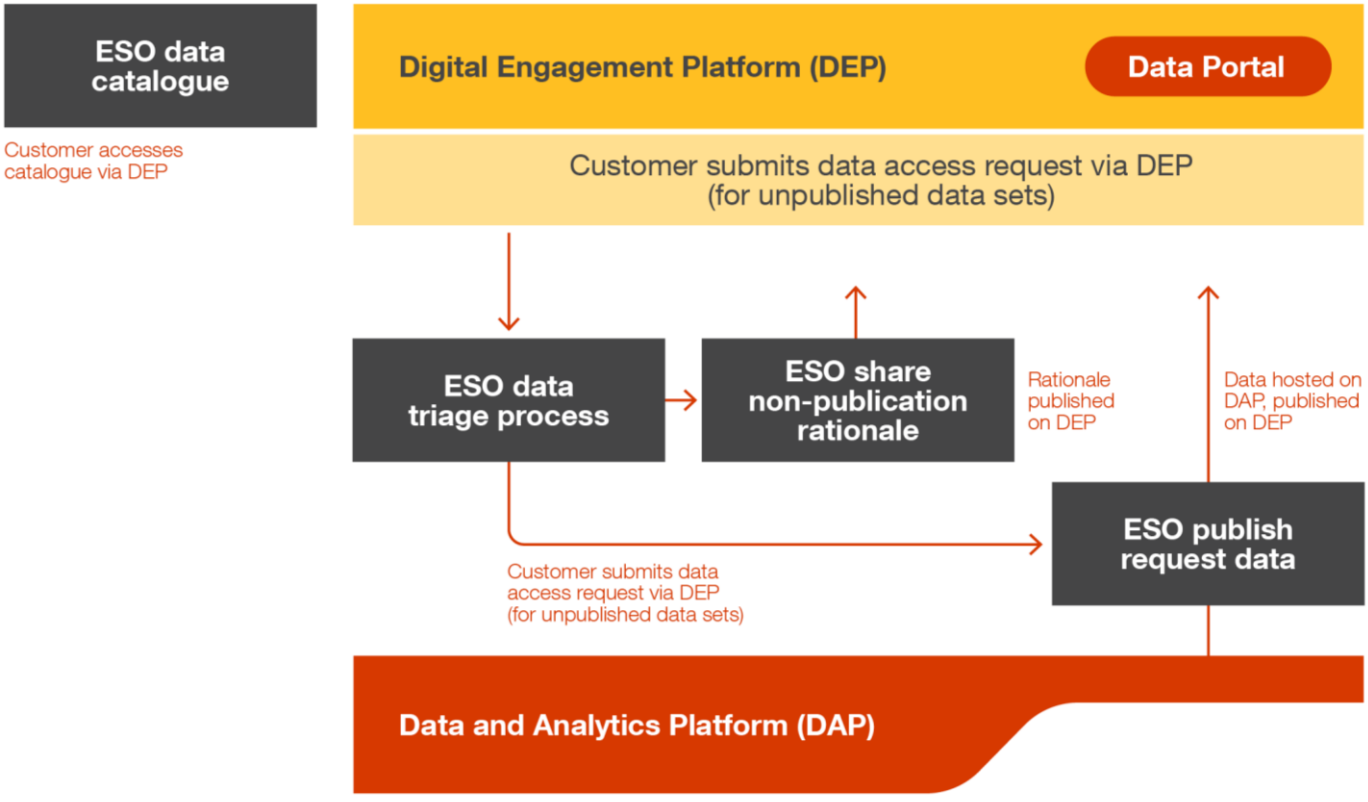
What will we deliver in BP2 in open data?

At the beginning of the BP2 period, the DEP Minimum Viable Product (MVP) will be operational. We are therefore introducing the new continuous deliverable **D17.8 DEP continued phased deployment** to our BP2 submission to describe how we will further evolve the DEP capabilities. The target outcomes and capabilities for DEP in BP2 are detailed in **Annex 1 – Supporting Information**.

We are also introducing the new continuous deliverable **D17.9 Open Data Catalogue**. This will include maintaining the catalogue (delivered in BP1) and continuing to engage with market participants to identify opportunities to enhance our open data service. We will improve the transparency of our data triage process and data sharing risks.

The interactions of our open data deliverables are shown in the following diagram.

Figure 22: Open data deliverable interactions



What will we deliver in BP2 in terms of transparency?

The Operational Transparency Forum (OTF), formed during the COVID-19 pandemic, has been enormously beneficial to achieving our ambition of providing the highest level of transparency possible. The forum was introduced in 2020 when in-person Control Centre visits became impossible due to COVID-19 restrictions. The format has proved so valuable that we have included the forums as an ongoing RIIO-2 deliverable. The benefits we have seen include:

- Rapid insight is given to industry on recent events, enabling timely feedback to the ESO.
- Experts attend the deep dive sessions, giving stakeholders direct access to the people who can answer their technical questions and increase transparency of our decision-making processes.
- The format is more engaging and has allowed us to effectively establish a two-way dialogue with stakeholders. This two-way dialogue is breaking down barriers and building lasting relationships between us and industry organisations.

The OTF is now the weekly stakeholder touchpoint for our transparency activities, and it provides signposting for the delivery of our open data commitments and deliverables. The forums are supported by the six-monthly publication of the Transparency Roadmap, which outlines the commitments we have made to address stakeholder feedback on transparency and open data over the coming year. The continuous deliverable **D17.3 Transparency Roadmap** will continue unchanged into BP2.

The continuous deliverable **D17.6 ESO Operational Transparency Forum** will continue into BP2 with a small change to its scope. In light of the rapidly changing market conditions and environment, the weekly forums will expand to also include a focus on markets and relevant procurement activities.

The new continuous deliverable **D17.7 Proactively driving transparency of ESO decision-making** will be introduced to replace **D17.4 Transparency of operational decision-making** and **D17.5 Trading Transparency**. Through **D17.7**, we will proactively identify areas of ESO decision-making that are of high significance to industry, not limiting ourselves to only operational or trading decision-making, and we will engage stakeholders to understand their priorities for data publication.

Transparency of decision-making in our BM and trading actions remains a priority. We are merging these deliverables into **D17.7** to widen our scope to include any ESO decision-making that is of high significance to industry. For example, this could include transparency of our decisions which are further from real-time, such as setting market requirements for the BM. **D17.7** is a complementary deliverable to establishing the data catalogue and data triage process. As well as responding to open data requests from stakeholders, we will also commit to engaging stakeholders (and subsequently initiating the data triage and publication process, if appropriate) where we can foresee the significance of a data set to industry.

What do we need to deliver this activity?

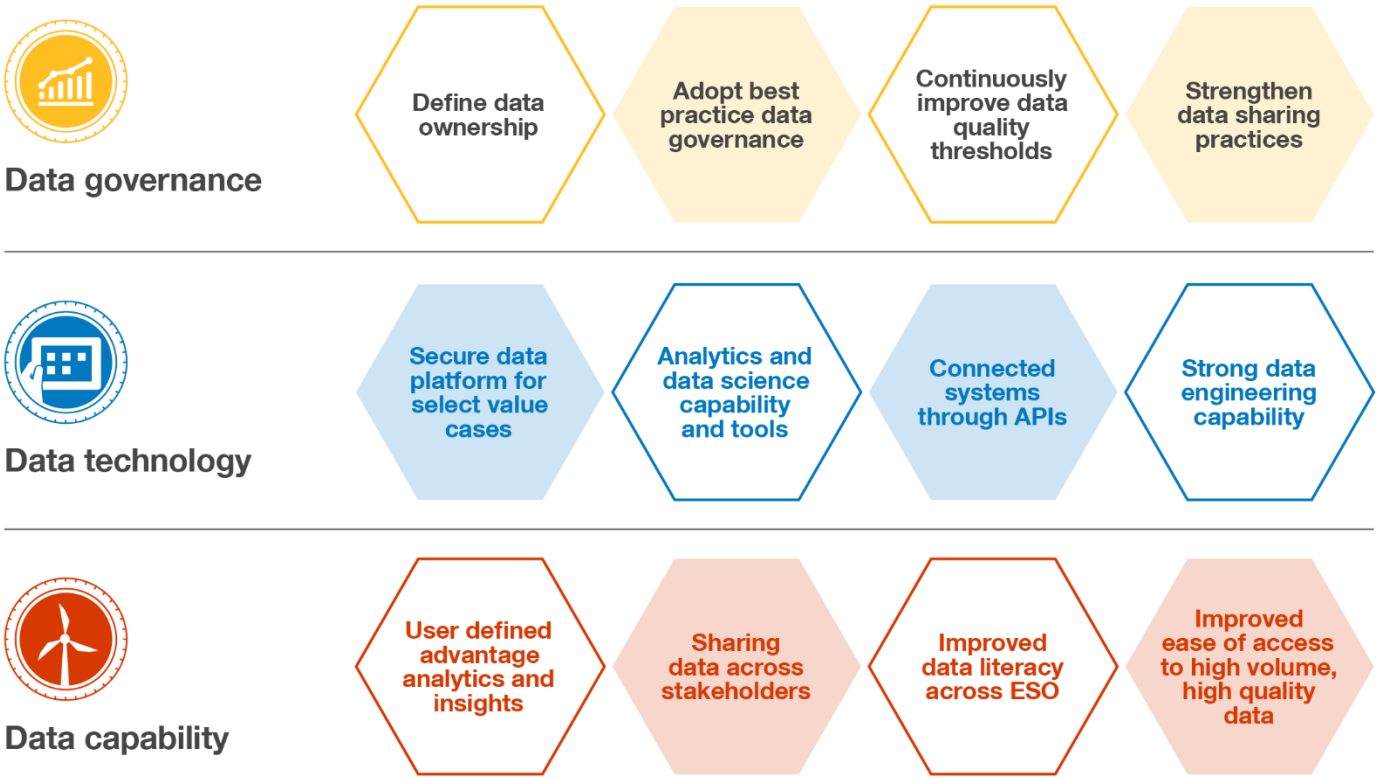
The success of our transparency activities depends upon engagement with industry through the Operational Transparency Forum. The key IT investments for our open data activities are **250** Digital engagement platform and **220** Data and analytics platform.

6.11.2 A19 Data and Analytics Operating Model (new)

What will we deliver in BP2?

We will deliver a fully functional data and analytics operating model by the end of the BP2 period that moves us towards being an insight-driven organisation, will continue to build on our open data platform commitments and gives our stakeholders the opportunity to drive insights from the data.

Figure 23: Data and Analytics operating model example components



A key concept driving our operating model is "data as an asset" thinking. A data asset fulfils our and our stakeholders' specific needs. It provides value driven thinking towards how data is managed, organised, presented, interpreted, shared, and used to create insights.
Our pillars for the operating model are:

- Data Governance: Specifically, centralisation of the governance to drive standardisation, ownership, and policymaking.
- Data Capability: This will focus on three key areas: sharing our data with our stakeholders, centralised capability to create insights products and data literacy across the organisation to create a self-service culture.
- taking us from a journey of descriptive data analytics to predictive data analytics.
- Data Technology: This will focus on data platforms and tools that enable the above areas and build the foundations to drive self-service and complex analytics.

At the start of the BP2 period, we will have put into operation vital elements fundamental to data governance, such as stewardship. We anticipate that our operating model will evolve over the BP2 period as we bring more complex data products online and grow in our data maturity journey.
The activities delivered through the model are illustrated in the diagram below.

Chapter 6 – Role 1 Control Centre operations

A full description of the characteristics of our target data and analytics operating model, serving both internal and external stakeholders, is set out in **Annex 1 – Supporting Information**.

What do we need to deliver this activity?

The success of our data and analytics strategy depends upon:

- implementation of the DAP and DEP platforms
- upskilling existing business resources to adopt the new technology delivered through the DAP
- implementation of our data and analytics operating model
- continued build of our data science and data engineering capability
- sufficient support from Data Custodians – these are staff in operational roles that provide data and support to open data and transparency deliverables.

The key IT investment for this activity is **220** Data and analytics platform, described in **A1.** The detail behind this investment can be found in **Annex 4 – Digital, Data and Technology**.

6.12 Role 1 detailed costs explanation

Role 1		BP1			BP2			BP3	
		Actuals	Forecast		Forecast			Forecast	
		2021/22	2022/23	TOTAL (2 years)	2023/24	2024/25	TOTAL (2 years)	2025/26	TOTAL (5 years)
Capex (£m)	BP2 submission	49	64	113	71	70	141	49	**304**
	Original BP1	25	38	64	47	42	88	32	**184**
	Variance	**23**	**26**	**49**	**25**	**28**	**53**	**18**	**120**
Opex (£m)	BP2 submission	34	41	75	53	58	111	58	**244**
	Original BP1	36	40	76	43	43	85	44	**206**
	Variance	**(3)**	**1**	**(1)**	**10**	**15**	**26**	**14**	**39**
Totex (£m)	**BP2 submission**	**83**	**105**	**188**	**124**	**128**	**253**	**108**	**548**
	Original BP1	**62**	**78**	**140**	**89**	**84**	**174**	**76**	**389**
	Variance	**21**	**27**	**48**	**35**	**44**	**79**	**32**	**159**
FTE	BP2 submission	287	355		384	386		384	
	Original BP1	294	312		322	318		311	
	Variance	**(7)**	**44**		**62**	**68**		**74**	

Table 5: The table above shows our forecast costs and full-time-equivalent headcount (FTE) for the five-year RIIO-2 period, comparing the original BP1 to our BP2 submission. These Role 1 costs exclude support functions and cross-cutting activities which are shown separately in **Chapter 12 – Enabling activities**. Opex costs include all Role 1 overhead costs as well as project opex for IT investments and incremental run-the-business overhead IT costs associated with new investments.

A more detailed breakdown of the key Role 1 activities driving costs changes are described below.

A1 – Control Centre Architecture and systems

In the BP2 period, it is proposed that costs for **A1** are increased by £78m totex, with an additional 72 FTE. The principal components of these increases are:

- The **Balancing Programme** investments **180** Enhanced Balancing Capability**, 210** Balancing Asset Health, **260** Forecasting enhancements and **480** Ancillary Service Dispatch, are forecast to increase by £36m (£29m capex, £7m opex excluding RtB and 31 FTE). These investments are required to develop new balancing capabilities and associated platforms to ensure that we have the flexibility required to facilitate expected and emerging changes in the industry.
- The **Network Control Programme** investments **110** (Network control), **130** (Emergent technology and system management), **140** (ENCC Operator Console) and **150** (Operational awareness and decision support) are driving an £13m increase (£13m capex and six FTE). The increased investment is largely due to the significant and evolving cyber-security requirements and adoption of an enhanced IT architecture which will improve future cyber-security and performance.
- **120** Interconnectors - a further £3m increase in this investment is based on our view of the amount of future interconnection to other transmission systems. This investment drives no additional run-the-business or project opex costs compared to BP1.

It is critically important to our net zero ambitions that our Control Centre can manage workloads which have increased

substantially ahead of the deployment of our transformed network control and balancing capabilities. To date, this has been absorbed by existing resource. However, to meet our 2025 ambitions, the Control Centre needs a dedicated project focus to ensure the effective implementation of market reforms into real-time operations, processes, and systems. As a result, we propose 15 additional FTEs at a cost of £5m opex for the BP2 period.

Other cost increases include:

- 6 FTEs to support the greater use of automation, ML and AI through the work of the ESO Labs in the Innovation team. ESO Labs is not a new team, but its costs were not included in BP1.
- 6 FTEs for our market requirements team, to improve our demand and BSuoS costs forecasting capabilities and due to an internal restructure in Role 2.
- 5 FTEs will contribute to delivery of the new transformational sub-activity **A1.5** Operational Coordination with DSO and DER at a cost of £1m.

A17 Transparency and Open Data

There is a £2 million increase in capex, including 2 FTE, associated with the IT investment **250** Digital Engagement Platform.

A18 Market Monitoring – NEW ACTIVITY

This new activity adds £1m opex spend and 7 FTEs, who were recruited in BP1 to deliver this new Licence condition, will continue into the BP2 period.

This new team has been in place from FY22, and by the end of BP1 we expect to be able to monitor all product groups, including ancillary services and bi-lateral and interconnector trades. This will be supported by governance processes and training to ensure we have the expertise to carry out these obligations. This team completes daily analysis of market activity and transaction data, detects suspicious behaviour and submits Suspicious Transaction Reports (STR) to Ofgem. They also undertake independent reviews of our market monitoring compliance activities against our PPAT and licence obligations alongside the emerging market services.

The remaining Role 1 activities

A2 – Control Training and Simulation, **A3** – Restoration and **A19** Data and Analytics Operating Model do not drive a material change in spend or FTE compared with BP1.

Please see **Annex 1 – Supporting information** for a cost breakdown by activity.

Chapter 7

Role 2
Market development and transactions

Chapter 7 – Role 2 Market development and transactions

Role 2 requires the ESO to develop and procure Balancing Services in a way that promotes competition and drives efficiency in our operational activities. In addition, we administer the charging arrangements on behalf of industry, we are the Electricity Market Reform (EMR) delivery body, and have responsibilities related to implementing network codes and regulations.

The focus for Role 2 in the RIIO-2 period is on transforming our markets to be more efficient and accessible, minimising the spend on procuring the services that we require now and into the future. We are also digitalising industry codes and reforming charging frameworks, reducing barriers and driving efficiencies.

The markets that we are developing will enable zero carbon operability from 2025 and will set us on the trajectory for full decarbonisation by 2035. We will achieve this through the design of new services and procurement methodologies that harness innovation and continue to remove barriers to entry. This will promote efficient market participation from a wide range of technologies, such as demand side flexibility and renewable generation.

To unlock a net zero future, we will continue to engage with our stakeholders to deliver industry code and charging reform. These reforms will improve accessibility and remove charging distortions through an enhancement of the code administration services that we provide and by deploying our expertise to work with industry on the content of necessary code reforms.

For example, over the last year, we have responded to 69 per cent more consultations than the previous year and facilitated a 22 per cent increase in the volume of code modifications, as the pace of industry change quickens.

Our BP2 submissions reflect the increased operational complexity in managing vital processes on behalf of the industry in a cost-efficient way. For example, during the first year of BP1, with the introduction of day-ahead procurement, we have moved from running three Short Term Operating Reserve (STOR) tender rounds a year, to running them 365 days a year. While this adds greater complexity, it allows us to provide more commercial opportunities to market participants and optimise our procurement strategies for the benefit of consumers.

While our RIIO-2 strategy for Role 2 remains broadly consistent with what we set out in BP1, our plans continue to evolve in response to the changes taking place in our industry. Examples include:

- **An accelerated drive to net zero**: The generation mix continues to rapidly evolve, accelerating towards zero carbon operation by 2035. As the types of generation and demand on the system change, we have differing operability requirements but also new opportunities to expand the volume and type of participants in our markets. **To help deliver on the quickening pace of decarbonisation we are overhauling the services that we procure, creating new markets and opportunities to leverage the fullest suite of technologies and market participants to support our operational needs.**
- **Post-Brexit relationship**: We will continue to shape our post-Brexit relationship with Europe through the Trade and Cooperation Agreement (TCA), **ensuring seamless transfers of electricity across borders**.
- **Shaping Market Reform:** The energy industry is governed by multiple codes and regulations, which have evolved over the last couple of decades to set out relevant market frameworks. However, given the challenge of hitting net zero by 2035, deeper and quicker reform of these frameworks is required. As a result, we will continue with our **Net Zero Market Reform Programme**, helping identify and assess macro-opportunities for reform that will deliver net zero at least cost to consumers.

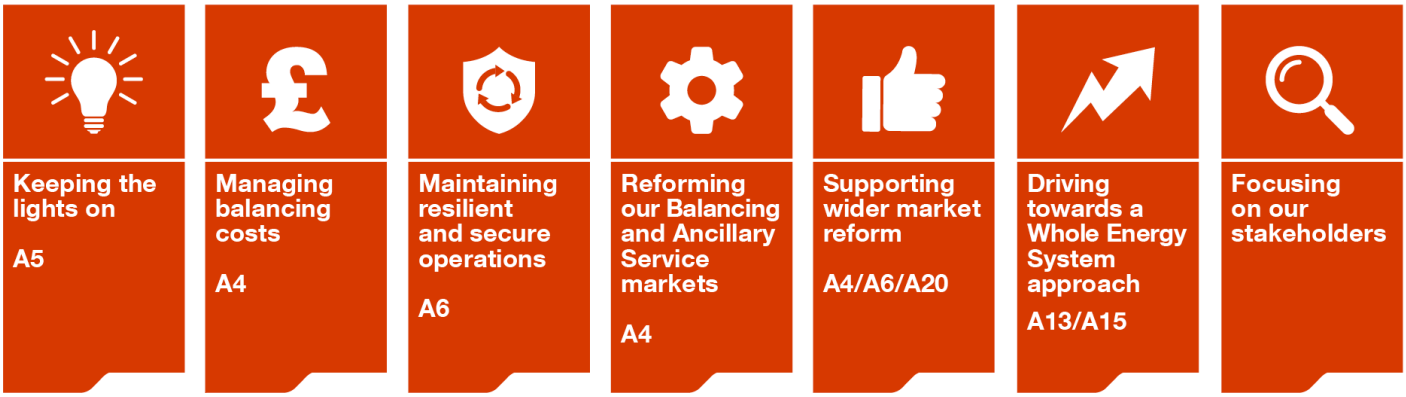
Chapter 7 – Role 2 Market development and transactions

7.1 Role 2 activities during BP1

During BP1, we have commenced delivery of our ambitious RIIO-2 agenda, building the foundations for delivering the reform of our existing suite of ancillary services, while setting the trajectory for enduring long-term reform – all supported by code and charging frameworks that are fit for purpose. For example, by the end of BP1 period we will have:

- developed, delivered and optimised a new suite of response products, procured at the day-ahead stage on a pay-as-clear auction platform.
- published a full market design for a reformed set of reserve products.
- enabled participation in market auctions through our new Single Markets Platform (SMP) interface, developed in close coordination with our stakeholders.
- delivered a local constraints management (LCM) service, specifically targeted at reducing constraint costs on the B6 transmission boundary between Scotland and England.
- implemented a new Balancing Service Use of System (BSUoS) charging and billing system.
- delivered recommendations from the BSUoS Task Force to reduce the volatility of BSUoS forecasting and established a fixed BSUoS charge.
- enabled greater charging reform by establishing and coordinating the Transmission Network Use of System (TNUoS) Task Force.
- delivered alignment for ESO–DSO flexibility services contracts as well as for tendering and procurement timescales.
- facilitated annual Contracts for Difference (CfD) rounds to promote more low carbon generation, helping to enable government targets such as connecting 50 gigawatts (GW) of offshore wind by 2030.
- Established our Net Zero Market Reform programme of work, helping stimulate and lead the discussion on necessary change to markets to facilitate the transition to net zero.

Activities in this role that support our priorities



7.2 How Role 2 supports our BP2 priorities

As set out in Part A of this document, building efficient and effective markets is one of our main priority areas for BP2, where **reforming our markets** and **supporting wider market reform** are central to our Role 2 activities.

While contributing to many of the other BP2 priorities, Role 2 also **drives competition** and innovation in markets for the benefit of consumers and spearheads some of our work to **develop a whole energy system approach.** As with all our Roles, **stakeholder participation** is integral in our standard way of working, to help guide our change and reform agenda.

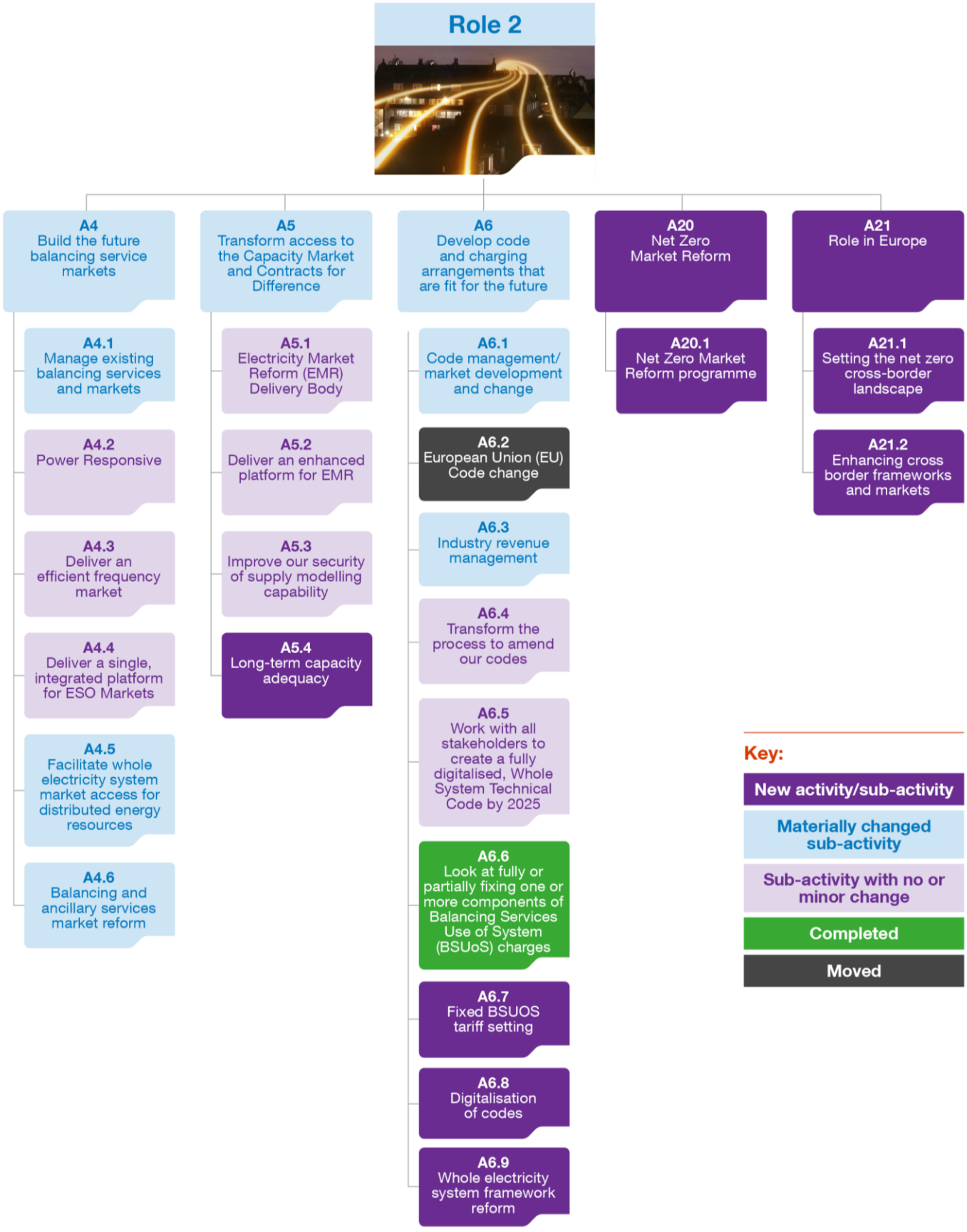
7.3 What does this mean for BP2?

The acceleration of market reform to support full electricity decarbonisation, associated regulatory and code changes, and the evolving relationship that we have with Europe post-Brexit have required the inclusion of a significant number of materially changed or entirely new activities in our BP2 submission when compared to BP1.

The following diagram identifies these changes and additions:

Chapter 7 – Role 2 Market development and transactions

Figure 24: Role 2 activity level of change



Chapter 7 – Role 2 Market development and transactions

7.4 What is new and what has changed?

New activities and sub-activities in BP2

We have included two new activities in our BP2 submission.

A20: Deliver Net Zero Market Reform

- Having already defined the problems associated with, and the potential solutions to, the current suite of electricity markets, during BP2, we will work in collaboration with Ofgem/BEIS and industry stakeholders to deliver Net Zero Market Reform. This includes detailed recommendations for market options and working with the new Markets Advisory Council (MAC) to set the strategic direction for reform.

A21: Define and build our new role in Europe

- Plan for the vital role of interconnectors in a flexible and secure future electricity system. This includes a cross-border strategy for interconnectors which will focus on operability, adequacy, system planning, flexibility and balancing.
- Meet the obligations of the UK– EU Trade and Cooperation Agreement (TCA) to continue operating an efficient exchange of energy with Europe.
- Build on our relationships with EU stakeholders to maintain our level of influence in Europe.

Materially changed activities and sub-activities

A4: Build the future balancing service markets – we aim to embed and continuously improve the markets we delivered in BP1, and drive further significant market reform in BP2, by:

- delivering a new frequency management strategy to identify future system needs out to 2030.
- overcoming barriers to flexibility markets through greater data transparency and innovative design.
- delivering an integrated day-ahead response and reserve market, and continued development of the Single Markets Platform (SMP).
- responding to the growth of flexibility markets by embedding processes and systems to coordinate distributed energy resource (DER) services. In particular, we will make sure ESO markets are interoperable with DNO markets and that they facilitate access for smaller providers.
- improving each of our market categories and driving new reforms.

A5: Transform access to the Capacity Market (CM) and Contracts for Difference (CfD)

- Supporting the development of policy and rules for the CM and enabling the transition to annual CfD auctions, helping deliver 50 GW of offshore wind by 2030.
- Exploring options for the capacity mix to deliver adequacy through the 2030s. This will support policy development and longer-term decision-making needed to meet net zero.

A6: Develop code and charging arrangements fit for the future

- Modifying industry codes to support major net zero programmes for example: Offshore Coordination, Early Competition, system restoration and stability market participation.
- Evolving charging and billing processes to meet the needs of our customers. This includes transformation of codes and charging systems to allow for half-hourly charging.
- Leading charging reform through a Transmission Network Use of System (TNUoS) Task Force, working collaboratively with the industry to define future changes to the methodology that will drive consumer value through more efficient utilisation of, and investment in, the network.
- Working with stakeholders to continue removing barriers to entry and simplifying code governance – increasing market participation.
- Digitalising the Grid Code, to make interaction easier for all parties.
- Building on our capability for Balancing Services Use of System (BSUoS) forecasting and delivering fixed BSUoS tariffs – providing certainty of costs to the industry.
- Recommending the best structure for whole electricity system frameworks, so that Great Britain can reach its net zero goals.

Activities and sub-activities with no change, or minimal change

A4.2 Power Responsive – deliverables facilitating development of demand-side flexibility, and greater provision of Balancing Services.

A4.3 Deliver an efficient frequency market – this focuses on enhancing our procurement process for our reformed ancillary services markets, including our auction capability and maximising user participation.

A4.4 Deliver a single, integrated platform for ESO markets – this forms the basis for the creation of the Single Markets Platform (SMP), which is an important enabler of our decarbonisation and digitisation strategy.

A5.1 Electricity Market Reform (EMR) Delivery Body – this includes deliverables shaping our ongoing role as the EMR Delivery Body, such as delivering CM and CfD auctions.

A5.2 Deliver an enhanced platform for EMR – this is our commitment to adding functionality to the EMR platform in response to customer feedback and regulatory changes.

A5.3 Improve our security of supply modelling capability – the continual enhancement of our modelling through development of new data sets, with prioritisation of focus areas agreed with BEIS and Ofgem.

A6.4 Transform the process to amend our codes – this focuses on strategic changes to the code change delivery process, enabling a more transparent and time-efficient experience in line with stakeholder feedback.

A6.5 Work with all stakeholders to create a fully digitalised, Whole System Technical Code by 2025 – this aims to create a single technical code for distribution and

transmission connections. The digital solutions aspect is linked to **A6.8 Digitalisation of Codes.**

For activities and sub-activities identified as new or materially changed, we have included further details in the sections that follow in this chapter. For those activities and sub-activities which have not materially changed, further details can be found in **Annex 1 – Supporting Information**.

7.5 Role 2 benefits

Direct consumer benefits from the activities in Role 2 are mainly delivered through the transformation of balancing service markets and wider market reform. Our Role 2 activities ultimately lower costs for energy consumers, allow future zero carbon operability and are essential to increasing competition and leveraging data and digitalisation.

What is in our RIIO-2 CBAs?

We have updated the RIIO-2 CBAs for transformational activities in A4, A5, A6.5 and A6.6 in **Annex 2 – Cost-Benefit Analysis**. We have also included break-even analyses for the new activities A6.9, A20 and A21, and updated the break-even analyses for A6.4 and A4 (relating to A4.1, A4.2 and A4.5).

Activity	Analysis name	NPV[25] BP1 (£m)	NPV BP2 (£m)	Change (£m)
A4 (A4.3, A4.4, A4.6)	Build the future balancing service markets	67	58	-9
A5	Transform access to the Capacity Market	62	40	-22
A6.5 and A6.8	A6.5 Work with all stakeholders to create a fully digitalised, Whole System Technical Code by 2025 and A6.8 Digitalisation of Codes	4	32	+28
A6.6 and 6.7	A6.6 Look at fully or partially fixing one or more components of Balancing Services Use of System (BSUoS) and A6.7 Fixed BSUoS tariff setting	280	68	-212
	Total	**414**	**198**	**-216***

Table 6: Role 2 NPV change across the five-year RIIO-2 period
*Totals may appear incorrect due to rounding

[25] The net present value (NPV) is a measure of the net benefits of an activity over the five-year RIIO-2 period, accounting for the time value of money. Our NPVs are calculated at an activity level, using the total activity costs and the total gross benefits of the benefits cases associated with the activity. A description of the largest benefits cases is provided below the table.

Chapter 7 – Role 2 Market development and transactions

The largest gross benefits contained in our Role 2 CBAs are for:

- More liquid response and reserve markets: closer to real-time markets will increase the number of potential market participants and lead to savings of around £72 million in response and reserve costs.
- Enhanced modelling capability for security of supply: by improving our recommendations to BEIS on how much capacity should be secured in each Capacity Market auction, we will create savings for consumers of around £68.2 million.
- Digitalised whole system grid codes: removing barriers to entry for our customers will reduce their application times, with savings of around £40 million in labour being passed to consumers.

Our activities in BSUoS reform[26] will also deliver significant financial benefits for consumers. The reforms will make BSUoS charges more stable by removing charging arrangements from generators and fixing tariffs.

How have the RIIO-2 CBAs evolved from BP1?

The NPVs of all our Role 2 transformational activities remain large and positive, but their total NPV has decreased since BP1. This is mainly due to a decrease in the NPV of A6.6 and A6.7, caused by a one-year delay in starting BSUoS reform[27] and an improved CBA methodology[28].

Benefits outside of the scope of the RIIO-2 CBAs

Direct consumer benefits are also delivered through our BAU activities in:

- **Code Administration**: Efficiently running a process that maximises industry participation and pace, in delivering code changes which unlock end consumer benefit.
- **Ancillary Service Procurement**: Determining daily buy curves that optimise the procurement process of short term operating reserve (STOR) and response products. By updating our volumes and willingness to pay each day, we can optimise our costs for ancillary services when compared to alternative actions in the Balancing Mechanism.
- **Net Zero Market Reform:** Driving the debate and critically assessing the options to reform markets to deliver net zero at least cost to the end consumer.

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7.6 Role 2 costs overview

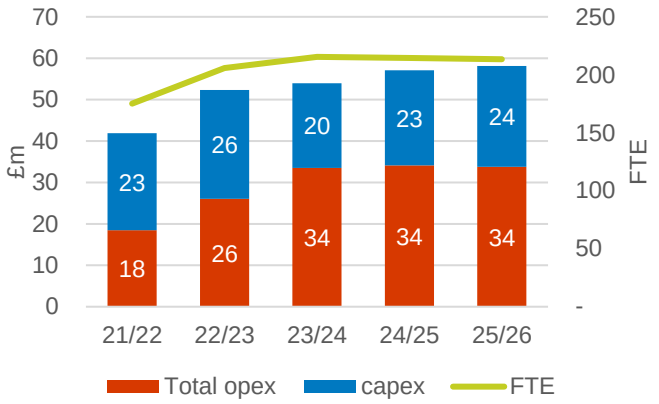


Figure 25: Role 2 costs

Over the five-year RIIO-2 period, our proposed totex spend for Role 2 is up by £40m compared to BP1, with an additional 45 FTE by the end of FY26. £37m of the increase relates to our IT capex investments. This increased IT capex includes an additional £16m for the EMR and CfD systems, which reflects a higher level of regulatory change in the RIIO-2 period, as well as a clearer understanding of the required reporting capabilities. We also have a better understanding of the scoped required to allow integration with the Digital Engagement Platform (DEP) and Data and Analytics Platform (DAP), which was not known at the time of the original BP1.

The BP2 submission also includes £19.3m for the full end-to-end replacement of our charging, billing, and settlement systems, as opposed to the system update that was planned in BP1. This will deliver a sustainable and adaptable long-term system that can easily be reconfigured to allow us to introduce new requirements at speed and at a lower cost to consumers.

Finally, we plan to spend an additional £21m on our Single Markets Platform (SMP), which reflects a greater understanding of the requirements to allow this system to integrate with other downstream systems. This will provide an end-to-end user experience for market participants who engage with us in balancing service markets. The increases in IT investment programmes over the RIIO-2 period have been partly offset by a lower amount of regulatory change from the EU and Great Britain, leading to a forecast reduction in spend of £23m.

Our proposed totex spend over the BP1 period (FY22 and FY23) is broadly in line with our original plan. Higher capex investments of £13m are largely driven by additional spend on the EMR portal delivery and the charging, billing and settlement system, as set out above. This has been offset by £12m of lower opex spend, with the majority of this (£10m) associated with reduced project opex across a number of IT schemes.

[26] BSUoS reform options have been progressed through code modification proposals CMP308 and CMP361/362. At the time of writing a final decision is still outstanding from Ofgem regarding CMP361/362.

[27] The delayed start date of April 2023 is aligned with the outcomes of the BSUoS Task Force.

[28] Our BP1 CBA was created in 2019, well before the final report of the Second Balancing Services Task Force was published in September 2020 and therefore before the proposed changes to BSUoS were known. We now use analysis commissioned by Ofgem for CMP308 to calculate our RIIO-2 NPV for BSUoS reform.

Chapter 7 – Role 2 Market development and transactions

For the BP2 period our proposed totex request is up by £23m, with an additional 45 FTE, by the end of FY25.

7.7 Role 2 interdependencies

Activities in Role 2 are enablers of many of our Role 1 and 3 deliverables and, in turn, are dependent on the delivery of other activities in this BP2 submission and, in some case, a few external factors. The most significant internal and external interdependencies for Role 2 activities are summarised below:

Internal activity:

Role 1:

- Ensuring distributed energy resources (DER) can participate in services and markets will be a key aspect to deliver Accelerating Whole Electricity Flexibility (AWEF) activities (A1.5).

Role 2: Volume and management of code changes, and the processes around our revenue management are dependent on a number of Role 2 sub-activities:

- Delivery of Net Zero Market Reform
- Outcomes of TNUoS and Market Wide Half Hourly Settlement (MHHS) code reform
- Transforming the process to amend codes.

Role 3:

- Developing new products such as RDPs and DER and (as per Role 1) ensuring they can participate in services and markets, now and in the future, is a key aspect of AWEF delivery.
- Offshore Coordination and Network Planning Review activities (A22) will lead to several code changes and provide direction for our future cross-border strategy (A21.1).
- Following the Security and Quality of Supply (SQSS) review (A12) we will need to ensure there is alignment between code changes.
- Whole electricity system framework reform will be informed by the outputs of Early Competition, Network Services Procurement and the Open Networks programme.

External factors:

- Outcomes of government reforms/policy.
- We will rely on participation with stakeholders/third parties.
- Market participation and volume of providers.
- Outcomes of code reforms, such as the Energy Code Review and Future System Operator.
- UK and European policy decisions could materially change our activities namely A21.

Key IT investments:

- 610 Settlements, Charging and Billing
- 400 Single Markets Platform
- 180 Enhanced Balancing Capability

Across all our sub-activities, we will seek to engage with external stakeholders where appropriate. We recognise that these interactions could mean that some of our BP2 deliverables are amended, or that the scope, cost and time to implement may change. However, it is important that our plans remain adaptable to meeting the current and evolving needs of Great Britain's market.

7.8 Role 2 New activities

7.8.1 A20 Net Zero Market Reform (New)

As the system transitions to net zero, linking ESO markets to wider markets (for example, wholesale and capacity markets) and policies (like CfD and carbon pricing) is becoming more important. It is also widely accepted that the framework of Great Britain's markets and policies for electricity is not fit for purpose given the imperative of delivering net zero in the most efficient way. To improve outcomes these markets and policies need to deliver across four key categories:

- **Investment:** new generation and flexible capacity must come online at an unprecedented rate. This includes new and emerging technologies, such as hydrogen electrolysers and bioenergy with carbon capture and storage (BECCS). Strong investment signals are therefore needed to encourage this capacity to be built.
- **Flexibility**: given the intermittency of some types of renewable generation, flexible technologies will be required to meet both demand and, at other times, avoid significant curtailment of generation.
- **Location**: connecting generation to exploit the locations with the greatest renewable resources will cause greater levels of network congestion, triggering more investment in onshore and offshore transmission infrastructure. Market reforms are required to incentivise accurate dispatch in operational timescales and, in the longer term, to drive more efficient asset siting.
- **Operability:** maintaining a secure and balanced system will become increasingly complex as the system approaches net zero, and supply and demand gets increasingly volatile and unpredictable. ESO balancing and ancillary service markets will need significant reform, as indicated earlier in this Business Plan. However, these reforms must be coherent with how wider markets are being reformed to deliver investment, flexibility and locational signals. Otherwise, we risk inefficiencies and distortions, resulting in unnecessary costs to consumers.

We identified the need to tackle these challenges two years ago and launched our Net Zero Market Reform (NZMR) activity in January 2021.

So far NZMR has completed three phases (see additional detail in **Annex 1 – Supporting Information**):

- Phase one: Scoping and stakeholder landscape
- Phase two: Defined 'Case for Change' and developed options assessment framework
- Phase three: Assessment of shortlisted options.

Our case for change analysis has shown that, while current market arrangements have been effective in delivering the first phase of decarbonisation, they are unlikely to deliver the next phase in a way that secures supply at least cost.

Evidence indicates that current market design is already giving rise to negative outcomes, particularly in operational timeframes, and is not well-positioned to solve future challenges. In response, we have identified effective packages of market reform to facilitate the necessary changes. We will work with BEIS, Ofgem and industry stakeholders to develop, de-risk, trial and implement appropriate changes.

Stakeholder feedback

Stakeholder feedback received on this topic during the development of our proposals can be split into three high-level themes; namely our role, the interaction with BEIS and Ofgem, and the level and type of reform needed. Whilst there is a consensus that reform is needed, some feedback questioned why we are leading on this work. However, this has been significantly outweighed by positive support for our role in this area and how we are working together with BEIS and Ofgem.

Stakeholder responses to our draft plan consultation and ESO's NZMR phase 3 conclusions were similarly mixed. However, most of the feedback has been supportive of the ESO working on holistic electricity market reform. As a result of collective feedback in this space our proposals for Activity A20 remain broadly unchanged since our draft BP2 proposals.

To see our full responses to stakeholder feedback, please refer to **Annex 3 – Stakeholder Engagement**.

A20 sub-activities

This activity is made up of the following sub-activities:

Sub-activity #	Sub-activity name	Status
A20.1	Net Zero Market Reform Programme	New

7.8.1.1 A20.1 Net Zero Market Reform Programme (New)

What is this sub-activity and why is it important?

As outlined above, our role in Net Zero Market Reform is to provide BEIS and Ofgem with insight and analysis to support timely decision-making around market reforms that deliver the most value for consumers. Without these reforms there is a risk that Great Britain won't meet its net zero goals. What will we deliver in BP2?

We will deliver the following work **(D20.1)**:

- **Analysis** – Recognising that BEIS' Review of Electricity Market Arrangements (REMA) programme will set out what market design options are pursued, two key areas of focus will be how:
  - different market design options interact with the operational challenges posed to the electricity system by net zero.
  - external incentives that inform market outcomes (like subsidy mechanism design, investment incentives etc) can be constructed to support well-functioning wholesale and balancing markets.

These findings will be developed in much more detail, before being designed, tested and de-risked. Technical and economic impact assessments will be needed. This will be done in conjunction with:

- **Stakeholder engagement** – there is a vast amount of knowledge, experience and innovation across the industry, both in Great Britain and internationally. Over the course of phases one to three, we have engaged with over 1,000 stakeholders and we expect this level of engagement to increase over BP2.
- **Markets Advisory Council (MAC)** [29] **–** we will be working closely with the MAC to test our ideas for the strategic direction for NZMR, to embed stakeholder perspectives and international best practice, and to provide transparency around our decision-making.
- **BEIS and Ofgem support –** we will be working closely with BEIS and Ofgem over FY22/23 and BP2.

What do we need to deliver this sub-activity?

Our assumption is that the issues in current electricity market arrangements, identified above, will continue to impact Great Britain's ability to meet its net zero targets throughout the BP2 period.

NZMR is not directly dependent on any internal or external workstreams to deliver successfully. However, it must consider external developments in electricity market reform, particularly BEIS' REMA programme to make sure any recommendations are timely and effective.

Depending on which market reforms are recommended, there may be impacts on our systems and processes. These investments could be initiated in BP2, and we may need to develop prototype/simulation capability to test these new

29 Meet the ESO Markets Advisory Council (MAC) | National Grid ESO

market models. If so, we believe the Network Innovation Allowance (NIA) funding route could be appropriate.

In BP1, we funded the six FTE to deliver the NZMR work through efficiencies achieved elsewhere in Role 2. We will continue with this scale and approach in BP2, however, should there be an urgency to increase the pace of reforms due to, say, failures in the current markets, we may need to further grow the size of the team.

7.8.2 A21 Role in Europe

The total interconnector capacity between Great Britain and European markets is forecasted to increase from ~8 GW today to 16-27 GW by 2035. Working with industry, we must make sure that these new resources deliver the flexibility, capacity adequacy and operability support that we will need to keep the lights on in a 100 per cent net zero electricity system for Great Britain.

Following the UK's exit from the European Union, a new TCA was agreed between the UK and the EU, which must be implemented.

Shorter term, we must develop the right frameworks and procedures so that the growing capacity of interconnection can access ESO markets to support the electricity system and drive down costs for Great Britain's consumers.

Stakeholder feedback

As part of our BAU stakeholder engagement during BP1, both BEIS and Ofgem have been consulted in detail on the anticipated scope of the new cross-border strategy. This deliverable has been well supported by both parties. Furthermore, UK Transmission System Operators (TSOs) have welcomed the leadership we have taken to develop enduring engagement routes with the European Network of Transmission System Operators for Electricity (ENTSO-E), in order to implement and maintain the TCA.

In response to the consultation on our draft plan, most stakeholders were supportive of our plans for A21, especially if our work could help remove barriers which may hinder efficient delivery across the Great Britain/European interface and improve coordination between parties that play a role in delivering or enabling cross-border capacity.

To see our full responses to stakeholder feedback, please refer to **Annex 3 – Stakeholder Engagement**.

A21 sub-activities

This activity is made up of the following sub-activities:

Sub-activity #	Sub-activity name	Status
A21.1	Setting the net zero cross-border landscape	New
A21.2	Enhancing cross-border frameworks and markets	New

7.8.2.1 A21.1 Setting the net zero cross-border landscape (new and name change)

What is this sub-activity and why is it important?

This sub-activity has had a name change from "cross-border initiatives".

This sub-activity is made up of new deliverables that will deliver a future cross-border strategy for interconnectors and multi-purpose interconnectors (MPIs), looking particularly at the impact of cross-border infrastructure on flexibility, operability and adequacy in a net zero system. It will also look at how we can support this transition, ensuring Great Britain's consumers get maximum value from our connection with Europe. It will use working arrangements established with the European Commission by the start of BP2 to fully deploy a programme of strategic engagement with our European counterparts.

Deliverable D21.1.2 Enhancing interconnector operations and access to Great Britain's markets has moved under A21.2 as deliverable D21.2.3. This is because the deliverable is more appropriately aligned to A21.2 Enhancing cross-border frameworks.

What will we deliver in BP2?

We will work with key stakeholders including BEIS, Ofgem, UK and European TSOs to deliver a future cross-border strategy for how a significant increase in interconnector capacity can support a net zero power system in Great Britain, by supporting the capacity adequacy, flexibility and operability needs of the system. The conclusions of this will form a roadmap for how we will work with our key stakeholders to deliver this strategy.

The key levers that this strategy will focus on are expected to be:

- cross-border relationships
- commercial and market arrangements
- systems, data and processes
- regulation and frameworks.

Interconnection is being considered in other BP2 activities, see, for example, **A20 Net Zero Market Reform** and **A4.6 Balancing and ancillary services market reform**. Our long-term strategy will ensure interconnectors are approached across all workstreams in a coherent manner and become an enabler to net zero.

We need to enhance strategic relationships with EU TSOs, as well as develop additional strategic relationships **(D21.1.1).** By the start of BP2, we anticipate that the enduring Working Arrangements agreement with ENTSO-E will be in place, allowing cooperation between EU and Great Britain's TSOs and facilitating our strategic engagement. This will help us to:

- share information on security of supply risks, disruptions, events and best practices on short-term and seasonal adequacy
- cooperate with ENTSO-E on network development plans and pan-European market modelling
- establish networks and maintain influence with:
  - cross-border industry groups

- our European counterparts – i.e. the European Commission, ENTSO-E, EU TSOs, EU trade associations, etc.

– identify significant EU legislative measures and consultations and respond accordingly.

What do we need to deliver this sub-activity?

Deliverables are dependent on how energy and environmental policy evolve in both the UK and in Europe, including what level of interconnection is approved by the UK government, and how geopolitical developments impact on how interconnector frameworks and arrangements are implemented. The result of the UK government's Offshore Transmission Network Review (OTNR) will provide direction on the future operation of MPIs. More information is included in **A22 Offshore Coordination and Network Planning Review**.

The development and implementation of Trade and Cooperation Technical Procedures (see **A21.2**) will feed directly into these workstreams and will outline some of the principles for future operational solution design. All workstreams will work closely together to ensure that short-term deliverables are compatible with the longer-term strategic outlook and vice versa.

It is assumed that we will continue with the same level of resources in BP2 as in BP1 to manage this activity.

Further assumptions relating to the direction of this sub-activity can be found in **Annex 1 – Supporting Information.**

7.8.2.2 A21.2 Enhancing cross-border frameworks and markets (new and name change)

What is this sub-activity and why is it important?

This activity used to be called **A6.2 EU Code Change**. We are still required to manage elements of European Network Codes and associated legislation following the UK's exit from the EU and we also need to focus on implementation of the TCA. We have increased the level of resources in this area during the BP1 period to enable us to do this.

We are currently working on development and testing of the required systems and processes to be compliant with the requirements of the Clean Energy Package[30]. We are also working with all UK TSOs to agree a UK position before engaging with the EU TSOs on each element of the TCA. This work covers developing technical procedures for capacity calculation at multiple timescales, developing cross-border balancing products and working on re-dispatching and countertrading.

We recognise that as we progress work in this space, we may need to deliver other pieces of work to support the TCA, which are not known at this stage. Activities have also focused on enhancing interconnector operations and access to Great Britain markets as described in **D21.2.3**.

What will we deliver in BP2?

D21.2.1 will develop EU-driven short-term market framework changes for interconnectors while long-term initiatives are implemented. We will review the arrangements for interconnectors connected to Great Britain's system and assess these against all retained UK law post EU Exit. We will develop a set of operational and commercial arrangements that will ensure legal compliance and safe system management, whilst also ensuring competition and value for money for consumers.

We will be working with other TSOs to implement BEIS technical procedures relating to the TCA. These will continue to support efficient energy trades with Europe. We clearly understand what needs to be delivered under the TCA (**D21.2.2**) but the detail behind the technical requirements is still somewhat uncertain. See **Annex 1 – Supporting Information** for more information on the TCA technical elements that we will deliver.

Historically, interconnector operations have been developed on a bespoke, bilateral basis which may not achieve the maximum value for consumers and could cause unintended issues in wider system operations. While the ultimate details of some technical and commercial arrangements are still uncertain, we are progressing several amendments in the short term to enable efficient operation and mitigate risk **(D21.2.3**). This will also align the treatment of interconnectors more closely with other technologies.

Work is also underway to agree with EU TSOs and Ofgem how cross-border flows will be managed in the interim prior to capacity calculation implementation and analysis being undertaken and published on current barriers preventing interconnectors participating in the Dynamic Containment market (as described **in D4.6.3**)

What do we need to deliver this sub-activity?

There is a clear understanding of what needs to be delivered through the TCA. However, there are wider, external political factors, outside of our control, that may impact the timescales for the delivery and implementation of these obligations. This may lead to TCA-related projects significantly changing through BP2. We therefore need an agile approach to delivery that recognises both the effort required to implement the various elements of the TCA, including gaining agreement between UK and EU TSOs, as well as wider external factors.

Further assumptions relating to the direction of this sub-activity can be found in **Annex 1 – Supporting Information.**

This sub-activity is aligned to IT investment line **270** Role in Europe. The detail behind the investment can be found in **Annex 4 – Digital, Data and Technology.**

7.9 Role 2 materially changed activities

7.9.1 A4 Building the future Balancing Services market (materially changed)

For Great Britain to achieve a fully decarbonised power system by 2035, it is vital that ESO Balancing Services markets are fit for purpose. This means we need to build on the reforms delivered in BP1 by further improving the functionality of these markets, increasing accessibility for market participants and improving the efficiency of our

30 The Electricity and Gas (Internal Markets and Network Codes) (Amendment etc.) (EU Exit) Regulations 2020 (legislation.gov.uk)

procurement across multiple services. We also must continue to develop the right portfolio of market reforms to facilitate a smooth transition to net zero, provide efficient investment and dispatch signals to the industry, and ultimately deliver value for consumers.

Stakeholder feedback

In June 2021, we approached stakeholders for feedback on our Markets Roadmap 2025, which helped inform our draft plan. Stakeholders told us they wanted to see more data for service providers/participants as well as on market interactions and value. Accordingly, we will have a greater focus across all areas going forwards, drawing out benefits to providers, more detailed analysis around market insights and signposting what our reforms may mean for wider market interactions.

In response to our draft plan consultation, stakeholder views and feedback provided on our A4 activities was mixed. Most stakeholders were supportive and welcomed the need for reform. Others recognised challenges such as the potential for designs of certain products to create barriers to entry to the market, and some felt our draft plan lacked detail with regard to clear ambitions and goals for the work.

In response we have updated the Delivery Plan to clarify what we intend to achieve in BP2. We will also continue to listen to industry regarding reducing barriers to entry and, going forward, Power Responsive will be used to form working groups to address specific barriers to entry for DER, where appropriate.

To see our full responses to stakeholder feedback, please refer to **Annex 3 – Stakeholder Engagement**.

A4 sub-activities

This activity is made up of the following sub-activities:

Sub-activity #	Sub-activity name	Status
A4.1	Manage existing Balancing Services and markets	Materially changed
A4.2	Power Responsive	No change (please see **Annex 1 – Supporting Information**)
A4.3	Deliver an efficient frequency market	Name changed from “Deliver a single day-ahead response and reserve market” (please see **Annex 1 – Supporting Information**)
A4.4	Deliver a single, integrated platform for ESO markets	No change (please see **Annex 1 – Supporting Information**)
A4.5	Facilitate whole electricity system market access for DER	Materially changed and name changed from “Alignment of ESO–DSO flexibility markets".
A4.6	Balancing and ancillary services market reform	Materially changed

7.9.1.1 A4.1 Manage existing Balancing Services and markets (materially changed)

What is this sub-activity and why is it important?

Our balancing service markets need to evolve to allow efficient and optimised operation of the rapidly decarbonising generation mix. We will design and deliver new services and procurement approaches which achieve this. We have already reformed aspects of our frequency response and reserve products, and we will continue to drive greater competition in these markets to deliver value for consumers.

Through the development of regional competitive tenders for our restoration requirements, we have reduced the cost of procuring these services by £4.5m per annum, while also increasing the diversity of service providers. We have also enabled the aggregation of units to participate in the BM via our Wider Access programme and have evolved the pre-qualification process to enable market participants to complete large scale applications, removing barriers to entry and making the BM more competitive.

We have proposed a new deliverable in BP2 to look further ahead than a year in our frequency strategy, which we believe will deliver significant savings.

What will we deliver in BP2?

During BP2 our approach to managing balancing and ancillary services will continue to evolve. This will include:

- Introducing an end-to-end process to ensure procured Balancing Services deliver system stability at lowest cost to consumers (**D4.1**).
- Developing our abilities to optimise across services through our buy order methodologies, backed by clear communication on our system needs
- Continuing to work with industry to facilitate competitive markets. To manage this additional workload, including an increased level and complexity of modelling expertise and the need to run processes daily, we have increased our overall headcount in BP2 for this area
- Continuing to widen access to the BM and make the entry process quicker and easier to complete.

During BP1, increasing system challenges led to the development of new services and procurement approaches

through Network Services Procurement (Pathfinder) projects to efficiently meet our system security needs.

Role 2 provides project lead activities for the implementation of each Pathfinder project and for the units that secure contracts. This ensures projects are progressed, providing commercial support for each project, through the tender process to contract award. We also provide implementation support for each successful project, bringing the contracted units into operation by working with SMEs in our different teams. This includes establishing the end-to-end delivery process, so that the units can be dispatched in real-time ready for go-live. More information about our Network Services Procurement (Pathfinder) approach can be found in Activity **A8 – Enable all solution types to compete to meet transmission needs**.

The implementation of our Frequency Risk and Control Report (FRCR) proposals is already generating consumer value by decreasing operational costs **(New D4.1.1).** The proposed new Frequency Management Strategy increases our modelling capability, underpinning the FRCR process, and allows greater consumer value to be realised by expanding the time horizon the modelling assesses. This will help identify future system needs out to 2030.

This is a critical time period because, as the system decarbonises, it drives larger and more numerous loss risks on the network, while inertia continues to reduce. Growing the modelling capability supporting FRCR will be critical to identify a frequency policy to accommodate this. It will also maximise consumer value by assessing the risks that may result in unacceptable frequency conditions and proposing the optimal mitigation controls.

What do we need to deliver this sub-activity?

Implementation of Network Services Procurement projects needs coordination with business and IT teams as well as confirmation of changes needed for internal systems.

This sub-activity is linked to IT investment **610** Settlements, Charging and Billing. The detail behind these investments can be found in **Annex 4 – Digital, Data and Technology**.

7.9.1.2 A4.3 Deliver an efficient frequency market (sub-activity name changed from Deliver a single day-ahead response and reserve market)

The name of this sub-activity has been changed to better reflect that as we go through the process of optimising the response and reserve service, we might find better solutions that sit outside the wording in the original title.

D4.3.6 Future developments to frequency response services is a new deliverable under this sub-activity.

Please see **Annex 1 – Supporting Information.**

7.9.1.3 A4.5 Facilitate whole electricity system market access for distributed energy resources (materially changed and name changed)

This activity's name has been changed from "Alignment of ESO–DSO flexibility markets" to reflect our broader ambition for the participation of flexibility service providers. Due to the direct interdependencies of facilitating whole electricity flexibility activities, detail of the deliverables for this sub-activity (D4.5.3 - D4.5.5) are found in the **Accelerating whole electricity flexibility spotlight**. D4.5.1 and D4.5.2 were proposed to be continuous deliverables, however, they will have concluded in BP1 and are now superseded by D4.5.5.

This section includes a resource increase of six FTE to support development of the DSO flexibility markets. More information can be found in the Accelerating Whole Electricity Flexibility section of this plan.

7.9.1.4 A4.6 Balancing and ancillary services market reform (materially changed)

What is this sub-activity and why is it important?

Our Markets Roadmap provides a view of how and why we are reforming our Balancing Services markets, driven by the changing operability requirements set out in our Operability Strategy Report (D1.1.6), as well as the rapidly changing technologies and business models of providers and the evolving wider market context. Most of our markets are continually being reformed, with some further along the 'transformation' journey than others. For example, our response markets reforms have been designed and delivered, and are now being optimised. Other markets, like stability and voltage, are in the design stages, having gone through the strategy definition stage. We are still in the early stages of reviewing other market areas, such as the Balancing Mechanism (BM), to understand what the possible reforms might look like.

What will we deliver in BP2?

We will continue with our long-term procurement approach for both stability (D4.6.1) and reactive power (D4.6.2) which will include establishing and sharing requirements and launching procurement events to deliver investment signals for the development of investment-heavy solutions.

In addition to long-term procurement, dedicated short-term markets for stability and reactive power could enhance competition and liquidity, by providing a route to market for additional providers, potentially resulting in significant savings. We will therefore continue development work in both areas over the second year of BP1. Reform activities in BP2 will depend on whether we can demonstrate benefits for consumers for potential new designs.

The Stability Pathfinder (now called Network Services Procurement) (**D4.6.1**) approach was launched in 2019 as a competitive way to procure shortfalls in long-term stability requirements.

The current innovation project (Stability Market Design) is exploring an enduring design of stability procurement, looking at different designs and recommending the preferred option. Phase 1 of this project found that a combination of short- and long-term procurement is the best option, with the potential of delivering benefits of approximately £58m by 2030[31].

(D4.6.2) We access reactive power through four routes which include TO network assets, Obligatory Reactive Power

31 page 42
https://www.nationalgrideso.com/document/247946/download

Service (ORPS) providers, voltage contracts and contracted Pathfinder projects. The primary route to market for large generators is through ORPS which requires units to be running to provide this service.

The current innovation project (Reactive Market Design) is exploring an enduring design of reactive power procurement. Phase 1 of the project found that a combination of short- and long-term procurement is the best option (similar to the findings in the Stability Market Design project), with potential benefits of up to ~£65m each year by 2025.

(New) D4.6.3 will develop Balancing Services that meet our changing system needs and allow technologies to compete on a level playing field. The Smart Systems and Flexibility Plan[32] seeks interconnector participation in ancillary services to facilitate efficient and flexible access to cross-border markets. We will be exploring barriers to entry across ESO markets; by identifying mitigating actions and working with industry to implement the changes needed to facilitate routes to market, we will increase participation and liquidity.

(New D4.6.4) Ahead of longer-term considerations of Regional Development Programme (RDP) functionality across Scotland, there is a growing need for a DER solution to manage rising constraint costs. The Anglo-Scottish (B6) boundary currently has the highest constraints of any boundary in Great Britain, and these are set to increase. We will establish a Local Constraint Market (LCM) to specifically target B6 constraint costs (which may be expanded to cover other constraint boundaries later in BP2). The LCM will offer a day-ahead competitive alternative to BM actions at the Anglo-Scottish boundary via a generation turndown/demand turn-up service. It will mirror the simple construct of the Optional Downward Flexibility Management (ODFM) service developed during the COVID-19 pandemic.

We are seeking to deliver the service through a third-party software-as-a-service (SaaS) solution, which will enable us to accelerate delivery. During BP1 we will award the contract and have the platform operational. This will then be in operation throughout BP2.

What do we need to deliver this sub-activity?

D4.6.1 and **D4.6.2** require detailed analysis to be completed with industry stakeholders to understand the most efficient design and implementation of potential new procurement approaches for stability and reactive power.

For **D4.6.3** we will work with industry to implement the changes needed to facilitate participation in ancillary service trials.

This sub-activity is aligned to IT investment 130 Emergent technology and system management. The detail behind these investments can be found in **Annex 4 – Digital, Data and Technology**.

7.9.2 A5 Transform access to the Capacity Market and Contracts for Difference (materially changed and name changed)

As the Electricity Market Reform (EMR) Delivery Body, we manage the end-to-end process for all Capacity Market (CM) participants, supporting them through prequalification and multiple annual auctions, to the issuing and management of capacity agreements. Through our security of supply modelling, we advise the Secretary of State on the volume of capacity to be procured. We are also responsible for running the qualification and allocation processes for Contracts for Difference (CfD), which is the government's main mechanism for supporting low-carbon electricity generation.

We use our expertise and the insights we gain from our customers and stakeholders to advise BEIS on their strategic reviews of the Capacity Market and CfD regimes, to ensure capacity adequacy and to drive the transition to net zero. Working with BEIS, Ofgem and other EMR delivery partners, we help shape the policy and rules for the CM and CfD mechanisms to make processes efficient and effective. During BP2, we will continue to improve our processes and systems to enhance the customer experience as well as co-create guidance and effective support.

We will continue to improve security of supply through use of enhanced modelling and more granular data sets. We will also explore options for the capacity mix that could deliver capacity adequacy through the 2030s to support policy development and longer-term decision-making to meet net zero **(new D5.4**).

Stakeholder feedback

In response to the consultation on our draft plan, all stakeholders who responded were supportive of our plans for A5 and the introduction of our new sub-activity A5.4. Some provided recommendations and ideas in relation to the new sub-activity.

As a result of the stakeholder feedback we received, we will work with stakeholders to deliver incremental modelling improvements and we are happy to adopt a proposal to set a two-year cycle as the maximum interval between reports for the proposed studies being carried out as part of D5.4.

To see our full responses to stakeholder feedback, please refer to **Annex 3 – Stakeholder Engagement**.

A5 sub-activities

This activity is made up of the following sub-activities:

Sub-activity #	Sub-activity name	Status
A5.1	Electricity Market Reform (EMR) Delivery Body	No change (please see **Annex 1 – Supporting Information**)
A5.2	Deliver an enhanced platform for EMR	No change (please see **Annex 1 – Supporting Information**)
A5.3	Improve our security of supply modelling capability	No change (please see **Annex 1 – Supporting Information**)
A5.4	Long-term capacity adequacy	New

32 Transitioning to a net zero energy system: Smart Systems and Flexibility Plan 2021 (publishing.service.gov.uk)

7.9.2.1 A5.4 Long-term capacity adequacy (new)

What is this sub-activity and why is it important?

For the power system to be fully decarbonised by 2035, we need to ensure that we are assessing the risks to security of supply and the types of resource needed in the capacity mix.

What will we deliver in BP2?

We intend to build new modelling capability **(new D5.4)** to undertake longer-term capacity adequacy studies that will be published at least every two years. These studies will:

- identify the risks to electricity security supply of a fully decarbonised power system
- assess how different options for the capacity mix could mitigate these risks
- consider the economic viability of the different options.

We may undertake shorter follow-up studies, working closely with industry stakeholders to explore aspects of interest arising from the main study.

What do we need to deliver this sub-activity?

Collaboration with stakeholders to deliver incremental modelling improvements is central to our work in this area.

There is an interdependency with the market reforms recommended under **A20 Net Zero Market Reform programme** in terms of understanding the resources needed for adequacy and having market arrangements to ensure they are economically viable.

7.9.3 A6 Develop code and charging arrangements that are fit for the future (materially changed)

It is crucial that we continue to reform the codes and frameworks that govern our market. These arrangements establish the commercial and technical parameters within which market participants operate. We will also continue to develop and deliver sustainable improvement in our relationship with Europe through the requirements of the TCA, which will now be covered by the new **A21 Role in Europe**.

In BP2 we will develop new tools and processes to ensure we continue to recover transmission system costs and adapt to the demands of the changing market and wider industry reforms. Following the conclusion of the BSUoS reform code modifications, we will set and bill the new BSUoS tariffs to realise the consumer benefits identified by Ofgem to 2040[33] and lead the newly established TNUoS Task Forces established by Ofgem and us. We will remove complexity and barriers to participation in the code change process and a new team will be established to consider frameworks in a more holistic way to take account of new markets and new participants.

In the first year of BP1, we engaged with stakeholders on the benefits of consolidating the technical codes. As a result, we are going to alter our focus to more fully consider the opportunities presented by digitalisation of the codes. We will do this whilst looking at examples of alignment, simplification and rationalisation in advance of the outcomes of BEIS and Ofgem's Energy Code Reform, which may include code consolidation.

Stakeholder feedback:

Most of the feedback received on A6 has been at a specific rather than overarching level, although broadly supportive. This includes support for the TNUoS Task Force and Market Wide Half Hourly Settlement, although we note the feedback from stakeholders around the need for these projects to be taken forward at pace.

Stakeholders supported the principles of fixed BSUoS setting, but further details were requested on the tolerance levels of the forecasts and the corresponding reporting metrics and the increase in headcount required for this sub-activity was queried. At present we are initiating consultation on our fixed tariff model inputs and would invite stakeholders to participate in any consultations we run. Following both this and direction from Ofgem, we can start to consider any continuous improvements beyond FY24. In relation to headcount, BSUoS forecasting is a complex activity and improvements to accuracy are underpinned by a transformed modelling approach. This modelling requires multiple inputs and assumptions from across the ESO and, therefore, additional resource will need to be brought in to undertake this increased activity.

We also received broad support for the new sub-activity on whole system codes reform and our role in this alongside network operators and wider industry participants. However, stakeholders flagged that we should be mindful of whole system thinking already developed through existing channels. As we take these plans forward, we will work with all interested stakeholders as this project develops, with co-creation being a key focus for BP2.

These themes very much echo the feedback we have been hearing as part of our BAU stakeholder engagement completed so far during BP1.

Our full responses to stakeholder feedback on A6 can be found in **Annex 3 – Stakeholder Engagement**.

A6 sub-activities

This activity is made up of the following sub-activities:

Sub-activity #	Sub-activity name	Status
A6.1	Code management /market development and change	Materially changed
A6.2	European Union (EU) code change	Name changed and moved under **A21**

33 CMP308 Minded to decision https://www.ofgem.gov.uk/sites/default/files/2021-12/CMP308%20Minded-to%20-%20FINAL%20PDF.pdf

		(please see **Annex 1 – supporting information**)
A6.3	Industry revenue management	Materially changed
A6.4	Transform the process to amend our codes	No change (please see **Annex 1 – Supporting Information**)
A6.5	Work with all stakeholders to create a fully digitalised, Whole System Technical Code by 2025	No change (please see **Annex 1 – Supporting Information**)
A6.6	Look at fully or partially fixing one or more components of Balancing Services Use of System (BSUoS) charges	Complete (please see **Annex 1 – Supporting Information**)
A6.7	Fixed BSUoS tariff setting	New
A6.8	Digitalisation of codes	New
A6.9	Whole electricity system framework reform	New. Name changed from "Whole system codes reform"

7.9.3.1 A6.1 Code management/market development and change (materially changed)

What is this sub-activity and why is it important?

This sub-activity is made up of new deliverables that will support and enable major net zero programmes by making changes to industry codes and frameworks. It also focuses on how we will lead the review of TNUoS charging and support the implementation of Ofgem's Market-wide Half Hourly Settlement (MHHS) programme.

What will we deliver in BP2?

Enabling the connection of 50 GW of offshore wind by 2030 is a key priority to facilitate net zero. Changes to industry codes and frameworks, including the Security and Quality of Supply Standard (SQSS), the System Operator–Transmission Owner Code (STC), the Connection and Use of System Code (CUSC) and the Grid Code are needed to underpin the design of the offshore transmission network and the arrangements between industry parties.

We need to increase our resource in the first year of BP2 to manage the high level of change needed to enable coordinated offshore networks. This resource will also be used to take forward the code and standard changes for the enduring regime in the second year of BP2 (**D6.1.1**). Additional resource may be needed when the code changes for the Central Strategic Network Plan (CSNP) are set out in Ofgem's Electricity Transmission Network Planning Review (ETNPR).

(**D6.1.2**) will deliver the code change to facilitate onshore competition**,** which will benefit consumers by driving innovative solutions and efficient delivery.

(**D6.1.3**) will continue the work that has already commenced in delivering code modifications needed to facilitate meeting the Electricity Supply Restoration Standard (ESRS). This will allow us to meet our licence obligation to comply with the ESRS by the end of 2026. Our Distributed ReStart programme will enable us to achieve this and is included in these modifications. It will help safeguard our ability to restore the system using DER providers and contribute to our goal of operating a carbon free system.

Using new technology in our markets to provide system stability is essential to meeting our net zero ambitions (see **D4.6.1**). **D6.1.4** will deliver the code modifications and guidance so that technical specifications can be set for stability equipment. We will continue the progress already made on Grid Code modification (GC0137) by providing more detailed guidance and engaging with stakeholders.

Following feedback from stakeholders about the unpredictability and volatility of TNUoS charges and the suitability of the underlying principles, we are working collaboratively with Ofgem to lead TNUoS Task Forces[34] to review the current TNUoS methodology in the short to medium term, working closely with industry to define any future changes. There will also be a longer-term review of TNUoS alongside wider market reform.

The new deliverable **D6.1.5** also covers the support the revenue team will provide to sub-activity **D6.3.2** TNUoS reform, covering the code change element and defining what the future TNUoS charging methodology will look like. We have now launched the TNUoS Task Force through the Charging Futures arrangements. Following industry feedback, this work will consider the root causes of unpredictability in TNUoS charges and how they might be addressed, as well as a review of data inputs used within the current charging methodology (used to calculate the locational element of TNUoS) to ensure charges are cost reflective.

We will deliver code modifications to support the delivery of Ofgem's MHHS programme and implement the ambition for MHHS within the CUSC and BSC **(New D6.1.6).** We are participating in the development of the detailed design of the MHHS and are a member of the Industry Programme Steering Group. The feedback from the industry group can be found in **Annex 3 – Stakeholder Engagement**.

What do we need to deliver this sub-activity?

We have assumed progress will be made in externally led programmes such as MHHS. Other dependencies include interaction with the onshore and offshore coordination activities, the Competitive Appointed Transmission Owner (CATO) regime, the OTNR and NZMR project, as these may impact the timeline of framework and code modification changes in BP2.

[34] https://www.ofgem.gov.uk/publications/tnuos-task-forces

Progression of the BEIS/Ofgem led Energy Code Reforms (ECR) and the Future System Operator work both have the potential to substantially impact code changes, especially the consolidation of codes that form part of the ECR project. Future interaction with the Whole System Digitalised Technical Code deliverable is also likely.

Certain other key modifications, such as GC0117[35], which instigates a review of the threshold at which generators are required to participate in the BM, also need careful coordination with other ongoing work

As part of TNUoS reform work, data flows, some IT systems, business processes and the TNUoS methodology will need to change but no additional FTE are needed in the Code Management team to support this work.

This sub-activity is aligned to IT investment line **280** Great Britain regulations and **610** Settlements, Charging and Billing. The detail behind these investments can be found in **Annex 4 – Digital, Data and Technology**.

7.9.3.2 A6.3 Industry Revenue Management (materially changed)

What is this sub-activity and why is it important?

This sub-activity focuses on transforming charging and billing processes for our customers. This means updating our systems, modelling and processes so that customers have a better experience.

What will we deliver in BP2?

Our deliverables in this area support the code change activity outlined in **A6.1.** See **D6.1.6** for information about MHHS and **D6.1.5** for information on our role in TNUoS charging reform and the code changes required in this area.

We've created two new deliverables to embed these code changes into our charging activities:

(New D6.3.1) Current TNUoS charging is based on non-half-hourly and half-hourly metering, and both TNUoS and BSUoS charges are levied in line with the industry settlement timetable. The change to settle all electricity metering on a half-hourly basis is mandatory and is expected to be complete by the end of 2025, as directed by Ofgem, with a reduction in settlement timescales immediately after. The programme timelines may change depending on how the industry-led development and resulting code modifications progress, so the plan will need to be flexible.

(New D6.3.2) Once code modifications are identified we will be able to plan reforms to our charging systems and processes. Our charging methodology will continue to adapt to the changing landscape.

What do we need to deliver this sub-activity?

Our plans for both the above deliverables will need to evolve once we are clearer on code modifications for TNUoS charging reform and MHHS.

We need flexible systems so that the Charging and Settlements landscape can change quickly. This aligns to IT investment line 610 Settlements, Charging and Billing and 280 Regulatory Change in Great Britain. Through this investment, we will create a more reliable automated system that can keep pace with change and deliver a higher quality and more efficient service to our customers. The detail behind this investment can be found in **Annex 4 – Digital, Data and Technology**.

7.9.3.3 A6.7 Fixed BSUoS tariff setting (new)

What is this sub-activity and why is it important?

This sub-activity focuses on building on the progress made in BP1 (completed activity **A6.6**), on improving our BSUoS forecasting capabilities, so that these can be factored into decision-making and can support fixed BSUoS tariffs from April 2023 onwards. Fixed tariffs will help reduce uncertainty and volatility for customers and reduce the wholesale cost of electricity, in turn reducing the cost to the consumer.

What will we deliver in BP2?

We will deliver more accurate BSUoS forecasts by continuing to invest in our BSUoS forecasting capability and help the market understand our methodology by providing certainty and visibility of the costs of balancing the system (D6.7). Once the code modifications have been implemented, we will need to run the forecasting model and continually improve and refine it to reflect market changes long-term. This will realise the value of fixing BSUoS by providing certainty and visibility up front of the associated costs of balancing the system.

What do we need to deliver this sub-activity?

The new approach to modelling is fundamentally different to the current tariff setting process. We will need two additional FTE to deliver this work.

This sub-activity is linked to IT investment **610** Settlements, Charging and Billing. BSUoS Task Force outputs are likely to require significant system changes and would be implemented on a new charging and billing solution. The detail behind this investment can be found in **Annex 4 – Digital, Data and Technology**.

7.9.3.4 A6.8 Digitalisation of codes (new)

What is this sub-activity and why is it important?

Digitalisation is fundamental to delivering code consolidation and there is widespread industry support for it. This work supports activity **A6.5** to create a fully digitalised Whole System Technical Code by 2025 and will help us to make code change more efficient and easier for market participants. It also supports our ambition to become a Code Manager **(A6.4)** by creating a digital solution that can be applied to other codes.

Benefits of digitalisation identified so far include:

– Allowing users to navigate more efficiently whilst minimising risks of missing 'relevant information'.

[35] https://www.nationalgrideso.com/industry-information/codes/grid-code-old/modifications/gc0117-improving-transparency-and

- Delivering value to new users who may not be fully aware of all obligations relevant to them.
- Automated version control would reduce risk of using old documents.
- Encouraging new entrants by supporting a more efficient customer journey.
- Providing greater clarity on relevant sections of code if it is signposted by metadata/tagging.
- The potential to reduce the level of industry resource used to propose changes by reducing the amount of analysis needed.

What will we deliver in BP2?

Digitalisation of the Grid Code: we will use feedback from stakeholder consultations to implement a digital solution for easier interaction with the Grid Code for all parties **(new D6.8).** The solution will consider the outcome of the ECR to ensure a fit-for-purpose tool that meets the future needs of the industry. The solution will consider the nuances and requirements specifically for the Grid Code and will be flexible enough to provide a common approach for the digitalisation of other industry codes. We will use best practice gathered from the digitalisation projects of other code managers to inform our thinking.

Any benefits and lessons learned from the Digitalisation of the Grid Code project will be considered as part of further code digitalisation as we move forward into the RIIO-3 period.

What do we need to deliver this sub-activity?

We had outlined in **A6.5** (Work with all stakeholders to create a fully digitalised Whole System Technical Code by 2025) the interrelation of these two activities. However, delivery of the more specific scope in **A6.8** can run on independently.

We will create engagement channels reaching a diverse and inclusive audience to fully test and refine the user experience.

This sub-activity is aligned to IT investment line **330** Digitalised Code Management. The detail behind this investment can be found in **Annex 4 – Digital, Data and Technology**.

7.9.3.5 A6.9 Whole electricity system framework reform (new)

What is this sub-activity and why is it important?

This sub-activity will help us to take a broader view of industry framework reform across the whole electricity system and understand the impact of non-traditional market participants on our electricity market governance frameworks. Through our work on the CATO, Early Competition, Offshore and Pathfinder projects, as well as our involvement in Open Networks and the requirements of the Smart Systems and Flexibility plan, we know that a more holistic view is needed and that many changes interact, requiring greater coordination to arrive at a single optimum solution.

Having the right structure for future market frameworks will help us to achieve the UK's net zero ambition, deliver increased value to consumers and facilitate more effective participation in markets. Without this work, any change to the frameworks for new types of market participant or connection would not be managed efficiently.

What will we deliver in BP2?

We will establish a new whole electricity system market policy team to identify solutions for cross-role challenges **(new D6.9)**. For further details on DSO activities, see the spotlight on **accelerating whole electricity flexibility**. This team within Role 2 will make proposals in the following areas:

- Changes to licences, regulations and codes on behalf of ourselves and other electricity market bodies.
- Consideration of zero MW markets within the codes, licences and market frameworks and the implication for costs and efficient economic signals.
- Consideration of the effects of future non-network solutions on the electricity frameworks.
- Consideration of changes to electricity market frameworks to facilitate DSO and whole system outcomes between us and the DNOs.

This new team will assess relevant frameworks and create a delivery plan, which will then be fully assessed in collaboration with stakeholders to ensure alignment with policy goals.

Deliverables may include specific changes, where these are within our control, or recommend areas of development. Ongoing assessment and prioritisation will be necessary throughout BP2 to respond to the changing environment.

By the end of the BP2 period, we will have made recommendations on appropriate changes to electricity market frameworks and developed a case for change.

What do we need to deliver this sub-activity?

Delivery of this activity requires resources to achieve coordination of associated programmes such as Early Competition, Network Services Procurement (Pathfinder) projects and the Energy Networks Association Open Networks programme, as well as other wider market developments that do not necessarily fit within the frameworks as originally envisaged. Evolution of the frameworks to ensure the success of these critical programmes and to allow the market to develop will be a critical measure of success.

Chapter 7 – Role 2 Market development and transactions

7.10 Role 2 detailed costs explanation

Role 2		BP1 Actuals 2021/22	BP1 Forecast 2022/23	TOTAL (2 years)	BP2 Forecast 2023/24	BP2 Forecast 2024/25	TOTAL (2 years)	BP3 Forecast 2025/26	TOTAL (5 years)
Capex (£m)	BP2 submission	23	26	50	20	23	43	24	**117**
	Original BP1	22	15	37	14	14	28	15	**80**
	Variance	**1**	**11**	**13**	**6**	**9**	**15**	**9**	**37**
Opex (£m)	BP2 submission	18	26	45	34	34	68	34	**146**
	Original BP1	29	28	57	30	30	59	28	**144**
	Variance	**(11)**	**(1)**	**(12)**	**4**	**5**	**8**	**6**	**2**
Totex (£m)	**BP2 submission**	**42**	**52**	**94**	**54**	**57**	**111**	**58**	**263**
	Original BP1	**51**	**42**	**94**	**44**	**44**	**88**	**43**	**224**
	Variance	**(9)**	**10**	**1**	**10**	**13**	**23**	**16**	**40**
FTE	BP2 submission	175	206		215	214		213	
	Original BP1	164	164		168	170		168	
	Variance	**11**	**42**		**48**	**45**		**45**	

Table 7: Role 2 forecast costs and full-time equivalent headcount for the five-year RIIO-2 period

The table above shows our forecast costs and full-time-equivalent headcount (FTE) for the five-year RIIO-2 period, comparing the original BP1 to our BP2 submission. These Role 2 costs exclude support functions and enabling activities which are shown separately in **Chapter 12 – Enabling activities**. Opex costs include all Role 2 overhead costs as well as project opex for IT investments and incremental run-the-business overhead IT costs associated with new investments.

A more detailed breakdown of the key Role 2 activities driving costs changes is given below:

A4 Build the future balancing service and wholesale markets

In the BP2 period, it is proposed that this activity is increased by £14m totex, with an additional eight FTE. The key drivers of these increases are:

- IT investments **400** Single Markets Platform (SMP) and **420** Auction capability are driving an £11m increase (£10m capex, £1m opex). The digital SMP will be an important enabler of decarbonisation. It will provide frictionless access to our markets and is part of the wider strategy to digitise the way we work. Since our original RIIO-2 submission we have gained a greater understanding of the system scope and interaction with other systems. The additional investment allows interaction with downstream systems that will drive a better user experience. The SMP will also align and interact with wider DSO/flexibility markets, and allow us to enact change more quickly, as well as adapt to new markets. The auction capability investment will also be moving into the delivery stage for BP2, allowing greater procurement optimisation, enhanced automation, and system integration with SMP.
- We also propose to add six FTE for delivery of the new transformational sub-activity **A4.5** Facilitate whole electricity system market access for distributed energy resources at a cost of £2m. A further three FTE are needed to support Pathfinders and enable our frequency management strategy to look further ahead and to expand the time horizon that our modelling considers.

A5 Transform Access to the Capacity Market and Contracts for Difference

In the BP2 period, it is proposed that this activity is increased by £8m totex, with an additional 19 FTE.

- An additional £3m of opex will support the delivery of EMR auctions, delivering regulatory change, and covering the revised implementation date of the EMR portal and process automation. They will support the 2030 modelling capability, which includes earlier delivery of modelling enhancements than originally intended. There will be improvements to the delivery assurance for the new sub-activity **A5.4** Building Capability Studies, which will deliver incremental modelling improvements.
- Investment **320** EMR and CfD improvements results in an increase of £5m capex. This will enable us to continue to advance the user experience optimisation and deliver regulatory changes in the new salesforce based EMR portal, following its implementation in BP1.

A20 Net Zero Market Reform

This new activity will be carried out by six FTE with opex of £1m for the new NZMR team.

Activity within the NZMR programme started in April 2021 and has been ramping up since. It has already completed three phases – scoping and stakeholder landscape; defining the

case for change and developing the option assessment framework; and assessing the shortlisted options.

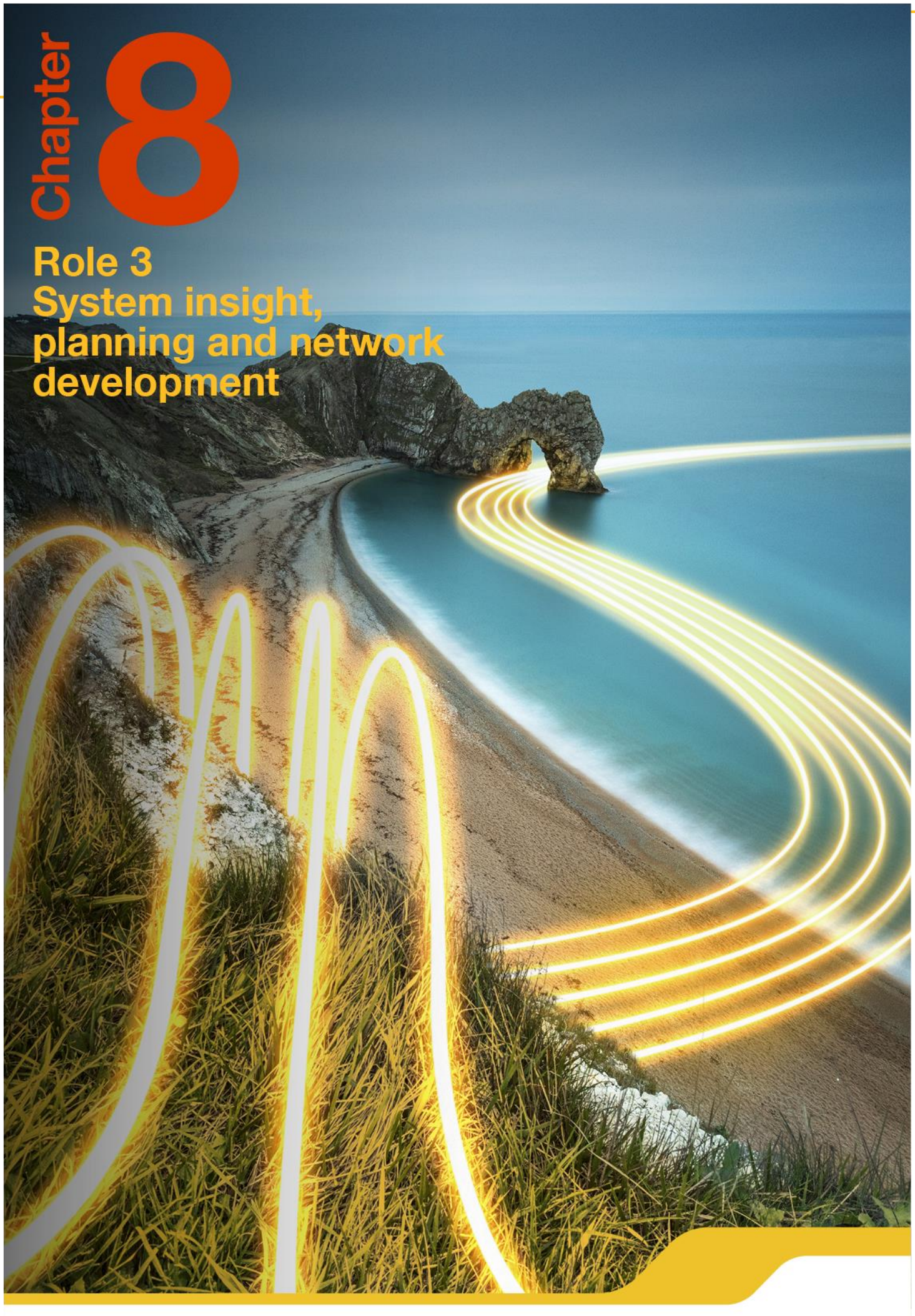
Phase three concluded that the status quo will not deliver net zero cost-effectively and a nodal pricing market with central dispatch has the potential to deliver significant consumer benefits. The responsibility for these decisions lies with BEIS and Ofgem and we continue our role in providing insight and analysis to enable them to make progress in this area.

The remaining Role 2 activity

A6 Develop code and charging arrangements that are fit for the future does not drive a material change in spend or FTE compared with BP1.

Chapter 8

Role 3
System insight, planning and network development



Chapter 8 – Role 3 System insight, planning and network development

Under Role 3, we are responsible for providing key insights and leadership on credible long-term pathways for the energy sector and for defining long-term electricity system needs. We are responsible for managing the process to connect to the electricity transmission system and for managing impacts on this system from connections of new generation offshore and at distribution level. We are also charged with defining and delivering solutions to long-term operability needs, including through our innovative Pathfinder programme.

Through these core activities of system insights, planning, and network development, we provide leadership to ensure the network is always ready for the demands placed upon it. Never has this been more important given the transformational changes now taking place in the energy sector as it decarbonises. Indeed, the scope and scale of activities related to system planning and coordination have grown significantly over the BP1 period as we work with Ofgem and BEIS to introduce more strategic network planning processes. This includes making further progress towards introducing competition in networks, supporting the Offshore Transmission Network Review (OTNR), including delivering the first ever Holistic Network Design (HND), and working with Ofgem to introduce a future Centralised Strategic Network Plan (CSNP).

The UK power system is decarbonising at a faster rate than almost anywhere in the world and our BP1 commitment, to be ready to operate the electricity system carbon free from as early as 2025, remains very much at the heart of our plans. This is now complemented by a UK Government commitment to achieve a fully decarbonised electricity system by 2035, subject to security of supply being maintained. This throws up a variety of new challenges for the system operator to overcome; challenges we are willing and excited to accept. We are also using our experience to provide global leadership on the transition to net zero through our role in the Global Power System Transformation Consortium (G-PST). The learnings and tools developed during BP1 to deal with significant network changes will be further built upon in BP2, including our innovative Pathfinder projects and Regional Development Programme (RDP) integration strategies. And, as we move further into unchartered territory, with an increasingly complex network, our BP2 submission is designed to ensure that we continue to lead the way.

We will achieve this through gaining a deep understanding of the technical issues that result from operating a fully decarbonised system and then seeking the solutions and investment to enable it to happen. At all times, we will favour solutions that drive the best value for consumers and, where appropriate, use competition to drive innovation and value.

Further examples of how our plans are responding to the changes taking place in our industry include:

- **An accelerated drive to net zero** – This has driven a massive increase in connection applications across transmission (a 100 per cent increase in 2021 alone) and distribution. Many of these new applications are for new technologies and innovative solutions that don't fit neatly within the existing frameworks. **To ensure that those that need to connect to the system can do so, we are undertaking a fundamental review and reform of the connections process.** This reform will enable a whole electricity system view that can connect additional demand, generation and storage and facilitate the transition to zero carbon operation.
- **Working across the whole electricity system** – Through the DNO price control (RIIO-ED2), the role of distribution system operation (DSO) has been developed. This includes DNOs taking a 'flexibility first' approach, where a DNO market is created to avoid or delay asset investment. **We will ensure coordination with these markets and play our part in removing any blockers to allow increasing volumes of distributed energy resources (DER) to participate in our markets, thus accelerating whole electricity system flexibility.**
- **Ever higher energy prices contributing to a cost-of-living crisis –** The unprecedented increase in energy prices over the last twelve months, compounded by the war in Ukraine, has thrown an even sharper focus on the cost of our activities and, in particular, on the cost of balancing the system. **Accordingly, in Role 3 we have specifically targeted reducing constraint costs in the short- to medium-term through deployment of a "5-point plan" and, in the longer term, through our work on strategic network planning and connections reform.**
- **Responding to increased complexity and the changing nature of the network** – In network access planning, the ability to grant our customers access for maintenance and construction at the most secure and least cost time is becoming increasingly challenging, due in part to the variable nature of renewable generation. **In response, we are facilitating more system access than ever to allow the replacement of ageing assets and cater for the unprecedented levels of system growth.**
- **Developing a strategic approach to network planning –** while we already have world-leading approaches to planning the electricity transmission network, we recognise that these processes need to continue to evolve. Through our new activities of the **Network Planning Review** and **Offshore Coordination** we will develop a **strategic planning regime** that ensures the network is an enabler for the net zero transition.

Chapter 8 – Role 3 System insight, planning and network development

8.1 Role 3 activities during BP1

During BP1, we have commenced delivery of our ambitious RIIO-2 agenda, such that by the end of the BP1 period we will have:

- successfully executed 5 Pathfinder procurement exercises (now called Network Services Procurement) and delivered innovative solutions to solve voltage and stability issues on the transmission system at a much-reduced cost for the consumer.
- delivered an Early Competition Plan and progressed detailed planning to commence network competition for transmission solutions within the BP2 period, subject to enabling legislation.
- delivered the first ever Holistic Network Design (HND) to connect an additional 23 GW of offshore wind, together with a second HND Follow-up Exercise providing connection solutions for at least a further 20GW of offshore wind projects. These designs constitute transitional stages towards delivering the first Central Strategic Network Plan (CSNP) during the BP2 period.
- accommodated a 64 per cent (FY23) and 47 per cent (year to date) increase in connection applications and commenced a programme to reform the connections process with strong cross-industry support. Utilised the new STCP 11-4 mechanism across England and Wales to provide circa £100m of value through enhanced service provision following collaboration with Transmission Owners. The success of the mechanism rollout was achieved while continuing to exceed customer and consumer value saving targets.

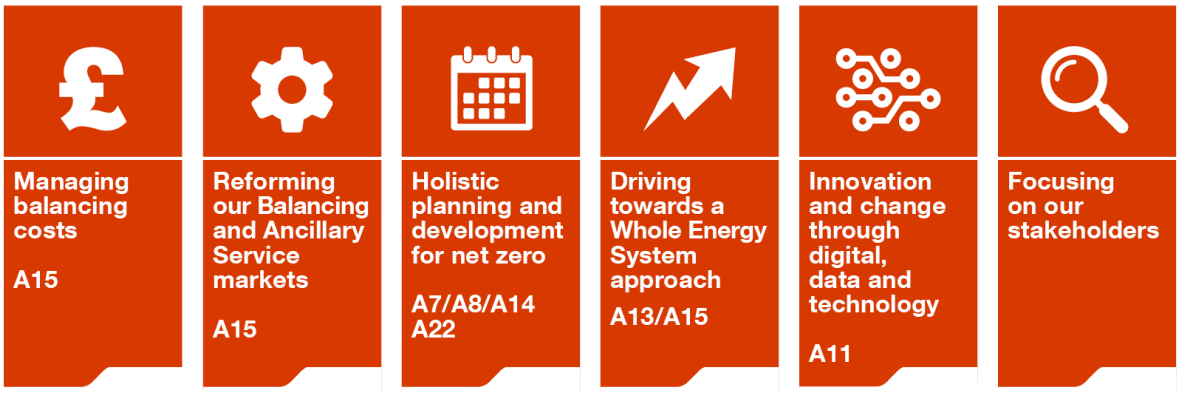
Our BP2 submission will build on these foundational capabilities delivered during BP1 and take us closer towards the achievement of our ESO mission and ambitions.

8.2 How Role 3 supports our BP2 priorities

As set out in Part A, building efficient and effective markets and driving towards net zero are main priority areas for BP2. Specifically, **holistic planning and development** and **driving towards a whole energy system approach** are central to our Role 3 activities.

While contributing to many of the other BP2 priorities, Role 3 also **tackles balancing costs**, in both the short- and longer-term, **creates new markets**, through our work on Pathfinders and Early Competition and **improves our stakeholders' experience,** through improvements to network connection and development processes.

Activities in this role that support our priorities



8.3 What does this mean for BP2?

The industry trends and objectives described above result in the inclusion of a significant number of materially changed or entirely new activities in our BP2 submission when compared to BP1. The following diagrams identify these changes and additions:

Chapter 8 – Role 3 System insight, planning and network development

Figure 26: Role 3 activity level of change for A7-A11

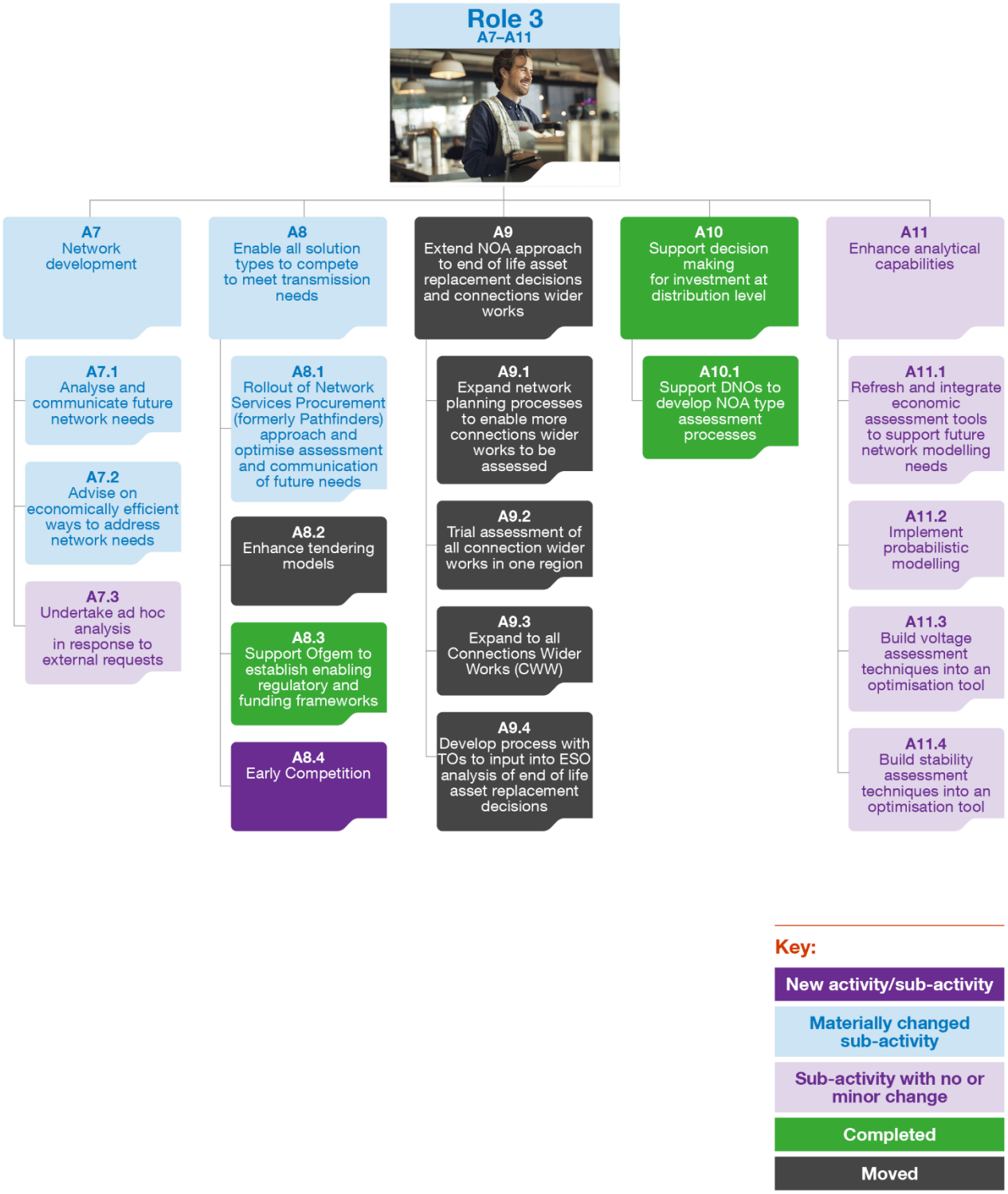
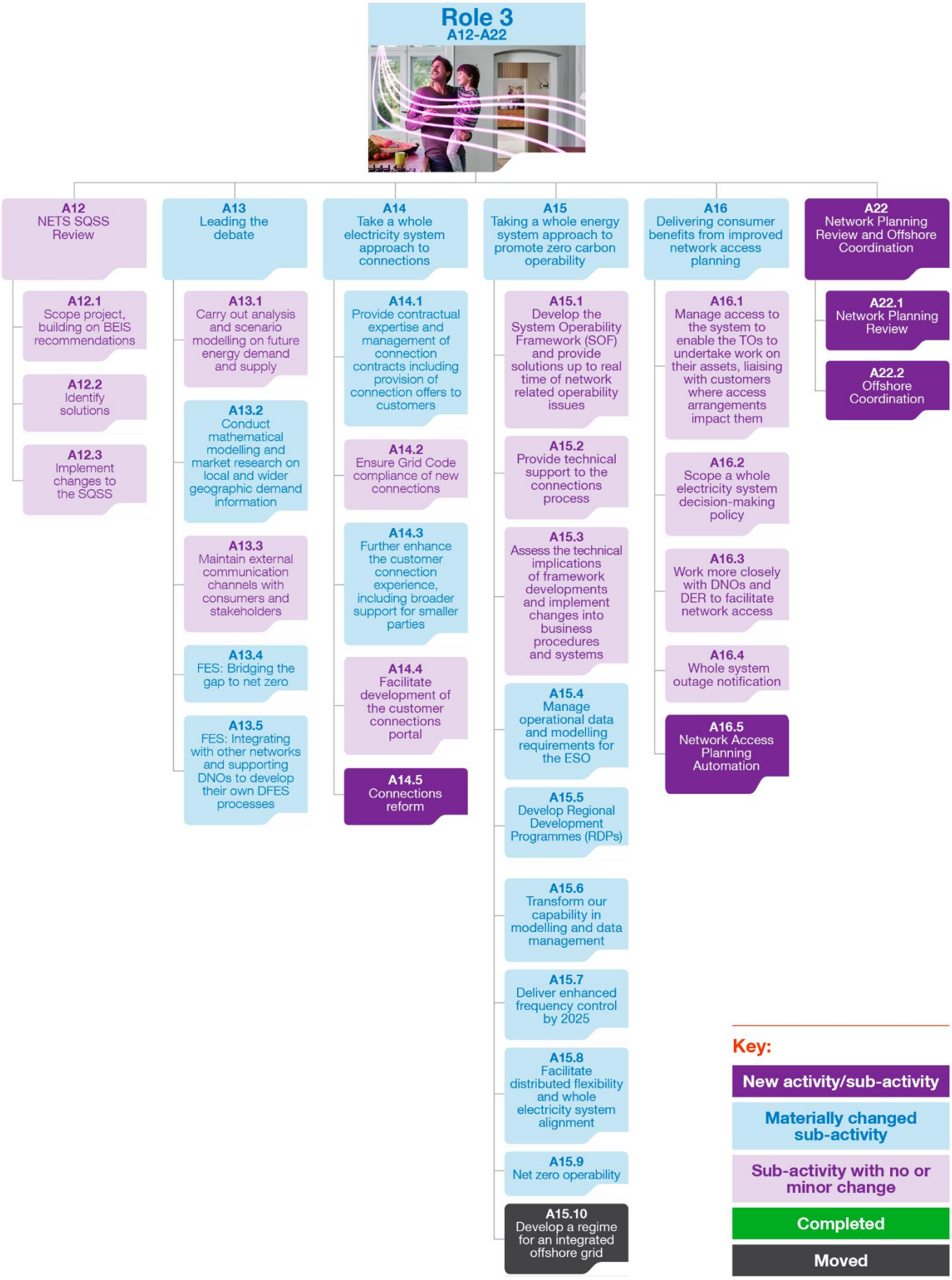


Figure 27: Role 3 activity level of change A12-A22



Chapter 8 – Role 3 System insight, planning and network development

8.4 What is new and what has changed?

New activities and sub-activities in BP2

During the first year of BP1, we have worked with Ofgem and BEIS on the following new Role 3 activities, which are now included within our BP2 submission:

- **A22 Network Planning Review and Offshore Coordination:** Recognising that the current network planning approach is no longer fit for purpose, we are leading on a project with Ofgem to design a new long-term approach for making strategic decisions on what network to build and when, or what markets or whole system solutions could be available. We will develop an end-to-end network planning process to support net zero.
- **A8.4 Early Competition**: Ofgem has asked us to continue developing a regime in which transmission assets that meet the necessary criteria can be subject to a competitive delivery process. We are therefore continuing to develop the roles and processes for carrying out the assessment and tender process for Early Competition.
- **A14.5 Customer Connections**: The volume and complexity of customers wishing to connect to the network has grown very significantly during BP1. We have an ambitious plan to transform the customer experience in this area, and to lead a wholesale reform of the connection process.
- **A16.5 Automation of network access planning**: Beyond solely working closely with the TOs to find flexibility in their outage plans or ways to enhance network capability, we need to invest in our closer to real-time offline modelling tools and provide automation of constraint management so that more outage scenarios can be considered. This will allow us to find optimal consumer value solutions to outage combinations and to understand and mitigate their impact ahead of real-time.

Materially changed activities and sub-activities

- The 2024/25 milestones for **A7.1 Analyse and communicate future network needs** and **A7.2 Advise on economically efficient ways to address network needs** have been removed, as that work will be undertaken under the new **A22**.
- **A8.1 Rollout of Network Services Procurement (formerly Pathfinders) approach and optimise assessment and communication of future needs** confirms our updated commitments to the procurement of vital network services to address key operability needs.
- **A8.2 Enhance tendering models** has been removed and subsumed within **A8.1**, as we will continue to apply lessons learned from each procurement cycle.
- **A8.3 Support Ofgem to establish enabling regulatory and funding frameworks** has completed in BP1 as intended and does not extend into BP2.
- **A9 Extend Network Options Assessment (NOA) approach to end-of-life asset replacement decisions and connections wider works** – while **A9.1** and **A9.2**'s deliverables are complete in BP1, this activity and its remaining BP2 commitments have been removed and subsumed under the work of **A22.1 Network Planning Review**.
- **A10 Support decision-making for investment at distribution level** has completed in BP1 as intended and does not extend into BP2.
- A new deliverable within **A13.2 Conduct mathematical and modelling and market research on local and wider geographic demand information** focuses on enhancing our modelling and coordination with other networks, to enable a more complete view of *FES* projections by incorporating more regional insights.
- **A13.4 *FES*: Bridging the Gap to Net Zero** has become an ongoing activity in BP2, as the value of these reports has been recognised by stakeholders.
- **A13.5 *FES*: Integrating with other networks and supporting DNOs to develop their own Distribution Future Energy Scenarios (DFES) processes** sees a new deliverable focused on ongoing development of our new energy demand model.
- The growing volumes and complexity of connection applications has led to significant developments **in A14 Take a whole electricity system approach to connections**. In addition to the new **A14.5** outlined above:
- **A14.1 Provide contractual expertise and management of connection contracts** has led to significant resource growth within the team to manage the increased workload.
- **A14.3 Further enhance the customer connection experience** sees three new deliverables focused on improving current and future systems and processes.
- **A14.4 Facilitate development of the customer connections portal** sees exploration of additional functionality to enhance the original ambitions, and the timeline for delivery is adjusted as a result.
- A new Grid Code modification means the ambitions of **A15.4 Manage our operational data and modelling requirements** have expanded to account for migrating planning data exchange to a Common Information Model (CIM) standard. Milestones are included to seek improvements to current processes in the interim.
- New deliverables in **A15.5 Develop Regional Development Programmes (RDPs)** detail our RDP project commitments for BP2.
- **A15.6 Transform our capability in modelling and data management** adds a new deliverable which will enhance our Electromagnetic Transients (EMT) modelling capability. This will aid our planning for future impacts of operability challenges resulting from the decline of synchronous generation.
- Additional analysis introduced in BP1 for **A15.7 Deliver enhanced frequency control by 2025** means phases 2 and 3 of the project have moved out to BP2 –

however the remaining project milestones remain on track. A new deliverable details second-stage rollout commencement.

- The ambitions of **A15.8 Facilitate distributed flexibility and whole electricity system alignment** have evolved through two new deliverables, focused on enhancing operational visibility of DER and service coordination with DNOs. These are key enablers for the delivery of whole electricity system alignment, in conjunction with **A1.5 Operational coordination with DSO and DER** and **A4.5 Facilitate whole electricity system market access for distributed energy resources**.
- **A15.9 Net zero operability** has a full refresh of approach for BP2, with all previous deliverables replaced. The sole new deliverable is dedicated to our role in leading engagement with stakeholders on implementing technologies required for net zero operation.
- **A15.10 Develop a regime for an integrated offshore grid** is removed as a sub-activity and subsumed under the activities within **A22**.

Activities and sub-activities with no change, or minimal change

- **A7.3 Undertake ad hoc analysis in response to external requests** – this activity consists of work in three main areas: the Large Onshore Transmission Investments (LOTI) reopener process (formerly Strategic Wider Works), boundary studies for the Connections and Infrastructure Options Note (CION) process for offshore connections and conducting CBA analyses for small schemes like localised network issues.
- **A11 Enhance Analytical Capabilities** – this activity looks at how to expand our analytical tools and capabilities to effectively cover all energy-related network issues in our modelling. All sub-activities remain on track for BP2.
- **A12 SQSS Review** – this activity focuses on bringing the NETS SQSS up to date to make sure that the standards it applies are appropriate for the transmission system today and in the future.
- **A13.1 Carry out analysis and scenario modelling on future energy demand and supply** and **A13.3 Maintain external communication channels with consumers and stakeholders** – these sub-activities represent some of the business-as-usual continuous activities used to feed into the *FES.*
- **A14.2 Ensure Grid Code compliance of new connections** – this consists of providing support to our customers to make sure new connections are fully compliant.
- **A15.1 Develop the *System Operability Framework* (SOF) and provide solutions up to real-time of network related operability issues** – this is our role in publishing the *SOF*, identifying system operability requirements in a rapidly changing landscape.
- **A15.2 Provide technical support to the connections process** – this is our role in making sure the connections process has the technical input required, helping to mitigate delays and barriers.
- **A15.3 Assess the technical implications of framework developments and implement changes into business procedures and systems** – as codes and standards are developed, this sub-activity ensures we assess the technical implications and implement changes to our procedures and systems.
- **A16.1 Manage access to system to enable TOs to undertake work on assets, liaising with customers where access arrangements impact them** – this focuses on our Network Access Planning (NAP) function, coordinating network outages so network owners can carry out maintenance.
- **A16.2 Scope a whole electricity system decision-making policy** – this focuses on creating a GB-wide NAP process, so that decisions are made with a wider range of stakeholders than just the affected TOs.
- **A16.3 Work more closely with DNOs and DER to facilitate network access** – this drives coordination of network access requirements more specifically with DNOs, making sure we collectively optimise network flows.
- **A16.4 Whole system outage notification** – these deliverables extend our advanced outage notification system (eNAMS) to cover a wider range of stakeholders and make it more interactive.

For activities and sub-activities identified as new or materially changed, we have included further details in the sections that follow in this chapter. For those activities and sub-activities which have not materially changed, further details can be found in **Annex 1 – Supporting Information**.

Our activities across Role 3 span a range of topics, and more potential areas of work will likely emerge during the BP2 period. We will continue to lead new areas of work where it is in the consumer interest, making use of the pass-through model and flexible regulatory framework as appropriate.

8.5 Role 3 benefits

Direct consumer benefits from the activities in Role 3 are mainly delivered through our NOA and our whole system approaches to zero carbon operability. Our Role 3 activities deliver significant financial and environmental benefits through network coordination and are essential to transforming to a fully decarbonised electricity system by 2035.

What is in our RIIO-2 CBAs?

We have updated the RIIO-2 CBAs for transformational activities in A7-A11, A14, A15 and A16 in **Annex 2 – Cost-Benefit Analysis**. We have also included a break-even analysis for the new activity A22. Updates were not required to the break-even analyses for A12 and A13.

Activity	Name	NPV[36] BP1 (£m)	NPV BP2 (£m)	Change (£m)
A7	Network development	663	820	+157
A8	Enable all solution types to compete to meet transmission needs			
A9	Extend NOA approach to end-of-life asset replacement decisions and connections wider works			
A10*	Support decision-making for investment at distribution level			
A11	Enhance analytical capabilities			
A14	Take a whole electricity system approach to connections	2	11	+9
A15	Taking a whole energy system approach to promote zero carbon operability	466	1,238	+772
A16	Delivering consumer benefits from improved network access planning	204	252	+48
A22	Offshore Coordination/Network Planning Review	New break-even analysis		
	Total	**1,335**	**2,322**	**+987**

Table 8: Role 3 NPV change
*Completed in BP1

The largest gross benefits contained in our Role 3 CBAs are for:

- Whole system operability assessments: by taking a whole system approach to reducing future operability costs, we will deliver savings of around £1.3 billion[37].
- Facilitating competition by embedding Network Services Procurement (Pathfinder) projects into NOA: implementing commercial solutions to operability challenges will deliver around £564 million of consumer benefit, mainly through postponing asset build.
- Improved network access planning: better notification of planned outages, increased liaison with DNOs and greater coordination with DER will create constraint cost savings of around £284 million.

How have the RIIO-2 CBAs evolved from BP1?

The total NPV of our transformational Role 3 activities has increased since BP1, mainly due to the increase in the A15 NPV. This is driven by an improved methodology for estimating the benefits of our whole system operability assessments and higher forecasts for constraint costs[38]. The increased NPV for A7-A11 is due to including a benefits case for annually undertaking the Network Options Assessment[39] (NOA) and increased forecasts for the value of commercial solutions to operability challenges.

Benefits outside of the scope of the RIIO-2 CBAs

Direct consumer benefits are also delivered through our BAU activities in:

- Enabling distributed flexibility services (D15.8.2): Our proposals in **A15.8** will deliver systems and processes that will ensure ESO and DSO markets develop in coordination. This will ensure efficient dispatch of distributed generation and help facilitate greater market participation of DER.
- Future automation development (D16.5.2): Although not finally delivered until BP3, the automation of offline

[36] The net present value (NPV) is a measure of the net benefits of an activity over the five-year RIIO-2 period, accounting for the time value of money. Our NPVs are calculated at an activity level, using the total activity costs and the total gross benefits of the benefits cases associated with the activity. A description of the largest benefits cases is provided below the table.

[37] Based on the case study of the Phase 2 Stability Pathfinder (now called Network Services Procurement) project.

[38] Increased constraint cost forecasts are factored into the calculation of the Phase 2 Stability Pathfinder (now called Network Services Procurement) counterfactual.

[39] This benefits case is also valid for the process that will succeed the NOA under the Network Planning Review.

planning tools will occur incrementally. As new concepts are developed in Minimum Viable Product (MVP) or even as more mature systems, we will utilise them in cases when a balancing cost reduction can be achieved

– Connections Reform (D14.5.1): Beyond the tangible consumer benefits of connections reform and delivery of the connections portal, our improvements will enable the connections of renewable generation projects. This will improve energy security and resilience whilst supporting the effort to reduce overall costs for managing the system.

8.6 Role 3 costs overview

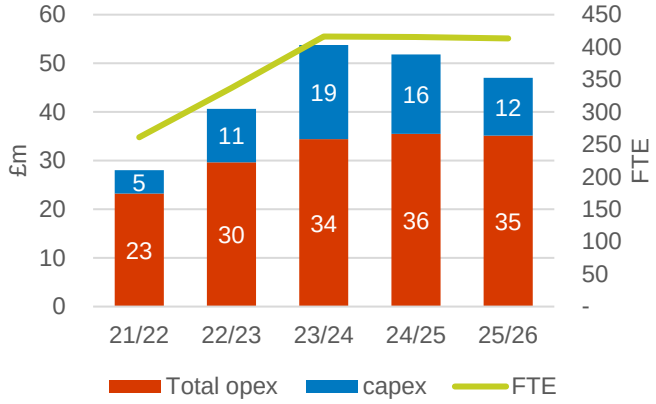


Figure 28: Role 3 costs

Over the five-year RIIO-2 period, our proposed totex request is up by £26m compared to BP1, with an additional 162 FTE by the end of FY26. We propose a £34m increase to opex, partly offset by a reduction in capex, which is down by £8m. The opex increase over the RIIO-2 period predominantly relates to new activities, as described below.

Our role in Offshore Coordination and the Network Planning Review was not included in BP1 and we estimate to spend a total of £15m opex over the RIIO-2 period. Our role in Offshore Co-ordination will deliver significant cost, environmental and community benefits by taking a coordinated approach to planning connections and extensions to the onshore and offshore transmission systems. Our role in Early Competition was also not included in BP1 and will increase opex by £9m over the RIIO-2 period. Early Competition will introduce competition in the delivery of new transmission infrastructure investment and has a key role in delivering reliable and affordable greener power for consumers. These new activities will require 53 FTE by 2026. The other major area of headcount increases in Role 3 is in Customer Connections, where 56 additional FTE will be needed. This is due to adapting to new requirements driven by a huge increase in connection applications from complex, low carbon and decentralised technologies. A significant proportion of the cost of these additional resources will be recharged to connecting parties.

Our proposed totex spend over the BP1 period (FY22 and FY23) is £2m lower than BP1, with higher opex of £8m more than offset by £10m lower capex. The additional opex spend is mainly driven by additional FTE supporting the new activities, notably Offshore Coordination, Network Planning and Early Competition. Most of the lower capex spend compared to BP1 is due to re-phasing of investment in zero carbon operability, which is not forecast to impact the timing of overall benefits.

For the BP2 period (FY24 and FY25), our proposed totex request is up £24m, with an additional 163 FTE by the end of FY25, with the main drivers being the same as the ones identified above.

8.7 Role 3 interdependencies

Activities in Role 3 are enablers of many of our Role 1 and 2 deliverables and, in turn, are dependent on the delivery of other activities in this BP2 submission and, in some cases, a number of external factors. The most significant internal and external interdependencies for Role 3 activities are summarised below:

Internal activity:

Role 1:

– AWEF activities and RDPs need Control Centre support and expertise to feed in to increased operational visibility and coordination of DER.

Role 2:

– New commercial solutions developed in Role 3, such as RDPs, are dependent on building future Balancing Services markets (A4) outcomes.

– Net Zero Market Reform (A20) will determine how procurement will work in the future which will impact any new initiatives developed to enable all solution types to compete (A8).

– Ensuring there are markets that can facilitate the growth of DER will be integral to deliver AWEF.

Role 3: some our sub-activities within the same Role depend on each other.

– Enhanced NOA tools delivery will support analysis and advice activities throughout Role 3.

– Outcomes of the Network Planning Review (NPR) could impact our procurement approaches, such as under Network Services Procurement. As the NPR is a fundamental change to our existing network development processes, it has the potential to change the direction of a number of Role 3 activities.

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External factors:

- Ofgem's interconnector policy review, Future System Operator (e.g. roles and remit) and Electricity Transmission Network Planning Review (ETNPR).
- We will need to work with stakeholders to deliver a number of activities, such as GDNs and DNOs supporting our scenario work.
- Obtaining data from stakeholders such as TOs and DNOs will provide transparency.
- Volume of TO/LOTI projects and numerous code changes will impact resource requirements and workload.

Key IT investments:

- **390 NOA enhancements**
- **290 Data Analytics platform**
- **380 Connections platform**

More detail on these can be found in the following activity narrative and **Annex 1 – Supporting Information.**

8.8 Role 3 New activities

8.8.1 A22 Network Planning Review and Offshore Coordination (new)

The Network Planning Review (NPR) and the Offshore Coordination (OC) projects will fundamentally transform how we undertake network planning and will have a significant impact on our ongoing Role 3 activities. The need for reform is to ensure we have infrastructure that both enables and facilitates the transition to net zero. Both projects will build on our strong, existing expertise in network planning and will develop new, holistic fit-for-the future approaches to network planning.

Stakeholder engagement

NPR – Stakeholder engagement will be essential during both the key stages of the NPR i.e. development of the end-to-end strategic planning methodology, and the more general review of network development and planning processes, including further engagement as part of Ofgem's ETNPR.

OC – Through the development of the OC projects, stakeholders have provided feedback through several routes, which has shaped our proposals. More recently, stakeholders have provided technical input on phase 2 deliverables (connections recommendations for approved in-scope projects), through meetings and dedicated working groups. These include regular Central Design Group (CDG) meetings and subgroups, helping to inform various elements of the Holistic Network Design (HND) in the Pathway to 2030 workstream.

In response to the draft BP2 consultation, stakeholders were supportive of our pioneering work in this area but highlighted that we shouldn't underestimate the length of time that associated code changes will take to implement. We agree with the feedback and are working to prioritise and progress the required changes at an appropriate speed while managing expectations.

More information can be found in **Annex 3 – Stakeholder Engagement.**

A22 sub-activities

This activity is made up of the following sub-activities:

Sub-activity #	Sub-activity name	Status
A22.1	Network Planning Review	New
A22.2	Offshore Coordination	New

8.8.1.1 A22.1 Network Planning Review (new)

What is this sub-activity and why is it important?

The NPR is a major project which will fundamentally change the way we undertake network planning, to ensure it is fit for the future, and able to facilitate the transition to a net zero system through strategic and anticipatory investments. The NPR will bring together the capability and operability challenges faced by the electricity transmission network into a coordinated process, developing an end-to-end network planning process that supports the delivery of net zero for the best value to the end consumer. It will support the delivery of strategic network planning capabilities envisaged by the ETNPR project and will also undertake a more general review of network development and planning processes.

Led by the ESO, and conducted in partnership with stakeholders, the NPR will develop a new Centralised Strategic Network Planning (CSNP) process. The CSNP will encompass our established network development processes, such as the NOA, as well as more recent processes such as the analysis we have been asked to undertake on Interconnector Cap and Floor Window 3 (**A7**). Part of the remit of the NPR is to continue to enhance the range and type of options that can be considered to solve network issues, beyond asset-based solutions, driving consumer value through timely signals, innovation and competition. We recognise the need to prioritise this important work and our proposals will ensure that there is adequate skilled resource to deliver our activities in this area.

What will we deliver in BP2?

During BP2, we will continue to provide strategic leadership to the development of new network planning processes, working closely with Ofgem, BEIS and the industry. Specifically, we will:

- identify gaps in current planning processes and options for addressing them

- develop and deliver an end-to-end Centralised Strategic Network Planning (CSNP) methodology, as envisaged by Ofgem's ETNPR programme; and
- start the transition of existing network planning activities (such as those in A7) to the enduring Centralised Strategic Network Planning process.

No further milestones will be added to the delivery schedule at this point as the specific details of this work are still in development.

What do we need to deliver this sub-activity?

NPR activities will touch on a wide range of teams, and we expect there will be activities that other business-as-usual teams will need to pick up, with accompanying additional FTE uplift expected. The additional FTE requirement for NPR and to deliver CSNP capability is 42 in total. This number of FTE will need to be drawn from a varied pool of experience. Specifically it will include six FTE for generation and demand modelling, two FTE to manage the impact of the development of strategic seabed leasing, six FTE to identify and model system operability needs, 16 FTE for detailed design of strategic options, four FTE for options appraisals, five FTE focused on stakeholder engagement, and three FTE for project management and delivery of the CSNP. Consultancy support will also be used to progress the NPR throughout 2022, assessing the FTE and capability impact of acting as Central Planner to deliver an enduring strategic approach to network planning. The FTE requirement of 42 across **A22.1** includes 35 FTE who are already in the business and working on Offshore Coordination, an activity which was not included in BP1. The net requirement for BP2 is an additional 7 FTE.

The cost of IT changes for NPR is expected to become clearer as the new processes are designed. As such any associated IT investment will be managed through the pass-through mechanism.

Please see **Annex 1 – Supporting information** for more detail.

8.8.1.2 A22.2 Offshore Coordination (new)

What is this sub-activity and why is it important?

Offshore wind is a critical generation technology for achieving the transition to net zero. To realise this transition, a step-change in both the speed and scale of offshore wind deployment is required. This growth must be enabled efficiently for consumers and take account of the impacts on coastal communities and the environment.

Therefore, a new and innovative way of planning for the connection of offshore wind to the network, and of transferring power from where it is generated to where it is needed, is required. The OC project started as a new initiative in BP1 and will continue into BP2, recognising the need to continue to evolve our work in this area.

By the end of BP1, our OC project will have delivered the Holistic Network Design Follow-Up Exercise, building on the first Holistic Network Design published in July 2022, and will have examined how windfarms more advanced in their planning can coordinate their connection activities through the 'Early Opportunities' workstream of the OTNR programme. During BP2, we will finalise the work started during BP1, including updating connection contracts and initiating necessary code changes, and we will implement an enduring approach to planning and connecting offshore resources – a large part of which will be steered by the wider Network Planning Review (**A22.1)**.

What will we deliver in BP2?

The OC project will work closely with the Network Planning Review (A22.1). Together these projects will deliver a forward looking, strategic view of the network development processes needed to facilitate the transition to net zero, including the large-scale deployment of offshore wind.

Specific activities covered in this sub-activity during BP2 include:

- Finalising the work started during BP1 to deliver the Pathway to 2030 workstream activities, including updating connection contracts for in-scope offshore windfarms.
- Implementing an enduring approach to planning and connecting resources located offshore, including the resultant code changes. We also need to consider two new developments, strategic seabed leasing and multi-purpose interconnectors, and how these interact with our proposed approach.
- Assessing the application of the onshore early competition regime to offshore networks. Schemes under the initial Holistic Network Design were not eligible for early competition due to time constraints associated with achieving the government's 50 GW by 2030 offshore wind target. We need to understand the interaction of onshore early competition and the enduring offshore planning regime as preparatory work for it being included in future, if it delivers consumer benefit.

No further milestones will be added to the delivery schedule at this point as the detailed work under this activity it is still in development.

What do we need to deliver this sub-activity?

Some of the activities in this area will be dependent on decisions being taken by BEIS and/or Ofgem, such as on the planning and operational framework for multi-purpose interconnectors and the applicability of Early Competition in an offshore context. At present, five FTE will be required to work on the strategic seabed leasing plan, multi-purpose interconnectors in the enduring regime and initial work on assessing the application of the onshore Early Competition regime to offshore networks. We also assume an additional ten FTE and £250k external consultancy support would be required for FY25 to carry out further preparatory work on offshore Early Competition.

Please see **Annex 1 – Supporting information** for more detail.

8.9 Role 3 Materially changed activities

8.9.1 A7 Network Development (materially changed)

Chapter 8 – Role 3 System insight, planning and network development

During BP1, we have continued to deliver world-leading analysis to support the development of the transmission network, through processes such as the Electricity Ten Year Statement (ETYS), the Network Options Assessment (NOA) and independent economic analysis to support regulatory decision-making (through the Large Onshore Transmission Investments (LOTI) process). These processes have served the industry well, and during BP1 we have grown our capacity to deliver the increased requirement for independent economic analysis, as well as new analysis to support Ofgem's Interconnector Cap and Floor processes. However, at a time of significant change for the industry, we recognise that our processes need to be reformed and refreshed to ensure that they facilitate the infrastructure needed to deliver net zero. As such, many of the processes delivered under A7 will evolve and change due to the work being undertaken in our new activity **A22 Network Planning Review and Offshore Coordination.**

Stakeholder feedback

We held network development webinars with stakeholders in early 2022 to discuss our proposals, where stakeholders were broadly supportive of our plans. However, as part of the BP2 consultation and the development of our NPR, stakeholders have expressed a preference for consolidating some of the NOA related activities within the NPR. Accordingly, we have aligned our activities in A7 with the NPR.

For further information see **Annex 3 – Stakeholder Engagement.**

A7 sub-activities

This activity is made up of the following sub-activities:

Sub-activity #	Sub-activity name	Status
A7.1	Analyse and communicate future network needs	Materially changed
A7.2	Advise on economically efficient ways to address network needs	Materially changed
A7.3	Undertake ad hoc analysis in response to external requests	No change (please see **Annex 1 – Supporting Information**)

8.9.1.1 A7.1 Analyse and communicate future network needs (materially changed)

What is this sub-activity and why is it important?

Operating the power system is becoming more complex. Ensuring we have the right network in place for the future, and communicating that need, is key to facilitating the transition to net zero. The changing generation mix means that we need to evolve how we assess future network needs to reflect new complexities. As part of our work, and ahead of changes brought about by the NPR, we intend to expand the ETYS to consider thermal needs on a year-round basis and include voltage and stability need.

What will we deliver in BP2?

As part of the NPR, we expect the requirements of this sub-activity to change. The requirement to analyse and communicate future network needs, across the broad range of parameters such as thermal, voltage and stability, is growing and our new approach will be defined by **A22.2 Network Planning Review**. This review will have a significant impact on the future deliverables in this sub-activity.

In 2023/24, the expectation from Ofgem is that we will deliver a second *Transitional Centralised Strategic Network Plan*, building on the first plan delivered by the Holistic Network Design and NOA 2021/22 Refresh in July 2022. The milestones for deliverable **D7.1 – Electricity Ten Year Statement** have been adjusted to reflect updated timelines to align with the HND Follow-up Exercise (**A22.2**).

For 2024/25 onwards, the need for analysis and communication of future network needs remains critical, but the specific deliverables will be defined as part of the **A22.2 Network Planning Review.** Therefore, specific milestones have been removed for delivery year 2024/25 pending further clarification through the NPR.

What do we need to deliver this sub-activity?

In future, the evolution of this activity is strongly linked to the outcomes of **A22.2 Network Planning Review.**

In the first year of BP2, delivery of enhancements to ETYS relies on the enhanced NOA tools being developed to improve our view of year-round system needs. For example, if the Pouya thermal modelling tool **(D11.2)** is delayed, ETYS enhancements will be delayed as a result.

8.9.1.2 A7.2 Advise on efficient ways to address network needs (materially changed)

What is this sub-activity and why is it important?

We publish the annual NOA report advising on the requirement for TOs to build new transmission assets, together with recommendation of where non-network solutions such as intertrips can deliver additional network capacity. Historically, the NOA has primarily been focused on the thermal requirements of the network. Our innovative approach to other topics, such as voltage and stability has evolved through the use of Network Services Procurement (Pathfinders) (**A8.1**). The requirement to advise on efficient ways to address network needs is growing and our new approach will be defined in **A22.2 Network Planning Review.**

What will we deliver in BP2?

The requirement to advise on efficient ways to address network needs, across a broad range of topics such as thermal, voltage and stability is growing, and our new

approach will be defined via A22.2 Network Planning Review. This review will have a significant impact on the future deliverables in this sub-activity.

In 2023/24, the expectation from Ofgem is that we will deliver a second *Transitional Centralised Strategic Network Plan*, building on the first plan delivered by the Holistic Network Design and NOA 2021/22 Refresh in July 2022. The milestones for the deliverable **D7.2 – Annual NOA Report** have been adjusted to reflect an updated timeline to align with the HND Follow-up Exercise (**A22.2**).

For 2024/25 onwards, the need to advise on economically efficient ways to address network needs remains critical, but the specific deliverables will be defined as part of the **A22.2 Network Planning Review.** Therefore, specific milestones have been removed for delivery year 2024/25 pending further clarification through NPR.

What do we need to deliver this sub-activity?

Delivery relies on NOA tools, so this activity will benefit from improvements from IT investments for related enhancements. In future, the evolution of this activity is strongly linked to **A22.2 Network Planning Review.**

8.9.2 A8 Enable all solution types to compete to meet transmission needs (materially changed)

During BP1 we have developed new approaches to keep costs down for consumers, through solving issues and finding innovative ways of operating the electricity system. Our pioneering 'Pathfinder' approach (**A8.1**) has delivered significant benefit to consumers by adopting a 'learning by doing' approach to ensure we attract competitive and innovative service proposals.

Our Pathfinder approach initially meant incentivising investment in new or repurposed stability and voltage service capability to meet the expected shortfall in capacity and/or to avoid the significant costs of having to use conventional carbon plant. Pathfinders have been very successful in demonstrating how future competitive procurement exercises should evolve. We are therefore reviewing how best to take this programme forward and, instead of Pathfinders, we will be using the name 'Network Services Procurement' (NSP) in future to reflect the more mainstream application of this approach.

We have also created a new sub-activity (**A8.4**) to continue our work on Early Competition, in response to Ofgem's request for us to develop an Early Competition Plan, and now, to continue work in this area to deliver the expected benefits in terms of innovation and lower costs that result from extending competitive network procurement.

Stakeholder engagement

For A8.1, Pathfinder projects are based on a 'learning by doing' approach and stakeholder feedback has been an inherent part of this process since its inception. Whilst we have not significantly changed the scope of our BP2 activities as a direct result of stakeholder feedback, we will continue to improve BP2 Network Services Procurement by engaging with stakeholders.

For **A8.4**, during the creation of the Early Competition Plan (ECP) we received many strong and often opposing views from our stakeholders. The ENSG (Electricity Networks Stakeholder Group) was formed to ensure we responded to stakeholder input. ENSG confirmed its support for our stakeholder engagement during development of the ECP in its final report[40]. Full documentation is available on the Early Competition page of our website.

We have undertaken extensive stakeholder engagement on our BP2 proposals. We received feedback on topics such as whether competition will deliver value for consumers, our independence when running tender processes, implementation timescales and whether the TOs should have a role in network planning. Ofgem's Early Competition impact assessment suggests that it could deliver significant consumer value. We will continue to engage with stakeholders as our work in this area evolves, particularly regarding project selection and our CBA process.

More engagement was requested at each stage of the process, and we've been asked to make the links between Future System Operator and NPR clearer which we explain in **A8.4**.

For further information on stakeholder engagement in this area, please see **Annex 3 – Stakeholder Engagement**.

A8 sub-activities and deliverables

This activity is made up of the following sub-activities:

Sub-activity #	Sub-activity name	Status
A8.1	Rollout of Network Services Procurement (formerly Pathfinders) approach and optimise assessment and communication of future needs	Materially changed
A8.2	Enhance tendering models	Moved under A8.1
A8.3	Support Ofgem to establish enabling regulatory and funding frameworks	Completed (please see **Annex 1 – Supporting Information**)
A8.4	Early Competition	New

8.9.2.1 A8.1 Rollout of Network Services Procurement (formerly Pathfinders) approach and

[40] https://www.nationalgrideso.com/electricity-transmission/document/191176/download

optimise assessment and communication of future needs (materially changed)

What is this sub-activity and why is it important?

This sub-activity establishes a competitive approach to evaluate both regulated TO and commercial third-party solutions to deliver Transmission Network services.

From our initial procurement projects, we have improved the process and the identification of future needs to the market. The approach is driven by the development of new services and procurement approaches to meet security and net zero ambitions as efficiently as possible.

There are six separate Network Services Procurement (NSP) projects (with a seventh currently being assessed): Mersey Voltage, Stability phase 1, Constraint Management B6, Stability phase 2, Pennines Voltage and Stability phase 3.

This is in line with our original proposal of doubling the number of NSP projects (Pathfinders) carried out in RIIO-1. These projects have led to consumer cost savings, enabled increased renewable output from the market and supported system compliance.

What will we deliver in BP2?

We will continue with our three thermal projects (East Coast 5 (EC5) boundary in East Anglia, constraint management pathfinder (CMP) year two and CMP year three) in BP2 as per the delivery schedule. We have updated the milestones associated with these projects in deliverable **D8.1**.

We are continually analysing and assessing the need for future NSP projects. This is an ongoing and iterative process that will identify and then trigger subsequent voltage, stability or congestion management NSPs. Over BP2 it is our expectation that we would run one stability, one voltage and two congestion management tenders per year. We will flex around this number, dependent on future network needs, identified net value to consumers and whether we run large multi-location single tender events or break them up into smaller events and stagger them over a longer time horizon. The approach taken will be influenced by the date the service needs to be available, how interconnected different locational needs are and any ongoing impact of international supply chain volatility and uncertainty.

We have used the provider driven lessons learnt activities from previous NSPs to develop a standard approach to these procurement events. However, we will continue to engage solution providers on how best to improve tender processes.

We have maintained our resource level in this area, based on experience of running and refining the original projects. It is crucial to retain the appropriate market, procurement, and implementation resources to deliver these projects going forward.

What do we need to deliver this sub-activity?

This sub-activity is aligned to IT investment line **130 Emergent Technology and System Management** to develop the controls and communication capability to dispatch and monitor the delivery of these services as procured via the Network Services Procurement tenders.

This activity also relies on **A4** 'building the future Balancing Services markets' to create markets for new commercial solutions and **A20** 'Net Zero Market Reform' for developments in how competitive procurement will work.

8.9.2.2 A8.2 Enhance tendering models (moved)

Since publishing our draft plan, we have reviewed this sub-activity and have now developed a sound baseline structure and process for running NSP events. Therefore, we will be removing **A8.2** (Enhance Tendering Models) as a separate sub-activity for BP2, and its remaining ambitions will be subsumed within **A22.1**'s activities. We will continue to follow best practice and run lessons learnt events with our stakeholders after each event to apply insights and improvements to subsequent tenders under **A8.1**. As the ESO collectively, we also share ideas for improvement across the NSP, Early Competition and Role 2 Stability and Voltage market development teams in a combined community of best practice.

8.9.2.3 A8.4 Early Competition (new)

What is this sub-activity and why is it important?

Introducing and maintaining competition in the delivery of new transmission infrastructure investment has a key role in delivering reliable and affordable green power for consumers. Ofgem has been developing competition policy for onshore electricity transmission for several years and identified there is likely to be millions of pounds worth of consumer benefit.

We are tasked with planning how a competition to design, build and own onshore transmission assets could be run in the early stages of the project lifecycle, known as Early Competition. This could deliver the most benefit for consumers as it allows innovation across the whole project lifecycle. Our Early Competition Plan (ECP)[41] was published in April 2021 and sets out high level proposals for how this could work. Since then, we have been progressing with 'low regrets' activity to maintain the momentum towards implementing Early Competition. We are working with Ofgem, BEIS and industry to progress the required framework changes to complete development of the Early Competition model. This includes the detailed design of end-to-end tender processes.

In their Early Competition decision document[42] Ofgem broadly agrees on the proposals for roles and responsibilities in our Early Competition Plan (ECP). This would see us taking on the roles of Network Planning Body, Procurement Body, Contract Counterparty and Payment Counterparty roles, and we are planning to take on these roles and responsibilities accordingly. We would only take on the role of Procurement Body once we are separate from the National Grid Group and become the Future System Operator and are appointed into the role by the Secretary of State. As the Procurement Body role is linked to Future System Operator implementation, details for this are included in **Chapter 15 – Future System Operator**.

[41] https://www.nationalgrideso.com/document/191251/download

[42] Decision on Early Competition in onshore electricity transmission networks | Ofgem

What will we deliver in BP2?

In BP2, we will launch the first Early Competition tender. We have included the activities required to complete implementation of Early Competition, and for the roles that will sit with us on an enduring basis.

From Q1 to the end of Q3 of 2023/24 we will be continuing to conduct Early Competition planning and aim for pre-tender engagement to begin during Q4 2023/24 and for the first tender event to be launched in Q4 2024/25, subject to Ofgem approval.

To support the first tender to be delivered, we will be identifying a suitable project and embedding an ongoing identification process, incorporating any changes to planning processes as outlined in **A22** Offshore Coordination/Network Planning Review. We are also enhancing our procurement processes through **A8.1** Network Services Procurement to align elements of the processes to the Early Competition model where relevant.

Since the publication of the draft BP2 consultation, we have extended the implementation phase by three months. This is our best view of the likely timescales following the publication of the decision to establish the Future System Operator, which is expected in 2024, and as the legislative timetable has also commenced later than our initial assumptions.

What do we need to deliver this sub-activity?

Completing implementation of Early Competition, and the launch of an actual tender, is dependent on legislation being put in place by BEIS by Q4 2023. The Future System Operator decision affects whether it is appropriate for us to become the Procurement Body for Early Competition.

There is also a dependency on the NPR, which is developing new network planning processes. We have assumed a project suitable for Early Competition will become available, whether through NOA, strategic planning, connections or asset replacement planning processes. There is a further interaction with offshore network planning and the use of competition as a delivery method. The activities set out here do not include resource to develop Early Competition proposals for any offshore enduring regime – these are included under **A22.2**.

The cost of IT changes for the Network Planning Body role and Payment Counterparty role during BP2 is expected to be minimal and will not require specific IT investment. Further IT costs to integrate a new TO and network solution into our IT systems are expected to be incurred after BP2, and once the competition has concluded.

For the Procurement Body, as set out in **Chapter 15 – Future System Operator**, we will need to build organisational capability ahead of the pre-tender phase of an Early Competition. This will be achieved, in part, through resources involved in the implementation phase but will require further strengthening once the full detail of the process is understood. We have included indicative estimates in the Future System Operator chapter and will have further clarity as the implementation phase progresses. We will also require IT investment in appropriate software to facilitate the tender process.

8.9.3 A9 Extend NOA approach to end-of-life asset replacement decisions and connections wider works (moved)

This activity is made up of the following sub-activities:

Sub-activity #	Sub-activity name	Status
A9.1	Expand network planning processes to enable more Connections Wider Works to be assessed	Moved under A22
A9.2	Trial assessment of all Connection Wider Works in one region	Moved under A22
A9.3	Expand to all Connections Wider Works (CWW)	Moved under A22
A9.4	Develop process with TOs to input into ESO analysis of end-of-life asset replacement decisions	Moved under A22

The activity **A9**, as detailed in BP1, centred on a proposal to incrementally extend the NOA methodology to include additional functionality, such as assessment of asset replacements and wider works for connections. We will still undertake this work, but the objectives have been repositioned as part of the broader sub-activity **A22.1 – Network Planning Review (NPR)**.

For clarity, and to further emphasise, although the network development process will be changed under the NPR, and as part of the Centralised Strategic Network Planning (CSNP) process, anything contained within this repositioned activity will remain within the remit of the Business Plan. Please note the FTEs associated with this activity will be repositioned under **A22**, however at present they are still represented under the **A7- A11** finance table.

Stakeholder engagement

In response to the consultation on our draft plan, stakeholders queried why NOA enhancements are continuing in **A9** as the NPR will supersede this work through a broader reform of the processes. In response to this feedback, our approach is to relocate the activities into **A22** as part of the broader reform of our network development processes.

8.9.4 A13 Leading the debate (materially changed)

In our Future Energy Scenarios (FES), we outline the ways Great Britain may generate and use energy between now and 2050. Interest and scrutiny of our activity from consumers and their elected representatives is increasing – motivated by greater awareness of the impacts of climate change and significant increases in the cost of energy.

Stakeholder engagement

In *FES 2022* we asked our stakeholders to provide their views on what aspects of the whole energy system would benefit from a more bottom-up regional modelling approach. Areas included the deployment of hydrogen across the whole energy system, electricity generation topics including how technologies alter over time, more information on distribution-connected technologies and consumer engagement.

Stakeholder feedback also demonstrates the value in the Bridging the Gap reports delivered so far, so we will continue to enhance our approach in this area.

On **A13.5,** stakeholders identified a need to ensure scenario creation is coordinated to avoid a duplication of effort. There also needs to be transparency of the assumptions driving the regionalisation of the FES, and potential for feedback loops with stakeholders to sense-check outputs. Through engagement and feedback on our draft BP2 consultation, it is clear there is broad support for closer collaboration on the creation of more granular scenarios, especially with DNOs. More interactive tools can make it easier to use FES outputs to generate insights, and more visibility of upcoming changes can help manage downstream impact. Feedback has provided us with the requirements of stakeholders, and where improvements can be made to how we handle the data when delivering against this activity.

For further information see **Annex 3 – Stakeholder Engagement**.

A13 sub-activities and deliverables

This activity is made up of the following sub-activities:

Sub-activity #	Sub-activity name	Status
A13.1	Carry out analysis and scenario modelling on future energy demand and supply	No change (please see **Annex 1 – Supporting Information**)
A13.2	Conduct mathematical modelling and market research on local and wider geographic demand information	Materially changed
A13.3	Maintain external communication channels with consumers and stakeholders	No change (please see **Annex 1 – Supporting Information**)
A13.4	FES: Bridging the gap to net zero	Materially changed
A13.5	FES: Integrating with other networks and supporting DNOs to develop their own DFES processes	Materially changed

8.9.4.1 A13.2 Conduct mathematical modelling and market research on local and wider geographic demand information (materially changed)

What is this sub-activity and why is it important?

In BP1, we outlined our intentions to conduct electricity and energy mathematical modelling and market research, to understand how the operational landscape could change. We also highlighted our intention to enhance our modelling to allow a more regional approach to understand, for example, the locational impact of heat decarbonisation.

We will continue to develop our regional modelling, for example through our new heat model[43]. This will provide a deeper level of insights alongside the national FES projections, considering more local actors which impact on the national scenarios. It will provide greater clarity, supporting policy makers and other stakeholders in their decisions, as well as improving whole system planning processes and investment. This will produce more robust analysis and more consistent whole system scenarios, ensuring consumer and industry input is fed into future modelling.

Our work to date in understanding the value our stakeholders get from a whole system view of FES has led us to expand our analysis to understand cross-vector impacts. With the shift toward hydrogen and the importance of technologies like CCUS, our ambition is to provide insights and data to the same level of depth across the whole system, working closely with network companies and other regional stakeholders to understand what level of granularity will be required and how it can be used by our customers.

What will we deliver in BP2?

We have added a new deliverable **(D13.2.1) Provide Whole System Regional Insights**. By the end of Q2 2023/24 we will have started work agreeing how the feedback loop between the ESO, DNOs, Gas Distribution Networks (GDNs) and local area energy plans should operate. We will agree with industry the level of granularity needed in FES for hydrogen and natural gas analysis and include regional system insights within *FES 2023*. By the end of 2024/25, the feedback loop will be functional, with regional insights in *FES 2024* following stakeholder feedback. This will then become part of our business-as-usual approach, with continual improvement of the process.

We want to ensure that there is coordination between local and/or regional energy plans and national policies. We do not intend on duplicating effort, but rather to understand how the feedback loop between local area energy plans, DFES and the FES works in practice. Further, we recognise that we need to work closely with, and through, the regional network operators who have established relationships and data exchange processes with the local authorities.

[43] https://www.nationalgrideso.com/document/190471/download

We will also continue to promote innovation projects, such as developing consumer archetypes to display where consumers are on the network, how they use energy, and how they behave with respect to net zero.

What do we need to deliver this sub-activity?

Providing deeper whole system regional insights will be dependent on development of our energy demand modelling and obtaining the data inputs we need.

We are dependent on the success of innovation projects to make some of the enhancements for our regional scenario modelling.

This sub-activity is aligned to IT investment line **220** Data and Analytics Platform. The detail behind this investment can be found in **Annex 4 – Digital, Data and Technology**.

8.9.4.2 A13.4 FES: Bridging the Gap to Net Zero (Materially changed)

What is this sub-activity and why is it important?

Since its introduction, we have run three successful iterations of the Bridging the Gap project. Each has looked at the near-term challenges relating to achieving net zero and how whole energy system solutions can help. The 2021/22 project looked specifically at achieving a fully decarbonised electricity system by 2035.

Bridging the Gap provided the perfect opportunity to assess the implications of the government's 2035 target on today's actions. The recommendations contained within the report were designed to inform policy and regulatory decisions as well as communicate the need to take action. Further details and ongoing updates can be followed on our website[44].

What will we deliver in BP2?

We will deliver two further iterations of our Bridging the Gap report – one in each year of the BP2 period.

This sub-activity is changing to a continuous deliverable commitment for BP2 onwards. Stakeholder feedback demonstrates the value in the reports delivered so far, so we will continue to deliver reports based on the key elements of the FES deemed most appropriate to explore at the time.

What do we need to deliver this sub-activity?

Delivery is reliant on the timely publication of our annual FES, active stakeholder participation and feedback in our webinars and workshops.

8.9.4.3 A13.5 FES: Integrating with other networks (materially changed)

What is this sub-activity and why is it important?

In BP1, we outlined the benefits of replacing the electricity demand model (**D13.5.1**) and developing a new energy demand model (**D13.5.2**) to enable greater access to data, analysis and insights to further aid development of the regional FES. The new energy model incorporates the electricity demand model, and they are delivered as one item.

We have used our framework agreement with consultants to review the data, processes, and current models across the FES scenarios. We engaged with internal and external stakeholders in 'Voice of the Customer' sessions to understand their needs. We included questions on our current modelling and available data in our 'Call for Evidence' which was sent to over 6,000 individuals and organisations to gather their views on the FES. This has provided us with a good view of the requirements of stakeholders regarding our modelling, along with where improvements can be made to how we handle the associated data.

What will we deliver in BP2?

Following our stakeholder engagement, we have added a new ongoing deliverable (**D13.5.3**) reflecting our commitment to ongoing development of the new energy demand model, with a development plan to be in place by the end of 2023/24. The constant evolution of requirements (such as hydrogen strategy) and challenges across the network in Great Britain means we need to stay up-to-date with model functionality to ensure our analysis is as robust as possible.

These future enhancements will be based on customer and stakeholder feedback along with changes in industry and society as we advance towards a net zero future. These enhancements are expected to include extending the use of large data sets, such as the Electralink Data Transfer Service or smart meter data captured through the 'MHHS' programme (**D6.7**), to facilitate more effective modelling and to better reflect consumer behaviour and choices.

We will also work with GDNs to explore a more granular view of gas scenario projections that can be shared with industry to help understand actions needed to decarbonise the gas network. This includes considering how the co-creation of an agreed set of common building blocks can assist scenario development on the gas side, as it has on the electricity side.

What do we need to deliver this sub-activity?

This sub-activity is dependent on working with GDNs to get gas scenario projections and is aligned to IT investment line **220** Data and Analytics Platform. The detail behind this investment can be found in **Annex 4 – Digital, Data and Technology**.

8.9.5 A14 Take a whole electricity system approach to connections (materially changed)

The Connections team provides connection offers to new customers and manages connection contracts, while also ensuring compliance with relevant codes.

The scale of work has increased significantly in recent years due to the growth in the volume of connection applications for low carbon and decentralised technologies, and the added complexity of these connections. We expect this pattern of increased applications to continue. The existing connection

44 https://www.nationalgrideso.com/future-energy/future-energy-scenarios/bridging-the-gap-to-net-zero

processes were designed for low volumes of large connections, and we must adapt to the new requirements. We must also improve the customer experience, and we are developing a new connections portal to support this.

In sub-activities **A14.1** to **A14.4** we look to deliver improvements to existing processes whilst managing a continuous growth in the volume of applications. We understand that the efficient management of connections is important to our customers and stakeholders and is a key enabler for the connection of low carbon technologies to meet our net zero targets.

We will become more proactive in our approach to ensuring compliance with the Grid Code; we will make better use of data and systems and we will drive efficiencies in the process.

In the new sub-activity **A14.5**, we focus on delivering Connections Reform, introducing changes to contracts and the way we study and model connections and addressing the known congested contracted background.

Stakeholder engagement

Through consultation, surveys and other engagement activities during BP1, stakeholders have provided a wealth of feedback to shape our BP2 proposals, which are summarised below.

Stakeholders have told us we need to be more pro-active regarding connections policy. Accordingly, we are now creating a Policy and Change Management team. This team will work alongside internal teams and key groups such as BEIS, ENA, and Ofgem to ensure we can manage change whilst also ensuring communication to customers is timely and as clear as possible.

We have also heard that a greater amount of time and engagement needs to be available for each connection project. Due to increased volumes, the Connections Compliance team is particularly busy, and our response is not always as timely as we would like. We are therefore proposing to increase resources to enable increased volumes of connection applications and projects to be managed with increased quality of engagement.

Stakeholders have also told us we should take a lead role in developing a customer connections portal, with feedback informing the scoping of the minimum viable product. Customers also felt the applications process is complex and outdated. The portal will address these points by digitising the process and making it more transparent, guiding the customer through each of the steps.

During the consultation on our draft plan, stakeholders suggested that the pace of reform should be accelerated, which was strongly echoed by ERSG. Stakeholders would also like to see the connections portal extend to distribution level and more collaboration with key stakeholders such as the DNOs. Since we published our draft plan, we have further increased the proposed level of resource to deliver the connections reform activity. We acknowledge the request of the DNOs for the connections portal to accommodate distribution level connections and this will be an area of development once we have the completed the first phase of the portal.

Many stakeholders, including ERSG, would like us to take more of a leadership role in the connections space. Since the consultation on our draft plan, we have set up an ERSG "Connections sub-group" to enable further engagement and understanding of the areas of improvement for this activity. The newly introduced activities and changes from the draft plan have been shared for review and comment with this group. Feedback received has been included in the A14 plan, as described below.

For further information see **Annex 3 – Stakeholder Engagement.**

A14 sub-activities and deliverables

This activity is made up of the following sub-activities:

Sub-activity #	Sub-activity name	Status
A14.1	Provide contractual expertise and management of connection contracts including provision of connection offers to customers	Materially changed
A14.2	Ensure Grid Code compliance of new connections	No change (please see **Annex 1 – Supporting Information**)
A14.3	Further enhance the customer connection experience, including broader support for smaller parties	Materially changed
A14.4	Facilitate development of the customer connections portal	Name changed and materially changed
A14.5	Connections Reform	New

8.9.5.1 A14.1 Provide contractual expertise and management of connection contracts including provision of connection offers to customers (materially changed)

What is this sub-activity and why is it important?

As we are providing offers to an increasing number of customers with a variety of knowledge and expectations, we have to tailor our service to their specific needs. We must also modify our approaches to deal with the large increase in connection applications being experienced. Standardisation and automation of processes, where possible, is therefore desirable while also increasing our team's capability to deal with the non-standard aspects of applications. The creation of

a Policy and Change Management team will help in this regard.

What will we deliver in BP2?

As we anticipate the growth in connection application volumes will persist, we will continue with our activities around "Managing an increasing volume of connection offers for customers" and "Contract management of connection agreements", supported by development and growth of the Connections team. In BP2, the development of the connections portal (A14.4) will bring efficiencies to some of the manual processes, allowing the Connections Contract Managers (CCMs) to focus their expertise where they can add most value. This will result in benefits such as:

- Improved support to connections projects that require increased levels of engagement and support from the Connections team to deliver key electricity infrastructure targets, such as government targets for offshore wind.
- An improved customer journey experience.
- Management of the connection contracts programmes to secure delivery of connections to planned timescales and enforcing queue management milestones.

What do we need to deliver this sub-activity?

An increase of 17 FTE is required to support the delivery of these activities, which addresses the increase in volume of applications and the improved management of contracted connections.

To deliver this sub-activity, we also have a number of dependencies:

- Successful implementation of phase 1 of the Connections Customer Portal is required to enable a change to the tasks that are carried out by Contract Managers. The portal will help by reducing the time spend on repetitive administrative tasks introducing efficiencies to the overall connections process. It will allow both Contract Managers and Support teams more engagement time with customers, and a better allocation of tasks, including management of connection contracts. Engagement, support and collaboration from Transmission Owners and Distribution Owners where we seek to introduce improvements or changes to processes in which they have a key role or are also co-owners.
- Continuation of successful engagement with customers and stakeholders via the Connections Agoras, webinars and seminars as feedback and queries are vital to inform and drive the activities focused on improvement to connections.
- Connections Policy team's ability to engage successfully with CUSC parties ahead of new code changes, and during the review of proposed changes, to drive the need to recognise, measure and address the impact of changes to connections processes so that the best outcomes for customers are reached.

8.9.5.2 A14.3 Further enhance the customer connection experience, including broader support for smaller parties (materially changed)

What is this sub-activity and why is it important?

Smaller parties connecting to the network typically require an enhanced level of support to navigate the complex processes involved and we are committed to providing this. This includes expanding our connections seminars to include a whole electricity system view and providing additional support to new industry participants who may have unique and complex requirements. Accordingly, we are introducing deliverables (**D14.3.4**, **D14.3.5** and **D14.3.6**) in this area.

During year two of BP1, we have seen an increase in transmission network access constraints for both transmission and distribution-level Generation connections. This has consequently led to a need to look at whole electricity system options to further support and enable smaller parties to connect. This is done via **A15.5** Regional Development Programmes (RDPs).

What will we deliver in BP2?

- **Improving systems and data** (**D14.3.4**): We will make our systems more informative, user friendly and interactive, by improving the quality of the data on the Transmission Entry Capacity (TEC) register. For example, we will adopt unique reference numbers for each connection or contract and enhance the connections section of our website to share data and videos from webinars, and information on processes that have been updated. We shall also reinforce the focus on regular engagement with customers to provide awareness and insight into our systems and the information available online.
- **Improving our internal processes** (**D14.3.5**): Taking account of the increasing volumes of connection applications, we will improve our internal processes for managing connection applications and assessing compliance, ahead of the Connections Reform programme.
- **Proposing policy and code improvements** (**D14.3.6**): We will review the legal documents used in the connection application and offer processes, driving improvements via the industry codes process. We will work closely with leading industry experts, manufacturers and customers to identify requirements for Grid Code modifications and develop new policies for timely connection.

We will continue to work closely with DNOs and TOs to establish methods of addressing capacity and network constraints. This will include developing regional plans to address localised constraints, leading to improved management of DER. This deliverable (D14.3.1) has been delayed slightly into BP2.

What do we need to deliver this sub-activity?

In BP2, we will need additional resource of 13 FTE (compared with BP1) due to the increased workload in this area and the need to support new processes such as:

- Development of new Network Services Procurement projects and support for Ofgem derogation requests for connections process and code changes.
- SQSS review, construction planning assumptions policy, and code changes that impact customer connections, in particular relating to DNOs and RDPs.
- Delivery and development of RDPs, to enable the connection of DER.

Our proposed policy and code improvements are dependent on the timings and outcomes of code modifications. This work may also be influenced by the changing nature of connection applications due to technological evolution.

Some IT investments will be needed to enable the improvements to our systems, for example to update our customer relationship management (CRM) database to accommodate new processes.

This sub-activity is also aligned to IT investment line **380** Connections Platform.

8.9.5.3 A14.4 Facilitate development of the customer connections portal (name changed and materially changed)

What is this sub-activity and why is it important?

The connections portal will bring process improvements, allow customers to provide direct feedback and enable efficiencies to partly offset the increasing complexity and volume in connections. We are committed to working with industry to develop the portal and to evolving it from the minimum viable product stage right through to full implementation. The customer portal was previously referred to as the customer connections hub – it has been renamed to recognise the added functionality and scale of this substantial digitalisation programme.

What will we deliver in BP2?

The current project delivery plan allows for a period where changes and fixes to functionality can be addressed and to recover delayed phase 1 activities.

We will explore extra functionality for phase 2 of the portal (**D14.4.2**) during the BP2 period, which will subsequently be delivered in BP3. As more time will be needed to develop this extra functionality, it will necessitate a change from the original milestone dates. However, the project will still ultimately bring increased automation and interactivity which will:

- help customers to provide feedback and updates.
- enable uploading of documentation for the new application process during delivery and commissioning.
- enable links and automated processes between our own and TO platforms to facilitate sharing of information without the need to move data between systems or use email.
- facilitate links between updates to appendix J and Q (milestones) and the TEC register.

What do we need to deliver this sub-activity?

The customer connections portal work is dependent on IT investment **380** Connections Portal. Please see **Annex 4 – Digital, Data and Technology** for more information.

8.9.5.4 A14.5 Connections Reform (new)

What is this sub-activity and why is it important?

To connect the volume of renewable generation and other associated technologies required to achieve net zero, we need to facilitate quicker and easier access to the network.

Accordingly, we want to take the lead on a strategic programme of reform to redesign and replace the existing connection process.

This new activity aims to mitigate the impacts that we, and the wider industry are experiencing as the volume and complexity of connections is increasing and the capacity and capability of the existing process is stretched. An ESO-led, structured programme of reform will allow us to work with customers and stakeholders (including Ofgem, TOs & DNOs) to reshape the future of the connections process and, where possible, align to other programmes such as TNUoS reform, market reform and the objectives of the British Energy Security Strategy (BESS).

Improvements to the connections process will not only improve the customer experience but also drive efficiencies, enable competition and deliver value to end consumers. It will also give customers a clearer understanding of the respective roles and responsibilities of the ESO, TO and DNO parties respectively.

What will we deliver in BP2?

To deliver connections reform we have split our programmes into a number of different phases. Some of these can operate in parallel so there may be overlap with some of our deliverables. Due to the importance of and the urgent need for this reform, we have already begun Phase 1 activities within the current Business Plan period (BP1).

D14.5.1 Phase 1: Share early developments and carry out initial industry engagement

During this phase we will look to define the objectives and timelines of the reform programme. We will engage with key stakeholders and customers to not only confirm the need for the reform, but to ensure we obtain feedback on our proposal.

We have engaged with Ofgem in this regard and provided an initial problem statement paper, which was developed with support and input from Transmission Owners.

We have, and will, continue to identify opportunities to address challenges with today's connection process, and enable further insight and preparedness ahead of the next stage of the reform programme.

At the same time, we will be leading a final Transmission Entry Capacity (TEC) amnesty event in collaboration with the TOs and Ofgem. The TEC amnesty is not a new concept - it has been progressed in BP1 - but will come to its conclusion in BP2. This will enable termination of contractual TEC holdings for reallocation to other parties in the queue. This is in response to clear customers' needs for expedient connection and the drive for additional low carbon generation

to be connected by 2030. The TEC amnesty, coupled with the introduction of effective queue management (already in train in BP1), will allow all GB transmission owners to plan investments in their networks effectively.

Finally, in phase 1 we will focus on a review of the Construction Planning Assumptions (CPAs). CPAs are used by the TOs to study new generation connecting to the NETS. This review is driven partly by:

- an increase in the quantity of generation aiming to connect
- the diverse nature of this generation and a rapid change in the demand and generation mix.

As a result of review we will better understand the capacity that can be unlocked for earlier connection of some customers already in the TEC queue. We will also conduct periodic reviews of the inputs and assumptions such as the generation mix and demand expectations. As part of this process, we will also be reviewing how we model storage connections with a view to understanding their impact on system dynamics and network constraints thus enabling their earlier connection.

Please see **Annex 1 – Supporting Information** for further detail on these ambitions.

D14.5.2 Phase 2: Industry engagement for definition of the problem(s) and what good looks like

During phase 2, we will lead a detailed definition and mapping exercise of the problems that industry parties are telling us they experience with connections. The stakeholders we will engage with include customers, TOs, DNOs, as well as BEIS and Ofgem. Ultimately, we want to achieve agreement on the challenges we face and on 'what good looks like' for a future connections process. These focused problem statements will be analysed with support from external consultants over a 3–6-month period from April 2023 – October 2023.

D14.5.3 Phase 3: Design and development

The problem statements developed in phase 2 will be further developed and grouped (by nature, theme, priority, and complexity) across different workstreams. We will also set up working groups and a Reform Governance Body to identify and design solutions, outline measures of success and develop the implementation proposals. Timescales and objectives for each of these groups will be defined with recognition that this complex task will require input from independent facilitators.

The various working groups will outline implementation roadmaps for:

- code, legislation and contractual changes required
- the need for changes or new IT systems and platforms
- the connections reform governance process
- communication and engagement strategies with wider industry and customers
- Development of one TEC queue for Transmission and Distribution
- new connections process(es).

This phase will run from October 2023, with delivery in July 2024.

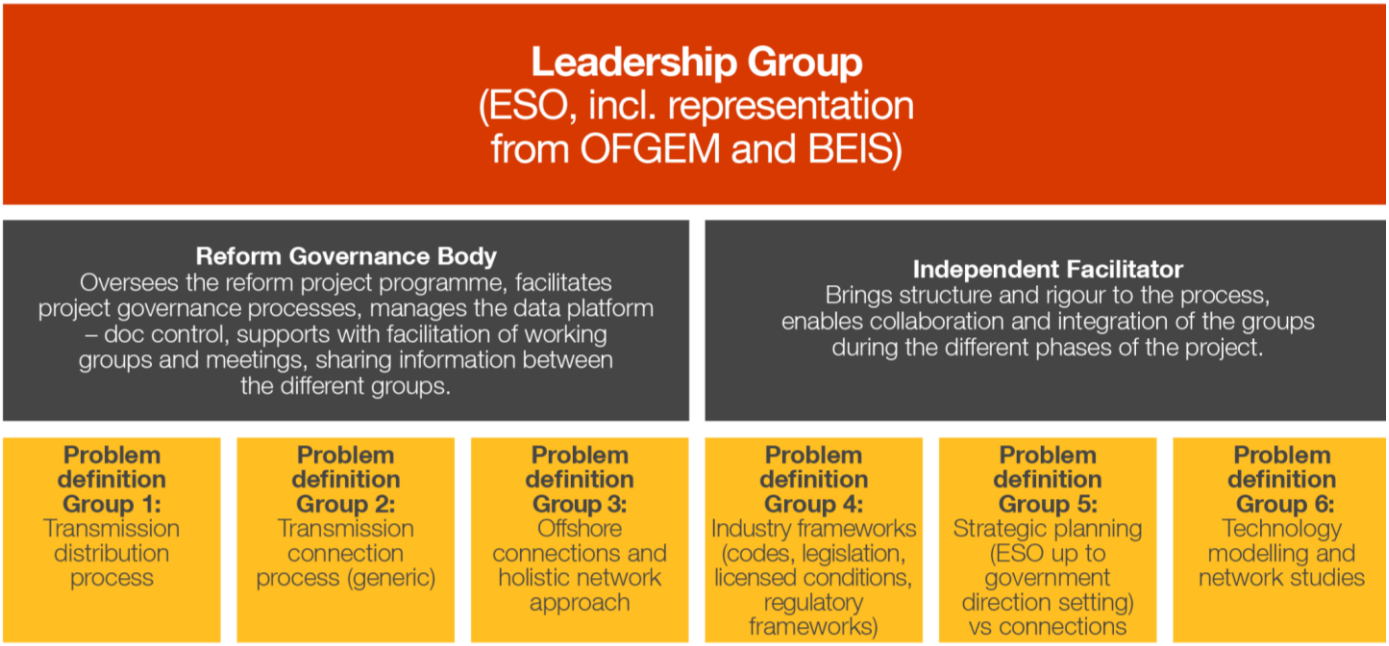

Figure 29: Development of problem statements to redesign and replace the existing connection process

D14.5.4 Phase 4: Implementation

Following phase 3, we see this implementation phase (phase 4) as a 12–24-month process with final delivery no later than September 2026). This will include a clear programme outline for each of the phase 3 outputs which will have dedicated programme managers to ensure efficient implementation. Programme managers, depending on the subject, will be resourced from within the ESO.

The programme of change to codes, legislation and contracts will be led by the Electricity Connections Compliance (ECC) Policy and Change Management team supported by legal resources and other teams (where required).

Connections reform governance is key to ensure we have the ability to report on the overall performance of the implementation phase against target(s). Therefore, the Reform Governance Body will be maintained through the implementation phase and until project close (phase 5), which falls in BP3 timescales.

Phase 5: Project close

Once phase 4 is completed we anticipate undertaking a review of project deliverables and providing a final report which will review what we have achieved against our original objectives. Dependent on when phase 4 completes, this may be in BP3 timescales or after the RIIO-2 period.

What do we need to deliver this sub-activity?

We have identified that a total of 15 FTE are needed to enable the reform programme and introduce the required new roles to the structure of the Connections Team. These new roles span different areas, including legal, customer and stakeholder strategy, communications, governance and process management, analysts, and data architects.

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We will also need consultancy support estimated as follows (2022 prices, based on initial enquiries with suitable service providers):

- Phase 1: £1m
- Phase 2: £1m

The successful delivery of connections reform is dependent upon a number of internal and external initiatives. For example, it must consider developments within the TNUoS task force and the Review of Electricity Markets Arrangements (REMA). Depending on which market reforms are recommended, there may be impacts on future connection requirements.

Connections reform is also dependent on the level of engagement and support that we get from different organisations and stakeholders in the energy industry. We will carry out a detailed customer and stakeholder mapping exercise that will help ensure engagement and support is achieved ahead of phase 1. To meet our programme timelines, we are dependent on getting agreement to adapt current industry frameworks and secure changes to legislation, regulation and codes within accelerated timescales.

Successful delivery of the early milestones of TEC amnesty (phase 1) and the introduction of a new queue management system will require the support of Ofgem and the TOs for the agreement of terms. The early CPA review milestone will require support from internal teams to develop proposals for presentation to TOs, for which dedicated resource will be required (included in the 15 FTE above),along with support to carry out a review of the relevant codes (CUSC, Grid Code and SQSS).

8.9.6 A15 Taking a whole energy system approach to promote zero carbon operability (materially changed)

We use our engineering expertise to ensure the electricity system remains operable and that appropriate market solutions are developed to deliver net zero in a timely manner. Much of this work is already focusing on future zero carbon operation, including assessing the technical requirements for new generation connections, implementing technical code and framework changes, and managing our operational data and modelling requirements. An example is the new modelling tools that are helping us understand the performance of a net zero network, including Electromagnetic Transients (EMT) modelling and power quality analysis.

Stakeholder engagement

For sub-activity **A15.6** on transforming our capability in modelling and data management, we have worked with TOs to establish the correct Electromagnetic Transient (EMT) modelling requirements in partnership with our model supplier. We've also been sharing learnings and discussing how to make best use of the model through the Joint Planning Committee Modelling Group.

In order for us to progress **A15.7** Deliver enhanced frequency control by 2025, during BP1, we set up a monthly working group and presented at the Technical Advisory Council (TAC). As a result of feedback we received, we engaged with experts to develop cyber-security requirements for the future system, added resources into our BP2 submission to manage the business change capabilities and we are looking at technologies used internationally to shape our work. A full programme of engagement will accompany the development of this project throughout 2022.

Our engagement for **A15.8** facilitating distributed flexibility is summarised within the Accelerating Whole Electricity Flexibility section.

In response to our draft plan, stakeholders expressed direct support for activity A15.9 Net zero operability. There were some concerns expressed that we were not modelling 100 per cent converter-based generation and the importance of engaging with stakeholders throughout this activity was stressed, which we note. However, we do not agree that modelling 100 per cent converter-based generation is a priority as we don't see this being likely in the near term, with synchronous hydro and nuclear power stations continuing to operate past 2040. More information can be found in **Annex 3 – Stakeholder Engagement**.

A15 sub-activities and deliverables

This activity is made up of the following sub-activities:

Sub-activity #	Sub-activity name	Status
A15.1	Develop the System Operability Framework (SOF) and provide solutions up to real-time of network-related operability issues	No change (please see **Annex 1 – Supporting Information**)
A15.2	Provide technical support to the connections process	No change (please see **Annex 1 – Supporting Information**)
A15.3	Assess the technical implications of framework developments and implement changes into business procedures and systems	No change (please see **Annex 1 – Supporting Information**)
A15.4	Manage operational data and modelling requirements for the ESO	Materially changed
A15.5	Regional Development Programmes (RDPs)	Materially changed
A15.6	Transform our capability in modelling and data management	Materially changed
A15.7	Deliver enhanced frequency control by 2025	Materially changed and name changed
A15.8	Facilitate distributed flexibility and whole electricity system alignment	Materially changed and name changed
A15.9	Net zero operability	Materially changed and name changed
A15.10	Develop a regime for an integrated offshore grid	Moved under **A22**

8.9.6.1 A15.4 Manage our operational data and modelling requirements (materially changed)

What is this sub-activity and why is it important?

Building on the delivery of ETYS/NOA data sets in BP1, we need to improve the quality of system data and models used to analyse future network needs and operability solutions. We will do this by moving to an automated approach of data and model maintenance in order to expedite processes, improve accuracy and remove inefficient manual interventions. Improvement of data and modelling accuracy will ensure that NOA signals and other ancillary market/industry triggers are correct and actionable.

What will we deliver in BP2?

Multiple new modelling scenarios will be required, resulting from Grid Code modification GC0139 (Enhanced planning-data exchange to facilitate whole system planning). The implementation will see us and all DNOs migrate to a Common Information Model (CIM) standard. We will collaborate closely with these parties throughout BP2. A new deliverable (**D15.4.3**) sets out the timeline for implementation of this technical data automation. This deliverable will set the requirements for us to prepare for a change to CIM standards. Our team will grow to support this.

As implementation will not happen before 2024, we will continue to engage with DNOs to explore other potential methods for developing the required data exchange.

What do we need to deliver this sub-activity?

Our team will grow by two FTE to support the improved quality of system data and models for determining operability solutions via automation. This sub-activity is aligned to IT investment line **350:** Planning and outage data exchange.

8.9.6.2 A15.5 Regional Development Programmes (RDPs) (materially changed)

What is this sub-activity and why is it important?

RDPs look across the whole electricity system landscape to resolve problems in key regional areas of the network in need of development. RDPs can unlock network capacity, provide tools to manage system constraints and lead to new revenue streams for market participants. Transmission constraint management services, which span the transmission and distribution interface, such as the MW dispatch programme are a crucial area of development to ensure net zero ambitions are realised. It's important that we build upon the progress made in BP1 in this area to further unlock the benefits already being either realised, identified or in proof-of-concept stages.

This sub-activity seeks to proactively develop needs cases for market-based non network alternatives to traditional investment, making RDP delivery a BAU activity in the future.

What will we deliver in BP2?

We will continue with our in-flight RDP projects Generation Export Management Scheme (GEMS) (**D15.11.2**) and RDP2 (**D15.5.2**) and the associated rollout of RDP functionality with partner DNOs (**D15.5.5**).

Following review of the needs case, the GEMS (D15.11.2) programme dates have been updated from Q3 2022/23 to Q4 2024/25 in discussion with our project partner, SPEN.

As detailed in **Activity A14 A whole electricity system approach to connections**, we are seeing a rapid increase in new connection applications. This is greatly increasing the range and complexity of RDP development works in BP1 and into BP2. These changes will result in a more flexible approach to delivery in BP2 that builds on the work undertaken in BP1.

Due to the increasing number of connection applications, we are broadening our work with WPD and UKPN, through RDP1 and 2, to other areas in their regions, as RDPs 3 and 4. We have determined that the solutions required in these areas may be similar and have aligned RDP3 and RDP4 timescales to ensure IT development is harmonised and the costs of implementation minimised. RDP3 and RDP4 will build on the functionality developed in RDP1 and RDP2, introducing enhancements where justified and new use-cases focusing on storage developments.

We will continue RDP development, building on previous learning and working with other DNOs and TOs in parallel responding to system needs and connections issues. Our investigations will determine the need for non-build solutions to accelerate new DER connections and the requirement for IT developments as part of these solutions. We anticipate that this will result in the need for two further IT projects (RDP 5 and RDP 6), with a possible third depending on need.

What do we need to deliver this sub-activity?

Since BP1, we have increased the number of FTE undertaking RDP development by two, and then by a subsequent eight due to increasing number of connections applications and as part of our requirements in sub-activity **A14.3 Further enhance the customer connection experience, including broader support for smaller parties**.

Two additional FTE are needed to support the delivery of IT projects. The costs of these FTE are incorporated within the relevant IT project budgets. One of these FTE is needed to support the delay in GEMS programme dates.

Deliverable (**D15.5.5**), delivery GB rollout of functionality developed through initial RDPs, will be progressed through new activities outlined in **A15.8** such as DER visibility **(D15.8.2)** and the development of primacy rules **(D15.8.3)** . We anticipate this work will also highlight the need for a proactive process in BP2 that will allow us to identify future local needs for non-network solutions. This will then allow the RDP development activities to transition to a full BAU process.

With the delivery of such complex projects, there is an ongoing risk of change to the overall delivery plan as a result of unforeseen factors such as dependencies on third-party actions. We have provided a 'best view' forecast of RDP development and delivery, but we recognise system requirements can change and the number of active RDPs in the BP2 period is subject to variation. Please see **Annex 1 – Supporting information** for further information.

This sub-activity is aligned to IT investment line **340** RDP Implementation and Extension – this investment will also provide us with greater visibility and control of parties

connected to distribution networks. Please see **Annex 4 – Digital, Data and Technology** for more information.

8.9.6.3 A15.6 Transform our capability in modelling and data management (materially changed)

What is this sub-activity and why is it important?

We must transform our capability in modelling and data management which includes upgrades to our data and modelling tools to cater for a more complex system and to facilitate zero carbon operation. We also need to provide the foundational architecture for an interchangeable suite of tools. This requires a common data set for seamless data exchange and enabling higher volumes of network data, regional models, and outage planning data to be exchanged.

With declining synchronous generation levels and increasing converter-based generators, phenomenon such as control interactions between different converter-based generations, system oscillation issues and power quality issues need to be analysed more intensively and more intelligently. We need new modelling capabilities to do this.

Failure to develop these new capabilities could impact our ability to accurately model future system operation and balancing needs.

What will we deliver in BP2?

We will make further enhancements to our combined hardware and software tools to allow us to undertake more complex modelling, providing an improved capability to carry out short circuit calculation which is a key operability challenge with declining synchronous generation.

We are adding a new transformational deliverable (**D15.6.8**) to enable more advanced Electromagnetic Transients (EMT) modelling to provide enhanced forward guidance and planning for the impacts of voltage oscillations and power quality.

What do we need to deliver this sub-activity?

Our team will grow by six FTE to develop and maintain EMT models and to carry out EMT analysis. A key deliverable will be the development of new capabilities in this area.

We will also explore carrying out more detailed and effective system analysis using a co-simulation approach with the existing Offline Transmission Analysis (OLTA) system combined with EMT capabilities. This has a new transformational deliverable (**D15.6.9**) to set out the timeline and expectations for this approach.

This sub-activity is also aligned to IT investment lines **360**: Offline network modelling, **350**: Planning and outage data exchange and **220**: Data and analytics platform. Please see **Annex 4 – Digital, Data and Technology** for more information.

8.9.6.4 A15.7 Deliver enhanced frequency control by 2025 (materially changed and name changed)

What is this sub-activity and why is it important?

This sub-activity was formerly named ‘Deliver an operable zero carbon system by 2025’, however, as the deliverables are specific to delivery of the enhanced frequency control tool it has been renamed to reflect this.

We are putting actions in place so that, as inertia decreases, the risk of incidents on the system is reduced. By implementing a monitoring and control system (MCS) we will be able to monitor the electricity network at a regional level and coordinate regional frequency response from a range of service providers to maintain frequency stability. The MCS system will help to improve the system security and could help to identify and avoid system oscillation in the future system operation condition.

A15.7 will deliver a MCS to provide fast and coordinated frequency response for the low inertia system. This is part of the proposed staged rollout of the Enhanced Frequency Control Capability innovation project’s MCS. The first stage is targeted for 2024/25 (**D15.7.1**) and the second for 2025/26 (**D15.7.2**).

What will we deliver in BP2?

During the BP1 period, we introduced a new phase 0 milestone for the first stage rollout (**D15.7.1**) to analyse the preferred future states and change strategy. Its purpose was to develop requirements and a technical design to contribute to the phase 1 non-operational demonstration works.

As a result of introducing phase 0, phase 1 non-operational demonstration is delayed from our original milestones. However, it is expected to be completed within BP1 timescales of Q4 2022-23. The subsequent milestones on operational demonstration (phase 2 and phase 3) will now be delivered in BP2. The rollout of the first stage (phase 4) is still on track for delivery in 2024/25, as is commencement of the second-stage rollout (phase 5).

Resource profiling for 2024/25 and 2025/26 will be the same as 2023/24.

What do we need to deliver this sub-activity?

Delivery is dependent on the onshore TOs installing required system capabilities needed to utilise the phase 1 non-operational demonstration. One TO is active with the capabilities so far, with a second expected by August 2022. The MCS architecture will use components common to projects such as inertia monitoring (deliverable **D1.2.2**) and frequency visibility (IT investment **170**) projects. The current phase 1 timeline is aligned with these project deliverables.

Timely delivery of the MCS is dependent on consideration and assessment of how it will operate in conjunction with and interface with the ongoing developments to the enhanced balancing capability programme.

The phased approach will help the transition of this complex scheme to be carefully managed and coordinated with other industry strategies. Based on the learning from phase 0 and phase 1, the need case for this scheme will be evaluated before proceeding to phase 2.

This sub-activity is aligned to IT investment lines **500** Enhanced frequency control. The detail behind this investment can be found in **Annex 4 – Digital, Data and Technology.**

8.9.6.5 A15.8 Facilitate distributed flexibility and whole electricity system alignment (materially changed, name changed)

Due to the direct interdependencies, detailed deliverables for this sub-activity are found in the **Accelerating Whole Electricity Flexibility** spotlight section.

8.9.6.6 A15.9 Net Zero Operability (materially changed and name changed)

What is this sub-activity and why is it important?

This activity in BP1 was named 'Identify future operability needs across whole energy system' and entirely focused on cross-energy vector work with whole system operability. As government targets regarding net zero have become more focused, and with increased discussion on the role of the Future System Operator in whole system development, it is appropriate to re-define this activity to focus on reaching zero carbon whole electricity system requirements. We need to have the right capabilities and tools to operate a future system that meets the 2035 full electricity decarbonisation target. Building on the work from the operability strategy, the addition of a Zero Carbon Operability team in BP2 will drive the increased ambition of a zero carbon power system by 2035. This will also build on our commitment to be ready for zero carbon operation of the system for short periods in 2025.

As we evolve our ability to manage a zero carbon network for short periods in 2025 to a fully decarbonised electricity system by 2035, the operational needs, especially in the new flexibility and adequacy workstreams, will become key in leading the debate around where market interventions and support are required. The ambition of the government to support these emerging technologies requires us to be engaged earlier than anticipated in the original BP1, so we've increased our focus in this area to enable us to act as a trusted partner on developing new technologies.

What will we deliver in BP2?

A15.9 will see a new deliverable (**D15.9.5**) replacing the existing deliverables, which will focus on engaging with stakeholders on implementation of technologies for effective zero carbon operation. This reinforces our role as a trusted partner, engaging and advising stakeholders in developing new technologies and enabling policy changes.

We will evolve our capability in three ways to deliver this activity:

Firstly, we are enhancing the operability strategy report (Role 1, **D.1.1.6**) to focus on the long term, increasing the scope from the current five engineering workstreams (voltage, thermal, restoration, stability and frequency) to also focus on adequacy and flexibility needs.

Secondly, to enable this, the Zero Carbon Operation team will coordinate across all Roles in driving the analysis to understand the requirements for all workstreams as follows:

- Role 1 – development of requirements for restoration (**A3 Restoration**).
- Role 2 – development of frequency and inertia requirements through an enhanced Frequency Risk and Control Report, as detailed in Activity **A4 Building the future Balancing Services markets**.
- Role 2 – development of the future energy mix (**A5 Transform access to the Capacity Market and Contracts for Difference**).
- Role 3 – development of needs for thermal, stability and voltage (**A8 Enable all solution types to compete to meet transmission needs**).
- Role 3 – approaches needed to meet whole electricity system operability needs (**A15 Taking a whole energy system approach to promote zero carbon operability**).

The third activity will be to coordinate and manage support in the early phases of industry and stakeholder policy development relating to new technologies, such as CCUS, hydrogen, long duration electricity storage and EVs. This will be where most of the work is focused – on deploying our knowledge and capability into decision-making forums and cross-industry working groups to ensure new technologies develop in line with system needs.

The changes driven by the activity in **A15.9** will be visible elsewhere, through a more in-depth and longer-term view of the requirements to meet the operational challenges as we further decarbonise.

This work will also support the development of the Network Planning Review outlined in **A22**, which will be tackling many of the same issues on a longer horizon.

What do we need to deliver this sub-activity?

These ambitions will require four additional FTE to perform the engagement and co-ordination activity across all stakeholders on the deployment of new technologies. Engagement is needed for both small-scale and industry-wide changes, such as the adoption of EVs and how smart technologies can support the development of the grid. We will also engage as new policies develop for delivering new large-scale technologies including CCUS, bioenergy with carbon capture and storage (BECSS), new nuclear, hydrogen and large and long duration storage. This engagement will require working with Original Equipment Manufacturers (OEMs), technical working groups, trade bodies and government departments.

Through Role 2 and the new activity **A20**, focused on Net Zero Market Reform, we have been developing proposals which will facilitate the procurement of tools and capability to meet operational needs. To support this, we need to articulate the needs of the system and the interdependencies between these and the role for new technologies, such as hydrogen or smart demand.

8.9.7 A16 Delivering consumer benefits from improved network access planning (materially changed)

Our Network Access Planning team continues to work closely with customers and stakeholders on the delivery of efficient outage plans, facilitating system access for the TOs to carry out their construction and maintenance activities while optimising plans and minimising constraints.

The rapid advance of renewable generation and additional network outage requirements on the network has led to a high increase in network constraints. In some areas, access

to the network is now dependent on favourable weather conditions, which introduces yet more complexity.

We have been working closely with TOs to reduce constraint costs using measures such as outage realignments, reviewing protection settings, circuit rating enhancements and post fault switching agreements. We estimate these changes have created around £1 billion worth of savings over a twelve-month period.

As full electricity system decarbonisation has been accelerated to 2035, we must bring forward our plans for operating a much more heavily constrained network, with greater demand uncertainty driven by penetration of renewables, a changing generation mix and electrification of heat and transport. Analysis and modelling will need to be carried out much more frequently rather than relying upon what were previously the most 'challenging' points of the day. Additional time stamps will be required for analysis.

We must also work more intensively with our DNO customers across the Transmission–Distribution interface in developing efficient whole electricity system processes for access planning, ensuring our decision-making results in the lowest costs to consumers. We will support increased levels of coordination to deliver significant consumer benefits, facilitating the connection of low carbon generation and the development of new flexibility market opportunities.

Stakeholder Feedback

We received feedback from customers and stakeholders regarding how we scope a whole electricity system decision-making policy, indicating a desire for us to be more engaged in commercial decision-making across the Transmission–Distribution interface. How we put this into practice is an area we will continue to engage on before and during the BP2 period.

For further information see **Annex 3 – Stakeholder Engagement.**

A16 sub-activities and deliverables

This activity is made up of the following sub-activities:

Sub-activity #	Sub-activity name	Status
A16.1	Manage access to the system to enable the TOs to undertake work on their assets, liaising with customers where access arrangements impact them	No change (please see **Annex 1 – Supporting Information**)
A16.2	Scope a whole electricity system decision-making policy	No change (please see **Annex 1 – Supporting Information**)
A16.3	Work more closely with DNOs and DER to facilitate network access	No change (please see **Annex 1 – Supporting Information**)
A16.4	Whole system outage notification	No change (please see **Annex 1 – Supporting Information**)
A16.5	Network access planning automation	New

8.9.7.1 A16.5 Network access planning (NAP) automation (new)

What is this sub-activity and why is it important?

Despite incremental improvements to our NAP automation, we still rely on manual processes for modelling system set-up and analysis. The 2035 full electricity decarbonisation target means bringing forward our plans. Our team will need to expand to facilitate this delivery, with more resource required to lead on this work. This work will create efficiencies in our modelling processes to allow more optimised constraint management plan tracking across each 24-hour period. An optimised plan in this context is one which maximises transfers across transmission boundaries, thus reducing consumer costs.

The arrival of new technology such as smart valves, new HVDC interconnection to Europe along with HVDC interconnection within Great Britain's network, and the power electronics associated with these, makes modelling and analysis more challenging and requires more and more scenarios to be examined and mitigated against. This leads to a greater requirement for intelligent automation of manual processes.

These changes, and the numerous Network Services Procurement programmes (previously Pathfinders) in progress, are set against a less predictable generation and demand profile than in the past. The volume of network outage change directed by TOs can also be difficult to address as quickly as needed. We recognise that a probabilistic approach to outage planning could be achieved and that BP2 is the time to begin scoping methodologies that could allow us to offer this service.

NAP automation improvements through BP2 will remove time-consuming manual processes, make system security studies more accurate, and provide greater scope for cost optimisation of the transmission outage plan. This expedient optimisation of the plan will facilitate two major benefits. Firstly, it will have the effect of accelerating the study time so that a quicker response can be granted to customers and Transmission Owners. Secondly, it will allow us to find the optimal solution to a constraint (or a combination of outage requests) and thus reduce balancing costs overall.

What will we deliver in BP2?

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We will focus on setting out an automation plan for the path to 2035. This will involve scoping, agreeing and developing a future platform for automation and fully training all power system engineers in the use of new tools. Our team will need to expand to do this and will need to use people with application development experience rather than power systems engineers. Five FTE will be needed for this work.

Successful delivery of automation will contribute to maintaining system security and enable delivery of an even more efficient and economic outage plan. We estimate that significant consumer value can be realised of up to £100m per year in reduced constraint costs post 2025 when automation programmes are complete and when NAP staff have received training.

What do we need to deliver this sub-activity?

Completion of proof-of-concept studies for voltage, stability and thermal automation techniques in 2023/2024 followed by successful training of all existing and new planning engineers in 2024/2025 will be needed. This sub-activity is also aligned to IT investment line **360** offline network modelling. The detail behind this investment can be found in **Annex 4 – Digital, Data and Technology.**

8.10 Role 3 detailed costs explanation

Role 3		BP1			BP2			BP3	
		Actuals	Forecast		Forecast			Forecast	
		2021/22	2022/23	TOTAL (2 years)	2023/24	2024/25	TOTAL (2 years)	2025/26	TOTAL (5 years)
Capex (£m)	BP2 submission	5	11	16	19	16	36	12	**63**
	Original BP1	12	13	26	16	14	30	16	**71**
	Variance	**(7)**	**(2)**	**(10)**	**4**	**2**	**6**	**(4)**	**(8)**
Opex (£m)	BP2 submission	23	30	53	34	36	70	35	**158**
	Original BP1	22	23	45	25	27	52	27	**124**
	Variance	**2**	**6**	**8**	**9**	**9**	**18**	**8**	**34**
Totex (£m)	**BP2 submission**	**28**	**41**	**69**	**54**	**52**	**106**	**47**	**221**
	Original BP1	**34**	**37**	**70**	**41**	**41**	**82**	**43**	**195**
	Variance	**(6)**	**4**	**(2)**	**13**	**11**	**24**	**4**	**26**
FTE	BP2 submission	261	337		416	416		413	
	Original BP1	225	236		247	253		251	
	Variance	**36**	**101**		**170**	**163**		**162**	

Table 9: Role 3 forecast costs and full-time-equivalent headcount (FTE) for the five-year RIIO-2 period

The table above shows our forecast costs and full-time-equivalent headcount (FTE) for the five-year RIIO-2 period, comparing the original BP1 to our BP2 submission. These Role 3 costs exclude support functions and cross-cutting activities which are shown separately in **Chapter 12 – Enabling activities**. Opex costs include all Role 3 overhead costs as well as project opex for IT investments and incremental run-the-business overhead IT costs associated with new investments.

Chapter 8 – Role 3 System insight, planning and network development

|A more detailed breakdown of the key Role 3 activities driving costs changes are described below:

A8.4 Early Competition

This is a new activity and part of the broader network planning ambitions, requiring £3m opex cost and three FTE.

- This team will be developing the detailed tender processes, supporting legislative and framework changes, and engaging the market and other stakeholders. External consultancy support with specialist procurement skills will help deliver this new activity and represents much of the costs in this activity.
- The bulk of the activity, and the resource required, for Early Competition is to run future procurement activities. This is detailed separately in the FSO chapter. The three FTE referenced are required to support the processes set out above, such as supporting legislative changes and stakeholder engagement.

A14 Whole system approach to connections

This activity proposes a £6m increase in totex with an additional 56 FTE.

- 56 FTE at an opex cost of £3m have been added to the Customer Connections team to support enhancements to the customer connections experience, manage the increasing volume of connection offers and the resulting connection agreement contracts and lead a programme of connection process reform. This cost is net of the recharges which are made to connection applicants.
- Capex investment in our connections platform has increased by £3m for enhancements to the customer connections portal which is vital in providing a seamless experience for customers.

A15 Whole electricity system approach to promote zero carbon operability

This activity proposes a £6m increase in totex with an additional 33 FTE.

- Activities **A15.1 –A15.5** require an additional 17 FTE costing £1m opex (net of recharges back for applications), for a variety of activities:
  - Enhanced network operability activities including supporting the volume of customer connection applications being processed.
  - Driving changes to Regional Development Programmes (RDPs), business-as-usual processes and systems, and collaborative work with partner DNOs.

Activities **A15.6– A15.9** require an additional 16 FTE costing £1m opex (net of recharges back for applications), for a variety of activities including:

- Developing and maintaining Electromagnetic Transients (EMT) models and to carry out EMT and power quality analysis.
- Our IT investment 500 Enhanced frequency control (formerly Zero Carbon Operability) proposes a £4m increase in capex. This investment will deliver a monitoring and control system (MCS) to provide fast and coordinated frequency response for the low inertia system that is required to achieve zero carbon and net zero ambitions.
- A further six FTE are proposed for delivery of the new transformational sub-activity A15.8 Facilitate distributed flexibility and whole electricity system alignment. These FTE will focus on delivering a smarter energy system, which will mean more efficient flexibility markets and a more coordinated approach to network planning and operation.
- Delivery of our new zero carbon operation team, which will focus on engaging with stakeholders on implementation of technologies for effective zero carbon operation.
- **A16** requires 11 additional FTE consisting of four FTE to deliver long-term network access planning requirements and to create efficiencies in the existing processes, two FTE to support the development of tools to coordinate deeper access planning and five FTE to progress the NAP automation activities in **A16.5**.

A22 Offshore Coordination/Network Planning Review

This is a new activity which is driving an opex increase of £7m and an additional 47 FTE.

- 42 FTE for Network Planning Review (NPR). NPR will bring together the capability and operability challenges faced by the electricity transmission network into a coordinated process, developing an end-to-end network planning process that supports the delivery of net zero at best value to consumers. These FTE are required for electricity generation and demand modelling and model development. They contribute to identifying and modelling system operability needs and detailed design of strategic options and design activities. Additionally, they will be focused on stakeholder engagement, working closely with TOs and developers to contribute to the CSNP plan and methodology.
- Five FTE for Offshore Co-ordination. Offshore wind is a critical technology for achieving net zero by 2050. To realise this target, a step-change in both the speed and scale of deployment is required, and this growth must be enabled efficiently for consumers while taking into account the impacts on coastal communities and the environment. The team will therefore focus on a strategic seabed leasing plan, and support development of the multi-purpose interconnector strategy. They will also support the development of Early Competition offshore.
- The FTE requirement of 47 FTE across **A22** includes 35 FTE who are already in the business and working on Offshore coordination, an activity which was not included in BP1. The net requirement for BP2 is an additional 12 FTE for BP2.

The remaining Role 3 activities

- **A7–A11** (excluding **A8.4**) Network Development, **A12** SQSS review, and **A13** Lead the Debate do not drive a material change in spend or headcount compared with BP1.

Please see **Annex 1 – Supporting information** for a cost breakdown by activity.

Chapter 8 – Role 3 System insight, planning and network development

8.11 Spotlight: Accelerating whole electricity flexibility

The decentralisation of the energy sector has accelerated since BP1, with significantly greater volumes of distributed energy resource (DER) connecting to the network. This trend is extending into our homes, with ever greater numbers of EVs and smart devices now being used. This not only impacts overall energy consumption but opens up the potential of a large and valuable source of flexible demand, which can be utilised to balance the system and keep costs down for consumers.

Facilitating participation of these new entrants in energy system services is a key enabler to delivering a reliable, affordable and fair net zero system for Great Britain. Electricity suppliers and aggregators are developing new products for this purpose. However, current market arrangements and frameworks can be blockers for smaller distributed assets. To meet the 2035 decarbonisation target, as the system operator we therefore need to increase our efforts to drive whole electricity system outcomes.

We recognise the importance of ensuring that our roles and responsibilities evolve in line with Distribution System Operation (DSO) and other institutional reform, such as that contemplated by Ofgem's 'Future of local energy institutions and governance[45]' call for input. Our updated plans for BP2 therefore reflect the ongoing developments in distributed flexibility and DSO, such as the Distribution Network Operator's (DNOs) price controls for RIIO-ED2.

In BP1, we continued to open up our markets, including the Balancing Mechanism (BM), to smaller parties. New products, delivered through initiatives such as the Regional Development Programmes (RDPs) (**A15.5**) and local constraint markets (LCM) (**A4.6**) are enabling new revenue opportunities for DER. Our Power Responsive programme (**A4.2**) has also continued to work closely with demand-side providers to enhance market opportunities. We have also provided thought leadership in this area through publishing our 'Enabling the DSO transition[46]' consultation, leading Energy Networks Association (ENA) Open Networks Programmes workstreams and products, and through our Markets Forum and Roadmap.

In BP2, we will facilitate aggregator and supplier models to increase liquidity and enable consumers to reduce their energy bills through a broader range of services and markets. There is great consumer value in accelerating whole electricity system flexibility markets and we need to ensure opportunities can be realised for DER service providers.

Facilitating greater market access for smaller distributed parties presents operational challenges. We need to have sufficient operational visibility of our service providers in real-time to understand the impacts of their actions and be certain services will be delivered. We also need to coordinate our operations with those of DSOs as distribution networks become increasingly constrained.

In BP2, we will expand our activities in line with our 'Enabling the DSO transition' consultation, where we detailed areas of coordination between ESO and DSO roles across networks, markets and operations. We will put in place the operational systems needed to manage a higher volume of DER service providers and increased DSO interactions in network planning.

As the energy transition continues, we recognise that there is a need to coordinate beyond the electricity system to consider networks, markets and operations from a whole energy system perspective. Any further roles and accountabilities we take on in these areas will be explored in the transition to a Future System Operator and will build on the foundations established by our activities in BP2.

Stakeholder feedback

Following our 'Enabling the DSO transition' consultation in April 2021, we engaged through webinars, bilaterals and round-table meetings with stakeholders. We have taken the feedback from that consultation, our ongoing engagement and from our review of the RIIO-ED2 Business Plans to help inform our proposals.

We have ongoing engagement with key stakeholders through the ENA Open Networks Programme, and our monthly Whole Electricity System Joint Forum is a key part of how we engage to support the DSO transition.

We shared our proposals with ERSG in January and March 2022 and, at the March ERSG, the group provided feedback on DSO/ESO cooperation. Whilst the group felt this type of cooperation was important, it challenged us to consider our role as ESO beyond a traditional utility-focused lens and look at how we can better engage with all parties who interact with consumers. We have taken on board this feedback, recognising the importance of consumer flexibility in enabling a net zero system. As a result, the Business Plan proposals have been updated to provide further clarity on the scope and ambition of our activities in this area.

We received feedback as part of our draft BP2 consultation to further clarify the activities and resource requirements for our plans to accelerate whole electricity flexibility (formerly called facilitating distributed flexibility). We have now explained the four key areas of work for BP2 and how the three Roles will support those areas, with resource requirements specified. We have also updated our delivery schedule with milestones to better reflect our activities. We're also regularly engaging stakeholders through forums and webinars regarding this activity area and will continue to do so throughout the BP2 period.

What will we deliver in BP2?

Our proposals can be summarised by the following four key areas of work:

1. **Facilitating market access for whole electricity flexibility.** This work will remove barriers for aggregators and energy suppliers, thereby facilitating access for DER assets to our markets. The work will be led by Role 2, and includes the following deliverables:
   - **Role 2: D4.5.3 Reforming markets to facilitate future growth of distributed flexibility technologies and models (new).** We will develop a

[45] Call for Input: Future of local energy institutions and governance | Ofgem

[46] https://www.nationalgrideso.com/document/190271/download

strategy to facilitate the growth of distributed flexibility. It will investigate the technical capabilities and business models of all distributed flexibility technologies and examine their unique challenges in accessing our markets. The output will be a defined vision for distributed flexibility in 2035, resulting in a set of actions to reform our markets to facilitate their growth and participation.

- **Role 2: D4.5.4 Facilitating market access for distributed flexibility (new).** We will deliver changes to our markets, identified by our strategy developed in **D4.5.3,** to facilitate access for DER to markets as identified by our strategy developed in **D4.5.3**.
- We also recognise the importance of interoperability between our own markets and those developed by DSOs. Increased interoperability ensures that providers can seamlessly access a range of potential revenue opportunities and clearly understand which are of greatest value. We will enhance our Single Markets Platform to enable interoperability with third-party platforms, including those being developed for DSO markets (**D4.2.2**). We will also enable our new services to be coordinated with DSO flexibility markets.
- **Role 1: D1.5.3 Development of RDP and LCM functionality into real-time environment (new).** Our RDP and LCM projects are developing new systems and interfaces that will introduce new DER flexibility services into our Control Centre. We need to ensure that these new systems work with our existing systems and that critical operational processes are modified to reflect these changes. The IT investments needed to deliver this are discussed in the 'What do we need to deliver' section below.

2. **Service co-ordination between markets.** To maintain security of supply and ensure maximum consumer value, we need to develop and embed operational processes and systems to coordinate markets across the whole electricity system. We will ensure that our service procurement and dispatch is transparently co-ordinated and we will support service providers' access to our, and DSO, markets. This work will be led by Role 3 and includes the following deliverables:
   - **Role 3: D15.8.3 Enabling whole electricity system operational service coordination (new).** To manage service co-ordination efficiently and transparently, whilst facilitating the potential for flexibility market platforms, we are leading the development of a set of 'primacy rules' through the Energy Networks Association (ENA) Open Networks Programme. These rules will resolve service conflicts between ESO-procured and DNO-procured flexibility. These requirements have been recognised by Ofgem and BEIS through their 2021 Smart Systems and Flexibility Plan update.[47]
   - Co-ordination frameworks will be in place at the start of BP2, with the initial use case delivered into Control Centre systems through the RDPs. In BP2 we will implement other use cases into our Control Centre and extend their use across all distribution markets.
   - **Role 1: D1.5.2 Whole electricity system operational service coordination (continuous).** We will need to ensure there are robust and transparent processes in place to enable the co-ordination of activities between us and DSOs to facilitate DER participating in both markets. This activity is complementary to the work in Role 3 and will use dedicated control resources to update operational processes to account for the introduction of the primacy rules. We will establish regular engagement with DER service providers on the operational impact of this service coordination and use it to inform future rule development.

3. **Improving DER visibility.** We need greater visibility of the increasing amount of DER on the system. This is a significant enabler for DER to enter into our markets, with benefits ranging from facilitating greater aggregation of DER services through to better management of system events. Our initial work has shown a range of potential use cases, indicating an annual benefit of up to £150m per annum.[48] This work will be led by Role 3 and includes the following deliverables:
   - **Role 3: D.15.8.2 Enabling whole electricity flexibility service provision through operational visibility (new).** We will work with industry to deliver real-time visibility of DER. This will involve the development and delivery of the required IT systems, which will also enable other use cases within BP2.
   - **Role 1: D1.5.1 Increased DER visibility in real-time operations (new).** The accelerated growth and impact of DER requires increased operational visibility to ensure Control Centre actions are coordinated in the best interests of consumers and wider system security. We will work with the project delivery team in Role 3 to ensure Control Centre systems accommodate greater volumes of real-time data from DER, and provide operational input into the project. Facilitating increased visibility of DER in real-time operations will enable balancing and security actions to be coordinated across the whole electricity system.

Role 2: D4.5.5 Ensure co-ordination of markets across the whole electricity system (new). Throughout BP1, we have led work in ENA Open Networks on service coordination, resulting in a common framework structure for flexibility services and aligned procurement processes. In BP2, this work will extend to facilitate greater coordination across all relevant Balancing Services. This will include greater visibility of locational information of our service providers, which will allow more efficient management of all networks across the system.

- To achieve this, we will improve our processes and systems for managing data relating to service providers, ensuring locational data is made available

[47] https://www.gov.uk/government/publications/transitioning-to-a-net-zero-energy-system-smart-systems-and-flexibility-plan-2021

[48] https://www.nationalgrideso.com/document/250251/download

to those that need it. We will also be expanding the use of contractual arrangements, initially developed through the RDPs and the Distributed ReStart Network Innovation Competition (NIC) project, to a wider range of use cases. This will provide clarity to service providers of roles and responsibilities when procuring services connected to distribution networks.

4. **Facilitating DSO**: In BP1 we have already been implementing many of the policies and procedures that are enabling DSO. BP2 will coincide with the start of the new DNO price control, RIIO-ED2, and we expect a step-change in the pace of DSO implementation, particularly in the operational functions. In BP2, we will build on the existing work in Role 3, leading our input to the DSO transition with the following activities:

–

Role 3: D15.8.1 Develop policy areas to accelerate whole electricity flexibility (continuous). This deliverable sees milestones updated to reflect the need for ongoing framework development across all Roles to ensure coordination with DSO. We will continue engagement to develop coordination with DSOs in line with the RIIO-ED2 ambitions of each DNO, and support the changes led by Ofgem for DSO governance. We will continue active engagement in the Open Networks Programme.

– **Role 1; D1.5.4 Increased operational liaison (continuous).** In a highly decentralised sector, the need for operational coordination will become ever more critical. We will extend our operational liaison channels with DNOs to include DSO liaison, ensuring we are learning from real-time use of flexibility services. During BP2, we will work with DNOs to develop appropriate forums for this knowledge exchange.

The diagram below shows how the different activities described above fit under each role area.

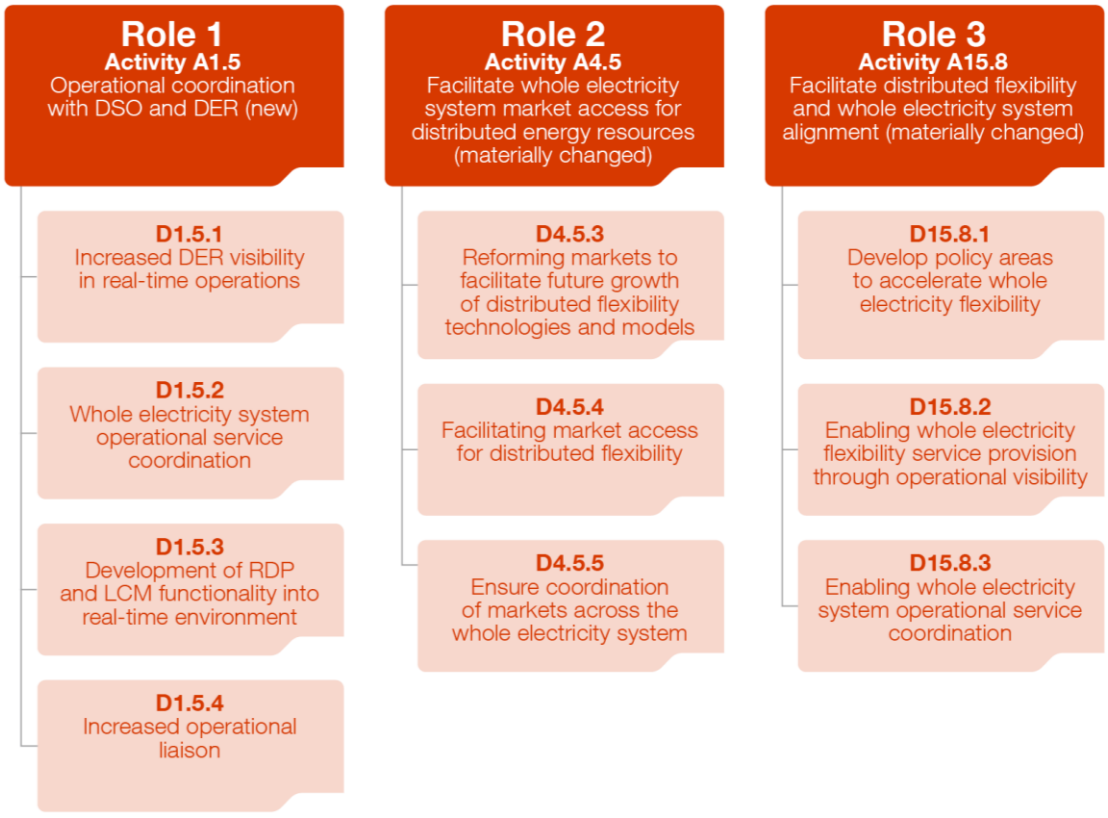

Figure 30: Accelerating whole electricity flexibility activities in each Role

Chapter 8 – Role 3 System insight, planning and network development

What do we need to deliver this activity?

AWEF		BP1		BP2		BP3
		Actuals	Forecast			
		2021/22	2022/23	2023/24	2024/25	2025/26
FTE	Role 1	-	-	3	5	5
	Role 2	-	-	6	6	6
	Role 3	-	-	6	6	6
	Total	**-**	**-**	**15**	**17**	**17**

Table 10: FTE needed to deliver AWEF activities in RIIO-2

In total, we are requesting 17 new FTE in BP2 across our three Role areas to continue to accelerate whole electricity flexibility. The split of FTE across each Role area is shown in the table above. Role 1 will need a total of five FTE in BP2 to cover the four deliverables (D1.5.1 – D1.5.4). For Role 2 there are two FTE for each of the three deliverables (D4.5.3, D4.5.4 and D4.5.5). For Role 3 there are three FTE each for the two new deliverables (D15.8.2 and D15.8.3).

We have identified the following new IT investments in BP2, which will need further work to understand the full scope and cost. At present, we have proposed provision for Discovery stage funding for the following:

- Implementation of operational co-ordination systems into our Control Centre, which will require new IT functionality to be developed and delivered.
- Service coordination.

These investments are covered by IT investment **650** Accelerating Whole Electricity Flexibility with more information detailed in **Annex 4 – Digital, Data and Technology**. There is also a dependency with the delivery of **110** Network Control.

Our work under deliverable **D15.8.2** will require installation of high-speed Inter Control Centre Protocol (ICCP) data links to the remaining DSO Control Centres, which will enable transfer of operational data in both directions. This work will be covered under the Role 1 deliverable **D3.2.2** Electricity System Restoration and IT investment **460** Restoration.

Our work is also heavily influenced by external factors. At a high level these start with the BEIS Smart Systems and Flexibility Plan; in their 2021 update, BEIS stressed the need for progress in this area. Our activities are also dependent on the developments of DSO under the RIIO-ED2 price control, where areas such as the development of primacy rules will require DSO funding from Ofgem. We will also align our activity with Ofgem's work on the 'Future of local energy institutions and governance' once further detail is developed in early 2023.

Accelerating whole electricity flexibility cost-benefit analysis

Distributed markets for flexibility are a significant enabler for delivery of BEIS' Smart Systems and Flexibility Plan. In the plan, BEIS highlight, "…the transition to a smarter and more flexible energy system is an opportunity. It will reduce the costs of our system by up to £10bn a year by 2050, by reducing the amount of generation and network we need to build to meet peak demand".

We have been able to quantify the benefits of enabling greater whole electricity system flexibility in the following areas:

- Our initial work on DER visibility has shown a range of use cases and described benefits for each. In many areas we have been able to quantify these benefits, which indicated a potential annual benefit of up to £150m.
- The RIIO-2 CBA for activity A15 includes benefits cases for DER visibility savings. For further information see **Annex 2 – Cost Benefit Analysis**.

Chapter 9

Digital, data and technology

Chapter 9 - Digital, Data and Technology

9.1 Our plans and value proposition

As described under **Priority 8 – Innovation and change through digital, data and technology**, our digital, data and technology plans are a key enabler of our ambitions for zero carbon operation, creating and maintaining competitive markets and driving towards net zero. During the BP2 period we will:

- replace our ageing systems with modern, modular IT architecture, with extensive use of cloud computing.
- develop customer-centric products that prioritise the experience of the internal and external end-users of our technology and data services.
- provide greater transparency, engagement and access to our data for industry and consumers, through our commitment to open data.

We are delivering our target IT architecture and new products through the portfolio of 33 IT investments presented in **Annex 4 – Digital, Data and Technology**. Our IT investments underpin the delivery of priority activities across our three Roles and are essential to delivering the £2.8 billion estimated net present value[49] of our five-year plan. All our investments remain cost-beneficial, with robust business cases for their delivery in the RIIO-2 period. We have listed our eight most crucial investments in the table below.

Investment	We will…	Role	Key RIIO-2 sub-activities
110 Network Control	Introduce a new real-time situational awareness capability which gives Control Centre operators a better understanding of changing network limitations, leading to more efficient risk-based operation.	1	A1.3 Transform Network Control
180 Enhanced Balancing Capability	Deliver the Open Balancing Platform as the foundation for our future balancing capabilities.	1	A1.2 Enhanced Balancing Capability
220 Data and Analytics Platform (DAP)	Provide a primary source of data for analysis and publication, improving data accessibility and transparency for stakeholders.	1	A1.4 Control Centre Architecture
250 Digital Engagement Platform (DEP)	Create a single point of access into our systems and external facing processes, with secure, open access and visualisation of content and data.	1	A17 Open Data and Transparency
340 RDP Implementation and Extension	Establish an integrated data exchange and situational awareness capability with DSOs, enabling coordinated access to Distributed Energy Resources (DER) and management of service conflicts.	3	A15.5 Develop Regional Development Programmes (RDPs)
380 Connections Platform	Digitise the connection application process, introducing efficiencies and automation for us and our customers.	3	A14.4 Facilitate development of the customer connections portal A14.3 Further enhance the customer connections experience, including broader support for smaller parties
400 Single Markets Platform	Deliver an enhanced experience to market participants for their end-to-end processes and implement changes for new market services.	2	A4.3 Deliver an efficient frequency market A4.4 Deliver a single integrated platform for ESO markets
420 Auction Capability	Unlock more efficient auction-based procurement activities and facilitate closer to real-time procurement, whilst co-optimising across our products.	2	A4.3 Deliver an efficient frequency market

[49] Please see **Annex 2 – Cost-Benefit Analysis** for the details of our cost benefit analyses.

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The technology choices we are making in RIIO-2 will deliver flexibility and create value for customers beyond 2026. Modular solutions, built from discrete building blocks, will allow features and functionality to roll in and out of service as required. Integration technologies (such as Application Programming Interfaces) will minimise disruption as we transition from legacy to new solutions. By investing in flexible systems and tools now, we are avoiding monolithic system upgrades and dependencies on solutions which have single use cases. These choices drive spending in RIIO-2 but will allow us to align with our customers' IT platforms and rapidly deliver incremental change in the long term.

More information about our BP2 submissions for data can be found under our Role 1 activities in **Transparency, Data and Analytics (A17, A19)**. Our latest Digitalisation Strategy and Action Plan[50], published in June 2022, contains our strategic plans for digitalisation.

9.2 Delivering our plans

We are adopting new ways of working to make our delivery more agile, break down the silos in our organisation and speed up the delivery of value. These include:

- transitioning from a project-focused approach to a product model of delivery,
- bringing our business operations and technology teams closer together in closer together into a single community, with clear sponsors and product managers.
- adopting a customer-centric view and standardised ways of working with our technology customers, and
- using both agile and waterfall delivery methods, as appropriate for each of our investments.

The organisational and cultural changes required to transform our delivery approaches are on a maturity journey. We are confident in the direction we are taking and have set a realistic timescale to drive the change. Starting with prioritising the rollout of new ways of working to the programmes where their adoption will have the biggest benefit for consumers.

We continue to evolve our digital, data and technology operating model and organisational structure to effectively deliver our BP1. Since BP1, we have recruited key leadership roles, which are directly accountable to the ESO, in the technology team for cyber-security (CISO) and data (Head of Data). We are focusing on building capabilities in data science, data engineering, architecture, business analysis and software engineering. Our plans for upskilling, recruiting and retaining our people are outlined in **Chapter 11 People, Culture and Capability**.

Our overarching aims for technology transformation in BP2 are unchanged since BP1 However, there have been changes in IT investment timescales and milestones due to delivery challenges and external factors. Please see **Annex 4 – Digital, Data and Technology** for detailed BP2 delivery plans.

[50] https://www.nationalgrideso.com/document/262371/download

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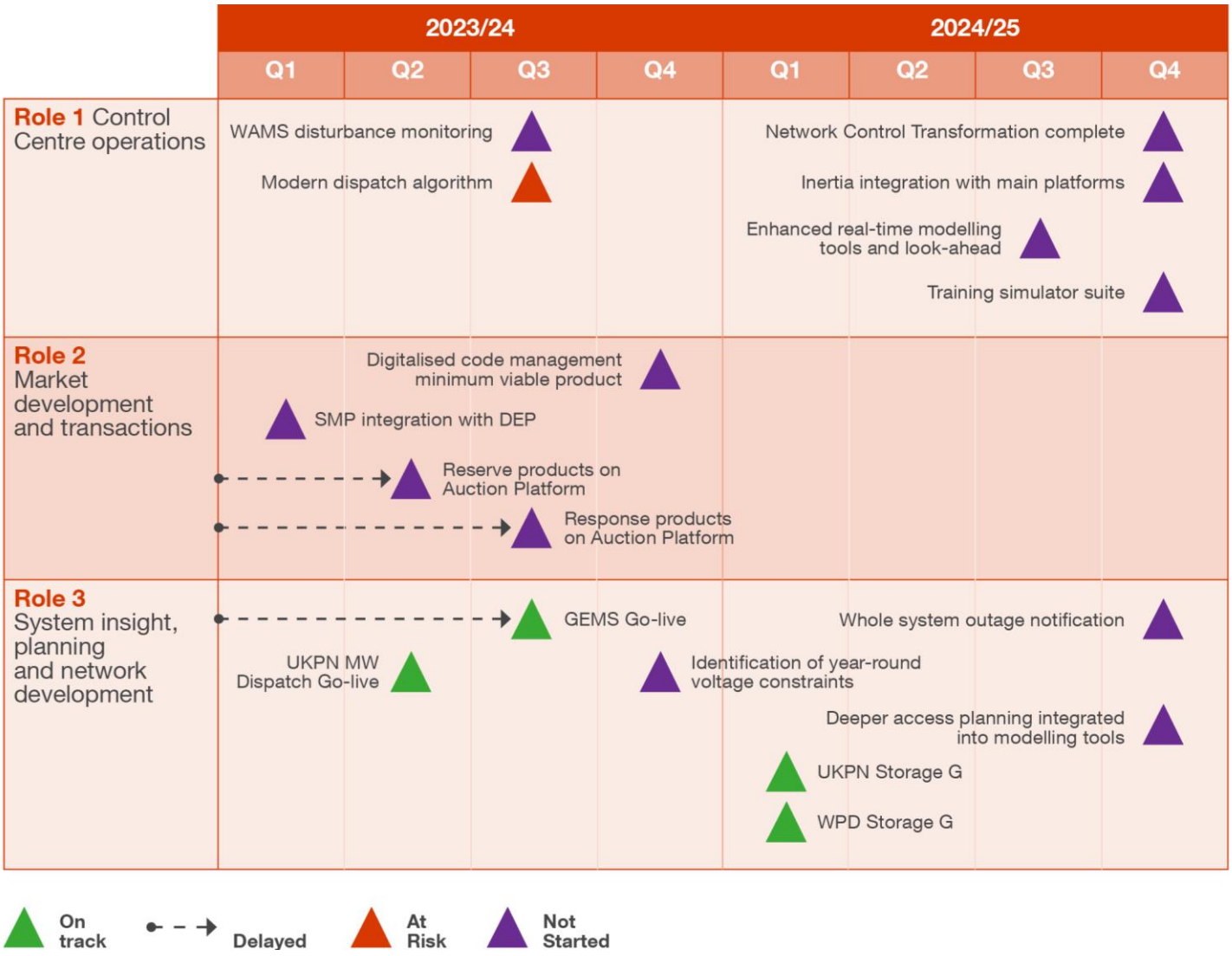


Figure 31: Some of the key milestones for our technology delivery in BP2.

9.3 Our technology cost estimates

The total cost estimate for our 33 IT investments has changed from £407 million to £556 million, an increase of £149 million (37 per cent) since BP1. This change is mostly driven by an overall increase in the scope of our investments which has materialised as we have refined our assumptions about requirements. Our technology running costs have also increased from £50 million to £83 million. Our indirect technology costs (those which are shared between National Grid Group functions) remain as presented in our BP1 submission.

Our portfolio-level cost drivers are summarised below and cost drivers for each investment can be found in **Annex 4 – Digital, Data and Technology.**

Accelerated drive to zero carbon operation Accelerating the pace and complexity of some investments and leading to new requirements in others. For example, higher volume of regulatory changes in Charging and Billing space **(~£11m)**.	Total impact of cost driver on portfolio: **£12m**
Systems or assets requiring unexpected spend Systems or assets have become obsolete faster than expected or have become unsupported, bringing forward spend or leading to new spend. For example, we need to replace our Frequency and Time Error (FATE) system due to loss of support by the vendor **(~£2m)**.	Total impact of cost driver on portfolio: **£2m**
Rapid development and deployment of new technology Leading to the need to productionise and integrate a higher volume of tools than anticipated. For example, the initial phases of the Data and Analytics Platform development has identified the need for investment in Grey IT **(~£6m)**.	Total impact of cost driver on portfolio: **£6m**
Increase of cyber-security threats Adding new scope to protect against malware. For example, we have included costs for cyber resilience in our Network Control investment to align with the latest cyber-security intelligence for CNI **(~£9m)**.	Total impact of cost driver on portfolio: **£9m**
Technology market exposure Leading to the refinement of our cost assumptions. For example, vendor quotes for auction capability investment were higher than anticipated **(~£1m)**.	Total impact of cost driver on portfolio: **£9m**
Evolved or refined scope since BP1 Scope assumptions have proven to be incorrect and/or scope has been added or removed from investments. For example, ancillary service reform was expected to be mostly completed in RIIO-1, as it continued into RIIO-2 for longer than anticipated, the scope of the Single Markets Platform investment increased **(~£20m)**; scope relating to whole energy system has been removed from RDP investments and is now tracked as a scope risk **(~ -£10m)**.	Total impact of extra scope: **£177m** Total impact of removed scope: **-£52m**
Efficiencies We have found ways to deliver the same scope at lower cost. For example, the platform component of the Single Markets Platform investments is being delivered at a lower cost than forecasted at BP1 **(~ -£4m)**.	Total impact of cost driver on portfolio: **-£14m**

Figure 32: Our portfolio-level cost drivers

Chapter 9 - Digital, Data and Technology

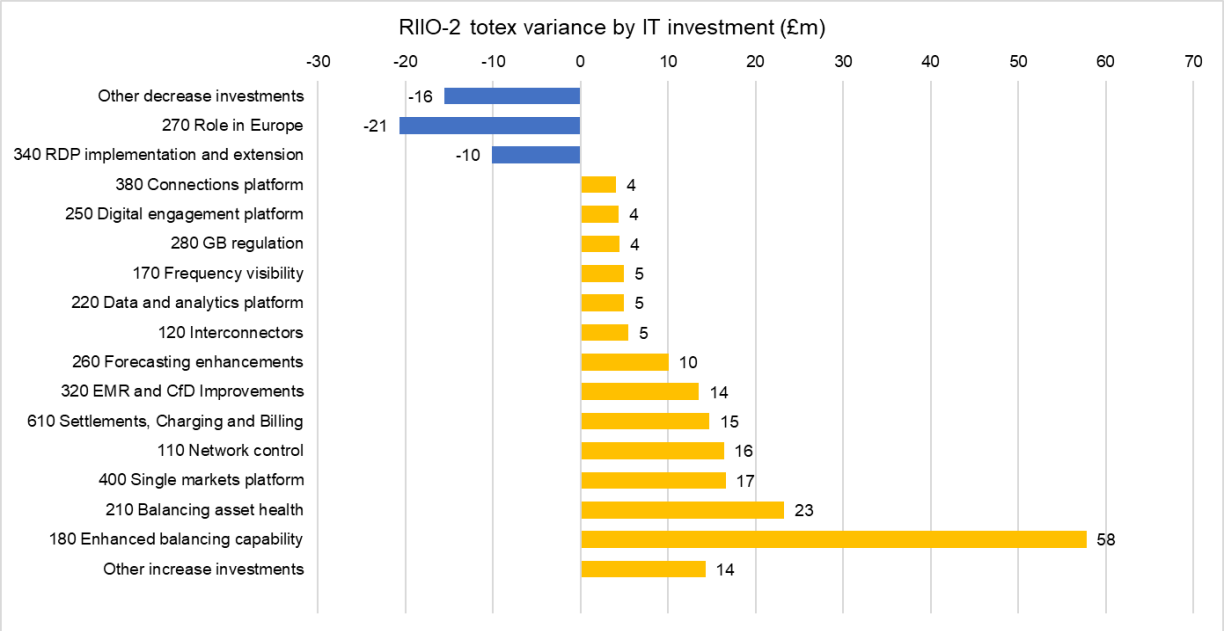


Figure 33: A summary of the changes in our estimates for technology totex since BP1.

Further changes to the scope of some of our IT investments is likely as projects continue to mature and we therefore expect that our cost estimates, and outcome expenditure, may need to be adjusted again. In line with our proposed enhanced engagement approach (see 9.4.1 below), we will update Ofgem and, where relevant, other industry stakeholders should such changes arise.

9.3.1 Cost efficiency

Our use of competitive procurement and sourcing strategies drives cost efficiency. We competitively procure around 45 per cent of spend on RIIO-2 platform technologies, using a varied sourcing model in which we:

- *Procure* – where the market offers the technology we need at an efficient cost.
- *Select* – where we need a commodity service, through existing National Grid Group contracts.
- *Build* – where we require niche and/or bespoke solutions that are not available from the market or National Grid Group.

We use external technology partners and offshoring to benchmark and constrain costs. To secure best value from our partner frameworks we operate mini tenders which ensure fair competition and provide opportunities for suppliers to demonstrate value to us.

9.3.2 Cost assurance

Our BP2 cost estimates have been scrutinised through a portfolio-wide deliverability assessment. We reviewed all plans across the whole portfolio to identify key dependencies and risks. Our roadmaps, milestones and costs were then adjusted accordingly. More information about this exercise can be found in the **Chapter 13: Deliverability of BP2** chapter.

PriceWaterhouseCoopers (PWC) carried out an external assurance on 26 of our technology investments which included, among others, Enhanced Balancing Capability, DEP and Network Control. They assessed the estimates for these investments based on eight criteria, such as delivery plans, reliability of data sources, and estimation approach. A current confidence level and expected confidence level was assessed for each of the investments in scope, using a rating scale of 1 (low) to 5 (high).

Our key findings of the assessment was that investments are within a reasonable tolerance of the level of cost confidence/certainty we would expect based on their stage of delivery. Most of the investments are in their definition phase, or in the early stages of delivery, where the level of maturity or certainty in cost forecasts is expected to be 3 or under. Some examples of areas of strengths that were established are:

- Costs are specified to a granular level of detail, with “bottom-up” costing.
- Costs are based on a clear scope and roadmap and have received a degree of challenge internally.
- Costs models include expected cost categories with a clear rationale provided as to how costs have been arrived at.

We also found areas where there were opportunities to further strengthen cost estimates as projects move through their lifecycle stages. They were mainly focused on:

- stronger audit trails between forecasts and plans
- standardised cost models and approaches across all investments
- integrated portfolio assurance, Quality Assurance (QA) and challenge process.

Strengths and opportunities highlighted in the report are built into our current plan through two activities. Firstly, the current implementation of Technology Business Management (TBM) across the investments will ensure the standardisation and granularity of cost estimates. Secondly, through a focused

team looking at portfolio assurance we will further strengthen the control and monitoring of programme delivery.

9.4 Transforming under uncertainty

It is hard to predict what our energy system will look like in the future, but we know that the scale and pace of change will increase. We must be ready to meet future industry and regulatory requirements, so our technology cannot stand still. Energy markets and regulation have continued to evolve since the beginning of our RIIO-2 technology transformation, and we have had to adapt our plans for new cyber malware threats and faster adoption of wider access. Accommodating this unforeseen change has slowed some of our activities to transform, but it was the right choice for consumers.

The scope and costs of our investments can be impacted by uncertainty in markets, regulation and technology. The investments which are most exposed to uncertainty are those with requirements that are unique to our role as the Electricity System Operator for Great Britain, such as the Balancing and Regional Development Programmes. Some examples of the uncertainties we are facing include:

- **Ancillary services reform:** Ancillary services are undergoing a wholesale reform (**A4.6**) and this makes it difficult to forecast the costs of implementing new services. We must make assumptions about the requirements of new services, and if these assumptions do not materialise this can have a significant impact on our scope and cost estimates. Ancillary services that need to be dispatched in the Control Centre have higher costs than those that don't, since they require new logic in our balancing and situational awareness tools, new communication links with market participants and data integration with settlements systems.
- **Changes in EU and Great Britain's regulation and in Connection and Use of System Codes (CUSC):** The accuracy of our cost forecasts depends upon having a mature understanding of upcoming legal changes and their impacts on our processes and systems. We had planned to introduce day-ahead auctions for new response and reserve services in our transformed systems, but due to the Clean Energy Package regulation we had to include this type of auction for one of our legacy services in our legacy systems, therefore increasing the costs of the associated investment.
- **Radical technology change:** We use our **450** Future Innovation Productionisation investment to investigate technology change from our innovation pipeline. We provide early technical guidance on integration with our technology estate to innovation projects, but the level of change required to processes and systems can only be fully understood once recommendations are made and accepted by industry stakeholders. The Distributed ReStart project was originally planned to complete during the first year of RIIO-2 with its recommendations flowing into the **510** Restoration Decision Support Tool investment, ahead of implementation. The Distributed ReStart project is now expected to complete in spring 2023 to allow for further investigation, which may lead to scope changes for **510**.

The extent of change to our BP1 cost estimates reflects the difficulty of accurately forecasting the scope and cost of technology projects in a rapidly evolving industry. Though based on the best information available at the time, the assumptions used and the value of past experiences have turned out to be less applicable than anticipated. We also excluded cost items relating to system maintenance and updates because our plans for transitioning between existing and future systems were not fully scoped. The cost assurance exercise undertaken by Gartner for our BP1 costs was based on the same high-level assumptions and therefore also contained a lot of uncertainty.

While we are confident our BP2 cost estimates are much more robust, given the potential for additional changes in scope to reflect the evolving needs of our stakeholders, it is necessary to increase the level of transparency around projects as they mature. We propose an approach specifically for this purpose in the next section, with more detail contained in **Annex 4 – Digital, Data and Technology**.

9.4.1 Increasing transparency

We will increase cost transparency in BP2 to help Ofgem and stakeholders understand how and why our costs evolve. The Technology Business Management (TBM) data model created alongside our BP2 submission provides a consistent and detailed view of our technology costs, which we will continue to develop and maintain. Currently our TBM data model is based on a forecast-only view, which we intend to mature into an actuals-driven "Bill of IT" view in the coming months.

Our focus on cost management and transparency, which is detailed in **Annex 4 – Digital, Data and Technology**, aims to achieve three strategic outcomes:

1. **Demonstrating the value of technology:** providing our business sponsors and technology leadership with transparent views on the Bill of IT.
2. **Delivering regulatory compliance:** using TBM to provide cost transparency data in our reporting to Ofgem.
3. **Improving our portfolio practice:** growing the skills of our people and enhancing our TBM and cost estimation processes through dedicated cost management tools.

We have also proposed enhanced regulatory reporting on our technology portfolio between Business Plans, which will include more information about risks and uncertainties. Our proposals for enhanced regulatory reporting are detailed in **Annex 4 – Digital, Data and Technology**.

For our largest delivery programmes, we will also grow our stakeholder engagement activities. Engagement with industry is vital for validating the requirements for our bespoke technology investments. The Balancing Programme has already set out a schedule of quarterly engagement with industry to maintain a co-created roadmap (see **A1.2**). We will continue to use our Technology Advisory Council to obtain stakeholders' input into the design of new systems.

9.4.2 Transitioning to the Future System Operator

The technology transformation we are delivering in RIIO-2 is essential to becoming the Future System Operator. We are investing in systems and tools that will deliver foundational capabilities for driving net zero outcomes, focusing on competition and innovation, and taking a whole energy systems approach. However, the transition to becoming Future System Operator is still uncertain, and it may impact our BP2 submissions for technology transformation. Further work on mapping the detailed dependencies between our BP2 technology plans and the Future System Operator transition will follow in late 2022.

Figure 34 – increasing cost transparency in BP2.

Chapter 10

Innovation

Chapter 10 – Innovation

10.1 Innovation in ESO

RIIO-2 is a critical period for achieving Great Britain's net zero targets. Our position at the heart of the energy system means we have an important role to play in enabling and accelerating innovation in the entire sector. In its RIIO-2 Final Determinations, Ofgem also set clear expectations for us in this role.[51] **Annex 1 – Supporting Information** provides an overview of our innovation process, stakeholder engagement activities and outputs.

In this chapter we describe how our innovation activities have changed since we developed BP1, and we set out our current priorities for innovation. We then elaborate on our activities and funding proposals under:

- the Network Innovation Allowance (NIA),
- the Strategic Innovation Fund (SIF), which replaces the Network Innovation Competition (NIC), and
- our Virtual Energy System (VirtualES) programme.

10.2 Stakeholder feedback

In response to the consultation on our draft plan, the Performance Panel set out that they would like more detail on our innovation proposals, and we have provided further information within our plan and in **Annex 1 – Supporting Information**. Other stakeholders articulated that they would like to work collaboratively with the ESO on innovation projects and priorities. We agree that this is important and believe that projects where we partner with other parties are only likely to increase as we address more whole system challenges. We will also continue to provide opportunities for stakeholders to engage in our annual innovation priority refresh.

For further information on our responses to this feedback and other queries please see **Annex 3 – Stakeholder Engagement**.

Innovation Priorities 2022/2023

Our innovation priorities for 2022/2023, and their rationale for inclusion, are listed in figure 35.

[51] Ofgem (2021) RIIO-2 Final Determinations – ESO Annex. "… we need [the ESO] be proactive, forward-looking, and ambitious. We also need it to work closely with other industry parties and wider stakeholders to ensure there is a coordinated, whole system approach to solving energy system challenges. Finally, we need the ESO to be agile and ready to adapt to emerging issues." (para 1.5), "Our overall approach to the ESO's incentives and price control design recognises that much greater value is drawn from the ESO's delivery of wider energy system outcomes, than from achieving efficiencies within its internal expenditure. The introduction of a pass-through funding approach, supported by incentives to deliver value for money, will enable the ESO to be agile and adapt quickly as the pathway to Net Zero evolves." (para 1.8), and when consumer protection through DIWE disallowance is introduced, Ofgem reminds that "[the] focus is encouraging the ESO to maximise overall benefits for consumers rather than driving efficiencies in its totex" (para 4.47).

Figure 35: Our innovation priorities for 2022/23

Our innovation priorities for 2022/23

Our innovation priorities highlight what challenges we are looking to help solve and all project proposals must demonstrate that they address one or more priorities. The specific challenges that we expect to address under each role are summarised in the NIA section below.

Order	22/23 Priority	21/22 Priority	Rationale
1	Zero Carbon Transition	⊕	New priority: focused on how the ESO will be ready to tackle issues such as the potential effect of climate change, and how to enable and encourage the operation of a decarbonised energy system. It will capture projects to improve how we monitor/track carbon in ENCC (Electricity National Control Centre) operations and markets etc, make sure the system is resilient enough to deal with the effects of climate change, and increase the ESO's expertise and capacity to help deliver a zero carbon power system.
2	Digital & Data Transformation	↓	Remains a top priority as a key enabler of the energy system transition, and supporting solutions for the other priority challenges. Addition of 'Data' to ensure this priority reflects the type and quantity of new information being shared, as well as the process to digitalise how we operate.
3	Future Markets	↓	Remains a top priority as a key enabler for unlocking greater competition and flexibility in the system.
4	Constraint Management	↓	Still a key challenge for the ESO, more opportunities remain for innovation projects to help address the challenge.
5	System Stability	⊖	Remains a priority based on feedback from the business, and as indicated by the significant level of innovation activity towards this last year.
6	Whole Energy System	↓	A lot of research and insight have already been gained, the development and testing of new ways to optimise between vectors will remain a focus.
7	Whole Electricity System	⊖	More progress has been made on integration between ESO and DSO operations (e.g. through ENA (Energy Networks Association) workgroups and RDP (Regional Development Plans).
–	Forecasting of Supply and Demand	✓	Many prior innovation projects have addressed this issue, and next steps are focused on improving source data (part of BAU activities).
–	System Restoration	✓	This priority will be paused while we await further implementation of the Distributed ReStart project and outputs of the new ESRS (Electricity System Restoration Standard) work. This will help us better understand how innovation can contribute to solving this challenge in future.

Key:

↑ Increase in priority ↓ Decrease in priority ⊖ Priority level unchanged ✓ Complete ⊕ Added this year

We will use the innovation priorities given above to guide the content and volume of innovation activity in BP2. This is reflected in the descriptions of expected innovation activity by Role presented in the next section.

Innovation activity in BP2

The table below shows a summary of the expected outcomes of our innovation activity in BP2 under each of our Roles. More detailed information can be found in **Annex 1 – Supporting Information**.

Roles	Expectations
Role 1 – Control Centre Operations	We will continue to integrate advanced machine learning techniques and automation to help prepare our Control Centre for the energy system transition. VirtualES and its component modelling and simulation scenarios will form a key component of Role 1 activities. We will continue to understand the influence of future changing weather patterns on system operation. The investment in NIA projects in Role 1 will increase significantly as our newly appointed Role 1 Innovation Business Partner sources and develops new ideas and addresses a backlog of initial proposals.
Role 2 – Market Development and Transactions	We will investigate how future markets will facilitate increasing levels of competition and a greater variety of participants in the energy system. We will further explore the role of the consumer within our markets with the associated development of demand response products. We will create market "sandboxes" that allow us to acquire and test new products and services (in limited quantities) from non-traditional resources, informing future product decisions. Our market simulators will support market reform, allowing us to explore nodal pricing scenarios to ensure the most up-to-date projections and benefits. Research will support the development of a 2035 cross-border strategy.
Role 3 – System Insight, Planning and Network Development	We will continue to play a central role in innovation across networks. Including across the electricity Transmission–Distribution interface and in the interaction between electricity and gas networks (for example, through hydrogen). Machine learning techniques and new data will be used to power our models. We will explore ways to achieve comprehensive system analysis that allows for whole system simulations close to real-time. Constraint management will continue to be an important focus for innovation.

Table 11: Outcomes of our innovation activity in BP2

10.3 Network Innovation Allowance (NIA)

The NIA funding mechanism[52] is the best resource available to us and other network licensees to fund uncertain and risky activities, and to allow us to respond to emerging challenges.[53] NIA has enabled us to support early stage, higher-risk activities to better understand, de-risk, and scale new solutions faster and more effectively than would otherwise be possible with other funding sources.

NIA spend forecast

Following an initial BP1 request of £50m NIA for RIIO-2, Ofgem awarded us:

– £20.7m of NIA,

[52] To ensure NIA funding is used correctly we follow Ofgem's NIA governance conditions and ENA's benefit tracking protocols (e.g. Innovation Scorecard) as well as our own robust processes, as described in **Annex 1 – Supporting Information**.

[53] Without dedicated funding available outside of the Business Plan process, progress towards net zero would be severely diminished. This was acknowledged by Ofgem in their RIIO-2 NIA Governance document: "1.4. […] certain innovation Projects are speculative in nature and yield uncertain commercial returns. In addition, where benefits are linked to the decarbonisation of the network or addressing consumer vulnerability, it may be difficult to commercialise the respective social, carbon and/or environmental benefits and shareholders may be unwilling to speculate on such Projects. This additional funding is designed to underpin the ethos, internal structures and third-party contracts that facilitate innovation." https://protect-eu.mimecast.com/s/0nIjCDRwMFQAqWOfWU7dn?domain=urldefense.com. We provide more detail on NIA funded innovation in BP1 in Annex 1 – Supporting Information.

- plus a required 10 per cent contribution funded through totex pass-through costs,
- totalling an overall allowance of £23m.

Ofgem agreed that we could ask for additional funding for years three to five of RIIO-2 by showing progress, providing more details of planned innovation activity, and evidencing how these activities build upon our wider Business Plan.

We still believe our initial assessment of £50m for RIIO-2 is consistent with the size of the opportunity we face and our ability to deliver against it. Less than this amount would limit the amount of value we can add at a critical time for the energy system in Great Britain. As such, we believe our innovation activities for years three to five of the RIIO-2 period require a minimum additional NIA funding of £24m (totalling the £50m contained in the original RIIO-2 request).

We have attempted to predict the scale of innovation activities in the BP2 period against each of our three Roles. These predictions reflect the longer-term strategies for each Role, as well as the outcomes from current BP1 projects, which are due to be implemented but could be developed further in BP2.

Various cost drivers have led us to forecast annual spend of approximately **£11.5m in 23/24 and 24/25 and a larger spend of £16m in 25/26** to deliver and embed a larger share of mature-stage projects. This is shown in figure 36 below and results in a **total NIA spend of over £50 million over the RIIO-2 period**.

Expected annual NIA investment (£)

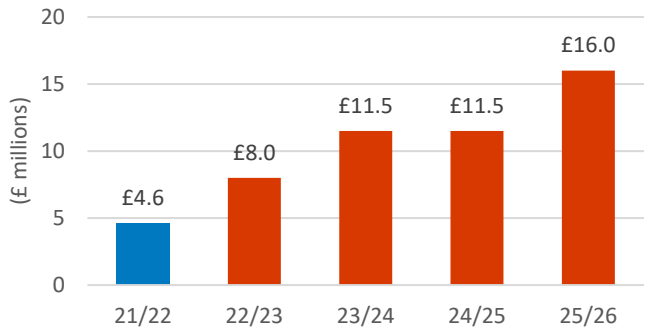


Figure 36: Forecast NIA spend profile across RIIO-2

The main drivers of the NIA portfolio cost increases year-on-year are:

- Delays in initiating new projects in the first year of RIIO-2, compared to a now accelerating pace of new proposal approval and project contract agreements.
- Costs are now ramping up quickly, as new projects start before ongoing ones are completed.
- The portfolio will increasingly consist of more mature, higher Technology Readiness Level (TRL) projects; since development and demonstration projects, which typically require more investment, will follow on from the smaller, research-type projects initiated closer to the start of RIIO2.
- Higher quotes are being received from potential partners and suppliers because of the higher cost of living combined with a recruitment squeeze across the industry.

We anticipate an average of five new projects starting each quarter, reaching a peak of approximately 50 live projects at any one time.[54]Our NIA spend profile is based on a conservative assumption of ten proposals approved and five project registrations each quarter. Typical innovation project durations and costs are described in **Annex 1 – Supporting Information**.

Since our understanding of energy system challenges is constantly shifting, innovation activities must adapt and refocus each year to take advantage of the latest research and technology. Innovation is inherently uncertain, so funding must be flexible. The NIA funding mechanism was designed to support the type of activities which are difficult to plan accurately in advance[55]. For this reason, we rely on trends in the current portfolio to anticipate future activity levels. We also use our most recent innovation strategy to attach indicative spend profiles against each challenge we believe will require continued support from innovation.

Indicative NIA spend profile (RIIO-2)

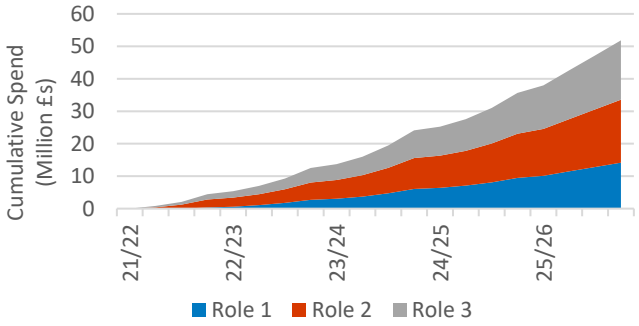


Figure 37: Indicative NIA investment profiles against each of our Roles

10.4 Strategic Innovation Fund (SIF)

The SIF mechanism offers an alternative to fund specific larger, long-term projects, replacing Network Innovation Competition (NIC) funding. In addition to projects that we have been developing with our partners since the start of the RIIO-2 period, we have seen a significant increase in third-party requests for us to join and/or lead collaborative projects[56]. Calls for ideas as part of the SIF process,

[54] Please note that (1) this does not account for additional growth in collaborative projects (where we partner on other network-led NIA projects); and (2) the total NIA spend could increase as DNOs begin their RIIO-ED2 price control.

[55] If further certainty was available, innovation projects would arguably be better suited for business-as-usual in the Business Plan and therefore not meet the conditions of NIA funding.

[56] This is partly due to the SIF requirement to support each project proposal with at least two different types of network licensees.

particularly the 'whole system' challenge[57], saw us receive more proposals than we currently have the capability to process within a short timeframe. For instance, in the final two weeks of our application window, we received 43 Discovery phase proposals from third parties, which we had to review, in addition to progressing our existing proposals. This has put significant strain on our Innovation team and SMEs.

We submitted two proposals and supported a further nine from other networks for the first SIF Discovery phase window in late 2021.

We plan to grow the Innovation team further throughout 2022 to support the application windows for Discovery and phase challenges. We also expect a further increase in project requests when SIF availability is extended to the DNOs as part of RIIO-ED2. Our expansion plans are based on our resource management experiences from 2021, where each application to SIF took an estimated 60 person-days to complete, and an expectation of multiple coincident Discovery/Alpha/Beta windows throughout the year.

10.5 Virtual Energy System (VirtualES)

The national Digital Twin programme has set out proposals for the development of an ecosystem of digital twins representing the built environment in the United Kingdom. The ambition of the VirtualES is to bring together all industry stakeholders across all fuel types and all voltage and pressure levels. It will facilitate the secure and resilient sharing of energy data across organisational and sector boundaries, enable more advanced scenario modelling and whole system decision-making. Through this, the VirtualES will facilitate better outcomes for society, the economy, and environment, while also providing the level of system visibility that will unlock innovation across the industry. We have initiated the VirtualES in BP1 and are leading this ambitious programme, supported by extensive stakeholder engagement in two focus areas:

- **Creating a common framework and principles for industry**. We originally applied for SIF funding in this area, however after a successful Discovery phase it was deemed unsuitable for the next round of funding (Alpha). The project was declined funding on the basis that the deliverables did not have a clearly articulated route to production and would benefit from smaller trials. We intend to act on this feedback and are developing a separate demonstrator project, for the common framework workstream, that continues at pace and has clear deliverables. This is currently being considered for NIA funding. During the delivery of this project, we will ensure that the value of the activity is clear and that next steps are identified for implementation. Further information on our approach is set in our VirtualES programme update[58]
- **Developing use-case projects to test new applications and prove the benefits of a VirtualES**. This will continue to be funded through a combination of NIA (for the feasibility studies and initial models) and SIF (e.g., the Crowflex programme of work was advanced into Alpha phase and will ultimately provide data to VirtualES on consumer flexibility). The VirtualES will be a replica of the entire energy system in Great Britain. As such, we will not develop or own the components. This raises the challenge of agreeing with stakeholders which use cases to build and how to prioritise them to deliver whole system value. While the programme develops in maturity, we are leading by example with three initial use case projects. These projects build out high-value areas of the VirtualES and generate learnings for future use case projects. Examples of key current use cases by Role can be found in **Annex 1 – Supporting Information.**

We consider totex funding as the most appropriate funding model for the **large amount of stakeholder engagement and facilitation** we need to do as part of the VirtualES programme. The whole sector will eventually be impacted by the VirtualES and so we must have the appropriate level of input into its development, with supporting governance to navigate the broad range of opinions available.

What do we need to deliver our innovation activity?

Increasing demands resulting from the new SIF process[59] and our newly conceived VirtualES programme[60] have resulted in a greater need for resources and support. Similarly, our central leading role in the GB energy system has meant that we are increasingly being asked to participate in and enable innovation activities led by others. Consequently, we have seen the growth of new projects in the pipeline outpace our team's growth in BP1. This is a clear indication of how the team has successfully started to unlock the true potential for innovation in the business and the industry. Delivery of this increased innovation activity requires a £3m increase in totex and an additional 14 FTEs to deliver the VirtualES programme. We will continue to increase our innovation activity in BP2, in line with our strategic innovation priorities, to focus funding towards solving the challenges where innovation can make the greatest positive impact

[57] These SIF 'whole system' projects aim to support innovation which benefits the wider system (and not the ESO directly). They need to be prioritised alongside our existing BAU and NIA-funded innovation activities.

58 ESO VirtualES Programme Strategy Update – August 22: https://www.nationalgrideso.com/document/266076/download

59 https://www.ofgem.gov.uk/energy-policy-and-regulation/policy-and-regulatory-programmes/network-price-controls-2021-2028-riio-2/network-price-controls-2021-2028-riio-2-riio-2-network-innovation-funding/strategic-innovation-fund-sif

[60] https://www.nationalgrideso.com/virtual-energy-system

Chapter 11

People, capability and culture

Chapter 11 – People, capability and culture

People are at the heart of our organisation and achieving our ESO mission will require us to build upon our already talented and diverse workforce, evolving and growing so we can overcome challenges on the path to net zero. This is reflected in a new ambition to be the net zero employer of choice. To successfully deliver our Business Plan we require the right people with the right capabilities. We need to have an agile approach to sourcing and we need to attract, retain, develop, motivate and engage our people to successfully tackle the challenges and maximise the opportunities presented by the energy transition. At the same time, we will further develop the culture of our organisation to be ever more purpose-driven, where our people relate to our goals and are passionate about achieving them because they align with their own beliefs and aspirations for a clean energy future.

11.1 People and capability trends

The most impactful people trend since the submission of BP1 has been the pandemic, which has challenged and changed traditional ways of working. This has also led to the phenomena of "The Great Resignation". After an extended period of working from home, many people have decided they want to make a change in their work-life balance. We will continue to adapt to colleague (and prospective employee) needs by offering a range of flexible working options. Our attraction and retention strategies must reflect the fact that expectations have changed. To keep and attract new employees we need to give stronger consideration to things such as their work-life balance, health and wellbeing. We need to continue to develop a diverse workforce that fosters inclusivity and a sense of belonging, both of which have a positive impact on wellbeing and engagement. Increasing diversity will ensure we represent the communities we serve as well as enabling greater creativity and problem solving.

The energy sector is growing and the market for talent is increasingly competitive. We need to ensure we keep abreast of best practice across all elements of the employee life cycle.

11.2 Drivers for our growth agenda in BP2

We are continuing with our growth agenda and look to grow the business by another 200 FTE during the last year of BP1, and then an additional 100 FTE during BP2.

The main drivers for the growth in BP2 are:

- ***Role 1*** – increases in headcount to support the greater scope of subject matter experts required to deliver the major programmes (Balancing Programme and Network Control).
- ***Role 2*** – additional headcount needed for new activities (Role in Europe and Net Zero Market Reform), in EMR, and across several BAU activities – mainly to manage the increasing volumes in code management.
- ***Role 3*** – increases in headcount are required to deal with more, and increasingly complex, customer connections and to drive our Offshore Coordination, Network Planning Review and Early Competition projects, which were not included in BP1. The headcount for these activities is likely to change as the requirements for the projects are further understood. Additional FTE are also needed to provide increased support for our Regional Development Programmes (RDPs), Network Services Procurement (Pathfinders), constraint management forecasting, zero carbon activities and electric vehicle planning.

FTE for RIIO period

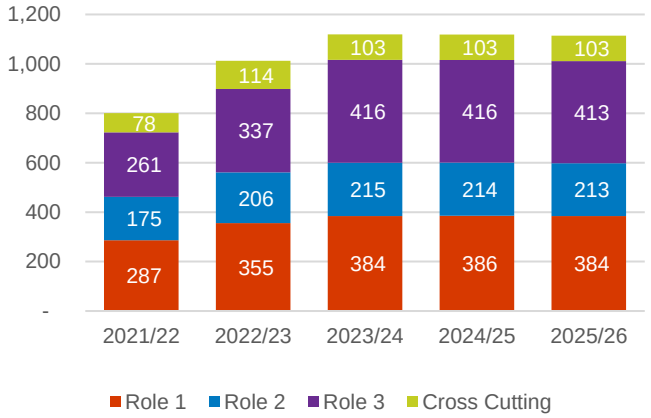


Figure 38: FTE for RIIO-2

11.3 Stakeholder feedback

We heard from both our ERSG, and through consultation feedback on our draft plan, about the importance of attracting and retaining a skilled workforce to deliver on our plan commitments and realise our ambition to become net zero employer of choice. For this final BP2 submission we set out more clearly our people plan for BP2 in the section below.

For further information on stakeholder feedback received please see **Annex 3 – Stakeholder Engagement.**

11.4 Our people plan for BP2

The approach we will take to ensuring we have the right people, in the right place, at the right time, is as follows:

5. **Undertake long-term strategic workforce planning (SWP) to understand our future resource needs**

The starting point for planning our workforce is building a strategic workforce plan. This provides the foundation for forecasting the supply and demand of people, skills and capabilities needed for the future. Building this picture of our future workforce needs, and keeping it up to date, will be critical to ensuring we can be agile and adapt our requirements dependent on business need and respond to how the employment market evolves.

6. **Undertake capability gap analysis to monitor ongoing and future needs**

We will build on the work we have done during BP1 in this space. We have recently conducted a capability diagnostic and confirmed that we need to grow and develop the following core capabilities:

- ***Power System Engineering*** – In addition to the capabilities related to the onshore electricity transmission networks, we need to develop our knowledge, skills and experience to meet the challenges of whole electricity system operation including the expansion of offshore networks. This requires engineers with a niche skillset which we have not sourced before.
- ***Data and analytics*** – Improving data skills is essential to make best use of all available data to maintain system security and stability. This will also be required to successfully drive innovation.
- ***Commerciality*** – Continuing to ensure the needs of the power system can be sourced through competitive processes, such as through the effective design of new markets. There is a requirement for novel and strategic thinking, combined with sound understanding of economic modelling, market optimisation and customer strategy to support market design.
- ***Leading the debate*** – Our people will need to employ content expertise, to articulate the wider energy market needs, to be able to influence stakeholders.

7. ***ESO technology*** – The need to digitalise our operations to interact with a rapidly expanding number of market participants and customers continues to grow, requiring continuous investment in a customer-focused digital capability. **Source the required capabilities through a variety of routes.**

Our sourcing strategy identifies the different ways we can plug a capability gap. This will be dependent on the timing, urgency, capability need, value for money, industry benefit and operating constraints. The capability gaps we identify during BP2 will be filled by one of the following sourcing strategies:

Build*:* We will build capability internally by:

- Looking at development at all levels of the organisation, starting with our leaders and the leadership skills required for the future. We will then review the development needs throughout the wider organisation to ensure we identify the capability and skills needed to deliver the energy transition.
- Training existing personnel to obtain the relevant skillsets and/or recruiting graduates and apprentices with related skills for further development. This will include partnering with professional institutions and academia to develop a pipeline of talent. Our new talent programmes are a good example of how we are building the pipeline via our Graduate Development programme, Higher Apprenticeships and our partnership with the Power Academy.
- Using Capability Leads that provide expert guidance on the specific training for each capability identified, and a central portal where all our development/training offerings are held so colleagues have easy access to the development they need. As our capabilities evolve, we will review and refresh the material to ensure the resources are up to date.
- Working with the power sector and other industry partners to understand how we can build capability and workforce resilience. We will build our understanding of potential labour markets we can target to reskill.

Buy**:** we will attract talent using our unique role and purpose to recruit seasoned and experienced individuals. We will recruit based on a passion to be part of the journey to net zero and we will develop our careers website to ensure we appeal to the broadest labour market. We are focusing on our social media platforms to ensure we effectively position ourselves as a net zero employer of choice with a compelling employee value proposition centred around our purpose.

Some of the skills we need are increasingly difficult to source in the UK labour market, so we have initiated some additional activities to address these key skills challenges which will continue in BP2. For example, we are exploring alternative entry routes for experienced hires by looking at “second jobbers” and “career changer” schemes. In addition, we are:

- Refining our university strategy and ‘STEM in Schools’ work to develop a pipeline of future talent and partnership opportunities, including considering the options for the creation of a central hub within the energy industry for innovation, training, webinars, development competitions and discussions.
- Building an alumni network of previous employees who may be interested in returning with knowledge and experience gained elsewhere, or in recommending ESO roles to their wider network, or to enhance cross-industry collaboration.

Borrow**:** Borrow professionals on a fixed time basis through a contractor/consultant role or right-source to a third party.

Bridge**:** Through a hybrid Borrow and Build method, we can use a third-party (i.e., contractor/consultant) workforce to bridge a capability gap, while internal expertise is developed through a managed ‘Build’ period (including strategic secondments with partners). We are exploring this route for our IT recruitment.

Bot**:** Robotic process automation/machine learning is used to improve efficiency and allow employees to direct their attention to more value-adding activities.

We will use clear criteria to evaluate each capability need and then select the appropriate sourcing strategy.

8. **Ensure we recognise and retain our people**

We remain committed to the principle of pay-for-performance and the need to remain competitive in the market. We continue to benchmark our pay and reward package to make sure we reward fairly and competitively as we look to attract talent and find hard-to-source skills. We need to flex our reward arrangements in line with market demands and will look to utilise levers such as retention payments, market supplements and welcome payments to help attract and retain talent.

9. **Building on our great culture**

We have a strong collaborative culture, with exceptionally high employee engagement. In our 2022 employee survey, 90 per cent of our employees said they are proud to work for us, 96 per cent agreed or strongly agreed that they are treated with respect by their manager, and 91 per cent agreed or strongly agreed that their ideas and opinions are valued. We believe our strong sense of purpose helps motivate and engage our colleagues and this remains central to our employee value proposition.

Chapter 11 – People, capability and culture

Specific plans to develop our culture during BP2 include:

Culture evolution: We will be running a culture diagnostic to understand what people like about our current culture as well as what they would want to see change. For example, we understand that we need to be more agile and flexible in the future. This diagnostic work will be used to develop a culture plan and road map, which is particularly relevant and timely as we begin our transformation to the Future System Operator.

Wellbeing: In recent months we have almost doubled the number of wellbeing champions across the business to help raise awareness of topics, facilitate campaigns and share key messages. Managing mental wellbeing in the workplace training has been assigned to all managers to recognise signs and symptoms of poor mental health, and we have also given all our colleagues access to the Thrive: Mental Well-being app which is an accessible platform for users to address any mental health issues.

Focus on diversity, equity, inclusion: Fostering a sense of belonging will continue to be a core area of focus for us. We strive to meet the needs of an increasingly diverse pool of employees and ensure that the organisation benefits from diversity of thought and experiences. To support this, we have established a Belonging Forum, made up of volunteers from around the organisation. The forum aims to understand how much our employees currently feel they belong in the organisation, what the barriers are to a greater sense of belonging, and how we can remove these barriers. The forum is already having an impact and will remain an important part of our approach to listening to and acting upon the voice of our colleagues.

Chapter

12

Enabling activities

Chapter 12 – Enabling activities

12.1 Supporting the delivery of BP2

As outlined in Part A, one of our BP2 priorities is '**Enabling our organisation to perform'**, which is vital for us to deliver on our ambitions.

There are several teams that work across the business rather than being dedicated to one of the Roles. They carry out activities that we refer to as "cross-cutting". These teams are ESO Regulation, People and Capability, ESO Innovation, Business Assurance, Business Change and Customer, Stakeholder and Consumer. We have also created a new team to carry out the Future System Operator programme within BP1 timescales. We have captured the costs of these teams within this chapter, along with more detail about each team's activities and our proposals for the BP2 period. The table and narrative below show the total costs and FTE for these teams.

12.2 Costs

Cross-cutting		BP1			BP2			BP3	
		Actuals	Forecast		Forecast			Forecast	
		2021/22	2022/23	TOTAL (2 years)	2023/24	2024/25	TOTAL (2 years)	2025/26	TOTAL (5 years)
Capex (£m)	BP2 submission	-	-	-	-	-	-	-	-
	Original BP1	-	-	-	-	-	-	-	-
	Variance	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Opex (£m)	BP2 submission	8	8	15	8	8	16	8	**40**
	Original BP1	8	7	15	6	6	13	6	**34**
	Variance	**(1)**	**1**	**(0)**	**2**	**2**	**4**	**2**	**6**
Totex (£m)	**BP2 submission**	**8**	**8**	**15**	**8**	**8**	**16**	**8**	**40**
	Original BP1	**8**	**7**	**15**	**6**	**6**	**13**	**6**	**34**
	Variance	**(1)**	**1**	**(0)**	**2**	**2**	**4**	**2**	**6**
FTE	BP2 submission	78	114		103	103		103	
	Original BP1	63	65		65	64		63	
	Variance	**15**	**49**		**38**	**39**		**40**	

Table 12: Cross-cutting team forecast costs and full-time-equivalent headcount for the five-year RIIO-2 period

The table above shows our forecast costs and full-time-equivalent headcount (FTE) for the five-year RIIO-2 period, comparing the original BP1 to our BP2 submission. Opex costs include all overhead costs.

Over the five-year RIIO-2 period, our proposed spend has increased by £6m, with an additional 40 FTE by the end of FY26. £4m of this increase is driven by the Innovation team due to the increasing demands of the new Strategic Innovation Fund process and our newly conceived Virtual Energy System (VirtualES) programme.

Our proposed forecast spend over the **BP1 period (FY22 and FY23)** is in line with BP1, with FTE increasing by 49. Of these increases:

- 14 FTE are working on the Future System Operator programme and do not impact totex.
- 19 FTE are due to Business Change transferring directly into the ESO from National Grid Group. This has no impact on totex as these costs were previously allocated to the ESO.
- 8 FTE are in the new People and Capability team.
- 7 FTE are in the Assurance team.

Both the People and Capability and Assurance FTE costs were offset in the BP1 period by choosing to resource these services internally rather than use external contractors.

For the BP2 period (FY24 and FY25), our proposed totex request is up £4m, with an additional 39 FTE by the end of FY25.

The key cross-cutting activities driving the BP2 period changes are described below:

Innovation (see Chapter 10 for detail)

- We are proposing a £3m increase in totex and an additional 14 FTE to deliver the VirtualES. This programme brings together stakeholders to create an ecosystem of connected digital twins for the entire energy system of Great Britain. It will facilitate the secure and resilient sharing of energy data across organisational and sector boundaries, enable scenario modelling and whole system decision-making, resulting in better outcomes for society, the economy, and the environment.

Business Change

This team are driving an FTE increase of 25, however there is no cost impact.

- 17 FTE are part of a flexible resource pool that focuses on specific projects. The changes since BP1 are cost-neutral because they include removal of a cost allocation from National Grid Group from where most of these activities had been previously resourced.
- 5 FTE are in the core Business Change team and they operate a business partnering service to support change delivery. The service involves a senior change specialist working closely with management teams to understand each Role-based portfolio.
- There are significant benefits to the revised structure, as delivery support services provided by the Business Change team can be fully tailored to our needs in the BP2 period. For example, recruitment for the flexible resource pool will focus on individuals with experience directly relevant to our activities.
- 3 FTE are in the People and Capability team which reduces from 8 in FY23. This team is key to ensuring we have an agile approach to sourcing the right people with the right capabilities.

The remaining cross-cutting activities – Customer, stakeholder and consumer, Regulation and Business Assurance – do not drive a material change in spend or headcount compared with BP1.

12.3 Customer, Stakeholder and Consumer

The Customer, Stakeholder and Consumer team supports the delivery of our customer experience (CX) strategy and our new consumer strategy. This is driven by our ambition to be a Trusted Partner to all our customers and stakeholders. We use the four elements of the 'trust equation' to measure this:

- Credibility – we provide credible expertise
- Reliability – we deliver our commitments
- Familiarity – we are transparent
- Self Interest – we care about our customers and how our decisions and activities impact them.

The Customer, Stakeholder and Consumer team supports the business to improve performance against these criteria, making sure we give our customers and stakeholders consistent support. This team also:

- manages insight and engagement plans, provides best practice advice, and develops new tools and training to upskill our people.
- delivers the bi-annual customer and stakeholder survey as part of the feedback required by Ofgem.
- co-ordinates stakeholder engagement across the business.
- drives effective use of the customer relationship management (CRM) IT system.

What will we deliver in BP2?

Continuous improvement is key to our CX strategy, as is developing a customer-centric culture where our customers are fully understood and considered consistently by everyone. For BP2, we will continue to work on the areas of focus outlined in BP1, building towards our Trusted Partner ambition.

However, insights collected in BP1 have shown customer expectations and needs are changing, in particular around transparency of decision-making, prioritisation, explaining how project work fits together, and having easier access to the right information.

New activities we will be working on in BP2 include:

- **Insights and feedback**
  - Improvements to how we analyse and act on feedback.
  - Continuing to maximise the benefits of our CRM system to enable greater visibility of how we manage customer and stakeholder interactions.
- **Engagement and communications**
  - Regularly bring customers into our business at all levels to hear the 'customer voice' first-hand and act on it.
  - Demonstrating how we and the Transmission Owners interact in our respective roles and responsibilities, highlighting where support is available.
- **Culture and capabilities**
  - Rolling out a relationship management training programme for all customer-facing teams.
  - Introducing new employee incentives to reward excellent customer work.
  - Embedding the new customer impact assessment work into our projects and processes, so it becomes business as usual.
- **Digital technologies**
  - Transforming our customer digital experience through a Digital Engagement Platform (DEP).
  - Integrating survey data with our CRM system to promote greater business ownership and action.
- **Customer journeys**
  - Understanding customer pain points, linking findings to product development.
- **Performance data and metrics**
  - Improving governance processes to ensure customer issues are acted on quickly.
  - Analysing enquiry and feedback data to identify and resolve root causes and to reduce query volumes.

We will also continue to manage risks associated with the delivery of our customer and stakeholder experience strategy.

12.3.1 Our consumer strategy

Consumers are fundamental to the energy transition. As we move from a centralised to a more decentralised system, consumers will play an important role in the energy system. A key message from *Bridging the Gap to Net Zero*[61] **(A13.4)** is that consumers are part of the solution to develop an efficient decarbonised system. The FES also demonstrates the importance of consumer flexibility in providing a more secure, reliable and cost-effective system.

We need to work with many others to unlock consumer flexibility. In BP1, we've been developing and defining our role in enabling consumers to participate in a decarbonised energy system. We have completed work to better understand the consumer experience and touchpoints throughout the energy ecosystem and mapped out the participants. We have engaged with energy suppliers, aggregators, technology providers, consumer groups, DNOs, academics and others. This work has helped us define our role (see the five focus areas of our consumer strategy below) to enable consumers to participate in and benefit from a flexible energy system which puts their needs at the centre of its design. We know that this landscape will evolve, with new entrants for us to engage with. In BP2 we will continue to work with stakeholders who are developing the products and services that enable seamless consumer participation.

Stakeholder feedback

To provide additional insight and focus as our role with consumers has developed, a consumer sub-group was formed with members of the ERSG. We have listened to feedback regarding our definition of consumers and the approach to improving our understanding of consumers, especially at the edge of the low voltage network, i.e., the point at which domestic consumers connect to the network and electricity reaches homes and businesses. Our definition of the role of consumers has been updated, and now better reflects our understanding of the symbiotic relationship consumers have with the energy system. We are further developing an understanding of consumers through relationships with third parties and their evolving roles, using existing insights and, where there are gaps, collaborating with others to develop new insights.

The ERSG also asked us to plan for the significant mindset shift that we need to make on the theme of consumers and how we expect this to be achieved, both within the organisation and across our many stakeholders. In BP1 we have formed an internal flexibility workstream, providing co-ordination and focus to consumer flexibility activities across the business. We have deepened our consumer understanding and insights to better inform our decision-making through leveraging relationships with industry, consumer groups and academics, industry knowledge share forums and horizon scanning. We will build on and extend our awareness and consumer understanding and continue engagement with stakeholders to identify gaps, and work together to address them, throughout BP2.

To gain wider input and feedback on our role with consumers, we hosted a virtual event[62] as part of our consultation on our draft plan. The aim was to provide context, share the proposed consumer strategy framework, gain feedback on the framework and develop this in more detail. This event was well attended by a mix of stakeholders, including energy suppliers, aggregators, consumer groups, technology providers and BEIS. The framework was well supported and was recognised to contain the right areas of focus. Stakeholders were keen to collaborate with us further to help develop these focus areas. Following on from this, we have started a programme of bilateral engagements with energy suppliers, aggregators, and technology providers to continue these discussions.

What will we deliver in BP2?

Five focus areas provide a framework for our consumer strategy that will be delivered collaboratively in BP2. Three of these areas focus on what outcomes we will drive: *Data, Digitalisation and Insight*; *Energy Markets*; and *Policy and Standards*. The other two areas focus on how we will deliver these: *Awareness*; and *Engagement*.

Figure 39: Five focus areas of consumer strategy

1. Data, digitalisation and insight

We will facilitate two-way sharing of trustworthy data, robust information and insights between participants in the energy ecosystem. This will be delivered via the open data and digital market enablement work (A17 and A19) in our Digitalisation strategy. We will work with stakeholders to understand data requirements and identify dependencies on IT systems to deliver demand-side flexibility at scale. We will drive innovation to support better consumer outcomes in the energy transition, supported by our Innovation strategy. This includes the VirtualES, Crowdflex phase 2 and the development of consumer archetypes (a consistent set of assumptions to integrate with Future Energy Scenario modelling to deepen our understanding of consumer behaviour). The Consumer Strategy team will continue to be involved in the Consumer Interest Representation Advisory

[61] https://www.nationalgrideso.com/future-energy/future-energy-scenarios/bridging-the-gap-to-net-zero

[62] https://players.brightcove.net/867903724001/default_default/index.html?videoId=6307398205112

Group, a Citizens Advice-led project, gathering a wide range of insights which will inform our decisions and activities.

2. **Energy markets**

We will develop energy market mechanisms that enable and incentivise consumer participation and identify interdependencies across markets. We will drive improved consumer insights for market design, ensuring that consumers are central to the design of markets and complementary policies. There will be a focus on supporting energy retailers and aggregators to enable domestic and small business consumer participation in the Balancing Mechanism and unlocking price signals. We will facilitate market access for DER to support a decentralised energy sector with increased volumes of energy resource connecting to distribution networks (**D4.5.3** and **D4.5.4**). The importance of maximising industrial and commercial flexibility will continue through the Power Responsive programme. The Net Zero Market Reform programme (A20), which considers future market design to unlock consumer flexibility, will be underpinned with consumer-focused principles to enable a consumer-centric design.

3. **Policy and standards**

In BP2 we will proactively contribute to discussions on energy and related policies to ensure a fair and flexible system is realised for consumers. We will achieve this by influencing policy makers to make it easy, attractive and beneficial for consumers to change their energy consumption patterns. We will focus on energy efficiency, services and technology (such as smart meters, electric vehicle chargers and heat pumps) that consumers will be using between now and 2035, and ensuring the right policies are in place to incentivise and support consumer confidence and/or mandate the changes necessary to enable a flexible system.

4. **Awareness**

We will build on the existing customer-centric culture across all areas of the business to embed consumer focus within projects, processes and decision-making, creating a deeper understanding of the consumer's role in a low carbon energy system and developing a more consumer-focused approach. In BP1 we provided a consumer focus within the Future Energy Scenarios and Bridging the Gap to Net Zero reports and this will continue in BP2.

5. **Engagement**

We are building a consumer communication and engagement plan to ensure we are working with participants across the energy ecosystem in a structured way. During BP2 there will be significant engagement with ecosystem participants who own the consumer relationship, including suppliers, aggregators, technology providers and consumer groups. We will identify new relationships and continue to develop existing ones with stakeholders and third parties with a consumer focus, leveraging their expertise to collaborate across initiatives and driving consumer participation in the energy market. We must continue working with suppliers and aggregators to enable them to develop routes for consumers to access demand-side flexibility, working to simplify the process of engaging with us and providing accessible points of contact to enable us to collaborate on consumer initiatives.

What do we need to deliver this strategy?

To successfully deliver the consumer strategy we will need to drive increased awareness and engagement with our employees and our stakeholders.

12.4 Business Change

The Business Change team is responsible for defining, monitoring and managing our change portfolio to make sure we deliver our RIIO-2 Business Plan. The team oversees portfolio governance and reporting processes, as well as guidance and support to individual business areas so that all change activities remain on plan.

The team also leads our portfolio management activities including planning, prioritisation, reporting and programme assurance. This includes ensuring all change initiatives have robust business cases and trackable benefits for customers, stakeholders and consumers.

We have recently substantially improved our processes and governance around change activities, and we continue to review how best to deliver and enhance portfolio management. More detail on the deliverability assurance and tracking of our plan can be found in Chapter 3 of Part A and in Chapter 13 of this Part B.

What will we deliver in BP2?

Our original plan was based on maintaining a core change team, supported by a central National Grid Group change function. However, this structure has changed to a standalone ESO function, containing a core support team and a flexible resource pool, with costs charged back to individual projects and programmes.

There are significant benefits to these structural changes. For example, recruitment for the flexible resource pool will focus on individuals with experience that is directly relevant to ESO activities. This work will drive standardisation of methods across the portfolio and will include a training programme and associated guidance documents to help build change delivery capability in all business areas.

We are also adding a senior change specialist, working closely with management teams to understand each Role-based portfolio. This supports the identification and resolution of delivery risks and issues, as well managing dependencies between business areas and activities effectively. This role will ensure portfolio planning and prioritisation activities are based on accurate information and are staying on track with delivery of Business Plan commitments. Further resourcing detail is contained in **Annex 1 – Supporting Information**.

12.5 Business Assurance

We operate a 'three lines of defence' model. The first line owns risks and controls, making sure these are operating in line with the business's guidelines. The second line consists of specialist support teams who own business standards, advise on specific areas and provide information on how the first line is operating to governance committees. The third line is independent from the business and audits activities to provide assurance over the effectiveness of first- and second-line processes.

Our vision is to design an integrated framework which provides a coordinated and efficient approach to all assurance activities. To deliver this vision, a centralised second line assurance team reports directly to our Executive Director. The team sets assurance standards, provides advice on risks and controls, and conducts assurance over their effectiveness.

The second line assurance team also provides assurance to governance committees that we have the right coverage and maturity of risk and controls across the business. Supported and led by the Audit and Risk Committee (this is an ESO Board sub-committee), we are improving the risk understanding, framework, and maturity across the business.

The current service from ESO Assurance covers risk and controls, health, safety and wellbeing, compliance and audit, engineering assurance, and portfolio assurance. Most of these teams provide reporting and support across all departments, with the others focusing on high-risk delivery and operational areas only. This approach means we can provide insights to inform, protect and strengthen fundamental aspects of our business – from people to performance, systems to strategy, and Business Plans to business resilience.

ESO Assurance delivers an annual assurance programme, approved by the Executive, which includes providing assurance to the business through services including audit, consultancy, risk assessment, peer reviews, and oversight of first-line self-assessments.

We will continue our transformation journey to a more mature risk and controls-based assurance methodology. To succeed, we need to significantly improve the quality of our risk and control landscapes, so we will continue to designate resource to engage and enable the first line of defence to improve this.

What will we deliver in BP2?

We have several core and new focus areas for BP2:

- Enhancing our portfolio assurance capability, which is delivered by an external provider but managed by the Assurance Senior Manager. This will improve our confidence around portfolio delivery to achieve our ambitions.
- We will enhance our wellbeing expertise in line with our focus on people, capability and culture.
- Engineering assurance will support our front-line experts by providing a ‘critical friend’ to help mitigate key operational risks.
- New assurance capabilities focused on sustainability and environment will support our strategy for a more sustainable future.
- Our new fraud and bribery capability will improve our testing of controls recorded in our risk management system.

Delivery of these enhancements will require an additional 7 FTE to be recruited during BP2.

There is a significant dependency on the delivery of assurance related to the resource and capability of the first line of defence, so services will be planned in advance (per financial year) and may be subject to change in line with executive and business priorities.

12.6 ESO Innovation

Please see Chapter 10 – Innovation for a description of how our innovation activities have changed since BP1, together with our current priorities. In this chapter, we also elaborate on our activities and proposals under:

- The Network Innovation Allowance (NIA)
- The Strategic Innovation Fund (SIF), which replaces the Network Innovation Competition (NIC)
- Our Virtual Energy System (VirtualES) programme.

12.7 Regulation

Our Regulation team provides support on all regulatory matters, giving advice and guidance on regulatory issues and risks, as well as managing the ESO licence. The team is accountable for all formal regulatory reporting under the price control arrangements, regulatory engagement and reporting for our incentives scheme, as well as the development of the regulatory Business Plans. It also supports the business on regulatory policy matters, including external consultation responses.

There are various supporting activities the Regulation team undertakes only periodically, which are consequently not set out in detail in our transformative RIIO-2 plans. The team has helped adapt to the new RIIO-2 regulatory framework, aligning our incentives reporting processes to meet the new RIIO-2 requirements, and ensuring that teams across the business understand and act on feedback received from Ofgem and the Performance Panel.

To support our engagement approach, the ERSG has been re-established with a renewed purpose and refreshed membership. We believe this group has provided valuable ongoing scrutiny and feedback to support the development of BP2.

What will we deliver in BP2?

There are no material changes to our plan for BP2. Due to the uncertain regulatory environment at present, and the ongoing work by BEIS and Ofgem on the Future System Operator, we have had to make some assumptions about the level of regulatory support needed by ESO colleagues in BP2:

- The regulatory environment and level of scrutiny remain the same and therefore the same level of resource is appropriate.
- The BP3 submission, covering the period 1 April 25–March 26, will be of a similar magnitude to the BP2 submission. The RIIO-3 framework will be developed concurrently, during the BP2 period.
- The RIIO-3 framework will be significantly different from RIIO-2 and will require a substantial change to align with any future business model.

Opex and FTE requirements for the Regulation team remain unchanged from our original plan.

12.8 Internal costs: shared services

In our BP2 guidance, Ofgem acknowledged our shared service[63] submission is prepared at National Grid Group plc level, with the methodology and allocation agreed for the whole RIIO-2 period. However, if there were material changes to our costs for BP2, we were invited to provide details.

For BP2, we expect no changes, apart from an update to IT indirect opex expenditure and a planned refurbishment of our Wokingham office, which is fully owned by the ESO. It was last refurbished around 2014/15 and is now in need of work to fix dilapidations and bring the working environment up to a modern standard.

The refurbishment is being designed with these key outcomes in mind: attracting the next generation of talent, showcasing our unique identity, demonstrating our commitment and contribution to net zero, and creating a workplace that can facilitate better connection and collaboration.

The estimated costs of this refurbishment are in the region of £7m, which includes £3m to replace the aged atrium roof and a £1m spend for office refurbishment in FY23.

We are also proposing to set up satellite offices in Scotland and Wales. Having these offices will support engagement with devolved governments and would also give us access to a wider talent pool and bring us closer to some smaller customers including, for example, developers of Scottish and Celtic Sea offshore wind projects. This will come at an additional cost; however, we feel the benefits in terms of access and proximity to important customer and stakeholders will more than outweigh this. The cost of these offices is expected to be small and will be managed within the property operating costs that have remained unchanged from BP1.

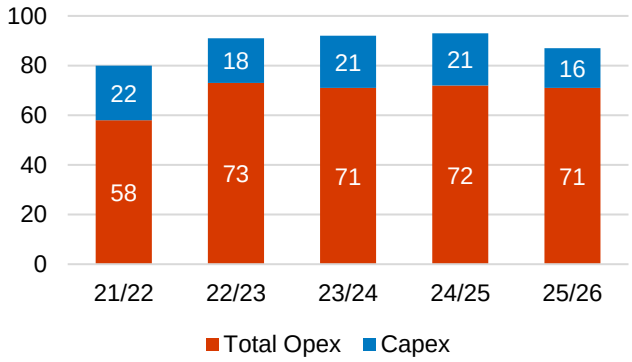


Figure 40: Graph of RIIO-2 cost and FTE for Shared Services

Table 13: RIIO-2 cost and FTE for Shared Services

Support functions (excluding direct IT)		BP1			BP2			BP3	
		Actuals	Forecast		Forecast			Forecast	
		2021/22	2022/23	TOTAL (2 years)	2023/24	2024/25	TOTAL (2 years)	2025/26	TOTAL (5 years)
Capex (£m)	BP2	22.4	18.1	41	20.7	21.4	42	16.0	**99**
	BP1	36.5	23.8	60	18.2	18.1	36	16.0	**113**
	Variance	**(14.1)**	**(5.7)**	**(20)**	**2.5**	**3.3**	**6**	**(0.0)**	**(14)**
Opex (£m)	BP2	57.7	73.0	131	70.6	72.0	143	71.4	**345**
	BP1	67.5	67.3	135	66.0	67.6	134	68.5	**337**
	Variance	**(9.8)**	**5.7**	**(4)**	**4.6**	**4.5**	**9**	**2.9**	**8**
Totex (£m)	**BP2**	**80.1**	**91.1**	**171**	**91.4**	**93.4**	**185**	**87.4**	**443**
	BP1	**104.1**	**91.1**	**195**	**84.2**	**85.6**	**170**	**84.5**	**450**
	Variance	**(24.0)**	**0.0**	**(24)**	**7.1**	**7.8**	**15**	**2.9**	**(6)**

We forecast an additional £6m capex and £9m opex over BP2 compared to BP1. These costs are to support the property refurbishment in Wokingham and increased IT operational expenditure within the underlying run-the-business costs driven by decisions made post our BP1 submission.

[63] Please note that shared services represent Human Resources, property, insurance, finance and audit, CEO, pensions and procurement as well as indirect IT costs. No FTE numbers are included as they are not considered a shared service.

Chapter

13

Deliverability of BP2

Chapter 13 - Deliverability of BP2

13.1 Deliverability

A key focus in preparing the content of our BP2 submission has been assessing whether the activities and investments are deliverable as a collective, rather than assessing each item individually. We were confident that the content within our draft plan was deliverable, however we had strong stakeholder feedback from ERSG suggesting we do a more detailed assessment. We undertook a deep dive on deliverability and, as a result, we have made some changes to our final submission. In parallel, we have made improvements to the internal governance used for portfolio management, which will improve how we manage deliverability on an ongoing basis.

13.2 Our approach

We split the deliverability assessment into three phases as set out in figure 41.

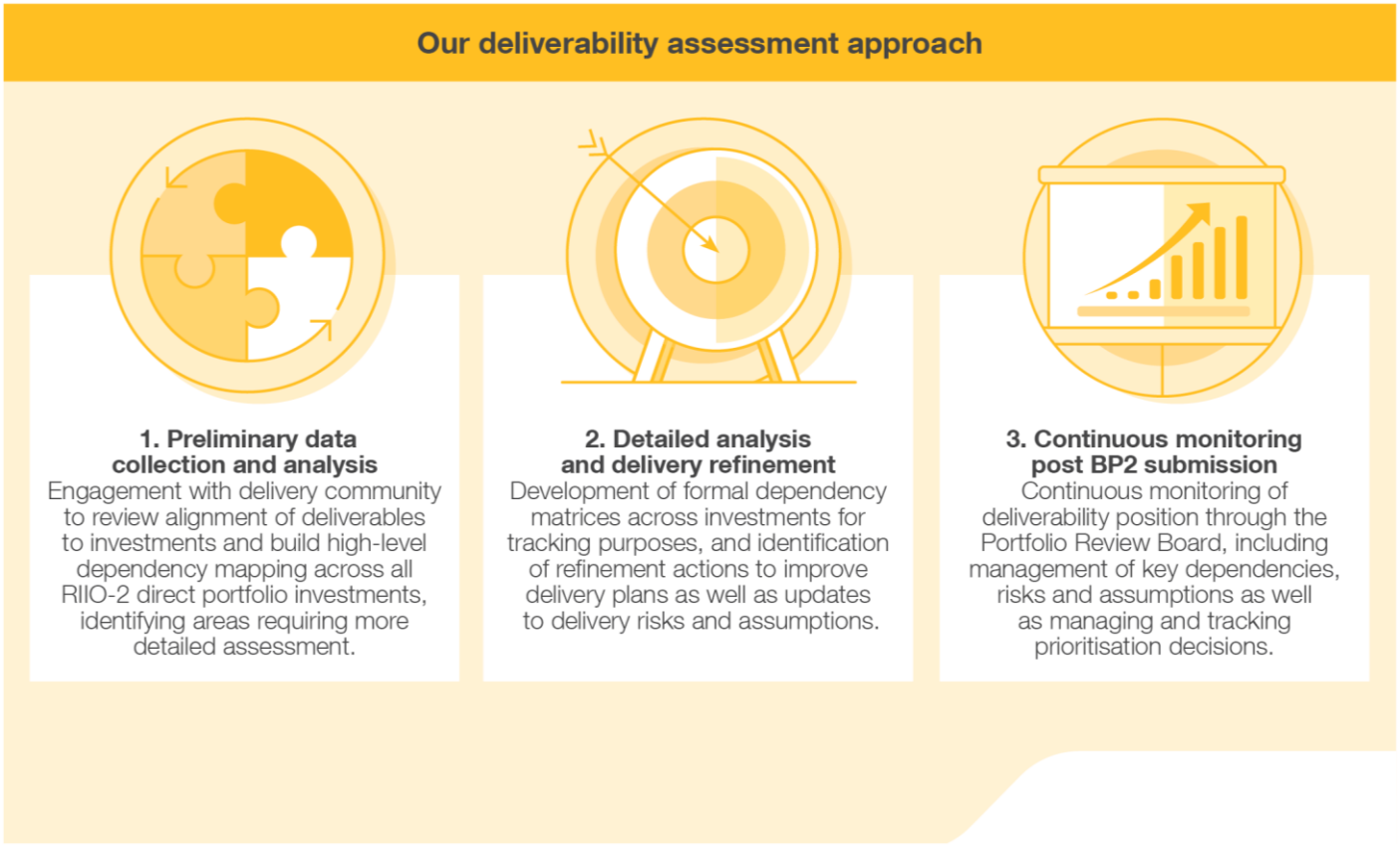


Figure 41: Our Deliverability Assessment approach

Key outputs and adjustments

This process supported our initial view that the plan is deliverable. We have also been able to increase the accuracy of cost forecasts and optimise key aspects of the delivery plan, including alignment of milestones and management of dependencies.

A summary of cost adjustments made is as follows:

- Twenty-one investments reduced in cost, with adjustments ranging between £20k– £11m. The reasons for these include clarification of scope, resulting in reduced timescales and cost in some cases, and identification of more efficient delivery options such as use of offshore development capability from our partner organisations.
- Eight investments increased in cost with adjustments ranging from £20k– £22m. The reasons for these increases included expansion of scope, often in response to stakeholder feedback, a greater level of complexity, and anticipated increases in resource costs, particularly in relation to scarce technical development roles.

A summary of scope and milestone adjustments made is as follows:

- Key scope adjustments were made to the Balancing Programme based on reductions in regulatory scope for investments **270** (Role in Europe) and **280** (Regulation in Great Britain) as a result of the European Trade Cooperation Agreement (TCA). Another example of scope adjustment was the removal of whole system deliverables for investment **340** (Regional Development Programme) because this will be included within the

scope of other investments in the plan including Net Zero Market Reform.

– Changes were made to milestones for 13 investments. The duration of changes made ranged from 1 month to 2 years, with examples being investment **340** (Regional Development Programme) shifting GEMS go-live from Q1 to Q3 FY24 and investment **420** (Auction Capability) implementing the reserve and response products in Q2 and Q3 FY24 instead of Q4 FY23.

Our ongoing monitoring of portfolio deliverability

The final stage in the assessment relates to the ongoing monitoring of portfolio deliverability. During the first year of RIIO-2, we streamlined our portfolio governance structure to set up a centralised Portfolio Review Board (PRB). The PRB aims to strengthen the level of visibility and control in relation to portfolio delivery. The PRB is chaired by our Chief Financial Officer and has executive-level representation across all Role areas. The PRB is responsible for overall performance review as well as investment sanctioning and strategic prioritisation decisions.

Ongoing monitoring of portfolio deliverability will be undertaken through the PRB. The information compiled through the deliverability assessment deep dive will be used as key inputs to the PRB process going forward. Dependency heat maps and overall milestone plans will be maintained and further developed during the BP2 period. The information on key delivery risks and assumptions will also be closely managed to ensure we maintain a position of tight control over the portfolio.

13.3 Risk management throughout the RIIO-2 period

Every day we are exposed to threats, opportunities and uncertainties that could impact our financial situation, operational results, and reputation. Our risk management and control framework is in place to identify, assess, manage, monitor and escalate risks and ensure internal controls are implemented to provide mitigation.

We accept that it is not possible to identify, anticipate or eliminate every risk and that taking appropriate risks is an inherent part of doing business. However, our risk management process provides assurance that we understand, monitor and manage the key risks and uncertainties we face in delivering our objectives.

For more information on our risk process please see our Annual reports and accounts webpage[64].

Through this process we define a set of principal ESO risks, which are agreed with our Executive team and the ESO Board. Beneath these principal risks lie a number of department level risk registers and individual business risks. For example, we have a risk, and corresponding mitigations, to ensure the delivery of our RIIO-2 business plan. Our current principal risks are as follows (please note these are in no particular order):

Principal risk	Description	Mitigation
Real-time operations	The ability to ensure we balance supply and demand in real-time in the most secure and economic way.	– Established control room operations, training, competency assessment, policies and procedures – Long and short-term energy forecasting and market information provision – Network Control programme – Balancing transformation
Physical, cyber and data security	The ability to protect our systems and sites from various threats including but not limited to cyber, physical, environmental, or terrorist activity that could impact our ability to deliver for our customers and the wider UK plc.	– Established cyber-security monitoring and testing – NIS system compliance and improvement programme – Tactical upgrade programmes – Strategic system change programmes – Data Management Framework

64 https://www.nationalgrideso.com/our-strategy/annual-report-and-accounts

Chapter 13 - Deliverability of BP2

Business resilience	The ability for us to respond to an event outside of our control and continue to deliver all key operational and customer activities.	– Compliance with ISO22301 and internal Business Management Standards for business continuity management – Regular testing – IT support contracts and monitoring for key systems – Provision of equipment and systems to enable remote working – Emergency exercises and industry testing
Technology and CNI system performance	Ensuring our IT systems deliver the expected services, enabling the business to deliver its outputs.	– Active system health monitoring – Tactical upgrade programmes – Strategic system change programmes – Data Centre programme
Legal, licence, code and internal compliance	Ensuring we comply with or adhere to all applicable UK and EU laws, licences, codes or other regulations or codes of conduct.	– Established assurance, compliance, and regulatory reporting frameworks and processes – Code delivery framework
Effective corporate governance	Ensuring we apply and demonstrate effective corporate governance as a new legal entity.	– Corporate Governance Framework – Risk Management Framework – Independent Board of Directors – Horizon scanning
Cashflow and efficient billing	The ability to maintain cashflow and undertake accurate billing and settlement.	– Governance and testing – Strong credit management process – Significant credit facilities – Bad debt management and recovery – Sarbanes-Oxley (SOX) controls
Change and innovation	Ensuring we have and operate effective change and innovation frameworks that enable and support business and wider industry objectives.	– Annual Business Plan – ESO Programme Review Board – Portfolio Assurance programme – ESO Design Authority
Reputation	Ensuring we manage our reputation. Presenting as an independent, competent organisation that can build trust and navigate through the uncertainty of the low carbon energy transition.	– Public Affairs and Policy strategy – Strategic engagement strategy – Customer experience strategy – Trusted Partner roadmap
Commercial market design, development and management	The ability to ensure we have effective commercial frameworks to support and enable our business.	– Established procurement frameworks – Market reform programme – Pathfinder programme – Operability strategy

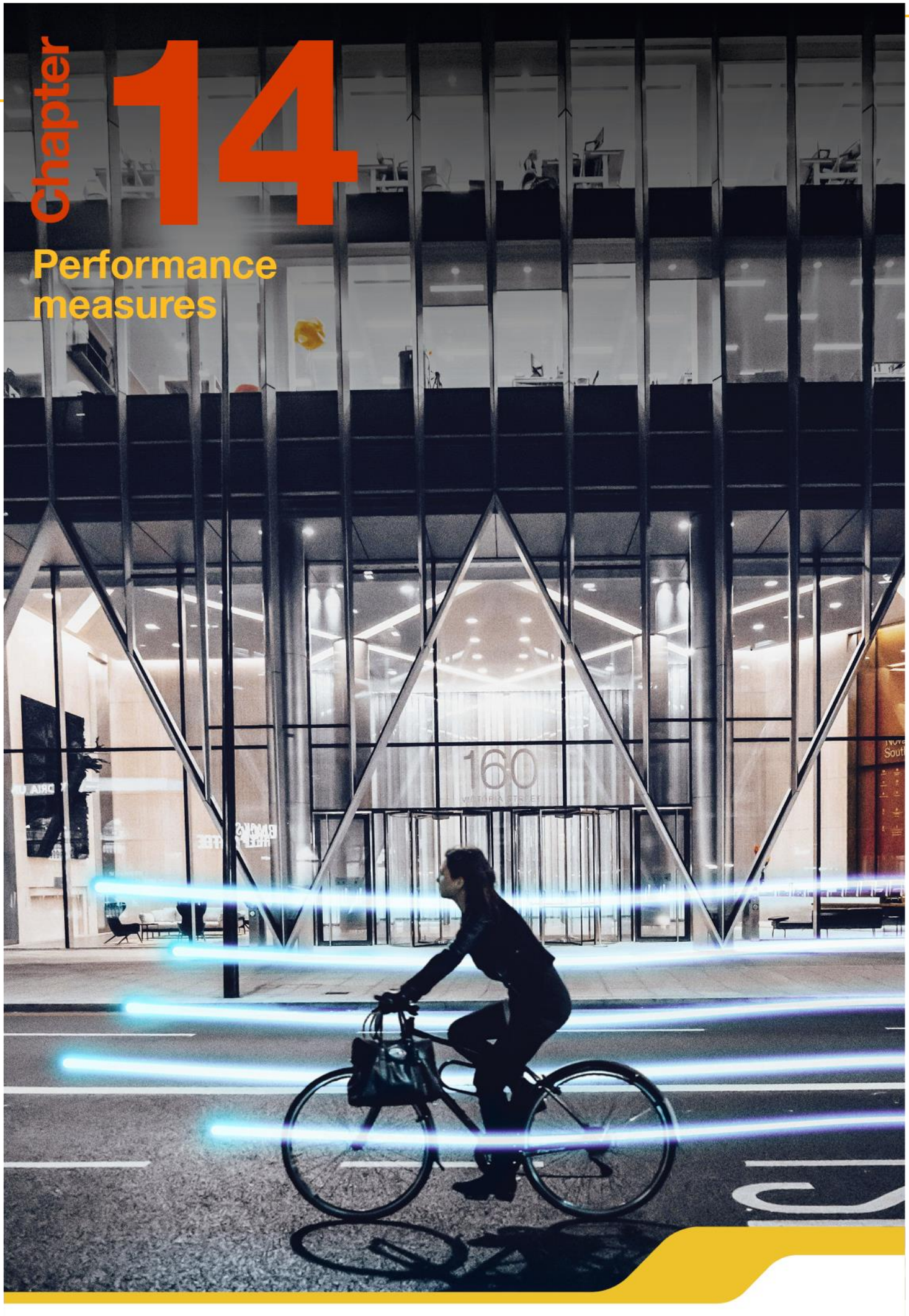
Data provision and strategy	Ensuring we exploit data/ information to its full potential in fulfilling our role as the ESO or shaping the wider energy industry.	– Implementation of the Digital Engagement Platform (DEP) – Implementation of the Data and Analytics Platform (DAP) – Data strategy
Network and operability planning	Ensuring that planning (strategic through to week ahead), processes and our wider safety management systems are developed and in place to enable the safe and efficient operation of Great Britain's electricity system in real-time.	– Strategic programmes have been set up to focus on the following: – Whole system – Zero carbon operation – Competition
Strategy development and delivery	The ability to align around a clear ambition and strategy that addresses the challenges of the energy transition and our role within it to meet the needs of our customers, regulators, and other key stakeholders.	– Proactive engagement to shape policies and public debate to ensure stakeholders understand the role of the ESO in a decarbonised system – Embed ESO Strategy Framework
People management, development and wellbeing	Ensuring that we have the right people with the right capabilities in the right place and at the right time to deliver our outputs.	– Established People Management Framework and processes – Strategic work force planning – Enhanced recruitment programme

We monitor these regularly within our business-as-usual risk processes and publish them externally on our website within our *Annual Report and Accounts*.

Chapter

14

Performance measures



Chapter 14 Performance measures

For BP1, we developed a set of performance measures with our stakeholders which were finalised by Ofgem.

For BP2, Ofgem does not expect us to propose revised performance metrics or Regularly Reported Evidence (RRE). Instead Ofgem will propose revised measures at the BP2 Draft Determination stage. However, after a year of incentive reporting under the RIIO-2 framework, we would like to share our initial views.

14.1 Stakeholder satisfaction surveys

We use a Roles-based survey to measure the level of stakeholder satisfaction in our performance against each of our Roles.

We agreed to target our stakeholders who are leaders, key decision-makers and experts across industry groups who regularly interact with us on one or more of the Role areas (around 650 contacts). These surveys are carried out every six months to align with our performance reporting timescales.

We identify the key feedback themes in the completed surveys and set up ESO-wide and local team action plans in response. For example, we carry out reviews of the data (which includes other insights) using problem solving sessions to identify root causes and possible solutions which we can then share with our customers in a “you said, we did” format.

A summary of some of the feedback from stakeholder satisfaction surveys is available in our incentives report.

14.2 Updated proposals for stakeholder satisfaction surveys

As part of our BP2 submission, Ofgem expects us to update proposals on aspects of the stakeholder satisfaction surveys, including the questions, survey method, participants, and performance benchmarks.

As part of the agreed process, we have run the new Roles-based survey twice. The results have fed directly into Ofgem's mid and end of year incentives report for 2021/22. From the surveys carried out so far, we have some areas we would like to discuss further with Ofgem:

- **More segmentation work** – The surveys had an overall response rate of 34 per cent, which is strong compared to industry standards. We realise however that we need to do further segmentation work to ensure we are getting more representative samples across each of the three Roles. For example, we had 32 responses against Role 1 versus 83 against Role 3.
- **Questions are too complex** – Some stakeholders have fed back that the questions are too long and complex. We will work with Ofgem and the survey provider to consider ways of ensuring the questions are easier to understand.
- **Review of survey targets** – When analysing the results, we can see that the majority of customers across all three Roles have scored us in the Meeting Expectations category, with a minimum of 70 per cent choosing this category in the March 22 survey. Now we have a set of results to work with, we feel that a review of the benchmark set at BP1 Final Determination stage is needed for future surveys. We would welcome a discussion on a new benchmark for the start of BP2 with Ofgem. One proposal is that when 80 per cent of the scores are in the meeting or exceeding expectations categories combined, we would be seen overall as exceeding expectations.

We will work with Ofgem following the publication of this plan to develop these proposals further.

14.3 ESO performance metrics

There is no requirement for us to set our performance metrics or Regularly Reported Evidence (RRE) within our BP2 submission. Instead Ofgem, as part of the Draft Determination process, will set out a revised set of metrics and RREs. We look forward to collaborating with Ofgem to develop and improve our performance measures for BP2.

Since publishing our draft plan we have been through a full year of performance reporting and so wanted to set out our initial views on the BP1 metrics and RREs and, in particular, whether these could be continued, removed, or amended for BP2. We have not considered any new measures.

Where we suggest changes to the existing measures, the notes below give the reasons at a high level. These are not intended as a definitive view, but rather as initial points for consideration.

14.3.1 Role 1

Metric/RRE	Name	Keep for BP2?	Explanation
Metric 1A	Balancing costs	Review	This metric is important to all stakeholders and balancing costs are a key driver of costs for consumers. We do not believe that the current methodology gives a benchmark that is suitable for tracking performance against. The electricity system has evolved significantly and wholesale prices have increased to unprecedented levels since the period that the benchmark is based on (2019-2022), and these changes are not fully reflected in the current methodology.
Metric 1B	Demand forecasting	Review	We question whether the benchmark of 5% improvement in historical 5-year average performance expected is realistic, given the rise of “invisible” embedded generation, particularly solar generation, which is weather dependent. Non-weather-dependent embedded generation also increases uncertainty of demand. We feel a metric based on MW error rather than % error would be more representative.
Metric 1C	Wind generation forecasting	Review	We would welcome a discussion on whether this metric is still beneficial and an area of focus.
Metric 1D	Short notice changes to planned outages	✓	Retain for BP2
RRE 1E	Transparency of operational decision-making	✓	Retain for BP2
RRE 1F	Zero carbon operability indicator	✓	Retain for BP2
RRE 1G	Carbon intensity of ESO actions	✓	Retain for BP2
RRE 1H	Constraints cost savings from collaboration with TOs	✓	Retain for BP2
RRE 1I	Security of supply	✓	Retain for BP2
RRE 1J	CNI outages	✓	Retain for BP2

14.3.2 Role 2

Metric/RRE	Name	Keep for BP2?	Explanation
Metric 2A	Competitive procurement	**Review**	We would like to understand whether this is still a suitable metric given the changes in available services in the market since the start of BP1. There are also two main issues with the current metric: (1) It reflects what is in operation this year, so doesn't show the benefit of new restoration contracts whose impact won't be seen until future years. (2) Results can be misleading: for example, when the market becomes more competitive, the market price drops. This can lead to a reduction in overall competitively procured spend and a lower percentage of services that are competitively procured.
RRE 2B	Diversity of service providers	**Review detail**	We're happy to continue to report this. Given the volume of data, it would be worth understanding if this is useful to Ofgem/ stakeholders. We also believe there may be a more suitable way of reporting units with multiple contracts.
RRE 2C	EMR decision quality	**Review**	We would welcome a review of whether this is the most suitable measure for EMR delivery. There can be significant scope in the interpretation of the Capacity Market and there would also be merit in considering whether the performance framework should be more explicit and span CM and CfD.
RRE 2D	EMR demand forecasting accuracy	✓	It is still appropriate to have a performance measure linked to the base case peak ACS electricity demand used within the Capacity Market, given the link to consumer costs and security of supply. Although the methodology makes it difficult to forecast, this is still the most suitable approach available.
RRE 2E	Accuracy of forecasts for charge setting – TNUoS	✓	Retain for BP2
RRE 2E	Accuracy of forecasts for charge setting – BSUoS	✓	Retain for BP2

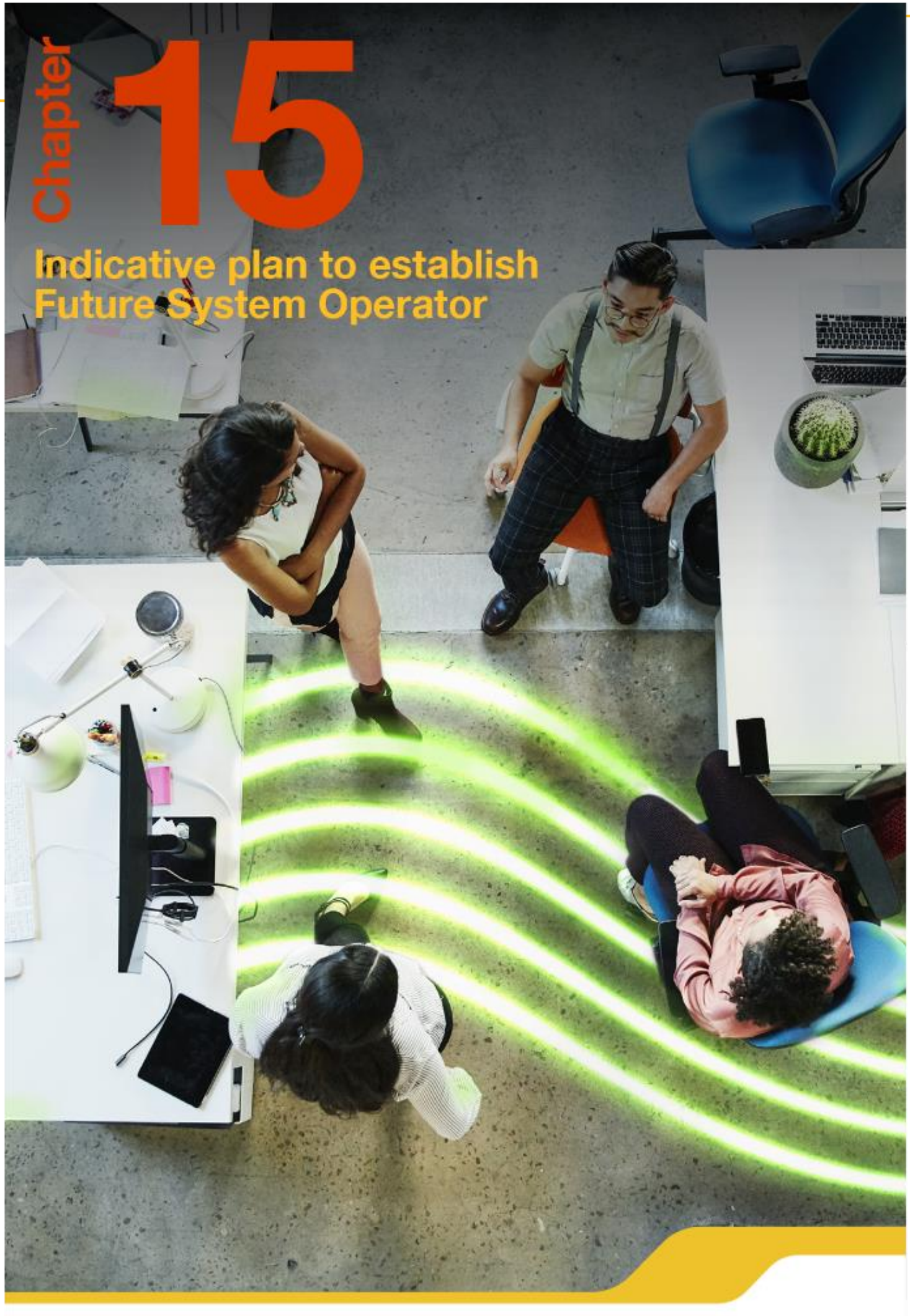
14.3.3 Role 3

Metric/RRE	Name	Keep for BP2?	Explanation
RRE 3A	Future savings from operability solutions	**Review detail**	It may be beneficial to review the interaction in the reporting of RDP benefits between the ESO and DSOs as there may be some overlap between the two from April 2023 (the start of ESO's BP2 and DSOs' RIIO-ED2).
RRE 3B	Consumer value from the NOA	✓	Retain for BP2
RRE 3C	Diversity of technologies considered in NOA	**Remove**	Whilst we note the rationale provided in the RIIO-2 Final Determinations, it is still our view that this should not be an RRE for us. We have no control over the diversity of options that the TOs propose. We communicate need and the TOs meet this with the available options.

Chapter

15

Indicative plan to establish Future System Operator



Chapter 15 - Indicative plan to establish Future System Operator

15.1 Introduction

Delivering a 'net zero ready' energy system requires an entity capable of addressing challenges from a whole energy system perspective. There is a need for coordination across the energy system, and an organisation that can translate decarbonisation policy into immediate strategy. It is against this backdrop that BEIS and Ofgem consulted on setting up an expert, independent Future System Operator with responsibilities across both the electricity and gas systems to start with, and the ability to expand its remit to additional energy vectors. This organisation will be able to drive progress towards net zero, deliver value for consumers by enabling potential cost reductions of up to £3 billion through improved whole energy system decision-making[65], and support energy security.

As part of our BP2 submission, Ofgem asked for an indicative plan setting out the transformational we would have to undertake should there be a decision to change our governance arrangements. In our April 2022 draft plan, we provided an annex setting out the key activities with indicative dates, timeframes and costs of transitioning to a Future System Operator. We are now working with BEIS, Ofgem, National Grid plc and our wider stakeholders to move from indicative planning to detailed design for the separation from National Grid and creation of a standalone entity under government ownership. Through the detailed design phase of work (July to November) we will refine our plans and costs, with updates to be presented to Ofgem in the autumn.

In the meantime, in considering our plans and priorities for the BP2 period, stakeholders have told us that they would like to see a more holistic view of our BP2 and Future System Operator commitments. We have therefore embedded our indicative plan into the core part of the Final BP2 document (rather than presenting it as a separate annex). This enables stakeholders to consider our overall proposals (costs and activities) in one place, albeit recognising that the Future System Operator costs and activities cannot yet be finalised.

Creation of the Future System Operator will be a significant transformation programme that must be delivered alongside other significant industry change, without compromising security of supply and continued delivery of our BP2 commitments. To deliver the activities needed, we have established a Future System Operator programme team, supported by an external project partner to bring additional expertise and resource. An internal governance structure has been designed to provide rigour and cadence to each phase of the project. We have also completed an initial impact assessment to make sure we understand key dependencies and can continue to deliver both our BP2 commitments and the transformation to the Future System Operator in parallel.

Since the publication of Ofgem's guidance on 6 April 2022, Ofgem and BEIS jointly confirmed their intention to proceed with the creation of the Future System Operator[66]. There has also been another significant milestone in the publication of the Energy Security Bill on 6 July, which, as well as including important proposals to boost Britain's energy independence and security, also enables the creation of the Future System Operator. While the Bill refers to the Independent System Operator and Planner (ISOP), for consistency, we will continue to use the term Future System Operator until we develop the new name of the organisation.

To maximise value and drive rapidly towards net zero, we believe the move to the Future System Operator should be delivered through a phased implementation. Starting this immediately is not only cost-effective, but also unlocks the value of the Future System Operator earlier, as well as reducing uncertainty for our people and the wider industry. Separating programme delivery into phases also enables a high degree of deliverability and reduces undue risk to our core operations, particularly recognising our continued role in maintaining current world-class system operation.

Building on the ambitious foundation set out in BP2, our goal for the Future System Operator is an innovative, world-leading organisation at the heart of Great Britain's energy system and the delivery of net zero. An organisation that supports security of supply and resilience; provides a whole energy system view to optimise decision-making and action in the decarbonisation of power, heat and transport; leverages data and digital technology to engage transparently across industry and society; and acts as a trusted partner and adviser to governments, regulators and industry, with deep engineering, data and technology expertise at its core. We are excited to submit our credible, deliverable and affordable plan to realise this goal.

15.2 Our people

Our success in achieving our goal is fundamentally linked to the people in our organisation. To become a world-leading Future System Operator at the heart of Great Britain's energy system and the delivery of net zero, we need to attract, retain, engage and develop talented individuals with passion and capability. Our people care deeply about the future direction of our organisation and are excited by the opportunities. At the same time, we know uncertainty can be concerning, with some of our people worried about the potential changes to an unknown future state. A critical challenge will be to minimise uncertainty in the transition, clarifying impacts for individuals as quickly as possible.

As the role of the Future System Operator emerges it is important that we build new capabilities that complement our existing strengths in power system engineering, customer and stakeholder engagement and commerciality. We will develop a people strategy that considers how to deliver in an increasingly technology and data-led organisation while attracting these new skills and developing our existing people too.

The Future System Operator has an exciting role to play in the energy transition. It is important that our employee value proposition is equally exciting and engaging for both our existing and future colleagues. Through a focus on culture and purpose, creating an employer brand that positions the Future System Operator as an employer of choice for future climate leaders will be critical to our success in attracting and retaining talent.

[65] Source: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1066721/future-system-operator-consultation-impact-assessment.pdf

[66] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1066720/future-system-operator-consultation-govt-response.pdf

Chapter 15 - Indicative plan to establish Future System Operator

15.3 Our plan

We have taken a pragmatic yet ambitious approach to the transition to the Future System Operator, with a plan that is both deliverable and affordable but can move at pace. Our plan is designed around a series of critical path activities between today and achieving an enduring state. Taking a phased approach enables us to safely plan to expand our remit to take on the new industry roles of the Future System Operator, while moving swiftly reduces uncertainty for our people and stakeholders, prevents delay in action on net zero and unlocks consumer value as early as possible.

Phased implementation would begin with detailed design activities to fully define the capabilities of the new organisation, separation planning from National Grid plc and implementation, followed by a phased move of back office operations to transitional service agreements (TSAs). While this submission includes an initial view of the potential agreements that may be needed, TSAs will be developed during the detailed design phase by National Grid plc, in consultation with us. We anticipate that for most activities, they will be in place for no longer than 24 months. By the end of the implementation, the organisation would be fully independent of National Grid plc (without the support of TSAs) and would have employees and the appropriate legislation in place to fulfil new and enhanced industry roles.

Figure 42 below outlines the indicative high-level transition timeline, highlighting some of the key ESO separation activities. The transition plan has assumed dates for illustrative purposes to provide a view on a possible pathway to implementation. Actual dates would be subject to joint discussion and agreement with BEIS, Ofgem and National Grid plc. Elements outside our direct control which could affect timings include licence changes, transaction process, legislative timetable, and activities to be completed by National Grid plc.

We have suggested that establishing the independence of the ESO from National Grid Group could take place by October 2023, dependent on progress in key areas. From that date, the new organisation would have the ability to position itself as the Future System Operator with external stakeholders, undertake key culture and branding activities, and begin to take on new roles or elements of roles that are not dependent on legislation.

Further new roles could then be developed once these had been enabled by legislation and the necessary licence and code changes. We have assumed full separation activities, including establishing standalone capability with no support from TSAs, will be completed between October 2025 and April 2026.

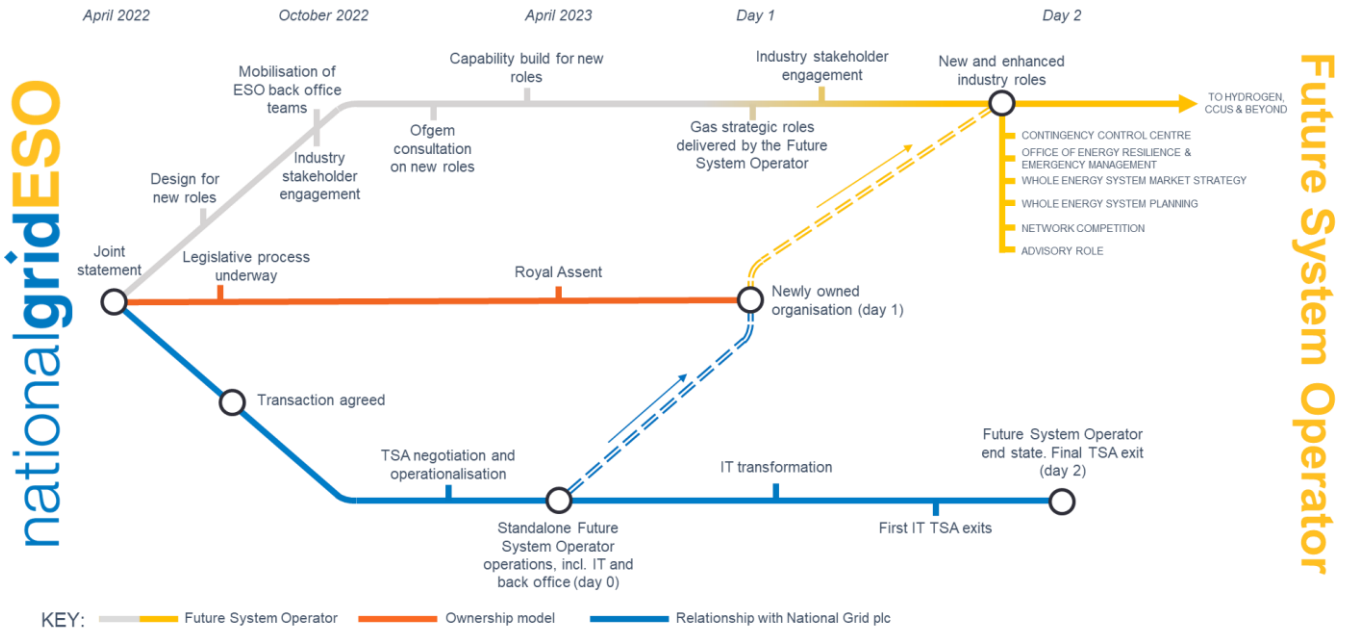


Figure 42: High-level transition and transformation plan

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Our plan refers to important milestones, which we have defined in figure 43 below.

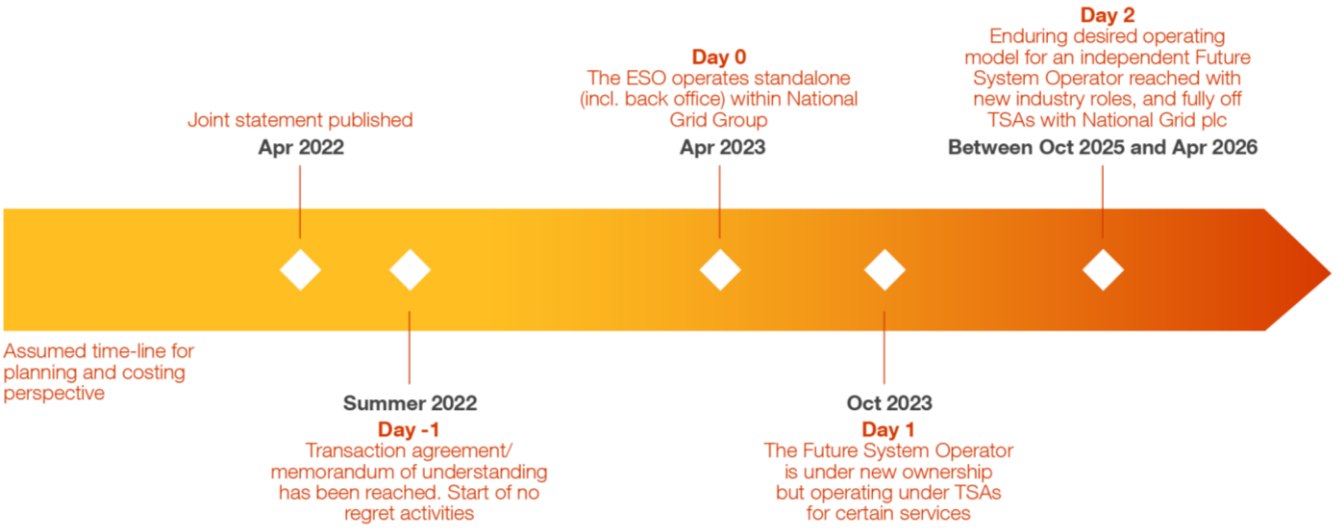

Figure 43: Definition of key milestones

There is a joint desire from National Grid plc and the ESO to identify opportunities to accelerate the transition to the Future System Operator. In the event of a potentially accelerated scenario, we believe there are six key factors to consider:

- More TSAs might be required.
- The ability to recruit for some key roles ahead of day one.
- Accelerated separation planning and readiness interactions with National Grid Group.
- Requirement to mobilise for the next phase as soon as possible.
- Validation of the critical path to day one.
- Clarity on the activities that the new owner will need to undertake on their side from day one.

Further engagement between the government, Ofgem, National Grid plc and the ESO will need to happen in the coming months to identify and validate the opportunities for acceleration.

15.4 Assumptions and principles

We have used a set of flexible macro assumptions and principles to underpin our Future System Operator design, costing and planning activities.

Our macro assumptions and principles are as follows:

Timing

- The Future System Operator will evolve over time as new and enhanced industry roles and capabilities are added. For planning purposes, we have assumed day one (under new ownership with some TSAs) could be in October 2023, with day two (full separation and end of TSAs) between October 2025 and April 2026. These timelines would span over different business planning periods, with day one within BP2 timescales and and day two within BP3.
- For some new industry roles, we propose to build capability through the separation and transaction preparation phase. This means planning for and developing the teams, technology and data needed in readiness for day one. Some new industry roles, which require legislation, licence or code changes, may begin later. These may still require capability build in advance to enable the Future System Operator to be ready to take on new roles and obligations at the point of 'role go-live'.
- We have set out the option to accelerate the adoption of enabling back office capability where there is a strong value case and where it would reduce transition risks. This means that in some areas we will prepare for separation by building additional capability. For example, we may build capability to manage our cash and debt position by the early establishment of a dedicated ESO Treasury function.

Capability

- The approach and costs for enhancing the ESO's existing capabilities, processes and systems is outlined under our three Roles and cross-cutting chapters. The plan and costs of the transition to the Future System Operator are over and above the BP2 proposals.
- In the back office we have planned and costed to mirror the people, process and systems we currently receive from National Grid Group, unless there was a strong business case to change. As a standalone organisation, these functions will then evolve to an enduring state design to be reflective of the scale, culture and our ambition for the Future System Operator, without compromising service quality.

Chapter 15 - Indicative plan to establish Future System Operator

Scope

- We only address the activities and associated costs to be undertaken by the ESO in the transition to the Future System Operator. Activities and costs incurred by other parties, such as National Grid plc, are not in the scope of this plan.
- We have planned for what we have reasonable certainty over today. This means we have scoped new industry roles only at the point of 'role go-live', or as indicated by BEIS and Ofgem. We have not planned or costed for a further evolution of roles thereafter. Future Business Plans will provide the opportunity to consider evolution.

Operational roles transformation

For the Future System Operator to play its crucial role in designing and driving optimal solutions across the energy system it must be technically excellent – with deep knowledge of each energy vector and the ability to optimise combinations and trade-offs across these. Our operational business will transform to ensure our new whole energy system remit is at the core of the organisation. While developing whole energy system solutions starts with the adoption of strategic gas roles in network planning and markets, the Future System Operator cannot be an electricity-based organisation with a few gas roles added to it. Where the new organisation can add value is by bringing these processes together to develop new insights and strategies across multiple energy vectors, unlocking value for current and future consumers through more effective strategic planning, management and coordination across the energy system. A whole energy system mindset combined with technical knowhow means the Future System Operator will also be well placed to act as an expert, impartial voice, providing advice to facilitate decision-making and policy definition.

We have assumed that teams associated with current ESO roles, systems and processes will be transferred to the Future System Operator as is, therefore BP2 is used as our starting point. Where the Future System Operator will take on new industry roles, we describe the key areas of change. Our plan includes some early recruitment to implement whole energy system thinking in areas such as network planning and markets, as well as strategic roles to consider other energy vectors and enabling technologies in the future.

New industry roles will go live at various points from day one of the Future System Operator. We have planned and costed these roles from their inception. We anticipate that the responsibilities of the Future System Operator will continue to develop over time as roles are clarified when legislation, licences and codes are drafted, as well as the associated industry engagement. During the detailed design phase of the programme, we will continue to scope and refine the activities and capabilities that we believe will be needed to fulfil the Future System Operator's new industry roles.

In planning new and enhanced roles for the Future System Operator, we are mindful there are currently significant industry change programmes underway. These include a number of stakeholder consultations that may well impact our assumptions, activities and costs. We will be tracking all relevant consultations to ensure that pertinent changes and decisions can be incorporated into our transition planning.

Figure 43 below summarises the new and enhanced industry roles and how they align with our existing regulated Roles. Undertaking these new activities will move us beyond electricity and gas to develop a whole energy system mindset for all of our work. Please note that these are **not included** in our base BP2 submission.

Role 1 – Control Centre operations	A Contingency Control Centre will be required to replace the contingency facilities we currently share with National Grid Electricity Transmission. It is crucial that any changes to the Control Centres and their operation should have a clear plan to deliver these efficiently and safely. This will require scoping and design ahead of day one by a team from the ESO, alongside external specialist support. The route to net zero will result in more cross-energy vector dependencies. This will be especially true during an emergency, where it will be important to develop a whole energy system response. We believe an Office of Energy Resilience and Emergency Management could be a significant and core element of the Future System Operator. This office could provide strategic management of emergencies, as well as performing resilience and standard assessments across different transmission networks, identifying where there are interactions or vulnerabilities, and setting out what needs to be done to address them. This will require a team at role go-live. This role will be enabled by changes to legislation, industry engagement and a capability build.
Role 2 – Market development and transactions	**Whole energy system market strategy** A vital first step in whole energy capabilities includes incorporating gas market strategy roles, including publication of the Gas Market Plan (GMaP) and leading Future of Gas forums. We have assumed the Future System Operator will take on these accountabilities on day one. This would be subject to agreement with the relevant parties, and would require appropriate legislation and licence change. The Future System Operator also needs to consider markets holistically across multiple energy vectors. With this in mind, we plan to recruit a small team to begin taking a whole energy system

	approach, considering market interactions and how best to implement a joined-up approach to gas, electricity and other markets in the future.
Role 3 – System insight, planning and network development	**Gas strategic roles** A vital step in growing whole energy functions will be to bring the strategic roles for gas and electricity into one organisation. For the purposes of developing this plan, we have assumed the Future System Operator will take on accountabilities in gas strategic network planning and publication of key related documents for day one. This would be subject to agreement and significant engagement with the relevant parties, and need to be enabled by the appropriate legislation and licence change. Medium to long-term gas supply and demand forecasting are already considered in the *Future Energy Scenarios*. This role may evolve over time as other energy vectors begin to have a more significant impact on the system. **Whole energy system planning** Reaching net zero will require a significant coordinated effort, of which system planning and network development will be a key part. Building on current industry workstreams coordinating electricity network planning, such as the Network Planning Review discussed in section 8.8.1, the Future System Operator would go further by developing whole energy system planning. This will not be a simple process and will require careful consideration, engagement and coordination across the energy industry. At the point of role go-live, a small team will be set up to undertake the initial assessment and design of this process.
Cross-role and cross-cutting activities	**Advisory role** Our plan has assumed that Ofgem and BEIS will be able to seek advice, analysis and information from the Future System Operator, focused on the organisation's areas of expertise. Alongside this we will continue to develop our engagement with regional and local organisations via our stakeholder work for the *Future Energy Scenarios*. A small whole energy system advisory team and role will be in place to enable this role with some capability beginning in advance of legislation. This team may grow over time to cover further energy vectors. **Driving competition** The preparatory and implementation work for Early Competition is discussed in section 8.9.2.3. Here we have included work relating to the Procurement Body role. We believe this is distinct from other Early Competition roles, particularly given feedback around the benefits of it being undertaken by an independent party, and so we have associated the costs and activities of the Procurement Body role with this Future System Operator section. This submission includes a plan to deliver one competition in electricity over four years, by building internal capability, as well as specialist contract resource and IT investment. Should the Future System Operator be required to run more competitions or expand beyond electricity transmission, additional resource would be needed. **Regulation** We anticipate the Future System Operator, with new industry roles and additional responsibilities, will have significantly lengthier licences covering broader subject areas, including gas from day one and potentially other energy vectors later on. In addition, the team will need to build standalone capability for cyber-security reporting, which has distinct reporting requirements. To reflect this, we have included an increase to the existing regulation team. A temporary team will also be needed to help design the licences for the Future System Operator, including informal and statutory consultations, to move current obligations into the new licences and to consider other necessary governance arrangements for the Future System Operator.

Figure 43: Overview of new industry roles

There are also additional areas where we believe the role of the Future System Operator could evolve in the future. For example, we recognise that the Future System Operator could be well placed to take on additional duties in relation to the Capacity Market or adopt an enhanced role in energy code management. We anticipate the advisory role could also expand in the future, to share expertise or provide guidance to a wider range of parties in the energy industry. At present, there is not yet sufficient clarity on the possible scope or role of the Future System Operator in these areas and as such these have not been included in our cost submission. Once

further detail is understood in each of these areas, then they will be included in further submissions.

15.5 Back-office transformation

The Future System Operator will need to stand up its own capability in back office functions, including human resources (HR), finance, corporate affairs, audit and legal. These functions are fundamental to the running of any organisation. For example, having the right finance capability will be integral to enabling the success of the organisation and our net zero ambitions, working hand-in-hand with the business to drive financial performance and support front line delivery. Likewise, a HR function that is agile, accessible and informed with data will enable the organisation to continue to attract and retain the best talent, create a fantastic candidate and employee experience, and embed our desired culture. Our proposed design of these back office functions reflects the scale, culture and ambition of the organisation, without compromising service quality.

The ESO currently uses back office functions shared across all the National Grid Group businesses. This was agreed with Ofgem as part of the legal separation process as appropriate for that model. By becoming fully independent, outside of the National Grid Group, the Future System Operator will need to establish its own capability to replace these services. Establishment of back office teams would be subject to discussion and agreement with National Grid plc and will follow the standard consultation process where required. A summary of these functions can be found below:

Finance	The Office of the CFO will be integral to enabling the success of the Future System Operator, working hand-in-hand with the business to drive financial performance and support front line delivery. The CFO role will be a critical senior strategic role. The CFO's team will have a broad remit, overseeing management of funding and liquidity, strategic and regulatory financial planning, controls and compliance, tax, pensions, insurance, property and procurement. On a day-to-day basis, the Office of the CFO will be responsible for critical activities such as paying for and invoicing customers for Balancing Services, and ensuring compliance in statutory and regulatory reporting across the business. This necessitates significant transformation and build from the current National Grid Group model. For some key roles, we intend to build some early capability up to six months ahead of day one. TSAs will be used on day one to reduce risk. We anticipate TSAs will be needed for pensions, business services technology, support for back office applications and property facilities contract management.
Human Resources	Our success will be built on our sustained ability to attract, retain, train, motivate and engage our people. To deliver this we will need a resilient, agile, skilled and diverse workforce. The HR function will be responsive, flexible and accessible, ensuring the Future System Operator can attract and retain the best talent. It will create a fantastic candidate and employee experience, and ensure our desired culture is embedded. It will support the business to develop strong leadership and the future capabilities it needs. The HR remit includes partnering and strategy, talent and capability, total reward, service excellence as well as service delivery. For day one we intend the core HR function will be fully mobilised, with some additional short-term roles supporting transition activity. Most of the HR services that will eventually be delivered by a third party in the enduring state will be delivered via TSAs with National Grid Group, with the exception of Talent Acquisition.
Corporate Affairs	The Corporate Affairs team manages and supports all external and internal communication activity. To do this, the team has capability in public affairs and policy, digital communications, internal communications, and media relations. The current ESO Corporate Affairs team is ringfenced from National Grid Group's Global Corporate Affairs function. The team is also supported by the EU Liaison office, with resource dedicated to representing the ESO in Continental Europe. Our plan mirrors the current resource allocated to the ESO, replicating the team to ensure ongoing support. We anticipate the Future System Operator will need to develop deeper relationships with a broader stakeholder landscape; for example, with the UK Government government and the devolved administrations. The team will need to evolve to reflect this wider role. For day one, our plan includes recruiting resource with the relevant experience in public affairs and policy to the team. Over time, the wider Corporate Affairs function will also need to enhance its capability to manage a wider range of stakeholders.

Corporate Audit and Assurance	The current ESO Assurance team is responsible for the 'second line of defence', overseeing and monitoring the management of risks and compliance with controls across the business. These assurance activities are already delivered by resource within the ESO and so our plan assumes this team will be transferred to the Future System Operator as is. As an independent organisation, the Future System Operator will also need to establish a standalone Corporate Internal Audit function. This 'third line' activity, which sits outside risk management processes, ensures both the business and the Assurance function itself are operating effectively, as well as advising on improvements where required. This capability is currently provided by National Grid Group. Our plan costs for establishing internal audit capability within the Future System Operator. This will be complemented by 'co-sourcing' of externally provided audit support. The Future System Operator could introduce a new 'Chief Risk and Internal Audit Officer' to oversee the amalgamated internal audit and assurance capability.
Legal	Legal expertise supports a wide range of activities, including managing our regulatory obligations, procurement of Balancing Services, codes changes and progressing innovation projects. We anticipate this will grow as the Future System Operator takes on new and enhanced industry roles, such as the advisory role. Legal support is currently provided using a ringfenced business partner model. Further resource is provided by a small non-ringfenced team from National Grid Group supporting the ESO on an ad hoc basis. Our plan mirrors the current resource providing legal support to the ESO, with a small increase to reflect its growing mandate. In addition to the in-house team, panel firms will continue to be used for legal specialisms, such as treasury and pensions, and to manage transactional workload. A standalone Company Secretariat will be needed, with responsibilities for governance, the Annual Reports and Accounts process and managing the formal shareholder relationship.

15.6 IT transformation

Establishing the Future System Operator as a technology and digitally enabled business means transforming our IT capability forms a large and ambitious part of our plan. This will be a critical and highly complex part of our transformation programme, with a high degree of interaction with National Grid Group. Significant work in the detailed design phase will be needed to refine and further cost the activities.

The IT activities for both BP2 and the Future System Operator transformation have been designed with each other in mind to make sure they can be delivered in parallel. As part of BP2, we are investing in systems and tools that will deliver foundational capabilities for driving net zero outcomes, focusing on competition and innovation, and taking a whole energy system approach. Activities to replace and decommission systems will avoid system migration costs for the Future System Operator transition, while technology plans have been designed to achieve independence from National Grid Group IT with minimal disruption to system operation and the services we provide. The activities set out in this section take the BP2 deliverables as a starting point and build upon this foundation. While our initial impact assessment has not identified any unforeseen issues for IT separation, we will continue work to map the detailed dependencies between our BP2 technology plans and the Future System Operator transition.

As part of the separation from National Grid Group, we will set up an independent, innovative and agile IT capability, with accountability for IT strategy, and the governance and management of IT budget. IT will play a full role, as an equal partner, in delivering the Future System Operator's objectives, performance and cost targets, and delivering customer outcomes.

An overview of how IT will evolve between day one (under new ownership with some TSAs) and day two (full separation and end of TSAs) is set out below. Transferring capability over time minimises operational risk while giving the Future System Operator IT independence, accountability, and control.

Chapter 15 - Indicative plan to establish Future System Operator

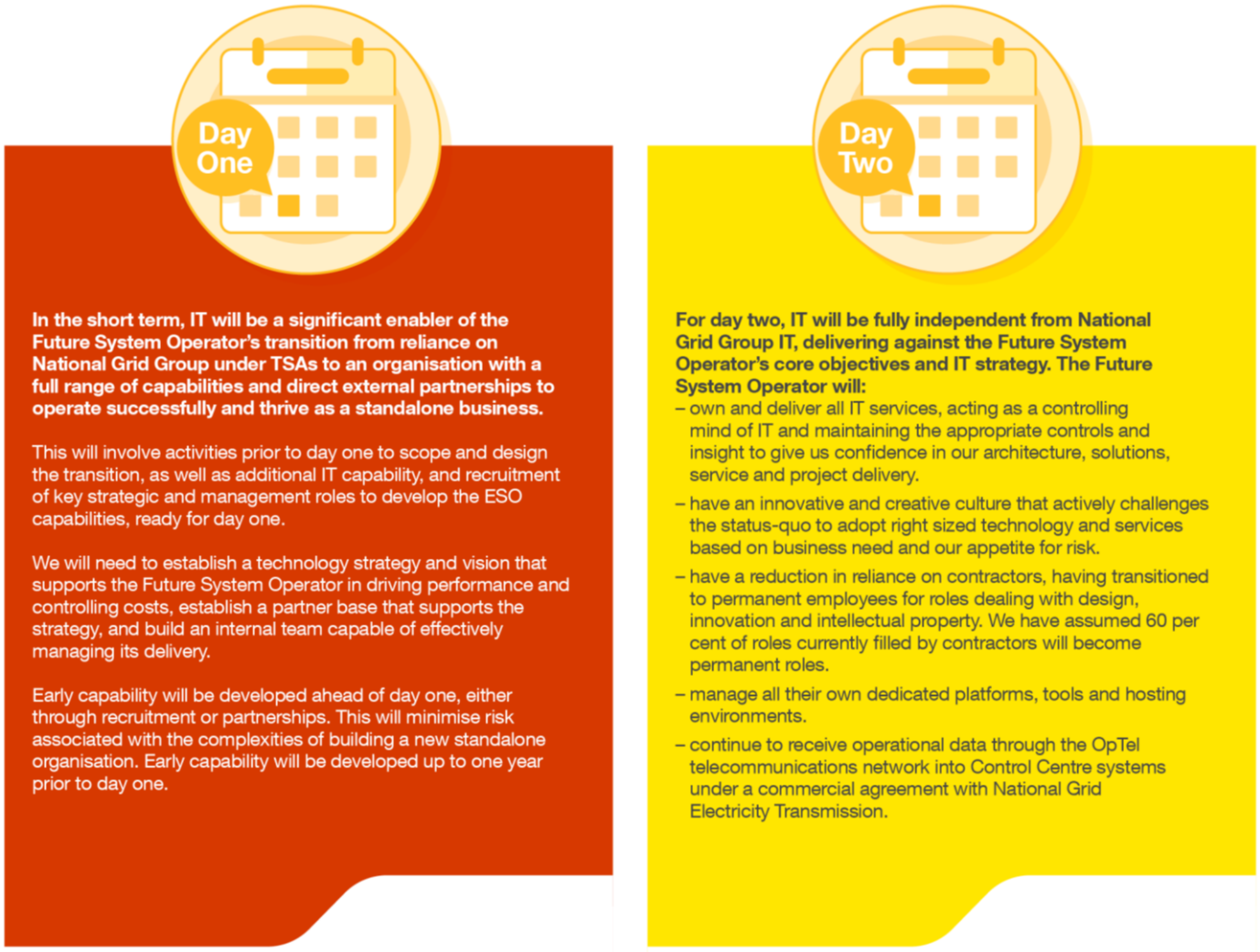

Figure:44: Overview of how IT will evolve from Day one to Day two

This transition needs significant transformation and build, especially in developing new capabilities such as infrastructure, delivery and cyber. We need these new capabilities so we can perform as a standalone business and take appropriate actions for the benefit of the Future System Operator and its customers, as well as augmenting existing dedicated capabilities with the specialist expertise needed for back office. New capabilities must be fit for purpose, deliverable and affordable for the size and scale of the new organisation.

To meet this challenge, we have proposed an IT model based on expected future capability needs and landscape changes. This includes outsourcing capabilities where this is the right model for the scale and level of expertise required. To ensure our proposals are fit for purpose, we have also considered comparators and benchmarks. The IT capability model (Technology Business Management (TBM) Taxonomy 4.0 aligned) focuses on IT management, applications, platforms, EUC/workplace, infrastructure, delivery and cyber-security and compliance to ensure the IT function is set up for success.

15.7 Transitional Service Agreements (TSAs)

We will need to efficiently separate from National Grid Group without disruption to business as usual (BAU) activities. Throughout the transition, TSAs will be used to maintain BAU while the Future System Operator develops its strategic suppliers, working environment and in-house capability.

The priority will be ensuring the protection of security of supply to the electricity grid, while minimising any impacts to our RIIO-2 commitments. This will require a detailed plan which will manage risks identified whilst minimising costs and not disrupting the business.

We will aim for TSAs to be in place for no longer than 24 months. From day one, the Future System Operator's provision of IT services can be summarised as:

- Transfer of third-party contracts where contracts are dedicated to the ESO.
- Continued capability build to manage Future System Operator IT services, design and govern TSAs, and ensure set up of services between day one and day two. This will be future looking, developing innovative practices and solutions to deliver customer outcomes.

– Continued provision of services from National Grid IT under TSAs, where those services are shared today, such as Infrastructure, End User Computing, Security and Compliance, Vendor Management, etc.

During the transition period TSAs will ensure the Future System Operator continues to operate as usual. Further details on TSAs and dependencies on National Grid IT will form part of the detailed design phase of the Future System Operator programme.

15.8 Conclusion

Our plan will deliver a Future System Operator ready to meet the challenge of making rapid progress towards net zero in a way that is efficient and fair for consumers while maintaining energy security.

We have developed a proposal for a phased implementation that provides a cost-effective approach to the transition to a Future System Operator with a high degree of deliverability, without presenting undue risk to the core operations of the ESO today. The plan builds on our role as a natural convenor for industry, taking on greater responsibilities to drive coordination, collaboration and alignment in the creation of whole energy system solutions. An independent Future System Operator can further demonstrate impartial decision-making that places consumer fairness and value at the heart of all its activities.

Please note:

Ofgem's direction in the ESO's RIIO-2 Business Plan Guidance requested that the ESO should include an indicative plan for the transformational activities it would have to undertake should there be a decision to change its governance arrangements. This submission, therefore, focuses only on the ESO activities and costs. For the avoidance of doubt, the plan and costs do not include the likely activities and costs borne by National Grid plc.

Separation of the ESO cannot be achieved without the support of National Grid plc and further work will be required to provide a complete view of the activities and associated costs required to deliver the Future System Operator.

A Future System Operator with the right roles and capabilities to take a fully whole energy system perspective, and the appropriate governance to enable agility and innovation, will play a vital role in the energy system's drive to net zero.

15.9 Future System Operator costs

15.9.1 Introduction to costs

Our submission identifies the indicative costs and relative phasing associated with the ESO transitioning to a Future System Operator, outside of National Grid plc, with new and enhanced industry roles. In all areas of our planning, we have sought to ensure a realistic and deliverable approach, reflecting this in our costing work to develop a plan that is pragmatic, credible, and efficient.

The initial high-level designs set the boundary for the costing element of the submission. By defining the day two cost base, we can understand and articulate the one-off ESO costs of transition and define the service delivery model, including the potential TSAs. Day two describes an enduring state for the Future System Operator with new and enhanced industry roles, and where there are no longer any TSAs in place.

The costs have been calculated using a combination of 'as-is' cost data, information from National Grid plc, comparator data and other relevant data points both within and beyond the energy industry. This has ensured our indicative cost estimates are as robust as possible at this early stage.

We have identified two areas of cost; run-the-business (RtB) on day two and one-off costs. The as-is cost baseline is taken from the core BP2. FY24 is a projection of the current cost base and is subject to change.

In developing our indicative costs, we have used a number of more detailed assumptions:

– The majority of direct ESO costs (i.e., for ESO dedicated activities) are assumed to pass through from the as-is state to the to-be state. There are some exceptions within the operational business, where incremental headcount requirements were identified driven by future growth of the business.

– Any allocations from National Grid plc will cease for the new standalone entity and be replaced by to-be costs.

– Specific considerations relating to the separation of pension liabilities are out of scope of this costing analysis.

– One-off costs for National Grid plc led separation activities are out of scope of this separation analysis. Further detail on what this means can be found in table 14.

The cost estimates included in this submission are indicative at this stage. Further work will be needed in the detailed design phase in collaboration with National Grid plc to refine people and non-people costs and agree key decisions (e.g., TSAs, dual running of roles, contracts etc.).

This submission only addresses the activities and associated costs to be undertaken by the ESO in the transition to a Future System Operator. Activities and costs incurred by other parties, such as National Grid plc, are not in the scope of this plan.

15.9.2 Our approach to RtB costs

RtB costs: people

To design the to-be organisation, target operating model (TOM) workshops were held with experts from each function. These workshops informed our view of the capability build needed, along with the indicative grades, to undertake new and enhanced industry roles, and build standalone back-office capability. Fully loaded costs per grade from the core BP2 were used to cost the to-be organisation.

Further detailed work will be needed to design organisational structures, and confirm roles, grades and reporting lines in the detailed design phase of the project.

RtB costs: non-people (contracts and outsourced activities)

Allocated costs by function, taken from the core BP2, were used as a starting point to develop estimates of to-be non-people costs. These as-is costs were reviewed to assess whether they would be required in the new organisation. Where a cost was deemed to be required, a replacement or additional cost was calculated using one of the following approaches:

- Bottom-up build, taking into account the impact of separation (e.g., dis-synergies). Where a granular split by people/non-people allocated costs was not available, these costs were passed through from the as-is to the to-be cost base.
- New contracts, such as for managed service providers (MSPs), were costed using comparators.
- Functional TOMs, external advisers, comparators, and benchmarking were used to ensure completeness of third-party standalone cost assumptions and to validate the costs and design outputs.

RtB costs: IT

Given the uniqueness of the IT function, we used a top-down costing approach to examine the likely dis-synergies and potential standalone opportunities for this crucial element of the business.

A set of low, medium and high dis-synergies were analysed against a comparator data set from seven carve-out transactions, where a smaller entity was being separated from a larger group. These dis-synergy ranges were then applied to the ESO's as-is IT cost base to obtain an estimated projection. To compare the spend for the referenced carve-out transactions to the ESO's baseline run costs, Ofgem's Technology Business Management Taxonomy 4.0 capability model was mapped to the ESO's IT sub-functions.

The high range from the top-down and dis-synergy approach has been considered as the to-be IT costs for the standalone state.

RtB costs: cost phasing

Assumptions were applied to the high range incremental RtB costs, to give an indicative view of their phasing and how we anticipate the increased running costs building over time. These assumptions will continue to be refreshed as we progress the detailed separation and transformation plans as part of the overall Future System Operator programme.

15.9.3 Our approach to one-off costs

Our one-off cost assumptions are indicative estimates. We have used input from external advisers and have reviewed costs against comparator data, making some initial assumptions about when we would expect these costs to be incurred. We have assumed that the ESO will bear the cost of establishing new capability, where it is required but not transferred by National Grid plc.

Table 14 (below): Summary of areas of expected one-off costs for National Grid plc and the Future System Operator (these areas will be clarified and agreed in the next phase of the Future System Operator programme work, considering detailed design).

National Grid plc activity		Future System Operator activity
Identification, consultation, and training of people transferring to the new entity, retention package.	**People**	Recruitment and training for new roles, entity specific training. *
Preparing systems for TSAs, replicating systems where they represent the enduring solution, data separation.	**Systems and data**	Establishing new systems, cleansing and deleting data, transitioning retained applications, standing up new networks and infrastructure, standing up service management integration (SMI), standing up cyber.
Separation of existing assets and liabilities.	**Assets**	Refreshed branding, any required new office space and fit-out.
Separation of existing contracts.	**Contracts**	Establishing new contracts, consenting costs for contract separation. *
Establishing the new entity, financial close, entity marketing and buyer interaction, Sales and Purchase Agreements (SPAs).	**Transaction/legal**	Third-party costs for legal support, specialist advisers/vendors, preparation of business plans, input into regulatory and legislative processes.
Preparation and running of the TSAs, managing TSA exit.	**Separation and transformation management**	Running of TSAs, managing TSA exit, Future System Operator management cost.

* Some of this activity may be led by National Grid plc, in collaboration with the ESO.

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15.10 Potential TSA considerations

As is typical in most transactions, we do not expect standalone services to be fully stood up on day one. Instead, TSAs will be put in place, where National Grid plc provides support while standalone capabilities are established. There may be a need for some reverse transitional requirements (rTSAs), where the ESO is required to support National Grid plc.

Detailed discussion with National Grid plc on the scope of transitional requirements and development of TSA/rTSA term sheets would form part of the detailed design phase of the programme.

15.11 Future System Operator cost tables

RtB costs

Our plan for the standalone Future System Operator includes approximately 1,700 FTE. Where it creates value for the consumer, we have outsourced some services. We have estimated an indicative annual standalone RtB cost to be c.£210 million to c.£223 million. Further detail on these costs can be found below.

	As-is costs FY24 BP2	Incremental cost adjustments	Standalone costs Low	Standalone costs High
Opex (£m 18/19 prices)				
Direct RtB costs	86	9	95	95
Non-IT indirect RtB costs	17	11–13	28	31
IT indirect RtB costs (with cyber)	71	2–11	73	83
IT project opex – ESO costs	14	-	14	14
Total opex	**189**	**22–34**	**210**	**223**

Table 15: Cost summary – RtB costs (numbers may not add exactly due to rounding)

The concepts of direct and indirect RtB costs are only valid within the current state of ESO as part of National Grid plc. Once the transition to a Future System Operator is complete, all functions would be direct functions.

Direct RtB costs

- A c.£6 million increase in incremental costs is driven by the growth of the business due to approximately 80 additional FTE needed to undertake new and enhanced industry roles. A summary of the indicative FTE associated with each role can be found in table 15. Our design for these industry roles is based on the decisions set out in the joint BEIS and Ofgem consultation response. We anticipate that the scope of roles will change as responsibilities are clarified when legislation, licences and codes are drafted, as well as the associated industry engagement. Further detailed work would be needed to refine our assumptions in the detailed design phase of the project.
- Approximately £3 million in incremental costs is related to direct procurement (specifically Network Competition) and operational and maintenance contracts (ongoing run costs related to the new Contingency Control Centre).

New and enhanced roles		FTE
Role 1	Office of Energy Resilience and Emergency Management	25
Role 2	Gas market strategy	10
	Whole energy system market strategy	5
	Network Services Procurement (Pathfinders) support*	4
Role 3	Gas network system planning	20
	Whole energy system planning	5
Cross-role and cross-cutting	Advisory role	6
	Driving competition (Procurement Body)	7

Table 16: Summary of FTE associated with new and enhanced industry roles

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Procurement expertise for the delivery of Network Services Procurement (Pathfinder) projects is currently provided by National Grid plc. As a standalone organisation, the Future System Operator would need to replicate this resource.

Non-IT indirect RtB costs

- In the Finance function, we will create new standalone capabilities. Incremental costs are driven by the additional c.74 FTE (c.£7 million) directly employed by the Future System Operator, and new contract and property requirements (c.£4 million) in this function.
- Given the growth in FTE in the new organisation, we have assumed that more office capacity will be required in the future. Due to constraints at our current site at Faraday House in Warwick, additional office space may be needed nearby, or a new site established in the Warwick area to accommodate this. Our plan also includes a London office to maintain a presence in the capital and support talent attraction and retention. No other changes have been assumed for other ESO locations.

IT indirect RtB costs

- The IT RtB to-be cost range of c.£73 million to c.£83 million reflects the aggregate analysis of dis-synergies in IT cost in a carve-out scenario. These are mainly driven by dis-economies of scale, cost of people, hosting (data centres), networks and end user devices.

Incremental RtB cost phasing

Table 17 below shows an indicative phasing of the incremental cost adjustments based on the high range cost estimates.

- Direct RtB costs – the majority of the new and enhanced industry roles for the Future System Operator are assumed to be in place by FY24, with the resource needed for the Office of Energy Resilience and Emergency Management role being built up during FY25. Costs relating to the new Contingency Control Centre are assumed to further increase cost adjustments in FY26.
- Non-IT indirect RtB costs – we have assumed that we will be building the back-office function teams during FY24, with the full year impact of additional costs from FY25. Further incremental costs for increased office capacity are expected to impact from FY26.
- IT indirect RtB costs – the phasing of cost dis-synergies has been estimated to increase over time as we continue to exit from TSAs with National Grid plc.

	Incremental cost adjustments High	Incremental cost adjustments	Incremental cost adjustments	Incremental cost adjustments	Incremental cost adjustments
Opex (£m 18/19 prices)		FY23	FY24	FY25	FY26
Direct RtB costs	9	-	4	8	9
Non-IT indirect RtB costs	13	-	6	12	13
IT indirect RtB costs (with cyber)	11	-	5	6	11
IT project opex – ESO costs	-	-	-	-	-
Total opex	**34**	**-**	**15**	**25**	**34**

Table 17: Cost phasing summary – RtB costs (numbers may not add exactly due to rounding)

One-off costs

To achieve the transition and transformation of the ESO into a new organisation, we have estimated one-off costs to be between c.£105 million and c.£145 million.

Programmes at this stage in their development would typically allow for 30 per cent uplift to cover variation in one-off transition costs. This would bring the range of estimated one-off costs to between c.£135 million and c.£185 million.

Non-IT one-off costs

Total non-IT one-off costs have been estimated to be between c.£66 million and c.£88 million. This is made up of costs across five categories:

- People costs, including transitional roles, and costs of retaining, recruiting, training employees, and building the employee value proposition.
- Assets costs mainly refer to the one-off costs of changes to the property estate, including a new Contingency Control Centre.

- Contract costs include legal support to establish new contracts and rebranding costs.
- Legal one-off costs refer to legislative and framework agreement input, and costs of creating new licences for the Future System Operator.
- Separation and transformation management costs refer to all the costs associated with implementing the transition, including but not limited to programme management, transition execution and readiness, and TSA management.

The total non-IT one-off costs are summarised in table 18 below.

Estimated one-off cost (£m 18/19 prices)		
Non-IT numbers	Low	High
People	5	7
Assets	20	39
Contracts	3	4
Transaction/Legal	1	1
Separation and transformation management	38	38
Non–IT total	**66**	**88**

Table 18: Summary of total non-IT one off costs (numbers may not add exactly due to rounding)

IT one-off costs

Total IT one-off costs are estimated to be between c.£38 million and c.£54 million. This is made up of costs across four categories, which are summarised in table 19 below. Further detail on each of these categories and the activities included can be found in **Chapter 9 – Digital, Data and Technology**.

Estimated one-off cost (£m 18/19 prices)			
IT cost summary	Low	Medium	High
Applications	26	31	36
Infrastructure	8	10	12
EUC/Workplace	5	5	5
Security	1	1	1
IT – total	**38**	**46**	**54**

Table 19: Summary of IT one-off costs (numbers may not add exactly due to rounding)

Migration of applications to the Future System Operator assumes a 'lift and shift' approach. This means no application enhancements will be carried out unless necessary. The migration also assumes that the initial set up of the cloud landing zone is already in place.

One-off costs of the migration have been calculated based on an estimated approximate effort/cost to migrate applications depending on the complexity of each application. Each application has been determined to be either low, medium, or high complexity based on a combination of attributes such as the complexity to separate, number of users and the nature of the application.

One-off cost phasing

An indicative phasing of one-off costs is shown in table 20 below. The focus of costs from FY23 to FY25 will be to implement the transition to a standalone Future System Operator, ensuring all TSAs with National Grid plc can be exited by FY26. In FY26, the majority of property one-off costs will be incurred as we increase office capacity and build the Contingency Control Centre.

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Estimated one-off cost (£m 18/19 prices)						
Non-IT numbers	High		High FY23	High FY24	High FY25	High FY26
People	7		1	5	1	-
Assets	39		-	1	6	32
Contracts	4		1	3	-	-
Transaction/legal	1		1	1	-	-
Separation and transformation management	38		12	12	10	4
IT	54		3	24	25	2
Non–IT total	**142**		**18**	**45**	**41**	**38**

Table 20: Phasing of one-off costs (numbers may not add exactly due to rounding)

Summary of estimated costs

Table 21 below summarises estimated costs to run the new organisation, as well as the one-off costs incurred by us in transitioning and transforming. Programmes at this stage in their development would typically allow for 30 per cent uplift to cover variation in one-off transition costs. This would bring the range of estimated one-off costs to between c.£135 million and c.£185 million.

These costs are indicative and based on a set of assumptions. They will change as we get greater clarity on the scope of the roles and responsibilities the Future System Operator will become accountable for, and on the approach to separating from National Grid plc.

It is important to note that our plan and its associated costs are entirely separate from any costs incurred by National Grid plc (e.g., costs to the relevant entities involved in the sale/purchase of the ESO). Typical activities associated with the sales process, such as setting the boundary of the business, will be subject to discussion and agreement between National Grid plc and the buying entity. It also does not include the costs National Grid plc may incur during any implementation process.

Estimated ESO costs (£m 18/19 prices)	
As-is run the business costs (per annum)	£189 million
Standalone run the business costs (per annum)	£210–£223 million
One-off transition cost (range)	£105–£145 million

Table 21: Estimated ESO costs

Chapter 16

Regulatory finance

Chapter 16 - Regulatory finance

Ofgem's RIIO-2 Final Determinations[67] in December 2020 set out a new funding framework for us taking into consideration our role in the energy industry and our unique asset light nature. Most of the parameters in the framework were set for the full RIIO-2 period, however there were a small number of areas of uncertainty which Ofgem indicated should be reviewed as part of the BP2 submission.

These areas are outlined in the table below, along with our proposal for BP2:

Area	Decision for BP1 in RIIO-2 Final Determinations	Our proposal for BP2 without Fixed BSUoS	Fixed BSUoS proposal
1. Demonstrably inefficient or wasteful expenditure (DIWE) Cap	2.5% of RAV	2.5% of RAV – no change proposed	
Additional Funding			
2a. Revenue Collection Role: Equity	£3.3m nominal, pa	£3.3m nominal, pa with the current BSUoS arrangements	£4.4m nominal, pa if the fixed BSUoS tariffs are approved and the ESO increases the capital employed by another £300m to cover the increased liquidity/cash flow risk
2b. Revenue Collection role: debt *(i.e. cost of procuring and maintaining a Working Capital Facility)*	£0.8m nominal, pa	£0.8m nominal, pa – no change proposed	
2c. Risk Asymmetry *(assuming the DIWE cap remains at 2.5% of RAV)*	£1.5m nominal, pa	£1.5m nominal, pa – no change proposed	
3. Capitalisation rates	Set for the BP1 period based on the share of capex/opex investments	Set for the BP2 period based on the share of capex/opex investments – no change in methodology proposed	

Table 22: Regulatory finance parameters reviewed for BP2

As expected, for most areas we do not propose any changes for BP2. This is either because we do not see a material change in risk, or because further time is needed to conclude whether certain risks, such as whether cost dis-allowances are likely, will materialise. We do see emerging risk in a couple of areas, namely the cash flow risk associated with fixing BSUoS tariffs and the potential increase in risk in taking on new activities.

If BSUoS tariff fixing is implemented under the current proposals of CUSC modification (CMP361), we will take on a sufficient and new proportion of the cash flow risk associated with under-recovery of BSUoS revenues. We would need to commit additional credit facilities and would be exposed to other risks such as profit volatility, legal and reputational risk. Since there are no assets associated with our role in supporting fixed BSUoS tariffs, there is no opportunity to earn a return for the additional risks and the contingent equity associated with raising additional credit facilities. We have proposed an extension to Ofgem's preferred ESO method of remunerating capital employed to provide funding for these additional risks. Based on us providing £300 million of additional credit facilities, this equates to £4.4 million of funding.

We have plans in BP2 for new activities which could, due to scale and complexity, present significant additional risks. We do not believe that any organisation would take on such additional activities with the prospect of, at best, only recovering its costs and, at worst, incurring fines, penalties, legal challenge, and reputational damage. We therefore propose future discussions on

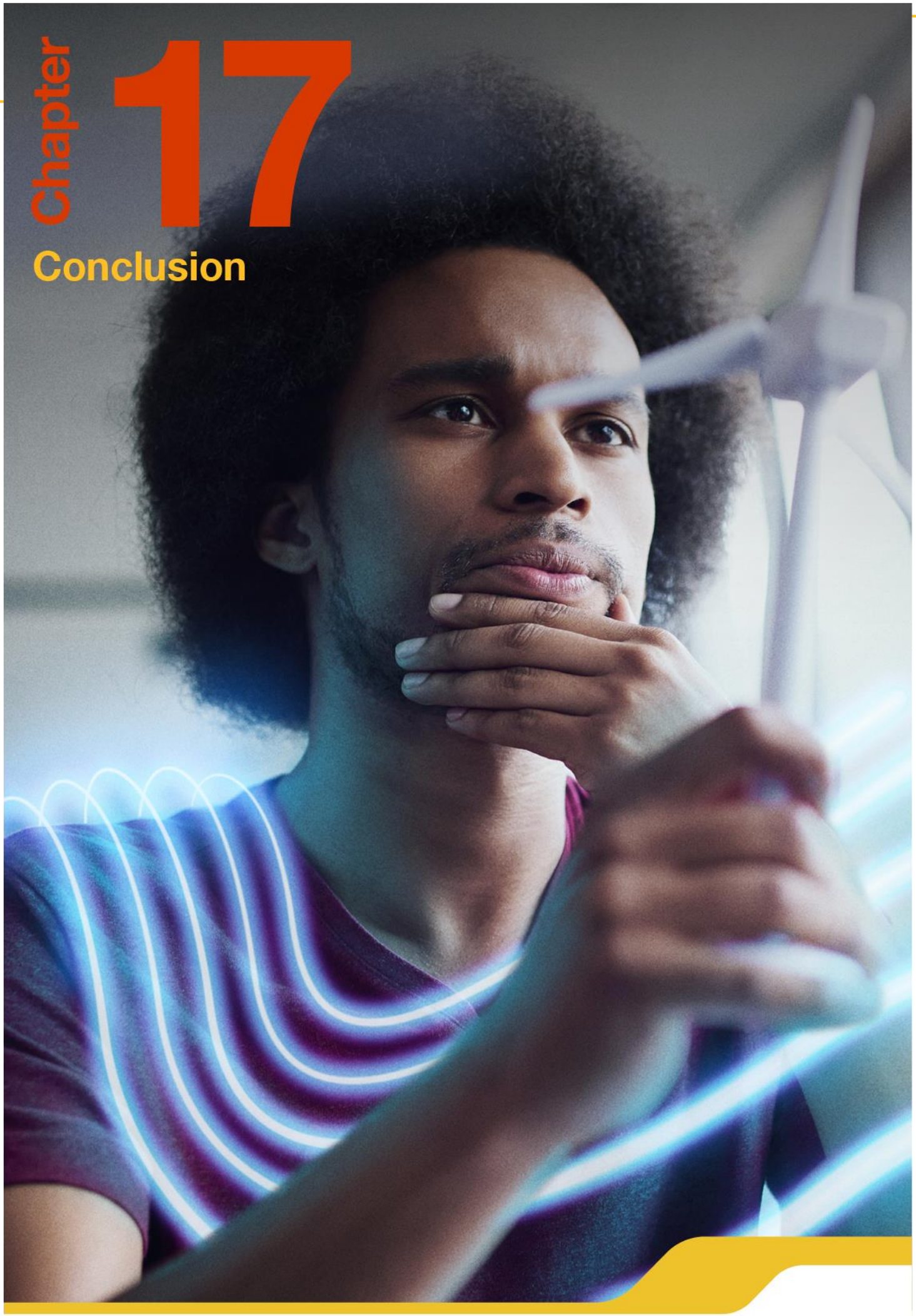
[67] RIIO-2 Final Determinations (Revised 3 February 2021) – Electricity System Operator Annex. Summary of all financial parameters forming the RAV*WACC plus Additional Funding package is on Table 10 (p.65).

adjustments to our additional funding, where we believe activities present additional material risk, which cannot be mitigated. In **Annex 1 – Supporting Information**, we set out in more detail our rationale for our BP2 funding proposals.

Ofgem agreed that we could ask for additional NIA funding for years three to five of RIIO-2 by showing progress, providing more details of planned innovation activity, and evidencing how these activities build upon our wider Business Plan. In **Chapter 10 - Innovation**, we set out our current plans for NIA projects and why we are requesting additional NIA funding for the rest of the RIIO-2 period.

Chapter 17

Conclusion



Chapter 17 Conclusion

Great Britain is at a critical point in our journey to net zero and energy is at the heart of that journey. Our mission is t**o drive the transformation to a fully decarbonised electricity system by 2035 which is reliable, affordable and fair for all.**

To achieve our mission, we know that we must go further and faster in pursuit of a decarbonised electricity system and deliver the outcomes our stakeholders need from us over the next two years.

Through our three Roles and our enabling activities we will deliver against the priorities we have identified:

- delivering excellence in system operation
- building efficient and effective markets
- driving clarity in our path to net zero, and
- enabling our organisation to perform.

This Business Plan, shaped by our stakeholders, sets out the activities and deliverables that will drive over £2.8 billion of benefits for consumers, support a reduction in consumer bills and accelerate Great Britain's journey to net zero.

We also highlight our evolution into the Future System Operator for Great Britain, transitioning out of National Grid plc with an expanded role in industry.

We are excited about the activities we have proposed in our BP2 submission and the future direction and growth of our business.

Next steps

We believe our proposals in this plan deliver value for consumers in Great Britain. In terms of what happens next, Ofgem will review the proposals as set out in the ESO Business Plan Guidance [68]. Alongside evidence from our stakeholders, including the Performance Panel and ERSG, Ofgem will form a view and consult on their draft determinations in November 2022, ahead of a final determination in March 2023. We encourage our stakeholders to engage with this Ofgem consultation process.

We are aware that the energy landscape will continue to change at a rapid pace in the coming months and years, which may drive further change and activity for us. We remain committed to working with our customers and stakeholders to help shape the future of the energy sector and understand how best we can deliver value. We appreciate the challenge and support we have received to date and look forward to continuing to work with our customers and stakeholders as we accelerate the transformation to a fully decarbonised electricity system.

If you would like to get in touch with the team about anything you have seen in this document, or would like more information about us, please get in touch via box.ESO.RIIO2@nationalgrideso.com.

[68] https://www.ofgem.gov.uk/publications/eso-business-plan-guidance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