Annex 1: further Information on proposed costs

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Further information on proposed costs

This annex provides further information and justification for a number of cost areas where Ofgem has proposed either an efficiency reduction, or that costs are too uncertain to consider now. These are as follows:

Investment line	Business plan data table (BPDT) reference	Amount proposed in business plan (£m)	Proposed efficient cost (£m)	Efficiency reduction (£m)[1]	Uncertain costs for future consideration (£m)
ESO opex – role 1					
ESO direct opex Control Support Review	E5.01	5.6	4.5	1	
ESO direct opex National Control and Day Team	E5.04	35.7	33.8	1.9	
ESO direct opex Commercial Operations	E5.03	7.3	6	1.3	
ESO direct opex Commercial Operation Strategy	E5.11	5.2	3.9	1.3	
Total role 1		***53.8***	***48.2***	***5.5***	
ESO opex – role 2					
ESO direct opex Industry Framework & Codes	E5.09	10.4	9.2	1.2	
ESO direct opex EMR	E5.10	6.3	5.1	1.2	
Total role 2		***16.7***	***14.3***	***2.4***	
ESO opex – role 3					
ESO direct opex Electricity Customer Connections	E5.06	6.7	5.5	1.2	

[1] The efficiency reduction for each Role in Table 1 and Table 2 sums to the efficiency reductions set out in Ofgem's ESO draft determinations document, table 22.

Investment line	Business plan data table (BPDT) reference	Amount proposed in business plan (£m)	Proposed efficient cost (£m)	Efficiency reduction (£m)[1]	Uncertain costs for future consideration (£m)
ESO direct opex Network Development	E5.18	5.3	4.3	1.1	
ESO direct opex Strategy Development[2]	E5.14	4.9	4.3	0.6	
Total role 3		***16.9***	***14.1***	***2.9***	
ESO opex – supporting operational costs					
ESO direct opex Innovation	E5.13	1.5	0.7	0.7	
ESO direct opex Regulation & Customer Stakeholder	E5.20	7.5	6.1	1.4	
Total supporting		***9***	***6.8***	***2.1***	
Capex					
Wokingham Electricity National Control Centre (ENCC) capex Role 1	E4.5 line 37	2			2
Project TERRE central project Role 2	E4.5 line 36	1.7			1.7
Property capex	E4.5 line 28	6.6	2.7	3.9	
Total capex		***10.3***	***2.7***	***3.9***	***3.7***
Business support costs					
HR and non-operational training (opex)	E4.6 line 29	4.8	3.7	1.1	

[2] While Strategy Development is a cross cutting team, this activity (market insights) directly supports Role 3 so has been allocated to Role 3

Investment line	Business plan data table (BPDT) reference	Amount proposed in business plan (£m)	Proposed efficient cost (£m)	Efficiency reduction (£m)[1]	Uncertain costs for future consideration (£m)
Total business support		*4.8*	*3.7*	*1.1*	
Total		**111.5**	**89.8**	**17.9**	**3.7**

Figure 1: Draft determinations proposals – areas for further justification

We welcome Ofgem's recognition that, based on discussions to date, £3.2 million of costs can already be added to its ex ante view of efficient costs. This comprises:

- £1.9 million costs in National Control & Day Team relating to a new contract for managing inertia
- £0.6 million in Commercial Operations reflecting resources moving from capex to opex activities.
- £0.6 million in Network Development to reflect:
  - Resources moving from capex to opex activities
  - An increase in opex to cover the costs of 1 FTE who was seconded to the European Network of Transmission System Operators for electricity (ENTSO-e) in RIIO-1
  - The ESO requiring its own subscription to the Institute of Engineering and Technology.

In addition to the items listed in Figure 1 above, a number of immaterial reductions have also been proposed by Ofgem to different cost lines. These are a combination of ongoing, or business-as-usual (BAU) costs and costs related to our transformational activities. We have been unable to ascertain the reason for these reductions so they are not included in the table above. However given the small materiality of these amounts and the importance of a robust, agreed baseline for the ESO's RIIO-2 costs, we consider that they should be included in Ofgem's ex ante view of efficient costs.

Investment line	Business plan data table reference	Efficiency reduction (£m) not included in Table 1[1]	BAU costs efficiency reduction (£m)	Transformational costs efficiency reduction (£m)
ESO opex – role 1				
Control support review	E5.01	0.1		0.1
Control system support	E5.02	0.2	0.1	0.1
Total role 1		*0.3*	*0.1*	*0.2*
ESO opex – role 2				
Market developments	E5.08	0.4	0.2	0.2
Industry frameworks and codes	E5.09	0.3		0.3
EMR	E5.10	0.1		0.1
Total role 2		*0.8*	*0.2*	*0.6*
ESO opex – role 3				

Investment line	Business plan data table reference	Efficiency reduction (£m) not included in Table 1[1]	BAU costs efficiency reduction (£m)	Transformational costs efficiency reduction (£m)
Electricity Customer Connections	E5.06	0.3		0.3
Network access planning	E5.07	0.1		0.1
Energy analysis	E5.17	0.1	0.1	
Network development	E5.18	0.1		0.1
Network operability	E5.19	0.3		0.3
Total role 3		***0.9***	***0.1***	***0.8***

Figure 2: Additional reductions not explained by Ofgem

As set out in our answer to ESOQ20, the transformational cost items subject to an efficiency reduction have been treated inconsistently to the capex associated with these projects. The capex has been classed as 'uncertain costs for future assessment'. It is not appropriate to impose an efficiency reduction on the opex when the capex for the same project has not yet been assessed.

The remainder of this Annex provides justification for the costs listed in Figure 1.

ESO direct opex Control Support Review BAU (BPDT E5.01)

We requested £6 million over two years for our Control Support Review team. In the draft determinations £4.8 million over two years was allowed in the efficient benchmark, with £1.1 million[3] proposed as an efficiency reduction.

The average RIIO-1 spend for control centre training and simulation was £2.4 million (eight-year average) and BAU restoration £0.7 million. Restoration costs started in 2017/18 so this reflects a four year RIIO-1 average. Ofgem has based its efficiency reduction on an eight-year average for both control room training and restoration, which understates the baseline because restoration costs did not begin until 2017/18.

Taking the Control Support Review team costs excluding Restoration, our proposed funding in RIIO-2 is £2.1 million average per year. This is £0.3 million lower than the RIIO-1 average levels of £2.4 million and reflects the efficiencies we expect to deliver in our training programmes.

The demand and requirement for training in the control rooms, is not decreasing or is any less important than it was in RIIO-1. The speed of change of the power system means that learning from experience is less relevant – we need to simulate the network and increasingly use scenarios to ensure we maintain the quality of our engineers. The current control training unit in Wokingham is focused on technical transmission training and this has been our primary training, delivered in an offline environment. In RIIO-2 we need to reflect new training needs to reflect the more agile, decentralised market we operate in. We aim to improve the time it takes to train, the quality of training and also deliver training using live data. Currently a lot of training involves shadowing control room staff which is sub-optimal. We want to enable trainees to learn using live data, freeing up control room staff to concentrate on their job in the more challenging energy landscape we operate in. Our proposed costs also include provision for partnerships with universities that will add ESO-specific content to electricity engineering degree courses. This will help with recruitment of new talent and capability into the control room.

For both activities – Control Support Review and Restoration – the correct RIIO-1 average should be £3.1 million. This reflects an eight-year average for control room training and a four-year average for restoration BAU. Our proposed average cost in RIIO-2 is £2.8 million for these activities, lower than this average.

[3] This does not sum with the £4.8 million to £6 million due to rounding.

ESO direct opex National Control and Day Team BAU (BPDT E5.04)

We requested £35.7 million over two years for National Control and Day Team. In the draft determinations £33.8 million over two years was considered efficient, with a £1.9 million efficiency reduction. The £1.9 million related to insufficient evidence for the increase in costs to measure inertia on the system or how the value of this increase had been derived.

The inertia investment has a signed contract and is currently in progress. The opex costs we requested in RIIO-2 reflected these costs. In follow-up discussions with Ofgem, we have provided a copy of the contract and a screenshot of the opex numbers in the inertia investment paper that went to our ESO investment committee. **Ofgem has agreed that this is sufficient evidence that these £1.9 million costs should be added back into the proposed efficient cost for this activity.**

ESO direct opex Commercial Operations BAU (BPDT E5.03)

We proposed to spend £7.3 million over two years for Commercial Operations consisting of £3.6 million for Modelling and Insights and £3.7 million for Commercial Operations.

In the draft determinations, £6 million over two years was allowed in the efficient baseline, with £1.3 million efficiency reduction. The £1.3 million related to £0.65 million in the Modelling and Insights team and £0.6 million in the Commercial Operations team.

Modelling and insights

Modelling and Insights requested an increase of £0.7 million each year on the two-year RIIO-1 average, which reflected the need for £0.4 million additional data subscriptions and £0.3 million due to RIIO-1 resources changing their focus from capex activities to opex activities in RIIO-2. The £0.4 million additional data subscriptions have been included in Ofgem's view of efficient costs.

The remaining £0.3 million annual cost is explained by a change in 1 full-time equivalent (FTE) moving from capex to opex activities, correctly reflecting the requirements of that role in RIIO-2. From the costing model below the £0.3 million change from capex to opex can clearly be seen, on the timesheeting line. **Ofgem has agreed this is sufficient evidence to include the additional £0.65m (over two years) in its ex ante view of efficient costs.**

Modelling and Insight £	2021	2022	2023
Gross Salary Costs	**1,122,918**	**1,041,427**	**1,034,666**
Staff Timesheeting / Capitalised Salaries	(302,785)	-	-
Net Salary Cost	**820,133**	**1,041,427**	**1,034,666**
Other employee costs	39,500	37,455	37,455
Total Employee Costs	**859,633**	**1,078,881**	**1,072,120**
Legal and Professional Costs	150,000	150,000	150,000
Communication and Stationery Costs	6,000	5,545	5,545
Subscriptions	-	400,000	400,000
Misc. Costs excl. Recruit. and Subscription Costs	25,000	23,864	23,864
Efficiency	-	-	(16,515)
Total Other Costs	**181,000**	**579,409**	**562,894**
Total Controllable Costs	**1,040,633**	**1,658,290**	**1,635,014**

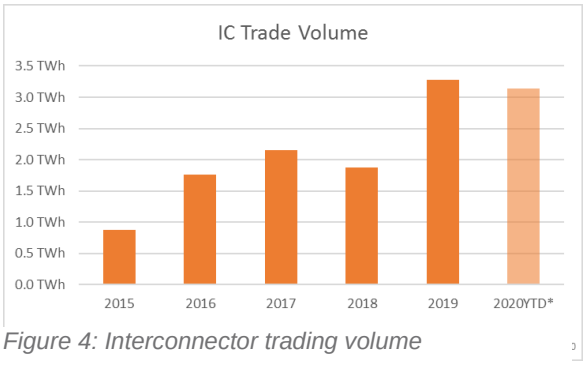
Figure 3: Modelling and insights

Commercial operations

Commercial operations requested £0.3m increase each year for 2 new FTEs: 1 FTE to support greater trading volumes due to the delivery of new interconnectors and 1 FTE to support a greater number of Regional Development Programmes which explore innovative ways to address network constraints.

Interconnector trading

Trading on interconnectors helps to meet system requirements while also using cheaper energy from Europe. Interconnector trading volumes have been growing year on year as shown in the graphs below. The increase in trading is more pronounced in 2019 and 2020 due to the addition of Nemo Link creating an intraday market in late 2019. Since then we have seen a 25 per cent increase in the volumes traded on interconnectors. The volumes for the first seven months of 2020 is almost as much as was traded during the whole of 2019.



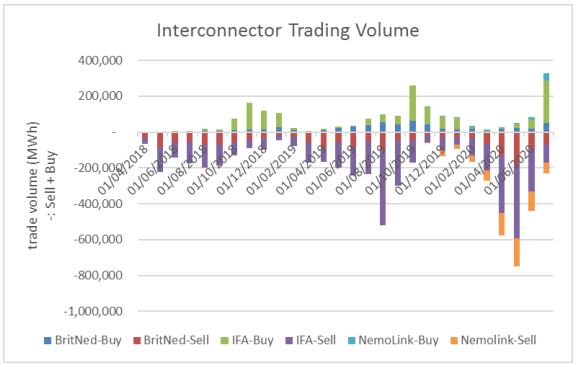


Figure 4: Interconnector trading volume

This is a trend that is expected to continue as additional interconnectors connect to the GB system (see the table below). This is not only because each additional interconnector's flow must be secured therefore increasing the number of megawatts (MWs) traded, but when added to the overall mix of lower demands, lower system inertia and a more congested network at the connection location, there is an increasing reliance on interconnector trading to manage these challenges. Growth isn't necessarily a problem on its own, but the pace of this growth is the driving force behind the increased FTE. To accommodate this increasing volume of trades whilst maintaining a consistently high level of delivery requires additional support over and above current levels as we continually refine and automate our processes and tools.

Interconnector	Capacity	Estimated start date
IFA 2	1000 MW	2020
ElecLink	1000 MW	2021
NSL	1400 MW	2021/22
Viking Link	1500 MW	2022
FAB Link	1400 MW	2023
Green Link	500 MW	2023
Grid Link	1500 MW	2023/24
Aquind	2000 MW	2023/24

Figure 5: Interconnector joining dates

Wider projects above BAU

Each new interconnector and market change comes with its own specific set of challenges and commercial arrangements that need extensive support from the trading team. Whilst there is a template of standard services, each one connects into a different area, with a different set of stakeholders that have different requirements. Furthermore, the end of the EU Exit transition period is likely to compound this problem with greater divergence of regulations and issues.

In parallel, extensive work is being undertaken to standardise the range of services on interconnectors and create an increased set of market-based services. This should bring greater harmonisation in the long run, however increases the workload on the existing team. Additionally, as more trading activity occurs a keen focus is always kept on increasing competition. This delivers substantial cost savings as the last forward plan report demonstrated but working with a greater number of providers and stakeholders requires more support and time given to enable these relationships to form.

Business resilience and succession training

The recent lockdown period has led to this role being reclassified as 'operationally critical' due to the level and nature of support provided to the electricity control centre. A thorough training and authorisation process to perform this role takes at least one year to complete. The ESO trading function operates a 24 hours a day, seven days a week rota and it is therefore critical that appropriate steps are taken to provide adequate resilience for leavers and movers, proactive recruitment and advanced training whilst safeguarding the wellbeing of existing staff. The current FTE allowance doesn't accommodate this and so the increased FTE will facilitate the necessary resilience and succession planning for this operationally critical role.

Regional development programmes

Our ground-breaking Regional Development Programmes involve working closely with distribution network operators to tackle constraints on specific parts of the network. This affects our Commercial Operations teams, particularly those responsible for ensuring all non-energy balancing services (frequency, voltage, thermal and stability services) are effectively and efficiently procured. As we progress through the development of Regional Development Programmes and related initiatives such as pathfinders[4] and our reserve and response roadmap[5] the number of products we will procure and the frequency at which we procure them will increase.

Our overall forecast is for a further 1-1.5 FTE to support the procurement strategy of the new products that are developed. These new products and services are outlined on our operability strategy[6], and include:

- Stability
  - Stability Pathfinder Phase 2 (In development)
  - Stability Pathfinder Phase 3 (Not yet started begins 2021)
  - Stability Market (Not yet started begins 2021)
- Response
  - Dynamic Containment Daily auctions (In development)
  - Dynamic Moderation Daily Auctions (Not yet started)
  - Dynamic Regulation Daily Auctions (Not yet started)
- Reserve
  - CEP 6(9) compliant STOR (In development)
  - Reserve Reform Products likely to be 3 new ones
- Thermal
  - Constraint Management Pathfinder developed tools (In development)
- Voltage
  - Mersey Pathfinder Long Term (running)
  - Pennies Pathfinder Long Term (about to start)
  - Mersey Short Term.

[4] https://www.nationalgrideso.com/research-publications/network-options-assessment-noa/network-development-roadmap
[5] https://www.nationalgrideso.com/document/157791/download
[6] https://www.nationalgrideso.com/research-publications/system-operability-framework-sof

ESO direct opex Commercial Operation Strategy BAU (BPDT E5.11)

We requested £5.2 million over two years for the commercial operations strategy team. In the draft determinations £3.9 million was allowed in the ex-ante view of efficient costs, with a £1.3 million efficiency reduction. We believe the efficiency reduction was reducing the spend to RIIO-1 eight-year average levels.

The eight-year average baseline should only be applied to the commercial operation strategy BAU team, and not to the new Data Stewardship team which begins in RIIO-2.

For the commercial operations strategy BAU team we asked for £1.7 million each year which is lower than the £2 million RIIO-1 eight-year average.

Commercial operations strategy team – justification for two new FTEs

Ofgem asked for further details of the two new FTEs included in our proposed £1.7 million cost. The commercial operations strategy team will support our transformational activities throughout the period in delivering the key elements of Roles 1, 2 and 3 which will ensure that critical system services can be sourced from new and existing providers in the most efficient way. The first phases of the operability challenges have focused on small scale regional developments in new services. During RIIO-2 these will be expanded to more complex nationwide services such as pathfinder phase 3[7], stability market[8], further voltage pathfinders and the further development of the Response and Reserve Roadmap[9]. These larger and more complex projects will require two additional resources to manage the interactions and overcome framework blockers to ensure that the services can be delivered for the lowest costs.

Data Stewardship team

This is a new team in RIIO-2 so we don't think that a comparison against RIIO-1 average costs is appropriate. Justification for this team and the number of FTEs required is given below.

With our current systems, data management and validation is performed when required, suitable for the limited size and complexity of the datasets we currently manage. Dataset sizes will increase in RIIO-2 as interactivity increases, with huge amounts more data as increasing numbers of smaller-scale providers interact with our systems. This also renders the analysis to be performed much more complex. This, combined with enabling data technologies, will allow more information to flow from all providers. There will be increasing requirements for this data to be interpreted by more systems and we will need a new Data Stewardship team as highlighted in section 8.3 of our RIIO-2 Business Plan.

Our new, underlying data management capability will be extendable, scalable and interoperable. It will integrate with the data portal, enabling rapid and scalable publication of our operational data.

Our proposals require two data analysts to:

- Administer data platform management and operate cataloguing tools to ensure a single source of operational data is used across multiple systems, applications, and/or processes.
- Carry out master data profiling and analysis to review source data and understand its structure, content and interrelationships.
- Maintain guidelines and ensure proper training of end users of data sources.
- Lead and/or support projects related to master-data management and drive further improvements as part of continuous progress.
- Investigate gaps around the creation and change of master data, which leads to inaccurate reporting. Our analysts will initiate measures for improvement and support the IT team during development and implementation.

The team will also include two data engagement and transformation officers to:

- engage with stakeholders on new data requirements

[7] https://www.nationalgrideso.com/research-publications/network-options-assessment-noa/network-development-roadmap
[8] https://www.nationalgrideso.com/news/national-grid-eso-outline-new-approach-stability-services-significant-step-forwards-towards
[9] https://www.nationalgrideso.com/document/157791/download

- lead on code changes needed to support sharing of new datasets
- create new datasets on the portal
- maintain existing datasets
- respond to internal and external queries and comments
- manage our data publishing pipeline
- carry out external engagement to support future developments.

It will also include two data quality and assurance officers to:

- ensure appropriate governance and standards for data publishing
- analyse data to ensure it meets agreed standards
- lead on exercises which improve data quality
- create data assurance reports
- liaise with stakeholders and IT to progress change, and maintain and improve data integrity
- guide and support data cleansing projects for older and less accessible data
- ensure the data dictionary, the set of information describing the contents, format, relationships and structure of data, and metadata standards, descriptive or contextual information for a piece of data, are applied correctly
- manage and monitor the access rights to datasets via the data portal.

We are confident that this team is the right size and structure as our views here are informed by the experiences of organisations that have embarked on similar transformations, such as the Office for National Statistics (ONS). The ONS is currently undertaking a digital and technology transformation. This includes an upgrade to user experience, efficient and secure platforms for data processing, and simpler and cheaper ways for data to be collected and verified. To deliver these changes, for transformation alone, the UK Statistics Authority has forecasted an average of 253 FTEs per year over a five-year period[10]. While this activity is not directly comparable with the data transformation we are undertaking, there are many similarities.

Additionally, our needs have been informed by the evolving Energy Data Taskforce (EDTF)[11] outputs, and our expectations of what we will need to continue to deliver the EDTF best practices and recommendations.

ESO direct opex Industry Framework & Codes BAU (BPDT E5.09)

We requested £11.5 million over two years for the Industry Framework & Codes Team. In the draft determinations £10.1 million was included in Ofgem's ex ante view of efficient costs, with a £1.5 million efficiency reduction. The efficiency reduction was for £1.2 million on BAU activities and £0.3 million on transformational activities. This £0.3 million is included in Table 2.

Of the £1.2 million BAU efficiency reduction, £0.9 million represents an increase to the RIIO-1 average to allow for the implementation of European Regulation EBGL (Electricity Balancing Guidelines). Under this regulation all transmission system operators (TSOs) are mandated to participate in the creation of shared IT platforms for the exchange of reserve products, namely the Trans-European Replacement Reserves Exchange (TERRE) and Manually Activated Reserve Initiative (MARI) European requirements. This £0.9 million represents ongoing IT maintenance (also known as run the business (RTB)) costs and legal costs. It is linked to the mandatory Project TERRE capex costs that are discussed later in this annex.

The remaining £1.1 million that was considered inefficient relates to year 2022/23 where we asked for three additional FTEs and £0.75 million consultancy costs for two expert advisers on codes. Additional interconnectors (IFA2, NSL and ElecLink) are coming on line over the early part of RIIO-2, which will increase the number and complexity of relationships with connecting TSOs. This increases our requirement for legal

[10] https://gss.civilservice.gov.uk/wp-content/uploads/2018/03/6.3908_SA_Better-Statistics-Better-Decisions-A5-Booklet_FINAL_WEB-4.pdf page 9
[11] https://www.gov.uk/government/groups/energy-data-taskforce

resource so that we can ensure that contracts and operating protocols reflect both GB and European codes. Please see Figure 5 for a list of the interconnectors that will be coming online in RIIO-2.

The nature of GB's EU exit will necessitate a different relationship with the European Network of Transmission System Operators for electricity (ENTSO-e) and the regional coordination centres. We have observed that other third country TSOs such as Swissgrid and European Economic Area (EEA) members such as Statnet have to provide significant additional resources to not only participate in, but also convene, ENTSO-e work groups and engage with the EU Commission in order to have any kind of influence in development of European regulations and policy. We need additional resource to ensure the specificities of the GB energy system are considered in the development of new methodologies and codes in a world where we do not have voting rights at a TSO, National Regulatory Authority or Governmental level. It is crucial that the ESO has the right resource for European engagement in RIIO-2. Managing the design and development of policy and codes requires significant stakeholder management, and getting this right delivers disproportionate benefits for GB consumers. This is particularly important where our engineering challenges (of an island network) diverge from those of the large alternating current European systems, exacerbated by the loss of voting/veto rights after the end of the EU exit transition period.

Our approach reflects our aspiration to be a code manager rather than a code administrator, reflecting the service required by our stakeholders and the feedback we received as we were developing our Business Plan proposals. This means we will:

- create and own a strategic and incremental industry change plan for our codes.
- seek more explicit powers to assess and prioritise code change to ensure the delivery of more strategic change which is expected to be of benefit to consumers.
- seek more explicit powers for managing the change process. This will help ensure change is delivered at pace, relevant modelling is undertaken if not available, and we have more ownership of change development and delivery throughout the process.
- place more emphasis on engagement with wider stakeholders outside our standard working groups. For example, by continuing to embed and learn lessons from the approach taken through Charging Futures.
- make better use of technology through initiatives such as code digitalisation, a more customer-friendly and accessible website, and better information management and communication channels.
- provide better user guidance and supporting documents that support self-service, but also have a service-focused and well-resourced team available to be a great critical friend where stakeholders require. Support could include an allocated code account manager as well as industry training events on certain elements of the code.
- take on additional responsibilities for developing code modification and directing incremental improvements for our own codes. For example, analysing and modelling change proposals, engaging stakeholders on proposals and developing options.

Building on the foundations of market development and change, we will also:

- place extra emphasis on larger and more coordinated programmes of work for our codes, in line with wider industry strategy. For example, we would take a more active and leading role in strategic change, particularly in relation to ongoing charging and access reforms, and Charging Futures responsibilities.
- give more focus to other industry change, which is less directly relevant to ESO but where we feel we could add value to the process. For example, for incremental and strategic change we could become more involved in other markets and codes, such as the Balancing and Settlement Code (BSC86) or DCUSA changes as and where we believe we could add value as ESO. In one example, Elexon is currently leading a design working group for market wide settlement reform. This is expected to have significant positive consumer impact, unlock flexibility and impact our own codes and processes, but we have had limited involvement to date. In our transformed position, we would aim to be much more involved in similar programmes in the future and bring an additional ESO perspective.

Therefore, in 2021 and 2022 we will enhance our code management powers and responsibilities and, in parallel, further drive the agenda for both strategic and incremental code change. Our resource proposals for RIIO-2 reflect these new ambitions.

ESO direct opex EMR BAU (BPDT E5.10)

We requested £6.7 million over two years for the Electricity Market Reform (EMR) team. In the draft determinations £5.3 million over two years was considered efficient, with £1.3 million removed as an efficiency reduction. The efficiency reduction was for £1.2 million on BAU activities and £0.1 million on transformational activities. This £0.1 million is in Table 2.

Ofgem has determined the efficient cost by using the average of the last three years of RIIO-1. We disagree that this is an appropriate comparator as the previous three years are not a direct comparison to the workload expected in 2021/22 and 2022/23. This is due to the increased volume of capacity market (CM) and contracts for difference (CFD) participants expected, the additional support and guidance those participants require and the significant forward plan of government regulatory change (UK and Europe) that we are due to deliver. Further, Ofgem has clearly stated that it wants the ESO, as Delivery Body, to provide a greater level of customer support and to facilitate all future change faster. This cannot be done with historic funding levels

The growth in our workload is in two key areas:

- The number of capacity market applicants. The introduction of a 1MW de-minimis threshold opens the CM open to a new tranche of applicants, including demand-side response (DSR) providers. DSR providers, by virtue of their structure, can contain separate components which can number in the 100s per applicant. Whilst this is great news for market liquidity and consumer value, these new applicants tend to have less knowledge of the CM and require a greater amount of time to support them through the pre-qualification and agreement management processes. This is a fundamental change – moving from simply running the CM processes to providing extensive advice and guidance to participants – in our role since the beginning of RIIO-1. In Ofgem's 2019 EMR re-opener decision it gave us a clear steer that we should be spending more opex to support participants in this way[12].
- The growing complexity of the CM regulations and rules. There have been large numbers of significant and complex changes to the rules and regulations over the past four years, as can clearly be seen in Appendix 2 of Ofgem's August 2019 consultation on EMR Delivery Body funding[13]. With both the Ofgem and BEIS five-year reviews, implementation of foreign participation in capacity markets and the government white paper being finalised in the near future, significantly more are envisaged over the next two years. As rules are rarely applied retrospectively and the lead time from auction to delivery year is four years, this means we will have to maintain four sets of live rules and processes at any one time. This then leads to greater resource to develop processes for the business and guidance for applicants, including a greater number of new and inexperienced applicants as detailed above. Ofgem has given us a clear steer in RIIO-1 that we should be facilitating timely change to the markets.[14]

The Contracts for Difference (CfD) Market is also envisaged to grow with a forecast growth rate of between 2000% and 2500% in 2021 compared to the 2019 auction. This will require an increase in resource to accommodate this and so support Government's net zero targets. At this stage we have not provided for these costs in our RIIO-2 plan as we are still at early stages of discussion with BEIS to understand the full impacts of forward CfD proposals. However this illustrates the general pressure on our role as EMR delivery body.

[12] Ofgem 'Adjustments to the EMR delivery body allowances' September 2019 https://www.ofgem.gov.uk/system/files/docs/2019/09/decision_on_adjustment_to_allowances_for_the_emr_delivery_body_0.pdf Executive Summary p. 4: "We... encourage the DB to increase opex spend if appropriate to deliver the requested service to EMR applicants"

[13] https://www.ofgem.gov.uk/system/files/docs/2019/08/consultation_on_proposals_for_adjustments_to_revenues_for_the_emr_delivery_body.final_.pdf

[14] For example in the latest draft performance report for the EMR delivery body.

ESO direct opex Electricity Customer Connections BAU (BPDT E5.06)

We requested £7.9 million over two years for our Electricity Customer Connections Team. In the draft determinations £6.3 million over two years was allowed in Ofgem's view of efficient costs, with a £1.5 million efficiency reduction. The efficiency reduction was for £1.2 million on BAU activities and £0.3m on transformational activities. This £0.3 million is included in Table 2.

For BAU costs we asked for an average of £3.3 million each year. Ofgem compared this to a RIIO-1 three-year average of £2.7 million and proposed the £0.6 million annual efficiency reduction.

We would like to make the case for three additional FTEs in RIIO-2. The overriding driver for this change is to enable us to accommodate increasing distributed energy resource (DER) connections, consistent with a whole system approach and the UK's low carbon targets. We are seeing a wider range and number of customers wishing to connect. Many of these are smaller and new to the industry frameworks, so they require additional support. In the past 12 months, we have seen a 60 per cent increase in applications from new market participants from 210 to over 350. This is primarily driven by new, small generation units for battery storage and solar connections, new interconnectors and new demand points for data centres. We expect this trend to continue into RIIO-2 as the increased activity and interest in developing distributed energy resource and the move away from centralised generation continues, with distributed capacity expect to increase to at least 48 GW by 2030, from 31 GW today. In RIIO-1 the activity in this area commenced in the south-east and south-west of the UK, this has continued to increase and move through the country geographically. Through RIIO-1 we have managed this increase through efficiency gains including customer journey mapping to improve outcomes and the quality of experience. However, given the continued changing nature of our customer base and level of support we need to give to these customers, we need to increase our resources by three FTEs from 2021/22 levels to maintain an appropriate level of dedicated service.

Some of the new activities we need to undertake are:

- Putting in place contracts with DER parties, some of whom will be totally inexperienced in the connections process. There will potentially be hundreds if not thousands of additional customer parties to deal with, including:
  - engagement with new customer parties on the process
  - putting in place contracts
  - answering queries
  - ongoing management of contracts
- Supporting industry code changes in relation to DER.
- Developing and maintaining the new ESO customer portal

The graph below shows the actual and forecasted increase in connection applications.

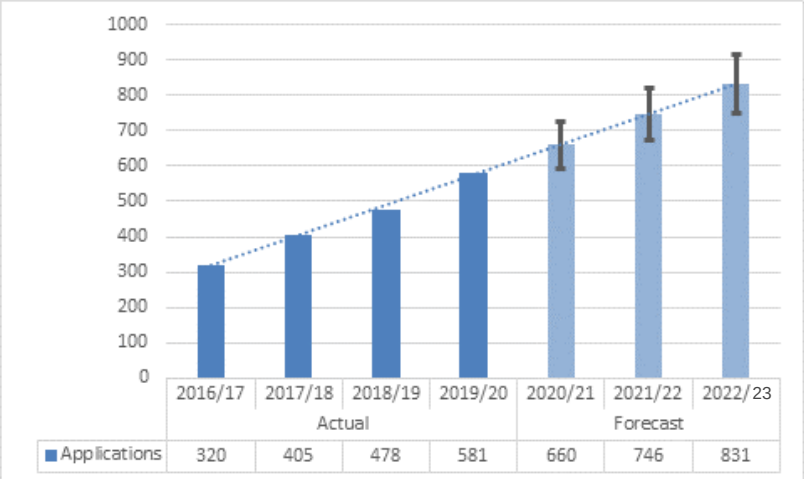


Figure 6: Actual and forecasted connection applications

ESO direct opex Network Development BAU (BPDT E5.18)

We requested £5.8 million over two years for Network Development. In the draft determinations £4.6 million was considered efficient, with a £1.2 million efficiency reduction comprising £1.1 million of BAU and £0.1 million of transformational costs).

The £0.5m in 2021/22 and £0.56m in 2022/23 (£1.1 million over two years) that has been removed as an efficiency reduction represents annual costs for:

- 1 FTE in RIIO-1 who was working on a capex investment that ends in 2020/21. In RIIO-2 this individual will be working on opex activities and the costing model below shows this £0.1m move of costs from opex to capex.
- 1 FTE in RIIO-1 was seconded to ENTSO-e and we recovered the costs from ENTSO-e. This arrangement ends in 2020/21 so in RIIO-2 we must cover this £0.1m cost.
- In RIIO-2 we need to pay for the Institute of Engineering and Technology £75,000 subscription, that had previously been paid for by National Grid Electricity Transmission (NGET).
- £0.2 million increased cost for two additional FTEs that are required to support pathfinder projects and evaluation of third party options.

In follow-up conversations, Ofgem has agreed to include £0.6 million (over two years) in the efficient cost benchmark to cover the costs listed in the first three bullet points above.

NOA £	2021	2022	2023	
Gross Salary Costs	**1,784,060**	**2,001,699**	**1,987,805**	**1**
Staff Timesheeting / Capitalised Salaries	(99,529)	-	-	
Net Salary Cost	**1,684,531**	**2,001,699**	**1,987,805**	**1**
Other Staff Related Costs	51,207	64,899	64,899	
Total Employee Costs	**1,786,945**	**2,131,497**	**2,117,602**	**2**
Communication and Stationery Costs	3,755	14,503	14,503	
Property	1,440	890	890	
Cost Recovery	(73,183)	-	-	
Subscriptions	2,740	77,945	77,945	
Misc. Costs excl. Recruit. and Subscription Costs	6,703	7,201	7,201	
Total Other Costs	**(58,545)**	**100,539**	**79,006**	
Total Controllable Costs	**1,728,400**	**2,232,036**	**2,196,609**	**2**

Figure 7: Network development costing model

We would like to justify the £0.2 million for two extra FTEs, outlined in the last bullet point above. These additional resources will enable us to:

- Analyse double the number of network solutions - we intend to increase our capability to assess more options to support our ambition to increase the diversity of options within the *network options assessment (NOA)* and respond to the requirements on the network driven by the broad range of credible pathways for the future of energy over the next 30+ years.
- Study more of the GB network. Historically, under RIIO1, the *NOA* has been limited to studying a set of defined boundaries. We have suggested increasing, and being more flexible, with the number of boundaries studied so as to focus on a wider area – approximately ten per cent bigger – to reap greater benefits for the consumer from the *NOA* process. This will require more resources across our system analysis, economic assessment and stakeholder engagement activities that vary according to the size of the area and the number options studied.

- Manage a significant increase in the complexity of the network needs we will model. This complexity is driven by the continuing growth of distributed generation and new technologies, which create operability challenges such as system inertia and reactive power demand - we intend to increase our capability to understand these changes and assess them to the required level of granularity so we can quantify the network requirements as well as enhancing how we communicate these requirements and the range of options to meet them to our stakeholders through the *Electricity Ten Year Statement* and *NOA* publications.
- Accommodate the potential for integrated offshore networks and interactions between different energy sources, such as gas and electricity. The projected growth in both offshore wind and interconnection and the drive towards integration mean the number and complexity of options that will be assessed through the *NOA* will increase significantly and we intend to increase our capability in assessing these options and understanding their technical and economic benefits. There will also be a requirement to consider interactions between different sectors such as gas and electricity and we want to increase our capability to assess the most cost-effective solutions for the transportation of energy to the end-consumer.

In addition to in the above, we foresee an increase in the resource requirement for the team based on Ofgem's new approach to large onshore transmission investment (LOTI). The threshold for projects to be include in the LOTI approach is £100 million, reduced from £500 million under the RIIO-1 strategic wider works process. We anticipate that the new threshold will result in increased workload for the team who will have to conduct cost-benefit analyses and assess a greater number of projects. This is not included in our analysis above.

ESO direct opex Strategy Development BAU (BPDT E5.14)

We proposed £4.9 million over two years for the Strategy Development team. In the draft determinations Ofgem proposed that £4.3 million over two years was efficient benchmark, with a £0.6 million efficiency reduction. We understand this efficiency reduction was based on an eight-year RIIO-1 average cost. We would welcome further discussions with Ofgem to understand its assumptions and rationale for this efficiency reduction.

We believe that our proposed costs are efficient and reflect the strategic inputs needed to address the increased volume of work required from a more frequent ESO RIIO-2 cycle and ensure alignment to external changes. These include:

- Support implementation and ongoing operation of whole system *FES* analysis which is currently being developed through the Open Networks programme. Increased FTE required to liaise and coordinate with DNOs to ensure that ESO *FES* and distribution future energy scenarios (DFES) analysis have appropriate inputs and feedback loops to deliver continuous improvement through analysis cycles.
- Increase in scope of *FES* due to market changes and net zero target means that the team needs to model more sectors of the economy, and needs to conduct more stakeholder engagement and research on these sectors as well. Examples of new sectors which require analysis since the net zero target was introduced are shipping and aviation, and market changes mean that there is an increasing breadth of stakeholders and technological solutions expected in the future which require research, engagement and analysis (for example: developments in different storage, carbon removal, and hydrogen production technologies).
- Development and operation of more specialised, bespoke software models to replace existing Excel tools. For example, we are currently developing a new heat model, which has much more detailed inputs which will require greater effort to source and test inputs for. We also intend to increase the granularity of our modelling for other demand sectors such as transport, residential, industrial and commercial – so this requirement will continue to increase.
- The increasing importance of *FES* in network planning and investment has increased the level of engagement and oversight by BEIS, Ofgem, and industry throughout the *FES* process. For example, for the 2020 *FES* we had weekly meetings with Ofgem with a higher level of reporting, sharing of documentation, inputs and stakeholder feedback than we have experienced before. We welcome this level of interest and scrutiny, as it improves the robustness and quality of our

outcomes, but it adds a significant time and resource burden on our analysis teams, and we are keen to be able to resource these asks from our stakeholders appropriately.

ESO direct opex Innovation BAU (BPDT E5.13)

We requested £1.5 million over two years for the innovation team. In the draft determinations £0.7 million over two years was proposed, with an £0.8 million efficiency reduction. We believe the efficiency reduction was based on RIIO-1 eight-year average spending levels which is not appropriate because the innovation team did not exist in its current form until 2015/16. (More information on the legacy arrangements are given below). Revising this baseline would imply an increase in Ofgem's proposed efficient cost to £1m over the 2 years.

We would like to provide further information for our proposed size and structure of Innovation team in RIIO-2

Proposed increase in innovation Team for RIIO-2

Given the scale of the energy transformation challenge, including newer whole system considerations, and in line with our innovation funding proposals, our innovation team will need to be further strengthened and restructured (from 6 FTE in 2020/21 to a minimum of 9 FTE in RIIO-2). This will enable us to better plan and respond more effectively to opportunities, use innovation funding even more efficiently, and reprioritise our strategic challenges as new ones arise.

Greater innovation in the industry is needed to achieve the ambition of net zero. The ESO has a pivotal role and our innovation function needs to be fit-for-purpose to deliver this. This will mean building up the team in a modest way (with our proposed team still significantly smaller in size to the typical innovation teams of network companies), to ensure there are sufficient innovation resources capable of the increased workload and to be able to run the innovation process for the new network innovation allowance (NIA) conditions (e.g. increased reporting, collaboration and dissemination). Furthermore, the larger team will allow us to support i the definition of subject areas for the new Strategic Innovation Fund, as well as ensure greater collaboration with other entities within and outside the energy industry in line with Ofgem's ambition for RIIO-2. To date, the size of the team has proven inadequate in establishing wide industry collaboration, while ensuring proper project oversight and providing the required level of reporting.

Our preferred option is to retain a dedicated innovation team in RIIO-2, which will keep our focus on an overarching system strategy and further enhance our innovation capability across the ESO while facilitating wider industry collaboration across all areas.

Our model features:

- A **central innovation team** (5 FTE) with increased focus on cost-benefit analysis and stakeholder engagement. Stakeholder feedback has highlighted the need to focus resources on broader industry engagement. This will unlock our open innovation ambitions, allowing us to share internal knowledge, while leveraging industry insights and ingenuity. This team will also ensure more detailed and wider dissemination of the content generated by our projects, increasing the number of our external events such as Open Innovation days or Hacks. The team will also be responsible for continued portfolio governance and project management.
- New, dedicated **innovation business partners** (4 FTE) semi-embedded in the ESO business departments. This will drive the growth of our innovation culture, streamline the discovery of new ideas from our internal teams, and help to connect external ideas from our stakeholders with the right subject matter experts within the ESO. Having dedicated innovation business partners will also help ensure that innovative solutions are successfully deployed into ongoing activities (i.e. more effective planning from early stage innovation into BAU activity). They will achieve this by staying close to our business operations, and by providing a clear link between ongoing and planned innovation activities and the teams responsible for implementing these.

We will continue to operate an efficient, matrix team structure that does not monopolise innovation for the entire business, but instead governs activities that are delivered from our various business lines from a central team. We refer to this structure as Business Partnering; where innovation leads within each business department report to a central innovation team for the innovation activities, while remaining under direct management of their original teams for all other activities. This ensures close links between the business departments with the subject-matter experts and the innovation function, helping to further embed an innovation culture and making efficient use of opex.

The central innovation team will continue to govern the funding (including our innovation process), have full ownership of our annual innovation strategy, be responsible for ensuring an open innovation approach with stakeholders, and manage the portfolio in a cost-efficient way. Having a central team in place frees the project teams from many of the administrative responsibilities that are essential to running successful innovation projects – such as contract negotiations, completing CBAs, regulatory reporting and organising stakeholder-engagement events. It allows them, and innovators within our partner organisations, to use their time more effectively and focus on innovation activities that add the most value.

We will embed an innovation culture throughout the ESO and extend our external engagements to ensure we deliver our strategic priorities and, through collaboration, maximise benefits for consumers and energy industry stakeholders.

The innovation team will liaise between the subject matter experts and stakeholders to source new project ideas, ensure learnings are disseminated, and help implement successful solutions into the business. Projects will continue to be carefully planned, with steps taken to ensure successful outputs are effectively implemented into ongoing activities. This will include better coordination with our IT function to ensure sufficient resources are available for implementation. The team will also ensure there is committed buy-in from the relevant teams and senior management, to successfully realise benefits from our innovation projects.

Legacy of the ESO Innovation team in RIIO-1

The current size of the ESO innovation team is a consequence of business separation, where the Electricity Transmission (ET) innovation function had FTEs transferred out to become the new ESO innovation team. The size of the team was based on the existing portfolio of ESO projects (about 10-15 projects each year, compared with 30 today) and didn't take into account the duplication needed in some roles (e.g. the same level of resources is now required for regulatory reporting in both the ET and ESO innovation team), or the size of the ESO's NIA budget and future increase in the number of projects.

The refresh of the ESO innovation process, following this separation from ET, meant that there was an increasing requirement for resources to assess, develop, then ensure projects deliver and report more effectively. This was not planned in the original team structure which was based on the existing process and number ESO projects within the larger ET innovation portfolio (e.g. there were only 10-15 small ESO projects, undertaken by a limited number of internal collaborators at the time).

Throughout RIIO-1 the ESO innovation team has had difficulty in undertaking all the ambitions it has set out to achieve, due to limited team size. Running the governance for the NIA funding and innovation process, as well as business partnering and ensuring projects deliver successfully, has been difficult to manage with the increasing requests from external stakeholders to participate in innovation activities with the ESO. With the increasing focus on whole system and achieving net zero, the level of interest from academia, networks and third parties to innovate with the ESO will only continue to increase in RIIO-2. We need to make sure we have the right capabilities and resources in the team to ensure we can engage externally, as effectively as we engage with our internal stakeholders, to innovate and solve the increasing challenges of the energy transition.

More activity, collaboration and stakeholder engagement requires more resources

The ESO will have more NIA funding for projects in RIIO-2 (increasing from approx. £3.2 million pa in RIIO-1 to currently £8 million proposed just for the first two years of RIIO-2 (including ten per cent ESO internal funding), and £50 million for the full five years) which aims to solve the increasingly complex challenges faced by the energy system. This bigger budget will require more people to manage the portfolio of projects and the complexities that will arise from it. The new NIA funding conditions, focused on lower technology readiness level activities (e.g. research and early stage development), will likely result in more projects rather than a few, large projects. It is expected that the ESO will be undertaking about 40-50 projects per year to fully utilise the new NIA allowance. This compares to around 30 live projects today.

The additional four innovation team members will be able to better leverage the technical knowledge of our ESO subject matter experts. These new innovation business partners will also take on some of the project management, which is currently a resource constraint on our innovation activities (in RIIO-1 it has been difficult to free up BAU resources for managing innovation projects).

These new innovation business partners will help us form an even closer link with ESO teams and help instil a culture of innovation, so project ideas will come from a greater variety of ESO subject matter experts (RIIO-1 saw a lot of the same experts repeatedly proposing and undertaking NIA projects).

There will be a push for increased stakeholder engagement and more collaborative innovation in RIIO-2. This increased engagement requires more resources, including organising events, more regular communication of outcomes and new opportunities for collaboration, as well as better reporting and dissemination of ESO innovation activities (which is required to increase in RIIO-2).

More resources will help enable the ESO to participate in wider, third party-led innovation

The Flexibility Exchange (FleX) demonstration competition was established last year by BEIS, which we were asked to support. This provided us with an opportunity to show how we could work with the energy industry and their innovation efforts. The original BEIS guidance to participants was to engage with the ESO, which resulted in numerous flexibility platform providers contacting us and wanting to partner with us. However, we did not have the resources necessary to engage with all of them. As a result, BEIS had to change the terms of the competition such that the ESO would only be involved in the final stages. With more resources we could have played a greater part and worked with all the participants.

More requirements on the innovation team under the new NIA conditions

The changes to NIA conditions proposed by Ofgem will mean that the type of projects able to be funded is more limited, and the assessment, then reporting of these projects will also increase. This includes the new benefits reporting framework being developed through the electricity networks association (ENA), which requires more team resources to assess benefits of innovation projects in greater detail, then continue monitoring projects for longer after they have completed, to calculate actual financial and non-financial benefits that have been delivered.

Potential new requirements to increase the level of peer review of new projects, and third-party audits of completed projects, will also increase the amount of team resources diverted to focus on this reporting. Greater sharing of innovation project outcomes, including more stakeholder engagement opportunities and dissemination events, will be resource-intensive for the innovation team in RIIO-2. To free up capacity to do these activities effectively, some responsibilities, such as business partnering with every department within the ESO, will need to be delegated to new innovation team members.

Budget for an increased innovation team frees up NIA for higher-risk innovation activities

NIA funding has a 25 per cent cap on internal spend. If this is used to fund the innovation team in place of BAU funding there will be less available for the innovation projects this funding is intended for. As the ESO is a service-based business, without expensive asset-heavy projects that require large external costs, the internal costs of ESO innovation projects are already higher than other NIA-funded licensees (i.e. the ESO has a higher proportion of internal/external costs). Funding the innovation team through the ESO's baseline funding will allow the necessary internal experts in the ESO to be resourced appropriately through the NIA. More internal ESO costs will be needed on projects in RIIO-2, as the demand for ESO expert to partner with academia, networks and third parties on collaborative innovation projects increases.

Freeing up NIA funding by covering the cost of the ESO innovation team through the ESO's baseline funding will allow NIA to remain focused on new, higher risk innovation opportunities as they arise in RIIO-2 (outside of the business planning cycle). BAU funding is more appropriate to cover the lower risk aspects of the ESO innovation function, including the business partnering process and governance of NIA funding.

Comparison with other innovation teams

- [content redacted for publication].

ESO direct opex Regulation & Customer Stakeholder (BPDT E5.20)

We requested £7.5 million over two years for our cross-cutting Regulation and Customer and Stakeholder teams. In the draft determinations Ofgem proposed £6.1 million over two years, with £1.4m efficiency reduction. The RIIO-1 two-year average that Ofgem used is an appropriate baseline as both teams were new post legal separation. We think the efficiency reduction relates to £0.3 million in 2021/22 for Regulation and £1m for the Customer and Stakeholder team over two years.

Further explanation of our proposed costs for these teams is given below.

Customer & Stakeholder

In RIIO-2 we propose to introduce a new team called the Consumer Engagement which will cost £0.5m each year. This is made up of 3 FTEs (1 band D manager, and 2 staff members), costing £0.2 million, with an additional £0.3 million of marketing and communication costs. These marketing and communication costs are derived from similar work done by our Power Responsive team, whose marketing and communication costs were around £0.5 million.

This new team would have three main roles:

- To enable the ESO to be a champion for the consumer
- To empower consumer understanding of the energy transformation
- To drive decarbonisation

To enable the ESO as a champion for the consumer

We want to be a Centre of Excellence within the ESO, providing advice, insight, support and education. We will focus on highlighting the impacts that the ESO can have on consumers (domestic, industrial, commercial) through its activities, and working with the delivery teams to identify how these impacts can be improved. This will include the provision of toolkits to enable segmentation and impact assessments. By undertaking this activity, we believe the ESO will be better placed to champion the consumer in our wider interactions across the energy sector.

To empower understanding of the energy transformation

Building on the work of the Future Energy Scenarios (what the energy landscape of the future could look like) and Bridging the Gap to Net Zero (what needs to happen now to meet net zero by 2050), the new team will undertake a communication and engagement programme with consumers. This would seek to:

- help consumers to understand how their behaviour and systems within homes and businesses can both enable and benefit from the energy transition;
- understand current levels of knowledge as well as consumer views and preferences, to identify quick wins and areas likely to be blockers.

The intention is to start with a programme of research into the views, behaviours and interests of energy consumers, to understand how this could inform, drive or hinder the energy transition. In the interests of efficiency, this will include information-gathering about research and work already undertaken by other energy sector participants, think-tanks and academia, as well as undertaking our own research where we identify gaps. This will enable us to identify key areas of interest or knowledge gaps we can then seek to address. We anticipate that this will support our long term work under Role 3 (system insight, planning and network development).

To drive decarbonisation

We will use the findings and outputs of the engagement programme to understand what products and services the ESO could offer or encourage to enable consumer decarbonisation. For example, what data could the ESO provide, to help people to make the right decisions? What opportunities might there be for us to highlight opportunities for individual homes or businesses to save (or even make) money, thereby incentivising change? How can we make active and conscious engagement in energy more accessible to a wider audience? What role could we play in supporting more local or community energy initiatives? How could we involve participants from across the whole energy system in this debate?

Whilst the ESO has considerable experience of engaging our direct customers and stakeholders, this has historically been predominantly confined to organisations or groups who already have an active interest in the energy sector. We can learn from programmes like Power Responsive, which has gone some way towards this by involving businesses interested in demand side response, but engaging with a much broader group of consumers and ‘lay’ audiences will require expertise we do not currently have in-house, for example PR and community engagement.

Cost information

We anticipate that consultant support is required to advise on best practice and processes, run some of our consultation events, branding of the external engagement programme. We hope to partner with other

organisations where this would drive higher engagement levels or increase trust in the process and outcomes. We may also opt for new approaches such as working with social media influencers or vloggers in order to ensure we engage with the energy consumers of the future. We also want to ensure that we consider a diverse audience, including traditionally 'hard-to-reach' or vulnerable groups, as well as groups whose voices may have historically not been heard so loudly in the energy debate (e.g. the elderly, black and minority ethnic, and understanding the role of women in the energy transition).

Our costing assumptions have been based on the £0.5 million Power Responsive campaign, with additional efficiency assumptions built in which we believe demonstrates good value for money. The outputs of our initial research phase will inform the next steps and consequently also drive any subsequent requirement for consultant support.

Our proposed team structure of 3 FTEs is based on a role-by-role plan for the work required and the capabilities needed. We compared our team plan to the Power Responsive team to ascertain that we have the appropriate resources in place.

Direct investments – Wokingham ENCC capex (BPDT E4.5)

We requested £2 million investment in RIIO-2, which Ofgem set aside for future assessment as there was insufficient information within the ESO Business Plan for a full assessment to be carried out.

The ESO control rooms in Wokingham and Reading have a specific capex budget investment line, separate to the property and IT capex budgets. The control rooms are unique and have bespoke requirements and therefore these requirements are managed by experts in the control room, not through the property and IT shared functions.

Please see in the table below (in 2018/19 prices) the RIIO-1 spend and the requested spend in RIIO-2.

	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Direct investments – ENCC (£m)	0.5	2.7	0.1	0.0	0.1	0.1	0.5	0.5	0.5	1.5

Figure 8: RIIO-1 spending and RIIO-2 forecast spending

In RIIO-1 the spend primarily related to:

- 2014 – viewing gallery refurbishment
- 2015 – Control Room upgrade and refurbishment
- 2021 – Improving accessibility to Control Room 1 for people with physical disabilities or limited mobility

At the start of RIIO-2 the ESO's control rooms will have old equipment, lighting, fixtures and communication equipment. This equipment needs updating for new ways of working in RIIO-2.

Our proposed costs are generally based on previous levels of spend which in turn are assured for efficiency by a third party. Investments over £20,000 would be sourced competitively in line with National Grid's procurement policies.

Below we provide further details of the proposed spending in the first two years of RIIO-2.

£'000	Control Room	RIIO-2	
		2021/22	2022/23
Kitchen equipment	1 & 2	5	5

£'000	Control Room	RIIO-2	
		2021/22	2022/23
Chairs and pedestals	1 & 2	5	5
Other equipment	1 & 2	15	15
Lighting - Control Room 1	1	258	
Lighting - Control Room 2	2		258
Control room audio visual comms	1 & 2		31
IT hardware – Building Local Area Network (BLAN)	1 & 2	10	10
IT hardware – monitors	1 & 2	46	46
Viewing gallery / visitor areas	1		206
Silver Command upgrade	1 & 2	41	62
Control Training Unit (CTU) upgrade	1 & 2		412
CTU hardware upgrades (inc. Monitors)	1 & 2	10	103
IT hardware – other	1 & 2	21	
Security improvements	1 & 2	21	21
ENCC communications improvements	1 & 2		10
Décor	1 & 2	11	11
Control room layout changes	1 & 2	21	21
Control room building enhancements	1 & 2		232
Branding and signage	1 & 2	10	10
Annual total (£'000)		474	1458

Figure 9: ENCC proposed spending

Kitchen equipment

The cost has been kept in line with RIIO-1 spending levels. The control rooms have their own kitchen facilities to allow them to cater for themselves outside of normal office hours where the onsite catering is not available. As the equipment is in constant use, the equipment is heavily used and regularly needs replacing. Across the two sites there are 9 fridges or fridge freezers, 4 ovens, 4 hobs and 2 dishwashers.

Chairs, pedestals & other equipment

The cost has been kept in line with RIIO-1 spending levels. The control rooms have high specification office chairs which are in constant use, during the day and night. There are 60 chairs across the two control rooms, which have a 6-year asset life, and cost £500 per chair. Other equipment such as IT peripherals are also in constant use and require replacement regularly.

Control room 1 & 2 – lighting

The current control room lighting is 15-20 years old, at end of life and out of support, in both control rooms, where spares are hard or impossible to obtain anymore. The current systems were designed to vary lighting levels according to circadian rhythms to help the health of shift workers by varying lighting levels such as those you might get during normal daylight hours. This also reduces eye strain. The replacement system would use LED lighting which will reduce energy consumption and last longer reducing the need for maintenance.

Control room audio visual communications

Working across two live control rooms means some of the operational teams work remotely to each other. Systems introduced such as the intercom system (which allows immediate communication for the energy team even if their main telephone is in use) and the surface hubs (a surface hub is a Microsoft smart device, a large touchscreen monitor with built in computer, we use them to communicate and share information between the control rooms) have improved the cross-site communications for the control rooms. These systems will have finite life and will need to be replaced to maintain effective communication.

The proposed investment is also to replace the smartboards that were last installed in 2018, information screens last installed in 2010-13 and the intercoms that were installed in 2012.

Inter-control room communications spent £88,000 in RIIO-1 to replace an intercom system used for instant communications between the two control rooms. Having investigated different options, we found a cheaper solution using regular VOIP (voice over internet protocol) phones. The cost for six devices will be £11,000 with configuration and installation. In addition, in RIIO-2 investment is required for the replacement of the surface hub smart boards (two boards at £9,000 each) and to replace some wall mounted screens (large monitors at around £400 each, with eight across the two control rooms). Totalling this up comes to £32,000, with the RIIO-2 budget set at £31,000.

IT hardware - Building Local Area Network (BLAN)

BLAN last had a major replacement in 2015 and now, as hardware is ageing and beginning to have failures, replacements are required. There are approximately 80 BLAN (non-CNI) terminals across the two control rooms, and other pieces of hardware such as faxes. As items fail they need replacing.

The budget is to replace hardware that fails. Each terminal cost around £500-£1,200 depending on the specification, so this would allow us to replace somewhere between 10-20 computers across the two sites (around a ten per cent annual replacement rate).

IT hardware – monitors

Control room monitors were last replaced in 2011 and now are ageing hardware that need to be replaced. These monitors are in constant use and need to be of high specification. Across the two control rooms there are around 220 monitors on desks or wall-mounted.

We have around 130 30 inch monitors and 90 24 inch monitors. The original monitors were around £3,000 for a 30” model, lately we have ordered from Dell at around £1,000 per monitor (last order was in Feb 2020, so prices are recent). The cost of the 24” monitors is much lower at around £500. The costs are higher than for average monitors as we are buying professional grade equipment designed for 24 hours a day, 7 days a week usage. The budget would allow for around 10-15 monitors to be replaced per year (equivalent to a 7 per cent failure rate, with some monitors being 8-9 years old now).

Viewing gallery / visitor areas

Viewing gallery refurbishment was previously completed in 2013 at a cost of £250,000. The viewing gallery in control room 1 is a high-profile area of the St Catherine’s Lodge building where ESO host a large number of external visitors and is heavily used for visits to the ENCC and for media filming. Since the refurbishment in 2013, there was some minor spend as part of ESO legal separation to update to the new ESO branding. This budget is to update the facilities in this area to improve the visitor experience, maintaining the ESO’s relationships with industry and education. While we do not have a quote for the next update, we have reduced the budget and would review any requirements against this budget to ensure we do not exceed this amount.

Silver Command Upgrade

The ENCC Silver Command is a meeting room within the control room secure area used in emergency situations to manage control room communications with other areas of National Grid and external parties such as Ofgem and BEIS. It is also used frequently as a meeting room as it enables control room staff to meet others without leaving the control room itself. It was last updated in 2008, and the proposed investment will be used to bring the facilities in the room up-to-date and to ensure we have the latest communication systems needed to ensure system incidents are managed in the most effective way.

The spend in 2008 was £60,000, and included remodelling the room, providing new furniture and technology updates (audio visual services for incident management – television, projectors, etc). No quote has been requested, so this is based on historic information, and expectations. Requirements would be managed to stay within budget.

Control Training Unit (CTU) upgrade

The current CTU facilities were last replaced in 2009, with redecoration and modification to the room layouts done in 2017. The CTU provides the offline training capacity to train our control room engineers and is critical to maintaining a workforce that is authorised to operate the power system. The last update in 2018 rearranged some of the rooms and created a better training environment. The rooms were also redecorated and re-carpeted at this time. This was the first update since the facility was created in 2009. The budget here will be used to replace the desks as they are no longer fit-for-purpose, as well as to ensure the room meets our future training requirement. The 2018 refurbishment cost around £190,000, so the £400,000 budget has been estimated from this to include the desk replacements.

CTU hardware upgrades

Aligning with the CTU upgrade, a major replacement of the IT hardware has been planned at the same time.

With around 25 desks designed to replicate the control room environment, they require the same equipment on the desks to allow people to be trained effectively. Some of the equipment may not be to the same standard however (for instance the monitors will not be in use 24 hours a day, seven days a week). This budget is to replace the IT hardware (BLAN PCs and monitors in the room). Some of the monitors are over 10 years old and we are seeing increasing numbers of failures. The monitors are also much smaller than in the control room so it does not allow the trainee to get as much information on the screen as they would in the control room which reduces the effectiveness of the training, (30 BLAN PCs – between £15,000 and £30,000 based on the current prices, and 125+ monitors £70,000). Annual budget of £10,000 to replace failed items in addition to the main replacement project.

IT hardware

This budget is to allow for replacement as other items of ENCC hardware fail, including fax replacement with electronic storage/auditable emails, and changes to printers on each of the segregated networks. There are six fax machines per control room, 18 in total, as we have to supply those for evacuation to the transmission national control centre too. We were using Canon fax machines which were around £1,000 each (high capacity and auditability) but have since found that we can get a more basic model for £300 from Xerox. The printers too are the standard supplied by Xerox, but we have to have resilience in the control room, and across the three different and physically segregated networks: BLAN, ION and IEMS. BLAN is the Business LAN (the primary IT network for National Grid); ION is the Integrated Operational Network; IEMS is the Integrated Energy Management System. The last two are the critical networks used to manage the power system. They have high resilience and are separated from the main network for security reasons. All three networks are used in the control room and require their own IT equipment There are around 10 high capacity printers in the control rooms which need to be maintained.

Security improvements

The ENCC security is paramount to the safe operation of the power system. This budget will allow us to maintain the existing security systems in line with the latest recommendations from our security teams. This includes improvements to access controls, security doors, blast blinds, passes / lanyards / card holders and card reader upgrades.

There are two identified areas for improvements, recording who is in the control room at any given time and restricting use of non-authorised electronic devices in the control room. The current airlock system allows more than one person in at a time, and only one person needs to swipe for access. We currently use a visitor's book for those people who do not have an access card, but this means that it is not always possible to know who was in the room should an incident occur. We want to look for ways to improve this situation on the recommendation of our security team. Similarly, visitors could also bring in (and potentially leave) unauthorised electronic devices, such as mobile phones which could be used to record and transmit confidential information. We would like to investigate ways to improve this as well.

ENCC communications improvements

Within the control room there are a number of non-electronic communication methods: whiteboards, pinboards etc. This budget will allow us to replace as needed and to upgrade the facilities if required, with installation.

Décor

This budget will allow us to replace existing parts of the control room fabric as needed to maintain a safe and healthy working environment for our 24 hours a day, seven days a week shift teams. Examples of this type of spend include changes to sound-reducing cladding, and ancillary furniture.

Control room layout changes

With the energy landscape constantly evolving and the ESO changing in RIIO-2 to deliver more and be more innovative, there is a need to keep the ways of working under review. Changing operational needs, and changes to the ways shift teams work, results in a need to ensure the control room is laid out in the correct way for health and safety as well as efficiency.

This is a budget to allow us to change the layout of the desks in each control room, to reflect the latest working arrangements. The costs here are based on recent experience with the carpet replacement project. The desk supplier charged £12,000 to move the desks around as the carpet is replaced. It is worth noting these are not standard office desks but electrically height adjustable both on work surface and monitors. They require a team of people to move each one without damaging it. The additional costs are to cover moving network and power connections to new locations.

Control room building enhancements

Similar to the above, but this is for a more significant change to the layout of the room itself, moving walls or partitioning up the control room to reflect the latest best practice. The costs here are largely unknown as we do not have any firm requirements at this stage. As we have seen with other building work, such as the current accessibility changes being made to control 2 (circa £870,000), the £225,000 would not make a significant change to the building but could be used to look at improving areas such as the acoustics in the room and providing partition walls if needed.

Branding and signage

The ENCC is used as a backdrop to many interviews that are broadcast. This budget is to maintain the corporate branding used within the ENCC and to maintain a professional appearance. The main branding was replaced as part of the replacement of the wall coverings last year, so the costs are known. This would only be used should our corporate brand change during these times, or should the existing branding become damaged or faded.

ESO property capex (BPDT E4.5)

We proposed £6.6 million of property capex in RIIO-2. Ofgem considered £2.7 of this to be efficient and made an efficiency reduction of £3.9 million. Below we provide full details of how our proposed £6.6 million would be spent and why it is efficient.

We have three properties that need to be maintained: Faraday House (National Grid House Warwick), Wokingham (contains Control Room 1) and Reading (contains Control Room 2). These costs are managed by National Grid group property and do not include refurbishments to the control rooms outlined in the previous section.

Faraday House was newly converted as part of Legal Separation in FY19 and does not need any major investment in RIIO-2. The ESO pays for any property capex required at Faraday House which in 2021/22 includes a proposal for the lift to be refurbished.

The **National Grid House** property capex spend follows the Unified Cost Allocation Methodology and ESO receives an allocation to reflect its use of the security infrastructure, grounds and car parks as well as the overhead relating to National Grid's property management business support function.

Our Reading and Wokingham sites require investment in RIIO-2 due to the ageing buildings and CNI asset health policies. The Reading site was constructed around 1996 and the Wokingham site around 1989, with many assets being in place since the original construction.

Many assets are aged and are classified as 'at end of life' in-line with recommendations within the industry standard, the Chartered Institution of Building Services Engineers Maintenance Engineering and Management Guide M (CIBSE) and will need to be replaced to ensure resilience to our buildings is maintained.

Replacing aged assets and the introduction of new technologies such as solar panels and electric vehicle charging points will improve sustainability with the assets running more efficiently, which will also assist with our requirement to meet sustainability targets and to reduce carbon emissions.

The table below shows the investment required in these buildings and the estimated cost. Our call-off consultant, the engineering and sustainability specialists Cundall, and their quantity surveyors assisted with the budget costs and provided cost advice by utilising historical benchmark data and recent market-tested data for similar projects. Additionally, we used industry standard Quantity Surveyor £ per square metre rates in the budgets.

Location	Investment	CNI?	Category	Description of the investment	2021/22 (£k)	2022/23 (£k)
Reading	Sustainability improvements	No	Sustainability	To fund carbon reduction and energy efficiency measures as discrete projects and to enhance wider, planned mechanical, electrical and fabric repair and replacement works. Identified investments include: LED lighting and controls, heating, ventilation, air conditioning modifications and optimisations, solar panels, electric vehicle charging points and motor and drive upgrades.	75	10
Reading	Floors - Replace tiles in the server room	Yes	Fabric	The floor tiles in the server rooms cover approximately 200m^2. Approximate age, 30 plus years. Standard, imperial heavy-duty metal pan measuring 5990mm/sq. Tiles and pedestals have exceeded life expectancy, and all need replacing. The IT cabinets resting on the metal pan tiles will need to be lifted in-situ to enable the flooring to be replaced. Budget costs include replacing with metric 600mm/sq. heavy duty antic-static computer type metal pan flooring with corresponding pedestal supports. Due to the age of the flooring, health, and safety risks (and potential loss of IT cabinets) it is proposed to start phase 1 of this project immediately. Please note, material costs of anti-static raised flooring is £95m^2. However, the tasks are labour intensive, because IT Cabinets will need to be lifted/jacked up, existing pedestals removed, new installed, and cabinets lowered. The budget cost reflects the nature and complexity of labour tasks.	45	
Reading	Major overhaul of passenger lift	Yes	Lift	The lift is more than 25 years old and has exceeded life expectancy by increasing, frequent maintenance. The hydraulic lift will need to be replaced or overhauled to meet current standards and legislation for safety and components. It is more		75

Location	Investment	CNI?	Category	Description of the investment	2021/22 (£k)	2022/23 (£k)
				economically viable to replace with new. Budget cost allows for new 6-person passenger lift and hydraulics but maintaining shaft construction. New shaft lighting and safety features such as lift over-run, auto-dial are required to meet current lift regulations.		
Reading	Power - Uninterruptible Power Supply (UPS) / Batteries (15/5) - System 1 (A) & Power - UPS / Batteries (15/5) - System 2	Yes	Electrical	An upgrade of the power supply is required following a fire at the Reading site, which led to the loss of two units and the loss of CNI functionality. The standards for the replacement works are equivalent to those for our Wokingham control room, namely, Piller Hybrid Rotary UNIBLOCK™ UPS modules. The budget costs are based on the Wokingham quotations.	350	
Reading	CNI Electrical upgrades / replacements	Yes	Electrical	This is to upgrade two generators. Our CNI policy is that generators must be upgraded every 20 years. The existing generators were installed in 1996 and 2007 so an upgrade is overdue for one of the generators. (It was not carried out due to constraints associated with other asset works). In order to maintain N+1 resilience (N+1 is a form of resilience that ensures system availability in the event of component failure where components have at least one independent backup component), larger generators are required. Efficiencies will be achieved by procuring and replacing two units as opposed to one in 2021 and another in 2026. Budget costs are based on 500kva Gensets with associated day and bulk diesel fuel tanks, associated cabling, alarms and controls.	150	150

Location	Investment	CNI?	Category	Description of the investment	2021/22 (£k)	2022/23 (£k)
Reading	CNI Mechanical upgrades / replacements	Yes	Mechanical	There are numerous standalone air conditioning units within our Reading site. These are now at the end of their economic life expectancy and require increasing maintenance. They are also inefficient in comparison to modern units. The benefits of upgrading this equipment are reduced energy consumption, protection of the environment, reduced down time due to equipment failure, and lower maintenance costs. Budget costs are based on a mixture of wall and ceiling mounted DX units, typically ranging from 5kw to 10kw rating using environmentally friendly refrigerants with N+1 resilience and associated controls.	100	100
Reading	Electrical upgrades / replacements	Yes	Electrical	This is to replace power distribution units and distribution boards. These boards are no longer compliant with current (2019) Institution of Engineering and Technology (IET) Regulations and/or have been around since base build and are over 25 years old. Spare parts are no longer supported. Their failure will result in prolonged downtime of CNI functionality. Complete replacement is required using CNI standard Schneider distribution boards with residual current circuit breakers incorporated as required for IET compliance	10	25
Reading	Mechanical upgrades / replacements	Yes	Mechanical	A number of component parts are now failing, e.g. fire/smoke dampers and associated control panels due to the age of the installations exceeding 25-year life expectancy. The building regulations and British Standards have changed since original base build. This is a rolling programme to upgrade motorised actuators, smoke, and fire dampers associated controls and interface with the central fire alarm panel - to ensure compliance with current standards.	10	25
Reading	Civils upgrades / replacements	Yes	Civils	Generally, wear and tear and upkeeping are overdue for the parking and security areas. Areas requiring investment include: enhancements to security compound, line/car parking space painting,	10	10

Location	Investment	CNI?	Category	Description of the investment	2021/22 (£k)	2022/23 (£k)
				improvements to the inner fencing compound housing air conditioning units as well as access gates.		
Reading	Fabric upgrades / replacements	Yes	Fabric	Reading suffers from water ingress into the data rooms and low voltage rooms. We have installed hydrostatic pressure relief pumps and undertaken bunding with puddle pumps to address/alleviate the problem. However, further work is required to properly identify the cause and resolve the issue permanently, whilst installing damp proofing and base seal. A number of trial pits are proposed with hand digging Cat scans. Budget costs based on £200-£250m^2 for exploratory work – further costs allowed for remedials (depending on final remedial works) and any diversion of underground services including CCTV surveys of drainage.	10	100
Reading	Security upgrades / replacements	Yes	Security	This allowance will enable us to maintain a high level of security at the facility, replacing ageing CCTV systems and access control systems and doors with new technology. Budget cost for doors are £25,000 per set - Centre for Protection of National Infrastructure Standard – based on recent change of door set in Gas National Control Centre (GNCC). It is envisaged that the majority of the power supplies and data connections to the CCTV cameras can be retained and reused – the CCTV cameras are aged and require replacing in line with current CNI security standards.	100	
Wokingham	Controls - upgrade building management system to enable monitoring of critical infrastructure and energy usage	Yes	Controls	Recent changes to Part L2a of Building Regulations with CIBSE TM39 (Building Energy Metering) has put the onus on to the “user” to be able to collect data and make assessments as to whether anything unusual is happening that could be wasteful of energy. This is a rolling programme of upgrades to comply with the part L2 of the building regulations and to embrace new technology and the benefits that brings. This is for software/hardware		10

Location	Investment	CNI?	Category	Description of the investment	2021/22 (£k)	2022/23 (£k)
				upgrades. I.e. an allowance as technology advances to ensure we have the best control of our equipment possible.		
Wokingham	Monitoring - flood/leak detection	Yes	Controls	The leak detection in the raised floor voids is circa 30 years old and has reached the end of its economic life expectancy. Catching a leak early is critical to minimising flood damage as well ensuring no safety (electrical shock) or operational impact. Areas affected are the control room, Apparatus Rooms (apps rooms are where all the computer network servers are housed), UPS rooms and data services, covering approx. total area of 600m^2 x £58/m^2 (remove existing, supply and install new)	35	
Wokingham	Computer room air conditioning (12)	Yes	Mechanical	20 x units in total. 4 x in each apps room x 4 apps rooms; 2 x in control room and 2 x in print room adjacent to the control room. Units are both chilled water and direct expansion cooled. They are aged, work is in an extremely sensitive area and costly to upgrade. Additional resources need to be allocated to ensure safe, non-disruptive delivery of works and full time oversight/support. Includes change control, electricity change implementation panel, and change approval board approvals which are time consuming and costly. Temporary cooling required in 'hot spot' areas to ensure downtime does not impact IT/CNI equipment. National Grid's CNI Policy is change/replace assets after 12-15 years. Units were installed in 2010.		1320
Wokingham	Major overhaul of passenger lift	No	Lift	The lift is more than 20 years old and has exceeded life expectancy by increasing, frequent maintenance. The hydraulic lift will need to be replaced or overhauled to meet current standards and legislation for safety and components. It is more economically viable to replace with new. Budget cost allows for new six-person passenger lift and hydraulics but keeping and maintaining the	100	

Location	Investment	CNI?	Category	Description of the investment	2021/22 (£k)	2022/23 (£k)
				existing shaft construction. New shaft lighting and safety features such as lift over-run, auto-dial are required to meet current lift regulations.		
Wokingham	Power - UPS / Batteries (15/5) - System 1 (A1 + B1)	Yes	Electrical	CNI Policy is to change these electrical items every five years. The budget reflects the cost of previous replacements.	60	
Wokingham	Power - UPS / Batteries (15/5) - System 2 (A2 + B2)	Yes	Electrical	A1 and B1 changed in 2021. A2 and B2 due to be changed in 21/22. The budget reflects the cost of previous replacements.	370	
Wokingham	Power - UPS / Batteries (15/5) - System 3 (A3 + B3)	Yes	Electrical	CNI Policy is to change these electrical items every five years. The budget reflects the cost of previous replacements.	60	
Wokingham	Power - UPS / Batteries - W2 replacement (15/5)	Yes	Electrical	CNI Policy is to change these electrical items every five years. The budget reflects the cost of previous replacements.	10	
Wokingham	Refurbishment of reception	No	Fabric	The reception at St Catherine's Lodge, Wokingham is used 24/7 and is the main entrance for all visitors, employees and control room staff. The reception has not been changed in 20 years. The current layout forces staff and visitors to circulate in the same area which offers an opportunity for security breaches by tailgating. Due to the presence of the control rooms, the Wokingham site receives a large number of visitors from members of parliament to school parties. Because this area has not been refurbished for a number of years, it does not lend itself to modern ways of working and does not have best practice facilities for disabled visitors. We would like to reconfigure and make alterations to the reception area, which will improve security to the site, provide a larger waiting area for visitors and improved accessibility for disabled visitors. This will support a less congested flow of people, which will improve the customer		1250

Location	Investment	CNI?	Category	Description of the investment	2021/22 (£k)	2022/23 (£k)
				experience whilst promoting and strengthening our brand as being a modern and inclusive company. The work will be competitively tendered and managed by our internal project management team, with costs being verified by our external cost consultants.		
Wokingham	Electrical upgrades / replacements	No	Electrical	Replacement of obsolete distribution boards. Failure of these will result in prolonged downtime.	25	25
Wokingham	Mechanical upgrades / replacements	No	Mechanical	Aged plant/pumps/motors etc upgrade. Nearing end of economic life expectancy (1-2 years remaining). Mixture of plant items and component parts. Replacements to incorporate energy saving technology where practicable, such as frequency inverter drives – varying speed directly proportional to power used.	25	50
Wokingham	CNI electrical upgrades / replacements	Yes	Electrical	The main electrical control panels in Wokingham plant rooms are all aged and showing signs of corrosion. Spare parts are no longer supported. They have exceeded life expectancy by some 3- 5 years and need urgent replacement /upgrade to ensure efficiencies, resilience, availability of spares etc. The loss of some of these panels will result in a direct impact on Wokingham CNI function e.g. air conditioning in the control room.	150	150
Wokingham	CNI mechanical upgrades / replacements	Yes	Mechanical	Chillers supply chilled water to CNI areas. Lead times are excessive in terms of failure replacement parts impacting resilience. Efficiencies are relatively low when compared to modern equipment and maintenance costs are high. Recently, two compressors have failed on one chiller due to age and condition exceeding life expectancy. The reciprocating chillers are becoming increasingly redundant and the modern alternative scroll type has been budgeted as replacement.	150	150
Wokingham	Civils upgrades / replacements	No	Civils	Various items need replacing during the year as footfall at Wokingham is high and in constant use.	50	

Location	Investment	CNI?	Category	Description of the investment	2021/22 (£k)	2022/23 (£k)
Wokingham	Fabric upgrades / replacements	No	Fabric	Installing new doors, renewing various dilapidated building elements. Renewal of heating and power.	50	50
Wokingham	Security upgrades / replacements	Yes	Security	Wokingham houses our main electricity control room, This allowance will enable us to maintain a high level of security at the facility, replacing ageing CCTV systems and access control systems and doors with new technology. New CCTV and access control will form part of the proposed enhanced CNI security room currently located in the reception area. Introduction of turnstiles will be consistent with CNI Standards. Budget costs based on £/m^2 commercial refurbishment rates.		500
Wokingham	Sustainability improvements	No	Sustainability	To fund carbon reduction and energy efficiency measures to as discrete projects and to enhance wider, planned mechanical, electrical and fabric repair and replacement works. Already identified opportunities include LED lighting and controls, HVAC modifications and optimisations, solar PV, electric vehicle charging points and motor and drive upgrades.	100	100
Warwick	Faraday House lift	No	Lift	The lift is over 20 years old and needs either a major refurbishment or replacement. CIBSE Guide M recommends the asset life of key components to a lift as being 20years	50	
Warwick	Warwick various projects	No	Mechanical	Building management system upgrades, replacement CCTVs, Sustainability improvements (LED lighting/Hot water system). This includes ESO's share of maintaining the grounds, car parks and security.	205	200
Total Property Capex investment (BPDT E4.5 line 28)					**2300**	**4300**

Figure 10: Proposed property capex

Direct investment – Project TERRE central project (BPDT E4.5)

Our business plan includes £1.7 million capex and 0.6 million opex for this area. Ofgem proposed that the capex is assessed at a later date but the £0.6 million opex has been included in its view of efficient costs.

Under the European Regulation called EBGL (Electricity Balancing Guideline) all TSOs are mandated to participate in the creation of shared IT platforms for the exchange of reserve products. The ESO has been a founding member of these projects and they are already in flight. The benefits to Trans-European Replacement Reserves Exchange (TERRE) and Manually Activated Reserve Initiative (MARI) are savings to t

consumers of up to £17 million per annum, compliance with EU law, fulfilling ESO priorities of participating in EU markets for Great Britain parties, and added energy security by accessing reserves from EU partners.

All TSOs must contribute to the central costs for these implementations and each TSO contributes according to the size of electricity consumption on its respective system. The costs we proposed cover our contribution to the development of these shared platforms. Please note that they do not cover costs for any ESO-specific IT.

Capex costs (18/19 prices) £m (BPDT E4.5 line 36)	**Assumption costs split by**	**RIIO-2 21/22**	**22/23**
Project TERRE - enhancements	10 TSOs	0.2	0.2
Project MARI - initial cost (go live Dec 21)	6 TSOs	1.0	
Project MARI - enhancements	10 TSOs		0.2
Total capex[15]		**1.2**	**0.4**

OPEX ongoing IT costs (18/19 prices) £m (BPDT E5.09 within other costs and Business Plan A6.2)	**Assumption costs split by**	**RIIO-2 21/22**	**22/23**
Project TERRE	6 TSOs	0.3	0.3
Project MARI	6 TSOs		0.04
Total opex		**0.3**	**0.3**

Figure 11: Proposed Project TERRE and MARI investment

Project TERRE covers the exchange of a reserve product with a full activation time of 30 minutes. The project has been running since July 2016 and is due to complete in October 2020. £2.2 million capex has been invested in RIIO-1 to cover the initial development of the platform.

ESO is now incurring opex costs for the running of the TERRE platform which will continue in RIIO-2. These costs are £285,000 per annum (19/20 prices).

In future years of RIIO-2 there will be additional capex requirements to accommodate further regulatory developments, enhancements and changes to the methodologies of the platform, driven by the Agency for the Cooperation of Energy Regulators (ACER).

Project MARI covers the exchange of a reserve product with a full activation time of 12 minutes. The project is starting this year with a delivery date of Summer 2022. This project has the same arrangements as TERRE; the ESO will be mandated to pay its share of the costs. MARI costs have been calculated using TERRE as a baseline but with efficiencies built in by using the same developer of TERRE and receiving a discounted price. The opex cost for MARI in FY23 is costed as £38,000.

The capex funding requests were stated in their own investment line and the opex funding request was part of the EU Code Change and Relationship business as usual activity costing. Please see Business Plan Data Table E5.09, activity A6.2 to see these opex costs.

Currently the costs are being shared between six TSOs but there is expectation that there will be ten TSOs participating in in the future. The table below shows the expected dates for each TSO to join the TERRE Platform, which include the delays driven by COVID-19.

[15] The total capex rounds to £1.7 million when each of the two years of RIIO-2 is added together.

Country	TSO	Date of accession (financial year)
Portugal	REN – Rede Eléctrica Nacional, S.A	Q3 2020
France	Réseau de Transport d'Electricité	Q4 2020
Switzerland	Swissgrid ag	Q4 2020
Great Britain	National Grid Electricity System Operator plc	Q4 2020
Italy	Terna - Rete Elettrica Nazionale SpA	Q4 2020
Poland	Polskie Sieci Elektroenergetyczne S.A.	Q1 2022

Figure 12: Expected dates for each TSO to join the TERRE platform

ESO-specific HR and non-operational training costs (BPDT E4.6)

The UK is on a path to reach net zero by 2050, and the ESO is a key player in that transition. We are committed to attracting and retaining passionate, talented and driven people to drive our net zero ambitions in RIIO-2 and beyond.

Our annual budget for HR and non-operational training is £1.9 million in 2020/21, and made of £1.1 million dedicated to our New Talent schemes, £0.2 million for wellbeing and leadership training, and £0.6 million for other HR costs such as reward, recruitment, cases and data.

Ofgem's draft determinations suggest that the ESO should spend a similar budget for RIIO-2 as the average budget we spent across RIIO-1, equating to around a £1.1 million efficiency reduction over 2021/23 compared to the costs in our business plan.

We are proposing to increase Ofgem's proposed efficient spend by £1.5 million over 2021/23 compared to RIIO-1, to adjust for increasing the use of our new talent schemes (plus £0.60 million over 2021/23), increasing training costs (plus £0.55 million over 2021/23) and increasing recruitment costs (plus £0.24 million over 2021/23) as described below.

This reflects our latest view of costs and brings the total budget to £5.2 million over RIIO-2, which is £0.4 million more than we had originally included in the Business Plan.

Investment line	Amount proposed in business plan (£m)	Revised business plan proposal (£m)	Proposed efficient cost (£m)	Efficiency reduction (£m)
HR and non-operational training (opex)	4.8	5.2	3.7	1.1

Figure 13: HR and non-operational training

The £5.2 million proposed cost over 2021/23 breaks down as follows:

- £2.8 million for new talent
- £0.97 million for training
- £1.44 million for reward, recruitment, contracts and other HR costs.

Please see the explanation provided below.

New talent schemes

New talent schemes like the higher apprenticeship scheme (24 months), the graduate scheme (18 months) and the industrial placement scheme (12 months) have successfully provided a pipeline of highly sought-after

science, technology, engineering and maths (STEM) talent to our power system engineer and commercial roles, and they have proven to be a more reliable and cheaper source of talent than what the labour markets have traditionally been able to provide.

We want to continue using our current new talent schemes to attract and retain STEM talent, and want to adapt those schemes to include additional technical career and development paths, to better reflect the skills we need for the future (e.g. engineering, data analytics, economics, IT).

In addition to the above, our strategic workforce planning forecasts indicate that retirement rates will be higher in the second half of RIIO-2 among power systems engineers. Bringing new talent in the company will allow us to free up some more experienced staff to fill those gaps.

In our Business Plan, we initially asked for £0.3 million increased spend for new talent over 2021/23. Our thinking has moved on since then and we believe the right amount of spend for this is £0.6 million over 2021/23. This is because new talent is one the key sources for filling our level 6 (L6) entry-level positions. The number of L6 positions in the ESO is expected to increase by 30 per cent (with more senior level 7/8 positions also increasing by 25 per cent). We are therefore planning to recruit 30 per cent more new talent positions in RIIO-2, to ensure we have a pipeline of talent to fill those L6 roles, bringing the number of individuals on new talent schemes from 28 to 36 (an additional 8 compared to today). This would increase our £1.1 million annual new talent costs by £0.3 million, and bring the total cost over 2021/23 to £2.8 million.

Development of current workforce and onboarding of new recruits

We are also committed to developing our current workforce to:

- fill the more versatile roles required to deliver our transformational activities. This includes, for example, specialised Agile IT training to support the development of a digitalised ESO, advanced and expert stakeholder engagement training for specialist roles to support the enhanced industry engagement we are committed to (particularly with distribution network operators throughout their own price control preparations), and foundation customer and commerciality training across the ESO. Our more junior staff will also need to be trained to backfill the roles that the more experienced staff will be leaving behind.
- fill the more advanced data analytics or digital roles we require to create, to deliver on our zero carbon operations strategic goal. We are currently exploring partnerships with companies who can help us do that (e.g. General Assembly, the Analytics Academy).
- build new online modules for our training curriculum. Our curriculum already provides many relevant training interventions but does not cover all our needs, so we are planning to build new online modules to include in our curriculum for our traditional business capabilities, and to develop partnerships with specialised training companies for the more specialist capabilities like advanced analytics or IT.

The £0.2 million annual training costs we spend today are dedicated to building new courses for wellbeing and leadership training. National Grid group is also developing new collateral for culture change that we will be able to use at no additional cost.

In our business plan, we initially asked for a £0.4 million increased spend for training over 2021/23. Since then, we have had exploratory conversations with potential suppliers on options for sourcing the training we require and our thinking has moved on as a result. We believe the right amount of increased spend for this is £0.57 million over 2021/23 compared to RIIO-1 numbers, for a total spend of £0.97 million over 2021/23 on training, including the wellbeing and leadership training (£0.2 million per year, and £0.4 million over 2 years).

The additional training actions we will take to upskill our workforce's technical and business capabilities in readiness for RIIO-2 – and which will bring our training costs up by £0.57 million over 2021/23 – include:

- an estimated £140k to refresh existing, and build new, training interventions in our curriculum. This money will go towards building 15-20 training modules as described below, which will cost approx. £5-£10k per module to build, for an estimated total cost of £75-£200k, i.e. an average of £140k which we are using in our calculations. Once those training modules exist, they are free for all to use. We are planning to:
  - work with partners to build two to five training interventions that upskill people on general industry knowledge, and specific codes and markets knowledge. This will allow for more rapid onboarding in several teams.

- tailor around 10 existing online training modules to ESO requirements, including foundation modules for stakeholder, commerciality, regulation, data management, IT etc.
- build a series of three to five new online modules in data analytics to upskill people from zero to expert.

- an estimated £0.43 million (average based on a £0.34 million to £0.53 million range) to cover for a significant increase in people taking external training courses to develop advanced or expert business capabilities that are necessary in RIIO-2. This would cover:
  - 30-50 people to upskill in advanced and expert stakeholder engagement. The modules we already have access to cost £4,100 for a combined advanced and expert training. Assuming we are upskilling 10-15 people to become experts in the ESO and the remaining 20-35 to be advanced, and that most people will only need to follow part of the comprehensive £4,100 training, this will cost circa £80,000-£120,000.
  - 30-50 people to upskill in advanced analytics (data science) through external training. The training interventions do not exist in our curriculum and we are planning to source those externally through companies like General Assembly (who can train people offline) or the Analytics Academy (who can train them on-the-job). As a rule of thumb, specialist offline courses sourced on the market cost £2,000 per head at a minimum (we are assuming £2,500 here), i.e. circa £75,000-£125,000; and exploratory conversations are indicating that effective on-the-job training of 30-50 people like the one proposed by the Analytics Academy would cost £0.15 million-£0.3 million.
  - 70-90 people to upskill in IT, with around 30 taking on specialist product owner/ manager responsibilities. The interventions to train those specialist skills are not part of our curriculum. We are planning to source them via our application development and maintenance partners and specialist training for the 30 product owner/ managers mentioned above would cost £2,000 per head at a minimum (we are assuming £2,500 here), i.e. around £75,000.
  - Further, and more ad-hoc, training will also be required to upskill lower numbers of individuals in advanced or expert levels of project management. We have assumed a buffer of £30,000 for these.

We will procure training interventions and partnerships using competitive processes to ensure the costs are efficient. Based on experience, any competitive procurement process will take three months, to allow time for a review of the market, a review of proposals from potential suppliers and to work through any contracts.

Reward, recruitment, contracts and other HR costs

In 2021/23, we are going to recruit for around 100-130 roles, hence will be bringing 100-130 people in the company, not counting attrition. This is 3 to 4 times more the volume of recruitment that we usually take on, to compensate for attrition. This extra activity means we will require more support from the central recruitment team to process applications, interviews and contracts, and it will cost the ESO more. We will also work to build new recruitment channels to source talent that we have not had to source up until now (e.g. for data analytics and IT capabilities).

Recruitment only accounts for part of the £0.6 million annual spend in this category, so we are proposing a 20 per cent increase in costs in this category, rather than a mechanical three- or four-fold increase as per the above. This would bring our spend up from £0.6 million per year to £0.72 million per year, i.e. £1.44 million over 2021/23.