nationalgridESO

National Grid Electricity System Operator (NGESO)

Our Performance 2019 - 2020

Regulatory Report

September 2020

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Forward

Energy is the lifeblood of our economy and society. As the Electricity System Operator (ESO) for Great Britain, we hold a unique position at the heart of the nation's energy system. Our actions influence investment decisions and markets worth billions of pounds. Our role is critical for the transformation of the energy system and together with our stakeholders, we are responsible for tackling some of Great Britain's most pressing energy challenges. We are committed to working towards our ESO mission to operate the electricity system of the future and play our part in delivering a system that supports the net zero by 2050 ambition.

ESO Mission

Our mission is to enable the transformation to a sustainable energy system and ensure the delivery of reliable, affordable energy for all consumers.

This is our second Annual Performance Report published as a legally separate ESO. This report is a requirement of our Regulatory Reporting Pack (RRP), in line with the Regulatory Instructions and Guidance (RIGS). The aim of this report is to highlight the work that we have carried out in 2019/20 and outlines our plan for the remaining year of RIIO1.

In this Annual Report, I'd like to share with you how we have continued to perform solidly for our customers – delivering against our outputs, the steps we are taking to meet challenging environmental targets taking us towards a lower carbon future and how we are keeping the network safe and reliable. We also continue to focus on innovation that will keep the electricity system secure, reliable and cost-effective for the benefit of future consumers.

I hope you find this report informative and welcome your feedback on how we can improve our reporting in the future.

Fintan Slye

Executive Director

Electricity System Operator

Who we are and what we do

Legal Separation

The ESO became a legally separate entity within the National Grid Group on **1st April 2019.** Separating the ESO business from National Grid Electricity Transmission provides transparency in our decision-making and gives confidence that everything we do will promote competition and is ultimately for the benefit of consumers.

Who are we?

As National Grid Electricity System Operator (NGESO), we make sure that Great Britain has the essential energy it needs by making sure supply meets demand every second of every day.

We work with industry to plan for future requirements of the electricity system. This ensures we are prepared for every eventuality and so we look up to 30 years ahead. In doing this we can provide the control room with the tools they need to balance the system.

The electricity industry is governed by a set of rules and codes which form the framework and rules for operating the transmission network. We work with industry to ensure the rules that govern the industry are fit for purpose. We also forecast charges for use of the transmission network which allows network users to plan their businesses.

The industry is changing at a rapid pace and this provides opportunities to deliver consumer benefits. To enable this to happen we need smart solutions, marketplaces and a level playing field for all. We want our stakeholders to see that we are impartial and so provide transparency on our governance and decision-making. We also want to break down barriers to realise value and work to ensure everyone benefits from the energy transformation. We play an essential role in enabling the transition to a more sustainable future.

What we do?

National Grid ESO moves high voltage electricity from where it's generated, such as a wind farm, through the energy system.

Using the infrastructure owned by the 3 transmission companies - National Grid Electricity Transmission, Scottish Hydro Electric Transmission Ltd. and SP Energy Networks, this high voltage electricity is passed onto one of the fourteen Distribution Network Operators across the country. They own the local networks and convert electricity into a more manageable voltage that's suited for domestic use. Your local distribution network operator then feeds low voltage electricity through to your home or business property. We don't generate or sell electricity, but our role is to ensure homes and businesses have the power they need whenever it's needed. It might sound simple but it's a complicated job to deliver electricity every single minute of every single day, making sure that demand and supply are always balanced.

The energy system in Britain is transitioning to a low carbon future with new, smaller, and more diverse parties entering the market. Our unique position operating the National Electricity Transmission System gives us the perspective and reach to play a pivotal role in this transformation.

The rules we are governed by

NGESO is required, as part of its licence, to plan, develop and operate the National Electricity Transmission System (NETS) in accordance with the System Security and Quality of Supply Standard (SQSS). The SQSS sets out the criteria and methodologies for planning and operation of the NETS.

NGESO is also required under its licence to comply with the Grid Code. The Grid Code is the technical code for connection and development of the NETS. It sets out the operating procedures and principles governing the relationship between NGESO and Users of the NETS, including Generators.

How we are regulated

We are regulated by Ofgem. Ofgem makes sure we're delivering value for existing and future consumers while supporting the transition to a more decentralised and decarbonised electricity system. One of the ways Ofgem does this is by setting regulatory price controls – these detail the services we'll provide and the amount we can recover from consumers for delivering them.

The services we provide and investment we need is informed by our own work and what our stakeholders think we should deliver. Our business plans are then reviewed by Ofgem to determine our allowed revenue and how our performance will be evaluated.

RIIO

Ofgem's regulatory framework is known as RIIO (Revenue = Incentives + Innovation + Outputs). The RIIO model offers energy companies incentives for securing investment and driving innovation, so they can develop sustainable energy networks and system operation services at the right cost for current and future consumers.

We're currently in the RIIO1 period, which began on 1 April 2013 and runs through 31 March 2021 and are building plans for the next regulatory period, RIIO2, which will start on 1 April 2021.

The RIIO2 price control period is an opportunity for us to engage extensively with stakeholders, customers and consumers and to define and develop our role during a time of significant market change. Supported by a new, bespoke regulatory model, we will continue to deliver energy safely, and reliably, and play our part in driving decarbonisation – the challenge of a generation. Our RIIO2 Business Plan[1] sets out how we will facilitate the transition to a zero carbon power system, helping

[1] https://www.nationalgrideso.com/our-strategy/riio/riio-2-final-business-plan

to achieve the UK's recent commitment to net zero emissions by 2050. We estimate that delivery of the proposed new activities will generate net benefits of around £2 billion for consumers over the five-year RIIO2 period.

We recognise that delivering the ambitious outputs that stakeholders want will require significant change within the ESO. Our capabilities and culture must evolve as we become an organisation at the cutting-edge of technology, trusted by the industry, consumers and citizens to facilitate the energy transition.

In the remainder of the RIIO1 period we have commenced dedicated activities to prepare the business for RIIO-2 and ensure we are set up to successfully deliver our business plan.

The future

As the System Operator, we produce various publications as a result of stakeholder engagement. These documents set out what we believe the future of the whole energy system will look like, and what we are proposing to deliver for consumers, across three different timeframes.

- Our 2020-21 ESO Forward Plan sets out our immediate steps until the start of RIIO2 to achieve our ambitions. It helps you understand what we aim to deliver over the course of a financial year, by setting out our ambitious plan of deliverables. It also shows the metrics we will use to measure our performance during the year, and how our activities this year fit into the bigger picture of the energy transition.
- Our Towards 2030 document builds on our Future Energy Scenarios to identify what a decarbonised 2050 energy landscape might look like, and uses this to help us understand the energy system of 2030. The next decade towards 2030 is vital and the decisions we take today will pave the way to a new energy era.
- Our Bridging the Gap to Net Zero publication takes a closer look at what needs to be done to reach the UK's 2050 net zero target. We identify and investigate the areas from our recent future energy scenarios publication that we consider to be the most important and the most uncertain and bring together a wide range of stakeholders to progress the debate and recommend actions for policymakers and industry to move towards net zero.

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Our Performance

2019 - 2020

Revenue and costs

Costs and revenue impact (actual vs allowances for reporting year)

We have published the below tables to show what we have spent to date and what we forecast to spend in the rest of the RIIO1 period. Table 1 shows our actual and forecast total expenditure (Totex), which includes both our capital expenditure (Capex) and our operational expenditure (Opex)[2]. Table 2 shows our adjusted allowances[3] for the RIIO1 period and Table 3 shows the difference between costs and adjusted allowances with negative numbers indicating that costs exceed allowances.

Table 1: Actual/Forecast Expenditure (2019/20 Prices)

2.4 (a) Actual/Forecast Expenditure (£m, 2019/20 Prices)		Actual							RIIO1 Forecast	
		2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	Total
SO	**Non-Operational capex**	43.40	46.37	45.05	60.70	65.66	79.85	87.56	86.47	515.07
	Direct costs	64.66	60.97	64.54	69.83	70.04	71.13	73.98	70.56	545.71
	Business Support	46.89	45.10	46.95	48.82	56.17	74.75	55.81	61.76	436.25
	Adjustment for IAS 19 pension accrual	-1.10	0.78	-0.44	-1.13	-0.76	-0.80	0.19	0.19	-3.06
	Controllable Opex	110.44	106.85	111.05	117.52	125.45	145.08	129.98	132.51	978.90
SO	**TOTEX**	**153.85**	**153.22**	**156.10**	**178.22**	**191.11**	**224.93**	**217.54**	**218.99**	**1,493.96**

Table 2: Total Allowances (2019/20 Prices)

2.4 (a) Total Allowances (£m, 2019/20 Prices)		RIIO1 Allowances								
		2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	Total
SO	**Non-Operational capex**	70.05	49.16	46.62	47.22	57.69	71.84	54.86	50.51	447.96
	Direct costs	55.30	58.06	65.95	71.64	75.39	93.06	75.89	78.78	574.06
	Business Support	44.54	47.05	49.19	51.19	51.98	53.08	55.34	57.59	409.97
	Controllable Opex	99.84	105.11	115.14	122.83	127.36	146.15	131.24	136.37	984.03
SO	**TOTEX**	**169.89**	**154.27**	**161.76**	**170.04**	**185.06**	**217.99**	**186.09**	**186.88**	**1,431.98**

Table 3: Variance between Actual/Forecast and Allowances (2019/20 Prices)

2.4 (a) Variance Actual/Forecast v Allowances (£m, 2019/20 Prices)		Variance to Allowance								
		2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	Total
SO	**Non-Operational capex**	26.65	2.79	1.57	-13.48	-7.96	-8.01	-32.71	-35.96	-67.11
	Direct costs	-8.72	-3.36	1.67	2.47	5.77	22.32	1.80	8.11	30.06
	Business Support	-1.88	1.62	2.42	2.83	-3.86	-21.25	-0.55	-4.26	-24.93
	Controllable Opex	-10.61	-1.74	4.08	5.31	1.91	1.07	1.26	3.85	5.13
SO	**TOTEX**	**16.04**	**1.04**	**5.65**	**-8.18**	**-6.05**	**-6.94**	**-31.45**	**-32.11**	**-61.98**

[2] Capex is broadly the costs incurred in building new assets and replacing existing ones. For the ESO this is mainly IT systems. Opex is broadly the costs incurred for running day to day activities and maintaining IT systems.
[3] This figure is after alignment of allowance categorisation to be consistent with treatment of spend

Total Balancing Services Use of System (BSUoS) revenue in 2019/20 was £1,626.6m. This comprised of £1,323.5m with respect to External Balancing Costs and £303.1m covering Internal System Operator costs. Our external revenue was made up of £54.9m of Black Start revenues which were allowed by Ofgem as per Special Licence Condition 4G and other income including balancing system costs and adjustments relating to scheme updates from 2018/19.

Our internal revenue of £303.1m was £103.5m higher than the prior year largely due to adjustments to reflect backdated additional allowances for the 2018 security re-opener and ESO legal separation.

Overview of Opex & Capex

Our overall total expenditure forecast for the RIIO1 period is £1,494m against forecast allowances of £1,432m, meaning that over this price control period forecast costs are £62m higher than forecast allowances. This is an increase of £55m from the prior RRP submission.

We spent £130m on opex in 2019/20, which was £16m lower than in 2018/19. The primary driver of lower spend was the completion of our legal separation programme, which delivered the infrastructure, systems and processes for us to comply with our new obligations as a legally separate entity within the National Grid group. Additional ongoing opex costs associated with a separate ESO were more than offset by the continued delivery of our multi-year efficiency savings. We also saw further upward cost pressure due to our new role in looking at the introduction of early competition in in transmission networks and higher EMR auction costs following the resumption of the Capacity Market.

In 2019/20 we invested £88m in our capex programmes, with the same level of spend planned for 2020/21. Total investment is £41m more than previously forecast, with higher expected costs to deliver changes to IT systems resulting from EU legislation changes and additional investment planned for our cyber infrastructure, platform for ancillary services and finance system enhancements. We continue to invest in the capabilities to deliver our forward plan commitments and position ourselves to take on an expanded role in RIIO2.

Investment Summary

We continue to focus our investment in major programmes which deliver enhancements to our customers and consumers against a rapidly changing energy industry.

Our total capex expenditure for Electricity System Operator in 2019/20 was £87.6m, representing an increase from last year of £7.7m. The increase in spend was driven by three key investments; European future energy regulations, Platform for Ancillary Services (PAS) and Infrastructure for Business Services. Against this, there has been a decrease in spend on property driven by the completion of legal separation activities for ESO and a reduction in spend on our Electricity Balancing System (EBS), which was as a result of a favourable resolution of a commercial dispute.

Key areas of expenditure in 2019/20 were:

European future energy regulations £26.4m: This investment enables the development and implementation of the European Network Codes, stemming from the European Union's (EU) Third

Energy Package legislation, facilitating the journey to a single harmonised European electricity market. This impacts multiple systems, including our critical national infrastructure systems and operational processes. This year's investment has continued to deliver these changes, which need to be implemented over several years.

We continue to work closely with EU bodies and counterparts to deliver future regulatory obligations.

CNI Data Centre project £22.7m: 2019/20 saw the progression of electricity core services design as well as build and fibre network extensions to the new data centres which will enable the future migration of electricity CNI applications. Work was also completed to define a future electricity migration strategy.

Forecast over the remaining RIIO1 period

Our total forecast spend for the RIIO1 period is £515.1m, with investment of £86.5m in the final year of RIIO1. The forecast is £41.0m higher than previously reported. The biggest driver is due to significant additional investment in systems changes driven by future European energy regulations £21.6m. Changes in European legislation and policy have had a significant impact on the GB market and the ESO's related business processes, impacting on most key IT systems the ESO currently runs and maintains. There is also additional planned investment in our platform for ancillary services £7.1m, where scope has been broadened to ensure the ancillary services customer journey is addressed end to end in line with feedback we have received from stakeholders

Spend in the final year of RIIO1 is detailed below:

European future energy regulations £17.0m: This multi-year programme will continue into RIIO2, as we prepare our systems to enable compliance with the requirements and timescales of the Third Energy Package. Much of the regulatory interpretation and impact is under analysis and subject to discussions with regulators and European partners.

Platform for Ancillary Services (PAS) £8.4m: The programme will incur its highest level of spend in the final year of RIIO1. The project is split into three main areas which covers Settlements, Dispatch and Contracts. Most of the investment on the Ancillary Services platform will be spent on the first stage of replacing the current settlement system following the conclusion of the procurement stage. The investment in the dispatch system will deliver technical and functional enhancements requested by our internal and external stakeholders following implementation of industry code changes. The investment in the Contracts system will deliver industry code compliance as well as functional enhancements

CNI Data Centre project £8.5m: Completion of preparatory works for Electricity CNI services including the installation of a network essential for electricity CNI services and the extension of and connectivity to the OPTEL CNI Wide Area Network (WAN) between the electricity control room sites and the new CNI data centres is expected by March 2021.

Electricity Market Reform (EMR) £4.2m: As the EMR Delivery Body, we have continued to invest in the EMR Portal to deliver system improvements and ensure compliance with rules and regulations. This has included the implementation of regulatory changes arising from the suspension and then reinstatement of the Capacity Market associated with State Aid approval. We will continue to accommodate further changes in regulations, including changes arising from the Government's commitments regarding the restoration of the Capacity Market and the facilitation of direct Foreign Participation, as well as system enhancements in response to user feedback.

When we were awarded the role of EMR Delivery Body, an uncertainty mechanism was included within our allowances to take account of any changes to the role or system requirements over time. We utilised this reopener in May 2019 to request additional funding to cover major scope changes since the start of EMR. Ofgem have added another funding reopener opportunity in March 2021 into the Delivery Body licence.

Outputs

Customer and stakeholder

The 2019-20 period was the first year of legal separation for NGESO from the rest of the National Grid group. NGESO were no longer directly incentivised on customer and stakeholder satisfaction, rather this formed a part of the wider performance incentive scheme. We still utilised the SAT process (with surveys collected through an independent third party) as the main method of collecting insights and continued to engage with our customers and stakeholders through our website, our publications, consultations, newsletters, engagement forums, webinars, customer meetings and surveys.

Our SATs scores in 2019-20 were 7.61 for CSAT and 7.78 for SSAT against a target of 8.15. The SATs feedback from this period identified the key areas for improvement as, speed of response dealing with queries and our approach to communication and engagement. We introduced a new ESO customer performance hub, attended by the leadership team, to focus on improving the customer experience. As the number one pain point identified previously, query management has been a key area of focus. We have used the metrics and discussions at this hub to drive improvements across the business alongside a suite of SLAs to manage response time using our Salesforce CRM system. In terms of our approach to communication and engagement, we have introduced improved guidance and toolkits to support our people in identifying and segmenting customers and stakeholders, to increasingly tailor our communications and engagement approaches to their needs. These are used in conjunction with support from the Customer & Stakeholder team to ensure improvements to the way engagement plans are built and delivered.

We have also used the last 12 months to review how we gather insights as a business and developed a new insights programme tailored for NGESO customers and stakeholders. Moving forward the SAT process will be used as a specific measure against our “Trusted Partner” ambition laid out in the Forward Plan, focusing on the performance and perceptions of the ESO as a whole; this will be complimented with bespoke customer surveys targeted at measuring and improving our operational processes; and our CRM system will allow us to capture and review the interactions we are having with our customers and stakeholders on a day to day basis. This means we will be more agile in responding to feedback and more transparent with our customers showing them what we have heard, what improvements we have made, and explaining our decision-making process more clearly (the “You said, We did” approach).

Reliability and availability

Every year, NGESO publish a Performance Report pursuant to our Standard Licence Condition C17 (Transmission System Security Standard and Quality of Service), detailing the availability, security and performance of service of the NETS. Further detail on each of the transmission networks can be found in the Performance Report here. The detail in this Annual Report refers to the overall performance of the National Electricity Transmission System. The NETS in Great Britain is comprised of both onshore and offshore transmission networks. The onshore transmission networks are owned by National Grid Electricity Transmission (NGET) in England and Wales, SP Transmission plc (SPT) in south and central Scotland and Scottish Hydro Electric Transmission plc (SHE Transmission) in the north of Scotland. Following legal separation of the ESO from NGET on 1st April 2019, NGESO became the National Electricity Transmission System Operator (NETSO) for the onshore and offshore transmission networks

Availability: Annual System Availability

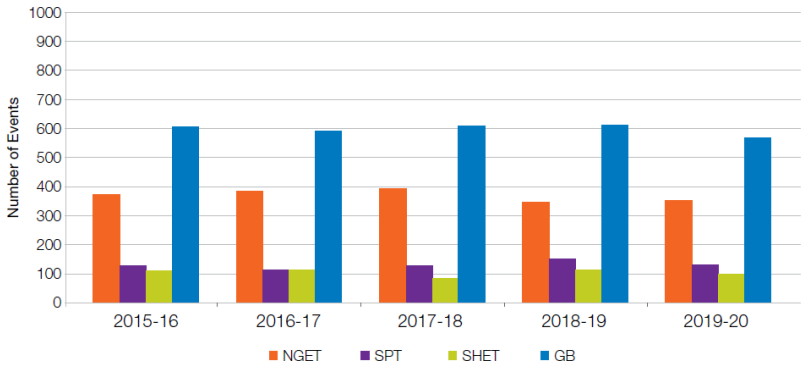
Annual System Availability of the NETS for 2019-20 was 94.69%.

GB % Annual System Availability				
2015-16	**2016-17**	**2017-18**	**2018-19**	**2019-20**
94.36	94.31	94.44	94.55	94.69

Security

The Overall Reliability of Supply for the National Electricity Transmission System during 2019-20 was: 99.999967% compared with 99.999967% in 2018-19 and 99.999975% in 2017-18.
During 2019-20 there were 586 NETS events where transmission circuits were disconnected either automatically or by urgent manual switching. The vast majority of these events had no impact on electricity users with only 20 resulting in loss of supplies to customers.

GB System Events



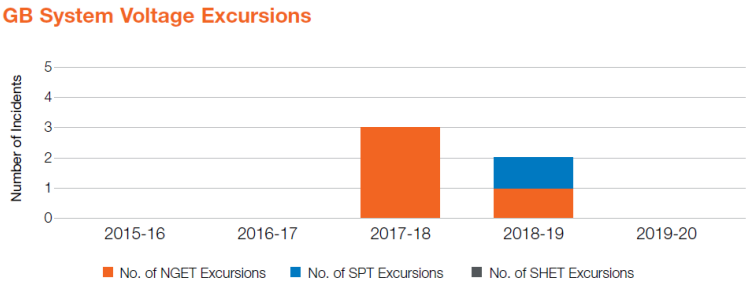
GB System Events					
	2015-16	2016-17	2017-18	2018-19	2019-20
NGET	374	379	398	347	355
SPT	126	108	124	157	131
SHET	104	109	85	108	100
GB	604	596	607	612	586

Quality of service

Quality of service is measured with reference to system Voltage and Frequency.

Voltage excursions: During 2019-20 there were no reportable Voltage Excursions within the National Electricity Transmission System. The chart below summarises the reportable Voltage Excursions that have occurred on the National Electricity Transmission System.

GB System - Voltage Excursions					
	2015-16	2016-17	2017-18	2018-19	2019-20
Number of NGET Excursions	0	0	3	1	0
Number of SPT Excursions	0	0	0	1	0
Number of SHET Excursions	0	0	0	0	0



Frequency excursions: During 2019-20, there was one reportable Frequency Excursion within the National Electricity Transmission System. The previous Frequency Excursion was in the 2008-09 reporting period.

GB System - Frequency Excursions					
	2015-16	2016-17	2017-18	2018-19	2019-20
Number of Excursions	0	0	0	0	1

Incident date and time	Statutory limits	Frequency	Duration
09 August 16:52:33 A lightning strike occurred on the Eaton Socon – Wymondley Main circuit at 16:52:33, which resulted in a cumulative loss of 1,481MW of generation and a rapid decline in system frequency outside of the lower statutory limit of 49.5Hz at 16:52:38, to a low of 49.1Hz after 20 seconds. As the frequency began to recover there was a further loss of 210MW of generation with the frequency hitting a new low point of 48.8Hz after 1 minute 20 seconds. Following response actions, the frequency returned to the statutory limit at 16:55:00. This event resulted in the system frequency being outside of the statutory limits for 2 minutes 22 seconds.	50.5 - 49.5Hz	48.8Hz	142 seconds

Safety

The safety of our employees is of paramount importance. Each year we undertake a safety survey with our employees to gauge attitudes to safety, how effective our safety culture is and where employees believe we can improve. We also measure safety using the Lost Time Injury Frequency Rate metric. This industry standard approach measures the number of lost time injuries occurring for every 100,000 hours worked.

Target: Lost Time Injury Frequency Rate 0.10
Performance: 0.08

This year's result was positive, with fewer injuries than target. In addition, key insights from the survey have highlighted areas for further work, including a need for a better focus on demonstrating action from information provided by our employees; ensuring safety targets drive value that can be recognised by all; and ensuring that safety is not seen as a 'priority' but 'the way we do things'. The ESO in conjunction with the Safety, Health and Sustainability team (SHS) and our local Safety, Health and Wellbeing champions are developing targeted plans to address the areas of concern and build on the work done to date.

Environmental Performance

As a Group, we have set a voluntary target to reduce our Scope 1 and Scope 2 Greenhouse Gas (GHG) emissions across our UK and US businesses to 'net-zero' by 2050. The net zero target, set in November 2019, replaces our previous target of an 80% reduction by 2050 from a 1990 baseline. Our baseline emissions level was set, at group level, at 21.6m tonnes of carbon dioxide equivalent. We have an interim target to reduce our GHG emissions by 70% by 2030, which we are on track to achieve and are reviewing our interim targets in light of our net-zero goal..

- Scope 1 and 2 emissions in the ESO are from energy consumption in offices and transport use. Scope 3 emissions are from transport use.

In 2019/20 the scope 1,2 and 3 emissions are 1.2kTCO2e, 1.1kTCo2e and 0.6kTCO2e respectively in comparison to 1.4kTCO2e, 1.7kTCO2e and 0.7kTCO2e respectively for 2018/19. This has mostly been driven by the smaller allocation attributed to ESO compared with the Electricity Transmission business and the rest of the business this year. This means that a smaller portion of the emissions have been allocated to the ESO.

We provide our annual emissions performance as part of our Carbon Disclosure Project (CDP) [4] submission. This enables us to benchmark our performance against other organisations. In 2019 (for 2018/19) we achieved an 'A' rating for our CDP submission, putting us in the top 3% of over

[4] The CDP runs the global disclosure system that enables companies, cities, states and regions to measure and manage their environmental impacts.

8,300 global companies who submitted a response. This recognises us for our actions to reduce emissions and mitigate climate change.

Incentives Performance

ESO Incentive Scheme

In April 2018, Ofgem introduced a new regulatory and incentives framework for the ESO in order to encourage the ESO to proactively identify how it can maximise consumer benefits across the full range of its activities. The new arrangements (detailed in Special Licence Condition 4M) include 3 Role areas for the ESO; a requirement to develop Forward Plans with industry; the publication of regular performance reports; the introduction of a new Performance Panel; and a move towards a broader, evaluative performance assessment (with associated financial incentives). In March 2019 we published our 2019-21 Forward Plan, setting out what we would deliver during this two-year period according to the three roles defined by Ofgem

In September 2018, we launched our new 'ESO' identity and branding as we established our distinct, more independent voice within the industry, with the consumer at the heart of our decision-making. In this second year of our Incentive Scheme, since we became a separate legal entity, we have delivered outcomes which are enabling the long-term transition to a decarbonised energy landscape.

In line with Ofgem's Electricity System Operator Reporting and Incentive (ESORI) arrangements guidance, we are required to publish an executive summary and report covering our end of year performance against our 2019-21 Forward Plan. Some of our key milestones for the incentive scheme include:

- Delivered up to £800m of consumer benefits across all role areas in 2019-20
- We actively identified the lowest cost solutions whilst ensuring system security
- We have increased transparency around our operations
- We are constantly evolving our systems and processes to operate in a zero-carbon world

- We are progressing several long term projects to improve system reliability
- We have introduced new tools, processes and contractual arrangements to improve our ability to operate the system with a higher proportion of renewable generation.
- We engaged extensively with stakeholders, actively seeking their feedback and acting on it where possible.

Our operation of the transmission system in 2019-20 has been the lowest carbon year we have ever had, as we transition towards being capable of carbon free operation by 2025 we anticipate this being a record which is beaten year on year. Many of our deliverables for 2019-20 contribute to this future ambition.

Following the publication of our End of Year report for 2019-20, Ofgem published their decision on our (NGESO's) financial incentive for 2019-20 on 31 July, in line with Special Licence Condition 4M. Ofgem directed that the ESO will receive a financial incentive of £1m for 2019-20.

We are disappointed by the 2019-20 incentive reward which we believe does not reflect the outcomes we have delivered and the positive feedback we have received from stakeholders.

Ofgem recognise that we have made continued improvements to our reporting (specifically the structure and coherence of the 2020-21 Forward Plan). Ofgem also welcome the positive engagement to date with stakeholders (in particular, a longer consultation window and a well-received stakeholder event).

Financial Incentives on EMR

We have specific incentives in our role as Electricity Market Reform (EMR) Delivery Body (Special Licence Condition 4L). In the Capacity Market (CM), the EMR Delivery Body is incentivised to forecast peak demands which then feed into the capacity to procure in the T-1 and T-4 auctions. In 2019-20 the accuracy of the forecast was to within 0.3 GW. In addition, the EMR Delivery Body has implemented improvements to the CM prequalification processes. This has driven an increase in first time prequalification for the CM and a reduction in disputed decisions. This was the result of enhanced engagement, customer guidance, and improvements query management. For the CM we achieved a customer satisfaction score of 6.92 out of 10. The Delivery Body also played a crucial role in the reinstatement of the CM following its suspension in 2019 and subsequent implementation of amended rules and regulations.

For Contracts for Difference (CFD), in 2019-20 the Delivery Body ran Allocation Round 3. In this process we delivered increased quality and customer support and achieving 0 appeals being made to the Authority and a Customer Satisfaction score of 8 out 10.

Innovation

As Great Britain's Electricity System Operator (ESO) we make sure that the electricity network operates safely and efficiently around the clock, so that homes, businesses and industry always have the power they need.

We're also helping to tackle one of the biggest challenges facing society: how to create a sustainable, low-carbon electricity system for the future that will help the UK meet its net zero commitments. Innovation plays a vital role in this effort, which is why we're working with partners from the energy industry and beyond to harness new technologies, markets and ways of working to support the energy transition.

Our innovation portfolio features a novel range of projects funded by Ofgem, through the Network Innovation Allowance (NIA) and Network Innovation Competition (NIC). This funding gives our business, and the people who work with us, the freedom to develop ideas in a way that wouldn't be possible in normal business operations. It allows us to test emerging technologies, or research and develop new systems and methods. We can also figure out how to deliver the biggest benefits at reduced costs, while providing reliable, low-carbon energy for the electricity system and consumers.

In 2018, we published our very first Innovation Strategy, and published our second refresh of this in March 2020[5]. This document sets out our innovation priorities for the final year of our RIIO1 regulatory period. We will undertake a more fundamental strategy review next year to set us up for our new RIIO2 framework.

2019/20 Performance

In 2019/20 the ESO spent £2.98m of our allowable Network Innovation Allowance (NIA) expenditure. 21 eligible NIA projects aligned to our new 2020 Innovation Strategy were progressed in the year. In the course of the year, we received £0.075m in 3rd party income / contributions for the RecorDER project.

In 2019/20 the Electricity System Operator spent £4.75m NIC expenditure. 5 eligible NIC projects were progressed in the year, three of these were ESO led EFCC (known as SMART Frequency Control), TDI2.0 (known as Power Potential) and Blackstart from DER (known as Distributed Restart). ESO provided input into and received NIC funding for two other projects, Phoenix, led by Scottish Power Energy Networks and Electricity Flexibility and Forecasting System (EFFS), led by Western Power Distribution..

[5] https://www.nationalgrideso.com/document/106786/download

The net costs at year end for these are reported in the table in Appendix 1, together with the costs at year end for the NGESO led EFCC (known as SMART Frequency Control), TDI 2.0 (known as Power Potential) and Black Start from DER NIC projects. (NB: The historic costs have been inflated to 2020 prices).

As GB's Electricity System Operator, we are naturally more sensitive to the changes that the system is undergoing, and we must be relentless in our drive for innovation to best meet what has been termed as the challenge of our generation. We committed to update our Innovation Strategy each year to reflect our progress against the ESO challenges, and to redirect investment towards the issues that we feel need more attention. As a consequence of this, our portfolio of projects shows the evolution of our understanding of the issues that sit at the heart of the energy transformation. In 2019/20 we continued to invest heavily in system stability but we also significantly increased our investment in digital transformation. Our projects also give us a rare view into the methods, practices and approaches that characterise the solutions that we are exploring. This allows us to recognise the emergence of solutions' macro trends across the various projects, some of which are:

Coordination between electricity transmission, distribution and system operation. An increasing number of our projects involve collaborating with other network companies: we recognise vertical and cross-coordination as key to making optimal planning and operational decisions as we transition to a more decentralised and complex system.

Mathematical, digital and analytical tools that deal with increased complexity and uncertainty in the system. We have launched projects that will help us manage this uncertainty through agent-based modelling and market simulators; exploring ways of making decisions in ambiguous conditions; and automating complex processes.

Investigation of alternative tools/technologies capable of supporting the system. Decarbonising the grid involves replacing thermal generation with non-synchronous renewables, which drives a need for non-traditional sources of stability. For the past 30 years, thermal generation has been serving several roles: not only in terms of providing energy, it has also contributed to system inertia, it has formed almost the entirety of our Black Start fleet; and provided a wealth of other grid services that are becoming increasingly critical (e.g. voltage support, fault ride through). Going forward we will continue to explore non-traditional solutions to provide these services, and our innovation portfolio is already reflective of that effort.

The Electricity System Operator Innovation Annual Summary can be found here, providing more information on how we performed against our key strategy areas. The Electricity System Operator Innovation Strategy can be found here, and sets out how we plan to innovate in 2020/21.

Case Studies:

Residential Response

A 2018 NGESO Open Innovation Event developed project. Residential Response is exploring how we can facilitate easier market access for small residential flexibility assets to help us keep the GB electricity system in balance.

Demonstration of Virtual Synchronous Machine control of a battery system

VSM – or Virtual Synchronous Machine – technology has the potential to provide stability to the GB electricity system of the future, by enabling us to control frequency and voltage fluctuations without relying on traditional fossil-fuelled power stations.

Testing Coordinated DSO-ESO Procurement and Dispatch

The creation of a Local Energy Market (LEM) for Cornwall is a multimillion-pound project led by Centrica to give homes, businesses and DER in the area the power to sell energy through a virtual marketplace and get paid to reduce or delay their consumption. This world-first project is looking at how we could establish a co-ordinated approach between the ESO and DNOs when procuring balancing services from local energy providers.

Advanced Modelling for Network Planning under Uncertainty

This project will help us improve the robustness of our analysis across a range of future scenarios. This helps TOs decide what reinforcement projects they should prioritise and invest in over the next year.

Mapping the Impacts and Visualization of Risks of extreme weather on system operation (MIVOR)

This project explores the impact that climate change could have on the electricity system in the future, and the possible risks we need to plan for to make sure we maintain a safe and reliable system for consumers.

Uncertainties

Uncertainty mechanisms are used to allow network companies' allowed revenue to change within the price control period. This permits adjustments to allowances in line with changes from forecast. This year we have utilised the following mechanisms allowed for in our Licence.

Enhanced Securities

At the time of setting RIIO1 allowances, there was uncertainty about the costs relating to compliance with future government recommendations and statutory requirements on the security of IT systems. Ofgem therefore included a reopener mechanism for Enhanced Security Costs in the RIIO1 price control.

In May 2018, National Grid (NG) submitted a joint reopener application for its gas and electricity transmission licensees under Special Condition 7D of NGETs electricity transmission licence and Special Condition 6D of National Grid Gas Transmission plc's (NGGT) gas transporter licence.

In September 2018, Ofgem set out their decision to increase NG's baseline allowance by £112.9m for Enhanced Security Costs. This includes:

- £76.5m of the £84.8m requested by NG for Data Centre investments.
- £36.4m of the £40.5m requested by NG for Cyber Security enhancements.

This funding was linked to the delivery of clear outputs to deliver the enhancements as set out in NG's reopener application and to report on the progress of delivery to the Competent Authority (CA).

Following legal separation in April 2019, NGESO and NGGET now report separately on the enhanced security projects, with costs allocated between the two organisations and with delivery still being undertaken jointly by shared functions.

This Enhanced Securities project remains on track to deliver the majority of outputs by the end of the RIIO1 period.

Whilst COVID-19 has delayed some interim milestones for Data Centres projects, these are still on track for completion by the end of the RIIO1 period.

The Cyber Security projects are broadly on track. However, since the reopener submission, the Network & Information Systems ('NIS') Regulation (2018) has introduced obligations on the ESO business to undertake appropriate measures to manage the cyber risks of our network. We have conducted a review of our Security Organisation and portfolio of investments to ensure we remain focused on addressing advancing cyber threats. The work undertook a deep dive of the state of cyber security controls across both our enterprise and critical infrastructure environments and resulted in a more sophisticated cyber security risk approach. This has led to a re-prioritisation of the current portfolio projects to address highest-risk areas first and deliver new capability to more readily detect and respond to potential threats. Accordingly, the Phase 1 (CS1) and Phase 2 (CS2)

prioritisation has been assessed alongside the work being undertaken as part of the ESO NIS Improvement Plan (Network & Information Systems Regulation). We have re-scoped the CS2 projects, and there are additional activities we need to undertake to be compliant to the Cyber Assessment Framework (CAF) and NIS regulations. Our delivery schedule for CS1/2 has therefore been updated to reflect a prudent approach to delivery across the respective programmes.

Electricity Market Reform (EMR)

When we were awarded the role of EMR Delivery Body, an uncertainty mechanism was included in our licence to account for major scope changes. In practice, the level of change in EMR has been significant, including changes to market rules, a significant increase in the number of market participants and the replacement of IT systems. As a result, we continuously develop our processes, guidance and systems to successfully facilitate all auctions. In addition to Ofgem's determination[6] on 30th September 2019 to grant additional allowances for the period April 2016 to March 2021, Ofgem also published a statutory consultation in March 2020[7] on our EMR licence conditions. Their decision, published in June 2020 introduces another uncertainty mechanism window, allowing the ESO to manage uncertain costs incurred between May 2019 to March 2021. This funding will largely cover costs associated with IT system upgrades and urgent regulatory changes.

[6] https://www.ofgem.gov.uk/system/files/docs/2019/09/decision_on_adjustment_to_allowances_for_the_emr_delivery_body_0.pdf

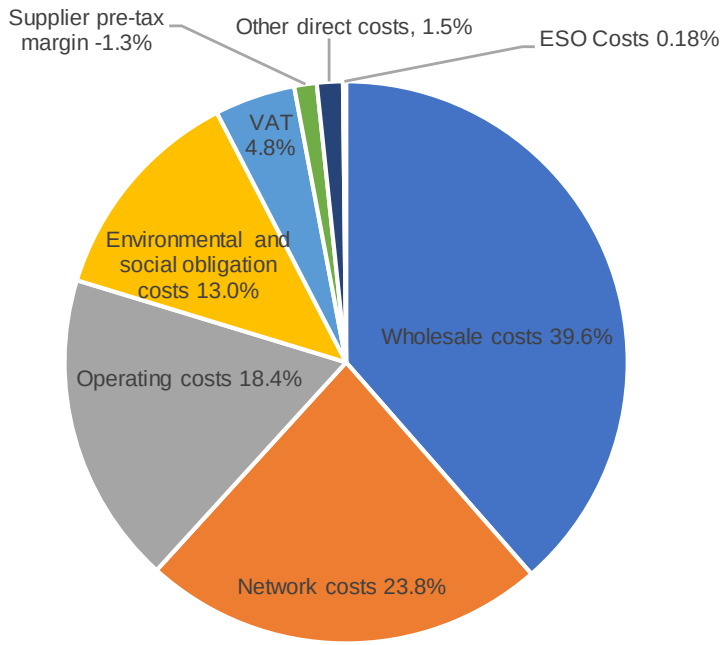
[7] https://www.ofgem.gov.uk/publications-and-updates/statutory-consultation-adjusting-electricity-market-reform-delivery-body-incentives-and-mechanisms-recover-uncertain-costs

Breaking Down your Bill

What are you paying for?

Energy bills can sometimes seem complex and it's not always clear what consumers are paying for. The ESO part of your bill, which is subject to regulatory approval, covers the cost of balancing supply and demand, making sure electricity is always there when you need it.

The below graph shows the different parts that make up the average domestic dual fuel bill[8]. The table below shows our actual contribution to the customer bill.



£	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20
NGESO	0.92	1.07	1.17	1.03	1.10	1.43	2.19

Therefore, for 2019/20, approximately £2.19 of the typical domestic household bill, or 0.18% of the consumer duel fuel bill costs were attributable to NGESO.

[8] Information sourced from Ofgem: https://www.ofgem.gov.uk/consumers/household-gas-and-electricity-guide/understand-your-gas-and-electricity-bills

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Other Information

Useful Information

Useful information

Contact

If you would like to know more about our incentive scheme, please contact us at box.soincentives.electricity@nationalgrideso.com

If you would like to know more about our innovation projects or want to get involved, please contact us at box.SO.innovation@nationalgrid.com

If you would to get involved in our future planning 2021 onwards, please contact us at box.eso.riio2@nationalgrid.com

Some useful links:

- **NGESO homepage -** https://www.nationalgrideso.com/
- **About us -** https://www.nationalgrideso.com/about-us
- **What does the ESO do -** https://www.nationalgrideso.com/about-us/what-eso-and-what-does-it-do
- **NGESO Incentives -** https://www.nationalgrideso.com/about-us/incentives
- **How we're performing (Forward Plan and performance documents) -** https://www.nationalgrideso.com/our-strategy/forward-plan/how-were-performing
- **Our Business Plan -** https://www.nationalgrideso.com/our-strategy/riio/riio-2-final-business-plan
- **Innovation website -** https://www.nationalgrideso.com/innovation
- **Charging Overview** - https://www.nationalgrideso.com/charging

Legal Disclaimer

This document relates to NGESO, which is a member of the National Grid group of companies and a subsidiary of National Grid plc.

This document contains certain statements that are neither reported financial results nor other historical information. These statements are forward looking statements within the meaning of Section 27A of the Securities Act of 1933, as amended, and Section 21E of the Securities Exchange Act of 1934, as amended.

These statements include information with respect to NGESO's financial condition, its results of operations and businesses, strategy, plans and objectives. Words such as 'anticipates', 'expects', 'should', 'intends', 'plans', 'believes', 'outlook', 'seeks', 'estimates', 'targets', 'may', 'will', 'continue', 'project' and similar expressions, as well as statements in the future tense, identify forward-looking statements.

Furthermore, this document, which is provided for information only, does not constitute summary financial statements and does not contain sufficient information to allow for as full an understanding of the results and state of affairs of National Grid plc and its subsidiaries, including the principal risks and uncertainties facing National Grid plc, as would be provided by the full Annual Report and Accounts, including in particular the Strategic Report section and the 'Risk factors' on pages 212 to 215 of National Grid plc's latest Annual Report and Accounts. Copies of the most recent Annual Report and Accounts are available online at *www2.nationalgrid.com* or from Equiniti. Except as may be required by law or regulation, NGESO undertakes no obligation to update any of its forward-looking statements, which speak only as of the date of this document. The content of any website references herein does not form part of this document.

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Appendix

Innovation project costs

NIC project costs:

	Status	2014	2015	2016	2017	2018	2019	2020	2021	RIIO total		
NIC funding by project	**2019/20**	actual	actual	actual	actual	actual	actual	actual	forecast	(£m)	Total funding	Lic fu
Power Potential (known as TDI 2.0)	in progress	-	-	-	0.0	1.66	2.76	2.77	3.0	**10.3**	9.5	
EFCC	successfully completed	-	-	0.67	2.26	1.22	2.37	0.12	-	**6.6**	6.8	
Phoenix	in progress	-	-	-	0.03	0.26	0.28	0.19	0.3	**1**	N/A	
Blackstart from DER	in progress	-	-	-	-	-	-	1.655	5.8	**7.5**	11.7	
EFFS	in progress	-	-	-	-	-	-	0.024	-	**0**	N/A	

NIA project costs:

	Status	2014	2015	2016	2017	2018	2019	2020	2021
NIA by Cost Project	**2019/20**	**actual**	**actual**	**actual**	**actual**	**actual**	**actual**	**actual**	**forecast**
Eligible Bid Preparation Costs		-	0.2	-	0.2	-	-	-	-
Review of Engineering Recommendation P2/6	Successfully Completed	-	-	0	0	-	-	-	-
UK-wide wind power: Extreme and Variability	Successfully Completed	0.1	0	0	0	-	-	-	-
Modelling of Embedded Generation within Distribution Networks and Assessing the Impact	Successfully Completed	0	0	0	0	-	-	-	-
Quantifying benefits and risks of applying advanced network control and demand response technologies	Successfully Completed	0.2	0	0.1	-	-	-	-	-
Impact of extreme events on power production at the scale of a single wind-farm	Successfully Completed	0.2	0	0	-	-	-	-	-
Optimising the operation of an integrated DC link within an AC system (ICase Award)	Successfully Completed	0	0	-	-	-	-	-	-
A Combined Approach to Wind Profile Prediction	Successfully Completed	0	0	0	0	0	-	-	-
Seconomics - Digital Risk and Cyber Security	Successfully Completed	0	0.2	0	0	-	-	-	-
Mathematics of Balancing Energy Networks Under Uncertainty	Successfully Completed	0	0	0	0	0	-	-	-

Scalable Computational Tools and Infrastructure for Interoperable and Secure Control of Power System	Successfully Completed	0	0	0.1	0	0	-	-	-
Protection and Fault Handling in Offshore HVDC Grids	Successfully Completed	-	0.1	0	0	0	-	-	-
UK Regional Wind: Extreme behaviour and predictability	Successfully Completed	0.1	0.1	0.1	0	-	-	-	-
Visualization of Renewable Energy Models	Successfully Completed	0	0	0	-	-	-	-	-
Development of Dynamic Demand Models in DIgSILENT PowerFactory	Successfully Completed	-	0.1	0.2	0	-	-	-	-
Reactive Power Exchange Application Capability Transfer (REACT)	Successfully Completed	0	0	0	-	-	-	-	-
Enhanced Weather Modelling for Dynamic Line rating (DLR)	Successfully Completed	0	0	0	0	0	-	-	-
Control and Protection Challenges In Future Converter Dominated Power Systems	Successfully Completed	0	0.1	0.1	0.1	0	-	-	-
Electricity Demand Archetype Model 2	Successfully Completed	0.1	0.2	0	0	0	-	-	-
Facilitating Enhanced Network Capacity Evaluation	Successfully Completed	0.1	0.1	-	-	-	-	-	-
Industrial and Commercial Gas & Electric Scenario Modelling	Successfully Completed	0	0.2	0	-	-	-	-	-
Project Samuel - Grid Data and Measurement Systems	Successfully Completed	0	0.4	0.2	0	-	-	-	-
Evolution of Energy Storage and Demand Management Services.	Successfully Completed	0	0	0	-	-	-	-	-
Avoiding voltage regulation action conflicts. (In conjunction with LCNF project CLASS)	Successfully Completed	0	0.1	0	0	-	-	-	-
EPRI Research Collaboration on Grid Operations and Control	Successfully Completed	0.1	0.4	0	-	-	-	-	-
EPRI Research Collaboration on Information and Communication Technology.	Successfully Completed	0.1	-	-	-	-	-	-	-
Clustering effects of major offshore wind developments	Successfully Completed	-	0.2	0.1	0	-	-	-	-
Investigation of sub-synchronous between wind turbine generators and series capacitors	Successfully Completed	0	0.2	0.1	0	-	-	-	-
iTesla	Successfully Completed	0	0	0	0	-	-	-	-
Granular Voltage Control (GVC)	Successfully Completed	0	0.2	0	0.1	-	-	-	-
Frequency sensitive electric vehicle and heat pump power consumption	Successfully Completed	-	0	0	-	-	-	-	-
PV Monitoring: Phase 1	Successfully Completed	-	0.1	0	0	-	-	-	-

Assessment of Distributed Generation Behaviour during Frequency Disturbances	Successfully Completed	-	0.2	0	0	-	-	-	-
Integrated electricity and gas transmission network operating model (ICASE Award)	Successfully Completed	0	0	0	0	0	-	-	-
Smart Grid Forum Work Stream 7	Successfully Completed	-	0.1	0	0	-	-	-	-
Open Source Interconnector Modelling: Phase 1	Successfully Completed	-	0.1	0.1	-	-	-	-	-
DNO Investigation into Voltage Interaction and Dependency Expectation (DIVIDE)	Successfully Completed	-	-	0.1	0	0.1	-	-	-
Black Start Alternative Approaches	Successfully Completed	-	-	0.1	-	-	-	-	-
Detection and control of inter-area oscillations (DACIAO)	Successfully Completed	-	-	0.1	0	0	-	-	-
South East Smart Grids	Successfully Completed	-	-	0.1	0.2	0	-	-	-
Transmission Network Topology Optimisation	Successfully Completed	-	-	0	0.2	0	-	-	-
PV Monitoring Phase 2	Successfully Completed	-	-	0.2	0.1	0.2	0	-	-
Embedded cyber risks within the procurement process	Successfully Completed	-	-	0	0	0	0	-	-
Improving cyber security culture within operational areas	Successfully Completed	-	-	0	0	0	-	-	-
Solar PV Forecasting Phase 1	Successfully Completed	-	-	0	0.2	0.1	0.1	-	-
Solar PV Forecasting Phase 2	Successfully Completed	-	-	-	0.1	0.1	0.1	-	-
Transient Voltage Stability of Inverter Dominated Grids and Options to Improve Stability	Successfully Completed	-	-	-	0.2	0.2	0.1	-	-
WI-POD- Wind turbine control Interaction with Power Oscillation Damping control approaches.	Successfully completed	-	-	-	0	0.2	0.2	0	-
SIM - Samuel Inertia Element	Successfully Completed	-	-	-	0.1	0.1	-	-	-
Project DESERT (hybrid battery and solar enhanced frequency control)	Successfully completed	-	-	-	0	0.1	0.3	0	-
Vector Shift Initial Performance Assessment	Successfully Completed	-	-	-	-	0	-	-	-
Spatial district heating analysis and impact on gas and power demand	Successfully Completed	-	-	0	0	-	-	-	-
Spatial GB Clean Heat Pathway Model	In Progress	-	-	-	-	-	-	0	0

Optimisation of Energy Forecasting - analysis of datasets of metered embedded wind and PV generation	Successfully Completed	-	-	-	-	0.1	0	-	-
GB Non-renewable Embedded Generation Forecasting Study	Successfully Completed	-	-	-	-	0.1	0	-	-
Assessing the stability of small-scale inverter connected PV generation	Successfully Completed	-	-	-	-	0.1	-	-	-
Virtual Synchronous Machine (VSM) Demonstrator	In Progress	-	-	-	-	0	0.3	0.1	-
Phase Lock Loop-Related Improvements to Non-Synchronous Generation Models	Successfully Completed	-	-	-	-	0	0.1	-	-
System Impacts of Embedded Storage (SIES)	Successfully Completed	-	-	-	-	-	0.2	-	-
Investigation & Modelling of Fast Frequency Phenomena ("F2P")	In Progress	-	-	-	-	-	0.3	0.3	0.2
Solar PV Monitoring Phase 3	In Progress	-	-	-	-	-	0.2	0.2	0.2
Situational Awareness Using Comprehensive Information	Successfully Completed	-	-	-	-	0	0	-	-
Application of New Computing Technologies and Solution Methodologies in Grid Operations	Successfully Completed	-	-	-	-	0	0.1	-	-
Risk-Based Analysis into Planning and Resiliency Processes	Successfully Completed	-	-	-	-	0	0.1	-	-
Flexibility and Resource Adequacy for System Planning	Successfully Completed	-	-	-	-	0	0.1	-	-
System Planning Methods, Tools, and Analytics	Successfully Completed	-	-	-	-	0	0.1	-	-
Optimisation of weather data to improve energy forecasting	In Progress	-	-	-	-	-	0.1	0	-
Frequency Response Auction Trial	In Progress	-	-	-	-	-	0.6	0.4	0.1
RecorDER	In Progress	-	-	-	-	-	0	0.2	-
Hybrid Grid Forming Converter	Successfully completed	-	-	-	-	-	0.1	0.2	-
Short-term System Inertia Forecast	In Progress	-	-	-	-	-	0.1	0.2	0.1
Development of GB electric vehicle charging profiles	Successfully Completed	-	-	-	-	-	0	-	-
Black Start Capabilities from Non-Traditional Technologies	Successfully Completed	-	-	-	-	-	0.1	0.1	-
Mapping the Impacts and Visualization of Risks of extreme weather on system operation (MIVOR)	In Progress							0.1	0.2
Enhancing Energy Flexibility from Wastewater Catchments through a Whole System Approach	In Progress	-	-	-	-	-	0	0.1	0.1
Residential Response	In Progress	-	-	-	-	-	**-**	**0.3**	**0.2**
Demonstration of Virtual Synchronous Machine control of a battery system	In Progress	-	-	-	-	-		**0.2**	**0.1**

Testing Coordinated DSO-ESO Procurement and Dispatch	In Progress	-	-	-	-	-		**0.1**	**-**
Advanced Modelling for Network Planning Under Uncertainty	In Progress	-	-	-	-	-		**0.2**	**=**
Applications of convex optimisation to enhance National Grid's NOA process	In Progress	-	-	-	-	-		**0**	**0.3**
Impact of Long-duration Energy Storage Systems on GB Transmission Planning	In Progress	-	-	-	-	-		**0.1**	**-**
Total Gross Costs		**1.3**	**3.6**	**2.4**	**1.6**	**1.8**	**3.5**	**2.98**	**1.4**

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