nationalgridESO

Our Performance 2018 - 2019

Regulatory Report

September 2019

Contents

Executive summary

As the System Operator for Great Britain, we are privileged to sit at the heart of the nation's energy system, running the gas and electricity networks safely and efficiently while enabling and accelerating progress towards a low-carbon energy future. This also means that, together with our stakeholders, we are responsible for tackling some of Great Britain's most pressing energy challenges.

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.

The aim of this report is to highlight the work that National Grid Electricity System Operator (NGESO) has carried out in 2018/19 and shows our plan for the future. The Electricity System Operator (ESO) became a legally separate entity within the National Grid Group on **1st April 2019** so this is the first year that NGESO has submitted an Annual Performance Report, a requirement of our Regulatory Reporting Pack (RRP), in line with the Regulatory Instructions and Guidance (RIGS).

In April 2018, Ofgem introduced a new regulatory and incentives framework for the ESO to encourage us to proactively identify how it can maximise consumer benefits across the full range of its activities. The new arrangements include a set of seven principles 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 this first Annual Report, I'd like to share with you how we are 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 our network safe and reliable.

I am also proud to report that we delivered all the people, process, system, and property separation requirements successfully throughout our legal separation period. NGESO has continued to perform solidly for our customers and ultimately for end consumers by delivering safe and reliable services in 2018/19. This year we have achieved a zero Injury Frequency Rate (IFR) and have continued 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
Director
UK 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?

National Grid Electricity System Operator (NGESO) became legally separated from National Grid Group on 1st April 2019. As the electricity system operator (ESO) for Great Britain (GB), we move electricity safely, reliably and efficiently through the system. We sit at the heart of the electricity system in GB, balancing the system in real time, ensuring that supply and demand is always met.

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?

We don't generate or sell electricity and we are not responsible for the infrastructure, for example the pylons and cables, needed to move electricity around. 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.

It can be helpful to think of GB's electricity system in terms of our road network. National Grid owns the motorways, or the transmission network. The ESO (legally separate from National Grid), uses these motorways to run high voltage electricity through the system until it gets to the B roads, which are privately-owned local distribution networks. From there smaller operators - Distribution Network Operators, or DNOs – reduce the voltage and take electricity to peoples' doors. Connected to these networks are privately-owned power stations, which are separate from National Grid. They generate and feed electricity into the network.

GB's electricity runs through over 4,500 miles of overhead cable and 870 miles of underground cables. And when the UK does not have enough of its own energy, we import it from different countries including the Netherlands and France. We export too, when we have too much.

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 are we 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 the ESO 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 RIIO-T1 period, which began on 1 April 2013 and runs through 31 March 2021.

We're now starting to build plans for the next regulatory period, RIIO-2, which will start on 1 April 2021. As the ESO became a legally separate business in April 2019, RIIO-2 will be the first time we have had our own bespoke price control.

We're required to submit our plans to Ofgem by the end of 2019 for the RIIO-2 regulatory period. We're currently working with stakeholders to make sure our plans reflect their priorities, and ultimately drive benefits for consumers.

The future

The System Operator has published three documents 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 2019-21 ESO Forward Plan sets out our immediate steps until the start of RIIO-2 to achieve our ambitions as set out in the Towards 2030 document. It details our deliverables, performance metrics and how the outcomes we drive deliver consumer benefit. This is the finalised product of deep engagement with our stakeholders; this plan will be refreshed for discussion with stakeholders in January 2020.
- Our RIIO-2 Ambition is a consultation that sets out our ambition for the ESO and a first proposal of our activities for the next price control (from 2021 onwards). Our ambition is dominated by four themes that build on our current roles and reflect the feedback we have heard from stakeholders over 18 months of extensive engagement. Sharing our ambition, our work to date and inviting further views will help us prepare an informed and robust business plan later in 2019.
- Our Towards 2030 document sets the scene with a high level long-term view of the energy landscape in 2050 and the whole energy system and its enablers for 2030. It also sets out the SO's high-level ambition for gas and electricity, from now until 2030.

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Our Performance

2018 - 2019

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 RIIO-TI. The Table 1 shows our actual and forecast Total expenditure (Totex) as it includes both our capital expenditure (Capex) and our operational expenditure (Opex)[1].

Table 2 shows our adjusted allowances[2] for the RIIO-T1 period. Lastly, Table 3 shows the difference between costs and adjusted allowances with negative numbers indicating that costs exceed allowances.

Table 1: Actual/Forecast Expenditure (2018/19 Prices)

2.4 (a) Actual/Forecast Expenditure (£m, 2018/19 Prices)		Actual						RIIO-T1 Forecast		
		2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	Total
SO	**Non-Operational capex**	42.31	45.20	43.91	59.17	64.00	77.83	73.90	55.74	462.07
	Direct costs	63.02	59.43	62.91	68.07	68.27	69.34	72.77	61.58	525.40
	Business Support	45.70	43.97	45.77	47.59	54.76	72.86	61.05	53.40	425.09
	Adjustment for IAS 19 pension accrual	-1.07	0.76	-0.43	-1.10	-0.74	-0.78	-0.77	-0.77	-4.88
	Controllable Opex	107.66	104.16	108.25	114.55	122.29	141.42	133.05	114.22	945.60
SO	**TOTEX**	**149.97**	**149.36**	**152.17**	**173.72**	**186.29**	**219.25**	**206.96**	**169.96**	**1407.67**

Table 2: Total Expenditure (2018/19 Prices)

2.4 (a) Total Allowances (£m, 2018/19 Prices)		RIIO-T1 Allowances								
		2013/14	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	Total
SO	**Non-Operational capex**	68.29	47.92	45.44	52.03	60.03	71.66	57.16	57.31	459.83
	Direct costs	53.90	56.59	64.29	66.83	70.46	87.79	71.29	70.24	541.39
	Business Support	43.42	45.86	47.94	49.90	50.67	51.74	53.95	56.14	399.62
	Controllable Opex	97.32	102.46	112.23	116.73	121.12	139.53	125.24	126.38	941.01
SO	**TOTEX**	**165.60**	**150.38**	**157.68**	**168.76**	**181.15**	**211.19**	**182.40**	**183.69**	**1400.84**

[1] Capex is broadly the costs incurred in building new assets and replacing existing ones. Opex is broadly the costs incurred for maintaining the assets and running the National Grid business.

[2] This figure is after alignment of allowance categorisation to be consistent with treatment of spend

Table 3: Variance between Actual/Forecast and Allowances (2018/19 Prices)

2.4 (a) Variance Actual/Forecast v Allowances (£m, 2018/19 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**	25.98	2.72	1.53	-7.14	-3.97	-6.17	-16.74	1.57	-2.23
	Direct costs	-8.50	-3.27	1.62	-0.59	2.59	18.83	-1.07	9.07	18.68
	Business Support	-1.83	1.57	2.36	2.76	-3.76	-20.72	-6.75	3.09	-23.28
	Controllable Opex	-10.34	-1.70	3.98	2.18	-1.17	-1.89	-7.82	12.16	-4.59
SO	**TOTEX**	**15.64**	**1.02**	**5.51**	**-4.96**	**-5.14**	**-8.06**	**-24.56**	**13.73**	**-6.83**

Total Balancing Services Use of System (BSUoS) revenue of £1,401.5m comprising £1,208.3m for External System Operator and £193.2m for Internal System Operator revenue was collected in 2018/19. Our external revenue was made up of £49m of Black Start costs 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 2017/18.

Our internal revenue consists of an increase in legacy revenue and Regulated Asset Value (RAV) terms, impact of Totex and outputs performance and an increase in allowances to deliver Supplementary Balancing Reserve (SBR) and Demand Side Balancing Reserve (DSBR) balancing products and new Integrated Transmission Planning and Regulation (ITPR) roles. There was also a decrease in our EMR dispute resolution incentive, coupled with a decrease in opening base revenues.

Overview of Opex & Capex

Our overall total expenditure forecast for the RIIO T1 period is £1,408m against forecast allowances of £1,401m. Total spend is £7m higher than our RRP submission last year.

Spend in 2018/19 is £5m below prior forecast, with year on year additional investment of £14m driven by projects noted in the next section. Opex spend increased compared to 2017/18 by £19m with £12m of this due to work required for legal separation of the ESO. There were also £11m increased costs in 2018/19 associated with a multi-year cost efficiency and restructuring programme covering a range of initiatives to drive further efficiency and lower costs for customers. This has

already started delivering Opex efficiencies and an organisation well positioned to take on an expanded role in the future.

Further investment in the remaining years of RIIO T1 of £130m will deliver new CNI data centres, IT systems which are compliant with EU regulations and continue to invest in capabilities to deliver on our forward plan commitments. Our Opex costs are forecast to decrease over the next two years as the legal separation work is completed and we continue to deliver savings following our restructuring programme.

Total expenditure for the full 8-year period is expected to be £6.8m higher than forecast allowances, which is broadly in line with our prior RRP submission. To better understand the underlying position of spend versus allowances, we have re-categorised the allowances to align to spend.

The table below restates published Totex to reflect true performance vs. allowances.

		RIIO-T1 18/19 prices								
		2014	2015	2016	2017	2018	2019	2020	2021	Total
SO	**Non Operational capex**	25.98	2.72	1.46	-7.35	-4.45	-8.22	-20.53	-4.76	-15.16
	Direct costs	-8.50	-3.27	1.70	-3.69	-4.68	-5.79	2.72	15.40	-6.11
	Business Support	-1.83	1.57	2.36	6.07	3.99	5.95	-6.75	3.09	14.45
	Controllable Opex	**-10.34**	**-1.70**	**4.05**	**2.39**	**-0.69**	**0.16**	**-4.03**	**18.49**	**8.33**
SO	**TOTEX**	**15.64**	**1.02**	**5.51**	**-4.96**	**-5.14**	**-8.06**	**-24.56**	**13.73**	**-6.83**

Capex costs are £15.2m higher than allowances after taking into account additional forecast Electricity Market Reform (EMR) allowances of £25.2m. Total Opex costs are £8.3m lower than allowances. Opex allowances include a £7.9m reduction in line with our EMR re-opener submission.

Capex Summary

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

Our total capex expenditure for Electricity System Operator in 2018/19 was £77.8m, representing an increase from last year of £13.8m. This increase reflects the additional investment across some of these major programmes including CNI Data Centre project, European future energy regulations and Legal Separation related expenditure. Against this, there has been a decrease in spend on the Integrated Electricity Management System (IEMS) which successfully completed in November 2017 and a reduction in spend in Electricity Balancing System (EBS) which went live last year with the scheduling components of the programme.

Key areas of expenditure in 2018/19 were:

CNI Data Centre project £24.3m - the programme is now in its full delivery phase which has resulted in a £11.9m increase in spend from 2017/18.

During 2018/19, we have concluded to fully procure two highly secure data centre facilities.

Extensive work has been undertaken in the preparation of these two new Data Centres, including the delivery of a highly secure CNI network that connects the new Data Centres to existing operational control rooms and other CNI sites and services. Additionally, works to build up the application network, infrastructure and software were completed to advanced stages. Work has also commenced on the initial Electricity designs for the core network and the implementation of the Integration Layer.

European future energy regulations £13.9m - this investment enables the development and implementation of the European Network Codes, stemming from the European Union's (EU) Third Energy Package legislation, which facilitates the journey towards a single harmonised European electricity market. Work has been undertaken during the year in the preparation of our systems to enable compliance with the requirements of the European Network Codes. The costs incurred to date have been driven by significant system and process developments and delivery.

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

Electricity Balancing System / Balancing Mechanism Sustain £8.1m - following the completion of the scheduling components of the system in July 2018, work has been ongoing during 2018/19 to make updates to the EBS Scheduler.

Legal Separation related spend £9.1m - during the year, we have made investments in relation to the legal separation of the ESO from National Grid Electricity Transmission (NGET).

These costs have predominantly been incurred in the creation of a new, physically separate office for ESO employees in Warwick (Faraday House) and investing in a separate Enterprise Resource Planning (ERP) system including a new company code to facilitate the appropriate financial ringfencing and process separation for the ESO to enable delivery of our new licence requirements.

Forecast over the remaining RIIO-T1 period

Over the remaining 2 years of RIIO-T1, we are planning to invest an additional £129.6m which will result in a total investment of £462m over the whole of the RIIO-T1 period. This is £15.2m higher than total allowances across RIIO-T1 which includes the recent request for additional EMR funding of £25.2m and is predominantly driven by an additional £38m investment

in European Network Codes. This additional spend has been partially offset by a reprioritisation of other investments.

Key areas of investment for the remaining RIIO-T1 period include:

CNI Data Centre project £24.8m: completion of preparatory works for Electricity CNI services including the installation of 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 alongside a defined strategy to migrate electricity CNI services.

European future energy regulations £21.3m: this programme, to prepare our systems to enable compliance with the requirements of the European Network Codes, continues into the last 2 years of RIIO-T1 and projects beyond 2021 and into RIIO-2. Work focusses on delivering to a series of regulatory deadlines. Much of the regulatory interpretation and impact is under analysis and subject to discussions with regulators and European partners.

Electricity Market Reform (EMR) £14.5m: As EMR Delivery Body, we have continued to invest in the EMR Portal to deliver system improvements and ensure compliance with rules and regulations. This work will continue to implement further changes in rules and regulations, including those arising from the restoration of the Capacity Market, 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 with the allowances to take account of any changes to the role or system requirements over time. We have utilised this reopener in May 2019 to request for additional funding to cover major scope changes since the start of EMR.

Outputs

Customer and stakeholder

In the 2018-19 period, NGESO remained part of NGET and its incentive arrangements for customer and stakeholder satisfaction. As a consequence, we do not separately report on NGESO CSAT/SSAT scores in this Stakeholder Document. We engage customers and stakeholders through a wide range of channels including information published on our website, our publications, consultations, newsletters, engagement forums, webinars, customer meetings and surveys. Effective engagement is critical to our ability to understand and meet the expectations of our customers. Customer satisfaction is therefore a useful indicator of how effectively we are listening to and acting on the feedback we receive to improve the service we deliver to all our customers. We have increased the numbers of customer and stakeholders surveyed. This has given a more robust and wider range of feedback. The feedback told us that the key areas for improvement are the clarity of our processes and ease of contacting us. Customer journey mapping is being used to improve both areas.

Please note, we will report ESO specific customer and stakeholder scores in next year's report.

Reliability and availability

9 August Events

Please note this report covers 2018/19 and so we do not cover the 9 August 2019 events in further detail within this report. We have carried out an extensive review of the performance of our system throughout the incident on Friday 9 August; this was consistent with our expectations. Details of the event, impacts to consumers, and communications during and after the event are reviewed in detail in the ESO Final Technical Report to Ofgem which was submitted on 6th September 2019. More information can be found here.

Every year, NGESO publish a Performance Report as per licence condition 17 (Transmission System Security Standard and Quality of Service) which details 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.

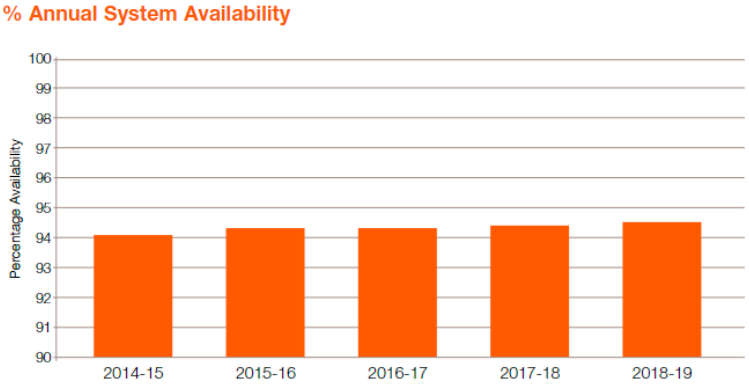
The NETS in Great Britain is comprised of both onshore and offshore transmission networks. The onshore transmission networks are owned by NGET in England and Wales, SP Transmission plc (SPT) in south and central Scotland and Scottish Hydro Electric Transmission plc (SHE Transmission) in the north of 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

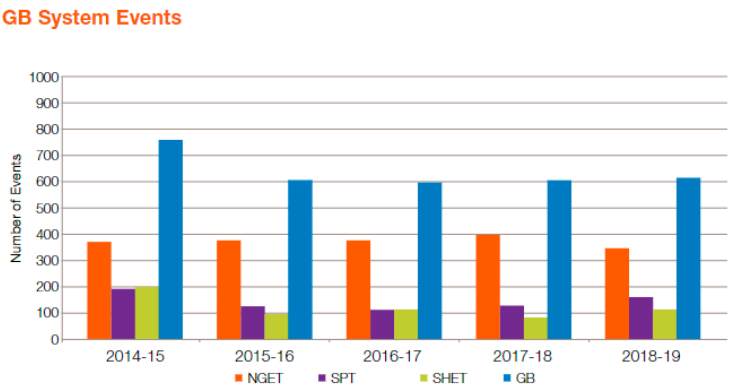
Annual System Availability of the NETS for 2018-2019 was 94.55%. During this period, there were 612 NETS events where transmission circuits were disconnected either automatically or by urgent manual switching. The vast majority of these events had no impact on electricity users with only 22 resulting in loss of supplies to customers.

GB % Annual System Availability				
2014-15	2015-16	2016-17	2017-18	2018-19
94.09	94.36	94.31	94.44	94.55



Security

The Overall Reliability of Supply for the NETS during 2018-19 was: 99.999967%. Compared with 99.999975% in 2017-18 and 99.999962% in 2016-17.



GB System Events					
	2014-15	2015-16	2016-17	2017-18	2018-19
NGET	371	374	379	398	347
SPT	190	126	108	124	157
SHET	199	104	109	85	108
GB	760	604	596	607	612

Quality of service

During 2018-19 there was two reportable Voltage Excursions within the NETS.

Incident Date, Time and Location	Nominal Voltage	Max Voltage	Duration
30 April 2018 15:20 at Alverdiscott 400kV Substation High circuit gain due to feeder no.2 open-ended at Indian Queens.	400kV	424.13kV	15.4 mins
31 January 2019 09:23 at Newarthill 33kV Substation SGT1 tap-changer runaway.	33kV	39.4kV	79.3 mins

There have however, been no reportable Frequency Excursion within the NETS. The last reported Frequency Excursion was in 2008-09 reporting period.

Safety

Safety continues to be our first priority as keeping our staff, contractors, and the public safe is paramount in importance. Our safety performance measured by injury frequency rate (IFR) for NGESO in 2018-19 was zero. We remain relentless in our focus on keeping safety a number one priority.

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 by 45% by 2020 based on 1990 levels. Our baseline emissions level was set, at group level, at 21.6m tonnes of carbon dioxide equivalent. Our current forecast is that we will better the 2020 target. In the longer-term we have targets to reduce our GHG emissions by 70% by 2030 and 80% by 2050.

- Scope 1,2 and 3 emissions in the ESO are from energy consumption in offices and transport use.
- Scope 1 emissions in 2018//19 are 1.4 kTCO2e, Scope 2 emissions are 1.7 kTCO2e and scope 3 emissions are 0.7 kTCO2e.

The ESO's Business Carbon Footprint has previously been included within the Electricity Transmission Business Carbon Footprint. After legal separation, these have been separated. In 2018/19, the ESO's total Business Carbon Footprint was 3830 tCO2e.

As a group, we provide our annual emissions performance as part of our Carbon Disclosure Project (CDP)[3] submission. This enables us to benchmark our performance against other organisations. In 2018 (for 2017/18) we achieved an 'A' rating for our CDP submission, putting us in the top 2% of global companies recognised for our actions to reduce emissions and mitigate climate change (NB: a 2018/2019 rating is not yet available). Our Greenhouse Gas (GHG) inventory, measurement, data

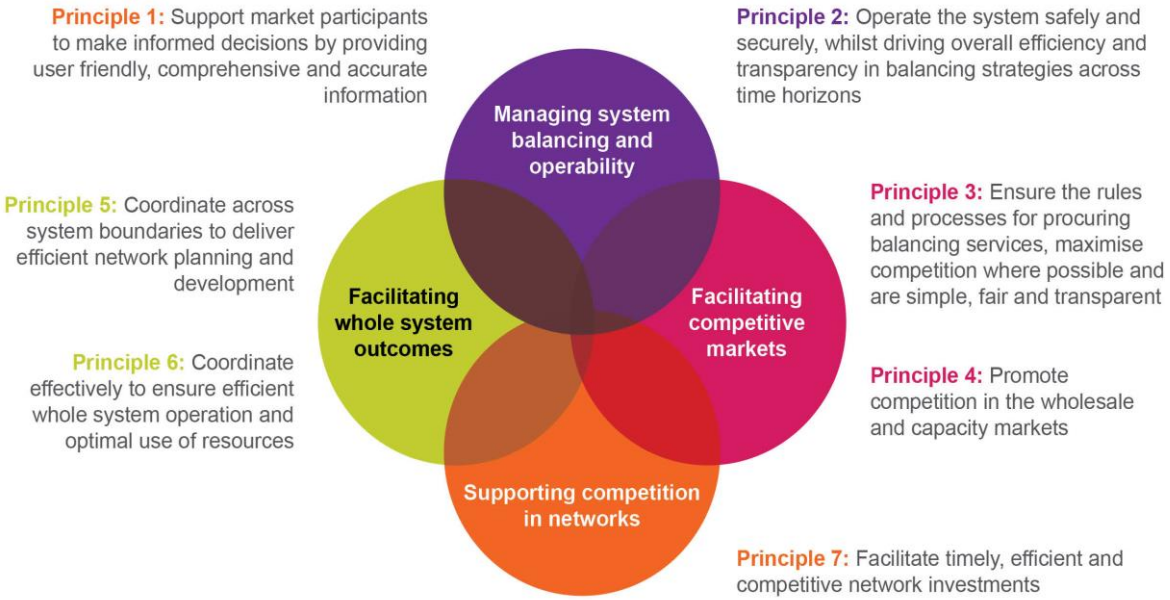
[3] The CDP runs the global disclosure system that enables companies, cities, states and regions to measure and manage their environmental impacts.

collection, aggregation and reporting processes are verified by an independent third-party providing assurance of relevance, accuracy, consistency, transparency and completeness.

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 a set of seven principles 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 this first year of our new Incentive Scheme we have delivered outcomes which are enabling the long-term transition to a decarbonised energy landscape. 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 line with Ofgem's Electricity System Operator Reporting and Incentive (ESORI) arrangements guidance, we are required to publish a report covering our end of year performance against our 2018-19 Forward Plan which can be found here. Some of our key milestones for the first year of our new incentive scheme include:

- Delivered consumer benefits across all of our roles in 2018-19 of up to £510m. In performing our role to manage balancing costs we have also pro-actively avoided £490m of further spend.
- Our 2018-19 Forward Plan set out 112 deliverables, of which we have delivered 105. Of these, 60% are new initiatives or tasks; with the others all involving improvements on our ways of working.

- We have proactively engaged and are building trust through close working relationships with our stakeholders based on openness and honesty.

Our operation of the transmission system in 2018-19 has been the lowest carbon year we have ever had, in our step 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 in 2018-19 are contributing to this future.

Following our RRP submission to Ofgem in July 2019, Ofgem published their decision on our (NGESO's) financial incentive for 2018-19 on the 9 August, in line with Special Licence Condition 4M. The Authority directed that the ESO will receive a financial incentive of £0.86m for 2018-19.

We are disappointed by the 2018/19 incentive reward which we believe does not reflect the outcomes we have delivered and the positive feedback we have received from stakeholders.

We are pleased Ofgem already acknowledge considerable improvements in our 2019/20 plan, the first full year since we became a legally separate company. We appreciate the valuable feedback provided by customers and stakeholders throughout the Forward Plan process and will use this to inform and guide our efforts as we work to deliver a more sustainable energy system and ensuring reliable, affordable energy for all consumers.

Financial Incentives on EMR

We have specific incentives in our role as Electricity Market Reform (EMR) Delivery Body (Special Licence 4L). Among other things, in 2018/19 we have seen an increase in approval rates for applications to the Capacity Market and a reduction in disputed decisions. This was the result of enhanced guidance, a series of 'teach in' webinars and videos as well as improvements to our query management. Ofgem is currently reviewing the EMR incentives as part of their Five-Year Review of the Capacity Market.

Innovation

As Great Britain's ESO we're at the heart of our nation's energy system, which gives us early visibility of the rising challenges on the grid. We therefore have the responsibility as well as the opportunity of addressing those challenges in the best way for our customers. Through innovation, we're finding new ways to improve how our systems are operated, both now and in the future.

The ESO is now a legally separate organisation, independent from NGET and is focusing on innovation that will keep the electricity system secure, reliable and cost-effective as we go through the energy transformation into a low-carbon and decentralised future.

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.

Last year, we launched our first ever System Operator Innovation Strategy, setting out our priority areas for innovation and how we planned to work with industry to tackle them. We produced 16 System Operator Innovation Priorities that we set out to focus on over the course of 2018/19.

2018/19 Performance

In 2018/19 the ESO spent £3.4m of our Network Innovation Allowance (NIA) expenditure. 27 eligible NIA projects aligned to our new innovation strategy were progressed in the year. We provide input into and receive Network Innovation Competition (NIC) funding from one project (Phoenix) that is led by Scottish Power Energy Networks. The net costs at year end for these are reported in the table in the Appendix, 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 2019 prices).

We invested heavily in the whole electricity system this year. Investigation and testing of Black Start from distributed energy resources, creating a whole electricity system register for flexibility assets, and facilitating residential Demand Side Response (DSR) providers to access balancing markets were some of the highlights.

Managing volatility in a low-inertia system and enabling more non-synchronous generation were a strong focus. We launched several projects, including building a machine learning-driven inertia forecast, and a study into how renewable generation might support the grid as synchronous generation would. Given the increasing urgency of system stability issues, we have consolidated these two issues, as well as voltage and reactive power, into one priority for the coming year, making it our top priority.

The high level of focus on cyber security and digital strategy at the National Grid PLC level, means we were able to prioritise ESO innovation spend in other key areas. Cyber security remains a critical priority for the ESO over the coming year.

Unlocking flexibility and creating markets for the future became higher priorities for the industry than we had initially foreseen. We invested heavily in these areas, through investigating new ways of procuring Black Start, frequency response and residential DSR to name but a few. These priorities have now been consolidated and given significantly greater importance.

The System Operator Innovation Annual Summary can be found here, providing more information on how we performed against our key strategy areas. The System Operator Innovation Strategy can be found here, and sets out how we plan to innovate in 2019/20.

Case Studies:

Black Start from Distributed Energy Resources

In November 2018, Ofgem awarded our project, in collaboration with SP Energy Networks and the consultancy TNEI, funding in the NIC. This £11.7m ground-breaking project will design and test ways to restore the GB electricity system from a black out, by coordinating distributed energy resources.

Frequency Response Auction Trial

We are trialling closer-to-real-time procurement of frequency response via a cleared-price auction platform. This should enable more non-traditional players such as wind and DSR to participate in the market, boosting liquidity and lowering overall system balancing costs.

RecorDER

We are working with UKPN, SPEN and Electron to design and test a prototype blockchain-based register for GB flexibility and generation assets. This creation of 'one version of the truth' should facilitate more trust in asset capability for trading of flexibility across the whole electricity system.

Short-term inertia forecast

We are working with Imperial College London to build a proof of concept for accurate day-ahead and intra-day system inertia forecast with multi-time resolution, using machine learning methods. This will help our Control Room engineers to continue to make data driven decisions to secure system stability.

The following projects are those outside of NIA or NIC funding:

- **Innovate UK Projects**: We are involved in 4 Vehicle To Grid projects, funded by InnovateUK, looking to test the technical and commercial feasibility of this technology.
- **Natural Environment Research Council (NERC)**: we supported and won a bid for NERC funding to support a project looking at the relationship between demand forecast errors and the large scale meteorological conditions

Uncertainties

Uncertainty mechanisms are used to allow network companies' allowed revenue to change within the price control period. This allows 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 RIIO-T1 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 RIIO-T1 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 NGGT 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 project remains on track to deliver all outputs as agreed as part of the reopener decision.

The cyber security enhancements are also 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 undertaken a self-assessment of risk and developed an Improvement Plan which sets out the measures we intend to take and activities in mitigating our cyber risk.

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

very significant, including continuous rule changes and a significant increase in the number of market participants. We have continuously developed our processes, guidance and systems and successfully facilitated all auctions. In accordance with our licence, we submitted a request to Ofgem in May 2019 to adjust our allowances. Ofgem made its determination[4] on 30th September 2019 and provided additional allowances for the period April 2016 to March 2021. Ofgem are also proposing a further reopener for EMR at the end of 2020 to deal with continuing uncertainty in EMR.

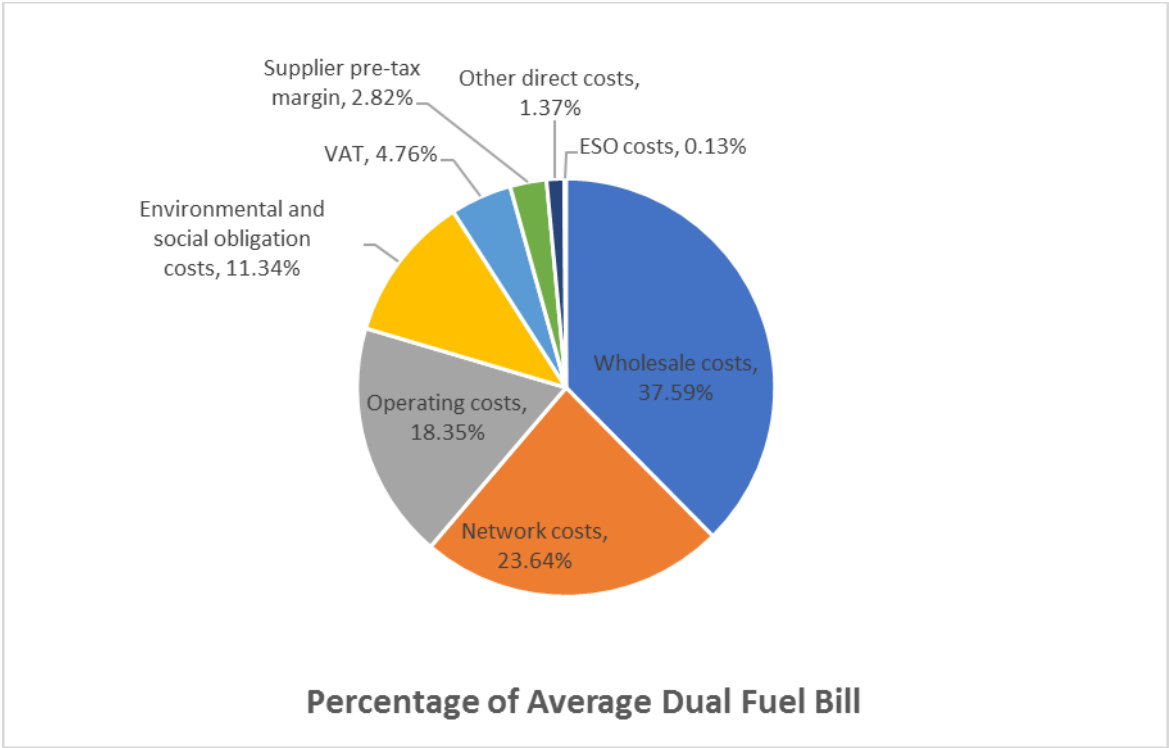
[4] Ofgem Decision: https://www.ofgem.gov.uk/system/files/docs/2019/09/decision_on_adjustment_to_allowances_for_the_emr_delivery_body_0.pdf

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[5]. The table below shows our actual contribution to the customer bill.



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

Therefore, for 2018/19, approximately £1.43 of the typical domestic household bill, or 0.13% of the consumer duel fuel bill costs were attributable to NGESO.

[5] 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 contacts 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
- **Our Business Plans (Forward Plan and RIIO2) -** https://www.nationalgrideso.com/about-us/business-plans
- **Towards 2030 document -** https://www.nationalgrideso.com/news/towards-2030-system-operator-gbs-energy-future
- **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	2018/19	Actual	Actual	Actual	Actual	Actual	Actual	Forecast	Forecast	(£m)	Total funding	Licensee funding
Power Potential (known as TDI 2.0)	In Progress	-	-	-	0.087	1.621	2.688	4.867	0.182	9.4	9.5	1.5
EFCC	In Progress	-	-	0.65	2.2	1.191	2.305	0.315	-	6.7	6.8	0.8
Phoenix	In Progress	-	-	-	0.03	0.256	0.274	0.222	0.222	1	N/A	N/A
Blackstart from DER	In Progress	-	-	-	-	-	-	4.163	6.297	10.5	11.7	1.2

NIA project costs:

	Status	2014	2015	2016	2017	2018	2019	2020	2021	Total
NIA by Cost Project	2018/19	actual	actual	actual	actual	actual	actual	forecast	forecast	
Eligible Bid Preparation Costs		-	0.2	-	0.2	-	-	-	-	0.4
Review of Engineering Recommendation P2/6	Successfully Completed	-	-	0	0	-	-	-	-	0.1
UK-wide wind power: Extreme and Variability	Successfully Completed	0.1	0	0	0	-	-	-	-	0.1
Modelling of Embedded Generation within Distribution Networks and Assessing the Impact	Successfully Completed	0	0	0	0	-	-	-	-	0.1
Quantifying benefits and risks of applying advanced network control and demand response technologies	Successfully Completed	0.2	0	0.1	-	-	-	-	-	0.2
Impact of extreme events on power production at the scale of a single wind-farm	Successfully Completed	0.2	0	0	-	-	-	-	-	0.2
Optimising the operation of an integrated DC link within an AC system (ICase Award)	Successfully Completed	0	0	-	-	-	-	-	-	0
A Combined Approach to Wind Profile Prediction	Successfully Completed	0	0	0	0	0	-	-	-	0.1
Seconomics - Digital Risk and Cyber Security	Successfully Completed	0	0.2	0	0	-	-	-	-	0.2
Mathematics of Balancing Energy Networks Under Uncertainty	Successfully Completed	0	0	0	0	0	-	-	-	0.1

Scalable Computational Tools and Infrastructure for Interoperable and Secure Control of Power System	Successfully Completed	0	0	0.1	0	0	-	-	-	0.2
Protection and Fault Handling in Offshore HVDC Grids	Successfully Completed	-	0.1	0	0	0	-	-	-	0.1
UK Regional Wind: Extreme behaviour and predictability	Successfully Completed	0.1	0.1	0.1	0	-	-	-	-	0.3
Visualization of Renewable Energy Models	Successfully Completed	0	0	0	-	-	-	-	-	0
Development of Dynamic Demand Models in DIgSILENT PowerFactory	Successfully Completed	-	0.1	0.2	0	-	-	-	-	0.3
Reactive Power Exchange Application Capability Transfer (REACT)	Successfully Completed	0	0	0	-	-	-	-	-	0.1
Enhanced Weather Modelling for Dynamic Line rating (DLR)	Successfully Completed	0	0	0	0	0	-	-	-	0.1
Control and Protection Challenges In Future Converter Dominated Power Systems	Successfully Completed	0	0.1	0.1	0.1	0	-	-	-	0.4
Electricity Demand Archetype Model 2	Successfully Completed	0.1	0.2	0	0	0	-	-	-	0.3
Facilitating Enhanced Network Capacity Evaluation	Successfully Completed	0.1	0.1	-	-	-	-	-	-	0.2
Industrial and Commercial Gas & Electric Scenario Modelling	Successfully Completed	0	0.2	0	-	-	-	-	-	0.2
Project Samuel - Grid Data and Measurement Systems	Successfully Completed	0	0.4	0.2	0	-	-	-	-	0.7
Evolution of Energy Storage and Demand Management Services.	Successfully Completed	0	0	0	-	-	-	-	-	0.1
Avoiding voltage regulation action conflicts. (In conjunction with LCNF project CLASS)	Successfully Completed	0	0.1	0	0	-	-	-	-	0.1
EPRI Research Collaboration on Grid Operations and Control	Successfully Completed	0.1	0.4	0	-	-	-	-	-	0.5
EPRI Research Collaboration on Information and Communication Technology.	Successfully Completed	0.1	-	-	-	-	-	-	-	0.1

Clustering effects of major offshore wind developments	Successfully Completed	-	0.2	0.1	0	-	-	-	-	0.3
Investigation of sub-synchronous between wind turbine generators and series capacitors	Successfully Completed	0	0.2	0.1	0	-	-	-	-	0.3
iTesla	Successfully Completed	0	0	0	0	-	-	-	-	0.1
Granular Voltage Control (GVC)	Successfully Completed	0	0.2	0	0.1	-	-	-	-	0
Frequency sensitive electric vehicle and heat pump power consumption	Successfully Completed	-	0	0	-	-	-	-	-	0.1
PV Monitoring: Phase 1	Successfully Completed	-	0.1	0	0	-	-	-	-	0.1
Assessment of Distributed Generation Behaviour during Frequency Disturbances	Successfully Completed	-	0.2	0	0	-	-	-	-	0.3
Integrated electricity and gas transmission network operating model (ICASE Award)	Successfully Completed	0	0	0	0	0	-	-	-	0.1
Smart Grid Forum Work Stream 7	Successfully Completed	-	0.1	0	0	-	-	-	-	0.1
Open Source Interconnector Modelling: Phase 1	Successfully Completed	-	0.1	0.1	-	-	-	-	-	0.2
DNO Investigation into Voltage Interaction and Dependency Expectation (DIVIDE)	Successfully Completed	-	-	0.1	0	0.1	-	-	-	0.2
Black Start Alternative Approaches	Successfully Completed	-	-	0.1	-	-	-	-	-	0.1
Detection and control of inter-area oscillations (DACIAO)	Successfully Completed	-	-	0.1	0	0	-	-	-	0.1
South East Smart Grids	Successfully Completed	-	-	0.1	0.2	0	-	-	-	0.4
Transmission Network Topology Optimisation	Successfully Completed	-	-	0	0.2	0	-	-	-	0.2
PV Monitoring Phase 2	Successfully Completed	-	-	0.2	0.1	0.2	0	-	-	0.6
Embedded cyber risks within the procurement process	Successfully Completed	-	-	0	0	0	0	-	-	0.1
Improving cyber security culture within operational areas	Successfully Completed	-	-	0	0	0	-	-	-	0
Solar PV Forecasting Phase 1	Successfully Completed	-	-	0	0.2	0.1	0.1	-	-	0.5

Solar PV Forecasting Phase 2	Successfully Completed	-	-	-	0.1	0.1	0.1	-	-	0.3
Transient Voltage Stability of Inverter Dominated Grids and Options to Improve Stability	Successfully Completed	-	-	-	0.2	0.2	0.1	-	-	0.4
WI-POD- Wind turbine control Interaction with Power Oscillation Damping control approaches.	In Progress	-	-	-	0	0.2	0.2	0	-	0.3
SIM - Samuel Inertia Element	Successfully Completed	-	-	-	0.1	0.1	-	-	-	0.2
Project DESERT (hybrid battery and solar enhanced frequency control)	In Progress	-	-	-	0	0.1	0.3	0	-	0.4
Vector Shift Initial Performance Assessment	Successfully Completed	-	-	-	-	0	-	-	-	0
Spatial district heating analysis and impact on gas and power demand	Successfully Completed	-	-	0	0	-	-	-	-	0.1
Optimisation of Energy Forecasting - analysis of datasets of metered embedded wind and PV generation	Successfully Completed	-	-	-	-	0.1	0	-	-	0.1
GB Non-renewable Embedded Generation Forecasting Study	Successfully Completed	-	-	-	-	0.1	0	-	-	0.1
Assessing the stability of small-scale inverter connected PV generation	Successfully Completed	-	-	-	-	0.1	-	-	-	0.1
Virtual Synchronous Machine (VSM) Demonstrator	In Progress	-	-	-	-	0	0.3	0.1	-	0.4
Phase Lock Loop-Related Improvements to Non-Synchronous Generation Models	Successfully Completed	-	-	-	-	0	0.1	-	-	0.1
System Impacts of Embedded Storage (SIES)	Successfully Completed	-	-	-	-	-	0.2	-	-	0.2
Investigation & Modelling of Fast Frequency Phenomena ("F2P")	In Progress	-	-	-	-	-	0.3	0.3	0.2	0.8
Solar PV Monitoring Phase 3	In Progress	-	-	-	-	-	0.2	0.2	0.2	0.6
Situational Awareness Using Comprehensive Information	Successfully Completed	-	-	-	-	0	0	-	-	0
Application of New Computing Technologies and Solution	Successfully Completed	-	-	-	-	0	0.1	-	-	0.1

Methodologies in Grid Operations										
Risk-Based Analysis into Planning and Resiliency Processes	Successfully Completed	-	-	-	-	0	0.1	-	-	0.1
Flexibility and Resource Adequacy for System Planning	Successfully Completed	-	-	-	-	0	0.1	-	-	0.1
System Planning Methods, Tools, and Analytics	Successfully Completed	-	-	-	-	0	0.1	-	-	0.1
Optimisation of weather data to improve energy forecasting	In Progress	-	-	-	-	-	0.1	0	-	0.1
Frequency Response Auction Trial	In Progress	-	-	-	-	-	0.6	0.4	0.1	1.1
RecorDER	In Progress	-	-	-	-	-	0	0.2	-	0.2
Hybrid Grid Forming Converter	In Progress	-	-	-	-	-	0.1	0.2	-	0.3
Short-term System Inertia Forecast	In Progress	-	-	-	-	-	0.1	0.1	0.1	0.3
Development of GB electric vehicle charging profiles	In Progress	-	-	-	-	-	0	-	-	0
Black Start Capabilities from Non-Traditional Technologies	In Progress	-	-	-	-	-	0.1	0	-	0.2
Enhancing Energy Flexibility from Wastewater Catchments through a Whole System Approach	In Progress	-	-	-	-	-	0	0.2	0	0.2
Total Gross Costs		**1.2**	**3.5**	**2.3**	**1.5**	**1.7**	**3.4**	**1.7**	**0.6**	**16**

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