Gas Transmission

Our Performance: 2020/2021

nationalgrid

National Grid Gas Transmission

Our Performance for 2020/21

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I. Strategic Performance Overview (SPO) for 2020/21

1. This document describes the financial and operational performance of National Grid Gas Transmission (hereafter abbreviated to National Grid) against the stakeholder outputs we have committed to deliver.

President update on performance, risks and future strategy

Performance Overview

2. Following what has been an extremely challenging year for the UK, I am proud to report that we have delivered good output performance for our customers and stakeholders in the final year of the RIIO-T1 price control. We have continued to deliver our reliability and safety outputs, focusing on priority works and are well prepared to begin the next period of price control.

3. In response to the pandemic, we put in place COVID-secure ways of working, approving risk-based approaches from our contractors and introducing new systems and technologies to improve virtual collaboration. Our Gas National Control Centre (GNCC) teams left their homes and families to live onsite at National Grid House in Warwick in temporary accommodation pods, minimising the risk of exposure to the virus and allowing the Gas Transmission system to keep operating reliably. COVID-19 has had an impact on a number of our capital programmes, with some delays caused by the development and implementation of new safety measures, restrictions to site access and constrained supply chains.

4. Overall, our Totex over the RIIO-T1 period is £3,240m, which is an overspend of £252m against allowances of £2,988m. This is an improvement in performance of £16m compared to last year. The main factors of change from 2019/20 include the impact of COVID-19 with delays to our asset health works, revisions to the timeline of the Peterborough and Huntingdon compressor programme and associated reductions in Opex.

5. Throughout the RIIO-T1 period we've continued to meet the challenges presented. We have kept the public and each other safe and delivered the gas our customers and consumers need. We've developed better systems, ways of working and priorities to help ensure we're doing the right things and meeting our obligations. As our focus now moves to RIIO-T2, the importance of maintaining a reliable and resilient network is ever greater. Following the announcement in March 2021 that National Grid will be selling a majority stake in the Gas Transmission business, we are confident that the work done over this eight year price control period will be an important foundation as we look to the future and the important role Gas Transmission as a standalone business has to play in the UK's transition to net zero.

Output Delivery

6. We have delivered good performance for our customers against our five output categories. Table 5 summarises our performance against each individual output and provides a comparison to our 2019/20 performance.

7. In 2020/21, we were once again compliant with our **safety** related outputs. There was one employee lost time injury. Our initiatives designed to promote and encourage safety and wellbeing at National Grid have factored in the challenges faced by employees during the COVID-19 pandemic. No serious process safety events occurred during the year.

8. We have facilitated the efficient delivery of 100% of our customers' gas requirements during 2020/21 and continued to provide high levels of **reliability and availability**. We adapted our industry forums presentation format to mitigate the impact of the pandemic and maintain strong communication with our stakeholders, as well as developing easily accessible resources to support our customers. A key topic again this year was Constraint Management, where we provided information about how we manage the system from both physical and commercial perspectives.

9. On 1 October 2020 the Charging Review was implemented, following approval of UNC0678A in May 2020. This introduced a "postage stamp" pricing structure for capacity products and a revised set of reserve prices. There was a significant increase in capacity revenues from 1 October 2020 as a consequence of these new charges, and some changes were observed in Shippers' capacity product usage. The primary change was that Shippers looked to more closely align their capacity bookings with their energy flows.

10. In 2020/21, we have delivered £75m of investment to deliver a safe and reliable gas transmission network for our customers. This year marked the final delivery year of the majority of our RIIO-T1 investments and preparations to commence RIIO-T2 delivery. In line with our new licence condition target for NOMs monetised risk, we have met our target, thus maintaining the health of the network over the RIIO-T1 period for the benefit of current and future consumers.

11. We responded fully to the challenges presented by the COVID-19 pandemic, making good progress with our key investment projects this year. The River Humber Gas Pipeline Replacement Project replaced an underwater section of the Feeder 9 pipeline with a tunnelled solution that became fully operational on 10 December 2020. Following the successful insertion process, this became a Guinness World Record for the longest hydraulically inserted pipeline into a tunnel. This pipeline section is one of the most critical to UK gas supplies on the National Transmission System (NTS) and this work is essential in continuing to provide a reliable and secure gas supply to our customers.

12. Changing supply patterns have the potential to have a significant impact on our **environmental** outputs. In 2020/21, the supply of gas into the NTS remained diverse, and although there was a reduction in LNG, this was balanced by

increases in continental imports through the interconnectors. The behaviour of these imports is heavily influenced by changing gas prices, and the variations of supply behaviour witnessed from these sources throughout the year has resulted in a higher requirement for compressor running to manage the change in geographical pattern.

13. This year, NTS demand reached its highest level since the Beast from the East on 1 March 2018, driven by both cold temperatures across the UK and a significant volume of gas demand for power generation. This occurred on 10 February 2021, with 415.2 mcm required, 14.5% greater than the highest demand experienced in 2019/20.

14. As a result of these demand and supply patterns, usage of our compressor fleet increased by 50%, leading to a subsequent increase of CO_2 emissions from compressors by 76% compared to 2019/20 levels as utilisation of our gas turbines rose. Despite this, we managed to meet our Greenhouse Gas (GHG) emissions incentive with emissions at 81% of the target allowance and the lowest level in the RIIO-T1 period. This came from a continued focus across our business to reduce compressor pressurisation and venting. This has been achieved by aligning, where possible, maintenance outage periods following operational requirements to make best use of the gas held within the compressor.

15. We provide our annual emissions performance as part of our Carbon Disclosure Project (CDP) submission. This enables us to benchmark our performance against other organisations. In 2020, for the fifth consecutive year we achieved an 'A' rating for our CDP submission, putting us in the top 3% of global companies recognised for our actions to reduce emissions and mitigate climate change.

16. As reported last year, in June 2020 there was a mutually agreed exit from the contract with the Main Works Contractor for our compressor emissions compliance work at Peterborough and Huntingdon. An accelerated 'best for task' procurement event was initiated for a two stage Early Contractor Involvement (ECI) contract, which has now been awarded and a revised programme timeline agreed. Work on both sites has been impacted by COVID-19 social distancing restrictions, but new control buildings have been constructed and work has continued on a number of elements, including interconnecting pipework.

17. For **customer satisfaction,** this year saw an unprecedented step change in how organisations engage and serve their customers and stakeholders. Although response rates were lower than the previous year, we were able to target a broader range of customer contacts due to our focused virtual events this year. We continued to improve our customer satisfaction rating from 8.00 last year to 8.17 in 2020/21 and our stakeholder satisfaction score also increased from 8.40 to 8.42. Throughout the year processes and behaviours have been implemented to ensure we provide the experience our customers need.

18. In terms of **customer connections**, we have met all requirements associated with connection and capacity requests submitted by our customers. During 2020/21, we

have commissioned the connection of the first bio-methane site to the NTS at the Murrow offtake. We have carried out a lessons learnt exercise and there are a number of process and policy enhancements we are planning to progress based on this experience and customer feedback.

19. We continued to focus on **Innovation** activities in 2020/21 that can facilitate our target of 'Net Zero by 2050' and closing out our projects to ensure their effective delivery across the business and maximise their value, in preparation for the start of RIIO-T2. 32 Network Innovation Allowance (NIA) projects were undertaken, many of which have built upon the feasibility studies carried out in 2019/20, to examine the suitability of hydrogen as a cleaner alternative to natural gas and identify what changes may be needed across Gas Transmission to facilitate this. We also continue to maintain a core component of our overall innovation portfolio that looks at increasing the efficiency of our day-to-day maintenance and operational activities, by utilising innovative tools and methods, enabling us to deliver the greatest value for consumers.

Financial Performance

20. Across RIIO-T1 our Totex is £3,240m against an allowance of £2,988m. This results in a spend above allowances of £252m, which is an improvement of £16m compared to 2019/20. Over the RIIO-T1 period we have invested circa £1.8bn of Capex across our overall business.

21. The change in performance is due to a decrease in forecast allowances of £4m, and a decrease in Totex of £20m. The allowances have decreased as a result of allowances determined for the Hatton emissions investment, with the funding now split between the RIIO-T1 and RIIO-T2 periods. The decrease in Totex results from reduced spend on asset health and rephasing of the Peterborough and Huntingdon emissions programme, which will now complete in RIIO-T2.

22. Details on performance against allowances for each area and changes in performance compared to 2019/20 are detailed in the Performance Summary section.

Consumer Bill Benefit

23. In RIIO-T1, less than £10 (2020/21 prices) of the average domestic consumer gas bill of £572[1] related to the gas network services we provide. In 2020/21, the proportion of the bill attributable to National Grid services was approximately £7.72 which equates to 1.3% of the typical gas bill. This is an increase compared to 2019/20 where the National Grid portion of the domestic consumer gas bill was £7.60 but remains a decrease on the first five years of RIIO-T1 where this value ranged between £7.97 and £9.92.

[1] Figure taken from the Ofgem publication 'Bills, Prices and Profits'

Key Risks and Looking Ahead

24. During this final year of the RIIO-T1 price control we have taken an adaptable and flexible approach which has resulted in some changes in delivery. Our planned work has been assessed and re-assessed against guidance provided by Ofgem and The Department for Business, Energy and Industrial Strategy (BEIS) at all the various stages of lockdown and restrictions lifting. Delivery of individual projects has been impacted differently, and we continue to operate with specific risk assessments for COVID-19 measures. This regulatory reporting pack contains details on a number of projects which have experienced COVID-19 delays, and as such are carried forward from RIIO-T1 to RIIO-T2.

25. A key event in the 2020/21 year has been the final determination of the RIIO-T2 price control. The outcome of this concluded with Ofgem setting of our allowances and outputs for the period 2021-2026 in Final Proposals in December 2020. We have undertaken a range of planning and preparatory works this year as well as closure of a range of RIIO-T1 projects, in order to ensure a smooth transition into the new price control period.

26. In agreement with Ofgem, planning and consultation on NGGT RIIO-T1 regulatory issues requiring 'close-out' at the end of the price control were paused in order to prioritise the RIIO-T2 engagements in the context of the other challenges during this year. The exception to this is the closeout of RIIO-T1 NOMs with our submission on incentive performance in July 2021.

27. Brexit remained an important focus during the first part of the year. Work continued on changes required to industry codes and related agreements in readiness for a 'no-deal' scenario implications of Brexit up until December 2020. Post Brexit, collaboration has remained key to our approach. We have established a UK Transmission Operators forum to coordinate engagement with BEIS and Ofgem to ensure we establish an enduring arrangement between the UK and European system operators.

28. The decarbonisation of the energy system remains at the forefront of our work. We were awarded £9.7m of funding, through the Network Innovation Competition, to build an offline hydrogen test facility and begin hydrogen testing as part of the first phase of the FutureGrid programme. We completed our first full year of the Gas Markets Plan (GMaP) with over 100 industry engagements across four projects - Gas Balancing, Hydrogen, Gas Quality and Capacity Access topics.

29. Following the announcement in March 2021 that National Grid will sell a majority stake in the Gas Transmission business, we remain committed to the investments delivered in RIIO-T1, having provided an important foundation for a successful future as a standalone business.

30. I trust you find this Regulatory Performance Pack informative, and we would welcome any feedback on how we can improve our reporting.

Jon Butterworth (President, National Grid Gas Transmission)

Performance Summary

Financial performance

31. Across RIIO-T1, our Totex spend is £3,240m against an allowance of £2,988m. This results in a spend above allowances of £252m, which is a decrease of £16m compared to 2019/20.

32. The change in performance from 2019/20 is due to a combination of changes in Capex spend (TO Non Load Related and Non Operational) and an adjustment to allowances to reflect the Final Determinations on the Hatton emissions investment.

33. With reference to the restated[2] table, compared to last year our spend has decreased by £20m on a constant 2020/21 price base and the adjusted allowances have decreased by £4m.

Activity	Spend (8 Year) (£m)	Allowance (inc. uncertainty mechanism) 8 year (£m)	Cost vs Allowance (£m)
TO Load Related Capex	28	47	19
TO Non Load related Capex	1,343	1,187	(155)
TO Non Operational Capex	155	75	(81)
TO Opex	925	788	(137)
SO Capex	280	344	65
SO Opex	509	546	37
Total	**3,240**	**2,988**	**(252)**

Table 1: Eight-Year Forecasted Spend and Allowances Overview (restated table)

[2] In order to better understand the underlying position of spend versus allowances, Table 2.4 is restated to better align allowance with spend categories.

34. Based on the table above, the main areas of differences between cost and allowances relate to:

- TO Load Related Capex – we have spent below our overall allowance, but our performance compared last year has reduced by £4m as a result of the inclusion of the Western Gas Network project. We have overspent on the ongoing works at Felindre and Tirley pressure reduction installation (PRI).

- TO Non Load Related Capex – we have spent above allowances for asset health, with our spend for RIIO-T1 £41m lower than forecast last year. This has been driven by the impact of COVID-19, leading to a revised delivery of our Asset Health works, and revisions to the Peterborough and Huntingdon compressor programme. We have incurred spend this year in order to prepare for an efficient start on our RIIO-T2 investment plans.

- TO Non Operational Capex – Our spend remained broadly stable from our forecast in 2019/20 at £155m. We have spent above allowances driven by the need to invest in data and systems to improve the management of the asset health of our network. This is driven by additional investment in Project One, enhancing enterprise resource planning and transforming finance processes and Cyber Security.

- TO Opex – In line with our forecast from last year, we have spent above allowances on Business Support costs and Closely Associated Indirect costs. Costs in this area are linked to the higher levels of asset health spend impacting on Business Support costs. There has been an increase in IAS 19 provision compared to last year, offset by decreases in Closely Associated Indirect costs, Direct Costs, Business Support Costs and Planned Inspections and Maintenance. There has been an increase related to provisions for COVID-19 working practices.

- SO Capex – we have spent below allowances as a result of lower spend on Xoserve and Telemetry separation, although total spend increased from our forecast due to delays to the migration of the gas Data Centres and some National Information Security Directive (NIS-D) projects. Our SO Capex costs are £6m lower than last year due to Gemini Replatforming going live.

- SO Opex – Our SO Opex costs have remained stable at £509m. We have spent below allowances due to a higher proportion of Xoserve allowances allocated to Direct Opex following the outcome of the review of agency costs. These are offset by Business Support costs and IAS 19 adjustment.

Return on Regulated Equity (RoRE)

35. The overall NGGT (TO) RoRE across RIIO-T1 is 6.65%, a marginal decrease of 0.01% in comparison to 2019/20. This is due to a decrease in post-tax financing performance. The change in post-tax financing performance is primarily due the impact of closing the gap between actual and the notional gearing level. The RIIO-T1 operational RORE has increased marginally from 6.04% to 6.07%, this is driven

by the marginal increase in Totex Performance with Enduring Value adjustments applied. Incentive and innovation performance has remained relatively static over the RIIO-T1 period. The decrease in financing performance is as a result of an increase in forecast RIIO-T1 financing costs. There has been a marginal increase in RIIO-T1 tax performance compared to the 2019/20 submission. Further detail on Totex performance is detailed below.

	2020/21	2019/20
Operational RoRE	6.07	6.04
Financing and tax	0.58	0.61
Total RoRE	6.65	6.66

Table 2: RoRE comparison

Primary outputs

36. Our primary outputs (as driven by incentives) are detailed in Table 5.

Maximum Allowed Revenue TO

37. The Gas Transmission TO Maximum Allowed Revenue for 2020/21 is £779.7m.

Licence Term	2019/20 (2019/20 Price Base £m)	2019/20 (Restated to 2020/21 Price Base £m)	2020/21 (2020/21 Price Base £m)	Commentary for year on year variance (Commentary in 2020/21 price base unless otherwise stated)
Base Revenue (BR)	694.9	706.2	766.3	• (£1.9m) decrease in opening base revenue (PU) allowances. • £64.9m increase in MOD. Detailed MOD commentary included in **Final Proposals base revenue against adjusted base revenue** section.

Licence Term	2019/20 (2019/20 Price Base £m)	2019/20 (Restated to 2020/21 Price Base £m)	2020/21 (2020/21 Price Base £m)	Commentary for year on year variance (Commentary in 2020/21 price base unless otherwise stated)
				• (£2.8m) relating to TRU in 2020/21 as a result of the movement between forecast and actual RPI in 2020/21 compared to the movement in 2019/20.
Pass Through (PT)	(4.2)	(4.3)	(7.9)	• Business rates, licence fees and policing costs are trued up against the ex-ante allowances with a two-year lag. The value from 2019/20 to 2020/21 has decreased by (£2.6m). • Independent systems costs are trued up within year. The true up value decreased by (£1.0m) between 2019/20 and 2020/21.
Incentives (OIP)	3.7	3.7	4.2	• The 2020/21 incentive includes the Customer and Stakeholder Satisfaction Incentive and Stakeholder Engagement Reward for 2018/19 performance. The incentive revenue has increased since 2019/20 by £0.5m.
Network Innovation Allowance (NIA)	4.3	4.3	4.4	• NIA costs have increased slightly on a year on year basis. Under the NIA rollover mechanism, there are two NIA projects rolling over to completion within 2021/22 but funded under RIIO-T1 2020/21 NIA Allowance.
Network Innovation Competition Funding (NICF)	13.8	14.0	7.9	• As per the Ofgem direction, the NICF revenue term has decreased by (£6.1m) compared to 2019/20. This year funding has been awarded to NGN (£6.8m less £0.9m funding return) and National Grid (£1.2m).
PARCA (PTV)	-	-	-	• The PTV term has been removed from the Revenue RRP and PARCA costs will be retrieved as part of the Base Revenue calculations in the PCFM.

Licence Term	2019/20 (2019/20 Price Base £m)	2019/20 (Restated to 2020/21 Price Base £m)	2020/21 (2020/21 Price Base £m)	Commentary for year on year variance (Commentary in 2020/21 price base unless otherwise stated)
Correction Term (-K)	(6.4)	(6.5)	4.6	• The correction term in 2020/21 is based on the £4.3m under-collection of revenue in 2018/19 (as reported in the 2018/19 submission) and subsequently uplifted as per the licence algebra requirements to £4.5m.
Maximum Allowed Revenue	**706.0**	**717.5**	**779.7**	

Table 3: Gas Transmission TO Maximum Allowed Revenue breakdown

Maximum Allowed Revenues SO

38. The Gas Transmission SO Maximum Allowed Revenue for 2020/21 out-turned at £220.8m.

Licence Term	2019/20 (2019/20 price base)	2019/20 (Restated to 2020/21 Price Base £m)	2020/21 (2020/21 price base)	Commentary for year on year variance (Commentary in 2020/21 price base unless otherwise stated)
Base Revenue (SOPU)	140.9	143.2	109.1	• (£1.3m) decrease in opening base revenue allowances (SOPU). • (£32.4m) decrease in MOD. Detailed MOD commentary is included in **Final Proposals base revenue against adjusted base revenue** section. • (£0.4m) relating to TRU in 2020/21 as a result of the movement between forecast and actual RPI in 2020/21 compared to the movement in 2019/20.
Constraint Management (CM)	14.1	14.3	12.9	• The 2020/21 revenue includes the cost adjustment of (£38.5m) plus incentive revenue of £15.5m for 2018-19 performance. • Above values are quoted after WACC and RPIF uplifts have been applied. • The cost adjustment and incentive revenues are subject to a two-year lag from the year of performance.
Transportation Support Services (TSS)	(5.9)	(6.0)	(3.0)	• The 2020/21 revenue does not include any ex-ante allowance. The cost adjustment is (£5.4m) plus incentive revenue of £2.4m for 2018/19 performance.

Licence Term	2019/20 (2019/20 price base)	2019/20 (Restated to 2020/21 Price Base £m)	2020/21 (2020/21 price base)	Commentary for year on year variance (Commentary in 2020/21 price base unless otherwise stated)
				• Above values are quoted after WACC and RPIF uplifts have been applied. • The cost adjustment and incentive revenues are subject to a two-year lag from the year of performance.
Incentives (SOOIRC)	106.6	108.4	89.8	• Further detail on incentive costs and performance is included below.
Correction Term (-SOK)	(12.3)	(12.5)	12.0	• The correction terms in 2020/21 is based on the £11.6m under-collection of revenue in 2018/19 (as reported in the 2018/19 submission) subsequently uplifted as per the licence algebra requirements to £12.0m.
Maximum Allowed Revenue	**243.4**	**247.4**	**220.8**	

Table 4: Gas Transmission SO Maximum Allowed Revenue breakdown

Innovation

39. In 2020/21, the team undertook 32 NIA projects at a cost of £4.9m. We have continued to focus on work that can facilitate our target of 'Net Zero by 2050' and closing out our projects to ensure their effective delivery across the business and maximise their value, whilst maintaining a key elements that seek innovative ways to increase the efficiency of our day-to-day maintenance and operational activities.

40. Primarily, our net zero projects focus on hydrogen, such as Roadmap to FutureGrid, Gas Transport Transition Pathways, Hyscale, HyTechnical and Zero 2050 South Wales. Building upon the feasibility studies carried out in 2019/20, these examine the suitability of hydrogen as a cleaner alternative to natural gas and identify what changes may be needed across Gas Transmission to accommodate this.

41. In November 2020, we were awarded £9.7m of funding, through the Network Innovation Competition (NIC), to build an offline hydrogen test facility and begin hydrogen testing as part of the first phase of the FutureGrid programme. The facility will be built from a range of decommissioned assets, to create a representative transmission network. Blends of hydrogen up to 100% will then be tested at transmission pressures, to assess how the assets perform.

42. The National Grid innovation strategy, developed over the last year, consists of three RIIO-T2 innovation themes: 'Fit for Future', 'Ready for Decarbonisation' and 'Decarbonised Energy System'. Fit for the Future focuses on extending the pipeline lifetime and enabling its use for the net zero future. Ready for Decarbonisation looks at those key assets and technologies that will be needed for the integration of net zero gases into the NTS and Decarbonised Energy System develops the systems and processes that are needed to run a net zero gas network.

Table 5: Outputs and Incentives Performance (primary & secondary)

	Safety			
	Our output	**2020/21 Target**	**2019/20 Performance[3]**	**2020/21 Performance**
1	Comply with HSE legislation	100%	**Complied**	**Complied**
2	Meet requirements for enhanced physical site security	Meet BEIS requirement by 2021	**On track**	**Completed**
3	Meet requirements for enhanced data security	Submit six-monthly report on delivery of data centre investments and cyber security enhancement initiatives	**Most initiatives remain on track, however some with minor delays. Subject to review with the NIS Competent Authority**	**Majority of outputs delivered. Subject to review with the NIS Competent Authority**
	Reliability and availability			
	Our Output	**2020/21 Target**	**2019/20 Performance**	**2020/21 Performance**
4	Maintain our security of supply obligations in Scotland (Network Flexibility)	Ensure compliance with 1-in-20 obligations by 2020	**Strategy in place to ensure compliance**	**Strategy in place to ensure compliance**
5	Meet our targets for investing in our assets to maintain their health (NOMs targets)	Deliver network replacement outputs in accordance with the licence	**In aggregate, on track to deliver eight-year target**	**Delivered RIIO-T1 monetised risk target**
6	Replace Feeder 9 (pipeline that runs across the Humber Estuary)	Commission new Feeder 9 pipeline by 2020	**On target - Construction underway, tunnel completed, commissioning planned for Autumn 2020**	**Pipeline has been inserted and became fully operational in December 2020.**
7	Deliver benchmark performance for maintenance outage days	11 days (for Remote Valve Operations)	**0 maintenance day called**	**0 maintenance day called**
8	Minimise National Grid driven changes to maintenance planning	9 days (<7.25% of workload 9.49 of 131 days)	**6 changes due to cancelled ILI**	**No changes**
9	Meet constraint management target	£22m x RPI = £30.43m target	**£0.69m costs**	**£0.55m costs**
10	Meet target for Transmission Support Services and for Constrained LNG & Long Run contracting	This incentive ended 1 October 2018	**£0m cost**	**£0m cost**

[3] As reported in the 2019/20 RRP. Please note that all previous year figures are in 2019/20 price base unless otherwise stated.

	Reliability and availability			
	Our Output	**2020/21 Target**	**2019/20 Performance**	**2020/21 Performance**
11	Deliver existing capacity obligations in accordance with Unified Network Code (UNC), Licence and Gas Act	All UNC, Licence and Gas Act capacity obligations to be met in full	**System issues, including planned outages, impacted a minority of auctions**	**System issues impacted a minority of auctions**
12	Deliver accurate 13:00 day ahead demand forecasting	8.83 mcm average forecast error	**8.55 mcm average**	**8.20 mcm average**
13	Deliver accurate demand forecasting at the two to five days ahead stage	13.70 mcm average forecast error	**12.91mcm average**	**13.52 mcm average**
14	Meet target for residual balancing linepack performance measure	<2.80 mcm average daily change	**1.73 mcm average daily change**	**1.5 mcm average daily change**
15	Meet target for residual balancing price performance measure	Average daily difference between max and min price paid, to be within 1.5% of System Average Price (SAP)	**Difference 1.12% of SAP**	**Difference 0.77% of SAP**
16	Procure Operating Margins (OM) in an economic and efficient manner	Incur OM costs efficiently and publish report on the steps taken to promote competition	**Report published on time, £0.4m decrease in cost in 2019/20**	**Report published on time. £1.8m increase in cost, mostly driven by increased volume. Unit cost similar to 2019/20**
	Environment outputs			
	Our output	**2020/21 Target**	**2019/20 Performance**	**2020/21 Performance**
17	Develop an integrated and cost-effective plan to ensure the remainder of our compressor units are compliant with the IPPC and IED legislation	Delivery date 2018	**Integrated plan submitted in May 2018. Needs case approved for Hatton. St Fergus investment included in RIIO-T2 business plan**	**Allowances for Hatton set as part of RIIO-T2 determinations. All other compressor emissions work including St Fergus, is subject to RIIO-T2 uncertainty mechanisms.**
18	Undertake works at Peterborough and Huntingdon Compressor Stations as part of IPPC legislation	Delivery date 2020	**Delays on the project have resulted in rescheduling outages.**	**New programme underway with completion in 2023. Project delivery delayed. New programme underway with completion in 2023 in-line with emissions compliance requirements.**
19	Undertake works at Aylesbury Compressor Station to ensure compliance with IED	Delivery date 2020	**Successfully commissioned 2018**	**Successfully commissioned 2018**
20	Report on our business carbon footprint	Publish in annual report	**Published in our annual report**	**Published in our annual report**

	Environment outputs			
	Our output	**2020/21 Target**	**2019/20 Performance**	**2020/21 Performance**
21	Meet greenhouse gas emissions targets	<2,897 tonnes for 2019/20	**2,500 tonnes**	**2,342 tonnes**
22	Meet our targets for the amount and the cost of the energy we use to run the network	<5,568 GWh (Gigawatt hours) gas equivalent usage target in 2020/21[4] <£76m cost target for 2020/21	**4,536 GWh** **£80.1m**	**4,754 GWh** **£67.7m**
	Customer Satisfaction outputs			
	Our output	**2020/21 Target**	**2019/20 Performance**	**2020/21 Performance**
23	Undertake annual satisfaction survey with our customers and stakeholders.	Customer 6.9/10 Stakeholder 7.4/10	**8.00 for customer** **8.40 for stakeholder**	**8.17 for customer** **8.42 for stakeholder**
24	Submit annual stakeholder engagement report	Cap of 9 and collar of 4	**Achieved a score of 3.11**	**Achieved a score of 4.81**
	Customer Connections outputs			
	Our output	**2020/21 Target**	**2019/20 Performance**	**2020/21 Performance**
25	Achieve our obligated times for delivering extra capacity on the system	Target of 24 months from the point of formal commitment	**Compliant - No incremental capacity due for delivery this year**	**Compliant - No incremental capacity due for delivery this year**
26	Meet timescales for connection applications as specified in UNC and comply with reasonable requests for a customer connection to the NTS	2 business days for application acknowledgment 5 business days to confirm competent connection application 2 months for initial connection offer 3 months for standard full connection offer 9 months for full connection offer 3 months for Feasibility Study Report	**All offers made within UNC obligations**	**All offers made within UNC obligations**

Key

Red – Missed an annual output and/or our eight-year output commitment
Amber – Missed annual output but met our eight-year output/successful achievement of annual output but missed our eight-year output
Green – Successful achievement of an annual output and our eight-year output commitment

[4] In accordance with the NTS Shrinkage Incentive Ex Ante Baseline Value Statement usage target and actuals are quoted in GWh gas equivalent, using a factor of three to convert from electricity to gas equivalent.

II. Operational Context

43. As the sole owner and operator of the Gas Transmission network in Great Britain, National Grid manages the day-to-day operation of the NTS including the residual balancing of the network, maintaining system pressures and assuring gas quality. Our performance in 2020/21 is contextualised by the continued evolution of the operational challenges the business has faced during the financial year.

44. During 2020/21, we have effectively facilitated the delivery of 100% of gas requirements for customers. Achieving this level of performance requires us to continually adapt to the changing use of the network by our customers. These requirements are becoming increasingly influenced by global markets and the continued trend towards decarbonising the economy, manifesting itself as interactions between the gas and electricity systems. Additional network challenges have been realised due to the global COVID-19 pandemic, impacting consumer demand behaviours as well as the delivery of network maintenance.

45. 10 February 2021 was our highest demand day of the year, and the highest since the Beast from the East on 1 March 2018. The high demand was driven both by cold temperatures across the UK and a significant volume of gas required for power generation. Supply into the UK remained diverse, although there were noticeable reductions in LNG throughout the year which were broadly balanced by increases in continental import through the interconnectors.

46. The variation in supply behaviour resulted in a higher requirement for compressor running to manage the change in geographical supply when compared to the previous year. The increase in compressor running hours is typical when there is a predominance of supply within a single geographical region.

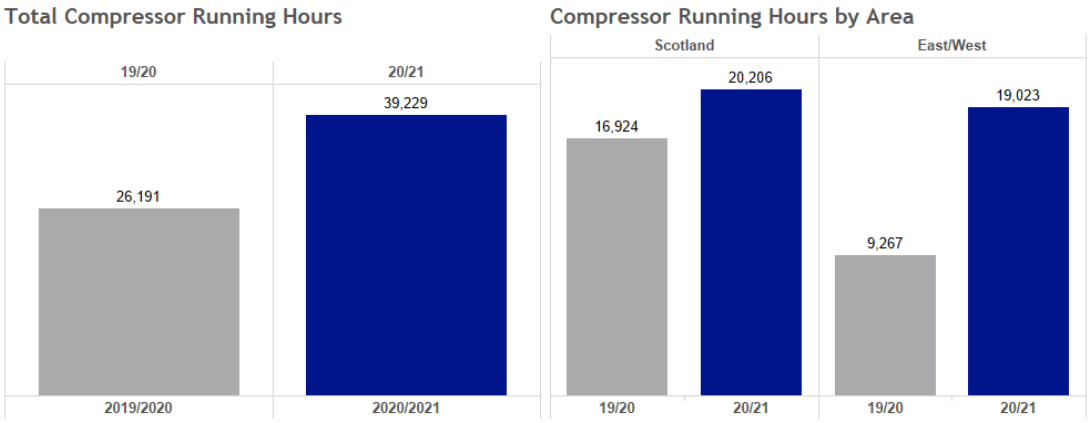

Figure 1: Compressor utilisation in 2020/21 compared to 2019/20.

47. Despite the macro trend towards lower LNG delivery and higher continental imports, the behaviour of these supplies throughout the year has been extremely changeable, broadly driven by variations in gas price. Facilitating the continued

supply of gas to our customers has required high levels of flexibility in our asset base dependant on the prevailing supply pattern. An example of this is shown in Figure 2, where changes from an east coast to west coast supply pattern result in significant changes in network configuration.

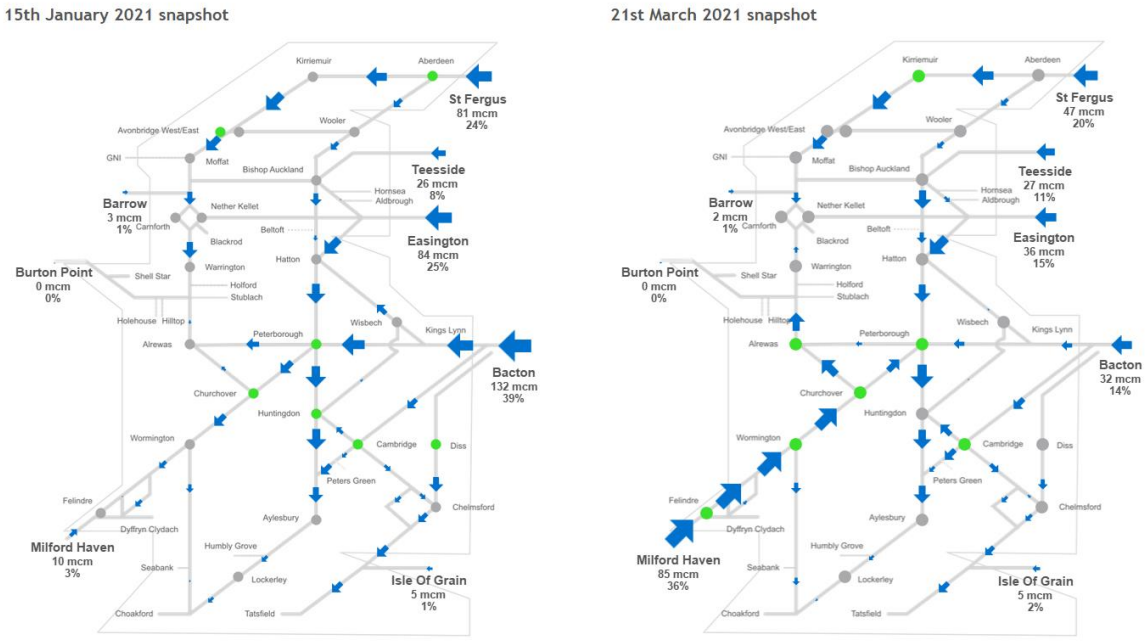

Figure 2: Example of variations in supply pattern over winter 2020/21. Blue arrows and green circles represent gas flow and active compression respectively.

48. The response to the COVID-19 pandemic and associated control measures has had a significant impact on the supply and demand flows onto the network. This was most apparent during the first lockdown period with significant shutdowns in industrial and commercial premises driving lower gas and power demand. With industrial premises largely unaffected during subsequent lockdown periods, weather corrected demand levels have returned to more normal levels. The impact of lockdown on domestic demand over the recent winter was minimal, although there was a noticeable flattening of the typical diurnal demand profile throughout the gas day.

III. Outputs

49. Under the RIIO-T1 framework, National Grid's performance as owner and operator of the gas NTS is assessed against five key outputs:

- Safety
- Reliability and Availability
- Environment
- Customer Satisfaction
- Customer Connections

50. These outputs focus on delivery of outcomes that our customers and stakeholders have told us they value most. There are also a series of more specific outputs that sit within each of these five key output areas. These are detailed within Table 5 and have been used in our assessment of our 2020/21 performance.

51. We have continued to implement a number of strategies and applied these through a range of initiatives to deliver our outputs as efficiently as possible and to provide the greatest benefit to customers. Our 2020/21 performance against these key outputs is outlined further in the Outputs sections below.

IV. Outputs – Safety

52. The safety of our workforce, the public and our assets, remains a top priority at National Grid. We aim to deliver world class safety performance which is crucial to our customers, the communities we serve and to the reputation of our business. Specific outputs under this theme relate to compliance with safety legislation and meeting the requirements for enhanced physical site security. In 2020/21 we were compliant with our safety related outputs and over the eight-year RIIO-T1 period have met BEIS's requirements for enhanced physical site security.

Gas Transmission Safety Performance

53. Within the Gas Transmission business, there were no public injuries as a result of our activities in 2020/21, but there was one employee lost time injury. This employee injured their ankle whilst dismounting a ladder. The combined employee and contractor lost time IFR was therefore 0.04. The combined employee and contractor Total Recordable Injury Frequency Rate (TRIFR) for Gas Transmission closed the year on 0.3, based on eight injuries.

54. There were no serious process safety events during 2020/21.

55. Throughout 2020/21, we have focused on a number of initiatives to promote and encourage safety and wellbeing at National Grid. These include:

- Behavioural Safety Training – 'SafeStart' behavioural safety training programme was delivered to all Gas Transmission Plant Operational Teams. This programme addresses unintentional human error and critical safety habits, thereby reducing risk and the probability of injury in the workplace, as well as whilst driving and in the home.

- COVID-19 Safety Measures – Throughout the COVID-19 pandemic National Grid has ensured all employees can continue to work safely. Risk assessments were prepared for all working environments and work activities. The control measures were implemented including working locations, associated arrangements and equipment, personal protection equipment, testing arrangements and prioritisation of work activities.

- Health and Wellbeing - Mental and physical health has continued to be a focus for National Grid, particularly as a result of the additional pressures associated with the COVID-19 pandemic. From a mental wellbeing perspective, guidance and available support has been regularly briefed to all National Grid employees and established training courses were updated and made available virtually alongside two new virtual webinar courses on 'Developing a Resilient Mindset' and 'Developing a Resilient Team'. From a physical wellbeing perspective, there was a continued focus on musculoskeletal health run throughout 2020 including updating Display Screen Equipment (DSE) training and completion of individual risk assessments to ensure adequate DSE measures are in place alongside providing general information and advice.

56. In the 2020/21 period, there has been a drive to close out the RIIO-T1 innovation projects and provide the solutions to the business to utilise. Several projects focused on safety have now successfully closed, such as the Mobile Condensate Tank and cyber security project suite. The Mobile Condensate Tank project has delivered a novel solution to replace our fleet of condensate storage tanks with safe, easy to use mobile condensate drain tanks rated for the full NTS line pressure. The cyber suite of projects are aligned with the IEC 62443 cyber security standard and further increase our resilience to potential malicious cyber-attacks, creating a blueprint architecture that supports compliance with the standard and enhances cyber security.

57. In addition, we have completed a number of safety focussed projects throughout the past year including:

- The Sarco Stopper and Inline Flow Stop projects, allowing us to safely undertake maintenance activities in locations where it is difficult to purge the gas and ensure the safety of the operational staff.
- The Geopolymer project, which provides a novel technique to re-level and stabilise the ground under gas pipework preventing damage.
- The Vegetation Management project, which enables us to better understand more fully the effect of vegetation on the NTS and ensure its stability into the future.

58. As we plan for a net zero future, we have increased our focus on the safety impact of hydrogen, with a range of key projects completed as outlined in the Innovation section of the strategic narrative. Visit our website (www.nationalgrid.com/gasinnovation) for the most up to date information on this and our whole suite of innovation activities.

Figure 4: Mobile condensate storage tank.

V. Outputs – Reliability and Availability

59. The reliability and availability of our transmission network and the service it provides is vital to our customers. In 2020/21, we continued to provide high levels of reliability and availability for our customers to input and offtake gas from our system. The section below details how we have performed against our Reliability and Availability outputs outlined in Table 5. We have met our outputs for the RIIO-T1 period with the exception of some system issues in the area of 'Capacity Obligations' (Output 11 in Table 5), which have impacted a minority of auctions. Reliability and Availability outputs not discussed in the below section, are covered in X. Load Related Capital Expenditure and XI. Non Load Related Capital Expenditure.

Network Output Measures (NOMs)

60. The reliability and availability of the NTS to our customers depends predominantly on the health of our assets, both today and into the future. NOMs have been used as a proxy for network risk to measure the risk across the RIIO-T1 period. The NOMs target metric has been changed to one based on achieving an absolute level of monetised risk, replacing the previous method which used a count of assets by Replacement Priority (RP). The RP-based target has been converted to a Monetised Risk target through a rebasing process, which concluded in July 2020. We successfully delivered our performance against NOMs target and closeout of this will be assessed through the RIIO-T1 closeout process, which is being run in parallel with RRP.

61. We have spent £55.0m on asset health works in 2020/21, compared to £66.6m in 2019/20. This spend is £24.3m lower than the £79.3 forecast in the 2019/20 RRP.

62. With the restrictions of working on site through the COVID-19 pandemic, we had to reassess our work programme for the year. Considering factors such as site working conditions, network risk and resource availability, some work programmes have taken longer to complete than expected. The closure of these investments and associated costs has rolled forward into next year. We have necessarily diverted some resources into preparatory works for RIIO-T2, including National AGI Renovation (NARC) and Cabs and Compressor themes, which need to be rapidly progressed to collect enough data to support our RIIO-T2 uncertainty mechanism submission. Overall, this has resulted in a lower spend than forecast in 2020/21.

63. Our overall spend for RIIO-T1 asset health expenditure is £694.7m (including Feeder 9 planning costs). This is £81.9m above our RIIO-T1 allowance of £615.8m.

64. Despite the COVID-19 challenges of the last year, we have delivered 184 network replacement outputs over the year, of which 165 contribute towards our rebased RIIO-T1 NOMs target. The remaining 19 are outputs claimed on the 10 Secondary Asset Classes which fall outside the scope of the rebased target. We have delivered 52 outputs at Bacton Terminal this year, predominantly on valves and filters. A range of work has been delivered at other sites and pipelines through our

ongoing Inline Inspection (ILI) process and remediation of defects found to comply with PSSR legislation.

65. As per the RIIO-T1 NOMs rebasing process, our definition of RP per asset is now based on monetised risk, rather than the assessed asset health and criticality grades as used previously. Because of this, the RP banding for each asset has changed when compared to previous RRP returns. This also means that not all claimed outputs are RP1s as assumed previously (the RP band is now defined by a combination of a quantified probability of failure and monetised consequence of failure). The criteria for claiming a network replacement output are unchanged and are equivalent to previous RRP returns.

66. Data supporting our RIIO-T1 NOMs performance against the monetised risk target, with accompanying narrative, forms stage 1 and 2 of the NOMs Incentive Methodology. This submission is part of the closeout of the RIIO-T1 price control and was submitted in July 2021.

Maintenance Days Used Incentive Scheme

67. The Maintenance Days Used incentive is designed to reduce the impact we have on our customers when we undertake our routine maintenance activities. For 2020/21, the incentive only included maintenance days for Remote Valve Operations (RVO); the In-Line Inspections (ILI) element of the scheme ceased in 2015/16.

68. Due to the COVID-19 pandemic, all RVO activities were cancelled prior to the 2020/21 maintenance season. This ensured that zero Maintenance Days were called in 2020/21 (as in 2019/20).

Maintenance Day Changes Incentive Scheme

69. The aim of the Maintenance Day Changes incentive is to reduce the impact our maintenance activities have on customers, should we make changes to our planned maintenance after 1 April for the forthcoming summer maintenance period. The incentive scope does not include changes which were initiated by customers, only those initiated by National Grid.

70. The Maintenance Day Changes incentive includes any maintenance days called; it is not limited to RVOs. In total, there were 131 days of planned maintenance in 2020/21, compared to 152 days in 2019/20. This decrease, driven in part by a higher volume of internally impacting works that do not have a third-party impact, led to an updated benchmark for changes of 9.49 days in 2020/21, which is 7.25% of all Maintenance Days and Advice Notice Days[5] called. This compares to a benchmark of 11.02 days in 2019/20.

[5] Where a single maintenance activity affects multiple NTS Exit Points on a day, this is construed as a single day for the purposes of the Maintenance Incentives.

71. In 2020/21, there were zero changes initiated by National Grid during the maintenance period. This is a decrease from six changes in 2019/20. This reduction demonstrates the conscious effort that has been made to minimise change, despite there being a large volume of In-Line Inspections having an impact on customers. Ensuring we minimised the impact of these inspections was crucial in demonstrating our continued commitment to be flexible to customers' requirements.

72. This performance was primarily delivered by several improvements that we made in 2020/21, including improving our planning processes. In addition, this included a continued increase in face-to-face meetings (ensuring COVID-19 safety via Microsoft Teams) with customers and telephoning/emailing customers eight weeks prior to the planned maintenance affecting them, allowing us to capture any changes to customer outages earlier.

73. Minimising the use of Maintenance Days throughout 2020/21 has ensured minimal impact to our customer's operations with National Grid taking on additional risk by aligning works, saving them approximately £10 million[6] in potential lost time revenue. This provides a better value service for our customers and the wider energy industry.

74. Our annual maintenance programme review for 2020/21 can be found on our website at:

https://www.nationalgridgas.com/data-and-operations/maintenance

Constraint Management Incentive Scheme

75. The Constraint Management Incentive is designed to drive National Grid to maximise available network capacity and minimise constraint management costs through the efficient and economic planning and operation of the NTS. We therefore release as much capacity as possible, develop effective constraint management strategies and make economic and efficient NTS investment and planning decisions. This benefits our customers, and ultimately end consumers, as the costs of commercial constraint management actions to Industry are mitigated or minimised and balanced against NTS investment whilst maximising NTS capacity. Running a constraint-free network provides choice for our customers to land and utilise the cheapest gas and has a positive impact on the market. A robust Constraint Management Incentive drives an effective strategy which delivers value to Industry and end consumers who share in the benefit of strong performance.

76. Following discussions with Ofgem regarding the financial performance for National Grid from the Constraint Management incentive scheme for 2020/21, which were triggered by a significant increase in capacity revenues following the introduction

[6] Figures derived from National Grid calculation tool, factoring, gas, carbon and electricity prices for a given period. In addition to this, the calculation also takes in to account the assumed efficiency of each individual customer.

of a new charging framework, as explained briefly in the next paragraph, a decision was published on 5th August to take effect from 30th September and define the incentive financial performance for 2020/21: Modification of National Grid Gas Plc (NGG) Gas Transporter Licence to change Part A of Special Condition 7.14 | Ofgem

77. On 1 October 2020 the Charging Review was implemented, following approval of UNC0678A in May 2020. This introduced a "postage stamp" pricing structure for capacity products and a revised set of reserve prices. There was a significant increase in capacity revenues since 1 October 2020 as a consequence of these new charges, and some changes observed in Shippers' capacity product usage. The primary change was that Shippers looked to more closely align their capacity bookings with their energy flows. More information on the Charging Review can be found in the Market Facilitation chapter.

78. In 2020/21 (pre-sharing factor), overall revenue from Entry Capacity products, including Entry Capacity Overruns, increased to £86.8m from £3.0m in 2019/20. Of this overall revenue, £85.0m was generated between October and March - this year on year increase can therefore be attributed to the increase in capacity reserve prices and changing Shipper product usage. There was an increase in entry overrun charges to £1.8m, from £0.7m in 2019/20, though this may also have been driven by the increase in prices rather than an increase in trade errors – £1.6m of the entry overrun charges were incurred between October and March. There was a £1.4m charge for Within Day Daily System Entry Capacity owing to a Shipper bidding error which resulted in a trade value of £1.4m. This was subsequently disputed, and investigated and concluded by us, though closure of this issue has to date not been confirmed by the Shipper. A further five smaller bid price errors were reported to us by customers in 2020/21, and work to reduce the future likelihood of erroneous data entry is described more fully later in this section.

79. We have seen an increase in revenue across all Entry Capacity products (excluding overrun revenues), increasing by £82.8m from 2019/20, owing predominantly to the increase in capacity reserve prices. The high demand levels in January (notably above seasonal normal levels) combined with a reduction in LNG imports, led to a spike in interconnector imports which contributed to Entry Capacity products for this month generating revenues of £16.5m.

80. Revenue from Exit Capacity products increased to £19.3m in 2020/21 from £1.0m in 2019/20. As for Entry, this again can be attributed to the increase in capacity reserve prices - £18.7m of this overall revenue was generated between October and March.

81. We assess the impact of maintenance planning throughout the year; be that planned maintenance forming part of the annual maintenance plan, or ad-hoc maintenance resulting from an unforeseen event. The commercial risks are then assessed alongside the physical risks, and a decision reached collectively as to the most efficient approach to be taken. Depending on the criticality of the work and likely physical and commercial impact to customers of carrying out the

maintenance, the work will either go ahead or be rescheduled, or other options may be considered. There is always a level of risk associated with taking assets out of service to any extent, though also an appreciation that maintenance work needs to take place. Across Gas Transmission, proactive management and communication of all physical works requirements and the potential commercial and physical impacts are considered. This is essential to ensuring the right decisions are made for our customers. If maintenance work is essential which increases the level of operational risk, a different approach may be developed with stakeholders and customers, to manage this risk effectively for the duration of the physical works.

82. In 2020/21 we managed several potential constraints, either proactively or in response to an emerging situation on the network:

- In April 2020, we responded to high LNG flows at Milford Haven by taking commercial actions between 13 and 21 April. Operational tools were used to move gas away from the area, with a pure LNG mix seen north of Manchester in an attempt to manage pressures. Lower than expected demands at key sites meant that use of commercial tools was necessary – Interruptible capacity was scaled back on 7 days and Locational Sell actions were taken on 5 days to manage the constraint. Buying back Firm capacity rights was considered less efficient in this situation due to the high levels of Firm capacity booked and therefore potential to incur significant costs without effecting the required physical flow change.

- In April 2020, we secured a turn-down contract for May to June to proactively mitigate a potential constraint risk at Milford Haven. The key factors contributing to the heightened risk included:

    - Periods of reduced capability due to planned maintenance (further exacerbated by low demands due to lower summer demand and COVID-19 lockdowns).

    - High LNG flows expected to continue (global lockdowns reducing Asian demand, and market price differentials driving UK deliveries).

    - A high level of Firm Entry Capacity bookings (increasing the likelihood of needing to buy back Firm Entry Capacity rights).

- From June to August, a considerable amount of constraint management work was undertaken to support a customer project which impacted the NTS. Teams across GT worked with the customer to manage the five week isolation of a 36km section of pipework, which presented an increased risk of entry constraints at an Entry Point. The work required capability analysis aligned with the project's physical works programme, and probabilistic risk modelling to determine the potential commercial risk. Physical optioneering and commercial mitigation options were explained and explored with the project team. A turn-down contract was ultimately put in place to provide mitigation throughout the outage duration. This work was undertaken on behalf of, and charged to, the customer project. A

primary objective for us throughout, was to mitigate any physical or commercial risk exposure to our wider customers.

- On 18 December 2020, commercial actions were taken to manage an entry capacity constraint at St Fergus. These actions were driven by three key factors: unplanned compressor outages; a significantly heavy market / over-delivery position going into the Gas Day, and an increase in aggregate St Fergus flows. The commercial actions taken were to scale back Interruptible capacity and withhold further Firm capacity sales on the day.

- In February 2021, we saw the highest demand day of 415 mcm (10 February) and an emerging entry constraint risk situation at Milford Haven. Whilst this day was managed solely through the use of operational tools, on 11 February a combination of higher LDZ demand, lower demand across the overall network and steadily rising pressures around the Milford Haven area meant that commercial intervention was needed. Locational bids were requested to ensure maximum pressure triggers were not reached, though end of day reductions at South Hook (of 8mcm) negated the need to accept bids or take further action.

- In March 2021, an entry constraint at Milford Haven was triggered by sustained high entry flows in excess of 80 mcm, compressor trips at Wormington and a heavy overall system. Commercial intervention was required on 20 - 24 March to manage the constraint. On this occasion, there was no Interruptible capacity to scale back or Firm capacity to withhold, so Locational Sell actions were taken on five days to manage the constraint. In order to maintain overall system balance, Secondary Actions were attempted by requesting offers from Shippers for Locational Buys on 21– 24 March. Offers were only received on 21 March and Locational Buys were taken on this day.

83. We continually strive to improve and maintain our customer relationships, and to support industry across all aspects of the capacity regime. Our aim is to help the Shipper community understand and participate in capacity auctions and provide them with a contact point for any capacity-related processes. Throughout the year, we used a number of different approaches as a means of raising awareness and offering support, all with the objective of managing network capacity in a more efficient way.

84. In 2020/21, we presented at several Operational Forums on capacity-related topics:

- In May 2020, we provided insight into the Constraint Management actions taken in April 2020 to manage high flows at Milford Haven. The presentation provided both general and specific information on how we manage constraints from both a physical and commercial perspective and the rationale behind the decisions made and commercial actions taken at the time.

- In September 2020, we provided information on how Shippers can mitigate against bidding errors in Gemini. The session highlighted the importance of entering correct capacity auctions data, clarified the consequences and the

process to follow should an issue occur, and reiterated the need to use Gemini bid validation parameters to mitigate the risk of erroneous data entry.

- In October 2020, we presented capacity updates relating to the introduction of the Charging Review (UNC0678A). These included Gemini system updates, queries received by the GNCC and NTS Capacity team, and a reiteration (from September) of the importance of using Shipper / User preferences in Gemini to mitigate bidding errors. We provided links to short-term auctions information to help customers understand the different products available and their associated bid and allocation windows.

85. In November 2020, we provided a reminder of all Entry and Exit Capacity auction timings alongside an update on improvements to Shipper Registration and User Management concerning the PRISMA system.

86. In January 2021, we covered three different topics:

- A reminder to Shippers of the short-term capacity product fundamentals with a focussed session on Interruptible Entry capacity. This was in response to receiving several Shipper queries regarding the declining availability of Interruptible capacity since the introduction of UNC0678A. We shared the key principles and methodology that determine the volume of Interruptible capacity release.

- A response to several queries around the volume and type of Bacton IP Entry capacity being offered, we explained the key principles surrounding the calculation and release of bundled and unbundled capacity.

- A focus on the proposed Gemini system changes relating to the pre-population of a minimum reserve price (to further mitigate bid errors), which were subsequently implemented on 11 and 18 April 2021. Also, a reminder of the future introduction of mandatory bid parameters in Gemini (UNC0745, “Mandatory Setting of Auction Bid Parameters”). This is due to be implemented on 1 October 2021.

87. In March 2021, we provided an update on the commercial actions taken to manage the entry constraint situation at Milford Haven, explaining the physical and commercial backdrop and rationale behind the decisions made.

88. We have also provided material relating to specific “interesting days” throughout the year. This has given industry the opportunity to ask questions and enhance their understanding of how and why we have used any commercial and operational tools to prevent and/or manage capacity constraint situations.

89. In addition to the Gas Operational Forum:

- On a daily basis, we provide support to customers on all aspects of capacity, via our email account and phoneline. We seek feedback as a means of continually improving the service we provide, ensuring customers’ needs have been fully

satisfied and that additional information is provided to further their understanding, where required. There was an increase in customer queries as a result of the UNC0678A decision, which required a number of more complex bilateral discussions and bespoke information provision.

- We have developed a constraint management educational pack, using this in presentations to the specific customers whose projects impact the NTS, to articulate how we manage the network at a high-level, and what a capacity constraint is. The pack explains how we forecast and manage a constraint situation, what the terms used mean, and tools employed are, and how decisions are made to limit the commercial risk whilst ensuring the overarching safe and efficient use of the network.

- We have continued to develop our Frequently Asked Questions (FAQ) document throughout the year, responding to customer query themes by expanding the content of this comprehensive go-to document. This is published on the National Grid website and we take opportunities such as Operational Forums, to raise awareness of this document with our customers. We continue to evolve the content as we receive further feedback, or where we identify a trend in topics being raised by our customers.

- We have enhanced our Capacity Customer Guidelines document by giving the document a refresh and adding more topics that we believe will be of interest to our customers.

90. During 2019/20, where we were made aware of a system issue with Gemini and/or Gemini Exit, which could prevent Shippers placing capacity bids in any of the numerous capacity auctions, we ensured that steps were taken to process auctions manually. More information on Gemini/Gemini Exit performance and our continued focus on delivering improvements for Shippers can be found in the Market Facilitation chapter.

Residual Balancing Incentive Scheme

91. The aim of the Residual Balancing incentive scheme is to incentivise our residual balancing activities in two ways:

- The Linepack Performance Measure (LPM) incentivises us to minimise differences in linepack volumes between the start and end of each gas day. This aims to ensure that any system imbalances within the day are resolved, and that any associated costs are levied across those system users responsible for that day's imbalance.

- The Price Performance Measure (PPM) evaluates the impact we have on the market in our Residual Balancing role by measuring the price range of our trading actions compared to the System Average Price (SAP). This incentivises us to minimise the impact we have on market prices.

92. For the LPM element for 2020/21 we achieved a daily average linepack performance of 1.5 mcm/d over the year, compared to the 2.8 mcm/d incentive target. This was slightly better than the level we achieved for 2019/20 which was, on average, 1.7 mcm/d. LPM was better than the target of 2.8 mcm/d on 311 days during the year (85% of days), an increase compared to 2019/20 (293 days, 80% of days).

93. For the PPM element we achieved an average price spread of 0.77% of SAP, compared to the 1.5% incentive target. This represented an increase in our performance on the 2019/20 value of 1.12%. We took residual balancing actions that enabled the system to balance on 201 days (55%) compared to 221 days (60%) in 2019/20. This represents a decrease in the number of days we entered the market to encourage balancing.

94. On the days we took balancing actions, the average price spread was 1.4%, compared with 1.8% in 2019/20 and 2.0% in 2018/19 which demonstrates an increased value to the customer despite a more challenging environment. As we continue to meet our customer requirements in a more volatile market, we continue to trade more frequently than in earlier years in RIIO-T1 to provide the same level of service. The NTS now accommodates much wider imbalances in supply and demand during a gas day, presenting a more challenging environment for Residual Balancing to operate efficiently in.

95. We continue to engage with Shippers to try and understand their own balancing drivers with a particular focus on the weekend and bank holiday periods where we see an increase in shippers leaving an imbalanced position.

96. There were a number of challenging days throughout the 2020/21 period. For example, on 7 February 2021, Shippers were 12.8 mcm light resulting in a 9.7 mcm loss in Linepack after residual balance action. Despite National Grid setting SMP Buy at 6.8 pence per therm (p/th) above SAP (51.2p/th) there was a limited reaction from the market. This is thought to be caused by the lower than forecast temperatures and as 7 February was a Sunday, Shippers provided less response day ahead and within day than perhaps would be expected compared to a weekday.

97. For more information on supply, demand and shipper behaviour during February please refer to the Ops Forum material at the following link.
February Forum 2021 - Gas Ops Forums - National Grid Gas Operational Data Community

Demand Forecasting Incentive Schemes

98. The national demand forecasts published by National Grid for day ahead (D-1) and for two to five days ahead (D-2 to D-5) are a key tool for the UK gas industry in ensuring the economic balancing of gas supply and demand. The provision of timely and accurate demand forecasts aid in ensuring efficient operation from both a physical and commercial perspective, ultimately reducing operating costs which directly impact on end consumers gas bills. National Grid strives to continually

optimise its forecasting processes, to deliver greater accuracy and increased consumer benefit.

99. From a demand forecasting perspective, 2020/21 proved to be a challenging year as the global pandemic struck leading to changes in gas demand usage. The various lock down variations between England, Wales and Scotland added further to the complexity of the forecasts.

100. Power Station gas usage continues to be volatile with changeable renewable generation being a direct factor on our demand forecasts. New sources of electricity generation from the greater availability of renewables, to the increasing capacity and number of our electricity interconnectors, has had a significant impact on typical gas for power requirements. This has made calculating gas demand for power more challenging.

101. These factors have resulted in the day-on-day average change in demand remaining high but decreasing slightly to 12.67 mcm from 13.79 mcm in 2019/20, with 11 days this year showing a greater than 40 mcm change from the previous day (18 in previous year). The most extreme of these daily demand changes was 71.8 mcm compared to 65.86 mcm last year.

102. In 2020/21, the weighted average error on the D-1 incentive was 8.20 mcm against a target of 8.83 mcm (fixed target of 8.5 mcm + storage adjuster of 0.3297 mcm). The weighted average error has decreased this year from 8.56 mcm in 2019/20. The associated incentive revenue for 2020/21 is £1.11m.

103. D-2 to D-5 incentive weighted average error was 13.52 mcm in 2020/21 against a target of 13.70 mcm. The weighted average error has increased from 12.91 mcm in 2019/20. The associated incentive revenue for 2020/21 is £0.13m, compared to £0.58m in 2019/20.

104. Throughout the year we have embarked on several activities to drive improvements in the accuracy of our demand forecasts, including:

- Ongoing staff development and process improvements to improve both demand and supply forecasting.
- Automation of processes where possible to save time and prevent data errors.
- Enhanced process to track Remit sites and assess impact of future maintenance.
- The continuation of the project to develop demand forecasting models inhouse to enable ongoing agile development of algorithms in reaction to the changing energy markets.

Operating Margins

105. We are required to procure our Operating Margin (OM) service requirements on an annual basis in accordance with TPD Section K of the Network Code, the obligations set out in National Grid's gas transporter licence, and the obligations detailed in the National Grid's Safety case.

106. The OM service may be used in the intermediate period following operational stresses to allow market actions to take effect and during the potential run-down of the system in the event of a Network Gas Supply Emergency. There was no OM service utilisation during the 2020/21 incentive year. The OM service was last used in March 2018.

107. All costs incurred for the procurement and utilisation of the OM service are cost pass through in accordance with our Licence obligations. Under the RIIO-T1 and RIIO-T2 regimes, we have a reputational incentive to promote competition in the procurement of OM services for our customers. We aim to meet the OM requirement in the most economic and efficient manner.

108. OM service procurement costs increased from £7.1m for the 2019/20 incentive year to £8.92m for the 2020/21 incentive year. This was primarily driven by a higher OM volume requirement for 2020/21 (699 GWh for May 2019 – April 2020, increasing to 841 GWh for May 2020 – April 2021). On a unit price basis, the increased cost was modest, from approximately 1.02 p/kWh in 2019/20 to 1.05 p/kWh in 2020/21, and this was partly due to an increase in locational OM volume requirements.

109. We continue to focus on stimulating a more competitive market response, through industry engagement to identify and secure new service providers.

110. Key deliverables achieved as an output from the 2021 procurement event for the OM service year 2021/22 include:

- Any contract deviations from our standard conditions (as a result of specific site characteristics) were required ahead of the tender submission date. This provided additional time for contract evaluation and for further clarifications / negotiation where required.

- Through industry engagement, we received an increase in the number of sites who offered the service, and one service provider re-entered the market. Most notably however was the increase in tendered volume at storage sites, which increased from 403 GWh in 2020/21 to 1,436 GWh in 2021/22[7]. This was mostly due to an increase in volumes tendered by third party providers at these sites.

[7] Figures exclude duplicated volumes

- As in 2019/20, 54% of our requirement was met by demand reduction; and reflects the continued high level of competitiveness in this area. Of the remainder, 35% was met by Storage and 11% by LNG.

111. We continue to engage with current and potential market participants with the aim of maximising competition. Whilst tender volumes and number of sites offered remains high, we still see some potential for further competition.

VI. Outputs – Environment

112. As one of our key outputs under RIIO-T1, minimising the impact our business has on the environment is important both to us, and our customers.

113. In 2020/21 we have made good progress against our environmental outputs outlined in Table 5. Despite an increase in the utilisation of the compressor fleet from 2019/20, we have outperformed against our GHG emissions target and reduced natural gas vented from compressors by 6%. 2020/21 represented the lowest volume of natural gas vented from compressors in the RIIO-T1 period. We have reported appropriately on our Business Carbon Footprint. The delivery of works at Peterborough and Huntingdon has been subject to delay due to the impacts of COVID-19 and negotiations that has led to the recent mutually agreed exit from the contract with the provider. We have appointed a new MWC and developed a new programme for delivery to meet our IED legislative obligations at both sites. Further information about IED and works at our compressor stations can be found in Section XI. Non Load Related Capital Expenditure.

Emissions

114. IED has been in force since January and February 2013, in Scotland and England/Wales respectively. We updated our plan to comply with this legislation and has been incorporated into our RIIO-T2 business plan. We report on progress within Section XI.

115. In addition to IED, the Medium Combustion Plant Directive (MCP) was transposed into UK legislation in December 2017 and January 2018 in Scotland and England/Wales respectively. As part of these changes in UK legislation, the derogation for gas driven compressors has been extended until 31 December 2029 from the original 2025, in part influenced by National Grid lobbying EU stakeholders.

116. The MCP Directive applies to the smaller gas compressors and affects 27 of the NTS compressor units, with a compliance date of 2030. Other combustion plants, such as pre-heat systems, are also captured as part of this Directive with a compliance date of 2025. The investment strategy plan for RIIO-T2 is now underway as agreed.

117. In 2020/21, compressor utilisation has increased by 50% compared to 2019/20, and is a direct consequence of changes in supply patterns across the network (further detail can be found in Section II. Operational Context). Consequently, we have seen an increase in CO2 emissions from gas turbine powered compressors of 76%, and also an increase in NOx emissions by 43% from 2019/20 levels. The change in NOx performance is also due to the increased utilisation of gas turbines and decrease utilisation of electric drive compressors (from 38% to 19% of the overall hours).

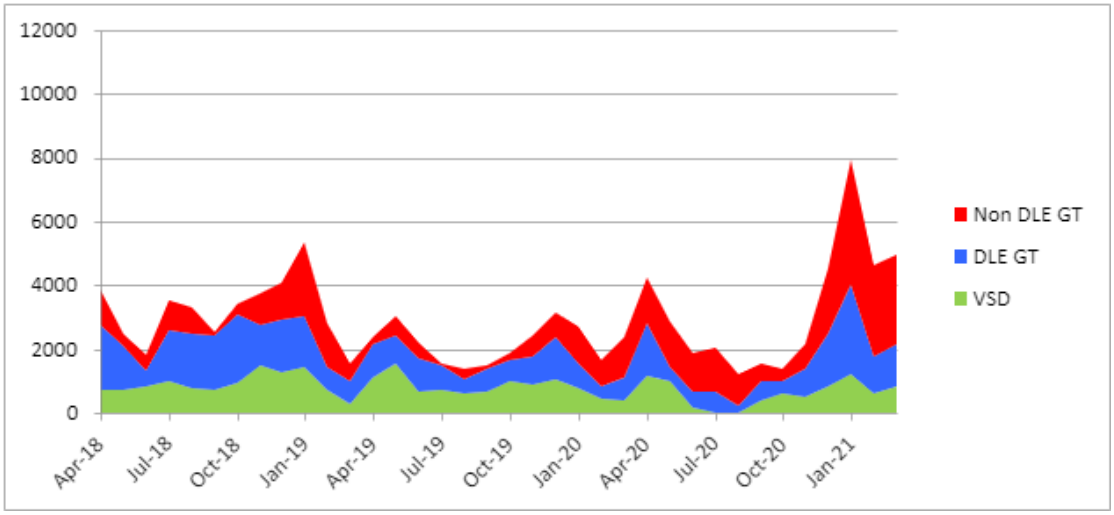

Figure 5: 2018 to 2020 Utilisation by unit type - Non Dry Low Emissions Gas Turbine (Non DLE GT), Variable Speed Drive (VSD), Dry Low Emission Gas Turbine (DLE GT), hours

Business Carbon Footprint

118. 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 80% by 2030 based on 1990 levels. Our baseline emissions level was set, at group level, at 21.6m tonnes of carbon dioxide equivalent. We have achieved a group reduction of 68% against our 1990 baseline. In the longer-term we have targets to reduce our GHG emissions by 90% by 2040 and net-zero by 2050.

119. Scope 1 and 2 emissions in Gas Transmission can be broken down into sources including compression, venting, leakage, buildings and transport. Scope 3 emissions are from business transport only.

120. Most of the emissions in Gas Transmission are from fuel use in gas and variable speed driven electric compressors. Emissions from compressor stations are largely dependent on the locational balance between supply and demand conditions, driven by market forces.

121. Scope 1 emissions have increased from 185 KTCO2e in 2019/20 to 278 KTCO2e in 2020/21. Most of the increase is due an increase in gas-fired compressor usage from 127 KTCO2e to 223 KTCO2e, which is due to a 96% increase in gas turbine utilisation. Scope 2 emissions have fallen, from 45.4 KTCO2e to 33.3 KTCO2e, due to a reduction in building electricity usage including electric drive compressor usage. Scope 3 emissions have fallen from 2.5 KTCO2e to 0.07 KTCO2e in 2020/21, due to COVID-19 restrictions reducing emissions from business travel.

122. We provide our annual emissions performance as part of our Carbon Disclosure Project (CDP) submission. This enables us to benchmark our performance against other organisations. In 2020 (for 2019/20) we achieved an ‘A’ rating for our CDP climate change submission, putting us in the top 3% of global companies

recognised for our actions to reduce emissions and mitigate climate change. This is the fifth consecutive year we have achieved this A rating. We also retained a Supplier Engagement Rating of 'A' recognising our supply chain leadership around climate-change.

123. Our Greenhouse Gas (GHG) inventory, measurement, data collection, aggregation and reporting processes are verified by an independent third-party providing assurance of relevance, accuracy, consistency, transparency and completeness.

Shrinkage Incentive Scheme

124. The aim of the Shrinkage incentive scheme is to minimise the costs we incur in our role as NTS Shrinkage Provider. These costs are recharged back to users as part of general non-transmission (commodity) charges.

125. The overall volume of shrinkage gas and electricity procured for the combined elements of Shrinkage (Compressor Fuel Usage (CFU), Unaccounted for Gas (UAG) and calorific value (CV) shrinkage) was 4,754 GWh gas equivalent in 2020/21. This represents an increase in overall volume of 218 GWh gas equivalent from 2019/20. This is due to an increase of 409 GWh gas equivalent in the volume of CFU, and 179 GWh in the volume of CV shrinkage, outweighing a decrease of 371 GWh in the volume of UAG. (This is pre-reconciliation UAG, which includes some energy that is reconciled to particular users after close-out - refer to the UAG Incentive section for further detail).

126. The volume of CFU was 36% higher than in 2019/20. Although annual NTS demand was similar to the previous year, compressor use is primarily driven by the supply/demand patterns presented by the market, which vary year-to-year, and different compressor units at different sites have different efficiencies in relation to CFU. Compressor use was particularly high in January 2021, with high supplies at Bacton, and high NTS demands driven by cold, still weather. We continued to manage the operation of electric units over periods of peak electricity demand to reduce Transmission Network Use of System charges (often referred to as Triad charges).

127. CV shrinkage volume was over four times higher than in 2019/20, although this component remains a relatively small part (around 5%) of overall shrinkage. This was caused by frequent occurrences of CV capping in the North and North-East LDZs, where gas of different calorific values (i.e. energy contents) from different entry points converged, and some energy associated with the gas of higher calorific value could not be billed. No practical mitigation was identified to prevent this happening. UAG volume was 11% lower year on year, which is presented in more detail in the section below.

128. In energy procurement for 2020/21, we bought our full long-term forecast requirements for gas and electricity in forward markets (aligned to the incentive principle of managing price risks for customers). We constantly reviewed our position against the market and achieved lower overall cost than target. We completed EU Emissions Trading Scheme (ETS) compliance for 2020 for gas

compressor emissions and sold surplus allowances at a higher value than purchased earlier in year, to return the difference of £148k to the customer.

129. In managing the NTS Shrinkage incentive scheme we incurred costs of £67.7m, including £51.6m for gas trades and £12.6m for electricity trades. This is lower than costs for 2019/20 (£80.1m in 2019/20 price base), with lower overall market prices outweighing higher volumes. Against the total incentive target of £76.4m, this represents a £8.7m outperformance, 55% of which is passed to customers.

Unaccounted for Gas (UAG)

130. UAG is a reputational incentive with a requirement to undertake projects and initiatives to investigate the causes and reduce sources of UAG, defined in Special Condition 8E of the Gas Transporter Licence in respect of the NTS during the RIIO-T1 period.

131. UAG continues to be reported as post-reconciliation UAG, to provide a more accurate quantification of UAG. This is calculated using closed-out corrected measurements after meter or data errors have been detected and reconciled. Please note; due to these UAG values being reported as post-reconciliation UAG, they will differ to the Shrinkage RRP Tables which use pre-reconciliation UAG values.

132. The annual UAG energy has decreased from 3,378 GWh in 2019/20, to 2,929 GWh in 2020/21, which is a 13% reduction. Although lower than last year, this is historically high compared to earlier years in RIIO-T1 and this is a similar trend to the high UAG that has been observed in the 2019/20 winter period. Both experienced an increased frequency of positive UAG days when compared to previous years, although the magnitude of high UAG was lower in 2020/21.

133. We review and investigate high UAG, paying particular attention to days where UAG exceeds ±20 GWh. During 2020/21 there were 65 days that exceeded the ±20 GWh tolerance, which is 20 days less than 2019/20. National Grid manage projects to investigate and build analytical tools to identify the causes of high UAG and UAG trends. So far, using correlation analysis across all site types connected to the NTS, no significant correlation has been identified between UAG and site measurements.

134. We have carried out 38 reconciliations during 2020/21, adjusting 869 gas days which equated to a net energy of -88 GWh. This negative net energy had reduced UAG and total Shrinkage. Most of these reconciliations adjusted the 2017/18, 2018/19 and 2019/20 periods with a minimum and maximum energy spread of -27 GWh and +11 GWh respectively. In 2019/20, we carried out 20 more reconciliations, but these equated to a lower net energy of -9 GWh due to a different energy spread.

135. In 2020/21, we have continued to look at ways to improve our UAG management and performance, the main focus areas have been:

- Continued development of internal after the day processes and system data, visualisation tools to improve the data validations within the Entry and Exit close out periods, which improve the ability to identify erroneous data; and
- UAG projects using data science to further investigate the high UAG trends that have been observed; and
- Maintaining a close relationship with all meter asset owners and validation agencies, providing a consistent approach to receive metering system validations and to solve measurement issues.

136. This year we received 99.9% of the meter validation reports for all the NTS entry and exit points, which is comparable to what we received in 2019/20. These validation reports have been reviewed, and where necessary, queries raised with the asset owners. For any sites that had equipment failure, were close to failure or are of particular interest we plan to include them in the 2021/22 witness schedule. We acknowledge that it may not be possible to witness validations due to the working arrangements being imposed as a result of COVID-19, however, we will continue to work with the meter asset owners to assess as the current situation progresses.

137. We have continued to improve the accuracy of the data. Understanding the end to end data flows through our physical and commercial systems has helped gain a greater level of confidence in the system measurements within the entry and exit close out periods. Review of system calculations such as Linepack, improving data models, understanding the variables that can cause UAG and utilising data science are within the next phase of the UAG project.

138. We have participated in a global UAG benchmarking exercise with a number of Network Operators to help improve the overall understanding of UAG and its causes. We have received the other TSO's findings which will be compared to our own UAG behaviours and management.

Greenhouse Gas Emissions Incentive (GHG)

139. The aim of the GHG incentive scheme is to incentivise National Grid to reduce the amount of natural gas vented from our compressors (primarily methane), and to reduce the effect of our operational activities on the environment. This is important both to us, our customers and stakeholders.

140. The emissions allowance is set each year by Ofgem, the allowance for 2020/21 was 2,897 tonnes, for each tonne of natural gas vented over the allowance we are subject to a price and cost payment, which is based on our NTS GT Licence formula using the latest non-traded carbon reference venting price published by The Department for Business, Energy and Industrial Strategy. For 2020/21, this

price was £1,496 per tonne of natural gas vented, this is an increase of £8.60 or 0.57% from 2019/20.

141. Compressors are used to increase pressure in parts of the National Transmission System (NTS) and to move gas from the sources of supply to areas of demand. To undertake this activity to deliver customer requirements, we will select the Best Available Technology (BAT) in accordance with the Industrial Emissions Directive (IED).

142. The need to operate an individual compressor on any given day is dependent upon several variables, including the sources of demand and supply, the prevailing network conditions and the need to accommodate maintenance and construction plans.

143. The total amount of natural gas vented from compressors in 2020/21 was 2,342 tonnes, which is 81% of the target allowance. This is a decrease of 6.36% compared to the total amount of natural gas vented from compressors in 2019/20, and the third year running that we have not exceeded our allowance. The average venting through compressors in the RIIO-T1 period including 2020/21 is 3038 tonnes, with a maximum venting of 3928 tonnes (2017/18) and a minimum of 2,342 tonnes this year.

144. Although the volume vented has reduced there has been an increase in the within-day and end-of-day variability flow patterns and less steady state operation, which in turn can lead to changing/additional compressor use.

145. Despite an increase of 50% in compressor running hours, the volume vented decreased from 2019/20 with a continued focus across our business to reduce compressor pressurisation and venting. This has been achieved by aligning, where possible, maintenance outage periods following operational requirements to make best use of the gas held within the compressor. This co-ordination of maintenance and testing work helps bundle work wherever possible to minimise the need to pressurise and vent.

146. The GHG emissions calculation methodology for calculating the mass of Natural Gas vented will be verified by an Independent Examiner and will be submitted to the authority by 31 July 2021.

147. The Network Innovation Allowance (NIA) funded project Monitoring of Real-time Fugitive Emissions (MoRFE) which came from the successful delivery of Special Conditions 8J and 3D.47, Greenhouse Gas Investigative Mechanism (GHGIM) was completed at the end of March 2021. The project was subject to extension due to COVID-19 controls preventing access to operational sites during 2020. The project has provided a solution for improved imagery and quantification of fugitive leak detection including venting, investigated alternative cost-effective materials and components, gas detector sensors and refinements to the original sampling methodology have been made.

148. All three field trials were completed; two at compressor stations and one at a gas terminal. Savings were identified in the materials of the reference Fugitive Emission Detection System (FEDS) as were improvements to the sampling methodology. The low-cost gas sensors, which were tested in comparison to the reference monitoring system, have been shown not to be a suitable alternative to the high cost fast response methane analyser in the reference system but could be used to widen the size of installation that the FEDS could be installed. For example, the FEDS on its own could not be installed on a gas terminal due to the size of the installation but the use of the low-cost sensors makes this possible.

149. The MoRFE project also reviewed new to market lower cost Optical Gas Imaging (OGI) camera technology for detection of specific leaking components and designed and built a test rig from replaced gas transmission assets for proficiency testing of equipment and personnel undertaking leak detection surveys.

150. National Grid has extended the fugitive emission monitoring using the FEDS at Bacton gas terminal for a period of six months (until the end of October 2021) to transition use of the system into business as usual leak detection and repair processes. During this period we are also reviewing the market place for alternative FEDS and OGI camera's which have been developed in the last two years prior to roll out of a FEDS system and use of OGI across NTS compressor stations and terminals in the RIIO-T2 period.

VII. Outputs – Customer Satisfaction

151. The RIIO-T1 price control recognised the need to encourage network companies to respond to the changing requirements of an evolving customer base and develop strategies to drive improvements in customer and stakeholder satisfaction.

152. Our customer satisfaction output is supported by two separate financial incentives:

- customer and stakeholder satisfaction survey; and
- stakeholder engagement incentive scheme.

153. This year saw an unprecedented step change in how organisations engage and serve their customers and stakeholders, due to the impact of COVID-19. Overall, our response rate for the year fell back to 38% for both CSAT and SSAT from 49% and 56% respectively, in the previous year. However, we were able to target a slightly broader range of customer contacts due to our focused virtual events this year, such as the Future Use of Our Gas Transmission Network. This meant that the overall response volume only dropped by a small amount from 91 in 2019/20 to 84 this year.

154. In 2020/21, we achieved a customer satisfaction score of 8.17 against a baseline of 6.90. This has increased by 0.17 since last year's score of 8.00 and we have achieved a steady year on year increase in customer satisfaction since 2017/18, whilst continuing to engage a broad range of customer contacts, across nine separate service areas.

155. Our focus on the customer experience in RIIO-T1 has helped us to improve our Customer Satisfaction from 7.15 at its start, to 8.17 at its close. The RIIO-T1 CSAT question focused on how each customer felt about gas transmission generally, whilst RIIO-T2 CSAT will focus the scoring against specific service experiences, so that we can continue to target what really matters. We will also offer an opportunity for the customers who need a variety of services from us to provide a score for each during the year.

156. The stakeholder satisfaction score was 8.42 against a baseline of 7.40, an increase of 0.02 from the 2019/20 score of 8.40. We have been able to maintain the increase made in 2019/20, despite the challenges of maintaining engagement levels through the COVID-19 restrictions.

157. We received increasing scores in six service areas for both customers and stakeholders from 2019/20. The area that received the highest material increase (>10 responses) in Customer Satisfaction since last year was Market Change which scored 7.95, an increase of 0.45. The customer feedback highlights we delivered a greater transparency and responsiveness than before in this particular area. The score for Connections and Diversions increased for a second year in a row to 8.60 from 8.41 last year. Feedback highlights communication as the key driver. The highest increase in Stakeholder Satisfaction has been linked to our virtual events, in particular the Future Use of our gas network which yielded 8.54,

compared to an average score of 8.00 across all events last year. The feedback highlights open discussion, communication skills and listening capabilities as the key drivers.

158. Due to the success of our sprint approach in 2019/20, we continued to focus on specific areas where we were losing the most satisfaction points. This year we paid particular attention to Market Change processes and practices, along with our first joint customer journey with Xoserve, which delivers a number of commercial services on our behalf. The former achieved its highest annual score yet at 7.95, up from 7.50 last year for CSAT, and 8.40 up from 8.26 last year for SSAT. Both customers and stakeholders who scored >8 cited our speed of response as a key reason for their score. We are expecting the Xoserve journey will start to show a positive impact through the next year.

159. We have continually focused on getting the basics right, keeping in mind our customer principles which encourage us to act with Care, Agility, Trust, Transparency and Value in mind. We decided to discontinue asking customers and stakeholders to rate us against these five principles to keep the survey as short and succinct as possible during this challenging year. However, the feedback they have provided continues to map back to these themes and although they were originally born from negative feedback, we are now seeing these mentioned in a positive way, accompanying scores of 9 and 10. In the last three years of this RIIO-T1 period, we have increased the proportion of scores of 9 and 10 received from 35% to 46%.

160. During 2020/21 we started to embed the new processes and behaviours needed to fulfil our stakeholder engagement strategy, that was developed in the previous year. This focused on the processes associated with annual stakeholder led business planning and Key Account Management (KAM) of those stakeholders who had multiple touchpoints across our UK operations. We also commenced building the foundations needed to more effectively manage the increasing amount of stakeholder data required to fulfil our stakeholder commitments in RIIO-T2. This focuses on developing the enabling systems and a data domain dedicated to customer and stakeholder to help us both capture the data accurately and interpret and understand it through analysis.

161. When we launched our Customer Experience strategy in 2018/19, our Customer Satisfaction was at 7.79. Our focus on what particularly matters to customers in their feedback in terms of specific service areas (e.g. Market Change) and a general way of working (e.g. Query Management) has yielded a CSAT score of 8.17 at the end this RIIO-T1 period. This is a significant increase from our starting position in 2013/14 which was 7.15.

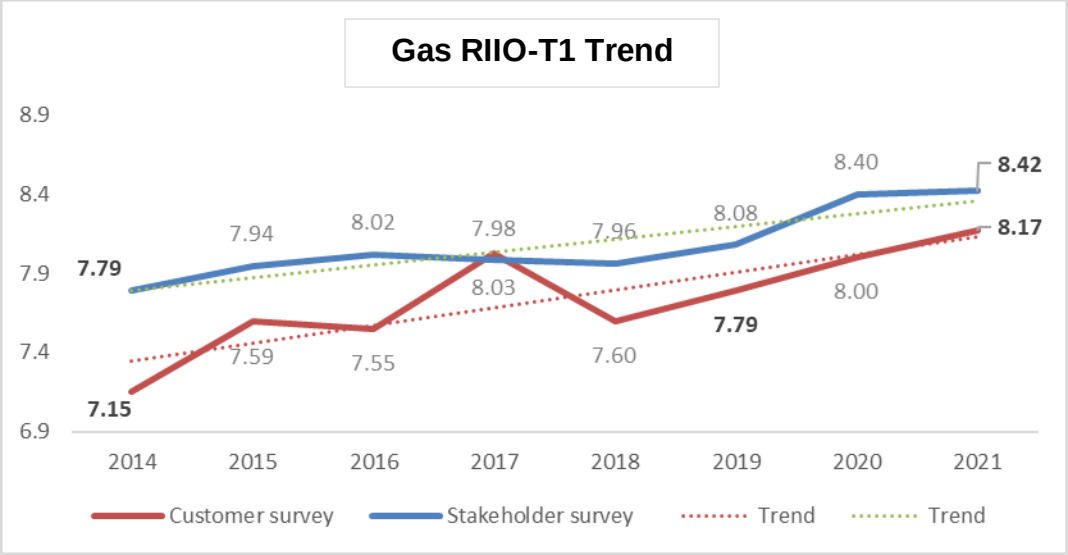

Figure 3: Survey score progression through RIIO-T1

162. We have just completed the fourth year of the Net Promotor Score (NPS) programme, however due to the challenges of COVID-19 we decided to postpone our Net Promotor Survey (NPS) this year to April, aligning it with the start of RIIO-T2 period. The purpose of this survey is to help us understand how we can continually improve our senior customer relationships in a strategic context. Early indications show that the engagement is still seen as extremely valuable, however more needs to be done on proactive communication, speed of response and finding better ways of working across departments, to help customers manage their own portfolios of work more efficiently. All of which will be focus areas in our year ahead plans.

163. As many studies have proven, the employee experience is inherently linked to the experience we provide our customers. Our NPS programme has helped provide an additional channel to listen to our employees in relation to their experience. In 2020, listening to employees took a change of direction when, like so many other businesses, our ways of working changed to cope with the pandemic. The majority of our employee base switched to working from home for the entire year, whilst our construction and control centre teams stayed on site, working with additional layers of safety measures. It was important to track how this was affecting our employees both from a well-being perspective and in terms of being enabled to perform their role. A collaboration between our HR, Customer Analytics (Voice of the Customer surveying and analysis) and Internal Communications teams launched a series of pulse style surveys to help shape and adjust the communications everyone needed and identify where help was required in terms of wellbeing support and tools for the job - from connectivity to PPE. This approach was largely born from a way of working adopted as part of our Customer Experience programme **– Listen, Understand, Act.**

Stakeholder Engagement Focus Areas

164. The challenges of COVID-19 from an engagement perspective, has pushed us to try new ways of engaging and to move almost exclusively to digital platforms. We found stakeholders were more able to participate in engagement due to the reduction of travel time and so, by taking advantage of all the new channels and developments, we were able to have more conversations and collaborate with more stakeholders than would have been previously possible. This is something we need to carefully consider as we move back into office working.

165. Following the success of delivering a stakeholder-led business plan for our RIIO-T2 submission, we embedded many of the processes and learnings into our BAU stakeholder engagement. A key learning relates to moving the ownership for stakeholder engagement to sit within our teams, with expertise and coaching provided by a central team. This has led to more engagement across more topics than ever before.

166. Following the publication of the RIIO-T2 Draft Determinations, we engaged extensively with stakeholders via webinars and 1-1s to help understand and articulate the impact.

167. We also undertook extensive market research to understand the implications of COVID-19 on consumers and to see if there had been any shifts in their priorities. We identified that consumer priorities hadn't really changed, with reliability still ranked number one. We have seen a slight shift towards affordability, specifically supporting the vulnerable.

168. For the first time, we formalised our annual engagement which aims to be a focal point for stakeholders, testing our priorities are still delivering what they need whilst providing an opportunity for them to engage on topics across our entire business. Over a five-week period, we held 13 targeted and tailored webinars covering 17 topics. Conversations were continued via LinkedIn community groups or one-to-one engagements. We closed the loop, demonstrating how we've acted on feedback, including our stakeholder priority refresh, via our 'closing the loop' newsletters.

169. During the course of 2020/21, we've transitioned the Independent User Group from their initial role, scrutinising and challenging the development of our RIIO-T2 business plan, to one with a focus of holding us to account in delivering the business plan commitments. This includes monitoring delivery, enhancing transparency and being a critical friend for strategy, culture and processes.

VIII. Outputs – Customer Connections

170. Delivering timely capacity and connections to our customers is a Licence obligation and key output under RIIO-T1. In 2020/21, we received six new NTS connection applications. There were seven further customer applications that were carried over from the previous year and were due to have a Full Connection Offer (FCO) made in 2020/21.

171. Under this output our performance can be split into two main areas:

- the Connection Application to Offer (A2O) process[8]; and
- the Planning and Advanced Reservation of Capacity Agreement (PARCA) process and the delivery of incremental capacity.

The NTS Connection Application to Offer (A2O) Process

172. In total, there were six NTS connection applications received within the A2O process during 2020/21.

173. Of the six applications made, four were for exit connections and two for an entry connection. One application is not yet deemed a Competent Application, per UNC.

174. Of the five competent applications received, one FCO was not due within this period and has been carried over to 2021/22. One application was not progressed by the customer.

175. The remaining three applications had FCOs made in the period, along with seven FCOs made for applications received previously. There was one application which was withdrawn by the customer ahead of the FCO being made and is therefore not included in our data.

176. In 2020/21 we issued ten FCOs within the timescales set out in the UNC.

177. Of the ten FCOs issued five offers were accepted and have progressed to detailed design and construction. Of the remaining five, two have lapsed and three were agreed extensions to signing with the customer.

[8] Details of the NTS Connection Application to Offer (A2O) process can be found at the following link.

Connection Applications		Offers made in 2019/20	
Received in 2019/20	10	Offer accepted	4
		Carried over to 2019/20 (including one ongoing from 2018/19)	7
Received in 2020/21	6	Applications not progressed	1
		Offers accepted	5
		FCO Extensions	3
		FCO Lapsed	2
		FCOs not made Application carried over to 2020/21	2

Table 6: Summary of the NTS Connection Applications and Offers

178. COVID-19 and the uncertainty in the market has slightly impacted the number of applications received compared with the previous year. However, we have adapted and continued to meet our obligations to make A2O and PARCA offers.

179. Following the commissioning of a self-lay connection project, we are continuing to review the lessons learnt from the trial to establish the necessary processes and standards required to allow self-lay as a future option for project developers.

180. During 2020/21, we have commissioned the connection of the first bio-methane site to the NTS at the Murrow offtake. As this was a trial site, we have carried out a lessons learnt exercise and there are a number of process and policy enhancements we are planning to progress based on this experience and customer feedback.

Disconnections

181. In 2020/21 we received two new applications for disconnection and have continued to progress one disconnection application received in 2018/19. We are in discussions with a number of customers regarding changing the use of their legacy connection or requesting to disconnect from the NTS, which demonstrates the changing nature of customer's requirements.

Future Connection Requirements

182. We have continued to work with our customers and stakeholders to understand their future connection requirements. An example from this year involved the connection of a customer with a low flow requirement, where we worked with them to understand how we could better meet their needs by offering flexibility in the

design and installation where possible and moving away from our existing policies, which were developed and applied to a more traditional NTS gas connection customer.

183. During 2020/21 we have continued to embed and publicise the new Gas Connections Portal and work with customers to find more efficient ways of them connecting to the NTS. We now have 81 potential customers registered to use our portal and are planning to make further investment in this during the RIIO-T2 period to reflect customer feedback gained from our engagement and a survey of users.

184. Based on feedback received during 2020/21, we hosted a Gas Connections webinar in May 2021, along with the Future Grid project, to gain more insight from our potential customers on their changing needs and what they value. There was good participation during the webinar and we will use the feedback received to build on our planned improvements and look to deliver more efficient and effective engagement and connections for our customers.

185. We continue to engage with the ENA and the Entry Customer Forum to encourage more green gas connections onto our network in support of the pathways to Net Zero.

186. This year we received a number of enquiries from customers interested in future connections for hydrogen production projects, wishing to use natural gas to produce hydrogen, and are in discussions to understand their needs and any changes required to accommodate these onto the NTS in future.

Figure 4: New and first Biomethane connection to the NTS at Murrow offtake

Incremental Capacity and PARCAs

New PARCA Applications

187. No PARCA applications were received in the 2020/21 formula year.

New PARCA Reservations

188. There was one PARCA application, Grain North PS, received in the 2019/20 formula year, for which Enduring Annual NTS (Exit) Flat Capacity was reserved on 26 May 2020. On 1 October 2020 this capacity reservation was reduced in quantity at the request of the PARCA Reservation Party. On 8 January 2021 this capacity reservation was put back to 1 May 2022, again at the request of the PARCA Reservation Party.

189. This exit capacity was originally proposed to be provided for through Non-obligated Exit Capacity followed by Non-incremental Obligated Exit Capacity provided for by exit capacity substitution. With the variation on time, the exit capacity is proposed to be provided for only through Non-incremental Obligated provided for by exit capacity substitution.

PARCA Allocations

190. One PARCA application received in financial year 2018/19, Saltholme PS, had Enduring Annual NTS (Exit) Flat Capacity allocated on 18 May 2020. This exit capacity was provided for via the release of three months of Non-obligated Exit Capacity from June 2020 to September 2020, followed by Non-incremental Obligated Exit Capacity provided for by exit capacity substitution from 1 October 2020.

PARCA Offers Withdrawn

191. One PARCA offer made in the previous formula year 2019/20, Tilbury Marshes PS, was withdrawn on 20 May 2020.

PARCA Terminations

192. There were three PARCA terminations during the 2020/21 formula year. These were:

- Keadby PS – terminated on 1 May 2020.
- Ferrybridge D – terminated on 13 May 2020.
- Medway PS - terminated on 22 May 2020.

193. None of the PARCAs above were proposed to be satisfied through the release of Funded Incremental Obligated Exit Capacity.

PARCA Applications received or offers made in Financial Year 2019/20			
Application Received	4	Offers made	0
		Offers signed	0
		Offers withdrawn	1

Table 7: Summary of the PARCA Applications and Offers

IX. Totex (TO and SO)[9]

194. In 2020/21, our Totex spend was £356m compared to £416m last year. The year on-year change is predominantly associated with the TO:

- Baseline Capex decreased by £26m, primarily due to a reduction in asset health spend £12m, load related £6m, other capex (including Emissions) £6m and Non Operational Capex £3m.
- Uncertainty Capex has decreased by £35m, primarily due to decreased spend on Asset Health and Other Capex (Security Resilience).
- Controllable Opex has increased by £7m, primarily due to an adjustment for IAS 19 pension accrual in 2020/21 £22m, offset by a decrease in Business Support costs £8m, Planned Inspections £5m, Closely Associated Indirect spend £1m, Faults £1m, Other Direct Costs £1m.

195. Our actual spend for the eight years is £3,240m compared to allowances of £2,988m. We have restated RRP Table 2.4 to align allowance with spend categorisations. This impacts TO Non Load Related Capex and TO Opex, SO Capex and SO Opex. The adjustments are a recategorisation only and do not alter Totex spend or total allowances.

Overview Transmission Owner (TO)

196. The TO total Totex for the eight years is £2,451m compared to an allowance of £2,098m.

197. In comparison to the 2019/20 Table 2.4, our spend has decreased by £20m overall and our adjusted allowances have decreased by £4m. The key changes to our allowances and the spend changes are listed below:

Allowances:

- In 2019/20, following Ofgem's decision on the needs case, the forecast additional IED allowances for Hatton was £9m where in advance of any decision from Ofgem, allowances were set as equal to spend. This has since been adjusted in 2020/21 to £6m expected through the RIIO-T1 Close-Out process, as referenced in the RIIO-T2 Final Determinations document.
- There has been no change to the allowances forecast for Pipeline Diversions of £12m.
- Our forecast allowances for Security Resilience include a return of £25m but a request for an additional £7m which is a net return of £18m. This broadly aligns to 2019/20.

[9] All numbers in this section are in 2020/21 price base unless otherwise stated

- The allowances for the enhanced physical security upgrade programme, granted in the 2015 Reopener process have been divided between 85% Uncertain Other Capex and 15% Controllable Opex as stated in the Reopener Decision. Thus forecast allowances include a transfer of £33m from Opex to Capex aligned to 2019/20.

- There have been no changes to forecast Quarry & Loss allowances since last year's submission.

Spend:

- Baseline TO Capex spend over the eight-year RIIO-T1 period has reduced by £33m. This is due to reductions in asset health £25m and Emissions £15m, offset by Non Operational Capex £5m and Pipelines £1m.

- Uncertainty TO Capex spend has increased by <£1m, primarily related to Load Related Capex £3m and Asset Health £1m, offset by Other Capex £4m.

- Baseline TO Total Controllable Opex spend has increased by £12m which is primarily due to an adjustment for IAS 19 pension accrual £23m, together with increases in Other Direct Costs £1m and Planned Inspections and Faults (£0.4m), offset by Closely Associated Indirect costs £10m and Business Support £2m.

- Uncertain Opex has increased by £1m.

198. The above items are covered in further detail within the relevant table narrative and in Section X. Load Related Capital Expenditure, XI. Non Load Related Capital Expenditure, Section XII. Non-Operational Capital Expenditure (TO) and Section XIV. Operating Costs (TO and SO).

Overview System Operator (SO)

199. The overall GSO Totex costs for the period are £788m against allowances of £890m. The main areas of difference on a restated basis are:

- SO Capex – we are forecasting to spend £65m less than allowances as a result of lower forecast spend on Xoserve and Telemetry separation. The lower Xoserve spend is driven by a change in strategy for Gemini investment and a lower level of EU driven Gemini change work.

- SO Opex – the underspend to allowances for Opex of £37m is largely driven by a higher proportion of Xoserve allowances being allocated to direct Opex following the outcome of the review of agency costs.

200. Compared to the performance of cost against allowance reported in 2019/20:

- SO Capex – our performance compared to last year has reduced by £4m, with an increase in forecast spend.

- SO Opex – performance has improved compared to last year by £4m, with a decrease in forecast spend.

- The above items are covered in further detail within the relevant table narrative and in Section XIII. Capital Expenditure (SO) and Section XIV. Operating Costs (TO and SO).

Summary of Spend and Allowances

201. The non-restated table below shows forecast spend and allowances against the six main activity areas as per RRP Table 2.4.

Activity	Spend (£m)	Allowance (incl. uncertainty mechanism) (£m)	Cost vs Allowance (£m)
TO Load Related Capex	28	47	19
TO Non Load related Capex	1,343	1,089	(254)
TO Non Operational Capex	155	75	(80)
TO Opex	925	887	(38)
Total TO	**2,451**	**2,098**	**(353)**
SO Capex	280	354	74
SO Opex	509	536	27
Total SO	**788**	**890**	**101**
Total	**3,240**	**2,988**	**(252)**

Table 8: Overview Eight-Year Forecasted Spend and Allowances (as per Table 2.4)

202. In order to better understand the underlying position of spend versus allowances, Table 2.4 is restated to better align allowance with spend categories. The adjustment made to the baseline position in Table 8 are detailed below:

- IED allowances of £99m are currently included within baseline Opex in Table 2.4. All IED spend is captured within the Non-Load Related Capex category. Therefore, the IED allowances within Opex are reallocated to Non-Load Related Capex to be consistent with the treatment of spend.

- SO allowances of £10m for the data and cyber security reopener are recategorised between Capex and Opex to better align with the actual categorisation of spend. The allowance split is based on generic allocations set at the beginning of RIIO-T1 with all allowance deemed as Capex.

203. See the restated Table 2.4 and main reasons for differences between costs and allowances in the Performance Summary.

Consumer Bill Impact

204. In RIIO-T1, less than £10 (2020/21 prices) of the average domestic consumer gas bill of £572[10] will relate to the gas network services we provide. In 2020/21, the proportion of the bill attributable to National Grid services was approximately £7.72 which equates to 1.3% of the typical gas bill. This is an increase compared to 2019/20 where the National Grid portion of the domestic consumer gas bill was £7.60 but remains a decrease on the first five years of RIIO-T1 where this value ranged between £7.97 and £9.92.

205. We have applied Ofgem's methodology for calculating the components of a domestic consumer's bill. Approximately 50% of gas transmission charges are recovered via entry charges and classified by Ofgem as costs entering the wholesale market prices. The exit costs, which include the 'direct' domestic sector consumption, are allocated to Gas Transmission network costs.

206. Our calculation of the customer bill impact is aligned to the above approach (allocating entry charges to the wholesale sector).

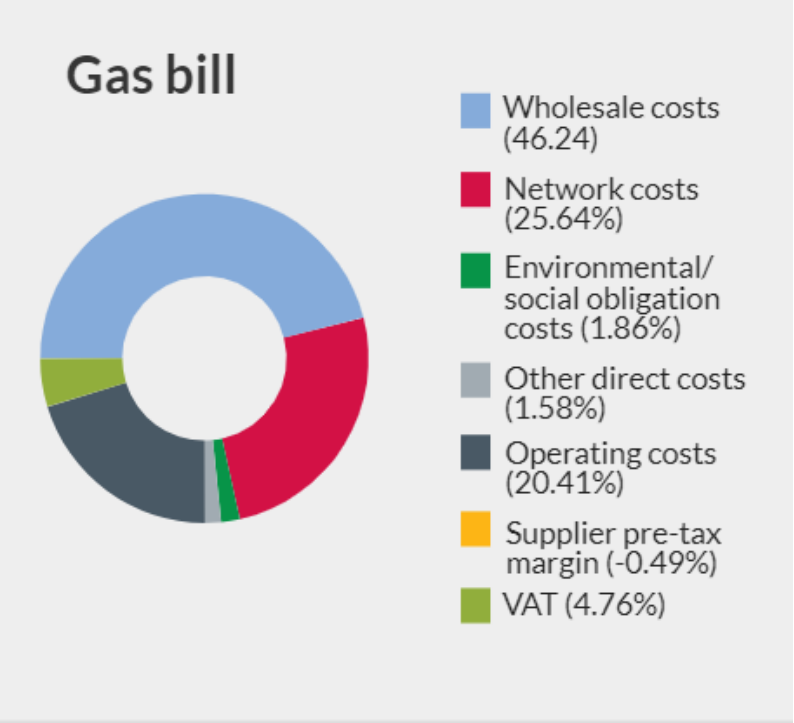

Figure 5: Breakdown of the Customer Gas Bill[11]

[10] Figure taken from the Ofgem publication 'Bills, Prices and Profits'
[11] Gas bill breakdown available from Ofgem: https://www.ofgem.gov.uk/publications-and-updates/infographic-bills-prices-and-profits

X. Load Related Capital Expenditure (TO)

Introduction

207. This section covers our Load Related Capital Expenditure. In 2020/21 our expenditure was £8.3m and our out-turn for the eight-year RIIO-T1 period is £46.1m compared to an allowance of £47.4m.

208. Our out-turn spend is £2.3m higher than our forecast last year. The key differences are due to increases at Felindre (£1.2m), and the inclusion of the Western Gas Network project (£2.2m). In 2019/20 the Western Gas Network project was reported in the Asset Health section but has been reallocated to Load Related Uncertainty (Entry) in 2020/21. These increases were offset by a decrease in Customer Offtakes (£0.9m).

System Flexibility

209. In 2020/21, system flexibility work has evolved to focus on enabling net zero, with a focus on hydrogen. Although the baseline allowances for this activity are included within Load Related Capital Expenditure, the spend incurred during 2019/20 falls within SO Opex, further detail can be found in Section XIV. Operating Costs.

Environmental Aftercare

210. The planning consent conditions for two pipeline projects completed during the Transmission Price Control Review 4 (TPCR4) (Wormington to Sapperton and Milford Haven to Tirley) included undertaking environmental monitoring and aftercare regimes for a period of 10 years after project completion. Both projects are now closed. The environmental aftercare category also included funding to complete the Tirley PRI and associated works that were delayed into RIIO-T1 due to difficulties obtaining planning consent at Tirley. The associated works included commissioning of Felindre compressor station.

Felindre

211. Felindre Compressor Station was built as part of the South Wales Expansion Project (SWEP), triggered by the requirement to connect the Milford Haven LNG terminal to the NTS.

212. The compressor station was designed as one electric variable speed drive (VSD) with two gas turbine units as back-up. Construction of the compressor station was completed in 2010 but final commissioning could not commence until completion of Tirley PRI. This was achieved in September 2012. However, the volume of gas for which the assets had been designed did not materialise, and flows were not high enough to commission the VSD compressor although progress was made in commissioning the smaller gas turbine units.

213. Since Tirley PRI was completed, work has been ongoing to complete the associated works. All work specific to the Felindre gas turbine units has now been

completed, allowing unrestricted use of the units. Full commissioning of the control system will be completed with the VSD commissioning. Total cost of the Tirley works (including Felindre gas turbine unit commissioning) in the RIIO-T1 period was £5.3m.

214. The Felindre VSD unit was put into preservation from 2014 to 2016, due to the continuing low flows through Milford Haven. In January 2016, the decision was made to progress with commissioning the VSD due to higher flow forecasts. The decision was also made at this time to proceed with creating a loop within the network for recycling gas to the compressor. The loop will reduce dependence on the unpredictable Milford Haven flows for commissioning the VSD, as well as operational and environmental testing of any of the Felindre units.

215. Construction of the new Alltwern site, the cross connection that will create the loop, was completed in winter 2019/20. Snagging works that had been expected to be complete in 2020 were delayed due to coronavirus but have now been completed and full project closure is expected in 2021/22.

216. Work to prepare the VSD for commissioning has been completed and commissioning test runs are currently in progress. Final commissioning is still expected in 2021, with full project closure in 2022. Final cost in the RIIO-T1 period for Felindre VSD, including preservation, de-preservation, commissioning and Alltwern was £18.5m.

Western Gas Network Project

217. Since receiving a PARCA for incremental capacity at the Milford Haven Entry Point, we have followed the approved capacity methodologies and framework obligations to develop a proposal for the Western Gas Network Project. The capacity request cannot be met be the existing network in any scenario and is therefore to be treated as Funded Incremental Obligated Entry Capacity.

218. We have developed our preferred strategic option, which requires the least new infrastructure, therefore minimising the impact of the project on communities and the environment. This option has the lowest capital cost with the greatest consumer benefit and represents the most economic and efficient solution for UK consumers. It is a modular solution, meeting the immediate requirements of the customer, whilst being flexible for future development as the energy landscape evolves.

219. Having completed the PARCA Phase 2 Strategic Options Report in 2020 we commenced our public engagement this year. We have also created a dedicated section of our website[12] and progressed a number of technical studies to refine the scope and inform future phases of design, construction, and consenting requirements. We submitted an Environmental Determination Report to BEIS in September 2020, and in December 2020 BEIS responded with confirmation that the project works would not constitute EIA development; this means that National Grid

[12] https://www.nationalgrid.com/uk/gas-transmission/wgn

can use their permitted development rights for the construction of the works rather than needing to pursue a Development Consent Order under the 2008 Planning Act. An initial Need Case Submission has been provided to Ofgem in June 2021 as part of the RIIO-T2 Funded Incremental Obligated Capacity process.

XI. Non Load Related Capital Expenditure (TO)

Introduction

220. This section covers our Non-Load Related Capex. In 2020/21 our expenditure was £102.8m and our out-turn for the eight-year RIIO-T1 period is £1,352m compared to an allowance of £1,187m. Our total out-turn spend for RIIO-T1 is £41m lower than our forecast last year, in a constant 2020/21 price base.

221. The key variances in forecast are due to:

- Asset Health - Whilst majority of our 2020/21 workbook delivery has remained on track, there has been significant disruption caused by the COVID-19 global pandemic. This has affected staff and material movements and availability, as well as a given rise to a risk averse approach from some of our stakeholders in relation to outages and financial commitments. As a result of this and the impact of social distancing on all projects, we spent below forecast by £24.3m in the final year of RIIO-T1. We successfully delivered our baseline safety and reliability outputs and investments, including our performance against NOMS target.

- Peterborough & Huntingdon - Work at both sites was impacted by COVID-19 restrictions which influenced how the work was carried out. In addition to this, following a contractual dispute with the Main Works Contractor, it was agreed by both parties to terminate the contract by way of a Termination Settlement Agreement. As a result, our out-turn spend was £15.6m lower than our forecast last year. A new MWC has since been appointed and works are scheduled to be completed in Q4 2023.

Asset Health

222. In 2020/21, we delivered £55m of asset health investment. This expenditure underpins our work to mitigate the risks of an ageing asset base and to continue to provide a reliable and safe network for our customers and stakeholders. This year marked the final delivery year of the majority of our RIIO-T1 investments and preparations to commence our RIIO-T2 delivery.

223. With careful management and significant individual effort from project team members, the majority of our 2020/21 workbook delivery has remained on track despite the significant disruption caused by the COVID-19 global pandemic. This affected staff and material movements and availability, as well as creating a risk averse approach from some of our stakeholders in relation to outages and financial commitments. One example of this is our project to modify regulator streams at a power station, where materials were ordered from a supplier in Italy in order to meet a summer 2020 outage. Due to the logistical uncertainty of the supply chain

it was agreed with the power station to defer the work to the following year. This allowed greater certainty over the efficient use of an outage. As a result of such issues, as well as impacts on all projects due to social distancing, we spent below our forecast for the delivery of capital investment. We successfully delivered our baseline safety and reliability outputs and investments, including our performance against NOMs target.

224. Our investment theme teams have established and sanctioned the no regrets work required in year one of RIIO-T2 and are preparing investment portfolios for delivery in subsequent years. These teams are cross-functional stakeholder groups, accountable for delivering the requirements of our business plan within the associated constraints, whilst managing risk and driving innovation. Since Final Determination, these teams have been analysing and prioritising their portfolio of work to target the most efficient risk reduction that delivers our business plan outputs.

225. We have taken significant steps to improve our project data capture. This has included further development of our new ways to capture defects, resulting in clearer surveys and scoping of projects.

226. We have also introduced new ways of tracking business plan outputs to align with our new regulatory deal and have been preparing for significantly increased levels of data for unit cost capture.

227. Using innovative techniques and solutions is always at the forefront of our approach, an example of which is the use of Britfoam to fill decommissioned pipework as part of the National AGI Renovation Campaign (NARC) at Kings Lynn. More information is detailed below.

228. The largest proportion of capex spend in 2020/21 was associated with the following projects:

- Bacton £6.4m
- St Fergus £9.6m
- Peterborough & Huntingdon Compressor Asset Health £3.2m

229. More details on each of these projects is provided in the 'Key Projects' section below.

Developing our Asset Management Capability

230. We have used our Gas Transmission and key stakeholder priorities to create a new long-term asset management strategy, which we have termed our Asset Management Strategy and Objectives (AMSO), formerly the Strategic Asset Management Plan (SAMP).

231. This initial version of the AMSO has supported our ongoing ISO55001 accreditation and we are working to embed these AMSO requirements across the wider

business. This includes a series of long-term network objectives which define how we need our assets to perform, both now and in the future, to ensure we meet our stakeholder commitments. Ongoing AMSO improvement work is focused on:

- Evolving our strategies for individual asset classes (e.g. Above Ground Pipework, Cladding and CP Systems), in line with our agreed RIIO-T2 business plan, including performance objectives and investment decision making criteria. We are also developing strategies for system wide investments (e.g. emissions, physical security, redundant assets, asset reuse and disposal, maintenance access)

- Developing key performance measures which will allow us to track and monitor progress towards achieving these asset management objectives

- Identifying how the network, and our asset strategies, will evolve to continue to meet customer requirements into the future

- Developing a Single Value Framework which allows all investments to be compared using a standardised benefits approach, based on monetised risk and long term risk reduction benefits

232. This allows us to define the next phase of our ongoing plan to improve our asset management maturity and adopt industry-leading and world-class asset management practices, ensuring we continue to deliver the best value to customers through our asset investments.

NOMs Methodology Development

233. Last year we reported that our updated Network Output Measures (NOMs) Methodology and rebased RIIO-T1 monetised risk target had been submitted to Ofgem for approval. We received notification in July 2020 that our NOMs Methodology had been approved and Special Condition 7E of our Gas Transporter Licence updated.

234. We have participated in a cross-sector working group with Ofgem to define the requirements for RIIO-T1 close-out data and narrative requirements. We submitted a data table and narrative in July 2021, explaining our RIIO-T1 monetised risk performance against this rebased monetised risk target.

235. We originally consulted on our Methodology for Network Output Measures (NOMs) in May 2018. As stated above this was formally accepted by Ofgem in July 2020. Between these dates the following activities were undertaken, based on consultation feedback:

- To improve the sensitivity testing and modelling of alternative supply and demand scenarios.

- To undertake a validation exercise to ensure the numbers produced by the Methodology were fit for purpose, to identify potential improvements and to give further information to Ofgem to allow them to issue final acceptance.

236. We were required to undertake a rebasing of our RIIO-T1 target and develop our RIIO-T2 business plan, which has meant it has not been possible to incorporate the outcomes of the validation work into the written NOMs Methodology to date. The new Network Asset Risk Metric (NARM) mechanism introduces the concept of Long-term Monetised Risk Benefit (LTRB) and the Unit Cost of Risk benefit (UCR) which is not covered explicitly in the original NOMs Methodology.

237. The scope of the migration from the NOMs to NARM Methodology is as follows:

- Update the Main Methodology document to reflect the new requirements of NARM and improvements identified through validation
- Update three supporting documents: Probability of Failure, Consequence of Failure and Service Risk Framework, to incorporate improvements identified through validation
- Create a new supporting document covering the creation of the LTRB and UCR metrics
- A further consultation exercise (undertaken in May/June 2021) prior to submission to Ofgem (planned for September 2021)

Data

238. We have implemented our Copperleaf (C55) investment management system and are actively using it for definition and control of our RIIO-T2 programme of work. Presently, long-term risk benefit values are not being reported directly from the Copperleaf system. Discussions will be held with Ofgem to agree the timescales and process for incorporating the data improvements implemented into Copperleaf into our Network Replacement Output targets for RIIO-T2.

239. We have also completed work to implement our new ISO14224 equipment unit taxonomy into our company assets. This will effectively refine our asset base using a more granular level of asset definition, enabling:

- A more specific definition of investment unit costs, by asset and intervention type.
- More transparency in how our investments are planned and prioritised (including asset-level long term risk benefits).

240. This redefinition of the asset base to an industry-standard will mean that the asset baseline used throughout RIIO-T1 into RIIO-T2 business planning will be reset. Again, further discussions are required with Ofgem to agree the process and timescales for implementation.

Key Project Delivery for 2020/21

241. This section of the narrative details key project deliveries in 2020/21.

Bacton Campaign

242. The Bacton terminal is a key gas entry point into the UK, both currently and into the future. At Bacton there is a strong interaction between asset health and the needs associated with the Future Operating Strategy (FOS). The works undertaken at Bacton in 2020/21 were:

Bacton AH-1A: Installation of five new valves

243. During the Summer 2020, a total of five new main line valves were installed. These valves were associated with the Feeder 3 area of plant and the supply to Great Yarmouth Power Station (GYPS). These valves represent some of the most critical interface points with our customers and connection to the wider network. This work necessitated customer liaison with GYPS. A temporary bypass arrangement was constructed to allow work to progress without further interruption to GYPS supplies.

Figure 6: Removal of old A3/1 valve 'Phase 9'

244. The highly invasive nature of the replacement of many of these valves necessitates outages that can only be commenced when gas demand is sufficiently low, since

significant areas of the plant and the wider network are required to be out of commission. In the case of works on Phase 8, this necessitated shut down of Feeder 3.

Figure 7: Valve installation during 'Phase 8' works

245. The closure of documentation and data-books associated with the early phases of this Asset Health project has continued during the past year. This is an ongoing process that will see documentation closure continue during 2021/22.

246. The use of 3D Building Information Modelling (BIM) has been part of business as usual within the Bacton projects. BIM has considerably reduced the likelihood of fabrication issues and on-site 'clashes' with other pipework or assets. It has been used during design review meetings to aid the discussion on plant layout. BIM is also key in associated review processes, required as part of the Formal Process Safety Assessment.

Bacton AH-1A: Painting and pipe supports

247. The corrosion protection painting works commenced in 2017 and were further progressed through to closure in the past year. These works generally utilise the depressurised areas of the plant that have been shut down to facilitate other works.

248. Work has also continued dealing with the repair of wind/water-line corrosion features. An earlier survey of the site had shown evidence of early coating failure on all of the surveyed sections.

249. Work has continued throughout 2020/21 on the inspections of pipe supports.

Figure 8: Final installation paint standard and pipe supports 'Phase 8'

Gas Robotic Agile Inspection Device (GRAID)

250. Separate to the asset health works on-site, was the installation of the GRAID connection launch facility. All physical works were completed in 2019, with the project progressing through drawing updates and data-book closure during 2020 and achieving approval for project financial closure in December 2020.

Preheat 3

251. The site Preheat system provides heat to the incoming gas supplies, prior to entering flow control equipment, to prevent the formation of liquids in the pipework and ice build-up on the external surfaces. There remained a number of Asset Health defect issues associated with the Preheat systems. The project suffered some programme slippage as a result of high Milford Haven LNG flows in the previous year. Preheat 3 passed into build phase during 2020/21 with connection and commissioning of the boiler fuel gas systems. This project addresses the prioritised Asset Health pre-heat works ensuring continued safe operation of the Preheat system and associated plant. During design selection a fuel supply option was adopted taking a lower supply intake pressure from the Cadent offtake onsite. This permitted considerable rationalisation of plant on the National Grid Terminal allowing for lower ongoing Opex costs associated with the upkeep of plant.

Figure 9: Simplified pressure regulator installation for boiler fuel gas

Human Machine Interface (HMI) replacement

252. The HMI provides the control room operator with the means to control the site via visual displays and associated keyboard and mouse. The system installed at Bacton was 19 years old and was therefore past its useful life with a depleting set of spares available and lack of technical support available from the Original Equipment Manufacturers (OEM).

253. The Bacton HMI project continued through the build stage during 2020/21 entering into the Customer Factory Acceptance Test (CFAT) stage during Summer 2020. CFAT involved the Operational site personnel witnessing varying stages of testing as part of their familiarisation with the new system prior to its' deployment at site. Following a successful CFAT, the system was installed at site and was initially powered up in a 'Listen Only Mode'. This permitted some further site familiarisation prior to commencement of the 'Cut-over' phase in late winter. This 'Cut-over' phase programme extends into Summer 2021, at which point the project will follow project data-book and drawing collation phases as it commences progress toward project closure.

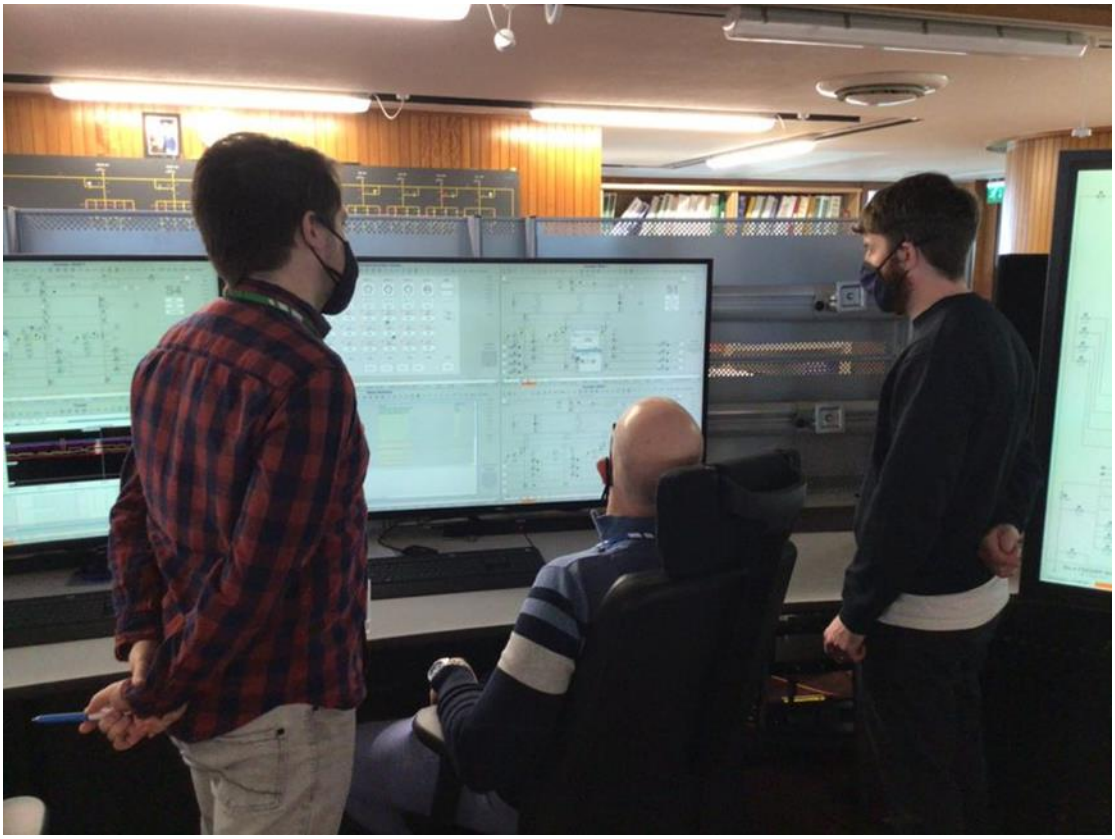

Figure 10: New HMI system in use as part of phased Cut-over to the new system

COVID-19 Impact

254. COVID-19 has resulted in delays to the project delivery programme. Works required to be postponed during the development and implementation of precautionary safety measures, and the associated re-planning of works to suit access to the site. Because of the critical operational nature of this site and its role in supply of natural gas to the UK and Europe, the operational teams had stringent requirements in place to ensure that critical operational personnel were protected.

255. Operations staff set up two teams and the project teams mirrored this arrangement with 'Red and Blue teams' in place in such a manner that no one team could create infection possibilities with the other team. The impact of this approach created additional handover and project continuity difficulties for management of onsite projects. The impact has largely been contained to a time extension with some additional cost incurred although these have been minimised and remain within the confines of the approved sanction risk values.

256. Because of the differing nature of suppliers, their own COVID-19 restrictions, and associated interfaces, the impact of COVID-19 has differed across the projects. Impact time delays range from 5 months to 9 months extension.

St Fergus Asset Health 2020/21

257. St Fergus Terminal is a key gas entry point into the UK. The terminal commenced build in 1975 in a coastal environment which accelerates corrosion degradation.

258. Corrosion remediation has remained focussed on reducing the defect population, which has been obtained through the corrosion and coating management visual inspection of the assets on the site. Work continues to close defects and snagging from previous year and to complete data-book and associated change management processes for those work phases.

Replacement of the Cathodic Protection system

259. Primary protection of the below ground pipe is provided by the pipe coating system. The Cathodic Protection (CP) system provides secondary protection for below ground piping systems in case of defects or deterioration of the primary protection system. Over previous years, review of condition reports have highlighted a deteriorated state of the original CP system. Design works have been undertaken to devise suitable CP protection system, with this work due to move into a delivery phase in 2021/22.

Replacement of Gas-Over-Hydraulic Actuators

260. The actuating system at St Fergus utilises natural gas as a motive power source for actuation. The pipework supplying this natural gas has a series of corrosion defects throughout site, with the system currently operating with a pressure restriction in place. The actuators themselves require intervention due to their aged condition and accelerating failure rates. A previous options assessment determined that the most effective means of addressing both issues would be the introduction of a different actuator technology. The actuator type being deployed is an Electro-Hydraulic actuator. Finalisation of detailed design for installation of these actuators has been undertaken in 2020/21 with the first installations being undertaken at the end of the reporting period. These works will continue into reporting period 2022/23.

Figure 11: Electro Hydraulic actuator and associated Hydraulic Power Unit

Remediation of corrosion and paint degradation defects

261. Remediation and isolation plans were developed in the previous year for delivery in 2020/21, including for the planned next isolation on the Plant 6 mixer. Return-to-Service defects associated with Plant 1 Aftercooler had prevented access the Plant 6 mixer. This Plant 6 mixer corrosion remediation work has been undertaken in 2020/21.

Figure 12: Freshly painted Ancala pipework and new pipe supports

Plant 1 Aftercooler

262. Plant 1 aftercooler consists of 12 individual finned radiator sections. These are arranged in groups of four, to make three cooling banks, through which process gas is flowed to be cooled by the circulation of air across the finned tubes. In the previous reporting year, unexpected issues were encountered in the form of leaks during recommissioning of the Plant 1 aftercoolers.

263. A re-evaluation of Plant 1 aftercooler issues resulted in a change in delivery options. The revised approach has considered the experience gained on this project over the previous two and a half years, with a continuing expansion of scope as assets were inspected. The revised approach removes the entire Plant 1 aftercooler and associated support superstructure, replacing the structural supports and gas containing components of this aftercooler with new. This delivery option provides far greater certainty in programme timeline and cost. The return-to-service phasing of Plant 1 aftercooler is critical to the timing of other phases of corrosion defect recovery work onsite.

Figure 13: Old Aftercooler section during removal Autumn 2020

COVID-19 impact

264. COVID-19 has resulted in delays to the project delivery programme. Works required to be postponed during the development and implementation of precautionary safety measures and associated re-planning of works to suit access to the site. Because of the critical operational nature of this site, the operational teams had stringent requirements in place to ensure that critical operational personnel did not become infected.

265. Operations staff set up two teams and the project teams mirrored this arrangement with ‘Red and Blue teams’ in place in such a manner that no one team could create

infection possibilities with the other team. The impact of this approach created additional handover and project continuity difficulties for management of onsite projects. The impact has largely been contained to a time extension with some additional cost incurred although these have been minimised and remain within the confines of the approved sanction risk values. Newly initiated project sanction risk assessments raised since this time have considered COVID-19 mitigations as part of the sanction development process.

Compressor Machinery Asset Health

266. The compressor machinery used on our gas turbine driven compressor units is made up of three component parts: gas generator, power turbine and centrifugal compressor. The investments on these parts carried out in 2020/21 are detailed below.

Gas Generator

267. There are five different types of gas generator making up the national fleet currently in operation across the NTS. In addition, we hold spare gas generators to provide resilience to the operational units. The gas generators are a combination of light industrial and aero-derivative gas turbines and are monitored and maintained routinely through a series of work and management procedures carried out by our operational field force. Gas generators provide heated and pressurised exhaust gas that drives the power turbine which then drives the compressor.

268. Gas generator major maintenance interventions are typically carried out every 25,000 consumed hours, unless the annual borescope inspection determines that condition has deteriorated to a point that early intervention is required. During 2020/21, there were no major overhauls of gas generators.

269. Relatively low utilisation of the Baker Hughes LM2500+DLE fleet has kept the installed engines in good condition. Only one spare engine is beyond the overhaul limit and will be overhauled in 2021. The other spare has a minor defect but is operational and is being retained as an emergency spare.

270. The Solar Titan DLE fleet is also in good condition despite greatly increased utilisation over the last few years due to the location of the units making them critical to supporting gas flows from the Milford Haven LNG terminals.

271. The gas generators and associated assets at Avonbridge 1B and 2B are in state of mothball. The Nether Kellet units are approaching overhaul, one of which will be done in RIIO-T2. The spare SGT400 DLE requires overhaul which will also be done in RIIO-T2. The three similar units at Kings Lynn and Cambridge are in good condition and saw little use in 2020/21.

272. The SGT A-35 (Rolls-Royce RB211) fleet reduced in size again over the last year as the compression at St Fergus unit 2D was isolated to reduce maintenance tasks. This follows on from Moffat and Warrington being isolated last year. These units are not expected to be reconnected to the NTS. This leaves only six units remaining

across four sites (St Fergus, Carnforth, Hatton and Wisbech). Two further SGT A-35s will be overhauled in 2021 to provide resilience to the central area of the network.

273. The SGT A-20 fleet is in good condition following the overhaul of seven engines over the last three years. One unit that was removed from Peterborough in 2019 is undergoing minor repairs. We are monitoring deterioration on a limited number of gas generators that are currently installed and suitable for operation. A recently overhauled gas generator from spares stock was installed at Wormington B to replace a gas generator that had reached the overhaul interval. One of our spare gas generators, which is not currently installed, has a known emissions problem that is being investigated.

Power Turbine

274. There are eight different types of power turbine making up the national fleet in operation across the NTS. In addition, we hold spare power turbines to provide resilience to the operational units. Power turbines convert the stream of hot pressurised exhaust gases produced by the gas generator into the torque that is required to turn the compressor. Power turbine maintenance and overhaul requirements, as with the other machine train components, are heavily influenced by both run hours and installed time.

275. During 2020/21 there were no major overhauls of power turbines. A defect was resolved on the St Fergus 1B power turbine. An issue is currently being investigated on the Huntingdon C power turbine as it is creating smoke and triggering alarms when the unit operates, resulting in intermittent unplanned shutdowns of the unit.

276. Due to power turbine age and usage throughout the fleet, an increased amount of power turbine work is expected in RIIO-T2 as many of the power turbines will approach the overhaul intervals.

Centrifugal Gas Compressors

277. Compressors are the machinery that drives the natural gas through the NTS. Each compressor is driven by a dedicated high voltage (HV) electric motor or gas generator and power turbine. All of the NTS compressors are centrifugal compressors, mostly single stage but some two or three stage where higher pressure lifts are required.

278. During 2020/21 there was one major overhaul of a gas compressor and work is ongoing on two major overhauls that will not be completed in this financial year. Kirriemuir unit A compressor was overhauled and modified to resolve a safety issue that had been identified. Service work of a Siemens gas compressor at Bishop Auckland unit A is ongoing. Work is ongoing to reinstate the Nether Kellet unit A compressor that failed in 2019. An investigation is ongoing to a problem with the oil seal on Cambridge unit B compressor.

Electric Variable Speed Drive Compressors

279. The electric compressor systems consist of a HV supply, typically 132 kV, 66 kV, 33 kV or 11 kV fed via a Converter Transformer to a Frequency Converter (Variable Speed Drive or VSD) at 5-6kV which then supplies power at a variable frequency and hence variable speed to an HV motor. In addition, a Harmonic Filter is usually required to 'clean up' the power supply and meet distribution network operator (DNO) connection agreement terms and conditions.

280. There are two different types of HV motor making up the national fleet in operation across the NTS. The systems either comprise of a Siemens synchronous motor connected by a solid shaft to a centrifugal compressor (see the section above) or utilise a MAN MOPICO motor in pipeline compressor, these consist of an integrated pipeline mounted induction motor connected to twin compressor units at either end of the motor.

281. During 2020/21, a full inspection of Unit A at Lockerley was carried out to ascertain the condition of the motor, compressor and magnetic bearing systems. The motor and compressor were found to be in generally good condition but do require some upgrade of parts. The magnetic bearing system requires a control system upgrade. These works are planned for RIIO-T2.

282. Lockerley also suffered a significant failure of the Harmonic Filter of Unit B resulting in extensive down time while the fault was diagnosed. The filter was found to be in poor condition with extensive corrosion and degraded cable insulation and connections. Unit A was also inspected and found to be in generally poor condition. The filters are planned for replacement along with the frequency converters in RIIO-T2.

283. The electric compressor systems at both Wormington and Churchover currently have failures of the Resistance Temperature Detectors (RTDs) on the HV motor stator windings. These RTDs are required to protect the machine in the event of overheating of the stator windings. The failure of these components means that the machines will need to be rewound during RIIO-T2.

National AGI Renovation Campaign (NARC)

284. The NARC campaign has continued from previous years, accelerating asset health works across the NTS. The campaign covers invasive work requiring gas outages such as valve replacement and pipe-throughs. NARC is now in its third batch of works and to date has isolated over 555 km of NTS and recompressed gas back into the system for re-use, saving around 17.5 mscm of natural gas being emitted to atmosphere.

285. Campaign Decision Panels (CDP)s remained an integral part of NARC decision making and project progression. The NARC 3 CDPs approved works on seven sites providing a NOMs target of 52 before April 2020 and 21 before April 2021.

286. Safety is our first priority when designing and delivering the NARC Campaign. In 2020 NARC maintained a world class safety record, completing two reporting years without a Loss Time Injury (LTI), Non Loss Time Injury (NLTI) or RIDDOR reportable incident.

287. The figure below shows locations of NARC works during 2020:

Figure 14: NARC 2020/21 Progress Map

Kings Lynn Unit A permanent disconnection

288. Challenging mechanical and civil works, along with complex control and instrumentation works, were successfully completed achieving permanent disconnection of Unit A Compressor.

Figure 15: Before and after photos showing unit A cab and valves

289. NARC worked closely with the Bacton project to develop an efficient outage program allowing both the Bacton project works and the Kings Lynn project works to be undertaken within the 2021 outage period and minimising impact to our interconnector customers. The complex Kings Lynn Non Routine Operation (NRO) involved two stages of pressure reduction and then purging, allowing the main works contractor to start excavation works before the full outage.

290. The station outage allowed the removal of old Unit 2C valves to also be removed, removing risk of leakage and requirements to inspect and maintain these in difficult locations.

291. Efficiencies achieved via a combined tender award and a multi-year project at Kings Lynn also provided a consistent principal contractor team and site arrangements with local operations teams. This aided a really successful project

delivery, enabling 21 asset health risks to be removed from the network and achieving 13 NOMS.

292. The announcement of the COVID-19 pandemic occurred just two weeks prior to mobilisation, so in spite of vast changes to planning in a short period, it was dealt with extremely well, A specific COVID-19 management plan was prepared and agreed in collaboration with site operations to ensure safety and wellbeing of all personnel. Plans included changes to site welfare arrangements, travel and accommodation and coordination with operations, updates to method statements for individual tasks, and additional go / no-go checks implemented prior to critical works to ensure key resources were healthy and available, and COVID-19 specific contingency plans were put in place.

293. Deep excavations, crane lifts to remove six no. 900mm ball valves and installation, welding and Non Destructive Testing (NDT) of two no. 900NB pipe throughs were undertaken to achieve this. This was done in parallel with electrical field and control room disconnections, Cab fire and gas modifications, telemetry updates and modification to the complex station control system allowing it to continue to run without Unit A.

Figure 16: Excavation with sheet piles and temporary works supporting frame being installed.

Figure 17: Deep excavation, valves removed and 36" pipework being carefully manoeuvred beneath the excavation support frames and adjusted into position.

Figure 18: Network welded into position.

294. The well managed project, use of Specialist Electrical & Instrumentation contractors and in-house expertise guaranteed a smooth delivery and the station was recommissioned with very few unexpected issues.

295. Some innovative SHES best practices were introduced by way of eco walkway matting. This provides a low cost solution for none-slip and trip walkway over grassed areas. It is also flexible, reusable, recycled, and eco-friendly. Following a sustainability review, Britfoam infill was used inside the small lengths of redundant

Unit A pipework. The non-toxic, non-flammable, virtually odourless and non-reactive with skin product provided benefits such as fewer vehicle movements, rapid curing, no waste. It also fills all cavities and avoids need for pipe cleaning as Britfoam absorbs hydrocarbons, as well as avoiding the carbon heavy cementitious grout or foam concrete products.

Figure 19: Eco-walkway at Kings Lynn CS and of the Britfoam being injected

296. The project worked with further departments for added benefits. The removed assets were assessed for potential re-use on the FutureGrid Hydrogen test assembly. NARC supported works to rectify issues with Unit B valves during the same outage period, enabling compressor availability for commissioning and operational readiness for winter. NARC also supported innovation works in the same site location to inform future asset health solutions for subsidence.

NARC 21 – Project Development

297. The development of NARC 21 works commenced at FEED optioneering stage in 2019, in parallel with NARC 3 work. The Refurbish and Relife (R&R) team conducted surveys on 27 sites and created design options to be further developed by our construction team.

298. Working with stakeholders from across the business, designs were developed with consideration of long lead materials, network access, constructability, cost, safety and the environment. A number of high-risk long lead materials were identified at

an early stage and were procured in advance of Detailed Design to ensure 2021 NARC delivery key dates could be met.

299. The Project Development team identified a number of opportunities for collaborative delivery, including working with the FutureGrid Hydrogen Innovation team to recover life expired assets to use as part of a Hydrogen testing programme. Works from Cathodic Protection campaign were also integrated into NARC 21 to leverage opportunities for Network Access and Contract Management efficiency.

300. Fully costed design options were presented at two Campaign Decision Panels, to stakeholders from across Gas Transmission, to approve the developed options in line with the RIIO-T2 business plan. Design options for 17 sites were approved to be taken forward to Conceptual Design stage.

301. Due to network access considerations, two sites were re-phased for 2022 delivery. Ongoing collaboration with the offtake network operator has ensured the works can be successfully planned for 2022 delivery, with improved design, allowing for continuity of supply and more efficient delivery.

302. The 15 approved sites were taken through a competitive tender process, progressing to Detailed Design and Build stage for on-site delivery in 2021.

Pipelines Campaign

303. The pipelines campaign delivers investment on the pipelines in the NTS that connect AGIs and terminals.

304. Work undertaken as part of the pipelines campaign aims to maintain and improve the pipework that connects the NTS. Improving the lifespan of the current network is critical to maintaining low costs to consumers, as replacement of the network would entail extreme expense and significant disruption to the UK.

305. The following work types in the campaign are:

- In Line Inspections (ILI) where a Pipeline Inspection Gauge (PIG) is inserted into the pipeline with various tools that measure wall thickness, geometry and other data. This is then used to inform the ILI dig plans.
- ILI Digs involve excavating the pipeline where the ILI inspections have identified features of interest e.g. corrosion or dents. The feature is then classified and remediated dependent on the classification including coating repair or an epoxy filled repair sleeve is mounted.
- Reduced depth of cover location remediate areas where the pipeline is closer to the surface than expected. Typically, this is in ditches where they have been cleaned out too deeply, but it can also be in areas where the land has eroded over many years. Remediations are frequently compensation to landowners and building a protective fence along the affected area.

- River crossing remediations are exposed pipelines within a river system or on the banks of the river. Typically, this is caused by the river moving or by bank collapse. The pipe is then protected by cover reinstatement on the riverbank, frond mats or gabion cages.

306. National Grid has delivered the following outputs in 2020/21:

- In line inspections covered a total of 887 km, over 19 pipelines in 2020/21. The selection of the pipelines requiring inspection is driven by a condition and risk-based approach, considering pipeline condition, criticality and performance of corrosion prevention. This is 86% of the distance completed in 2019/20.

- There were 28 significant pipeline excavations and repairs completed in 2020/21 to further examine and address defects identified from previous inspections in 2017, 2018 and 2019. This is 140% of the number completed in 2019/20.

- No reduced depth of cover or river crossing locations were completed during 2020 following a reprioritisation of the RIIO-T1 workbook and the impact of COVID-19.

Dangerous Substances and Explosive Atmospheres Regulations (DSEAR) Compliance Campaign

307. The DSEAR 2002 is the United Kingdom's implementation of the European Union ATEX (ATmosphères EXplosives) directives. The intention of the Regulation is to reduce the risk of a fatality or serious injury resulting from a dangerous substance igniting and potentially exploding. The Regulation requires operators to create an Explosion Protection Document (EPD) for any installation activity involving flammable or explosive atmospheres. Through this process the operator must prove compliance of equipment for continued use, otherwise it must be replaced with correctly certified equipment.

308. The DSEAR compliance campaign was sanctioned by National Grid in April 2017 to ensure that our assets fully comply with the Regulation. The campaign completed the upload of circa 150,000 EPD documents by April 2020. The overarching summary of each EPD is the DSEAR site specific risk assessment (SSRA).

309. The EPDs consist of the following documentation:

- A validated hazardous area drawing
- Hazardous area inspection records in compliance with BS EN60079-17
- ATEX certificates
- Intrinsically safe loop calculations
- Hazardous area asset register
- Site specific DSEAR risk assessment

- Schedule of responsibilities document for shared sites

310. Our initial approach to completing the EPDs required detailed physical inspection of all hazardous area assets to assess their compliance. This allowed sufficient defect data to be gathered to adopt a risk based inspection programme from September 2018 onwards. The type of inspection required is determined by the hazardous area zone and ignition potential of the asset. Under the new approach, assets that are classified as high/medium risk receive a 'detailed' inspection i.e. electrically intrusive, and low risk assets receive a 'close' inspection i.e. external inspection only.

311. At St Fergus, a prioritised list of high/medium risk DSEAR non-compliances was compiled, this work is being delivered by a team of three specialist electrical contractors and managed by a Project Engineer. The original completion date was December 2020, however there were a number of delays due to COVID-19, operational requirements and inclement weather. The project is currently on track for completion by September 2021. The remaining (deprioritised) non-compliances will be bundled up into a separate RIIO-T2 DSEAR project which will address all remaining DSEAR non-compliances which were out of scope of the original project.

Cab Infrastructure

312. The Cab Infrastructure theme aims to resolve three compliance issues that are specific to gas turbine compressor cabs and the closure of asset health related plant status items. This strategy has developed packages of appropriate investments as per below.

HSE Publication PM84

313. The HSE guidance note referred to as PM84, and the more recent BS ISO 21789 standard, refers to the risks in gas turbine enclosures. Whilst most compressor cabs were built before standards or similar equivalent guidance documents were published, the scoped elements below were identified as risk reduction measures. Typically, these relate to refurbishment of Cab Exhaust System, Air Intake System, Cab Ventilation System and Cab Structure (including Gas Detection).

Fire Suppression Systems

314. Fire suppression is the final element of the fire and gas system and is in place to protect the asset in the event of a fire. Due to the age, condition and design of some of our systems, they are no longer fit for purpose and need investment to enhance the integrity of the system.

Emission Sample Lines

315. Emission sample line upgrades are driven by Environmental Agency Legislation requirements, for homogenous emissions sampling of gas turbines that are compliant with the IED. This is to ensure compliance and removal of all non-compliances.

316. The following works have been completed in 2020/21 on our Cab Infrastructure:

Emission Sample Lines Works: Aberdeen (Units A, B & C), Nether Kellet (Unit A & B), Wooler (Unit A&B), Carnforth (Unit C), Cambridge (Unit C)

317. Emissions sample lines are being replaced and tested to comply with the industrial emissions directive.

Fire Suppression Works: Avonbridge (Units 1A & 2A)

318. Both units are equipped with separate nitrogen propelled water mist fire suppression systems and have been replaced to latest current standards. Solenoids, fittings, hoses and fire suppression heads were old and have been replaced to enhance life span, integrity and asset condition. Water cylinders have been re-pressure tested as part of Pressure Systems Safety Regulations (PSSR) requirements.

Fire Suppression Works: Nether Kellet (Units A&B), Wooler (Units A&B)

319. Uncertified flexible hoses and cylinders replaced at Wooler for compliance reasons.

320. Uncertified flexible hoses and replaced at Nether Kellet for compliance reasons. Pumps also replaced due to failures and now being obsolete with no spares available.

Replacement Diesel Tank: Nether Kellet Compressor Station

321. The site standby generator diesel tank was replaced due to corrosion.

Health and Safety Executive (HSE) Publication PM84 Works: Nether Kellet (Units A&B)

322. Combustion air intake filters and heater have been replaced. A new system was installed to prevent moisture from reaching the filters. Machinery and personnel doors on the HVAC and combustion housings have been replaced due to corrosion issues. The HVAC air intake housing louvres, acoustic splitters and filters have been replaced and weatherhoods installed. The acoustic duct linking the housing to the cabs were replaced due to corrosion.

Health and Safety Executive (HSE) Publication PM84 Works: Wooler (Units A&B)

323. Heat damaged cables over the GT were replaced by installing high temperature silicone cabling on Units A & B. The undamaged cables were re-routed where necessary.

<u>Gas Quality, Metering & Telemetry (GQMT)</u>

324. Several GQMT related projects were completed in 2020/21 and the focus therefore has been on closing out these projects which included work to update data books

and drawings and other documentation required by the G/35, RE/18 and governance processes. The key work for 2020/21 is as follows:

Gas Analysers

325. Several gas analyser projects remain in the closure phase as updates to required documentation such as drawings and records is ongoing. The MicroSAM carrier gas conversion project has completed this process and has been closed.

Local Gas Treatment

326. No local gas treatment works were carried out in 2020/21.

Metering and Fuel Gas Metering

327. Physical metering works were completed prior to 2020/21. The closure phase has been completed for the last live project (Year 5 metering campaign).

Telemetry

328. 25 outstations were upgraded from remote telemetry units which run on an IRIS solution to ones which run on DB1/SB1 solutions as part of the Cyber driven telemetry work. Preparation work was also commenced for Cyber work on shared sites which will enable a quick start in RIIO-T2, these works aim to eliminate the Cyber risk on some sites by converting Remote Operating Valves (ROVs). Asset Health work was also completed at the remaining sites on Telemetry Phase 3B and Telemetry Phase 5. Telemetry Phase 5 has some testing outstanding to repair a pre-existing fault which is the final piece of physical work to be completed before all RIIO-T1 Asset Health telemetry phases are in the closure phase.

<u>The River Humber Gas Pipeline Project (Feeder 9)</u>

329. In 2020/21, we continued to progress the replacement of the Feeder 9 pipeline where it crosses the Humber estuary. This investment is driven by our continuing concerns over the integrity of Feeder 9 due to rapid and unpredictable estuary movements that are reducing the depth of cover over the pipeline. As the sole transportation route across the river Humber, Feeder 9 is one of the most critical pipelines on the NTS. It plays a pivotal role in the provision of entry gas from the Easington area to demand centres in the South and East, and to the UK gas market as a whole. Through our strategic optioneering process and extensive stakeholder engagement including a national Development Consent Order (DCO) planning process, we determined that a replacement pipeline in a tunnel was the most economic and least environmentally harmful long-term solution.

330. During the reporting period we have completed installation of the replacement pipeline, with the new pipeline section becoming fully operational on 10 December 2020. With majority of the construction works completed, the project team have continued the demobilisation and project closure phase. This will continue over into next year.

Pipeline insertion

331. During this reporting period, the water filtration and filling operations were completed in preparation for pipeline insertion. Higher than expected impurities in the fill water impacted filling operations.

332. Whilst water filling operations were ongoing, the pre-prepared pipeline sections stored in the stringing yard since fabrication completion in September 2018 were loaded onto the bespoke pipe handling system, consisting of a network of rails and associated bogies, ready to be hydraulically 'jacked' into the tunnel.

333. Pipeline insertion commenced 22 June 2020. Making good progress, the pipeline arrived ahead of schedule, in the reception shaft at Paull on 9 July 2020, marking this pipeline as a Guinness world record for a hydraulically inserted pipeline into a tunnel.

Figure 20: Pipeline being hydraulic inserted into tunnel – June 2020

Figure 21: Pipeline in Paull reception shaft – July 2020

Pipeline tie-ins and commissioning

334. The design of the pipeline tie-in arrangements had previously been discussed with the Gas National Control Centre (GNCC) team, who had undertaken network modelling to determine if a pipeline shutdown would not be possible. The pipeline would need to be connected, whilst both sites would be required to remain fully operational.

335. The detailed design for tie-ins at both the Paull and Goxhill ends of the pipeline consisted of both the permanent designed pipework and the temporary pipework arrangements necessary to permit gas to continue flowing during tie-in operations. Specialised equipment was used to cut into existing live pipework under pressure. To commence, an under-pressure tee was fitted to existing pipework and was checked for sealing and integrity. A temporary valve was fitted to this tee, to which a specialised drilling arrangement was fitted. The hole was drilled, and the drill withdrawn, allowing the valve to be closed and the drilling equipment to be removed. The temporary pipework was connected to this valve. Other drilling operations are completed elsewhere in a similar manner to allow insertion of specialised stopple fittings.

336. All temporary pipework was connected and operations commenced to sequence commissioning of the temporary pipework. Once a live gas path was flowing through the temporary pipework, further operations commenced to isolate and decommission parts of the previously live pipeline. New pipeline connections were tied into their permanent connection points at this stage. By a series of sequenced operations, the new pipeline connection was completed, and the old Feeder 9 Humber crossing was decommissioned.

Figure 22: Temporary By-pass pipeline installation and drilling tool in situ – Goxhill

337. During the reporting period the outstanding works associated with the installation of the bespoke design Cathodic Protection (CP) system was completed. The commissioning of this system has been phased to supply full CP to the pipeline. The pipeline is protected, however due to the minimal amount of coating damage encountered during pipeline installation, the current demand is too low for the CP system to control.

338. A design change is being progressed to provide a new Transformer Rectifier (TR) that can control to this extremely low level of current. Final commissioning of the revised system is currently planned for July 2021, following installation of the revised TR design. Final adjustment of the CP system and its initial performance monitoring form part of the project handover to the Operational team, with full operational acceptance expected in August 2021.

Decommissioning of former Feeder 9 Humber crossing pipeline

339. Following disconnection of the former Feeder 9 pipeline, it was necessary to ensure that any potential contaminants were removed. An operation was undertaken during January 2020, using a cleaning PIG. This arrived in a clean condition at Goxhill demonstrating that no contaminants were lying in the low point formed by a River Crossing. Following confirmation that the former Feeder 9 pipeline section was clear, the ends were capped and the redundant section was filled with an inert Nitrogen atmosphere.

340. Final decommissioning of the former Feeder 9 Humber Crossing is subject to a separate project with ongoing review to determine the most environmentally

sustainable solution whilst recognising the need to complete this in a cost effective and efficient manner.

341. Throughout 2020/21 we have maintained the two monthly survey regime to continue close monitoring of the crossing. Latest survey results show that the frond mattresses remain in place, but that the level of silt build up remains variable and changing along the pipeline route. Some areas of the mattresses appear to be more exposed than others.

342. With the former Feeder 9 pipeline no longer in operational service, negotiations are currently ongoing to with Associated British Ports (ABP). These negotiations aim to alter the terms of the original lease agreement and the associated inspection regime of the now disused pipeline. These negotiations aim to significantly reduce the inspection frequencies and should align inspection practises to appropriate industry practice for a disused pipeline.

Construction site demobilisation and re-instatement

343. Following insertion of the pipeline into the tunnel, work commenced on the removal of the bespoke pipe handling system, consisting of a network of rails and associated bogies. In addition, work also started on the removal and down-sizing of Paull and Goxhill site offices, leaving only the necessary facilities for the much reduced team necessary for final completion of final works and site re-establishment.

Figure 23: Former pipeline stringing field and former Goxhill site office area

Paull AGI – rationalisation for Feeder 9 connection

344. As previously reported, all physical work associated with the rationalisation of the Paull Above Ground Installation is complete and the site was handed over for access to the Feeder 9 Humber Crossing construction team to complete all associated tie in requirements. This separate project has now closed awaiting final close out approval in April 2021.

COVID-19 impact

345. COVID-19 has resulted in some initial minor delays to the project delivery programme. Works initially required to be postponed for three days. This permitted the development and implementation of safety measures. The initial impact of COVID-19 was lessened on this site since the site was predominantly standalone from National Grid Operations at this stage.

346. Because of the differing nature of suppliers, their own COVID-19 restrictions, and associated interfaces, COVID-19 has further impacted time delays on the project, recently associated with commissioning of the CP system. Despite this, the project remains on track for closure within the approved time and budget.

Emissions

347. National Grid Gas have heard from our stakeholders that it is important to do the right thing for society by reducing the impact of our activities on the environment. We believe our nation should have a clean, reliable energy system to help address the effects of climate change, improve the quality of the air we breathe and power growth and prosperity in our economy for future generations. We also know that stakeholders want to be able to take gas on and off the system where and when they want, providing heat and energy to domestic consumers.

348. This regulatory reporting submission to Ofgem provides an update on the programme of works planned or currently inflight on the gas National Transmission System (NTS). These works ensure our assets are compliant with the Medium Combustion Plant Directive (MCPD) and Large Combustion Plant Directive (LCPD) elements of the Industrial Emissions Directive (IED) at the following sites: Peterborough, Huntingdon, Hatton, St Fergus, Wormington, and Kings Lynn.

349. The figure below illustrates the compressor unit types across the NTS and their compliance with environmental legislation.

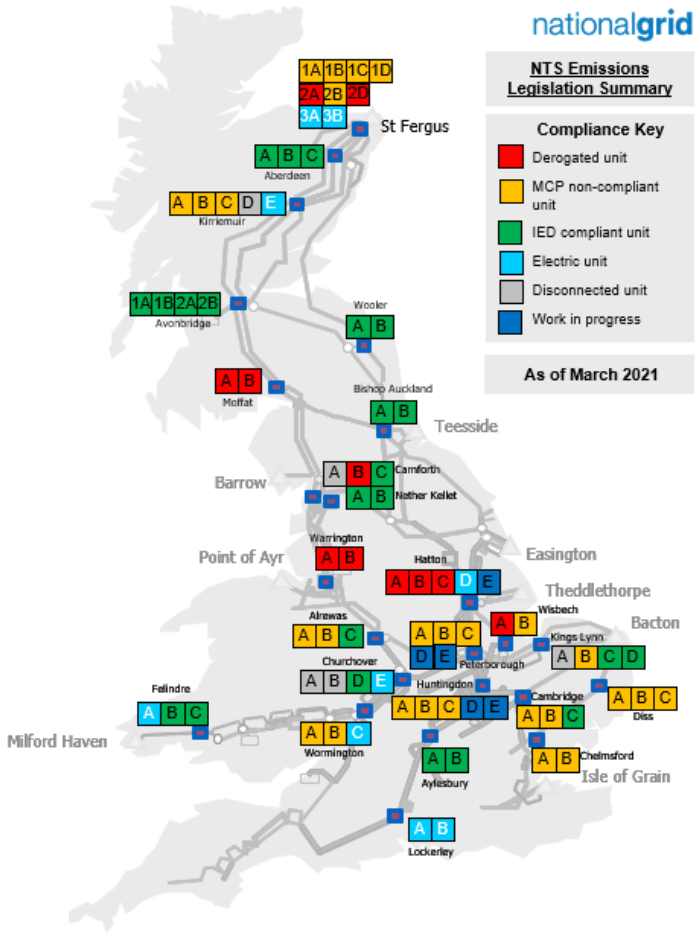

Figure 24: Compressor unit type and compliance with environmental legislation

Peterborough and Huntingdon Compressor Stations (IPPC)

350. At the start of the RIIO-T1 period, Peterborough and Huntingdon consisted of three Rolls Royce Avon machines each. Both sites are critical to efficient transmission across the centre of the network. They also ensure we meet south-east and south-west exit capacity obligations. We continue to advance the programme of works to deliver two new gas turbine compressor units from Solar Turbines at each site under Integrated Pollution Prevention and Control (IPPC).

351. The programme of works was sanctioned internally in late 2016, and the Main Works Contractor (MWC) mobilised to site in 2017 (Huntingdon) and 2018 (Peterborough). This included core and extraordinary work scopes, such as new station control buildings and new electrical supplies.

352. In June 2020, National Grid and the MWC agreed to terminate the existing Contract by way of a Settlement Agreement due to substantial dissatisfaction with the delivery of the works. Following the Agreement, an accelerated ‘best for task’

procurement event was initiated for a two stage Early Contractor Involvement (ECI) contract. The contract was awarded for the collaborative planning and pricing of works (delivery) required to complete the project (Stage 1). These Stage 1 works achieved a costed, deliverable programme to complete the projects (Stage 2).

353. Work at both sites was impacted by COVID-19 restrictions which influenced how the work was carried out. A key impact of these restrictions was a 60% reduction of resource headcount. Despite these challenges, works have continued at both sites to ensure all safety critical activities are carried out and that the necessary maintenance and inspections are being undertaken on equipment the project has purchased as well as equipment that is installed.

354. At Huntingdon during 2020/21, the key activities which were carried out include the construction of a new control building, the construction and commissioning of the new ISS security fence line and the installation of an instrument air building, the continuation of the duct route to the new control building and the completion and backfill of the upstream separator isolation valves. Works planned for the final outage were deferred due to the decision to end the contract with the MWC in June-20.

Figure 25: Telehandler moving Panel supports into the control building at Peterborough

355. At Peterborough during 2020/21, the key activities which were carried out include the construction of the new control building, construction of the new unit suction & discharge headers and the commencement of the duct run between the existing control building, new control building and station suction assets (valves, separators, meters – commissioned in 2019).

356. At Peterborough, upon completion of the IPPC works, there will be three remaining Rolls Royce Avon gas rotating machinery set (units A, B and C commissioned in 1973 (A&B) and 1978 (C) respectively) which are non-compliant with MCPD. The units can operate in series or parallel. Assessment of flows shows that once national demand is above 250 mscm/d, parallel operation at Peterborough is essential for most of the time the site is operated. Without a resilient compression solution at Peterborough we would not be able to comply with the 1-in-20 design

standard in the South of the country. The need for parallel operation is one of the drivers for additional compression to provide the necessary capability.

357. At Peterborough, the two new Dry Load Emissions (DLE) compressor units (Solar Titan 130s: units D and E, each with a powerbase of 15.3 MW) will take over the primary duty, leaving the existing Avon units to resilience status. Initial assessment of the requirements at Peterborough has demonstrated that two non-compliant units (A & B) can be decommissioned provided that one of the units (C) is replaced.

358. There is RIIO-T2 baseline funding to progress development costs and deposits on long-lead items, for the future investments at Peterborough, followed by a two step reopener process scheduled for December 2022 to May 2023 (agreement of the preferred option in the Final Options Selection Report (FOSR)) and June 2025 to July 2025 (agreement on costs for remainder of programme of works).

Figure 26: Installed Panels in the Control Building at Peterborough

St Fergus Gas Terminal Future Operating Strategy (LCPD / MCPD)

359. As the highest utilisation compressor site on the NTS, St Fergus Gas Terminal enables UK Continental Shelf (UKCS) and Norwegian gas supplies entry onto the National Transmission System (NTS). The terminal receives gas from three sub-terminals (currently owned by Ancala, Shell and North Sea Midstream Partners (NSMP)/Gassco). Uniquely on the NTS, National Grid provides 24/7/365 compression services for gas received from the NSMP terminal under the terms of the Network Entry Agreement (NEA). The NSMP terminal is operated by PX. Compression is required to raise the pressure of the gas supplied via the NSMP sub-terminal to NTS pressure. St Fergus comprises three plants; Plant 1 has four Avon units, Plant 2 has one Avon and two RB211s and Plant 3 has two electric Variable Speed Drives (VSDs). Although described as a Plant area, it should be noted that Plant 3 consists of compressors only, and use of these electric drive compressors relies upon using the auxiliaries of either plant 1 or plant 2, and therefore cannot be used as an independent plant.

360. Our plans to achieve compliance with the requirements of the IED legislation have evolved following Ofgem's decision not to approve the St Fergus needs case submission in November 2019. The previously phased IPPC, LCPD then MCPD compliance approach has now become a combined LCPD / MCPD compliance approach.

361. In terms of LCPD, we had gained approval from the Scottish Environment Protection Agency (SEPA) to enter the RB211 units, 2A and 2D, into the Limited Life Derogation (LLD) from 1 January 2016. We will continue to utilise the Avon units until the end of 2029, whilst replacement compression is installed by the MCPD compliance date of 1 January 2030.

362. Based on Ofgem's Final Determination in December 2020, St Fergus Gas Terminal is being funded via an uncertainty mechanism rather than baseline. However, Ofgem have provided a baseline allowance to cover development costs and deposits on long-lead items, subject to a true-up during the associated re-opener. A two-step reopener process has been agreed. St Fergus Gas Terminal reopeners are scheduled for December 2022 to May 2023 (agreement of the preferred option in the Final Options Selection Report (FOSR)) and June 2025 to July 2025 (agreement on costs for remainder of programme of works).

363. During RIIO-T2, we will undertake a significant FEED study to determine the best way to meet our site requirements (including compression) in the long term, whilst maintaining the remaining plant through our Asset Health allowances. This will allow us to become compliant with the MCPD by 2030. Upon a successful reopener submission, we will begin detailed design and build works for the future state of the terminal.

Hatton Compressor Station (LCPD)

364. Hatton is a high utilisation compressor station enabling the efficient movement of gas from the Northern and East coast terminals towards demand centres in the south of the network. In addition to the electric VSD, the site consists of three RB211 machines which supplement the VSD and provide backup capability. The RB211s are not IED-LCP compliant.

365. On 1 January 2016, one RB211 was placed on the 500-hour EUD and the remaining two units on the LLD. Entering one unit into the 500 hours' derogation provides flexibility in terms of the future solution for the site and extends the potential construction window for any new units. Our current investment plan is based on installation of new compliant gas-powered compression of equivalent capability to the 35 MW Electric VSD and the decommissioning of the two LLD machines after 2023.

366. In terms of developments since Ofgem's November 2019 needs case decision, we re-engaged Original Equipment Manufacturers (OEMs) using Process Duty Specification (PDS) duty points as accepted by Ofgem through the Needs Case process at Hatton. We used the outputs from the OEM tender proposals to update our Best Available Techniques (BAT) assessment on the options for LCPD

compliance at Hatton. This was followed by a detailed assessment of greenfield and brownfield build options, undertaken externally by our Front End Engineering Design (FEED) consultant and assessed internally via Cost Benefit Analysis (CBA). Based on findings from our CBA assessment, our preferred option as agreed with Ofgem, is to install one new gas turbine driven compressor unit, across RIIO-T1 and RIIO-T2 price control periods.

367. Following Ofgem's Final Determination in December 2020, the project is now in the final stages of FEED Conceptual Design Development of the Gas Network Development Process (GNDP). Through ongoing engagement with internal as well as external stakeholders, we are now seeking to agree the Engineering Procurement Construction Management (EPCm) contract, based on tender returns from our Framework Suppliers. The EPCm competitive procurement event was launched in March 2021 and bids are expected to be returned in May 2021. Siemens, our Original Equipment Manufacturer (OEM) have so far carried out their preliminary design phase alongside FEED and will be re-engaged once the EPCm contract has been awarded to undertake their detailed design phase alongside the project detailed design.

368. Following EPCm contract award, we will proceed to Stage 4.4 of the GNDP to deliver the project detailed design that will detail the integration of the physical interfaces and the interaction between any pre-defined OEM packages and the Balance of Plant (BOP) equipment.

Wormington Compressor Station (MCPD)

369. Wormington compressor station comprises two Rolls Royce Avon compressors (Units A and B) and one electric driven Siemens VSD compressor (Unit C). Units A and B are non-compliant with MCPD.

370. The use of compression at Wormington is strongly linked to the supply and demand levels in South Wales; critical in supporting NTS gas entering through the Milford Haven terminal and utilisation is forecast to remain high over a wide range of network conditions. Due to bi-directional flow capabilities, it is also used to support the extremities in Wales when demands are high and Milford Haven inputs are low.

371. As part of our 2019 RIIO-T2 business plan submission, we proposed replacing two Avon 1533 compressor machinery trains to reduce NOx emissions. Key activities undertaken ahead of RIIO-T2 commencement included the following preliminary activities: a screening study to identify potential new build locations, development of Process Duty Specification (PDS), Best Available Techniques (BAT) outputs, Formal Environmental Assessment (FEA) and Formal Consenting Assessment (FCA).

372. Based on Ofgem's Final Determination in December 2020, Wormington is being funded via an Uncertainty Mechanism (UM) rather than baseline. However, Ofgem have provided a baseline allowance to cover development costs and deposits on long-lead items, subject to a true-up during the associated re-opener. A two-step reopener process has been agreed. Wormington's reopeners are scheduled for

May 2022 to October 2022 (agreement of the preferred option in the Final Options Selection Report (FOSR)) and November 2024 to December 2024 (agreement on costs for remainder of programme of works).

373. We will continue FEED activities to deliver a FOSR that details the preferred and justified selected MCPD option for Wormington and justified reasons for discounting other options.

King's Lynn Compressor Station (MCPD)

374. King's Lynn comprises four existing compressor units of which the two Rolls Royce Avons (Units A and B) are impacted by MCPD.

375. Unit A was disconnected from the network in 2017 after becoming life expired and beyond economical to continue investing in for current requirements. This means that current site capability is lower than its designed capability.

376. King's Lynn provides several functions on the network including supporting the Bacton terminal exit flows through the interconnectors and moving gas away from the South East when combined flows from the Bacton and Isle of Grain terminals exceed local demand.

377. As part of our RIIO-T2 business plan we proposed proceeding with FEED studies to build two new, gas–driven compressor units (~15MW each), with a uncertainty mechanism within the RIIO-T2 period to agree the final solution. Key activities completed include development of preliminary PDS, preliminary BAT outputs and a screening study to identify potential new build locations.

378. Based on Ofgem's Final Determination in December 2020 King's Lynn is being funded via an uncertainty mechanism rather than baseline. However, Ofgem have provided a baseline allowance to cover development costs and deposits on long-lead items, subject to a true-up during the associated re-opener. A two-step reopener process has been agreed. King's Lynn reopeners are scheduled for October 2022 to March 2023 (agreement of the preferred option in the Final Options Selection Report (FOSR)) and April 2025 to May 2025 (agreement on costs for remainder of programme of works).

379. We will continue FEED activities to deliver a FOSR that details the preferred and justified selected MCPD option for Wormington and justified reasons for discounting other options.

Diversions

Overview

380. We can be required to divert sections of our pipeline network due to Integrity issues with the pipeline or requests from third parties.

381. Diversions requested by third parties enter the process via our plant protection team. Early engagement on these schemes is important, since it may be possible

for third parties to avoid the requirement or minimise the extent of any diversion. Our pipeline design and construction specialists work closely with the plant protection team to ensure we understand the needs of customers and explain options to them as early as possible, ideally at the scheme feasibility stage.

382. Under the agreements we have with land owners for our pipelines, there may be existing liabilities or obligations such as “lift and shift” or “loss of development” clauses which may require that we fund costs associated with a pipeline diversion or compensate for loss of development. For major infrastructure development, typically road and rail, requests to divert are covered by legislation which requires that statutory undertakers such as ourselves are compensated.

383. During 2020/21, we completed three diversions installing approximately 1,570m of diverted pipeline. All three diversions were for infrastructure development and fully customer funded. In addition, we advanced the development of a further 15 diversions which are due to take place over the next four years.

Highways England – A1 Morpeth to Ellingham Diversion

384. During summer 2020 we completed the Diversion of Feeder 13 for the Highways England (HE) A1 Morpeth to Ellingham Dualling scheme. The road scheme includes realignment of the A1 north of Morpeth with the new road in cutting.

385. Working closely with HE and their representatives the Diversion design was finalised and materials procured to complete the diversion during 2018. Due to HE funding delays the diversion was postponed to summer 2020 with a May 2020 mobilisation date. The Diversion was completed and successfully commissioned as planned during September 2020.

386. Aligning with our drive to promote sustainability, our Main Works Contractor utilised a solar panelled generator for the site accommodation power. This innovative use of technology reduces carbon dioxide emissions versus a typical diesel generator and also noise and vehicle movements for refuelling.

387. Opposite the diversion construction site are several residential properties, two of which are rented out as holiday homes. We’d visited the property owner to alleviate concerns they had in relation to the Diversion works in 2019. With the COVID-19 lockdown the property owner was unable to offer the properties to holiday makers so repurposed the accommodation to provide key worker accommodation for the Diversion Main Works Contractor site team.

Figure 27: A1 Morpeth diversion aerial view of route – pipeline string

Figure 28: A1 Morpeth diversion ariel view of tie-in pit final section installation

Highways England – A428, Black Cat to Caxton Gibbet Improvements Diversion

388. The A428 HE Improvement Scheme Impacts our Feeder 18 in four locations. In one location on the Spur to RWEs little Barford Power Station, a new section of road crosses the pipeline and a diversion is required.

389. At three other effected locations, we have worked with the Customer to ensure level changes associated with the new road scheme avoid the need for diversion saving the Customer around £2m.

390. The diversion is being completed as pre-work to the HE scheme largely to meet an extended gas outage that Little Barford power station have planned in for summer 2021. Aligning the Diversion works with the power station outage enables efficient use of our operational resource, reduces the overall cost to the Customer by £0.5m.

391. The redundant section of pipeline following the diversion is to be carefully removed for use by our hydrogen test project.

Highways England – A47 Improvements, North Tuddenham to Easton

392. We continue to work with the HE on a Diversion of Feeder 3 that is required for a new dual carriageway section of the A47, planned to cross our pipeline within a cutting. Ground Investigation has been completed to support the design of a Directional Drill crossing of the existing A47 plus several side roads. We've supported the HE with their stakeholder engagement, holding a virtual diversion project walk through with a residential children's home adjacent to the diversion site who have concerns about security and the impact of the works.

Highways England – Lower Thames Crossing

393. Two significant pipeline diversions are required to enable the Lower Thames Crossing scheme in a congested area for highway and utilities infrastructure. Ground Investigation has been completed and is being used to finalise the Detailed Design, which is to include a significant tunnelled section. The diversions are expected to take place during 2024/25.

High Speed 2 (HS2)

394. We have been working with HS2 since 2012. The final two diversions for HS2 Phase 1, were completed during summer 2020 under a full outage with recompression.

395. The design of the diversion and the pipeline route across the new rail track have been planned working in collaboration with HS2. Specific depth of cover and backfill above the pipeline are required to ensure the HS2 track foundations can meet the necessary standards. A non-standard open cut technique was selected for this dig, as it enables the installation of a concrete slab which allows the depth of cover to be reduced, performs best under CBA and decreases the land take impact.

396. An open cut road crossing and closure for Feeder 2 was identified as having a consequential negative impact on the HS2 main works programme. The road to be closed was included in the HS2 planning permission for use by construction traffic. At the time of the diversion, HS2 vehicle movements along this route would be 200 vehicle movements per day. An alternative route existed, but this would be limited to 12 vehicle movements per day. To reduce the impact on the HS2 works, the road crossing duration was reduced from six to four weeks and completed as planned.

397. The Feeder 23 diversion outage was booked over two years ago, however during summer 2020 we had greater than expected volumes of liquefied natural gas (LNG) being landed in South Wales. There was a risk that this flow would be higher than we could manage with Feeder 23 unavailable. The project team did their utmost to return the pipeline to service working 24/7 reducing the programme outage from 30 to 16 days.

398. Work with HS2 on Phase 2a from Birmingham to Crewe is also being progressed. Work has now commenced on Ground Investigation and Detailed Design works for five further diversions are to be completed in 2022 and 2023.

Figure 29: HS2, TX04, Feeder 23 Diversion

Diversion Development - Other

399. We have continued to work with Cheshire East Council on their A500 widening scheme throughout 2020/21. This involved completing the design, programme and budget, which have been used to support the Councils revised planning permission and funding approval which was successfully achieved. We are working on the Detailed Design with a view to complete the diversion in 2023.

400. The proposed West Winch Housing Access Road (WWHAR) is a scheme we've been working with Norfolk County Council on for two years. We've supported the Council with their funding submission and planning permission which includes the land take and consents for ourselves. The scheme requires two diversions which we completed Conceptual Design studies for during 2020, and subject to funding being made available are being scheduled for completion during 2023.

401. We are working with East Riding of Yorkshire Council to Divert Feeder 29 for a highway improvement scheme and with a private developer on proposals to Divert Feeder 18 to enable a retail development near Brentwood.

402. Preliminary discussions for future diversions associated with work on the A66, A96 and several housing development proposals have taken place.

403. We are committed to working with customers and by ensuring they understand that by early engagement and development of diversion options prior to overall schemes being fixed significant overall cost savings and simpler programming of works can be achieved.

Enhanced Physical Site Security

404. Our network is subject to a multitude of security threats, which are continually evolving and often increasing in sophistication and persistence. These threats include terrorism, criminality, espionage, activists/extremists, vulnerabilities within systems and vulnerability from insider action.

405. The Physical Security Upgrade Programme (PSUP) is a government mandated initiative to enhance physical site security with all works closely evaluated by the Department for Business Energy & Industrial Strategy (BEIS).

406. In 2014, National Grid worked with BEIS and the Centre for Protection of National Infrastructure (CPNI) to identify a number of gas transmission sites as PSUP based on BEIS' pre-defined criteria.

407. Of these gas transmission sites, those identified by BEIS prior to the site review in 2014 were designated Phase I of our programme of works. Solutions at all these sites were completed as of 31 March 2018, with all sites now being monitored by the Alarm Receiving Centre (ARC) now called the Security Control Centre (SCC). The remaining sites included by BEIS constituted Phase II of our programme of works.

Phase II

408. Phase II of our programme constitutes 20 sites, following agreement from BEIS in 2017 that for seven sites there was no driver for inclusion in the programme. Allowances for these seven sites were proposed to be returned through our May 2018 Reopener, but given the outcome, will now be trued up as part of the RIIO-T1 close out process.

409. Of these 20 Phase II sites 17 have had solutions constructed and commissioned and are now connected to the National Grid SCC. Ten of these sites have costs forecast for Financial Year 2021/22 relating to ND500 4.5 Project Closure and defect resolution activities.

410. The remaining three sites are forecast to be completed within Q1 of Financial Year 2021/22. The delivery of these sites was impacted due to COVID-19 where a delay of 6-8 weeks was seen due to temporary site shutdowns. Following recommencement of the projects, social distancing measures were enforced for health and safety reasons. However, this had an impact on the speed of project delivery. On these projects the resulting programme slippage could not be recovered during the year.

411. In 2019/20, we reported costs for our Phase II programme of £83.0m (2020/21 price base). Our latest cost forecast for these sites is slightly higher at £86.5m. This includes £4.0m forecast cost overruns for Financial Year 2021/22, £2.7m associated with 10 sites where project close out activities are required and £1.47m relating to project overruns at three sites. The overall increase compared to the

previous year predominantly relates to additional costs being incurred due to project delays associated with COVID-19.

Shared Sites

412. As part of the review of sites in 2014/15, several shared sites were classified as requiring Physical Security Upgrade Programme (PSUP) solutions. In this case shared sites are sites owned by Gas Distribution Networks (GDNs) but contain assets owned by National Grid.

413. Responsibilities for funding and delivering PSUP solutions at shared sites vary depending on if there are individual or joint drivers for the sites' inclusion in the programme. For several sites, National Grid is the sole driver and therefore responsible for funding and delivering the solutions. We originally submitted a cost proposal in our May 2018 reopener submission, however Ofgem's determined costs were less than materiality thus no funding was awarded.

414. We submitted a further cost proposal through our RIIO-T2 submission, with a plan to complete these solutions by the end of RIIO-T2 measured through an associated Price Control Deliverable. We have commenced the procurement event for the delivery of these sites, started engagement with the GDN site owners and will shortly be progressing FEED.

415. For a further site, there is a shared National Grid/GDN driver for the inclusion in the PSUP. The responsibility for funding the solution is split between National Grid and the site owner, however the responsibility for the delivery of this solution lies with the GDN site owner. A contractual arrangement was agreed between parties, and National Grid has paid all contributions up to the agreed contract sum. These costs are reported as opex through table 3.15.

Site Extensions

416. There are occasions when our sites need to be extended, for example to accommodate additional assets. If this is required at a site at which physical security has already been upgraded through the PSUP, then the existing solution must then be modified and extended to ensure the revised perimeter meets the PSUP specification.

417. Allowances for two PSUP solution site extensions were requested in our May 2018 Reopener, however, Ofgem challenged the efficiency of our original proposal and did not adjust our RIIO-T1 allowances. Due to the project timescales of the Industrial Emissions Directive (IED) activities PSUP site extension activities have also been required to be completed in RIIO-T1 unfunded.

418. The delivery of both projects was impacted by COVID-19 through site shutdowns and from changes to the principle contractor. We re-tendered the PSUP project scope at both sites moving from the Joint-Venture model to a principle PSUP contractor supported by internal SCC operatives.

419. One PSUP site extension project was completed on the 29 March 2021, has had its Tech2 Audit completed and been operationally accepted by the SCC. Costs relating to project closure and defect resolution are forecast in Financial Year 2021/22. At the other site, the PSUP solution is still within delivery and is expected to be completed by the end of Financial Year 2021/22.

420. Last year we reported forecasts for these projects totalled £7.76m (2020/21 Price basis). Our latest cost forecast is £6.16m, which includes £1.72m of forecast costs for Financial Year 2021/22. Overall project efficiencies have been achieved through our revised delivery approach, using one principle contractor supported by the SCC.

Phase III

421. In 2017 we worked with BEIS to update the collective understanding of threats to our assets and the impact of these on the NTS. Through further analysis additional sites were identified for inclusion in the PSUP, designated Phase III. Following discussions with BEIS in December 2019, it was confirmed the number of sites included in this phase had been reduced to one.

422. Funding for this site was agreed with Ofgem as part of the RIIO-T2 determination. FEED studies, detailed design and delivery of Phase III solution will be completed within RIIO-T2.

RIIO-T2 Preparation Work

423. In order to achieve a timely start to the delivery of our RIIO-T2 investment plans, in 2020/21 we commenced our investment processes for 2021/22 delivery. Using our business plan submission and feedback from the draft and final determination, the initial portfolio was identified, potential scope items were surveyed and options were selected. This allowed any necessary FEED activities to be undertaken as well as long lead time materials to be ordered. We have also been able commence testing of some of our new ways of working for data collection and cost allocation in line with the RIIO-T2 deal that was finalised in December 2020.

424. In particular, our prioritised themes of Plant and Equipment, Valves and Structural Integrity, Pipelines, Cyber, Compressors and Cabs have started new projects which are now fully underway in the Delivery Phase of our investment process for our 2021/22 outputs. Preparation for subsequent years' delivery are now also underway, along with early stages of investment preparation for all of our other asset health themes.

425. As an example, our NARC 2021 project (covering Plant and Equipment, Valves and Structural Integrity themes) commenced optioneering in 2019. We conducted surveys on sites planned for delivery in 2021 and created design options to be further developed by the delivery teams.

426. Working with stakeholders from across the business, designs were developed with consideration of long lead time materials, network access, constructability, cost,

safety and the environment. A number of high-risk long lead time materials were identified at an early stage and were procured in advance of detailed design to ensure 2021 NARC delivery key dates could be met.

427. The approach described above gives a detailed example of the method we have taken to strategically plan across our core delivery themes. These new working processes will enable planning in advance to support the efficient delivery of outputs to meet our regulatory commitments.

XII. Non Operational Capital Expenditure (TO)

Introduction

428. In 2020/21, our Non Operational Capex is £21.3m, a reduction of £2.7m in expenditure in real terms this year compared with last, but above the adjusted forecast in 2019/20 of £16.5m. Most of the year on year reduction relates to Technology Change Roadmap within IT and Fixtures and Fittings which are negative in year due to clearance of the holding account code from the previous year correctly bringing the cumulative balance to zero.

429. Our outturn for the eight-year RIIO-T1 period is £155.1m, broadly in line with the 2019/20 forecast adjusted for the annual RPI increase of £150.6m. This remains above fixed allowances of £74.7m, driven by additional investment in Project One, enhancing enterprise resource planning and transforming finance processes, and Cyber Security.

430. Project One continues to be a significant driver of IT investment in 2020/21, with expenditure this year of £6.5m. This programme has been initiated in order to drive improved efficiencies in relation to data management and reporting and involves investing in a new SAP system which will transform finance processes. Total forecast spend across RIIO-T1 has increased by £6.4m to £18.2m. FY21 is in line with prior years compared to a previous year forecast for FY21 which was minimal. This is driven by delays to the programme. The build and design of migration to SAP S4 Hana is complete for Gas Transmission, with go live due in Summer 2021. The second phase of works will introduce further functionality to support our unit cost reporting, with go live in 2022.

431. Investment in upgrades to software have slowed in 2020/21 with actual expenditure of £0.6m on upgrades to Windows 10 compared with prior year spend of £1.1m (forecast for the current year was zero). This has been driven by COVID-19 and the requirement for home working which has increased scope and accelerated spend compared to last year's forecast. The modernisation of software is important from a reliability, efficiency security perspective. A total of £3.1m was invested in these upgrades during the RIIO-T1 period.

432. Cyber Security is a key area of spend in the latter periods of RIIO-T1 as we continue to implement our strategy around mitigating cyber threats to critical systems and achieving compliance with the NISD EU Directive. Investment in this area has increased in 2020/21 to £2.4m vs prior year spend of £1.3m. This is compared to a prior forecast of £4.1m, spend has been lower due to difficulties in acquiring the required resource on projects. The total investment in the RIIO-T1 period has reduced to £4.4m.

433. Overall total forecast RIIO-T1 spend on transformation programmes such as the Technology Change Roadmap and Data and Tech GTO Process reduced slightly to £4.0m in 2020/21. The combined RIIO-T1 total is £57.6m compared with the

2019/20 amount adjusted for RPI increase to the current base of £57.9m. The details of transformation programmes are discussed below.

434. Expenditure on other smaller IT projects in 2020/21 was £4.5m, which is higher than the forecast adjusted for inflation of £2.1m. The spend for these smaller projects for 2020/21 has increased from £3.4m last year. The total RIIO-T1 Other IT Expenditure has increased from £19.7m to £22.1m.

435. Expenditure on vehicles in 2020/21 of £1.7m is slightly lower than the £1.8m last year and higher than the adjusted forecast of £1.2m. The replacement strategy follows a "whole-life costing model" to determine the optimum replacement for each type of fleet vehicle. Hence this spend fluctuates year-on-year depending on the replacement programme. The total investment in the RIIO-T1 period is £9.6m compared to £9.0m last year in real terms.

436. Investment in Land and Buildings has stayed broadly the same in 2020/21 compared with 2019/20. The overall RIIO-T1 total remains unchanged in real terms since last year at £6.1m.

437. Expenditure on fixtures and fittings and plant and machinery has also decreased in real terms from £3.3m in 2019/20 to £1.1m in 2020/21. Of this sum invested in 2020/21, £1.6m has been invested in plant and machinery and £0.5m in fixtures and fittings. The investment for the RIIO-T1 period has reduced from £23.3m last year to £19.9m due to movements in FY21.

Transmission Foundation System (TFS)

438. We have made some significant updates to key systems, including the upgrade of our asset management system, Ellipse, to the latest supported version ensuring its resilience. We have also updated our compressor health platform, providing us with better visibility of compressor running hours and reducing its annual running costs.

439. Our Pipeline Management System, Uptime, is being brought in house with inline inspection management functionality, which is already live. Cathodic protection functionality will go live in Summer 2021. This provides us with better capability to directly understand our asset condition and ensure the quality of our pipeline data.

440. Development of our field workforce platform has continued through the year, with go live scheduled for the second half of 2021. This will ensure resilience for our maintenance teams and will provide improved functionality.

XIII. Capital Expenditure (SO)

Introduction

441. This section covers our SO Capex Investment. In 2020/21, total SO Capex was £32.5m reflecting a reduction of £5.5m from the previous year. The decrease is mainly driven by the Gemini Replatforming due to project going live in FY21, resulting in lower activity compared to prior year.

442. Total spend of £279.5m across the eight-year RIIO-T1 price control period is £4.4m higher than the prior forecast of £275.1m. The main movements were due to a £3.6m increase to Data Centres driven by the re-sanction of the project as a result of delays to gas migration go-live and a £1.9m increase to IS Security and Risk management due to projects relating to National Information Security Directive (NIS-D) being delayed into FY21, moving spend from Q4 of FY20 into FY21.

Enhanced Security

443. Cyber security is viewed as a critical issue by the Government and this is evidenced by the development of the National Cyber Security Centre (NCSC). This has been formally recognised by the EU Government through the introduction of the EU legislation to enhance the security and resilience of Networks and Information Systems. The NIS Directive places requirements on providers of essential services, including National Grid, to ensure their networks and IT systems are effectively protected from cyber-attack. This new legislation was transposed into UK law in May 2018. As part of the May 2018 reopener, funding was provided to progress our enhanced security requirements. Below we discuss two of these aspects; Data Centres and Cyber Security.

Data Centres

444. Work has been undertaken to prepare the two new Data Centres, including the delivery of a highly secure Critical National Infrastructure (CNI) network that connects the new Data Centres to existing operational control rooms and other CNI sites and services. A reduction in capex for Data Centres in FY21 is driven by a slowdown of activity on the project as we approach Go-Live date. Gas Migration went live Dec 2020, with Electricity Core and Business Services Domain going live in June 2021.

Cyber Security

445. We initiated a review of our Security Organisation and portfolio of investments to ensure we remain focused on addressing advancing cyber threats. There was an increase in FY21 to IS Security and Risk Management due to key projects entering implementation stage in FY21. These include:

- **Security Orchestration Automation & Response (SOAR)** – software that allows advanced threat detection, forensics and incident management.

- **Strategic IAM (Identity Access Management) Programme** – IAM is a fundamental control in protecting our systems, data and Critical National Infrastructure (CNI) from cyber risks. IAM is about making sure that our entire global workforce only access the systems and data that they need, when they need it. Access is provided quickly and removed when no longer required.

- **Network Security Programme** – replacing End of Life (EOL) equipment and upgrading related software solutions whilst also re-designing network architecture to deliver new age security services with new firewall installed.

Telemetry

446. Telemetry systems allow us to use real time monitoring and control the flow of gas through the NTS. This facilitates safe operations and ensures a quality and quantity of gas meets consumer requirements. Gas Control Suites (GCS) is a suite of systems used for real-time monitoring and control, operational planning, data analytics and decision support by the GNCC and the wider Gas SO community. Key functionality includes management of site notifications for commercial operations, data publications and management and repository for commercial contracts.

447. In 2021 cost efficiencies have been made by reusing civil works rather than replacing and also using different telemetry units that were cheaper to procure. infrastructure enhancements, a new project started in FY21.

Regulatory Driven GSO System Enhancements

448. The expenditure on regulatory driven changes to systems has centred on being able to deliver the necessary changes to facilitate the Gas Charging Review, predominantly under UNC Modification 0678 and alternatives, for which Ofgem published a decision in May 2020 to implement for October 2020. In order to be able to deliver such significant changes, enabling GB compliance with the EU Tariff Network Code, spend on the necessary system changes was done ahead of a decision to enable delivery in the required timescales.

449. There was an increase in 2021 due to Regulatory Driven Gemini System Enhancements (GB & EU) due to project entering the implementation phase. This is broadly a new project in FY21, as only the early stages of the design phase were completed in FY20.

XIV. Operating Costs (TO and SO)

Introduction

450. This section covers our TO and SO operating costs. The costs and allowances outlined within this section are based on our restated Table 2.4, as referenced in the Executive Summary. In 2020/21 our expenditure was £194.6m and our updated spend for the eight years is £1,434m compared to an allowance of £1,334m.

451. Within the TO, our eight year spend is £925m compared to allowances of £788m.This is mainly driven by increases in Business Support costs partly offset by reductions in Planned Inspections and Maintenance and Other Direct costs.

452. Within the SO our eight year spend is £509m, which is in real terms is £37m less than allowances, this is driven by reductions in Direct costs partly offset by increases in Business Support costs.

453. As part of the RIGs consultation process in 2019, a change was requested in order to ensure a consistent approach across all licence holders to ensure that Operational IT systems in the SO's get disclosed in a consistent manner as currently happens in the TO's. This enables the costs of the operational IT portfolio to be consolidated and narrative to be written using bespoke drivers/trends in the operational estate vs the business support IT portfolio. Many of our operational IT systems are unique to National Grid and by leaving them in Business Support when Ofgem review our cost base, benchmarks are deployed in the Business Support space and having unique system costs potentially distorting the costs would result in an incorrect view of costs versus standard benchmarks. Actual numbers are included within the Operational IT & Telecoms activity.

TO Overview

454. TO Controllable Opex spend in 2020/21 was £106m, representing a real term decrease versus prior year of £14m. The main movements within year are:

- Closely Associated Indirect costs have decreased year-on-year in real terms by £1.4m. The decrease has been largely driven by savings in operational training and health and safety
- There is a decrease in Direct Costs of £6.6m being the effect of £1.0m decrease in fault repairs, £1.0m decrease in operational property management and £4.6m decrease for planned inspections.
- The TO has achieved some further cost savings in 2021. The COVID pandemic however, resulted in cost increases of £3.7m for sanitisation, safety wear, on site accommodation pods for staff and reduced time capitalised in FY21. There were mitigating costs offsets of £2.8m such as reduced travel and subsistence resulting in a net impact of £0.9m.

- Business Support costs have decreased year-on-year by £7.7m. The main decrease in costs is £3.1m relating to finance, audit and regulation, £2.3m relating to CEO and group management and £1.0m reduction in IT costs. The eight-year spend of £282m for Business Support costs is now £117m above allowances of £165m.

- Costs for the adjustment for IAS 19 pension accrual (including post cut off deficit payment) have increased to £23m in 2020/21 with a change in the deficit contribution to the 'post cut-off' pot, rather than predominantly 'pre-cut-off' as expected. There is further detail on this in the narrative for table 3.1.

- Uncertainty Opex costs are in-line with last year's costs.

SO Overview

455. Total SO Controllable Opex costs for 2020/21 were £52.5m which is £11.7m lower than prior year (excluding IAS 19 adjustment). The main movements within year are:

- Direct costs (excluding IAS 19 adjustment) were £8.7m lower than prior year. The main drivers were a reduction of £2.8m in operational support, £2.8m reduction in market facilitation, £1.1m reduction in Xoserve, £1.0m reduction in real time operations and £0.7m reduction in planning due to PEx value efficiency initiatives.

- Business Support costs were £5.8m lower than prior year. This was due reduction in finance, audit and regulation costs for the year.

- Closely Associated with indirect cost were £3.2m higher than prior year. The main driver is associated with Operational IT & Telecoms cost.

- Uncertainty Opex costs have reduced year on year by £0.4m.

System Flexibility

456. In 2020/21, system flexibility work has evolved to focus on enabling net zero, with a focus on hydrogen. This is as a result of stakeholder's request to see insight pieces on increasing low carbon gases in the gas networks.

457. We explored how operational tools, asset investment and commercial rules could be developed to support the potential future role of the NTS either as a Hydrogen NTS or Natural Gas NTS. Insights from this publication fed into the Gas Market Plan (GMaP). The GMaP brings together stakeholders to prepare for future gas market frameworks.

458. We continue in our network analysis as we explore the impact of hydrogen supplies on the NTS in terms of the penetration into the network for different scenarios. This will give stakeholders an understanding of how blended gas travels in the NTS.

459. We have been working toward the first publication in June 2021 of the Annual Network Capability Assessment Report (ANCAR), which has been driven by the process refined by National Grid during the RIIO-T2 Business Planning process. It enables us to calculate and demonstrate the physical capability of the NTS and how that capability compares to the needs of our customers now and into the future. This assessment is carried out against a range of future supply and demand scenarios using the Future Energy Scenario (FES) outputs produced by the Electricity System Operator (ESO). The output of this assessment helps inform potential changes to market rules, commercial tools or physical assets, to ensure continued safe and economic operation of the NTS in meeting our customers' needs.

XV. Innovation

460. In 2020/21, we continued to focus on innovation activities that support Gas Transmission in our goal to achieve net zero by 2050. This included closing out our projects from RIIO-T1, to ensure effective delivery across the business and maximise their value, in preparation for the start of RIIO-T2.

461. Throughout the year, the team has undertaken 32 NIA projects, and spent £4.9m with only two projects being carried forward into 2021/22 due to COVID-19 restrictions.

462. The National Grid innovation strategy consists of three RIIO-T2 innovation themes: 'Fit for Future', 'Ready for Decarbonisation' and 'Decarbonised Energy System' (figure 30).

463. Fit for the Future focuses on extending the pipeline lifetime and enabling its use for the net zero future. Ready for Decarbonisation looks at those key assets and technologies that will be needed for the integration of net zero gases into the NTS and Decarbonised Energy System develops the systems and processes that are needed to run a net zero gas network.

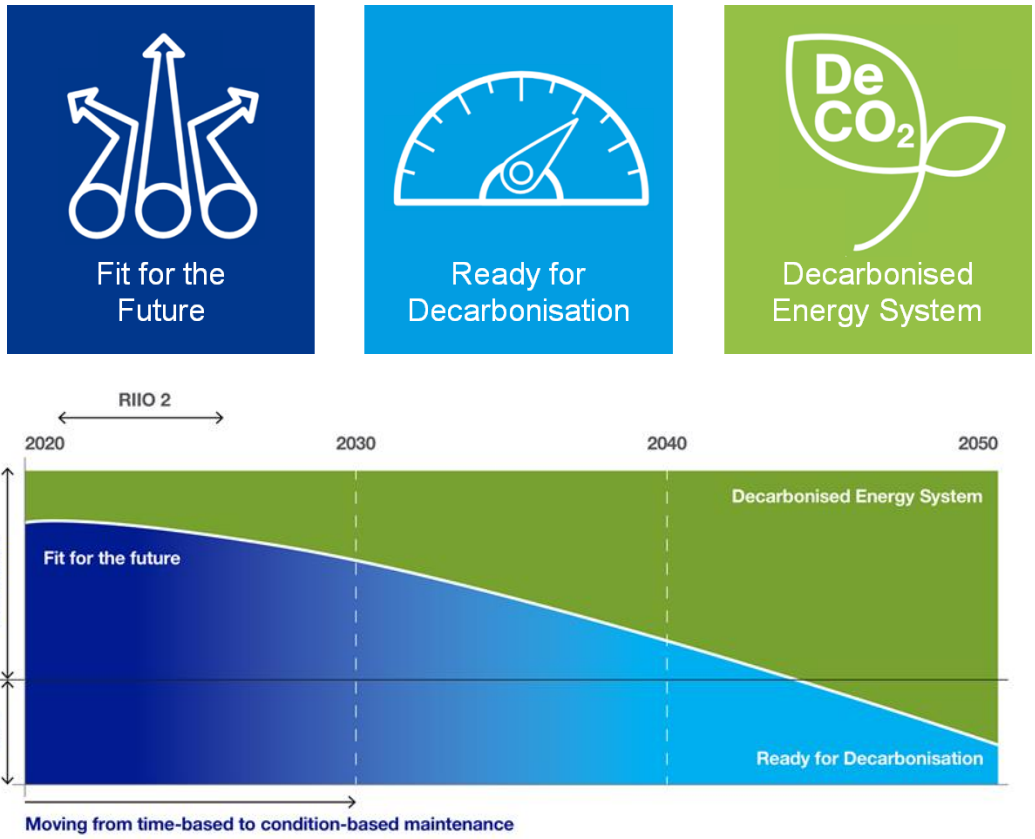

Figure 30: Gas Transmission RIIO-T2 Innovation themes

464. These themes provide a roadmap of projects through to 2050 but building technical capability within the innovation team is vital to understanding the technological landscape across the globe.

465. Therefore, to support the RIIO-T2 Innovation Strategy developed last year, we've established five Innovation Technology Portfolios, each with its own technology roadmap and specific project pipeline. These portfolios are aligned to all three RIIO-T2 innovation themes and set the direction for innovation projects delivered throughout RIIO-T2.

466. The five technology portfolios are:

- **Asset Development for Risk Mitigation:** focuses on developing an understanding of our current asset landscape and its capability with future net zero gases. This includes developing solutions for compression, storage and capture of hydrogen. This innovation technology portfolio ensures standards, policies and procedures are suitable for the energy transition and supports business as usual projects to ensure asset efficiency in the transition.

- **Automation & Measurement:** focuses on all sensing systems within the gas network, as well as assessment methodologies such as the use of pipeline inspection gauges and robotic assessments. The theme supports the roll out and use of the GRAID (Gas Robotic Agile Inspection Device) system developed in RIIO-T1 and looks to further develop this capability with improved autonomy and sensing. Measurement systems for the energy transition will be key to managing multi gas flows and understanding what is being supplied to customers.

- **Digital Systems and Simulation:** links with automation and measurement to develop Internet of Things (IOT) solutions that provide real insights for the core gas transmission teams and looks at the future options for digital twin solutions and the use of Machine Learning (ML) and Artificial Intelligence (AI). The innovation technology portfolio lead works closely with our internal data management and IT teams to deliver innovative solutions to managing and improving our asset data.

- **Materials and Processing:** Materials and processing focuses on solutions to help improve our materials resistance for current and future scenarios, whilst developing novel robust techniques to repair the NTS assets more efficiently and help extend their lifetime. This innovation technology portfolio also explores future materials technologies such as smart materials and links with automation and measurement to review automated repair technologies and in-built sensing.

- **Business Process:** Business process focuses on the operation of the NTS and builds an understanding of how this may evolve with the market changes through the energy transition. This innovation technology portfolio considers the skills and competencies required for the transition and how we best support industry and transport in the UK.

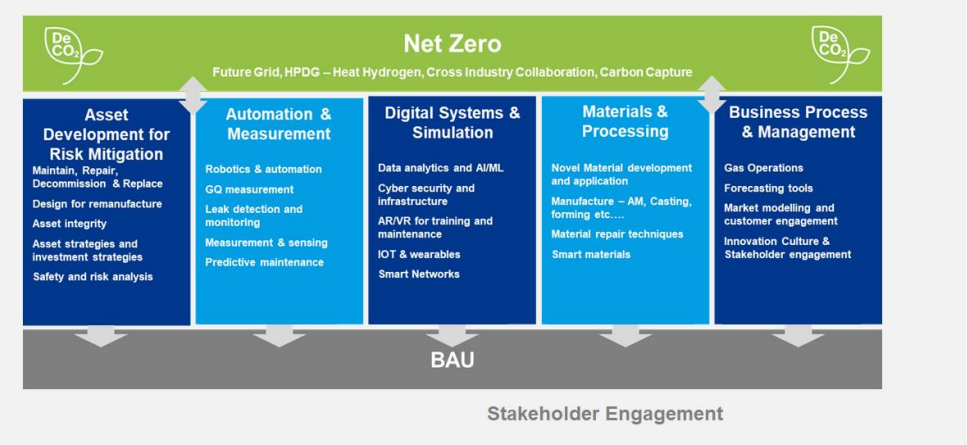

Figure 31: Gas Transmission Innovation Technology Roadmap themes

467. We have focused on improving our internal stakeholder engagement and have developed an annual engagement process looking at our Innovation Technology Portfolios and associated project pipelines. We carried out specific engagement sessions with each Gas Transmission team, to understand their challenges and identify areas of opportunity that would benefit from innovation support. Through these discussions, we generated a series of problem statements that were prioritised with support from teams across the business. These problem statements have been used to create project scopes to address these areas and have directly shaped the project pipelines for each technology portfolio. This process will be replicated each year, to allow us to continually shape our project plans, according to what brings most value to the business.

468. A core component of our overall innovation portfolio looks at increasing the efficiency of our day-to-day maintenance and operational activities, by utilising innovative tools and methods. Alongside these activities, we have continued to increase our focus on innovation projects that will support Gas Transmission to reach net zero by 2050. All five innovation technology portfolios focus on net zero in some way, across their project pipelines. Primarily, these net zero projects focus on hydrogen, building on the feasibility studies carried out in 2019/20, to examine the suitability of hydrogen as a cleaner alternative to natural gas and identify what changes may be needed across Gas Transmission to accommodate this.

469. These projects include:

- **Roadmap to FutureGrid:** focuses on the pre-work supporting the FutureGrid NIC project, looking at the design of the facility and the master test plan.
- **Gas Transport Transition Pathways:** which aims to examine the transition towards a hydrogen future for transport, providing insight into the potential technical challenges.

- **HyScale:** a feasibility study which looks at the technical and commercial issues associated with the application of Liquid Organic Hydrogen Carriers (LOHC) to capture, store, transport and release hydrogen at bulk scale in the UK.

- **HyTechnical:** a literature, science review and revision of technical standards for hydrogen pipelines, to enable the repurposing of existing gas networks.

- **Zero 2050 South Wales:** a project which brings together utilities, industry, academia, government and regional experts to adopt a whole-system view, to design a pathway that meets South Wales net zero targets while delivering the best value to customers.

470. Our team has developed a way to identify and fix faulty underground valves more efficiently, as part of the Valve Care Toolbox project. The project which consisted of three phases, utilised a new, less intrusive method to inspect valves for corrosion and clean them to protect against future damage. Using the toolbox will allow for easier monitoring of valve condition and more targeted planned maintenance using a risk-based approach. The team is now working to review the existing policy documents, to make the necessary changes to allow the valve care toolbox to be used across the business.

471. Corrosion is a challenge experienced across all NTS sites, that requires monitoring and if needed, remedial intervention. Through the corrosion modelling project, the team are looking at ways to predict how corrosion will affect above-ground pipework at St Fergus Gas Terminal. The conditions at the site – high winds and rain and the proximity to the coast – mean corrosion issues here are exacerbated. Two innovative modelling techniques have been used to help predict the likely development and spread of corrosion across the different assets. The data gathered throughout the project will help support strategic maintenance planning at St Fergus, by highlighting areas with corrosion defects likely to grow significantly during the RIIO-T2 period.

472. The CH4RGE project (Methane Reduction from Gas Equipment) is exploring the need case for the potential use of innovative technologies to reduce methane emissions on NTS sites, through a pre-feasibility study. Working with Project Environmental Solutions Ltd (PESL), the team have explored a range of potential technology options that could be used, and reviewed which of them could be a viable solution if implemented across the business. Following this pre-feasibility study, the team have secured funding for Phase Two of the project, which involves conducting a feasibility study on the solutions identified to date, with possible future phases looking at installing the chosen solution at a pilot site.

473. The team have been looking at ways to detect fugitive emissions on the NTS as part of the MoRFE (Monitoring of Real-time Fugitive Emissions) project. In collaboration with the National Physical Laboratory (NPL), they have been focusing on designing and testing a cost-effective continuous fugitive emission detection system (FEDS). While the FEDS can identify likely source areas of fugitive emissions, it can't identify the specific asset responsible for the leak, therefore they are looking at combining this with Optical Gas Imagery (OGI) cameras, which have

been trialled in the field as part of the project. Having the ability to continuously monitor fugitive emissions across the NTS, using technology solutions such as those trialled through this project, would bring considerable benefit to the Gas Transmission business, by helping to reduce natural gas emissions across all sites.

474. In November 2020, we were awarded £9.7m of funding, through the Network Innovation Competition, to build an offline hydrogen test facility and begin hydrogen testing as part of the first phase of the FutureGrid programme. The facility will be built from a range of decommissioned assets, to create a representative transmission network. Blends of hydrogen up to 100% will then be tested at transmission pressures, to assess how the assets perform. The hydrogen research facility will remain separate from the main NTS, allowing for testing to be undertaken in a controlled environment, with no risk to the safety and reliability of the existing transmission network. Construction of the facility will begin in 2021, with the first round of hydrogen testing due to commence in 2022.

475. Our FutureGrid stakeholder engagement and communication plans focus primarily on using digital channels, to offer our stakeholders greater flexibility. We've utilised our LinkedIn page to share updates and learning with our followers. This has led to an increase in followers and stronger engagement statistics for our posts. Our activities will cover FutureGrid specific information and broader hydrogen messages, to help strengthen understanding on net zero and the associated challenges. We've taken part in several webinars and online events to showcase our plans for the FutureGrid project and start building understanding around what the project aims to achieve.

476. Our hydrogen and FutureGrid 'Shaping the Future' stakeholder webinars, held in November 2020, received positive feedback and attendee numbers were high for both sessions – 145 attendees for the hydrogen session and 152 attendees for the FutureGrid session. We've created several videos to help stakeholders understand more about the project itself, the test network and how it will run, as well as broader information on hydrogen, including the different types of hydrogen available. These videos have been shared via our LinkedIn page and uploaded to the National Grid YouTube page (see figure 32 for statistics). We've also launched FutureGrid Chat, our podcast series that looks to bring stakeholders the latest information about the FutureGrid project. The first episode was published in May 2021 and looks at the test network in more details, including how it will be constructed to replicate the NTS and how hydrogen will move through the facility.

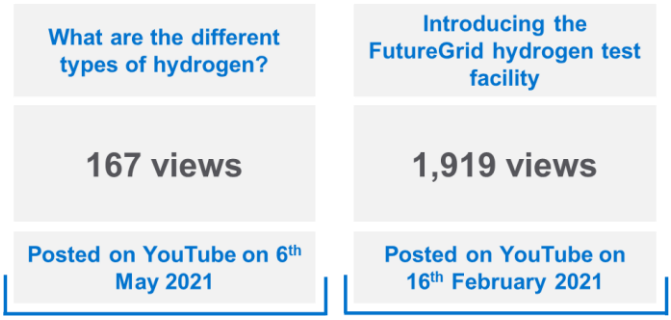

Figure 32: Statistics for latest FutureGrid videos

477. Over the past year, we have co-hosted two virtual events with the Department for Business, Energy and Industrial Strategy (BEIS), looking specifically at net zero and the decarbonisation of the gas industry. The first was a collaborative session introducing the UK and European innovation plans for net zero. The session was an opportunity for us to showcase FutureGrid and our collaborative work with Fluxys. The event received positive feedback from attendees and was well attended, with 140 people joining us on the day. The second was a larger event – the UK International Conference on Gas Decarbonisation – which highlighted the importance of gas decarbonisation in reaching net zero. The event was also an opportunity to showcase some of the UK innovation projects that are being developed to help the UK achieve this. There was a greater opportunity for audience participation during this event, with live Q&A sessions responding directly to audience questions submitted throughout the day. Again, the event had high attendance figures with a total of 350 people taking part.

478. Following feedback on the Low Carbon Networks & Innovation Conference (LCNI), the Energy Networks Association (ENA) decided to overhaul and rebrand the event, leading to the creation of the Energy Networks Innovation Conference. The first event was held in December 2020 across two days. Due to the COVID-19 pandemic, the planned face-to-face event was changed to virtual, and featured online presentations as well as virtual exhibition stands for sponsors to showcase their innovation projects and activities.

479. Our agenda presentations focused on Project GRAID and the work carried out to date, the FutureGrid programme and introducing the offline hydrogen test facility, as well as two of our environmental emissions projects; MoRFE and CH4RGE. We used our exhibition stand to launch our Innovation Technology Portfolios and introduce our hydrogen projects.

480. We also created a series of short interview style videos, that were hosted on the stand, to give an overview of some of our key projects including In Line Flow Stop, Valve Care Toolbox and Open Source SCADA. Feedback from the survey is now being used to develop the 2021 event, which will also be hosted virtually. We have started planning our content for this event, looking at which projects we want to showcase both in the agenda and through our exhibition stand.

Figure 33*:* Delegate feedback for ENIC 2020 – overall rating

Figure 34: Delegate feedback for ENIC 2020 – virtual experience rating

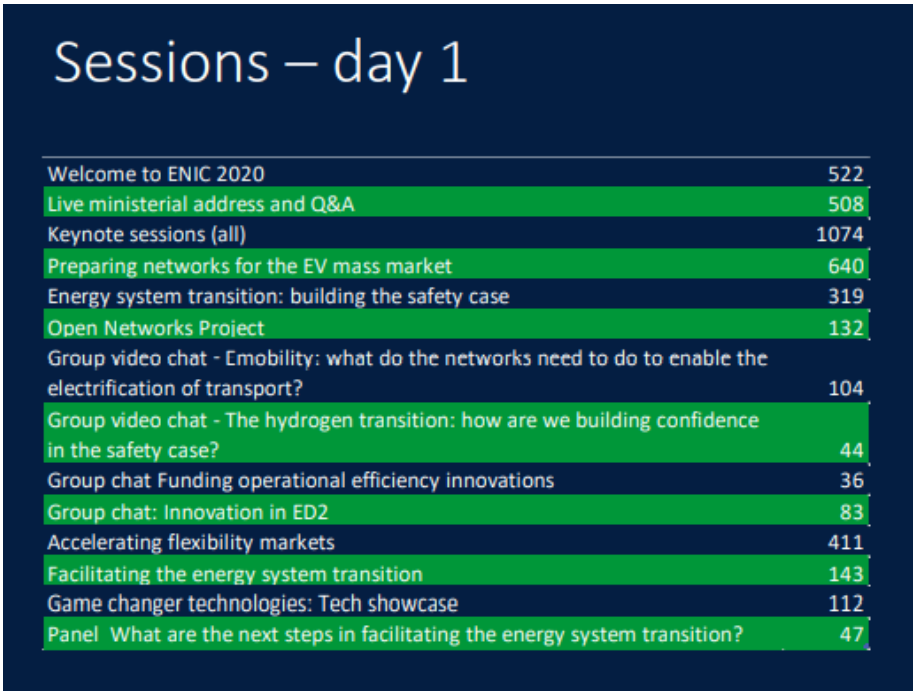

Figure 35: Attendee numbers for Day 1 agenda items

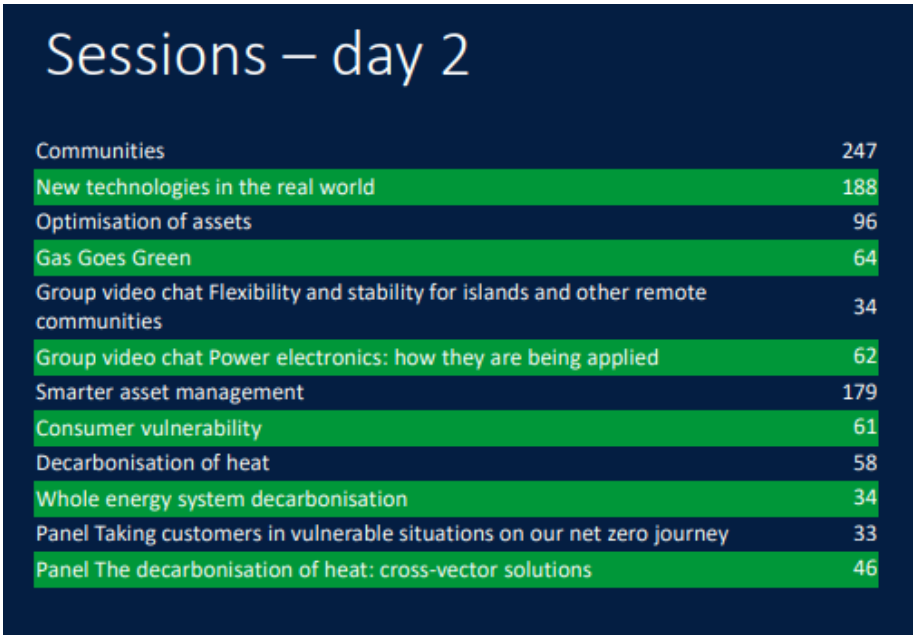

Figure 36: Attendee numbers for Day 2 agenda items

481. Throughout the last year, we have continued to work closely with the other gas and electricity networks through a variety of forums focused on preparations for RIIO-T2 and continuing to collaborate on projects, key learning and opportunities. With the GIGG (Gas Innovation Governance Group) and EIM (Electricity Innovation Managers) Group we have delivered several key outputs over the past 12 months. These include: an updated and consolidated Gas and Electricity Network

Innovation Strategy – taking on the feedback from our stakeholders to provide a joined up approach to facilitating whole system innovation, the Energy Networks Innovation Process (ENIP) which sets out the key processes from idea inception through to delivery and implementation, as well as key engagement with Ofgem and stakeholders across the RIIO-T2 Innovation workshops, and finally the development of the governance for the Network Innovation Allowance (NIA) and initial engagement for the Strategic Innovation Fund (SIF). Collaboration has remained a critical element to success, with these key outputs delivered jointly across the networks and several best practices shared between the GIGG and EIM groups.

482. As we move into RIIO-T2 we will continue to drive collaboration across the networks, identifying new opportunities to tackle key challenges across the UK energy industry, sharing best practice and knowledge to drive innovation.

XVI. Market Facilitation

483. National Grid has a number of roles in facilitating the GB and EU gas markets. This section discusses the areas we have focussed on in 2020/21, including the Future of Gas/Gas Markets Plan, the Capacity Access Review and the Gas Transmission Charging Review. One of the RIIO-T2 Stakeholder priorities is "I want you to facilitate the whole energy system of the future – innovating to meet the challenges ahead", this section will highlight examples of how we have been and are supporting the market through industry change in a way that delivers benefits to consumers.

Background

484. Over the coming years there is set to be significant change in the UK energy industry, and it will be important to ensure the GB gas regime remains flexible and adaptable to this change. Within RIIO-T1 our focus was to manage market change effectively. However, due to the expected increased volume and scale of developments within RIIO-T2, we envisage our role will evolve to leading and driving this change.

485. Financial year 2020/21 has been a very different year for us. The COVID-19 pandemic has resulted in a variety of challenges and resulted in changes to the way we work. However, we have continued to work with our customers and stakeholders to ensure our business strategy fully prepares us for the future. Most notable of these activities include:

- Progressing the Gas Markets Plan programme of work with support and collaboration with multiple stakeholders
- The Gas Transmission Charging Review delivering significant improvements to the GB charging regime
- Leading the industry on the Capacity Access Review to ensure the regime is fit for purpose and accessible to all in the future

486. We continue to play an active role in the GB and EU gas market activities by influencing the development of EU change both in terms of the continued development of EU Network Codes and other legislative developments. Within the GB market we are completing a review of the Capacity Methodology Statements, continuing work on gas quality developments and proactively reviewing our Gemini strategy and Xoserve arrangements, including the exploration of whether Gemini is still fit for purpose in our Future Capacity and Balancing Systems and Services work.

Future of Gas Project / Gas Markets Plan

487. By the end of 2020/21 we completed our first full year of the Gas Markets Plan (GMaP) and associated engagement activities such as the Future of Gas (FOG) steering group and FOG Forum. Under the programme we run four projects, within

Gas Balancing, Hydrogen, Gas Quality and Capacity Access topics. At the time of writing, two projects are complete, with final documents released and the other two are progressing to the final stages. All projects were run with an external working group throughout the life cycle of the project and the feedback provided was an integral component in shaping the projects scope, the progress of the work and the project outcomes. During the year we ran over 100 industry engagements, working groups and bilateral meetings.

488. The FOG Steering Group, which is made up of industry participants representing the whole supply chain, Ofgem, BEIS, academia and industry consultants, has matured over the last year. The purpose of the group is to help guide the GMaP by ensuring we are working on the right topics at the right time by taking the holistic view of the group. Through a feedback process undertaken at the end of 2020, with all the steering group members, we determined some improvements to the way the group operates. Key themes addressed include: allowing the members to take additional forms of leading the programme, a focus on using the group to explore the uncertainties of the future in addition to focusing on the GMaP projects that seek to manage the uncertainty, and a greater reflection on how we collaborate and run the Steering Group given the need to work remotely. This led to us increasing the meeting frequency to every two months with a reduced meeting length of two hours. We also changed the focus of the meetings to include more group wide sharing of relevant FOG updates that members would benefit to hear from each other. Lastly, we have created a FOG debate section where a member brings a topic for a deep dive discussion.

489. Since we started the debates, we have held three sessions on: Regionality and the future of gas, the Energy White Paper and Hydrogen. The aim of these sessions is to allow the exploration of a topic to gain the members input to a specific item of work, or to use the group to consider the unique perspective of the FOG Steering Group. Member feedback on the new Steering Group format has been positive. We will continue to look for opportunities to improve the way the Steering Group works going forwards as the direction for future gas market change starts to become clearer, and with it, consideration of how the group can reflect the needs of the time.

490. The FOG Forum last year was significantly impacted upon by the pandemic and the restrictions to society. The original aim was to hold an in-person event to a wider set of stakeholders that don't generally engage in strategic market change on a regular basis. Such events bring together parties involved in interesting projects that relate to possible gas market change in the future, together with updating stakeholders on our GMaP work. Through a combination of presentations, activities, and networking opportunities the industry has a chance to feed in and explore ideas. Last year, instead of the in-person event, we held an open webinar in November 2020 focused on the GMaP projects progress.

491. During 2020/21 we ran a Gas Quality project titled: 'Implementing the proposed gas quality standards'. This project dovetails with the work IGEM have been undertaking reviewing the current Gas Safety (Management) Regulations

(GS(M)R) gas quality limits, and proposing changes (e.g. widening the Wobbe range). If these proposed changes were implemented, they could have knock on impacts to the wider industry. Each party that wishes to take advantage of a new range is required to go through a UNC market-based process. This project therefore considered and reviewed the effectiveness of the existing market processes and made a number of recommendations for short term change to deliver tangible improvements by increasing transparency and industry engagement opportunities. The project also acknowledges there are still many uncertainties associated with gas quality and highlighted that further changes would be needed in the future to allow greater penetrations of hydrogen.

492. At the start of 2020/21, there was uncertainty surrounding the role of hydrogen in the energy transition. Some of this uncertainty has reduced due to the publication of the 10-point plan and the Energy White Paper, albeit there are many outstanding unresolved commercial framework questions and issues for the industry to work through. As a result of the uncertainty and as requested by the FOG Steering Group, we ran a holistic high-level project to examine some of the broad market issues associated with the potential UK adoption of a hydrogen economy. This included looking at the ways in which hydrogen could develop, the sectors impacted and when this could develop in order to provide a backdrop to assess the needed market developments. In addition, we reviewed the possible market needs for the proposed Hydrogen town. This work is detailed in two reports: Hydrogen Gas Market Plan Scenarios, Hydrogen GMaP Market Considerations to Support a Hydrogen Town.

493. From late summer 2020, we commenced a project to review the gas balancing arrangements, centring on the possible optimisations in 2030 as the way the gas network is supplied and used evolves, due to factors such as decarbonisation. The project is in the final stages, focused on documenting the results in the final report. The project has identified several possible evolutions to the balancing regime that could be taken forward where there is sufficient evidence of the needs and the benefits against any associated cost. As we stand today, the project confirms that the principles of gas balancing are broadly suitable for the current gas market.

494. The Long-Term Access Regime workstream of the Capacity Access Review has become closely linked with GMaP in the past year. We have been working with members of the GMaP Balancing and Capacity Working Group to develop a scenario which outlines the expected physical and commercial landscape for accessing the NTS by 2030.

495. The GMaP programme for 2021 will be continuing the work with the Gas Quality and Hydrogen areas together with starting a new area: hydrogen blending. The first project in the hydrogen blending area will examine the regulatory and market challenges associated with allowing hydrogen blending on the network and determine a possible timeline of projects to meet the challenges. We are shortlisting a number of projects to be taken forward this year, which will be selected from five theme areas including hydrogen market learnings, pricing and competition, customer transition, networks, and storage. The programme approach

to projects is to build agility and flexibility into the way we progress the priorities. UK Government have signalled a number of policy initiatives for this year and the coming years in the Energy White Paper, for example, the Hydrogen Strategy to come later this year. Such publications help detail the pressing areas of market development to be taken forward and the role the GMaP can play. Therefore, we aim to review the high priority topics before undertaking new projects.

Brexit

496. Following the UK's exit from the EU on 31 January 2020, a transition period was in place until the end of 2020. The UK and EU agreed a Trade and Cooperation Agreement in late December 2020 which retained existing regulatory arrangements for cross-border UK/EU energy flows.

497. During 2020/21 we continued our work to assess and prepare for the end of the transition period, again focusing on a potential no-deal scenario at the conclusion of this period and collaborating closely and regularly with BEIS, Ofgem and wider stakeholders, including interconnectors and other gas TSOs in Northern Ireland, Ireland, Belgium and the Netherlands. This included establishing a regular meeting involving ourselves and representatives from TSOs in Ireland, Northern Ireland, Belgium, Netherlands and Norway. This proved extremely useful to share information about the situation in the various jurisdictions and help all parties to manage risks caused by new arrangements (e.g. customs notifications). The changes required to industry codes and related agreements to maintain the legal basis for industry processes and commercial arrangements in light of the agreement for the Future Economic Partnership progressed through normal industry open governance and were implemented.

Future Trading Relationship with the EU

498. Following the UK's decision to leave the EU in the referendum held in June 2016, the two-year withdrawal process was triggered in a letter to the EU Council President on 29 March 2017. Following the UK general election on 12 December 2019, the European Union (Withdrawal Agreement) 2020 was finally enacted in January 2020 which enabled the UK to exit the EU on 31 January 2020. A transition period was put in place until the end of 2020. During this transition period: (a) the UK and EU negotiated a trade and cooperation agreement (TCA); and (b) existing regulatory arrangements for cross-border UK/EU energy flows remain unchanged.

499. During this period, we supported the work undertaken to agree a new relationship with the EU by participating in the BEIS Markets, Operations & Trading processes, assessing any operational and security of supply risks within our remits, responding to queries related to the future relationship and undertaking a UNC modification to ensure industry governance is applicable to UK law.

500. Post the TCA in December 2020, BEIS provided us with a letter instructing us to develop a Memorandum of Understanding (MoU) with the European Network of Transmission and System Operators (ENTSOG) which will replace our existing membership of ENTSOG. This agreement is intended to define the areas of

cooperation between UK TSOs and ENTSOG, given the importance of cross border gas flow both today and as we transition to ever greater decarbonisation of energy. Since February 2021 we have used our position on the board of ENTSOG to lead negotiations on behalf of all UK TSOs. We have also established a UK TSO forum involving IUK, Premier Transmission and GNI UK to coordinate discussions with BEIS and Ofgem as we make progress towards establishing an enduring MoU or Working Arrangements document between the UK TSOs and ENTSOG. The work is currently on track for completion by July 2021 at which point we will seek to exit our existing ENTSOG membership. We expect the MoU to be a high-level, 'goodwill' agreement, focusing on the areas we will continue cooperating on, such as security of supply.

Gas Transmission Charging Review

501. The Gas Charging Review reached a major milestone in 2020 with the decision to implement UNC0678A, effective October 2020. UNC Modification 0678A was the minded to preference in Ofgem's Impact Assessment on UNC0678 (and ten alternatives). National Grid was able to implement the necessary changes to systems and processes to implement UNC0678A from 1 October 2020. UNC0678A implemented a significant range of changes to the GB charging regime. At its core is a focus on using Capacity charges to recover Transmission Revenues. Approving UNC0678A, as identified by Ofgem, implements a regime compliant with the EU TAR Code.

502. Throughout the UNC0678 change process, we have provided the necessary support to enable Ofgem and industry parties to carry out the required assessments, including the development and publication of charging tools to enable comprehensive sensitivity analysis to be carried out by any party.

503. In the run up to a decision, National Grid took steps to be ready to implement following an Ofgem decision. We were prepared from a systems and process perspective, being able to implement on a date in line with an Ofgem decision and implementation date. We maintained regular communications with Ofgem to be open and transparent on our approach, to be able to fully support their decision making and ensuring deliverability of this substantial change under 0678 and alternatives. This ensured National Grid could implement with minimal notice following a decision for October 2020.

504. Following UNC0678A being implemented National Grid has raised some UNC modifications on charging:

- UNC0748 – changes to the Capacity Neutrality arrangements, that removed two revenue elements from Capacity Neutrality effective 1 January 2021. Consideration of the period October 2020 – December 2020 is being dealt with by a retrospective proposal UNC0765. UNC0748 was as a result of issues with revenues not contributing towards Allowed Revenue collection necessitating an urgent review of the capacity neutrality arrangements. Working closely with Ofgem on proposals, timescales and assessments of the impacts, this modification was considered urgent and

implemented successfully and quickly. This ensured that from an ongoing basis from January 2021 this issue was resolved.

- UNC0764 (urgent) and UNC0766 – in combination these two modifications deliver changes to the UNC to ensure that where necessary there is the appropriate reference or mirroring of algebra as per the updated Licence effective April 2021.

505. Both in the run up to October 2020 and since, we have focused on transparency and raising awareness of charging developments as well as providing opportunities to discuss issues, modifications. We are building a new foundation of transparency and access to this complex area of the UNC through National Grid led webinars, awareness via the National Grid Operational Forum, focused workgroups and the more familiar NTS Charging Methodology Forum. National Grid will continue to use this approach, learning from feedback to better engage and provide for our customers and stakeholders.

European Market Activities

EU Tariff (TAR) Network Code

506. The TAR code establishes a network code on harmonised transmission tariff structures for gas. It sets out the EU-wide rules which aim to enable market integration, enhance security of supply and to promote the interconnection between gas networks.

507. The TAR Code drives several changes to the GB charging regime such as the removal of fixed price capacity tariffs at interconnection points, a drive that most of the allowed revenue should be recovered via capacity tariffs and increased obligations in transparency and consultation. We were proactive in the development of the TAR code both at a European level and by working closely with BEIS and Ofgem by seeking to influence the codes and to ensure they are implemented effectively.

508. The TAR code entered into force on 6 April 2017, however elements of the TAR code would only be expected to be relevant to be applied to GB for the first tariff year after 31 May 2019, which for GB started 1 October 2019. Modification 0678A was implemented on 1 October 2020 delivering compliance with TAR in addition to additional benefits for a more fit-for-purpose charging regime.

509. Compliance with TAR continues to be a requirement of the GB charging arrangements. For any UNC change proposed since the implementation of UNC0678A that has a charging related element or impact, it is necessary to ensure that compliance with TAR is considered and provides justification of compliance with TAR with any such proposal.

510. As part of its role as Transporter, National Grid continues to monitor the GB charging regime and raise UNC modifications that we believe are necessary to maintain compliance with TAR as well as continued improvements of the regime

against the Licence objectives. National Grid also maintains the necessary transparency requirements for publication of the necessary tariffs and supporting information.

PRISMA

511. The EU Capacity Allocations Mechanism (CAM) Network Code introduced market based capacity auctions and the adoption of a Joint Capacity Booking Platform (PRISMA) for the sale and purchase of capacity at Interconnection Points. In 2020/21 we worked with PRISMA and its other TSO shareholders to develop a revised company vision for 2030. This has been a collaborative approach across all shareholders and is aiming to be finalised prior to being presented to the June PRISMA shareholder meeting.

512. Looking forwards into 2021/22, we will continue to support PRISMA in taking the next steps of developing a revised company strategy to bring the new vision to life, looking at the role they can play as the market transitions to net zero.

Gas EU Security of Supply Regulation

513. In May 2020, an infraction notice was raised against the United Kingdom by the EU Commission regarding implementation of the Security of Gas Supply regulation, specifically regarding the 'solidarity' mechanism. This mechanism obliges each member state to implement measures to support a neighbouring state in a Solidarity event. We have been working with BEIS and Ofgem to continue to develop an approach to implement the Solidarity principle and assist BEIS to fulfil their obligation. It has been important that we have played a key role to ensure that any revised implementation approach is compatible with current emergency procedures and so that effective solutions could be identified (e.g. repurposing of existing commercial mechanisms). A potential solution was developed, but this work has now been put on hold following our withdrawal from the EU and the cessation of any obligation to implement a solidarity mechanism. We will continue to assist BEIS in security of supply discussions, including those that would benefit from a coordinated response with neighbouring TSOs.

GB Market Activities

Capacity Access Review

514. In October 2019, along with industry stakeholders, we launched UNC 0705R "NTS Capacity Access Review". The aim of this review is to optimise the rules around accessing the NTS to ensure they are fit for purpose.

515. The review has been broken down into several workstreams:

Signalling and allocation of capacity

516. This workstream has resulted in changes to the User Commitment and Substitution arrangements which are now being implemented through the review of the capacity methodology statements (see below). These changes are:

- Reduction of User Commitment for Exit capacity within baseline from four years to two years.
- Reduction of User Commitment for Entry incremental capacity from 16 quarters to four quarters of the capacity application amount, with those four quarters being the incremental amount (maintaining the NPV test requirements for incremental capacity).
- Prioritisation of capacity at disconnected sites in our substitution analysis.

Capacity Products and Auctions

517. This workstream has been focussing on the development of the within day Entry and Exit products to provide Users with greater access and flexibility to purchase NTS Capacity. This has resulted in raising UNC Modification 0759S "Enhancements to NTS Within-day Firm Entry and Exit Capacity Allocations". Future work in this area will include reviewing the products currently available to ensure they are relevant, provide Users with required access and exploring any other potential opportunities that could be delivered through the capacity products offered.

Secondary Capacity Assignments

518. Following feedback from the Industry, through this workstream we have developed and raised UNC Modification 0755 "Enhancement of Exit Capacity Assignments" to enable Users to transfer exit capacity and the associated liabilities in full or in part at an Exit point.

Overruns

519. We developed UNC Modification 0716 "Revision of the Overrun Charge Multiplier" aiming to reduce the potential penal impact of the introduction of the new charging regime on overrun charges. This modification was implemented on 1 October 2020. Since then we have been reporting monthly on the level of Entry and Exit overruns that are occurring[13].

Review of the Exit Regime

520. As part of RIIO-T2, a new Licence condition was introduced which requires Gas Transporters to comply with the Exit Capacity Planning Guidance (ECPG). The ECPG provides a framework for processes and activities to ensure efficient capacity bookings are made that benefits the gas transportation network as a whole. In light of this, we are looking at various aspects of the Exit capacity regime, including User Commitment, substitution, PARCA process and ensuring the network as a whole can be accessed efficiently. Work will continue within this work stream and discussed with Industry as part of the 0705R Workgroup.

[13] This information is / will be available for each months Transmission Workgroup meetings and available to view on the Joint Office webpage here.

Long-Term Access Regime

521. This workstream is working closely with the Gas Markets Plan (GMaP). We have been working with members of the GMaP Balancing and Capacity Working Group to develop a scenario which outlines the expected physical and commercial landscape for accessing the NTS by 2030. From this we are building a series of options for a future access regime which will facilitate the expected changes identified in the scenario. Finally, we are developing a series of triggers to monitor the materialisation of these changes and identify the direction and speed of travel. This will result in a report being published that will outline our findings and seek views and input from the Industry.

Capacity Methodology Statements

522. National Grid produces capacity methodology statements as required under the Gas Transporter Licence. These methodology statements are reviewed every two years and we are currently in that process (due to conclude in July 2021). The main changes proposed to the capacity methodology statements are:

- Entry Capacity Release:
  - Reduction of the PARCA minimum duration quantity for incremental capacity from 16 quarters in a 32-quarter period to four quarters in a 32-quarter period
  - Minor changes to align with UNC Modification 0678A
  - Project costing – clarification with regards to what location National Grid NTS uses as a reference node
- Exit Capacity Release:
  - Reduction of the User Commitment for capacity within baseline from four years to two years
- Entry Capacity Substitution:
  - Disconnected sites are to be prioritised as donor sites in substitution analysis
- Exit Capacity Substitution:
  - Disconnected sites are to be prioritised as donor sites in substitution analysis
  - Additional rule to be applied to determine the quantity of the Exit Substitutable Capacity

Gas Quality Developments

523. We have been investigating the potential for National Grid to offer interruptible gas quality blending services at NTS entry points where multiple sources of gas co-

mingle within our terminal before exiting into the NTS pipelines. In Autumn 2020, we sought views from our customers and stakeholders on a range of related issues via a formal consultation, to which responses were positive towards the project while highlighting issues that would need to be worked through. We published our consultation report in December 2020. Since then, we have been working with our appointed external consultant, DNV-GL, to finalise a NIA study to assess the ability of the Bacton and St Fergus terminals to blend the volumes and quality that we could expect to see in the short term. In parallel, we have also conducted an internal assessment of the operational viability of providing such services.

524. As a result of this work, we have concluded that it would not be viable to offer such commercial services on an enduring basis for several reasons, chief among which is that they could not be offered without increasing the risk of non-GS(M)R compliant gas getting onto the network, and that we would be unable to provide them without the cooperation of other terminal operators at the relevant location. However, we remain open to working with NTS entry parties to seek to facilitate blending arrangements on a short-term basis where possible.

525. An example of such an arrangement is the work we have done to facilitate a temporary gas quality blending arrangement at Bacton in May-June 2021 as envisaged by UNC Modification 0714 'Amendment to Network Entry Provision at Bacton Perenco Terminal'. This modification sought to enable a reduction below the GS(M)R lower Wobbe Index limit for gas which Perenco deliver to us at Bacton, provided that we could achieve a compliant blend within our terminal from other supplies. We worked with the Bacton terminal operators to design additional operational controls such that the risk of non-compliant gas reaching the NTS was not increased, which was then submitted to the HSE as a temporary amendment to our GS(M)R safety case prior to Ofgem approving the UNC modification in March 2021. A final period of testing the operational controls that have been developed with Perenco is now required prior to this arrangement going live towards the end of May 2021 for a 40-day period.

526. We have also worked with other stakeholders on the IGEM Gas Quality Working Group which was tasked with producing a new UK gas quality standard with some changes to the combustion components from what currently is in force via GS(M)R. This group produced a draft standard which was consulted upon in summer 2020, which proposed a widened Wobbe Index range, replacement of other combustion parameters with a relative density limit and an increased oxygen limit on distribution systems. In our response, we supported the proposals in principle, noting the importance of concurrent reform of the flow-weighted average CV rules and now look forward to the HSE's impact assessment and consultation as the next stage in this process. We also began to think about how the revised standard, if approved, might be implemented on the NTS and sought views from all NTS entry, storage and interconnector operators about whether they would want to expand their permitted gas quality limits as a first step.

527. Finally, we reviewed the way in which we recover our costs associated with facilitating a gas quality parameter change by an NTS terminal operator. We

presented proposals to the Transmission Workgroup in September and October 2020 which proposed to target these costs more appropriately towards the party benefiting from the change. These reforms were concluded as part of amendments to our Connection Charging Statement which was published in January 2021.

Xoserve and Gemini

528. Xoserve provide a number of services to National Grid and to our customers, which in the main are associated with Gemini operation and change management, shipper invoicing, energy balancing processes and shipper lifecycle activities. Under the current regulatory arrangements, National Grid receives a funding allowance for the provision of these services from Xoserve.

529. The customer experience when interfacing with our back-office systems has continued to be a key area of focus for us throughout 2020/21, working closely with Xoserve to review and seek improvements across a range of operational areas in partnership with them. The collaborative journey between National Grid and Xoserve has been focussed on 'Manage my Profitability', which looks to improve the NTS invoicing processes linked to Energy Balancing invoicing, focussing heavily on voice of the customer to define and prioritise outputs, as well identifying the enabling actions suggested by colleagues to enhance the process and deliver better experience.

530. Improvements have been made such as Xoserve's implementation of PEGA software to tackle the backlog of Energy Balancing adjustments, resulting in an estimated 20-30 hours per month time saved in getting financial adjustments in a timely manner. Other areas of customer feedback are also being assessed (i.e. making invoice file formats more user friendly).

531. Following the creation of a new independently owned sister company 'Correla' and restructuring of Xoserve's existing operations in March 2021, we continue to work closely with Xoserve with a strategic account plan to better understand both key drivers and strategies for the future and to help leverage opportunities and to ensure both our business objectives and requirements for RIIO-T2 are aligned.

532. The Gemini re-platform programme is now complete, with the replacement of existing infrastructure, software upgrades, and moving the current system to a private cloud to ensure Gemini functionality will be in place to support some components due to its age. This sustains activity carried out within RIIO-T1 and will provide the foundations for an efficient and economical approach to be adopted to maintain the integrity of the Gemini platform going forwards.

533. Gemini System Enhancements continues and is due to go live in July 2021 which will deliver 65 improvements to the Gemini System, several cosmetic changes went live in Q1 2021. These improvements directly tackle shipper and National Grid pain points. The user community, including shippers, have been engaged throughout the project and shippers will get the opportunity to directly test the enhancements within a User Trials phase in June 2021. The improvements to the Gemini System include 13 new application programming interfaces (APIs), all APIs

being made available over the internet, increased automation, increased download functionality, and improvements to screen interfaces. The project has also incorporated automated testing software, for the first time, which has resulted in time and resource savings.

Future Capacity and Balancing Systems and Services

534. The network balancing and capacity services and systems are currently procured by NGG through a third party. Gemini, the system used to complete the balancing and capacity, is owned by NGG but managed and operated on our behalf. Gemini is the main system NGG used to communicate commercial information to/from shippers. This includes, gas flow nominations, energy allocations, capacity auctions and transportation invoicing.

535. Within 2020/21 we have been considering the requirements for the future of the capacity and balancing services and system; how and what we can deliver within the RIIO-T2 framework. This has led us to explore whether Gemini is fit for purpose, whether new, agile and modern technology would be better suited to an ever-evolving market and whether changing service provider may help us drive efficiencies, introduce innovation and set up for success for the future.

536. Activities for this project have included the following:

- In December 2020 we issued a PIN (Prior Information Notice) to the market to notify of our intention to procure the Capacity and Balancing systems and services. This directed any supplier keen to respond to the tender to register on the Achilles platform (the platform used by NGG for procurement). In parallel to this we notified the industry of our intention to complete a tender exercise with engagement, including email notifications and presentations at Gas Ops Forum and Transmission workgroup.

- In January 2021 we issued a questionnaire to industry and facilitated an industry workshop to discuss pain points associated with the current system and services and future requirements from capacity and balancing systems and services. The outputs of this workshop will be used to support the future requirements issued within the RFP (Request for Proposal).

- In January 2021 we issued an RFI (Request for Information) to market to obtain general information about products, services, or suppliers. We received responses from interested suppliers with information regarding potential future solutions, options for increased automation, future improvements based on industry pain points and cost efficiencies. Responses to the RFI were promising and reflect there is an appetite in the market to explore a system replacement of Gemini and changes to the Business Process Outsourcing (BPO) services

537. Over the next 12 months we will complete our detailed requirements gathering and issue a pre-qualification questionnaire (PQQ) to the industry to ensure potential suppliers meet the tendering criteria. Following the PQQ an RFP will be issued to market for which any organisations can submit bids to provide the future capacity

and balancing systems and services. It is anticipated any new contract will be awarded in February / March 2022.

Impacts of COVID-19

538. 2020/21 has been a year like no other in many ways, and the way the industry has worked and developed the framework has also had to adapt. The entire code change process has been managed remotely and there continues to be significant change being progressed via the Joint Office.

539. As COVID-19 and the associated lockdowns took effect, there were unprecedented impacts on businesses and society as a whole, and as transporters we recognised that there may be things that we could do to support our customers.

540. The market raised a number of Modification proposals looking to address the impacts of COVID-19 on the market and we, along with other transporters, developed UNC Modification 0726 “COVID-19 Liquidity Relief scheme for Shippers”. This modification effectively looked to give a subset of the market, the non-Investment grade rated market participants, the option of applying for a payment holiday for a period of 3 months. This was to support management of cash flow in the period where their customers were potentially having to close and have no income. This scheme was ultimately implemented by Ofgem and taken up by a number of shippers.

XVII. Operational Review

541. As the sole owner and operator of the Gas Transmission network in Great Britain, National Grid manages the day-to-day operation of the NTS including the residual balancing of the network, maintaining system pressures and assuring gas quality. The following section highlights some of the key facts and patterns observed during 2020/21 and the eight-year period of RIIO-T1 as a whole.[14]

542. The highest daily gas demand seen this year was 415.2 mcm on the 10 February 2021. This was 14.5% greater than the highest demand experienced in 2019/20 (362.6 mcm). This was due to increased LDZ demand following a cold snap during February, the 10 February 2021 was the second highest demand experienced in the last 10 years.

543. During the 2020/21 winter period, the System Average Price (SAP) was 45 p/th and ranged from 31 p/th to 77 p/th. The 2019/20 SAP was 29.5 p/th ranging from 18 p/th to 43 p/th. The increased price was primarily due to a decrease in storage stocks and global market conditions.

544. The total consumption for the year was 84.2bcm compared to 84.0 bcm in 2019/20. Although there were small decreases in overall LDZ and Power demand, this was offset with small increases in Industrials and exports to Moffat. A high-level overview of the impact of COVID-19 is covered in at the end of this section.

545. The coldest day in 2020/21 was recorded on 12 February 2021 with a National Composite Variable (CWV) of -2.00. All weekdays of the week commencing 8 February feature in the highest 30 demand days over the last 10 years. The lowest demand seen was 121.8 mcm on the 20 August 2020, similar to last year's minimum demand of 119.6 mcm.

546. LNG terminal flows have decreased, as the number of LNG cargoes received into the UK have reduced from 189 in 2019/20 to 153 in 2020/21. Significantly higher imports were seen at Bacton, particularly in January 2021; imports in winter 2020/21 were 1.99 bcm compared to 0.11 bcm in 2019/20.

547. In 2020/21, all significant offtake pressure customer obligations were delivered. The development and execution of our operational plans ensured 100% of firm capacity purchased by customers was made available for use and 565 maintenance operations were completed successfully during the year.

Operational challenges

548. Supplies have been changeable this year, with LNG flows lower overall, however, we have seen some very high flows on certain days/over certain periods as illustrated below. There have been increased imports at Bacton, particularly during

[14] Please note that winter refers to the 6-month period of the gas year, running from October through to March, with summer covering April to September.

January 2021. The change in supply patterns has led to a 50% increase in the use of compression, compared to the previous year, to manage the network.

549. The diagram below shows the differing supply profile on two days last Winter. Note this is a snapshot in time based on telemetry data. The arrows represent the flow of gas on the network and the circles denote compressors (green is on, grey is off)

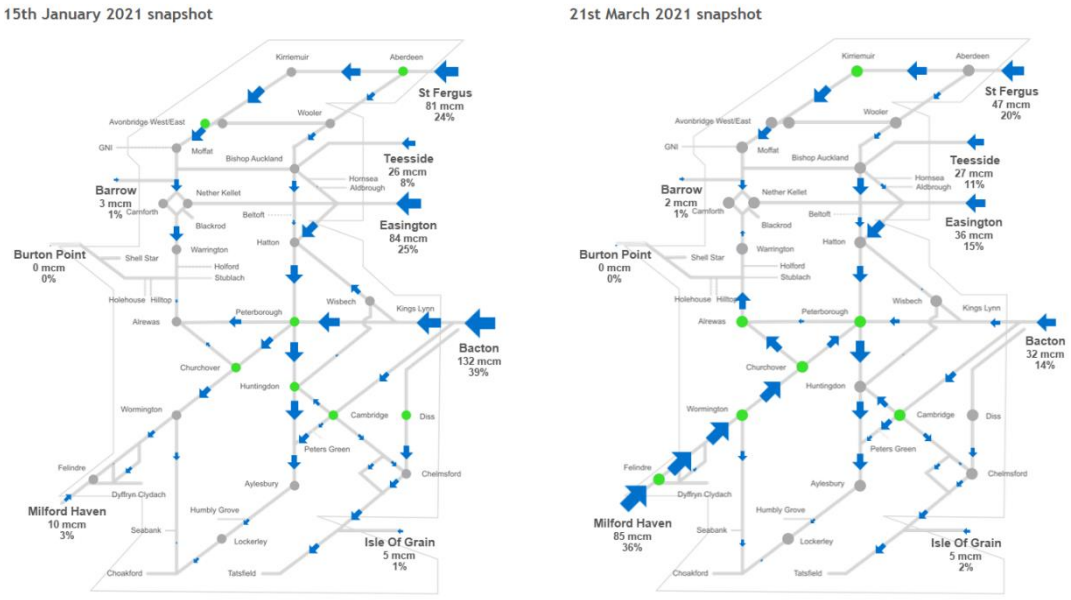

Figure 37: Different supply profile on two days during winter 2020/21

550. During the winter, there were 156 GS(M)R supplier gas quality excursions, which were resolved using the relevant processes i.e. discussion with relevant parties and ultimately a Terminal Flow Advice (TFA) notice being issued.

551. There were no unplanned system events at NTS offtakes.

Gas Demand and Supply

552. The chart below displays the gas demand for the past 12 months by the individual demand components.

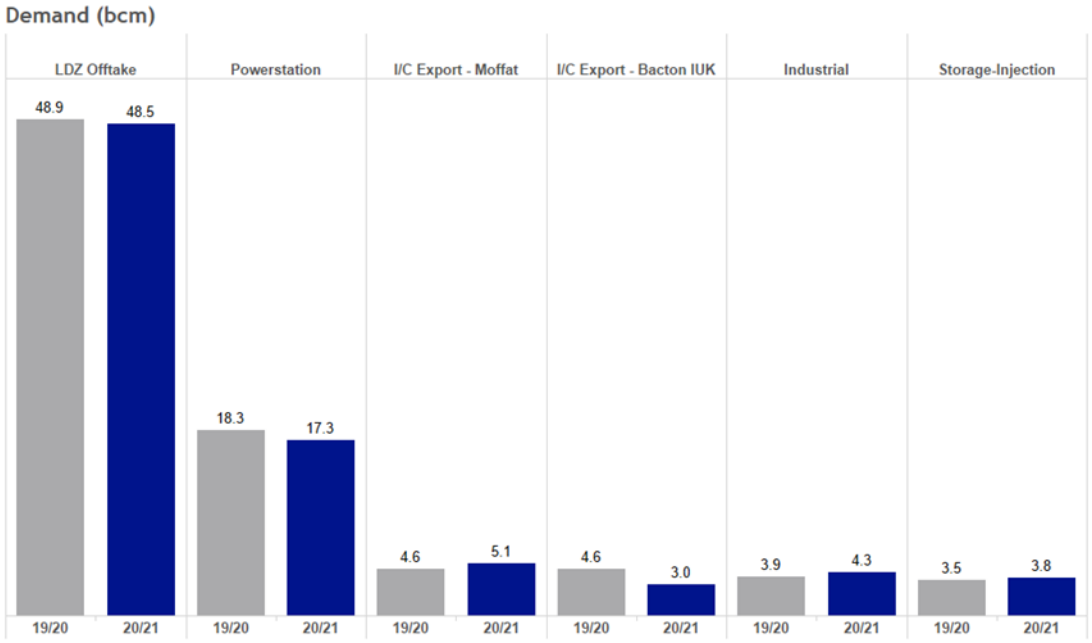

Figure 38: Gas demand in 2020/21 vs 2019/20 by demand components

553. LDZ demand was marginally lower overall this year at 48.5 bcm compared to 48.9 bcm in 2019/20; however, averaging slightly higher over winter at 193 mcm/d winter compared to 188 mcm/d in 2019/20. This winter, the maximum LDZ demand seen of 307.8 mcm was significantly higher than that seen in previous two years where LDZ Demand was 249.9 mcm and 289.3 mcm respectively. Winter 2017/18 saw a maximum LDZ demand of 357.1 mcm on 1 March 2018.

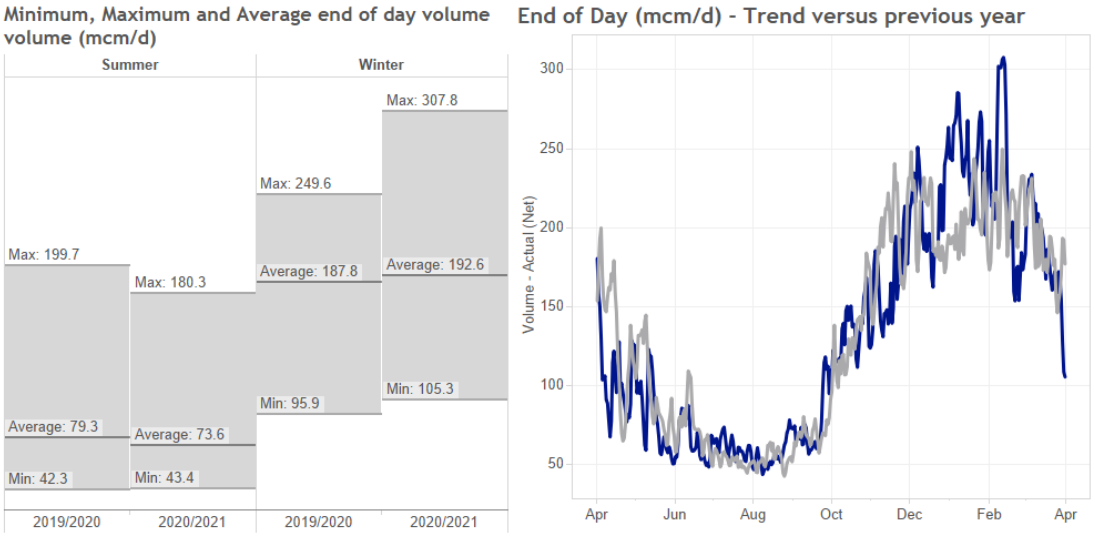

Figure 39: LDZ demand average daily volume, range and trend previous years

Weather

554. The CWV is a single measure of daily weather and is a function of actual temperature, wind speed, effective temperature and seasonal normal effective temperature. The CWV highlights a slightly cooler winter than last year, but with a cold snap which correlates with LDZ demand levels seen.

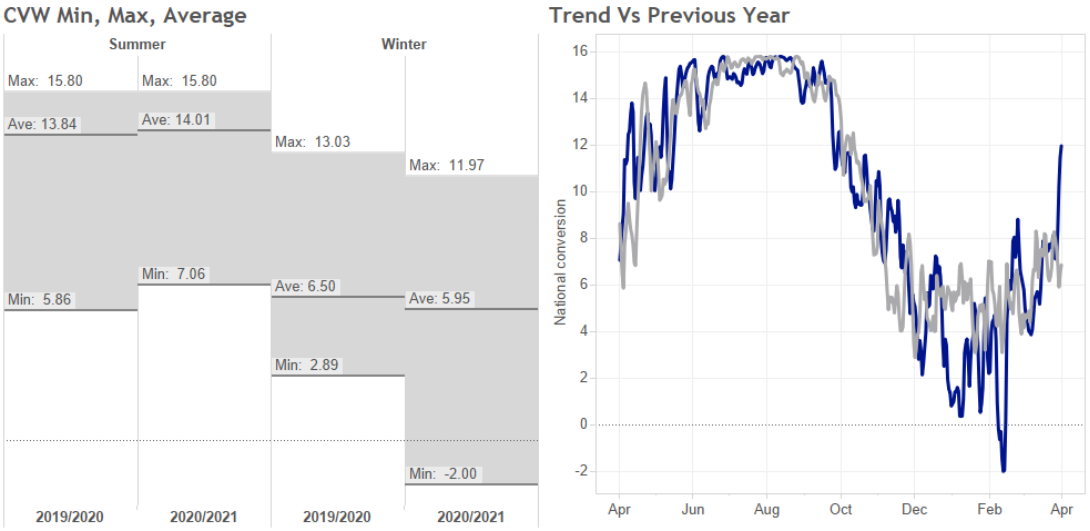

Figure 40: National Composite Weather variable data

Demand for Power Generation

555. The chart below shows the gas demand for power generation this year, compared to the previous year. Over the summer period, the average demand was less than the previous year by 8.8 mcm/d. During the winter period, the change was less pronounced with an increased average demand of 3.2 mcm/d.

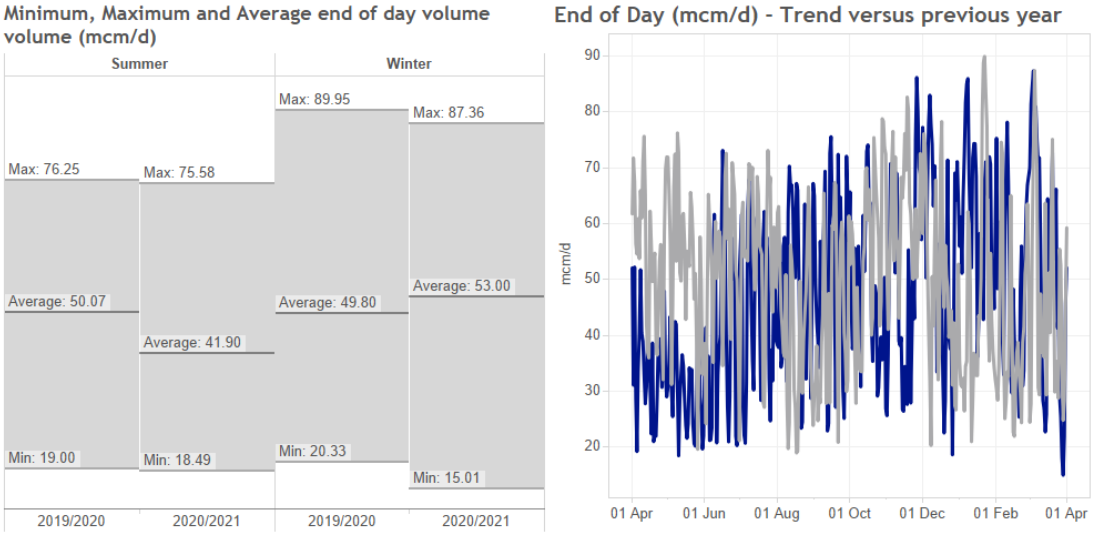

Figure 41: Demand for power generation

Import/Export Flows at IUK

556. The figure below shows the import/export flows at IUK for this year in comparison to last year, showing a large increase in imports over Winter and a decrease in exports. This was due to price differential between UK and Europe which peaked in January at circa 8 p/th.

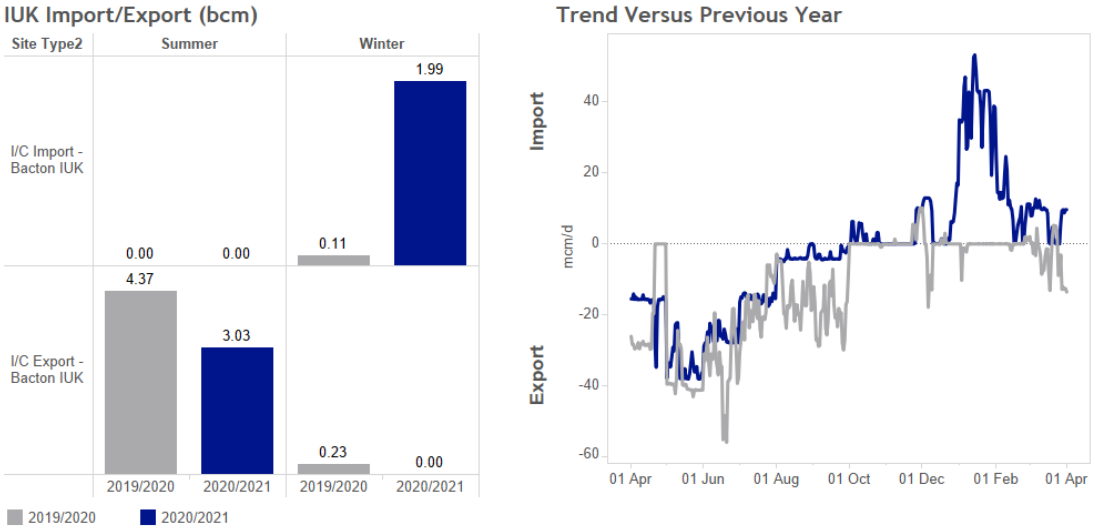

Figure 42: IUK import/export volumes for 2020/21 vs 2019/20

Supply Breakdown

557. The figure below shows the volume of supply by source type. Compared to the previous year, the largest elements of the supply profile; UKCS and Norway have remained at similar levels.

558. There has been a decrease in supply from LNG of 3.4 bcm from 2019/20, which has been offset by increases in BBL and IUK imports.

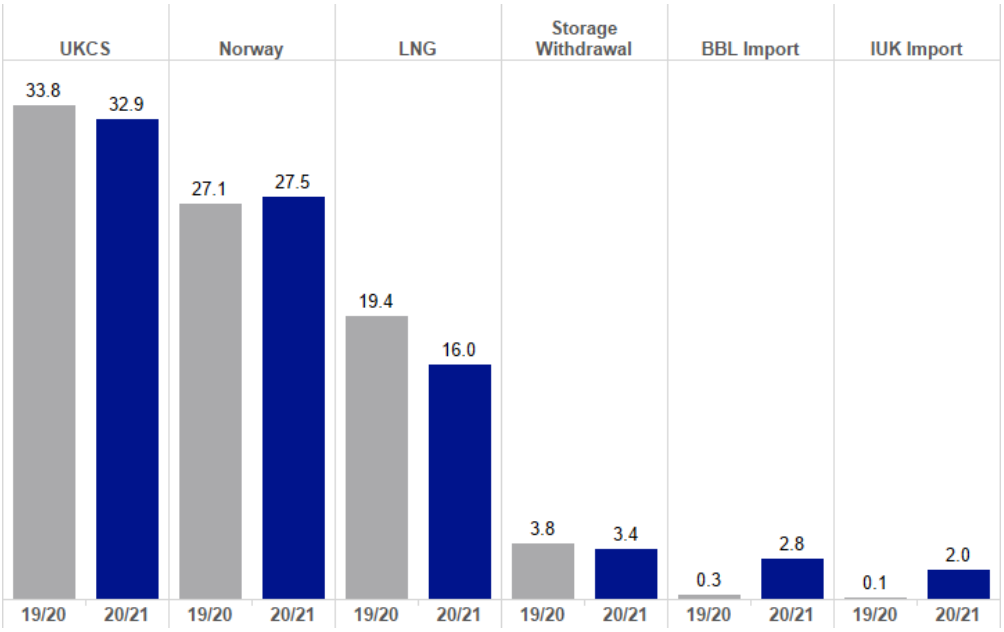

Figure 43: Gas supply breakdown 2019/20 vs 2020/21

559. The chart below illustrates the gas supplied to GB by geographical location. The majority of the volume of gas supplied continues to be via Easington, St Fergus and Bacton, however the locational profile has changed to some extent. When compared to the previous year, there has been a decrease in the volume of LNG supply entering the NTS in the west at Milford Haven and south east at Isle of Grain. Increased imports were seen at Bacton.

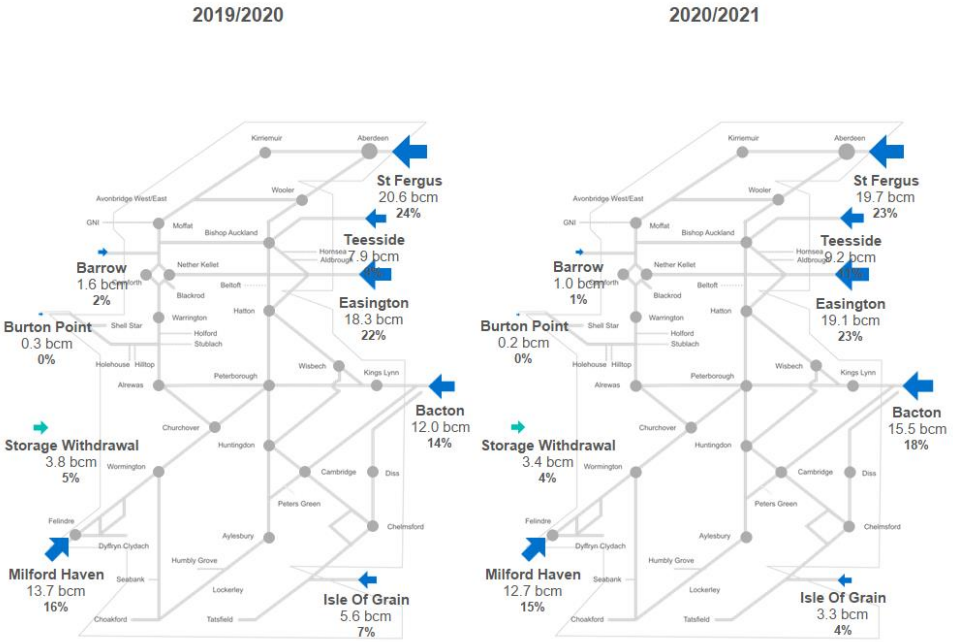

Figure 44: Supply profile by location for winter 2019/20 vs 2020/21

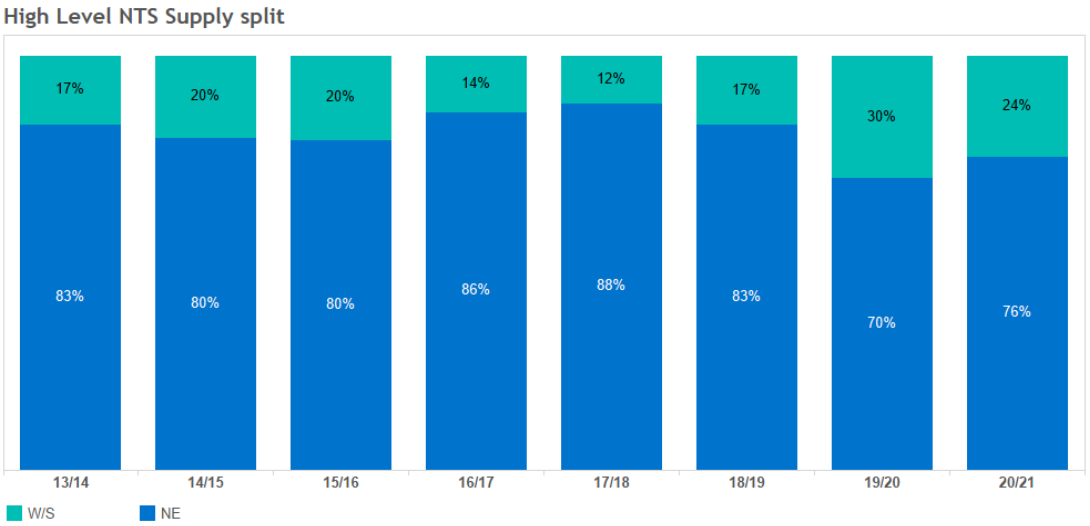

Figure 45: The change in high level supply location pattern (West/South or North/East) over the past eight years.

Supply (BCM) by Entry Point

Supply Site	13/14	14/15	15/16	16/17	17/18	18/19	19/20	20/21
Bacton	17.1	14.6	13.6	16.6	19.4	14.6	12.0	15.5
Barrow	2.1	0.2	1.5	0.9	0.5	1.0	1.6	1.0
Burton Point	0.6	0.5	0.5	0.4	0.5	0.5	0.3	0.2
Easington	22.2	21.4	21.1	21.0	23.3	22.8	19.0	19.7
Isle Of Grain	0.1	0.2	0.0	0.0	0.2	3.0	5.6	3.3
Milford Haven	7.9	11.9	12.6	7.2	4.9	6.1	13.7	12.7
St Fergus	20.3	19.4	23.2	30.7	29.4	24.8	20.6	19.7
Storage Withdrawal	2.9	3.1	2.6	3.5	4.4	3.1	3.8	3.4
Teesside	4.4	5.4	6.4	5.3	5.7	5.5	7.9	9.2
Theddlethorpe	3.4	3.3	2.6	2.2	1.9	0.5	0.0	0.0

Table 9: Highlights changing supplies at high level location over the past eight years.

Compressor Utilisation

560. Overall compressor running hours have increased by almost 50% from 26,191 hours in 2019/20 to 39,229 hours this year. (Note this is slightly different to running hours reported in table 5.5 as operationally we report by gas day as opposed to calendar day).

561. As a result of the changes in volume of supply by location, the regional profile of compressor running hours has changed, with an increase in Scotland and east/west running hours in order to bring supplies to centres of demand.

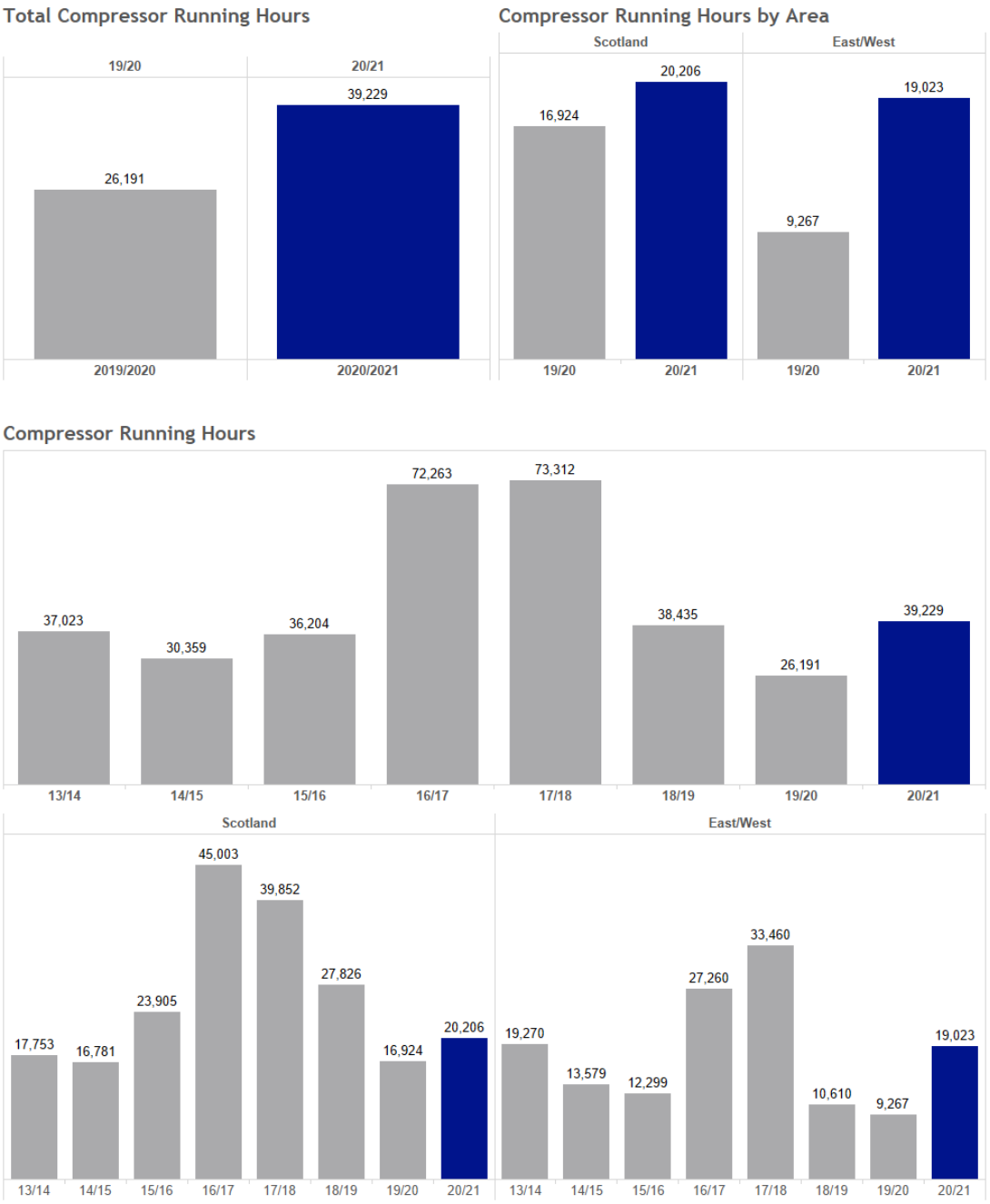

Figure 46: Compressor running hours 2019/20 vs 2020/21

562. Supply patterns have changed over the past eight years. High flows at St Fergus in 2016/17 and 2017/18 led to high compressor use in Scotland. Higher interconnector import flows 2020/2021 at Bacton has meant higher compressor use in the east.

Commercial Prices

563. Commercially, average gas prices were lower in summer and higher than winter than the previous year.

564. The increased price was due to a decrease in storage stocks and changing global market conditions.

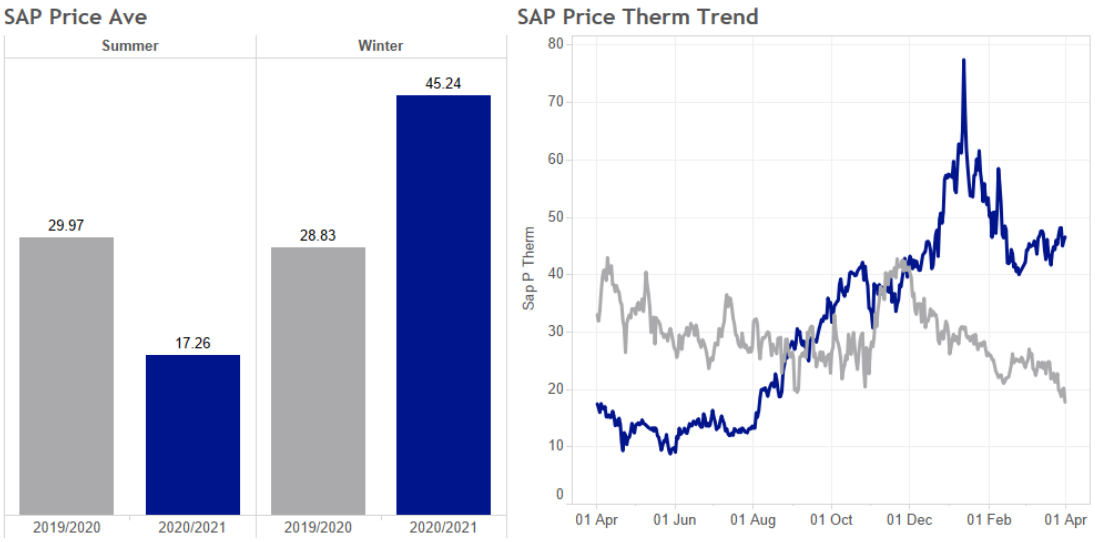

Figure 47: Daily SAP 2019/20 vs 2020/21

Comparison of NTS linepack swing

565. Within day profiling remains an ongoing issue for system operability, due to the NTS and associated contractual rules being designed for flat supply and demand profiles. It can therefore be challenging to meet our customer requirements, in particular maintaining the required pressures on days of significant linepack swing. Linepack swing is the difference between the volume of gas in the NTS at the start of the gas day, compared to its lowest point.

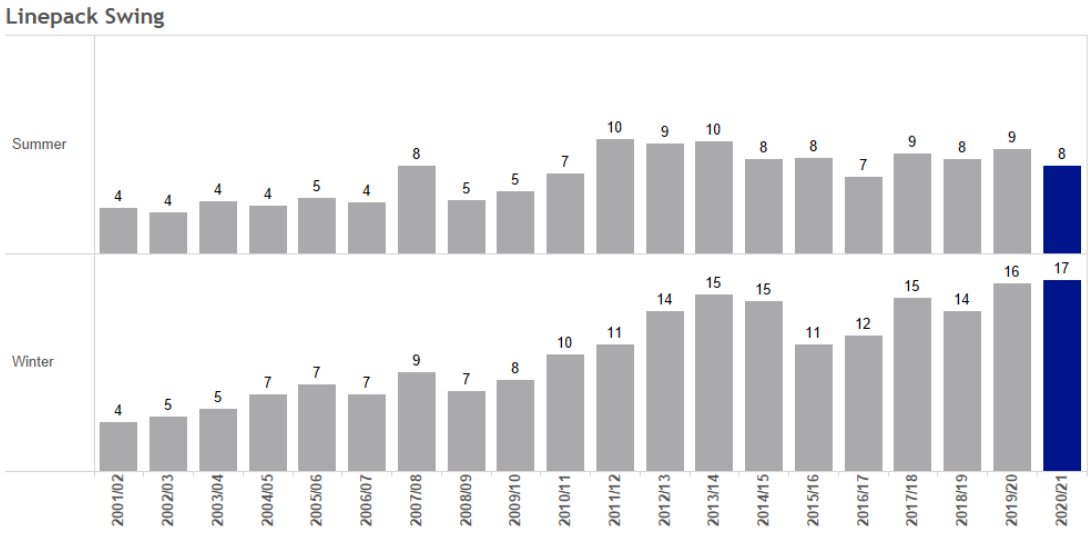

Figure 48: Chart showing average daily linepack swing since 2001/02

Impact of COVID-19 on Demand

566. During the early part of the summer (April – June 2020), there was a reduction in demand when compared to Seasonal Normal Demand (SND). This was due to the impact of COVID-19 control measures causing industry and some business to close, as well as a shift to working from home. As lockdown measures were eased, demands returned to levels more in line with SND.

Appendix I – Totex Tables

Totex
National Grid Gas Transmission
2020/21

2.4 Published Totex

Actual/Forecast Expenditure (£m, 2020/21 Prices)

		Actual 2014	Actual 2015	Actual 2016	Actual 2017	Actual 2018	Actual 2019	Actual 2020	Actual 2021	Total
	Load Related Capex	4.0	1.7	1.6	1.9	2.8	2.6	8.4	2.6	25.5
TO	Asset Replacement Capex	65.7	62.7	84.6	107.1	135.4	117.5	66.6	55.0	694.7
	Other Capex	35.0	38.8	32.0	16.6	48.0	53.0	34.0	28.3	285.7
	Non Operational capex	14.4	13.6	15.2	24.5	19.5	22.7	24.0	21.3	155.1
	Total Capex	**119.1**	**116.8**	**133.4**	**150.1**	**205.8**	**195.8**	**132.9**	**107.2**	**1,161.0**
	Opex									
	Faults	10.0	7.0	3.6	4.8	5.3	8.1	6.9	5.9	51.5
	Planned Inspections and Maintenance	28.1	30.1	27.1	30.4	28.5	27.3	31.4	26.8	229.7
	Other direct costs	1.2	7.3	5.7	5.6	6.1	7.1	7.2	6.2	46.4
	Closely Associated Indirect Costs	24.9	21.8	27.0	33.2	34.6	48.4	24.9	23.5	238.2
	Business Support	26.2	28.3	32.1	34.5	39.8	41.4	43.6	35.9	281.8
	Adjustment for IAS 19 pension accrual	- 0.7	0.3	- 0.2	- 0.8	1.0	- 10.5	0.8	23.0	12.9
	Total Controllable Opex	**89.7**	**94.8**	**95.2**	**107.5**	**115.3**	**121.8**	**114.8**	**121.4**	**860.5**
	UNCERTAIN EXPENDITURE									
	Load Related Capex	-	-	-	-	-	-	0.6	2.2	2.8
	Asset Replacement Capex	-	5.2	3.3	34.1	58.4	43.3	27.5	13.0	184.9
	Other Capex	41.7	27.1	16.5	4.4	24.3	28.3	28.6	6.6	177.6
	Total Uncertain Capex	**41.7**	**32.4**	**19.8**	**38.5**	**82.7**	**71.6**	**56.8**	**21.8**	**365.3**
	Controllable Opex	7.0	4.9	7.0	8.8	11.3	9.1	8.2	8.0	64.4
TO	**TOTEX**	**257.5**	**248.9**	**255.3**	**304.9**	**415.1**	**398.3**	**312.7**	**258.4**	**2,451.3**
SO	**Non Operational capex**	24.2	37.2	48.8	36.6	28.3	34.0	38.0	32.5	279.5
	Direct costs	32.0	37.1	38.6	36.9	37.5	37.3	35.9	27.2	282.7
	Closely Associated Indirect Costs	9.5	11.6	10.1	11.6	9.6	5.8	7.3	10.5	76.0
	Business Support	15.8	14.6	16.4	17.6	16.4	20.5	21.0	14.8	137.1
	Adjustment for IAS 19 pension accrual	- 0.4	0.2	- 0.2	- 0.6	0.7	0.3	0.5	12.7	13.1
	Controllable Opex	**56.9**	**63.4**	**65.0**	**65.5**	**64.2**	**64.0**	**64.8**	**65.2**	**508.8**
SO	**TOTEX**	**81.0**	**100.6**	**113.7**	**102.0**	**92.5**	**97.9**	**102.8**	**97.7**	**788.3**

Total Allowances (£m, 2020/21 Prices)

		RIIO-T1 Allowances								
		2014	2015	2016	2017	2018	2019	2020	2021	Total
	Load Related Capex	20.6	8.4	1.7	1.4	8.1	6.9	0.3	-	47.4
TO	Asset Replacement Capex	118.5	138.4	127.0	121.8	142.9	114.5	71.4	69.8	904.3
	Other Capex	36.6	24.8	14.7	17.2	43.6	44.6	28.0	8.8	218.2
	Non Operational capex	14.1	13.2	9.0	8.4	7.6	5.7	8.7	8.0	74.6
	Total Capex	**189.8**	**184.8**	**152.4**	**148.9**	**202.2**	**171.7**	**108.4**	**86.5**	**1,244.6**
	Faults	8.8	8.9	9.0	9.0	9.1	9.1	9.2	9.4	72.5
	Planned Inspections and Maintenance	30.9	31.2	32.2	32.1	32.6	32.8	33.9	33.4	259.1
	Other direct costs	11.9	10.3	15.5	28.2	35.3	33.7	25.2	19.9	180.0
	Closely Associated Indirect Costs	20.8	21.6	22.4	22.3	22.6	22.5	22.6	22.8	177.6
	Business Support	20.3	19.7	20.2	20.6	20.5	20.7	21.2	21.4	164.6
	Adjustment for IAS 19 pension accrual									
	Total Controllable Opex	**92.7**	**91.7**	**99.3**	**112.1**	**120.0**	**118.9**	**112.1**	**106.9**	**853.8**
	UNCERTAIN EXPENDITURE									
	Load Related Capex	-	-	-	-	-	-	-	-	-
	Asset Replacement Capex	-	-	-	-	-	-	-	-	-
	Other Capex	- 5.2	- 1.8	1.4	- 3.5	- 6.2	- 14.9	- 8.3	4.6	- 33.9
	Total Uncertain Capex	**- 5.2**	**- 1.8**	**1.4**	**- 3.5**	**- 6.2**	**- 14.9**	**- 8.3**	**4.6**	**- 33.9**
	Controllable Opex	**5.1**	**3.7**	**2.2**	**2.6**	**6.5**	**6.7**	**4.2**	**2.4**	**33.4**
TO	**TOTEX**	**282.3**	**278.4**	**255.3**	**260.1**	**322.5**	**282.4**	**216.3**	**200.5**	**2,097.8**
SO	**Non Operational capex**	**72.9**	**44.1**	**37.4**	**38.0**	**37.6**	**43.8**	**43.8**	**36.6**	**354.2**
	Direct costs	60.1	63.1	69.1	71.0	64.9	68.6	69.9	68.9	535.7
	Business Support	-	-	-	-	-	-	-	-	-
	Adjustment for IAS 19 pension accrual									
	Controllable Opex	**60.1**	**63.1**	**69.1**	**71.0**	**64.9**	**68.6**	**69.9**	**68.9**	**535.7**
SO	**TOTEX**	**133.0**	**107.2**	**106.5**	**109.0**	**102.5**	**112.4**	**113.7**	**105.5**	**889.9**

Variance Actual/Forecast v Allowances

		Variance to Allowance								
		2014	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**Total**
	Load Related Capex	16.6	6.7	0.1	- 0.4	5.3	4.3	- 8.0	- 2.6	22.0
TO	Asset Replacement Capex	52.7	75.7	42.5	14.7	7.5	- 3.0	4.8	14.8	209.7
	Other Capex	1.6	- 14.0	- 17.4	0.6	- 4.5	- 8.4	- 6.0	- 19.5	- 67.6
	Non Operational capex	- 0.3	- 0.4	- 6.2	- 16.1	- 11.9	- 17.0	- 15.3	- 13.3	- 80.5
	Total Capex	**70.6**	**68.0**	**19.0**	**- 1.2**	**- 3.6**	**- 24.1**	**- 24.6**	**- 20.6**	**83.6**
	Faults	- 1.2	1.9	5.5	4.2	3.8	1.0	2.3	3.4	21.0
	Planned Inspections and Maintenance	2.8	1.1	5.0	1.7	4.1	5.5	2.5	6.6	29.4
	Other direct costs	10.7	2.9	9.8	22.6	29.2	26.6	18.0	13.7	133.6
	Closely Associated Indirect Costs	- 4.1	- 0.2	- 4.5	- 10.9	- 12.1	- 25.9	- 2.3	- 0.7	- 60.7
	Business Support	- 6.0	- 8.6	- 11.8	- 13.9	- 19.3	- 20.7	- 22.4	- 14.5	- 117.2
	Adjustment for IAS 19 pension accrual	0.7	- 0.3	0.2	0.8	- 1.0	10.5	- 0.8	- 23.0	- 12.9
	Total Controllable Opex	**3.0**	**- 3.2**	**4.1**	**4.6**	**4.7**	**- 2.9**	**- 2.7**	**- 14.4**	**- 6.8**
	UNCERTAIN EXPENDITURE									
	Load Related Capex	-	-	-	-	-	-	- 0.6	- 2.2	- 2.8
	Asset Replacement Capex	-	- 5.2	- 3.3	- 34.1	- 58.4	- 43.3	- 27.5	- 13.0	- 184.9
	Other Capex	- 46.9	- 28.9	- 15.1	- 8.0	- 30.5	- 43.2	- 37.0	- 2.0	- 211.6
	Total Uncertain Capex	**- 46.9**	**- 34.2**	**- 18.4**	**- 42.1**	**- 88.9**	**- 86.5**	**- 65.1**	**- 17.2**	**- 399.3**
	Controllable Opex	- 1.9	- 1.2	- 4.8	- 6.2	- 4.8	- 2.4	- 4.0	- 5.6	- 31.0
TO	**TOTEX**	**24.7**	**29.5**	**- 0.0**	**- 44.9**	**- 92.6**	**- 115.9**	**- 96.4**	**- 57.9**	**- 353.5**
SO	**Non Operational capex**	48.8	6.9	- 11.4	1.5	9.3	9.8	5.8	4.1	74.7
	Direct costs	28.1	26.0	30.5	34.0	27.4	31.3	34.0	41.7	253.0
	Business Support	- 15.8	- 14.6	- 16.4	- 17.6	- 16.4	- 20.5	- 21.0	- 14.8	- 137.1
	Adjustment for IAS 19 pension accrual	0.4	- 0.2	0.2	0.6	- 0.7	- 0.3	- 0.5	- 12.7	- 13.1
	Controllable Opex	3.3	- 0.3	4.2	5.5	0.7	4.7	5.1	3.7	26.8
SO	**TOTEX**	**52.0**	**6.6**	**- 7.2**	**7.0**	**10.0**	**14.5**	**10.9**	**7.8**	**101.6**

Appendix II – Published Outputs

Totex
National Grid Gas Transmission
2020/21

2.5 Published Outputs

1. Stakeholder Satisfaction

	2014	2015	2016	2017	2018	2019	2020	2021
NGGT Customer survey - baseline	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9
NGGT Customer survey - score	7.2	7.6	7.6	8.0	7.6	7.8	8.0	8.2
Stakeholder survey - baseline	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4
Stakeholder survey - score	7.8	7.9	8.0	8.0	8.0	8.1	8.4	8.4

2. Incremental Capacity

	2014	2015	2016	2017	2018	2019	2020	2021
Signals for incremental capacity (GWh/day)								
Entry				0.0	0.0	0.0	0.0	0.0
Exit				0.0	0.0	0.0	0.0	0.0
PARCA Termination Value (£m)	0.0	0.0	0.0	(0.2)	(0.7)	0.0	(2.7)	0.0

3. Gas Constraints

	2021
Constraint management revenues - Entry	89.6
Constraint management revenues - Exit	19.3
Constraint management costs - Entry	0.5
Constraint management costs - Exit	0.0

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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 National Grid plc'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 'Internal control and risk factors' on pages 236 to 239 of National Grid plc's latest Annual Report and Accounts. Copies of the most recent Annual Report and Accounts are available online at www.nationalgrid.com or from Capita Registrars. Except as may be required by law or regulation, National Grid plc 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.