Northern Gas Networks

Annual Environmental Report 2021-22

September 2022

together we are the network

Document Structure

This document is structured as follows:

Chapter 1: Introduction

Chapter 2: Environmental Performance Dashboard

Chapter 3: Environmental Action Plan Commitments

Chapter 4: Environmental Impacts Performance

Chapter 5: Statement on Quality and Scope of Data

Appendices:

A: RIIO-2 Carbon Reduction Targets

B: Scope 3 Emissions Assessment

C: Embodied Carbon Assessment

D: Ecosystem Services and Natural Capital Assessment

Glossary of Terms

Report approved by:	Gareth Mills Regulation & Strategic Planning Director Northern Gas Networks
Date:	20 September 2022

1 Introduction

Northern Gas Networks (NGN) is the gas distribution network (GDN) for the north of England and one of four GDN operators in Great Britain. This document constitutes NGN's Annual Environmental Report for the period 1 April 2021 to 31 March 2022, publication of which is a licence obligation for the RIIO-2 gas distribution price control. This document has been completed in accordance with RIIO-2 Environmental Reporting Guidance, Version 1.0, Ofgem, 2 March 2021[1] ('reporting guidelines' herein) and should be read in conjunction with our RIIO-2 Environmental Action Plan (EAP)[2].

1.1 Introduction to Northern Gas Networks

Since 2005 NGN has been responsible for safely delivering gas to approximately 2.7m homes and businesses across northern England. Our network area covers approximately 25,000 km^2 across northern Cumbria, the North East of England and North, East, South and West Yorkshire, spanning densely populated urban areas and rural areas. We employ approximately 1400 colleagues across 13 offices and depots spread across our region, whilst also providing regular work for c.700 locally based contractors.

We do not produce or sell gas, rather we transport it via a network of underground pipes which extends for approximately 36,000 km. The operation of our pipe network is supported by over 5,500 strategic above ground infrastructure sites.

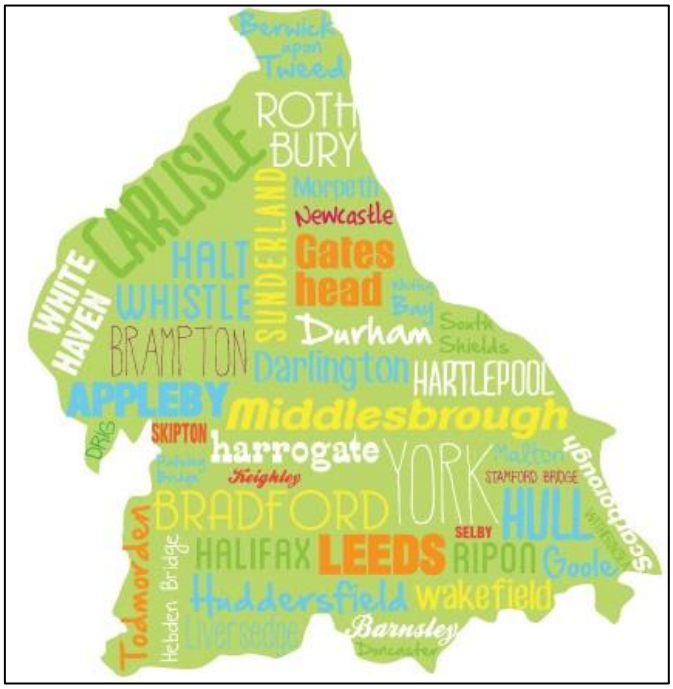


Figure 1 – Our network area

Like other gas distribution networks in Great Britain, NGN is a regulated business and operates under a licence issued by the Office of Gas and Electricity Markets (Ofgem) and is also subject to

[1] https://www.ofgem.gov.uk/publications/riio-2-environmental-reporting-guidance

[2] https://www.northerngasnetworks.co.uk/wp-content/uploads/2019/12/A8-NGN-RIIO-2-Enviromental-Action-Plan.pdf

common statutory requirements which are overseen by the Department for Business, Energy and Industrial Strategy (BEIS), the Health and Safety Executive (HSE) and the Environment Agency (EA). Allowed revenues for NGN, including for environmental protection, decarbonisation and adaptation to climate change, are currently set by Ofgem in periodic price reviews and require submission of a detailed business plan. Between 1 April 2021 and 31 March 2026 we are operating under the RIIO-Gas Distribution 2[3] ('RIIO-2' herein) price control framework. Prior to this we operated under the RIIO-Gas Distribution 1 ('RIIO-1' herein) price control framework between 1 April 2013 and 31 March 2021.

Our latest business plan included commitments to deliver an environmentally sustainable network[4], including an Environment Action Plan (EAP) which committed us to a series of actions to reduce the environmental impacts of our business operations, decarbonise our business, and support a net zero carbon future aligned to the United Nations Sustainable Development Goals (UN SDGs). Our EAP was built on strong stakeholder engagement evidence to ensure that we met the needs and expectations of our stakeholders. A summary of our RIIO-2 EAP commitments is provided in Figure 2.

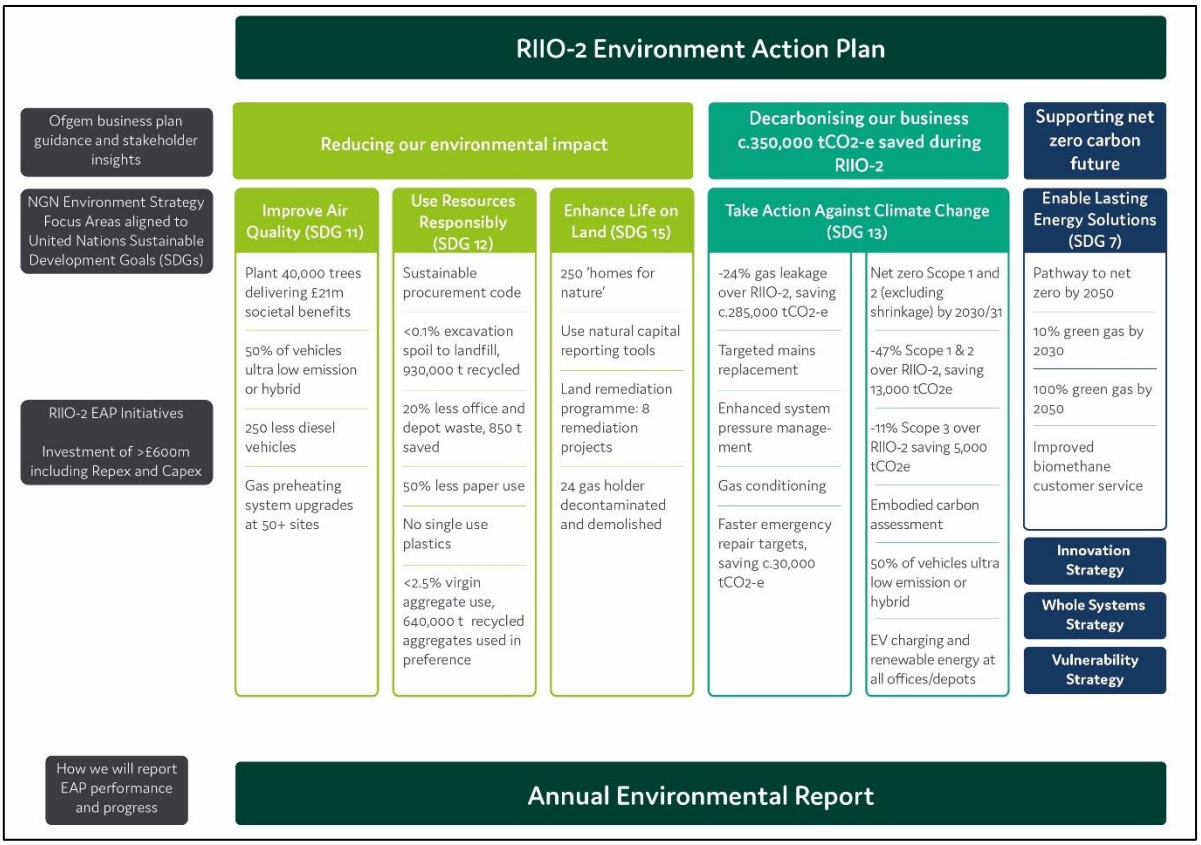


Figure 2 – Our Environment Action Plan for 2021 to 2026 (RIIO-GD2)

We have established a long term sustainability agenda for ourselves and our supply chain as demonstrated in our People and Planet Strategy[5] launched in November 2021. The purpose of this

[3] https://www.ofgem.gov.uk/energy-policy-and-regulation/policy-and-regulatory-programmes/network-price-controls-2021-2028-riio-2
[4] See Section 4.4 of our RIIO-GD2 business plan: https://www.northerngasnetworks.co.uk/wp-content/uploads/2019/12/NGN-RIIO-GD2-Business-Plan-2021-2026.pdf
[5] https://www.northerngasnetworks.co.uk/wp-content/uploads/2022/06/People-and-Planet-Strategy_FINAL.pdf.

strategy is to set a universal sustainable direction for our decision making and wider business strategy so that together with our colleagues, partners and supply chain we can deliver positive changes. Our People and Planet Strategy includes a roadmap of short term goals (to 2026) that are aligned to our RIIO-2 regulatory commitments (including our EAP commitments), medium term (to 2030) goals that are aligned with the UN SDGs, and longer term commitments that stretch out to 2050 and beyond in some instances. A summary of our People and Planet Strategy commitments is provided in Figure 3. These commitments are confirmed in our Sustainability Policy[6].

Figure 3 – Summary of our People and Planet Strategy commitments

[6] https://www.northerngasnetworks.co.uk/wp-content/uploads/2022/06/Sustainability-Policy.pdf

1.2 Message from our Chief Executive Officer

Not long ago, sustainability was a business buzz word. A term used to demonstrate an intention to go 'above and beyond' core responsibilities to reduce environmental impacts on the planet, without ever having to be truly accountable. Whilst sustainability is of course about protecting the planet, it's equally about responsible decision-making to ensure our customers, colleagues and supply chain can thrive long term too.

Two years into the most challenging operating conditions ever experienced, it's crystal clear that at NGN sustainability must be embedded in everything we do as a business in order to safeguard our future. The COVID-19 pandemic showed us just how interconnected we are, and how fragile our society is when exposed to unexpected natural and economic global events. The impacts of this are being felt by those on the lowest incomes in our diverse communities; the cost-of-living crisis adding even greater pressures on families; whilst the pathways to reaching net zero emissions by 2050 remain undecided.

As a gas network serving 2.7m homes and businesses across the north of England it's our responsibility to be a force for good in facing these challenges and effect positive change today and into the future, while continuing to keep customers safe and warm 365 days a year.

I am delighted that we, along with the other energy networks, Ofgem and BEIS have been able to make significant progress in developing the options to deliver our shared goal of achieving Net-Zero carbon emissions by 2050. This included the successful delivery of the HyDeploy 2 Project to demonstrate the feasibility of blending up to 20% Hydrogen, completing the final details of the H21 programme to understand the safety case for Hydrogen, and development of the feasibility study for the potential Hydrogen Village Trial in Redcar. Experience is now showing us that a safe, reliable and affordable pathway to 2050 is critical to the UK's long-term economic prosperity.

During 2021/22 in partnership with our committed supply chain we have continued to work hard to reduce our environmental impact including achieving our business carbon footprint reduction targets, becoming more efficient with our materials, producing less waste, and even planting more than 8,000 trees. We have continued to reduce our gas shrinkage and will keep focussed on this area throughout the remainder of RIIO-2. I also look forward to seeing the benefits of our new Supplier Code of Conduct.

This is the first year of our RIIO-2 journey and we will work hard to ensure we deliver our Environmental Action Plan commitments for our customers, communities and stakeholders.

Mark Horsley, Chief Executive Officer, Northern Gas Networks

1.3 Our Environmental Responsibilities

1.3.1 Assessing Our Environmental Impact

Since achieving ISO14001 accreditation for our environmental management system (EMS) in 2000[7], we have continually analysed and monitored our performance to understand, mitigate and reduce the adverse environmental impacts of our business. This process starts with understanding the context of our business as a regional GDN with core activities of operating and maintaining our infrastructure, responding to gas emergencies, providing new gas connections and replacing metallic gas mains. A summary of the key aspects of our business is provided in Table 1 below.

Key Aspects of Our Network and Business Operations			
Our Customers, Colleagues and Region	**Our Network**	**What We Do**	**Environment Performance and Innovation**
Deliver gas to 2.7m homes and businesses	36,000 km of pipe	>99% of uncontrolled gas escapes attended within 1 hour	c.0.5% of gas throughput lost as shrinkage per year
Varied network area – cities, towns and National Parks.	c.600 company vehicles – including cars, vans and HGVs	>500km of iron mains replaced per year	18 biomethane production sites connected to our network enabling supply of green gas
c.1400 employees across 13 offices and depots	No gas holders connected to network, 29 decontaminated and demolished since 2013	c.£200m of goods and services purchased per year	Award winning hydrogen research and development projects, including H21 and HyDeploy
46% of our domestic customers are reporting experiencing financial difficulties paying their energy bills during 2021/22^	c.150 asset sites built on known former gasworks sites	>15,500 fuel poor gas connections provided in RIIO-1	c.200,000t of waste generated per year, >99% recycled
Based on figures to end 2021/22. ^ Page 18: https://together.northerngasnetworks.co.uk/wp-content/uploads/2022/03/Customer-Perceptions-Research-Presentation-2021-Wave-2-SHORT-SUMMARY-.pdf			

Table 1- Summary of key environmental aspects of NGN business

With the help of our stakeholders, we identify aspects of our business that result in environmental impacts and then assign significance ratings to each based on a structured hazard-severity matrix. A summary of our current significant environmental aspects and impacts is provided in Table 2.

[7] https://www.northerngasnetworks.co.uk/wp-content/uploads/2021/04/NGN-ISO-14001-2015-Certificate-V9-2020-2024.pdf

Business Aspect	Environmental Impact								NGN RIIO-2 Mitigation
	Depletion of resources	Air pollution	Greenhouse gas emissions	Nuisance (eg odour, noise)	Water pollution	Land Pollution	Waste disposal to landfill	Ecosystem/habitat damage	
Use of Virgin Aggregate in reinstatement	✓								EAP
Plastic gas pipe production	✓		✓						EAP
Use of Gas	✓		✓						EAP
Venting Gas			✓	✓					IS
Use of Electricity	✓		✓						EAP
Use of Fuel	✓	✓	✓						EAP
Gas Transportation (upstream production, NGN losses, and downstream use)			✓	✓					EAP, WS & IS
Roadworks		✓	✓	✓					EAP, WS & IS
Contaminated Land				✓	✓	✓		✓	EAP
Disposal of Waste (excluding excavation spoil)							✓		EAP
Purchase of good and services	✓	✓	✓	✓	✓	✓	✓	✓	EAP

Significant aspects are those identified to have a significance of 15 out of 25 or greater on a 5 x 5 hazard-severity matrix.

Environmental impacts represents principal direct environmental impacts associated with the aspect, other secondary impacts may occur.

EAP = NGN RIIO-2 Environmental Action Plan. WS = NGN RIIO-2 Whole Systems Strategy. IS = NGN RIIO-2 Innovation Strategy.

Table 2 – Summary of NGN's most significant current environmental aspects and impacts

1.3.2 Incorporating Stakeholder Views

As detailed in our EAP (see Sections 5 and 6.1), we engaged with our stakeholders during 2017 to 2019 to inform the development of our EAP commitments to ensure they met the needs, priorities and expectations of our stakeholders. Since the development of our EAP we have continued our stakeholder engagement to ensure that we continue to approach our environmental commitments in the most appropriate and effective manner, taking into account the values and priorities of our stakeholders. This has included:

- Establishment of an internal Sustainability Working Group comprising relevant senior managers to enable the identification and discussion of material sustainability related

business aspects, and provide monitoring and oversight of business sustainability performance, including the performance of key individual sustainability initiatives/projects.

- Establishment of a colleague Sustainability Champions Networks to enable communication of business environmental performance with colleagues and act as a forum for the identification and discussion of new environmental initiatives.
- Annual customer perceptions survey incorporating environmental priorities research (2020/21[8] and 2021/22[9]).
- Workshops with external stakeholders on a number of focus topics relevant to our EAP commitments: environmental priorities and single use plastics (September 2020[10]), biodiversity (April 2021[11]), our RIIO-2 tree planting scheme (October 2021[12]) and our proposed Supplier Code of Conduct (January 2022[13]).

Table 3 summarises some of the actions we have taken since publication of our EAP to address stakeholder feedback and ensure we continue to deliver our commitments and meet stakeholder requirements and expectations.

Stakeholders Said	Information Source	Relevant NGN EAP Commitment	So NGN Will
Single use plastics remain important to us (rated 7.5 out of 10 in terms of importance)	External stakeholder workshop, September 2020	Eliminate single use plastics from our offices and depots by 2026	Continue to prioritise eradicating them from our offices and depots
Changing grass mowing regimes can deliver biodiversity benefits for limited extra, or even less, effort than current	External stakeholder workshop, April 2021	250 homes for nature on NGN land by 2026	Investigate the opportunities for this, including participating in 'No Mow May' and communicating it with our colleagues to encourage them to participate
Inclusion of hedgerows in tree planting schemes can broaden the benefits delivered, for example with respect to noise control and biodiversity	External stakeholder workshop, October 2021	40,000 trees planted by 2026	Expand tree planting scheme to include hedgerows from 2021/22 planting season onwards
It would be good if the Supplier Code of Conduct came with a guide to explain how to effectively demonstrate compliance.	External stakeholder workshop, January 2022	Implement a Supplier Code of Conduct and achieve 80% supply	A compliance guide was included in the final version of the Code launched in April 2022

[8] https://together.northerngasnetworks.co.uk/wp-content/uploads/2021/03/Customer-Perceptions-Research-Presentation-Final-Report-Outcomes-Customer-Facing-v1.pdf
[9] https://together.northerngasnetworks.co.uk/wp-content/uploads/2022/03/Customer-Perceptions-Research-Presentation-2021-Wave-2-SHORT-SUMMARY-.pdf
[10] https://together.northerngasnetworks.co.uk/wp-content/uploads/2020/11/Environment-Workshop-16-September-2020.pdf
[11] https://together.northerngasnetworks.co.uk/wp-content/uploads/2021/03/Environment-Workshop-18th-June-2021_FINAL.pdf
[12] https://together.northerngasnetworks.co.uk/wp-content/uploads/2021/09/Environment-Workshop-12-January-2022-v2.pdf
[13] https://together.northerngasnetworks.co.uk/wp-content/uploads/2021/11/Supplier-code-of-conduct-Workshop-12-January-2022-v2.pdf

Stakeholders Said	Information Source	Relevant NGN EAP Commitment	So NGN Will
It would be good to see suppliers provided with additional support to become compliant		compliance (by value) by 2026	Join the Sustainability Supply Chain School to enable our supply chain to freely access training, resources and support to help them become compliant (completed April 2022).

Table 3 – Examples of how stakeholder feedback received during 2020 to 2022 has been used to inform and refine the delivery of our EAP commitments

Our latest customer research from 2021/22[14] identified that sustainability and environmental actions remain high priorities to customers after providing a reliable and safe service and keeping bills as low as possible. When reviewing our sustainability commitments from our People and Planet Strategy, customers prioritised providing access to affordable energy solutions, ensuring our infrastructure is resilient, and enabling affordable decarbonised heat, power and transport solutions. We will continue to consider these priorities when delivering our EAP commitments during RIIO-2 and monitor how these priorities change for consideration when preparing subsequent business plans.

1.3.3 Our Strategic Approach to Delivering an Environmentally Sustainable Network

As detailed in Section 1.1, our People and Planet Strategy sets a universal direction for our sustainable decision making and wider business strategy to ensure we deliver positive changes. Our People and Planet Strategy includes 12 commitments, of which six are related to protection of the environment and mirror the objectives of our RIIO-2 EAP.

Performance against our EAP commitments is measured and reported monthly to our senior management team to ensure that performance is kept on track, with progress updates regarding our medium and long term targets provided regularly and also reviewed at our Sustainability Working Group.

Our shareholders pay close attention to our environmental performance and activities, including delivery of our EAP commitments, and require regular performance and activity reporting, including in the formats required by Dow Jones Sustainability Index and the Hang Seng Corporate Sustainability Index Series. Our shareholders completed an audit of our sustainability governance and management assessment during 2021-22 and identified areas where we can improve which led to the creation of our Sustainability Policy and Sustainability Working Group.

Corporate bonuses paid to NGN executives and colleagues include company environmental performance elements, most notably performance against our carbon reduction targets. This responsible approach further emphasises to our colleagues the importance of achieving our EAP commitments and contributed to us receiving full marks for climate action governance in the Responsible Business Tracker 2021 assessment by Business in the Community[15]. This assessment

[14] https://together.northerngasnetworks.co.uk/wp-content/uploads/2022/03/Customer-Perceptions-Research-Presentation-2021-Wave-2-SHORT-SUMMARY-.pdf

[15] See page 11 here: https://www.northerngasnetworks.co.uk/wp-content/uploads/2022/04/Northern-Gas-Networks-BITC-RBT-2021-Individual-Feedback-Report.pdf

identified an overall responsible business score of 74% for NGN, well above the cohort average of 47%, and full marks with respect to climate action governance, strategy and risk analysis.

2 Environmental Performance Dashboard

In accordance with the reporting guidelines, our performance against a series of identified key environmental performance indicators during the period 1 April 2021 to 31 March 2022 is presented below.

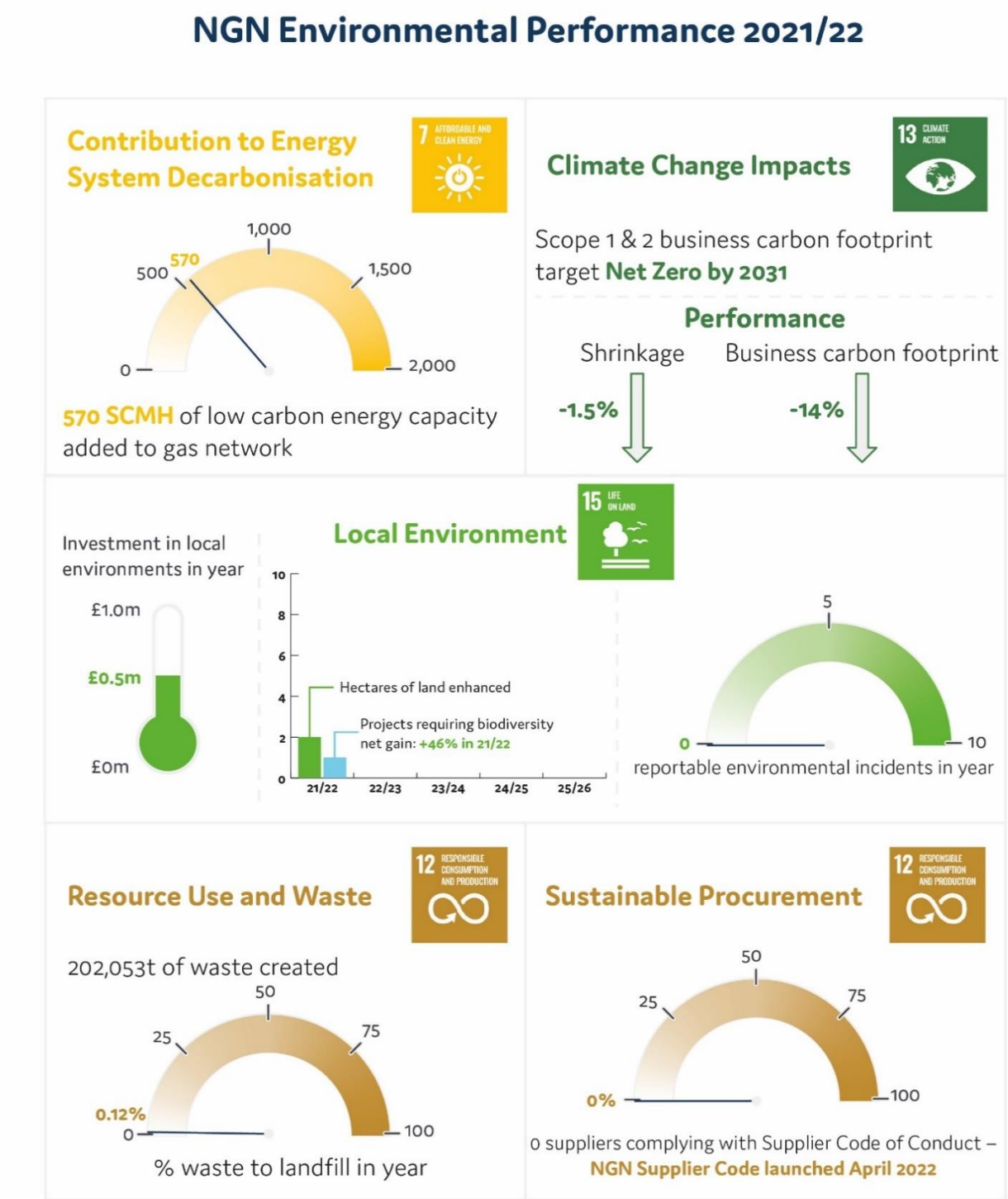


Figure 4 – Environmental performance dashboard for 2021/22.

There are no annual targets for low carbon energy capacity connection. Business carbon footprint as shown = Scope 1 and 2 emissions excluding shrinkage. NGN's Supplier Code of Conduct was launched after this current reporting period.

3 Environmental Action Plan Commitments

Table 4 contains a progress summary for each of our RIIO-2 EAP commitments as of 31 March 2022.

EAP Commitment	Description and Expected Benefit^	Target Year	Implementation Milestones	RAG Indicator*	Status Update
Commitments to Reduce Our Environmental Impact					
Plant 40,000 trees in our region	>£21m of cumulative benefits over 50 years including reduced air pollution, carbon sequestration (2,450 tCO2e), biodiversity gain, flood alleviation and amenity gain	2026	n/a	Green	8,142 trees planted across 18 sites in Leeds, Bradford and Wakefield (including five schools) during 2021/22 and enabled a planting of a further 551 trees. Programme on track.
50% of vehicle fleet ultra low emission or hybrid (25% of commercial vehicles and 100% of company cars)	Vehicle fleet changes delivering reduced air pollutant and carbon emissions (4230 tCO2e saving); 250 diesel vehicles removed from NGN fleet	2026	n/a	Green	99 new diesel vans purchased during 2021/22. Total NGN vehicle fleet comprises 8% ultra low emission or hybrid vehicles, with 80% of leased company cars being ultra low emission or hybrid. Two electric vans were forecast for purchase in 2021/22 however the COVID-19 pandemic delayed the preparatory work needed to deliver this, most notably the installation of charging infrastructure (see below for further details).
Gas preheating system upgrades at 50+ sites	Asset upgrades delivering reduced air pollution and carbon emissions (1890 tCO2e)	2026	n/a	Amber	6 units completed in 2021/22, which is behind the forecast in our business plan but recoverable. We have experienced some supply chain related delays and have undergone a comprehensive re-tender of our delivery contractor frameworks and we are in place to achieve our RIIO-2 commitments.
80% compliance with new Supplier Code of Conduct	Development and implementation of Supplier Code of Conduct embedding sustainability in supply chain	2026	n/a	Green	Supplier Code of Conduct development and launched April 2022: https://www.northerngasnetworks.co.uk/wp-content/uploads/2022/04/Supplier-Code-of-Conduct_FINAL_compiled.pdf
<0.1% excavation spoil to landfill	c.930,000 t of excavation spoil recycled saving 10 tCO2e	2026	n/a	Green	0.11% spoil to landfill performance in 2021/22
20% less office/depot waste (vs 2017/18)	850t waste reduction 4,800t waste diverted from landfill	2026	n/a	Green	14% reduction in office and depot waste tonnage in 2021/22 compared to 2017/18 baseline.

EAP Commitment	Description and Expected Benefit^	Target Year	Implementation Milestones	RAG Indicator*	Status Update
0% office and depot waste to landfill	480tCO2e saving	2026	n/a	Green	2.5% office and depot waste sent to landfill in 2021/22
50% less paper use	30t of paper use avoided; 30tCO2e saving	2026	n/a	Green	Paper use in 2021/22 85% less than 2018.
Eliminate avoidable single use plastics from offices and depots	Reduced carbon emissions, resource use and waste	2026	n/a	Green	Strategy to achieve this following post-COVID-19 return to office working under development
<2.5% virgin aggregate use in reinstatement	640,000 t of recycled aggregate preferentially used, saving 80 tCO2e	2026	n/a	Green	7.98% virgin aggregate used in 21/22 compared to 11.16% in 2020/21
250 homes for nature	250 positive interventions to enhance biodiversity	2026	n/a	Green	Interventions made at 66 sites to end 2021/22 since 2018. Strategy to delivery 250 sites by 2026 created.
Development of natural capital assessment	Report natural capital valuation of ecosystem services provided at up to 50 NGN sites during 2021, 2023 and 2025.	2026	n/a	Green	Ecosystem services screening completed, bespoke natural capital valuation tool developed and utilised on baseline assessments at 32 infrastructure sites.
Land remediation programme	Management programme including 8 remediation projects – reduced risk of pollution	2026	n/a	Green	Continuation of inspection, monitoring and investigation programme. No new remediation projects started, continuation of three existing remediation projects from 2020/21.
Gas holder decontamination and demolition programme	Decontaminate and demolish 23 gas holders – reduced risk of pollution	2026	n/a	Green	Five holders were demolished as forecast.
Commitments to Decarbonise Our Business					
Reduce gas leakage by 24%	Carbon savings of c.285,000 tCO2e	2026	n/a	Amber	Gas leakage reduced by 1.3% (3.8 Gwh) in 2021/22 vs 2020/21. 2021/22 performance (293 Gwh) is behind our original business plan target for 2021/22 (283 Gwh) as a result of delays in implementation of new System Pressure Management technology. We will start to implement this new system during 2022/23, which we expect will allow us to push average system pressures below the

EAP Commitment	Description and Expected Benefit^	Target Year	Implementation Milestones	RAG Indicator*	Status Update
					levels in our original business plan. In doing so this will achieve the aggregate levels of shrinkage reduction over the five year price control.
Repairing gas leaks faster – 89% within 7 days and 98% within 28 days	Carbon savings of c. 30,000 tCO2e	2026	n/a	Green	Targets achieved in 2021/22; repairs within 7 days = 90.6% and repairs within 28 days = 98.4%
Reduce Scope 1 and 2 emissions by 47% (excluding shrinkage)	Carbon savings of c.13,000 tCO2e	2026	n/a	Green	2021/22 emissions were 4,785 tCO2e against a target of 4,885 tCO2e. Emissions were 2% (100 tCO2e) below target for 2021/22.
Reduce key Scope 3 emissions** by 11%	Carbon savings of c.5,000 tCO2e	2026	n/a	Green	2021/22 emissions were 15,200 tCO2e against a target of 15,298 tCO2e. Emissions were 0.6% (98 tCO2e) below target for 2021/22
Development of embodied carbon assessment	Development of assessment methodology and metric	2026	2022	Green	Methodology developed, reporting completed for 2021/22 and reduction targets established for 2025/26.
Purchase of 100% zero carbon electricity	Only zero carbon electricity to be consumed at NGN premises from 2023, carbon savings of 7100 tCO2e	2023	2023	Green	Achieved in 2021/22 ahead of schedule. 100% of electricity consumption at NGN offices, depots and infrastructure sites from zero carbon sources.
Purchase of 100% renewable gas for metered use	Only green gas to be consumed at NGN premises from 2024, carbon savings of 530 tCO2e	2024	2024	Green	NGN continuing to explore the market availability of certified green gas
Install electric vehicle charging at all offices and depots	Enabler to achieve vehicle fleet decarbonisation and Scope 1 and 2 emissions reduction targets	2026	n/a	Amber	The COVID-19 pandemic delayed the preparatory work needed to deliver our forecast workload for 2021/22. We have now completed all the required surveys to ensure our offices and depots have the necessary electrical capacity to support the EV charging points. We are in the latter stages of a competitive tender exercise to appoint a contractor to install the charging infrastructure, with the majority expected to be completed in the second year of RIIO-2 to bring us back on track.

EAP Commitment	Description and Expected Benefit^	Target Year	Implementation Milestones	RAG Indicator*	Status Update
Install renewable energy production at all offices and depots	Carbon savings of 280 tCO2e	2026	n/a	Amber	Linear installation programme throughout RIIO-2 was forecasted in our RIIO-2 business plan. Installation programme commencement delayed as NGN review office and depot portfolio in consideration of post-COVID-19 return to office working.
Gas network infrastructure capital investments	Carbon savings of 22,480 tCO2e	2026	n/a	Amber	We have experienced some COVID-19 related delays associated with long lead materials and have undergone a comprehensive re-tender of our delivery contractor frameworks however we are in place to achieve our RIIO-2 commitments.
Commitments to Support a Net Zero Future					
Increased green gas capacity connected to network	Aspiration for 10% green gas flowing through network by 2030, 100% by 2050	2026	n/a	Green	Additional biomethane production site connected to NGN network during 2021/22 with 570 scmh capacity. Total capacity connected is now 16,910 scmh from 18 sites.
Improved customer service for biomethane providers	Green gas connection initial capacity studies within <=5 working days and detailed capacity studies within <=20 working days compared to <=15 and <=30 working days during RIIO-1	2026	2026	Green	During 2021/22 >98% of initial capacity studies were issued within our <=5 working days voluntary target time and 100% of detailed capacity studies for new connections within our voluntary target of <=20 working days.
Whole Systems thinking	Enable the achievement of net zero greenhouse emissions in the UK by 2050	2050	n/a	Green	We have an active portfolio of innovation projects to support the net zero transition. Please refer to our Network Innovation Annual Summary Report for 2021/22 for full details of our innovation work: https://www.northerngasnetworks.co.uk/wp-content/uploads/2022/07/NGN_Innovation-Report-2022.pdf

^ Reference: RIIO-2 EAP. Carbon savings reflect cumulative savings over RIIO-2.

*In accordance with the reporting guidance: Red = progress against milestones is at significant risk and highly likely to be missed; Amber = progress is delayed but likely to be achievable before the end of RIIO-2 price control period; Green = progress against the implementation milestones is on track.

** Contractor vehicles; production and transportation of polyethylene gas pipe and fittings; upstream emissions and transmission and distribution losses for electricity consumed; business travel via air and rail.

Table 4 – Summary of progress against RIIO-2 EAP commitments

Based on our performance during 2021/22 we remain confident that we will achieve our RIIO-2 EAP commitments. It is of note that significant global socio-economic and political changes have occurred since we prepared our EAP, most notably the COVID-19 pandemic and cost of living crisis. These events have impacted the business operations, and associated environmental impacts, of ourselves and our supply chain and continue to do so. The environmental impacts of these changes have been observed to be both positive (such as reduced avoidable business travel) and negative (such as increased usage of disposable personal protection equipment), and both temporary and longer term. We will closely monitor our environmental performance against our EAP commitments throughout RIIO-2, including reviewing our commitments to ensure they remain relevant, valuable to our stakeholders, and feasible in the prevailing operating conditions we face.

4 Environmental Impacts Performance

4.1 Decarbonisation

This section provides a performance summary of our actions to deliver decarbonisation of the energy system.

4.1.1 Biomethane and Other Low Carbon Gas Connections

We recognise the value that biomethane and other low carbon gas sources can make now to the net zero transition and work hard to enable their connection to our network. In addition, our engineers work closely with producers to enable them to maximise their gas injection volumes and minimise down time.

Throughout RIIO-1 (2013 to 2021) we worked hard to develop our connection procedures for biomethane and other non-conventional gas producers, including development of a dedicated website[16], and we have continued this work into RIIO-2. Our time sequence of biomethane capacity connected is shown in Figure 5. At the end of 2021/22 we had a maximum capacity of 16,910 standard cubic metres of gas per hour (SCMH) of biomethane production capacity connected to our network, enough to heat over 60,000 homes per year. It is of note that the development of new connection sites is typically significantly influenced by the availability of government subsidies / incentives.

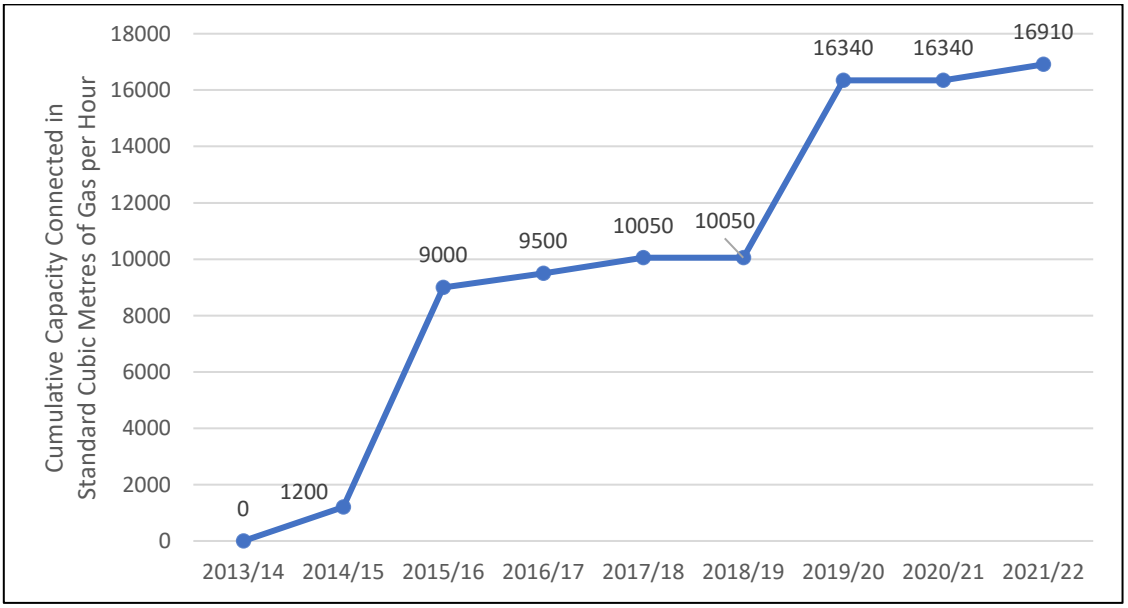


Figure 5 – Capacity of biomethane and low carbon gas injection capacity connected to NGN network

A summary of our RIIO-2 biomethane and low carbon gas connection workload is provided in Table 5.

[16] https://biomethane.northerngasnetworks.co.uk/

	Unit	2021/22	2022/23	2023/24	2024/25	2025/26
Biomethane Connections						
Enquiries	Number	51				
Connection studies	Number	7				
Capacity of connection studies	SCMH	7,800				
Connections	Number	1				
Capacity connected	SCMH	570				
Volume (energy value) of biomethane injected in year	Gwh	683				
Average monthly flow rate (all connections)	SCMH	5,177,255				
Other Green Gas Connections						
Enquiries	Number	3^				
Connection studies	Number	1^				
Capacity of connection studies	SCMH	1,000				
Connections	Number	0				
Capacity connected	SCMH	0				
Volume (energy value) of green gas injected	Gwh	0				
Average monthly flow rate (all connections)	SCMH	0				
^ All landfill gas sources.						

Table 5 – Biomethane and green gas connection performance

Helping Our Customers Get Connected

Our green gas connection process is detailed in our Biomethane Handbook, which can be found on our biomethane website[17]. Section 6 of the Handbook covers:

- A description of the key stages involved in connecting a biomethane plant to our network;
- An overview of how a connection is designed, and the personnel involved;
- An explanation of how to reserve a connection point on the network;

[17] https://biomethane.northerngasnetworks.co.uk/wp-content/uploads/2020/07/NGN_BiomethaneHandbook_0420_St04A.pdf

- An overview of the construction process; and
- Details of the inspection process for a completed project.

Representatives from NGN attend the Energy Networks Association (ENA) hosted Entry Customer Forum (EnCF), along with the other gas networks and stakeholders. The EnCF exists to:

- ensure entry connections processes, standards and associated commercial arrangements are kept under review to promote standardisation across the networks, remove barriers, share best practice, enable efficiencies and improvements, and respond to industry developments;
- provide a forum for gas networks, biomethane customers and other relevant stakeholders to raise identified issues; and
- establish and maintain an activity schedule of improvements and required framework changes to action with associated deliverables and timescales. Items listed and reviewed on the EnCF Action Plan tracker include; the standardisation of site acceptance testing, calorific value (CV) blips and flaring gas, in-grid compression, and blending strategy.

This encompasses the whole connection process, including initial application, assessment, building, commissioning of initial connection, operation and decommissioning. Further information about the EnCF, including minutes of the seven meetings held during 2021/22, can be found on the Energy Networks Association's dedicated entry page[18].

As well as the EnCF, we attend the Entry Technical Working Group with other GDN representatives. This technical group supports in addressing the issues identified via the EnCF and those raised directly from our connected sites.

Improving Our Green Gas Connection Customer Performance

Ofgem have set us a target of a 7-day turnaround for initial capacity studies for biomethane connection customers. In our RIIO-2 Business Plan we committed to an internal target of <5 days so that customers know quickly if the selected location is suitable for their project. We met the Ofgem target and our own internal target on 98% of the initial capacity studies completed in 2021/22, with one of the 54 studies being completed in 8 days.

In our business plan we also committed to produce detailed capacity studies within 20 working days, compared with 30 working days in RIIO-1. In 2021/22 we completed four out of four new customer detailed studies in <20 days. An additional four capacity studies were completed for our existing connections in relation to increasing their entry volumes, these were delivered in <30 days.

Listening to Our Stakeholders

In addition to the EnCF, we engage with our low carbon gas stakeholder by a range of methods summarised below to identify areas where we can improve.

Annual Operational Meetings

During 2021/22 we strengthened our stakeholder relations with our connected sites with the continuation of the annual operating meetings which take place each autumn.

The meetings provide an opportunity for site owners and operators to share successes and challenges and help us identify where we can provide support. The 2021 meetings were very useful

[18] https://www.energynetworks.org/operating-the-networks/connecting-to-the-networks/connecting-to-the-gas-network

in helping us understand operational issues, such as meeting the target CV issued from our Control Room and injection issues over the summer months when demand is lower (see below for further details). We're continuing with our strategy of adjusting down network pressures where possible to facilitate increased entry flow, as well as ensuring our target CV strategy is understood by our connected sites.

Planning of Investor Workshop

During the first quarter of 2022 we worked with the other GDNs via the ENA Gas Goes Green group, to plan a workshop with biomethane developers. The objectives related to gaining an understanding of what the Green Gas Support Scheme means for a developer's future investment plans, if there are any barriers and challenges to overcome, whilst ultimately understanding what GDNs can do to support investors in their future entry connection plans. This event was scheduled to take place in June 2022 but was postponed to the autumn due to the train strikes.

Smarter Grid Solutions Refresher Workshop

Smarter Grid Solutions (SGS) issues are monitored via a quarterly dashboard which is presented at each EnCF. In September 2021 we held an SGS Refresher workshop where we recapped on expectations of SGS contractors who audit biomethane sites (directed the Letter of Direction) to ensure compliance with Thermal Energy Regulations.

Stakeholder Engagement Case Study - Target Calorific Value Discussions

For three days in June 2021 the CVs entering our North Local Distribution Zone were particularly high, and our customers faced problems getting gas into our system as a result of not being able to meet the target CV issued from our Control Room (which we set to reduce capping and ensure Gas Safety Management Regulations obligations were met). We set up a series of meetings with our connected production sites to discuss the issues in detail and help us understand how we could support increased flow to the network. As a result of this we have liaised with National Grid to discuss a future CV forecasting service which will help sites understand when high CV events such as this might occur, allowing them to plan maintenance activities around this and reduce flaring and down time. We've also had further discussions with sites around potentially supporting their request to increase the 7% propane limit. It is expected that sites will likely take this forward in 2022/23. Furthermore, during the discussions we took the opportunity to promote the EnCF and encourage more attendance.

4.1.2 Innovating for Decarbonisation and Environmental Protection

We have an active portfolio of innovation projects to support the net zero transition and protect the environment, including trialling the blending of hydrogen (up to 20% by volume) with natural gas to 670 customers in our region (HyDeploy[19]), establishing the safety case for the use of 100% hydrogen as an affordable and sustainable alternative to natural gas (H21[20]), development of the feasibility study for the potential Hydrogen Village Trial in Redcar[21], and numerous improvements to our operational procedures and equipment. Please refer to our Network Innovation Annual Summary Report for 2021/22[22] for full details of our innovation work.

[19] https://hydeploy.co.uk/
[20] https://h21.green/
[21] https://redcarhydrogencommunity.co.uk/
[22] https://www.northerngasnetworks.co.uk/wp-content/uploads/2022/07/NGN_Innovation-Report-2022.pdf

4.2 Climate Change

This section provides a performance summary of our actions to reduce the carbon emissions associated with our business. As detailed in our RIIO-2 EAP, NGN commit to achieving net zero greenhouse gas emissions by 2050.

4.2.1 Shrinkage

Shrinkage is a Scope 1 emission and comprises (based on 2021/22 values) gas leakage (93.3%), gas illegally taken by third parties (4.3%) and own use gas primarily for pre-heating gas at locations where the gas changes from one pressure tier to the next (2.4%) as measured in Gwh using the Shrinkage and Leakage Model agreed with Ofgem. Natural gas is principally composed of methane which is a potent greenhouse gas, and produces carbon dioxide (also a greenhouse gas) on combustion. Shrinkage comprises both combusted and uncombusted natural gas and is our primary greenhouse gas emissions source, contributing 93% of our total measured greenhouse gas emissions in 2021/22.

Our RIIO-2 EAP identified reduction targets to be achieved over RIIO-2 for both shrinkage (-23%) and leakage (-24%) compared to the values we had forecast for end of 2020/21.

Our shrinkage and leakage volumes and emissions are summarised in Tables 6 to 9 as specified in the reporting guidelines.

Gas Leakage Volumes in Gwh	2021/22	2022/23	2023/24	2024/25	2025/26
Low pressure mains	171				
Medium pressure mains	25				
Services	37				
AGIs	59				
Interference	1				
Total	293				
Target total	283*				
* Forecast from end 2020/21					

Table 6 – Gas leakage volumes performance

Gas Leakage in tCO2e	2021/22	2022/23	2023/24	2024/25	2025/26
Total	359,482				
Target total (forecast from end 2020/21)	346,689*				
Volumes of gas leakage in Gwh converted into tCO2e using conversion factor of 1,226.42 tCO2e/Gwh as per reporting guidelines (page 24) * Forecast from end 2020/21					

Table 7 – Gas leakage in tCO2e performance

Other Gas Shrinkage Volumes in Gwh	2021/22	2022/23	2023/24	2024/25	2025/26
Own use	7.6				
Theft	13.4				
Total	21.0				

Table 8 – Other gas shrinkage volumes performance

Other Gas Shrinkage in tCO2e	2021/22	2022/23	2023/24	2024/25	2025/26
Own use	1,394				
Theft	2,468				
Total	3,863				
Volumes of gas leakage in Gwh converted into tCO2e using conversion factor of 183.85 tCO2e/Gwh as per reporting guidelines (page 25)					

Table 9 – Other gas shrinkage in tCO2e performance

Performance Summary

During 2021/22 we have continued our shrinkage reduction strategy which includes our optimised mains replacement programme which prioritises the leakiest metallic pipes, the installation of equipment to enable proactive system pressure management and conditioning our gas with Monoethylene Glycol (MEG) to saturate and swell metallic joints which might otherwise leak gas. Our gas shrinkage and leakage volumes reduced by 4.9 Gwh (1.5%) and 3.8 Gwh (1.3%) respectively compared to 2020/21, saving 4,800 tCO2e. Our shrinkage gas volume continues to comprise less than 0.5% of the gas transported through our network annually.

Our shrinkage performance during 2021/22 was behind our original business plan target as a result of some delays in implementing a new System Pressure Management technology that has been developed within NGN. We will start to implement this new system during 2022/23, which we

expect will allow us to push average system pressures below the levels in our original business plan. In doing so this will achieve the aggregate levels of shrinkage reduction over the five year price control. Further discussion regarding our 2021/22 and forecast future performance against the RIIO-2 gas shrinkage incentive is provided in our 2021/22 RIIO-GD2 Strategic Commentary report[23].

Repairing Gas Leaks Faster

Whilst not included in the Shrinkage and Leakage Model, it is recognised that gas escapes result in emissions of natural gas to atmosphere. As detailed in Part 4.2.2 of our RIIO-2 business plan document, we voluntarily committed to repairing emergency gas escapes quicker during RIIO-2. These commitments will reduce the amount of gas lost to atmosphere and deliver real-world carbon emission savings that whilst difficult to estimate, could amount to 30,000 tCO2-e over RIIO-2. During 2021/22 we have exceeded our end RIIO-2 performance targets as shown in Table 10 and significantly improved our performance compared to the previous year.

	2020/21	2021/22	2022/23	2023/24	2024/25	2025/26	2025/26 Target
Outstanding gas emergency repairs completed within 7 days (%)	86.21%	90.58%					>89%
Outstanding gas emergency repairs completed within 28 days (%)	94.88%	98.42%					>98%

Table 10 – Gas emergency repair performance

4.2.2 Business Carbon Footprint - Scope 1 and 2

Scope 1 (direct) and Scope 2 (indirect) business carbon emissions (excluding shrinkage) comprised approximately 1% of our total greenhouse gas emissions during 2021/22. Despite this imbalance, our stakeholders have told us that they expect us to reduce all elements of our carbon emissions, not just gas shrinkage[24].

Working with the Carbon Trust in 2018/19 we were the first UK gas network to establish and adopt science-based aligned carbon reduction targets for a well below 2 degree warming scenario in 2050[25]. We also utilised this work to set targets for key Scope 3 emissions. As detailed in our RIIO-2 EAP, after developing and adopting our carbon reduction targets we subsequently adopted more ambitious short and long term targets following the UK's commitment to achieving net zero greenhouse gas emissions by 2050. These targets, underpinned by our EAP initiatives and coupled with anticipated developments in technology, mean we are targeting the achievement of:

- 47% reduction in Scope 1 and 2 non-shrinkage business carbon emissions by 2025/26 vs 2017/18 baseline; and
- net zero non-shrinkage Scope 1 and 2 business carbon emissions by the end of the 2030/31.

[23] See Section 6.4.1, page 22: https://www.northerngasnetworks.co.uk/wp-content/uploads/2022/07/NGN-RIIO-GD2-Strategic-Commentary-2021-2022.pdf
[24] Customer Insight 43, RIIO-2 EAP.
[25] As defined by the International Energy Agency for a global emissions trajectory that represents a 50% chance of limiting average future temperature increases to 1.75^{O}C above pre-industrial levels. Our 2017/18 non-shrinkage carbon emissions form the baseline of this modelling.

These targets directly support the achievement of net zero emissions in our network regions and the UK. Our business carbon footprint reduction targets are presented in Appendix A. It is of note that our carbon reduction targets are not currently approved by the Science Based Targets Initiative as there is currently no approved target development methodology for the oil and gas sector to enable this. Our Scope 1 and 2 business carbon emissions are summarised in Table 11 and Figure 6.

Emissions in tCO2e	Specific Area	2021/22	2022/23	2023/24	2024/25	2025/26	2025/26 Target
Building energy use	Building – electricity*	0					
	Building – natural gas	317					
	Substation electricity	0					
Operational transport	Road**	4,468					
	Sea	0					
	Air	0					
Fugitive emissions	IIGs^	n/a	n/a	n/a	n/a	n/a	
Fuel combustion	Diesel	0^^					
	Gas	Included in gas shrinkage^^^					
Gas shrinkage		363,344					
Total excluding shrinkage		4,785					3,580
Total including shrinkage		368,129					
Total including shrinkage per £m turnover (tCO2e/£m)		874					
Total including shrinkage per Gwh gas transported (tCO2e/Gwh)		5.48					

^ Insulation and interruption gas - not relevant to gas distribution networks

^^ Fuel combustion in stationary and mobile plant included in Operational Transport – Road category as it cannot be distinguished from vehicle fuel consumption in source data (fuel card sales receipts).

^^^ Own use gas emissions included in shrinkage emissions = 1394 tCO2e

* Value reported in table is as per marked based methodology. Value for location based methodology = 951 tCO2e

** Including electricity used to charge electric vehicles

Full details of our business carbon reduction targets for the period 2021 to 2026 are contained in Appendix A.

Table 11 – Scope 1 and 2 greenhouse gas emissions

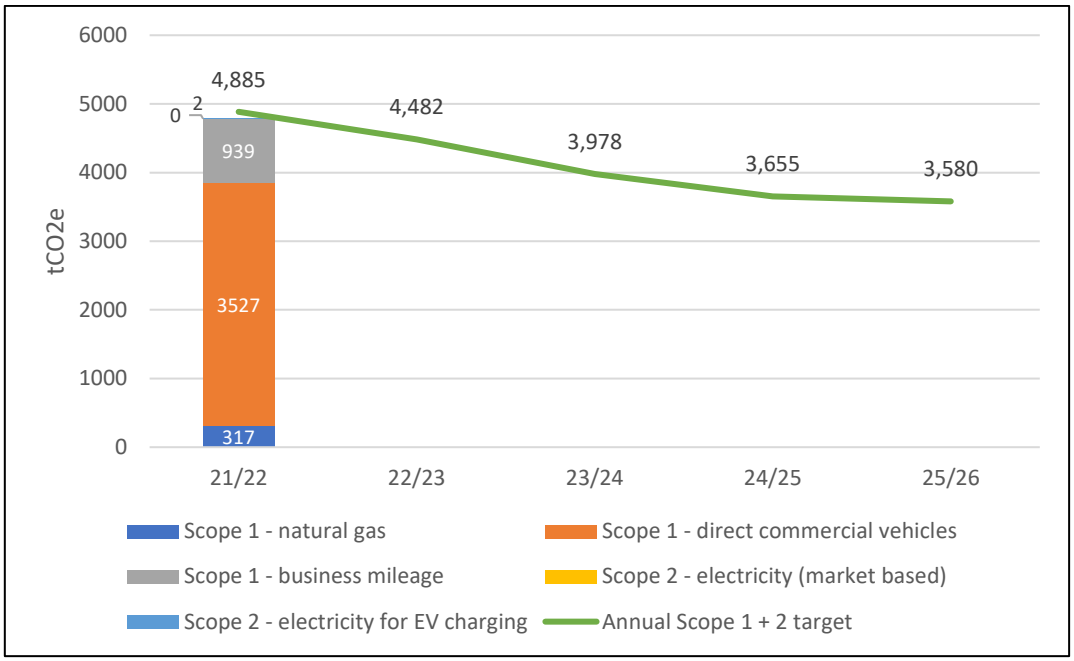


Figure 6 – Composition of NGN Scope 1 and 2 greenhouse gas emissions excluding shrinkage

The reporting guidelines request networks report the CO2e intensity of an operational mile travelled over the duration of RIIO-2. NGN's commercial vehicle fleet are fuelled using company fuel cards which provide total fuel consumption data in litres for all fuel purchases, including that purchased for use in vehicles and portable field equipment (such as generators), with fuel consumption purpose being indistinguishable in the purchasing data. The annual mileage of our commercial vehicle fleet is not known and cannot be determined from fuel purchasing records, or reliably determined from our fleet telematics system. In addition, our larger commercial vehicles often directly power field equipment (such as hydraulic breakers) and thus consume fuel whilst stationary. As such it has not been possible to provide the CO2e intensity of an operational mile travelled, however we will continue to investigate how we can accurately provide this data. The carbon intensity of Scope 1 business travel in company provided or controlled cars is available and is presented in Figure 7.

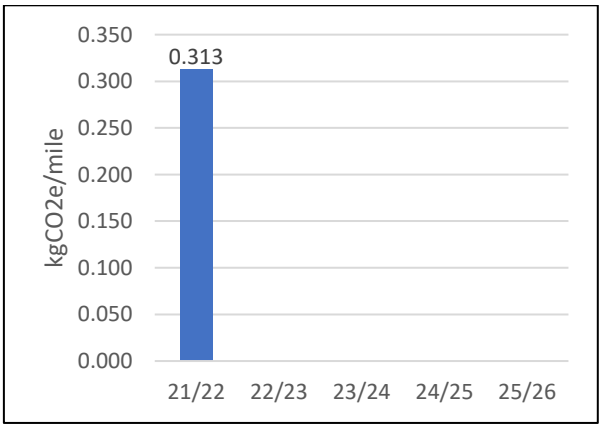


Figure 7 – Carbon intensity of NGN Scope 1 business travel in company owned/controlled cars

Performance Summary

The impacts of the COVID-19 pandemic temporarily influenced our Scope 1 and 2 BCF during 20/21 as our business travel habits changed and energy consumption fell. Our 21/22 Scope 1 and 2 BCF (market based method, excluding shrinkage) is 26% below our pre-COVID value from 2019/20, and 14% below 2020/21 (both location based method), in addition to being 100tCO2e (2%) below the 21/22 annual target contained in our EAP. The main drivers for this are:

- Vehicles – reduced fuel consumption in our commercial vehicle fleet (-1% vs 2020/21), purchase of 99 new EURO 6 diesel commercial vehicles during 2021/22, and decarbonising our company car fleet to 80% ultra low emission or hybrid composition; and
- Electricity – use of 100% zero carbon electricity at all of our premises and infrastructure sites during 2021/22 for the first time, ahead of our target for this of end 2022/23.

Gas consumption and business mileage increased in 2021/22 compared to 2020/21 as we returned to more typical working practices post-COVID-19.

We remain on track to achieve our RIIO-2 Scope 1 and 2 carbon reduction targets.

Relevant RIIO-2 Commitments Progress Summary

The Commercial Fleet Electric Vehicle (EV) Price Control Deliverable (PCD) is to support the networks in converting their vehicle fleets to EVs or other zero emission equivalents. The base totex allowance includes funding for updating the network vehicle fleets. The funding in this PCD relates to the incremental cost of purchasing an electric vehicle in place of an equivalent internal combustion vehicle. Whilst the unit costs are for vehicles and infrastructure based electric vehicle data, the PCD allows equivalent zero-emission vehicle types, such as hydrogen, to be substituted for an EV where this is efficient. The PCD is also subject to a volume driver which adjusts the five-year allowance to reflect the actual volume and mix of EVs delivered over the price control.

NGN's PCD includes replacing 146 small and medium vans with EVs and installing 182 electric vehicle charging points. Our plan was to begin installing the EV charging points in the first year of RIIO-2 and to purchase 2 EVs to fully trial and understand the impact on operations of adopting EVs, however the COVID-19 pandemic delayed the preparatory work needed to deliver this. We have now completed all the required surveys to ensure our offices and depots have the necessary electrical capacity to support the EV charging points. We will shortly complete a competitive tender exercise to appoint a contractor to complete the infrastructure installation work, with the majority expected to be completed in the second year of RIIO-2. We will also carry out a competitive tender event in the second year of RIIO-2 for the purchase of our first EVs, though delivery dates will be subject to the world-wide supply chain issues currently being experienced.

The effects of COVID-19 have impacted the delivery of our network infrastructure capital investment commitments during 2021/22 as we have experienced supply chain related delays, in particular in association with long lead materials, in addition to completing a comprehensive re-tender of our delivery contractor frameworks. We remain in place to deliver our RIIO-2 commitments. Similarly, we are currently reviewing our office and depot portfolio in consideration of the post-COVID-19 working practices prior to commencing our EAP commitment to install renewable energy generation at all of our offices and depots to ensure best value to the customer.

4.2.3 Business Carbon Footprint - Scope 3

Scope 3 greenhouse gas emissions are those associated with an organisation's value chain across 15 defined categories, including goods and services purchased, leased assets and waste disposal. During 2021 we completed a screening assessment of our Scope 3 emissions in line with the guidance provided in the GHG Protocol: Technical Guidance for Calculating Scope 3 emissions (V1). Only Scope 3 emissions categories 1 to 7 were considered to be relevant and material to our business operations.

Our assessment included estimation of our Scope 3 emissions in all relevant categories (1 to 7) for 2017/18 to 2020/21 to identify material Scope 3 emissions sources, and review source data availability and quality. The full findings of this assessment, including source data, methodologies and data quality rating, are provided in Appendix B. This assessment identified that Scope 3 emissions typically comprise approximately 15% of NGN's total greenhouse gas emissions (Scope 1 = c.85% and Scope 2 = <0.5%).

Reporting Improvement Programme

NGN completed reporting of key Scope 3 emissions throughout RIIO-1. Based on the findings of our Scope 3 emissions screening assessment we have expanded our Scope 3 emissions reporting for 2021/22 by c.50% by:

- Expansion of contractor vehicle emissions reported under Category 1 to include well to wheel (WTW) emissions compared to tank to wheel (TTW) emissions reported in RIIO-1;
- Expansion of the range of capital goods emissions reported under Category 2 to include steel and copper pipe purchased alongside polyethylene pipe and fittings as reported in RIIO-1; and
- Reporting Categories 3, 4 and 5 which were not previously reported in RIIO-1.

As identified in Table 12, these changes have resulted in the estimated data coverage of our Scope 3 emissions as reported in 2021/22 increasing to c.50%.

All Scope 3 emissions reported by NGN during 2021/22 are based on actual consumption data (such as tonnes of product purchased or litres of fuel consumed) multiplied by the relevant published carbon conversion factor, with none estimated from financial spend based factors/indices.

We have identified Category 7 (employee commuting emissions) as material and relevant to our business carbon footprint and are developing methods to calculate these emissions to enable future reporting in RIIO-2. Such calculation will need to reflect our current hybrid working policy and include travel emissions from employee commuting and energy consumption from colleagues working from home.

Throughout RIIO-2 we will continue to work to expand the range of our Category 1 (goods and services) and Category 2 (capital goods) reporting as supply contracts are renewed. Engagement with our supply chain to date has identified a general absence of carbon/environmental data availability for many of the capital products that we purchase, hence we are currently reporting the emissions from our consumption of uniform materials (polyethylene, copper and steel pipe) for which published carbon conversion factors are available and emissions can be readily calculated based on mass of product purchased.

Performance Summary

Table 12 and Figure 8 identify the Scope 3 categories identified as material to NGN and their emissions for 2021/22.

Scope 3 Category	Data Content	Estimated Data Coverage (%)	Emissions tCO2e				
			2021/22	2022/23	2023/24	2024/25	2025/26
1 – Goods and services	Gas mains replacement and helicopter survey contractor fuel emissions; Contractor reinstatement material (WTW)	45%*	14,590				
2 – Capital goods	Polyethylene gas pipe and fittings^^; steel pipe; copper pipe		6,163				
3 – fuel and energy related activity not included in Scope 1 and 2	WTT emissions and transmission and distribution losses for Scope 1 and 2 emissions (fuel use in direct commercial vehicles and company owned/controlled cars; metered natural gas use; electricity use)**.	100%^	1,154				
4 – upstream transportation and distribution	Logistics contractor emissions	100%^	102				
5 – waste generated in operations	Office and depot waste, excavation spoil and polyethylene pipe waste	100%^	314				
6 – business travel	Business travel via air, rail, hire cars and in personal cars	100%^	83				
7 – employee commuting	Not currently measured – included in improvement plan	0%	Not available				
Total		46%*	22,406				
Total per £m turnover (tCO2e/£m)			53				
Total per Gwh gas transported (tCO2e/Gwh)			0.33				

* 2021/22 emissions for data content shown divided by estimated emissions for 2020/21.

** WTT emissions for gas shrinkage excluded as per Ofgem Table 11.06 format. 2021/22 gas shrinkage WTT emissions = 314 Gwh x 31.35 tCO2e/GWh = 9848 tCO2e.

^ Source data available and included in emissions calculation for all relevant emissions sources.

Scope 3 Category	Data Content	Estimated Data Coverage (%)	Emissions tCO2e				
			2021/22	2022/23	2023/24	2024/25	2025/26
^^ Polyethylene pipe and fittings emissions based on carbon conversion factor for high density polyethylene published by UK government and includes manufacture and transportation of products. Value as calculated by pipe manufacturer's bespoke calculations in 2021/22 = 5,110 tCO2e. **Emissions from Downstream Customer Gas Consumption** It is of note that NGN do not own or control the gas that we transport and as such downstream emissions associated with customer gas combustion are not attributable to NGN as a Scope 3 emission. For completeness these emissions have been estimated as 14.3m tCO2e on the assumption that all gas transported through NGN network and not lost to shrinkage is subject to combustion by customers with carbon emissions generated as per carbon conversion factors published by UK Government Department of Business, Energy and Industrial Strategy for 2021: Gas consumption by NGN customers = 67,123 Gwh (NGN throughput) – 314 Gwh (NGN shrinkage) = 66,809 Gwh Gas consumption = 66,809 Gwh x (183.16 + 31.35) tCO2e/Gwh = 14.3m tCO2e							

Table 12 – Scope 3 greenhouse gas emissions

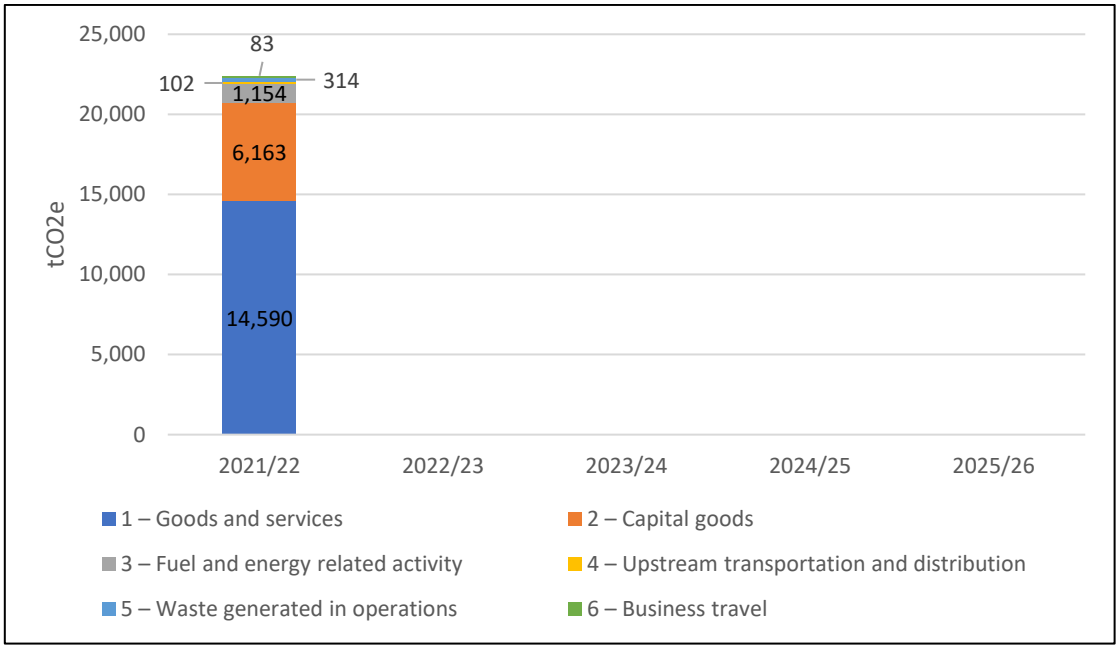


Figure 8 – Scope 3 greenhouse gas emissions by Scope 3 category

As referenced above, we have made changes to how we measure and report our Scope 3 emissions during 2021/22 to bring this in line with best practice, meaning performance comparisons with previous reporting years is not possible.

Our RIIO-2 EAP included reduction targets for key Scope 3 emissions sources as measured during RIIO-1. Our performance against these targets is shown in Table 13 and identifies that we were 98 tCO2e (0.6%) below our annual Scope 3 target during 2021/22. As referenced in Table 14, in agreement with Ofgem we have amended some of our Scope 3 emissions targets from those contained in our EAP to ensure we are reporting in accordance with best practice whilst also

achieving the same percentage emissions reduction and trajectory over RIIO-2 as included in our EAP. Our Scope 3 targets for RIIO-2 are presented in Appendix A.

Scope 3 Emissions Targets in tCO2e	2021/22		2022/23	2023/24	2024/25	2025/26
	Performance	Target	Target	Target	Target	Target
Contractor Vehicles – Mains Replacement Contractors Vehicle Emissions (Category 1 - Goods and Services)*	9,062	8,490	8,260	8,029	7,799	7,568
Contractor Vehicles – Helicopter Surveys (Category 1 - Goods and Services)*	53	77	77	77	77	77
Polyethylene gas pipe and fittings (Category 2 – Capital Goods)*	6,084	6,470	6,436	6,402	6,367	6,334
Electricity Generation and Transmission and Distribution Losses (Category 3 - fuel and energy related activity not included in Scope 1 and 2)*	0	41	38	0	0	0
Business travel – air (Category 6 – business travel)	0	198	196	194	192	190
Business travel – rail (Category 6 – business travel)	2	22	22	22	22	22
Total	15,200	15,298	15,030	14,724	14,457	14,191

* Business plan targets amended in May 2022 in agreement with Ofgem to bring Scope 3 emissions reporting in line with best practice methods:

- Contractor vehicles (mains replacement contractors and helicopter surveys): reporting of WTW emissions not WTT as included in EAP targets;
- Polyethylene pipe and fittings: use of carbon conversion factor for HDPE published by UK government instead of supplier provided values as used in EAP targets;
- Electricity generation and transmission and distribution losses: including of well to tank emissions (including upstream generation and upstream generation and distribution losses) in addition to transmission and distribution losses included in EAP targets.

Targets retain the same percentage reduction and trajectory over RIIO-2 as the targets contained in our RIIO-2 EAP.

Polyethylene pipe and fittings emissions based on carbon conversion factor for high density polyethylene published by UK government and includes manufacture and transportation of products. Value as calculated by pipe manufacturer's bespoke calculations in 2021/22 = 5,110 tCO2e.

Table 13 – Scope 3 emissions reduction targets and performance

Areas of Scope 3 emissions performance during 2021/22 of note:

- Polyethylene pipe and fittings (Category 2) – reduced material purchasing (-28% vs 20/21 by weight) as we utilised our stockpiles built up as part of our Brexit and COVID-19 contingency planning.

- Electricity losses (Category 3) – use of 100% zero carbon electricity at all premises and infrastructure sites during 2021/22 for the first time, ahead of our target for this of end 2022/23.
- Air and rail travel (Category 6) – no business air travel for the second consecutive year and much reduced business rail travel compared to pre-COVID-19 as we continued to use technology to engage with stakeholders virtually.
- Contractor vehicles (Category 1) – emissions were 7% over target as our contractors continued to utilise additional vehicles during 2021/22 due to COVID-19 precautions.

We remain on track to achieve our RIIO-2 Scope 3 carbon reduction targets.

4.2.4 Embodied Carbon

As identified in the reporting guidelines, embodied carbon (EC) is commonly defined as the whole life ('cradle to grave') total greenhouse gas emissions generated to produce a built asset, including emissions associated with extraction, manufacture/processing, transportation, assembly and end of life decommissioning.

As part of this new reporting requirement for RIIO-2 we have completed a scoping assessment of the EC associated with our principal areas of work expenditure, namely: gas mains replacement, diversions and reinforcements (<7 barg); new connections; and gas emergency repair. This assessment was aligned to PAS2080[26] and included consideration of asset lifecycles.

Process mapping of our work projects was completed to identify sources of EC associated with our works, including vehicle emissions, material consumption and waste disposal. It has been assumed that gas pipes have an indefinite life span (given that we have no confirmed asset management plans to decommission them) and as such EC associated with decommissioning of our gas mains does not require inclusion. Emissions sources were then identified for inclusion in our EC calculation based on assessment of their materiality and source data quality, resulting in c.90% of identified emissions sources being included based on 2020/21 data. A summary of our EC assessment methodology is included in Appendix C and has been shared and discussed with the other gas distribution networks to promote knowledge sharing and development of a common reporting approach. During the preparation of this report the gas distribution networks completed a comparison assessment of the content of their respective proposed embodied carbon calculations (led by NGN) and it has been agreed to hold a workshop after publication of the first round of reporting to compare results and identify areas for standardisation for future reporting.

Using the methodology in Appendix C, estimated baseline total and normalised 'as built' EC values for 2020/21 have been calculated for our principal workload, in addition to actual performance values for 2021/22. EC reduction targets to be achieved by end RIIO-2 based have also been developed based on our relevant EAP commitments (such as our excavation spoil recycling targets) and 2020/21 waste and material consumption volumes. This information is shown in Figures 9 and 10.

[26] PAS2080 Carbon Management in Infrastructure Verification: https://www.bsigroup.com/en-GB/our-services/product-certification/product-certification-schemes/pas-2080-carbon-management-in-infrastructure-verification/

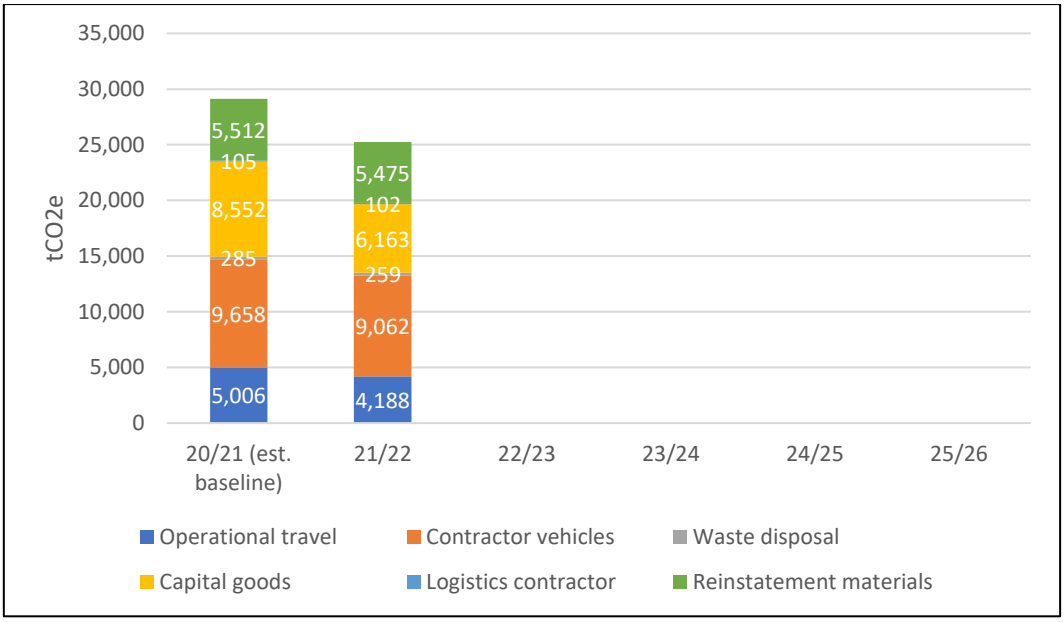


Figure 9 – Embodied carbon emissions for gas mains replacement, diversions and reinforcements (<7 barg), new connections and emergency repair work

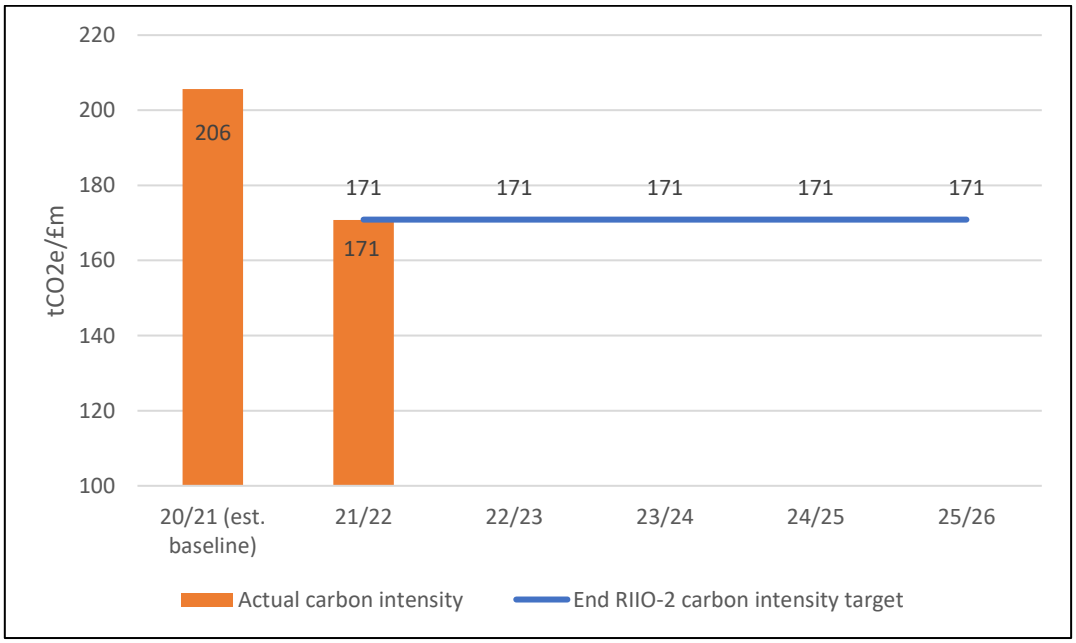


Figure 10 – Embodied carbon emissions intensity for gas mains replacement, diversions and reinforcements (<7 barg), new connections and emergency repair work

Figure 10 demonstrates that the EC for our main work types was 171 tCO2e/£m during 2021/22, a c.17% reduction compared to our estimated baseline for 2020/21. Based on our RIIO-2 EAP commitments we are targeting a 17% reduction in this value by end 2025/26 compared to our baseline, which we achieved during 2021/22. We will continue to monitor our performance against

this target throughout RIIO-2 whilst delivering our EAP commitments to ensure we achieve consistently achieve our target and where possible outperform.

The workload included in our EC calculation is varied and includes repair of gas leaks, installation of new gas connections, replacement of gas mains and associated services for a wide range of diameters, and network reinforcement (<7 barg). Estimated emissions for mains replacement, diversions and reinforcements workload based on expenditure identified that the carbon intensity of this work reduced from approximately 50 tCO2e per km of pipe installed in 2020/21 to approximately 35 tCO2e per km in 2021/22. Equivalent comparison values from other utility works are difficult to establish, however these values are similar to (but less than) those reported from the water industry (approximately 90-190 tCO2e per km for new polyethylene mains laid in roads[27]), with the difference anticipated to be due to NGN gas mains replacement being predominantly done by insertion techniques utilising the existing gas mains rather than traditional open trench methods anticipated to be utilised for new water mains.

We are looking to expand the scope of our embodied carbon data capture during RIIO-2 to include capital projects such as fixed asset site upgrades and diversions undertaken for third parties to enable a wider scope of EC reporting in the future.

4.3 Sustainable Procurement, Resource Use and Waste

4.3.1 Supply Chain and Sustainable Procurement

Our EAP recognised the need for us to develop a sustainable approach to procurement and resource consumption to reduce the environmental impact of our business operations and the c.£200m of goods and services that we buy each year from our 700 strong supply chain.

During 2021/22 we spent £214m on goods and services from over 700 suppliers, the top 80% of which was with 65 suppliers. Our principal area of expenditure was mains replacement and reinstatement contractors which accounted for approximately 40% of expenditure on goods and services.

For core business procurement events we preferentially engage suppliers who have been approved via the Achilles Utilities Vendor Database, an independent supply chain assurance assessment. In addition, potential suppliers for procurement events are typically required to complete a pre-qualification questionnaire (PQQ) which as standard includes questions regarding their environmental management systems, past environmental performance, corporate environmental objectives, how they meet our EAP objectives and their sustainable business practices, and are awarded scores accordingly. It is of note that we do not have access to data regarding the proportion of suppliers that have their own environmental key performance indicators (KPIs) and as such cannot provide performance data on this.

During 2021/22 we have worked with our stakeholders[28] to finalise our Supplier Code of Conduct ('supplier code') and associated compliance process. Our supplier code is aligned to the UN SDGs and requires our suppliers to operate to high standards of environmental management and sustainable business practices. We expect the implementation of our supplier code to ensure delivery of our RIIO-2 commitments in the most sustainable manner for both our stakeholders and

[27] Carbon curves for the assessment of embodied carbon in the wastewater industry; Smyth, Davison and Brow; *Water and Environment Journal* **31** (2017) 4-11.

[28] [28] https://together.northerngasnetworks.co.uk/wp-content/uploads/2021/11/Supplier-code-of-conduct-Workshop-12-January-2022-v2.pdf

the planet, including with respect to ethical working practices and reducing greenhouse gas emissions.

Following launch on our website in April 2022[29], our supplier code is subsequently being communicated with existing and potential suppliers and compliance tracked. We will report the percentage of our supply chain complying with our supplier code in our subsequent Annual Environmental Reports. This is currently our primary sustainable procurement KPI.

Examples from 2021/22 where we have included sustainability improvements in our procurement activities are:

- Inclusion of a secure recycling service for spent equipment within our new personal protective equipment (PPE) supply contract. Spent PPE was previously disposed via general waste streams; and
- Elimination of avoidable single use plastic items and preferential use of 'eco' items within our new stationery supply contract.

During 2022 we joined the Supply Chain Sustainability School and are currently exploring how we can harness this to improve the sustainability performance of our supply chain. Of note this will involve sharing of best practice amongst members via discussion groups and by providing our suppliers with access to free to use training materials to help them develop their awareness of sustainability issues and how they can improve their own sustainability performance.

4.3.2 Efficient Resource Use and Waste

Our business operations inherently involve consumption of resources and generation of waste by ourselves and our contractors.

A summary of our primary material/resource consumption types by volume/mass is presented in Table 14 including data from ourselves and our main contractors.

[29] https://www.northerngasnetworks.co.uk/wp-content/uploads/2022/04/Supplier-Code-of-Conduct_FINAL_compiled.pdf

Material/Resource Type	Unit	2021/22	2022/23	2023/24	2024/25	2025/26
Secondary (recycled) aggregates	tonnes	107,344				
Asphalt	tonnes	98,149				
Primary (virgin) aggregates*	tonnes	31,744				
Soil	tonnes	11,492				
Concrete and concrete products (eg kerbstones)	tonnes	7,782				
Polyethylene pipe and fittings	tonnes	1,861				
Diesel**	Litres	3,746,881				
Red diesel (gas oil)**	Litres	463,358				
Petrol**	Litres	65,370				

Materials/resources presented are those with annual consumption >1000 tonnes or litres.

Data represents consumption for NGN, gas main replacement contractors and reinstatement contractors.

* All aggregates including sand; not just stone as required in Ofgem reporting definition for 'virgin aggregate' for Table 11.07.

** Excludes consumption associated with travel in cars claimed as mileage as actual fuel consumption unknown.

Table 14 – Primary material/consumption volumes for NGN and contractors

In addition to the information provided in Table 15, we have an EAP commitment to use less than 2.5% primary (virgin) aggregate (crushed stone) in reinstatement by 2025/26. During 2021/22 we reduced our virgin aggregate consumption to 7.98% from 11.16% in 2020/21 and as such we remain on track to achieve our target.

We typically generate c.200,000 t of waste annually, >99% of which is excavation spoil and >99% of it is diverted from landfill. A summary of waste production and disposal performance to the best available detail is provided in Table 15 below.

Waste Type	Unit	2021/22	2022/23	2023/24	2024/25	2025/26	2025/26 Target
Waste Production							
Excavation spoil	tonnes	201,061					n/a
Mixed recycling	tonnes	57					n/a
General waste	tonnes	583					n/a
Metals	tonnes	53					n/a
Wood	tonnes	39					n/a
Plastics (inc gas pipe waste)	tonnes	206					n/a
Green waste	tonnes	13					n/a
Hazardous	tonnes	3					n/a
Other	tonnes	38					n/a
Total	tonnes	202,053					n/a
Total office and depot waste^	tonnes	981					916*
Total waste per £m turnover	Tonnes/£m	480					n/a
Waste Disposal Performance							
Total waste: disposed to landfill diverted from landfill (including reused)	%	 0.12 99.88					n/a
Excavation spoil: disposed to landfill diverted from landfill (including reused)	%	 0.11 99.89					 <0.1% n/a
Office and depot waste: disposed to landfill diverted from landfill	%	 2.48 97.52					 0% n/a

* Equates to 20% reduction compared to 2018 baseline (1145 t)

^ Waste disposed at office and depot sites only (excludes waste generated at infrastructure sites and temporary work sites).

Waste data from our leased office at Doxford Park, Sunderland could not be obtained from our landlords. In response the waste data for our head office at Thorpe Park, Leeds has been duplicated as a proxy for the missing Doxford Park data as the offices typically have similar numbers of colleagues working there.

Table 15 – Waste disposal performance

During 2021/22 we achieved 0.11% excavation spoil to landfill, continuing our excellent performance from RIIO-1 where we had significantly improved our spoil to landfill performance from our outset performance of 37% in 2013/14. In addition, during 2021/22 we achieved 2.5% office and depot waste to landfill and a 14% reduction in office and depot waste mass compared to the 2018 baseline. As such we remain on track to achieve our end of RIIO-2 targets as shown in Table 16.

We communicate our EAP waste and material targets with our colleagues via briefing videos and digital signage in our offices and depots, in addition to sharing them with our contractors. Our contractors are required to submit a detailed monthly waste, materials and fuel consumption report which identifies their performance against our EAP commitments. The performance data is subject to challenge and scrutiny at contractor performance review and meetings, and since April 2022 is included as scored criteria in our incentivised contractor 'Premier League' with similar weightings to health and safety and customer service performance.

4.4 Local Environment

4.4.1 Climate Change Resilience

NGN is designated as a reporting authority under the Climate Change Act (2008). During December 2021 we published our latest climate change adaptation and risk assessment report in response to the third round of the Climate Change Adaptation Reporting Power (CCARP)[30]. Our report details the climate change scenario analysis that we have completed collaboratively with the other energy networks of Great Britain and how we have used this to complete climate change risk assessments for our operations and assets in 2021 and 2050. Our assessments did not identify high risks in either 2021 or 2050. In addition, our report includes a case study of a riverbed erosion remediation project completed in summer 2021 to protect and improve the resilience of a high pressure pipe crossing. The UK Climate Change Committee noted that the third round submissions from gas network operators consistently demonstrated monitoring and evaluation and consideration of actions in the context of risks[31].

During 2021/22 our network area was subject to the effects of several significant storms, including Storm Arwen and Storm Malik. Whilst these events did not substantially negatively impact the operation of our network we have since undertaken a formal review of our severe weather operational management procedure to ensure it remains robust and appropriate, undertaken a review of back up power generation facility requirements at our critical infrastructure sites, and developed an infrastructure site access risk assessment to ensure we can continue to serve our customers and meet our regulatory obligations regardless of the weather conditions. We will continue to review our severe weather resilience processes as and when required to ensure they remain appropriately robust.

[30] Report available here: https://www.northerngasnetworks.co.uk/wp-content/uploads/2021/12/NGN-CCA-Rnd-3-Report-FINAL-DECEMBER-2021.pdf

[31] See page 41: https://www.theccc.org.uk/wp-content/uploads/2022/07/Understanding-climate-risks-to-UK-infrastructure-Evaluation-of-the-third-round-of-the-Adaptation-Reporting-Power.pdf

4.4.2 Enhancing the Local Environment

A summary of our principal scheme to enhance the local environment is provided in Table 16 with commentary provided below.

Scheme Name	Location	Description	Environmental Benefit	Timescales
Land remediation programme	Knottingley AGI, West Yorkshire	In situ remediation of former gasholder tank	Recovery of c.1,850 litres of hazardous coal tar for disposal	2017 to date (on-going)
	Howdon Holder Station, Tyne and Wear	In situ remediation of former gasholder tank	Recovery of c.2,100 litres of hazardous coal tar for disposal	March 2020 to date (on-going)
	Keswick AGI, Cumbria	In situ remediation of former gasworks tar tank	Recovery of c.7,500 litres of hazardous contaminated water and coal tar for disposal	March to May 2021
Tree planting scheme	Leeds, Bradford, Wakefield	Planting of >8,500 trees	Air quality, carbon sequestration, water retention and biodiversity	April 2021 to March 2022
Homes for Nature	Various NGN asset sites	Creation of habitat and changing vegetation management to encourage biodiversity	Changes made at 66 sites	2017 to date (on-going)

Table 16 – Schemes to enhance the local environment

Land Remediation

As detailed in our EAP, our stakeholders were strongly of the view that NGN should be doing more in relation to land remediation. During RIIO-2 we committed to continuing our award winning land remediation programme which was initiated in RIIO-1 to proactively manage our portfolio of approximately 150 asset sites built on former gasworks. This programme involves targeted inspection, investigation and monitoring works, with bespoke remediation where necessary, to ensure our sites are maintained in statutory compliant conditions, posing no significant pollution risks.

Our land remediation workload for RIIO-2 is summarised in Table 17.

Land Remediation Monitoring and Maintenance Works at Gasholder and Non-Gasholder sites		Statutory Land Remediation at Gasholder and Non-Gasholder Sites
On-going periodic site condition reviews for all sites within the portfolio (currently 148) to ensure conditions remain stable and existing environmental risk assessments regarding site pollution potential remain valid.	Environmental monitoring works at up to nine sites, and intrusive survey works at up to a further seven sites, to confirm site conditions and refine the existing site environmental risk assessment.	Remediation works at up to eight sites where RIIO-GD1 intrusive survey and monitoring works have identified potentially non-compliant conditions, or where remediation would deliver environmental betterment to reduce the long term contamination risks associated with the sites to ensure compliance.

Table 17 – RIIO-2 land remediation workload summary

During 2021/22 we continued our programme of managing our portfolio of sites with potential for land contamination, and land remediation monitoring and maintenance works were completed across 56 sites. This included desk top assessments at five sites, intrusive land contamination survey at six sites, and environmental sampling at a further 10 sites to provide an updated assessment of the environmental risk and potential liability associated with each site. In addition, site inspections were completed at a further 40 former gasworks sites to ensure their conditions remain stable and their existing environmental risk assessments remain valid. It is of note that some sites had more than one work activity undertaken. Total expenditure on our land remediation programme during 2021/22 in current year prices was £443k.

Our EAP included two new remediation projects for 2021/22, however these have not commenced due to potential third-party interest in the planned sites. We continued projects at three sites to permanently reduce environmental risks to receptors at each site:

- Keswick AGI, Cumbria: Completion of an 11 week remediation pilot trial to attempt recovery of viscous coal tar located with a below ground semi-circular former tar tank. The tank is located c.15m from a river in a wider urban area in this popular tourist town and had been identified to contain c.0.3m depth of coal tar in the tank base. The small site area and surrounding high pressure gas infrastructure prevented a traditional excavation-based remediation approach. As an alternative, an innovative bespoke thermal treatment system was established on site between March and May 2021 to attempt recovery of the coal tar to permanently reduce the environmental risks associated with this structure. The project successfully recovered c.7,500 litres of coal tar and contaminated waters for specialist licenced off-site disposal, reducing the thickness of coal tar present in the tank to below measurable thicknesses, whilst also reducing dissolved contaminant concentrations in the remaining tank waters by c.90%. The project won the *Best Remediation of a Smaller Site* at the 2021 Brownfield Awards[32].

[32] https://www.brownfield-awards.environment-analyst.com/2021-award-winners

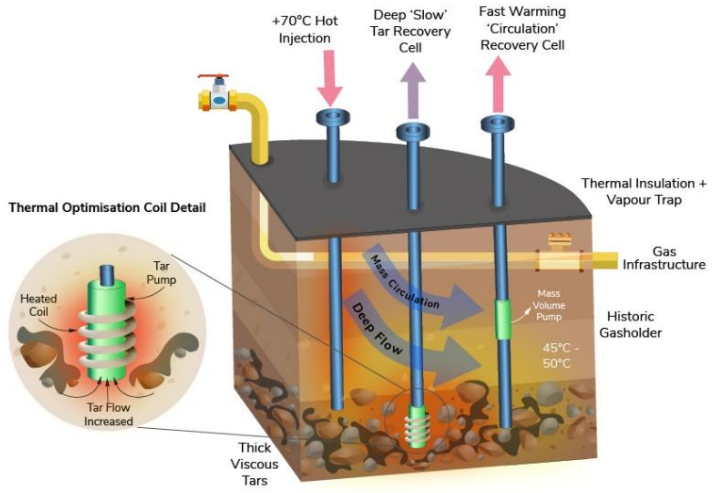


Figure 11: Overview of principles of operation of Keswick High Pressure Gas Site Thermal Remediation System.

Image courtesy of Geo2 Remediation Limited

- Howdon Gas Holder Station: Deployment of our award winning innovative solar powered in-situ remediation system (as previously used by NGN at Redheugh Gas Holder Station) to recover toxic coal tar from the base of an infilled 9m deep, 38m diameter former gas holder tank. Between project commencement in February 2020 and March 2022, this project has recovered c.2100 litres of coal tar for specialist licenced off-site disposal using only renewable energy. This project is continuing to operate into 2022/23.

- Knottingley AGI: During 2017/18 we commenced a land remediation project involving installation of an in-situ remediation system to recover coal tar from the base of an infilled, approximately 4.5m deep, former gas holder tank located beneath live gas infrastructure. Between 2017/18 and 2021/22 c.1,850 litres of coal tar was recovered for specialist licenced off-site disposal . The treatment system continues to operate into 2022/23.

We remain on target to achieve our RIIO-2 land remediation commitments.

Tree Planting in Our Communities

Poor air quality is recognised as the largest environmental risk to public health in the UK, with long term exposure to man-made air pollution having an annual equivalent effect of 28,000 to 36,000 deaths in the UK [33]. Air pollution is a complex mixture of particles and gases arisings from human and natural processes, with particulate matter (PM) (especially fine particular matter ($PM_{2.5}$)) and

[33] https://www.gov.uk/government/publications/health-matters-air-pollution/health-matters-air-pollution#call-to-action-reducing-air-pollution.

nitrogen dioxide (NO_2) being key pollutants in urban areas, with road transport providing key sources (12.4% of PM2.5 and 33.6% of NO_2).

We are conscious that as a business we contribute to poor air quality in our network, especially in urban communities, notably via the operation of our (currently predominantly diesel) vehicle fleet and the traffic congestion that can arise from our works in the road. As detailed in our EAP, during RIIO-2 we are committed to help improve air quality in our region by a range of methods, including:

- Transforming our vehicle fleet to be 50% ultra low emission or hybrid by 2026; and
- Investing c.£16m in upgrading our gas infrastructure at over 50 sites with more efficient, less polluting technology.

In addition to the above technology investments and in recognition of the benefits that tree planting can deliver to urban air quality[34] within communities, including to other ecosystem services, our shareholders committed to funding (at no cost to gas customers) the planting of 40,000 trees in the White Rose Forest[35] and Humber Forest (formerly HEYWoods)[36] areas in our network area during RIIO-2. We have established a bespoke partnership with the Community Forest Trust to deliver this tree planting and after care maintenance (to ensure plantations thrive), including funding the appointment of a dedicated Project Officer for a five year period. The Project Officer also supports our partners in enabling other tree planting activities, such as completing planting funding applications to other third party sources.

The NGN planting programme prioritises the planting of tree species known to trap particulates in urban areas close to transport corridors to directly combat the air pollution that we contribute to. The plantations are typically small (c.0.5 hectares) to enable establishment within urban environments. The scheme will also provide a range of secondary benefits, including providing greater community access to woodland in areas where it is often lacking, and carbon sequestration. NGN have valued the societal and environmental benefits delivered by the planting scheme at over £22m over 50 years[37]. It is of note that we are proposing to offset any of NGN's greenhouse emissions by this tree planting scheme.

During 2021/22 we directly funded the planting of 8,100 trees across 18 sites in Leeds, Bradford and Wakefield in West Yorkshire, including five school sites in Bradford (see Figure 12 for an example scheme). The total net area of land planted during 2021/22 was 2.1 hectares. This performance was in line with our forecast and combined with the further c.3,000 trees already identified for planting during 2022/23 means we remain on target to achieve our RIIO-2 tree planting commitments.

As detailed in Section 1.3.2 we engaged with our stakeholders during the design of the site selection methodology for the planting scheme and took on board their feedback by expanding it to include hedgerow creation to deliver broader environmental benefits. In addition to the direct outputs of our own tree planting scheme, our funding enabled the planting of an additional 551 large (standard) trees across Leeds, Wakefield and Kirklees during 2021/22. The project officer funded by NGN organised and managed a successful funding Urban Tree Challenge Fund application to the

[34] The Woodland Trust identify that trees can cut indoor and outdoor air pollution by 50% in urban areas: https://www.woodlandtrust.org.uk/media/1688/residential-developments-and-trees.pdf
[35] https://whiteroseforest.org/
[36] https://www.humberforest.org/
[37] CV6: https://www.northerngasnetworks.co.uk/wp-content/uploads/2019/12/A13-NGN-RIIO-2-Customer-Value-Proposition.pdf

Forestry Commission, securing £460k to deliver this additional planting. The cost to NGN shareholders of our tree planting during 2021/22 was £78k.

We remain on target to achieve our RIIO-2 tree planting commitments.

Figure 12: NGN tree planting scheme outputs at Byron Primary School, Bradford.

Homes for Nature

It is well established that biodiversity in the UK and worldwide is facing significant threats as a result of land use and climate changes. In accordance with our 'Homes for Nature' commitment in our Environment Strategy[38] which we commenced during RIIO-1, we have committed to make positive changes at 250 of our fixed asset sites by the end of RIIO-2 to encourage biodiversity, all at no additional cost to gas customers. These changes could include installing habitats or changing vegetation management techniques to promote conditions in which biodiversity can increase. To support this, we have developed a catalogue of biodiversity enhancement methods suitable for our infrastructure sites and shared this with our landscape management team to enable implementation.

By the end of 2021/22 we had made positive changes to create 'Homes for Nature' at 66 of our asset sites and created a strategy to get us to our target for end of RIIO-2, including trialling 'No Mow May' at five of our asset sites during May 2022. Example initiatives are shown in Figure 13.

We remain on target to achieve our RIIO-2 commitments.

[38] https://www.northerngasnetworks.co.uk/wp-content/uploads/2020/05/ENVIRONMENT-STRATEGY-JUNE-2018.pdf

Figure 13: Bug hotel, stacked felled timber and dead hedging proactively created at our Low Thornley depot to encourage biodiversity.

Ecosystem Services and Natural Capital Evaluation

In accordance with our EAP commitments, we have completed a screening assessment to identify material ecosystem system services delivered at our larger (c.0.5 hectares and greater) vegetated infrastructure asset sites. As detailed in Appendix D, and informed by input from our stakeholders, the following ecosystem services were identified as material to our sites:

- Provisioning services: pollination;
- Regulation services: air pollution removal, carbon sequestration, water regulation (fluvial and surface runoff) and local temperature regulation;
- Aggregated/bundled services: biodiversity and aesthetic appreciation of landscapes.

Based on the above a bespoke natural capital evaluation methodology was developed for NGN sites for the identified material ecosystem services except aesthetic appreciation of landscapes as this is difficult to measure. This methodology included a natural capital financial valuation for all of the identified material ecosystem services except pollination and aesthetic appreciation of landscapes as these could not be robustly valued.

As per our EAP commitment, we conducted baseline assessments at 32 of our infrastructure sites with a combined area of 40 hectares during 2021/22, which identified that our sites typically deliver multiple ecosystem service benefits including sequestration of 1.6t of carbon per hectare per year and 4.6 biodiversity units per hectare. In total our infrastructure sites provide natural capital valued at an average of £1500 per hectare per year in 2021 prices. Full details of the findings and valuation are provided in Appendix D alongside an example assessment. We will complete repeat assessments of the same sites (where still in NGN ownership) during 2023 and 2025 and analyse how we can use this methodology and information to optimise our future asset management investments to maximise delivered value.

4.4.3 Biodiversity

During 2021/22 we were granted planning permission for the development of our Customer Energy Village (CEV)[39] at our Integrel energy research and development centre in Gateshead[40]. The CEV will feature several retrospectively constructed residential properties reflecting the main property types of the UK enabling the research, testing, de-risking and demonstration of energy technologies, including hydrogen, within the home environment.

As part of the planning application for the project, a site specific ecological impact assessment and ecological mitigation and enhancement plan were prepared, including a biodiversity net gain calculation utilising the prevailing DEFRA 2.0 Metric methodology. As shown in Table 18, our project enhancement plans will deliver 46% biodiversity net gain. We have not undertaken any further projects during 2021/22 necessitating achievement of biodiversity net gain.

Project Description	Onsite/offsite	Baseline units	Post intervention units	Total net unit change	Percentage net change
Customer Energy Village development, Gateshead, Tyne and Wear	On site	0.45	0.00	0.21	46%
	Off site	13.30	13.97		
Values calculated in November 2020 using DEFRA 2.0 Metric methodology					

Table 18 – Impact on biodiversity during 2021/22

4.4.4 Environmental Incidents

We did not experience any environmental incidents which necessitated reporting to the Environment Agency or local authorities during 2021/22. In addition, we did not receive any enforcement action from environmental regulators (such as warning letters, enforcement notices, financial penalties or prosecutions) during 2021/22.

	2021/22	2022/23	2023/24	2024/25	2025/26
Number of reportable environmental incidents	0				
Enforcement action received from environmental regulators	0				

Table 19 – Reportable environmental incidents

[39] https://public.gateshead.gov.uk/online-applications/applicationDetails.do?previousCaseType=Property&keyVal=QPTCL0HKHF000&previousCaseNumber=00089CHKBU000&previousCaseUprn=010022994240&activeTab=summary&previousKeyVal=00089CHKLI000

[40] http://www.integrel.co.uk/

5 Statement on Scope and Quality of Data

The data contained in this report is presented to the best of our knowledge and capabilities in accordance with RIIO-2 Environmental Reporting Guidance, Version 1.0, Ofgem, 2 March 2021. All data contained in this report is subject to our own data assurance procedures prepared in accordance with the Ofgem Data Assurance Guidelines[41]. It is recognised that this is our first Annual Environmental Report prepared under the requirements of RIIO-2 and reporting may evolve in subsequent publications.

The scope of the environmental data presented (such as fuel consumption, tonnages of waste etc) is limited to that associated with our principal typical network workload activities, namely gas mains replacement, network reinforcements (<7 barg) and diversions, gas connections, and emergency repair. NGN do not currently hold data associated with abnormal workload activities such as infrastructure site capital installation / upgrades, gas holder demolition or land remediation projects, however we are looking to improve our collection of this data during RIIO-2. Any other additional exclusions associated with each data set is identified in the relevant section of the report. Wherever possible reported values are based on actual consumption data.

This report has been subject to audit by NGN's independent Internal Audit team. NGN's greenhouse gas emissions as contained in this document are also replicated in the Annual Report and Accounts of Northern Gas Networks Holdings Limited and as such are subject to independent third party audit[42] (by Deloitte for the period 1 April 2021 to 31 March 2022).

[41] https://www.ofgem.gov.uk/publications/data-assurance-guidance.
[42] See Statutory Accounts for period 1 April 2021 to 31 March 2022 here: https://www.northerngasnetworks.co.uk/document-library/

Appendix A – RIIO-2 Carbon Reduction Targets

Scope	Item	RIIO-2 Target (tCO2e)				
		21/22	22/23	23/24	24/25	25/26
1	Metered gas use	220	205	191	0	0
1	Operational vehicles	3,441	3,156	2,917	2,795	2,729
1	Business mileage	955	752	555	546	538
2	Electricity use - offices, depots and gas sites	165	158	0	0	0
2	Electricity use - electric vehicle charging (operational vehicles)	80	162	242	242	242
2	Electricity use - electric vehicle charging (business mileage)	24	49	73	72	71
3	Contractor vehicles - road vehicles	8,490	8,260	8,029	7,799	7,568
3	Contractor vehicles - helicopter	77	77	77	77	77
3	PE Pipe	6,470	6,436	6,402	6,367	6,334
3	Rail	22	22	22	22	22
3	Air	198	196	194	192	190
3	Transmission and distribution losses	41	38	0	0	0
Total Scope 1		**4,616**	**4,113**	**3,663**	**3,341**	**3,267**
Total Scope 2		**269**	**369**	**315**	**314**	**313**
Total Scope 1 & 2		**4,885**	**4,482**	**3,978**	**3,655**	**3,580**
Total Scope 3		**15,298**	**15,030**	**14,724**	**14,457**	**14,191**
Total Scope 1, 2 & 3		**20,183**	**19,512**	**18,702**	**18,112**	**17,771**

Appendix B – Scope 3 Emissions Assessment

A Scope 3 greenhouse gas emissions screening assessment for NGN based on GHG Protocol: Technical Guidance for Calculating Scope 3 emissions (V1) has been completed and shown in Table B1.

Scope 3 Emissions Category	Material to NGN?	Details	Included in RIIO-2 Scope 3 Emissions Reporting?
1: Purchased goods and services	Yes	NGN typically purchase c.£200m of goods, services and capital goods annually	Yes – where data available
2: Capital goods	Yes		Yes – where data available
3: Fuel and energy-related activities not included in Scope 1 and 2	Yes	NGN consume natural gas, electricity and liquid fuels purchased from third parties as part of their business operations	Yes
4: Upstream transportation and distribution	Yes	NGN utilise a third party logistics provider for the transportation and distribution of critical materials from the manufacturer to NGN premises	Yes
5: Waste generated in operations	Yes	NGN typically generate c.200,000 tonnes of waste annually in associated with business operations	Yes
6: Business travel	Yes	NGN employees regularly undertake business travel via air, rail, hire cars and in own private cars.	Yes
7: Employee commuting	Yes	NGN have approximately 1400 employees, approximately half of which are office based and commute to work in NGN premises. The remainder are mobile operational personnel.	Yes
8: Upstream leased assets	No	NGN do not lease any assets upstream of their value chain	No
9: Downstream transportation and distribution	No	NGN are a licenced gas transporter and do not sell any products.	No
10: Processing of sold products	No		No
11: Use of sold products	No		No
12: End of life treatment of sold products	No		No
13: Downstream leased assets	No	NGN do not lease any assets downstream of their value chain	No
14: Franchises	No	NGN do not operate any franchises outside of their reported Scope 1 and 2 emissions	No
15: Investments	No	NGN do not hold any investments outside of their reported Scope 1 and 2 emissions	No

Table B1: NGN Scope 3 greenhouse gas emissions screening assessment

For the identified material Scope 3 emissions categories an estimate of the total NGN Scope 3 emissions was calculated for 2017/18 to 2020/21 as shown in Table B2 showing close consistency across the four years. Scope 3 emissions were shown to typically comprise 13-16% of total NGN emissions.

Emissions Source	Methodology	2017/18		2018/19		2019/20		2020/21	
		tCO2e	%	tCO2e	%	tCO2e	%	tCO2e	%
Scope 1 – shrinkage	Shrinkage and leakage model	407,403	83	395,240	83	379,346	85	368,189	86
Scope 1 – natural gas use and vehicles	Use of actual NGN fuel/energy consumption values and relevant carbon conversion factors published by UK government	5,399	1.1	5,348	1.1	5,290	1.2	4,518	1.1
Scope 2 – electricity (location based)		2,019	0.4	1,389	0.3	1,211	0.3	1,019	0.2
Scope 3 – *estimated emissions*									
1: Purchased goods and services	NGN purchasing data (£) by sector / category multiplied by supply chain emissions factors (tCO2e/£m) published by UK government[43] adjusted for inflation. Exercise completed for top 80% of spend and then apportioned to represent 100% of spend.	61,546	13	64,447	13	51,894	12	46,339	11
2: Capital goods									
3: Fuel and energy-related activities not included in Scope 1 and 2 (excluding shrinkage)	Use of actual NGN fuel consumption values and relevant carbon conversion factors published by UK government	2,877	0.6	2,430	0.5	1,510	0.3	1,327	0.3
3: Fuel and energy-related activities not included in Scope 1 and 2 (shrinkage)	Use of NGN shrinkage volume (Gwh) and carbon conversion factor for natural gas published by UK government	9,805	2	8,333	2	7,581	1.8	7,627	1.8
4: Upstream transportation and distribution	Use of actual logistics contractor fuel consumption values and relevant carbon conversion factors published by UK government	83	0.02	88	0.02	88	0.02	85	0.02
5: Waste generated in operations	Use of actual NGN waste generation volumes and disposal analysis, and relevant carbon conversion factors published by UK government	213	0.04	240	0.05	226	0.05	251	0.06
6: Business travel	Use of actual NGN business travel data (distance and mode of travel) and relevant carbon conversion factors published by UK government	459	0.09	288	0.06	321	0.07	11	0.003
7: Employee commuting and teleworking	Bespoke calculation. *Commuting*	725	0.2	663	0.2	637	0.1	420	0.1

[43] Environmental Reporting Guidelines: Including streamlined energy and carbon reporting guidance, May 2019, HM Government – Annex E: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/850130/Env-reporting-guidance_inc_SECR_31March.pdf

Emissions Source	Methodology	2017/18		2018/19		2019/20		2020/21	
		tCO2e	%	tCO2e	%	tCO2e	%	tCO2e	%
	NGN colleague commuting habits characterised based on NGN employee numbers who are office/depot based and typical working patterns, and published UK transport statistics for our region (mode of travel and typical commuting distances). Commuting emissions estimated using characterised annual NGN commuting distances and carbon conversion factors published by UK government for relevant modes of travel. *Teleworking* This relates to in-home energy related emissions from colleagues home working. Estimated based on number of colleagues and typical working patterns, published data for typical home working energy consumption[44] and relevant carbon conversion factors published by UK government.								
Total	**n/a**	**75,708**	**15**	**76,489**	**16**	**62,523**	**14**	**56,060**	**13**
Estimated emissions from customer use of gas (not directly attributable to NGN)	*NGN gas throughput (Gwh) minus NGN gas shrinkage (Gwh) multiplied by carbon conversion factor published by UK government for natural gas (including well to tank emissions)*	*15.8m*	*n/a*	*14.3m*	*n/a*	*14.8m*	*n/a*	*14.6m*	*n/a*

Table B2: Estimated NGN Scope 3 greenhouse gas emissions for material categories for 2017/18 to 2020/21

Based on the findings of the Scope 3 emissions materiality assessment and baseline estimates presented in Tables B1 and B2, we have developed a scope of Scope 3 emissions reporting for our 2021/22 reporting as shown in Table B3. The assumptions and limitations of this approach are assessed in Table B3. We will look to expand the range of Scope 3 Category 1 and 2 emissions reporting that we complete throughout RIIO-2.

[44] https://info.eco-act.com/en/homeworking-emissions-whitepaper-2020

Scope 3 Emissions Category	Methodology and Assumptions	Data Source	Confidence in data (completeness and accuracy): RAG rating	Approximate data coverage 2020/21 vs 2021/22 (%)
1: Purchased goods and services	Includes: Gas mains replacement and reinstatement contractors; helicopter pipeline survey vehicle emissions; and reinstatement materials from connections, mains replacement, reinforcements (<7 barg), diversions, and emergency and repair works. Exclusions: all other purchased goods and services	Actual fuel consumption and material consumption data provided by contractors multiplied by relevant published carbon conversion factors from UK government	Amber High materiality (11-13% of total emissions);, robust source data and methodology, however c.45% data coverage	45%
2: Capital goods	Includes emissions associated with manufacture and transport of: polyethylene gas pipe and fittings; copper pipe; and steel pipe. Exclusions: all other purchased capital goods	Actual tonnes of product purchased as provided by supplier multiplied by relevant published carbon conversion factors from UK government and ICE.		
3: Fuel and energy-related activities not included in Scope 1 and 2	Includes well to tank, generation and transmission and distribution losses for: emissions for NGN electricity consumption, metered natural gas use, shrinkage, fuel used in own commercial vehicles, and business mileage in company owned/controlled cars (leased cars / cash option). Exclusions: none	Actual energy and fuel consumption data from company records multiplied by relevant published carbon conversion factors from UK government	Green Moderate materiality (c.0.5% of total emissions); robust data and methodology and full coverage	100%
4: Upstream transportation and distribution	Includes vehicle emissions for NGN logistics provider for transportation of essential materials. Exclusions: emissions associated with warehousing of stored NGN materials at third party premises	Actual fuel consumption data provided by contractor multiplied by relevant published carbon conversion factor from UK government	Green Low materiality (0.02% of total emissions); robust source data and methodology; however uncertain if data gaps exist	100%
5: Waste generated in operations	Includes emission from disposal of waste arising from: general office and depot waste; waste polyethylene pipe; and excavation spoil arising from connections, mains replacement, reinforcements (<7 barg), diversions and emergency and repair works.	Actual waste tonnage split by disposal destination (landfill / recycling) data provided by contractors multiplied by relevant published carbon conversion factors from UK government	Green Low materiality (c.0.05% of total emissions); robust source data and methodology; some low significance sources of	100%

Scope 3 Emissions Category	Methodology and Assumptions	Data Source	Confidence in data (completeness and accuracy): RAG rating	Approximate data coverage 2020/21 vs 2021/22 (%)
	Excludes: waste arising from abnormal workload sources, eg construction site waste from capital projects sites, land remediation or gas holder demolition. Excavation spoil is assumed to comprise (by weight): 25% asphalt, 37.5% aggregates and 37.5% soils.		waste not included	
6: Business travel	Includes NGN employee business travel via: air, rail, hire cars, and travel in personal cars not controlled by the company	Actual travel distance and mode data from company records multiplied by relevant published carbon conversion factors from UK government	Green Low materiality (c.0.05% of total emissions); robust source data and methodology; no known exclusions	100%
7: Employee commuting	Work in progress. COVID-19 significantly impacted the way we work and our colleague's commuting habits. We are working to develop a methodology that will allow us to capture the necessary data to enable reporting of these emissions in the future.			0%

Table B3: Scope, methodology and confidence assessment of NGN Scope 3 greenhouse gas emissions reporting for 2021/22

Appendix C – Embodied Carbon Assessment

Methodology

We mapped the work stages and activities associated with our principal areas of work expenditure (gas mains replacement, reinforcements (<7 barg) and diversions; new connections; and gas emergency repair) to identify material sources of embodied carbon (EC) associated with our work projects. This assessment is summarised in Table C1. It is of note that insufficient data was held to enable this assessment of our capital works investment programme, in particular due to the wide ranging characteristics of such works. In addition, loss of gas associated with gas emergencies and purging / venting of mains and service during operational procedures is excluded as it is very difficult to calculate[45].

Project Stage	Emissions Creation - Relevant Y/N?								
	NGN commercial vehicle travel	NGN other operational travel	Energy use at NGN premises	Energy use at NGN work sites	Contractor vehicle travel	Capital goods/resource use at NGN premises	Capital goods/resource use at NGN work sites	Waste creation at NGN premises	Waste creation at NGN work sites
Planned Works - Mains Replacement, Diversions, Reinforcement and Connections									
Design	N	Y	Y	N	N	N	N	Y	N
Works delivery	Y	Y	N	Y	Y	N	Y	N	Y
End of life / decommission*	N	N	N	N	N	N	N	N	N
Unplanned Works – Emergency and Repair									
Notification	N	N	Y	N	N	N	N	Y	N
Works delivery	Y	Y	N	Y	N	N	Y	N	Y
End of life / decommission*	N	N	N	N	N	N	N	N	N
* It is assumed that newly installed and active gas assets have an indefinite life span with no requirement for decommissioning. Our mains replacement programme inherently decommissions obsolete assets.									

Table C1: Process map of embodied carbon emissions sources for principal NGN work types

Based on the process map identified in Table C1 an estimate of total EC for our principal work types for the year 2019/20 was developed to enable a semi-quantitative materiality and data quality assessment as shown in Table C2. Emissions allocation by work type was based on procurement records and contractor records where available and where absent by total spend values. It is of note that obtaining EC values for purchased capital goods/materials proved very difficult and typically suppliers were not able to supply this information.

[45] Gas loss from manual purging or venting of mains and services during operations has previously been estimated to be c.1500-2000tCO2e per year for a typical GDN network area.

Emissions Scope / Source	Embodied Carbon Estimate for 2019/20 (tCO2e)					Data Quality and Materiality Assessment			
	Mains Replacement, Diversions and Reinforcements	Connections	Emergency and Repair	Total Embodied Carbon	% of total emissions	Data Quality Assessment - R/A/G	Materiality Assessment - H (>5%) / M (1-5%) / L (<1%)**	Include in RIIO-2 EC reporting?***	Approximate % of embodied emissions included in scope
3 – contractor vehicles*	8,546	387	721	9,655	31	Green Good quality source data	H	Y	31
1 + 3 – operational travel own vehicles*	3,825	597	1,191	5,613	18	Amber Good quality source data but difficult to distinguish operational and non-operational travel	H	Y	18
1 – gas use at NGN premises	53	8	72	133	0.4	Red Good quality raw data for office and depot energy consumption, however it is not possible to distinguish between consumption directly attributable to project (eg design team consumption) from consumption associated with general business operations.	L	N	n/a
2 – electricity use at NGN premises	66	10	64	139	0.5		L	N	n/a
3 – excavation waste disposal	180	10	19	210	0.7	Green Good quality source data	L	Y	0.7
3 – excavation reinstatement materials	4,072	50	91	4,214	14	Green Good quality source data	H	Y	14
3 – polyethylene gas pipe and fittings	5,885	858	1,600	8,342	27	Green Good quality source data	H	Y	27
3 – quantifiable goods/materials^	657	50	233	940	3	Red Product embodied carbon data not readily available from suppliers. Estimates have been calculated based on product weights and carbon conversion factors for principal component material types (where available) and therefore is inherently of low accuracy. EC data be obtained for relatively simple/uniform products, such as copper pipe and steel pipe.	M	Y Copper pipe and steel pipe only as data readily available	0.5^^
3 - unquantifiable goods/materials^	1,049	80	373	1,502	5		M		
3 – logistics emissions for goods/materials purchased	60	9	16	84	0.3	Green Good quality source data	L	Y	0.3

Emissions Scope / Source	Embodied Carbon Estimate for 2019/20 (tCO2e)					Data Quality and Materiality Assessment			
	Mains Replacement, Diversions and Reinforcements	Connections	Emergency and Repair	Total Embodied Carbon	% of total emissions	Data Quality Assessment - R/A/G	Materiality Assessment - H (>5%) / M (1-5%) / L (<1%)**	Include in RIIO-2 EC reporting?***	Approximate % of embodied emissions included in scope
3 – disposal of waste gas pipe/fittings	3	0	1	4	0.01	Green Good quality source data	L	Y	0.01
3 – disposal of general project work site waste at office/depot facilities	16	1	3	21	0.07	Red Good quality raw data for office and depot waste disposal, however it is not possible to distinguish between waste disposal directly attributable to project (site waste returned to depot for disposal) from waste associated with general business operations.	L	N	n/a
Total	**24,412**	**2,061**	**4,385**	**30,858**	**100**	n/a			**92**
tCO2e/£m spend	**235**	**145**	**159**	**221**	n/a				

* Well to wheel.
^ Quantifiable goods/materials: analysis identified that 30 suppliers provide NGN with materials/goods which comprise the top 80% of our spend; these suppliers were approached for product EC data and 10 responded; EC values identified represent best estimate of EC for all materials/goods purchased from these suppliers. Unquantifiable goods/materials: remaining % of supply chain products pro-rated based on spend value (representing materials comprising bottom 20% of NGN spend and 20 companies from top 80% which did not provide product EC data when requested.
^^ % of total EC emissions from copper and steel pipe purchases during 2019/20.
** % relates to % of total emissions from individual emissions source
*** Recommendation based on this assessment matrix:

Data Quality Assessment

Materiality Assessment	G	A	R
H	Include	Include	Include
M	Include	Include	Exclude
L	Include	Exclude	Exclude

Table C2: Estimated embodied carbon for principal works types in 2019/20 including data quality and materiality assessment

The assessment presented in Table C2 identified a recommended scope of EC emissions reporting for material sources where good quality base data is available, resulting in inclusion of c.90% of total identified emissions. This scope of reporting is the basis of our RIIO-2 EC reporting (as presented in Table C3) and has also been used to develop an estimated EC baseline for 2020/21 and end RIIO-2 EC performance targets based on our RIIO-2 EAP commitments (vehicle carbon reduction targets, excavation spoil recycling etc). Our EC assessment methodology has been shared and discussed with the other GDNs to enable standardisation of reporting. Our methodology may evolve over the course of RIIO-2. We aim to collect data from capital investment projects during RIIO-2 to enable EC reporting of such works, for example new pipelines or infrastructure site rebuilds.

Embodied Carbon Emission Source	Emissions tCO2e						
	2020/21 (estimated baseline)	2021/22	2022/23	2023/24	2024/25	2025/26	2025/26 Target^
Own operational and project related vehicle emissions*	5,006	4,188					4,167
Contractor vehicle emissions*	9,658	9,062					7,586
Waste disposal (excavation spoil and waste gas pipe)	285	259					284
Manufacture and transportation of principal capital materials – polyethylene pipe and fittings, copper pipe, steel pipe	8,552	6,163					6,584
Logistics contractor emissions*	105	102					105
Reinstatement materials (asphalt, aggregate etc)	5,512	5,475					5,446
Total	**29,118**	**25,249**					**24,192**
Total per £m expenditure (tCO2e/£m)	**206**	**171**					**171**
Total per km of pipe installed (tCO2e/km)**	**47**	**34**					**n/a**

* Well to wheel

** Estimate based on total measured EC emissions allocated by expenditure across pipe replacement, diversions and reinforcements divided by total length of pipe replacement, diversions and reinforcements completed.

^ Based on EAP commitments. Assumes waste disposal and reinstatement material consumption volumes remain as per 2020/21.

Table C3 –Embodied carbon emissions performance and reduction targets for gas mains replacement, new connections and emergency and repair work.

Appendix D – Ecosystem Services and Natural Capital Assessment

Ecosystems services scoping assessment for NGN infrastructure sites

Ecosystem Service category	Final effect on economic output or welfare		Scoping Status	Urban	Moor / Heath	Freshwater	Woodland	Grassland	Scrub	Hedgerows
Provisioning services		**Notes**								
Allotments	Food	No public access	scoped out	●	●			●		
Timber (standing)	Timber	Timber harvesting currenty not done on NGN sites	scoped out	●	●		●			
Water resources	Public water supply	Only relevant to waterbodies/watercourses, which may not be present on many sites	scoped out		●	●				
Water resources	Industrial / agricultural use		scoped out							
Fish capture	Food		scoped out			●				
Pollination	Food; recreation; non-use values	Relevant for semi-rural and rural sites, potentially relevant for urban sites as well, if urban farming (e.g. allotments) are nearby	scoped in					●	●	●
Regulating services		*Most regulating services are relevant for NGN sites, and are therefore included in the assessment*								
Air pollution removal	Health	Air pollution, Carbon sequestration and water regulation have been identified by the NGN Environment Workshop 16th September as key ecosystem services to be included in natural capital assessments.	scoped in	●			●	●	●	●
Carbon sequestration	Climate		scoped in	●	●		●	●	●	●
Water regulation (fluvial)	Reduced flood damage		scoped in	●	●	●	●	●	●	●
Water regulation (surface run-off)			scoped in							
Noise mitigation	Health	Many NGN sites are located in urban or semi-urban settings, where noise pollution from road traffic may affect residential areas adjacent or near NGN sites. Quantification of noise reduction very difficult without complex modelling.	scoped out	●			●			
Local temperature regulation	Reduced output loss	Many NGN sites are located in urban or semi-urban settings, where the Urban heat island effect (UHI) may cause increased temperatures during summer. Vegetation on NGN sites may therefore provide significant positive impacts on local temperatures.	scoped in	●		●	●			
Waste remediation	Avoided costs e.g. treatment	Too complex to accurately assess at high level- NGN sites can potentially have soil contamination depending on historic use of sites.	scoped out		●	●				
Cultural services		*Cultural services are generally difficult to assess, due to lack of public access on NGN sites.*								
Enabling recreation	Outdoor recreation	no public access	scoped out	●	●	●	●	●	●	●
Enabling physical activity	Physical health	no public access	scoped out	●	●	●	●	●	●	●
Enabling educational interactions	Educational benefits	no public access	scoped out	●	●	●	●	●	●	●
Volunteering opportunities	Various	no public access	scoped out	●	●	●	●	●	●	●
Environmental settings for mental health	Mental health	no public access	scoped out	●	●	●	●	●	●	●
Aggregate/bundled services		Wh								
Local environmental amenity	Various		scoped out	●	●	●	●	●	●	●
Biodiversity	Various	Assessed through biodiversity net gain survey. Biodiversity has been identified by the NGN Environment Workshop 16th September as key ecosystem service to be included in natural capital assessments.	scoped in	●	●	●	●	●	●	●
Soil health	Various	NGN sites can have contaminated soils and are generally not used as a source of topsoil or for food cultivation or similar.	scoped out	●	●		●	●	●	●
Water quality	Various	Due to the potential for soil contamination on NGN sites, it may be very difficult to quantify impacts on water quality from natural capital. As such, it may be better to exclude.	scoped out	●	●	●	●			
Aesthetic appreciation of landscapes	Various	Included as a cultural service. Aesthetic appreciation of landscapes requires no access. NGN sites may provide areas of greenspace, which are not open to the public, but can be viewed by the public. See: https://forestry.gov.scot/publications/sustainable-forestry/economic-research/665-the-social-and-environmental-benefits-of-forests-in-great-britain-main-report	scoped in	●	●	●	●	●	●	●
Non-use values	Various	Non-use values relate to the intrinsic value of nature. These can be estimated and monetised, however they may depend on a wide range of socio-economic factors.	scoped out	●	●	●	●	●	●	●

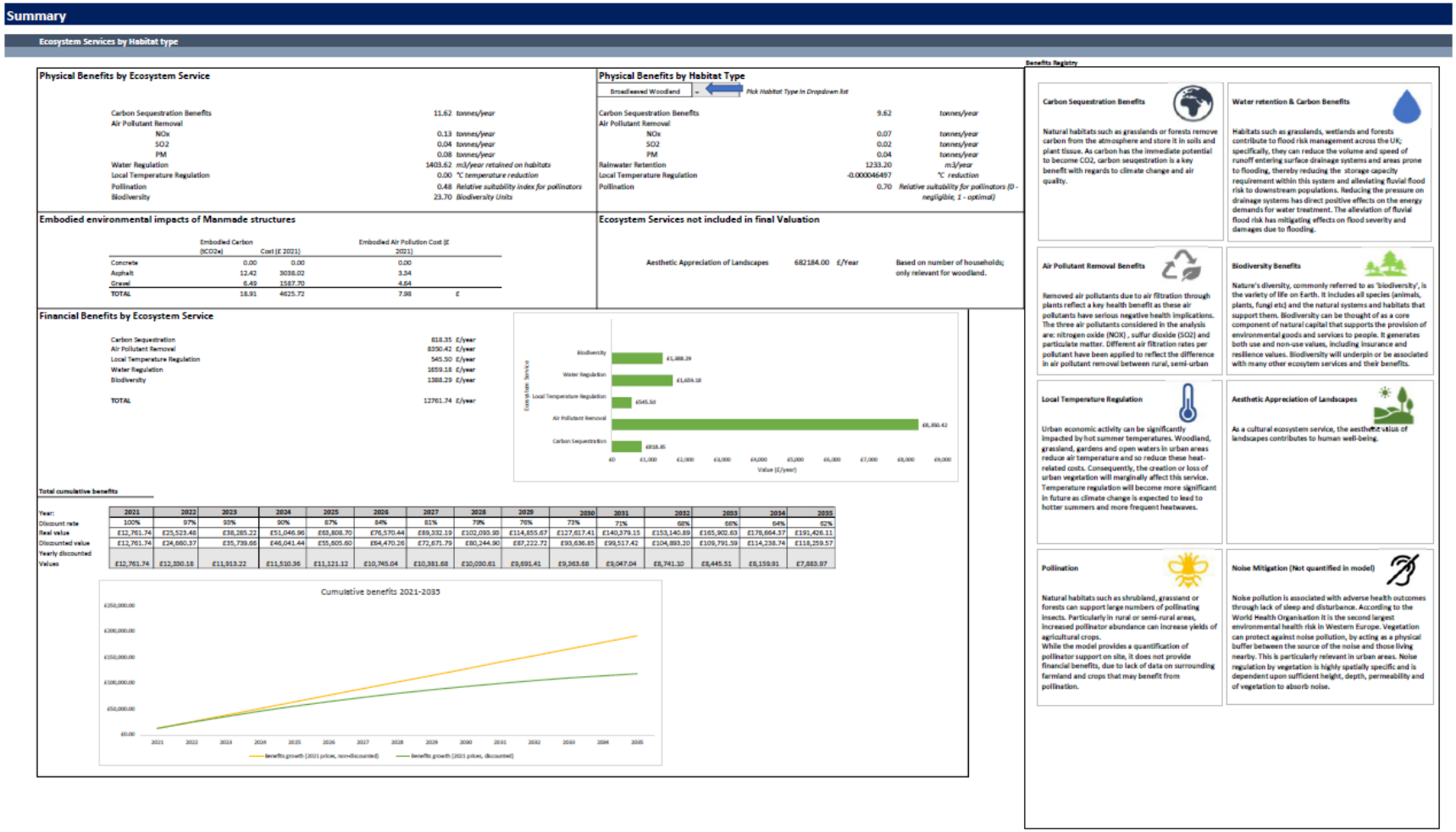
2021 NGN baseline natural capital assessment and valuation for 32 sites

NGN Natural Capital Assessment Summary

Year of Assessment: 2021

		Annual Physical Benefits by Ecosystem Service									Annual Financial Benefits by Ecosystem Service							
			Air Pollutant Removal															
Site Name	Site Area	Carbon Sequestration Benefits	NOx	SO2	PM	Total	Water Regulation	Local Temperature Regulation	Pollination	Biodiversity	Carbon Sequestration	Air Pollutant Removal	Local Temperature Regulation	Water Regulation	Biodiversity	Total	Total Financial Benefits over 15 years in 2021 prices (Discounted)	Total Financial Benefits over 15 years in 2021 prices (non-discounted)
	ha	*tonnes/year*	*tonnes/year*	*tonnes/year*	*tonnes/year*	*tonnes/year*	*m3/year retained on habitats*	*°C temperature reduction*	*Relative suitability index for pollinators*	*Biodiversity Units*	*£/year*	*£/year*	*£/year*	*£/year*	*£/year*	*£/year*	£	£
Outgang Lane, Pickering	5.1	11.62	0.134	0.038	0.075	0.247	1404	-0.000268	0.48	23.70	£818.35	£8,350.42	£545.50	£1,659.18	£1,388.29	£12,761.74	£118,259.57	£191,426.11
Low Thornley	5.9	8.55	0.072	0.021	0.044	0.137	839	-0.000236	0.55	32.46	£602.50	£4,771.71	£289.96	£1,002.09	£1,005.56	£7,671.83	£71,092.76	£115,077.45
Harrogate	0.7	1.41	0.004	0.002	0.005	0.010	21	-0.000208	0.31	1.34	£99.28	£469.77	£2.09	£13.64	£100.00	£684.78	£6,345.68	£10,271.71
Kirkburton	0.3	0.98	0.007	0.002	0.004	0.013	124	-0.000212	0.57	1.74	£69.32	£465.25	£49.91	£146.53	£132.09	£863.10	£7,998.08	£12,946.45
Halifax	0.9	1.55	0.023	0.007	0.013	0.043	142	-0.000215	0.56	5.77	£109.21	£1,469.96	£49.26	£158.39	£144.33	£1,931.16	£17,895.51	£28,967.37
Selby	0.6	0.71	0.008	0.002	0.005	0.015	71	-0.000209	0.63	3.18	£50.24	£506.02	£11.71	£76.81	£90.97	£735.74	£6,817.91	£11,036.12
Rawcliffe	1.3	0.39	0.022	0.006	0.010	0.038	62	-0.000214	0.53	5.80	£27.33	£1,187.98	£8.12	£64.25	£8.20	£1,295.88	£12,008.58	£19,438.23
Cooper Bridge	0.6	3.39	0.019	0.006	0.014	0.039	267	-0.000217	0.49	5.00	£238.61	£1,452.29	£108.97	£318.25	£362.78	£2,480.89	£22,989.77	£37,213.41
Burley Bank	1.1	1.54	0.021	0.006	0.013	0.041	46	-0.000213	0.45	8.36	£108.40	£1,442.17	£7.41	£50.28	£79.29	£1,687.55	£15,638.06	£25,313.24
Baldersby	0.6	1.59	0.011	0.003	0.007	0.022	122	-0.000212	0.64	5.36	£111.96	£762.30	£42.00	£139.17	£152.90	£1,208.33	£11,197.23	£18,124.89
Melkinthorpe	0.6	0.88	0.009	0.003	0.005	0.016	118	-0.000212	0.58	2.41	£62.07	£553.09	£45.49	£134.04	£111.04	£905.72	£8,393.05	£13,585.78
Newby	0.6	1.09	0.013	0.004	0.007	0.023	143	-0.000214	0.51	2.47	£76.95	£757.93	£56.36	£167.79	£134.75	£1,193.78	£11,062.43	£17,906.70
Thorner	0.3	1.68	0.010	0.003	0.006	0.020	281	-0.000215	0.52	2.52	£118.30	£685.23	£90.98	£337.05	£225.01	£1,456.57	£13,497.63	£21,848.54
Hopton Top	0.4	0.96	0.008	0.003	0.007	0.017	14	-0.000209	0.45	2.77	£67.40	£689.09	£2.44	£16.57	£36.62	£812.12	£7,525.66	£12,181.75
West Edmonsley	0.8	0.22	0.013	0.004	0.006	0.023	30	-0.000211	0.50	4.39	£15.47	£704.39	£4.90	£33.22	£4.39	£762.38	£7,064.76	£11,435.69
River Tyne NBV	1.0	0.48	0.017	0.005	0.008	0.030	57	-0.000212	0.54	1.82	£33.93	£956.05	£9.13	£60.58	£40.39	£1,100.08	£10,194.16	£16,501.23
Scremerston	0.5	0.69	0.007	0.002	0.005	0.014	34	-0.000209	0.54	2.19	£48.75	£496.35	£5.63	£37.07	£54.81	£642.62	£5,954.95	£9,639.25
South gosforth	1.1	3.60	0.020	0.007	0.017	0.043	406	-0.000211	0.35	4.96	£253.59	£1,737.30	£4.61	£483.77	£229.25	£2,708.52	£25,099.14	£40,627.84
Shipley	0.5	0.52	0.005	0.001	0.003	0.010	36	-0.000208	0.50	1.91	£36.31	£343.71	£6.34	£41.24	£55.63	£483.23	£4,477.92	£7,248.38
Kirkleatham	0.5	0.18	0.007	0.002	0.003	0.012	23	-0.000209	0.45	0.76	£12.92	£390.15	£3.66	£24.49	£11.81	£443.02	£4,105.38	£6,645.35
Wakefield	1.0	0.86	0.016	0.004	0.008	0.028	85	-0.000211	0.65	6.88	£60.51	£917.10	£14.87	£97.28	£99.05	£1,188.82	£11,016.47	£17,832.30
Alberto Street	0.8	0.82	0.012	0.003	0.006	0.021	81	-0.000210	0.63	2.72	£57.85	£709.34	£13.92	£90.71	£100.42	£972.24	£9,009.46	£14,583.56
Garforth	0.4	1.68	0.010	0.003	0.007	0.020	184	-0.000214	0.57	2.25	£118.49	£740.88	£76.29	£218.28	£208.77	£1,362.71	£12,627.85	£20,440.64
Keighley	0.9	0.77	0.008	0.002	0.005	0.015	76	-0.000211	0.52	3.06	£54.31	£510.97	£25.73	£80.42	£80.54	£751.97	£6,968.29	£11,279.54
Low Moor	0.9	2.29	0.024	0.007	0.013	0.044	297	-0.000220	0.50	5.94	£161.20	£1,494.86	£120.73	£351.72	£291.70	£2,420.20	£22,427.35	£36,303.03
Kidacre Street	1.9	2.36	0.018	0.005	0.011	0.034	217	-0.000211	0.65	6.63	£166.19	£1,175.68	£38.44	£248.81	£318.06	£1,947.19	£18,044.05	£29,207.80
Pudsey	0.3	1.24	0.010	0.003	0.006	0.019	143	-0.000212	0.44	1.29	£87.53	£655.60	£53.01	£172.20	£166.23	£1,134.56	£10,513.63	£17,018.36
Howdon	1.6	0.90	0.024	0.007	0.012	0.043	90	-0.000213	0.56	7.35	£63.41	£1,392.34	£16.36	£107.82	£89.00	£1,668.92	£15,465.41	£25,033.77
Hendon	2.8	1.18	0.018	0.005	0.010	0.033	108	-0.000211	0.37	2.43	£83.26	£1,138.28	£12.20	£120.38	£98.93	£1,453.05	£13,465.06	£21,795.82
Elton Offtake	2.7	5.52	0.043	0.013	0.027	0.083	565	-0.000231	0.54	12.24	£388.76	£2,960.04	£220.71	£645.41	£608.33	£4,823.24	£44,695.66	£72,348.62
Towton Offtake	2.2	2.09	0.022	0.007	0.014	0.043	73	-0.000213	0.53	5.95	£147.17	£1,542.54	£7.40	£50.17	£113.50	£1,860.77	£17,243.28	£27,911.60
Asselby	1.3	0.49	0.010	0.003	0.005	0.018	60	-0.000210	0.60	9.34	£34.56	£596.53	£3.47	£47.51	£24.90	£706.97	£6,551.27	£10,604.51
Total	**40.2**	**62.24**	**0.646**	**0.187**	**0.382**	**1.215**	**6219**	**-0.006884**	**16.68**	**185.02**	**£4,384.10**	**£42,025.32**	**£1,947.61**	**£7,195.10**	**£6,567.54**	**£62,119.67**	**£575,646.01**	**£931,795.04**
Mean benefit per hectare	-	1.55	0.016	0.005	0.010	0.030	155	-0.000171	0.42	4.61	£109.18	£1,046.57	£48.50	£179.18	£163.55	£1,546.99	£14,335.49	£23,204.78

Example 2021 natural capital assessment and valuation for NGN Pickering Offtake site



Summary

Ecosystem Services by Habitat type

Physical Benefits by Ecosystem Service

Carbon Sequestration Benefits	11.62	tonnes/year
Air Pollutant Removal		
NOx	0.13	tonnes/year
SO2	0.04	tonnes/year
PM	0.08	tonnes/year
Water Regulation	1403.62	*m3/year retained on habitats*
Local Temperature Regulation	0.00	*°C temperature reduction*
Pollination	0.48	*Relative suitability index for pollinators*
Biodiversity	23.70	*Biodiversity Units*

Physical Benefits by Habitat Type

Broadleaved Woodland — *Pick Habitat Type In Dropdown list*

Carbon Sequestration Benefits	9.62	tonnes/year
Air Pollutant Removal		
NOx	0.07	tonnes/year
SO2	0.02	tonnes/year
PM	0.04	tonnes/year
Rainwater Retention	1233.20	*m3/year*
Local Temperature Regulation	-0.000046497	*°C reduction*
Pollination	0.70	*Relative suitability for pollinators (0 - negligible, 1 - optimal)*

Embodied environmental impacts of Manmade structures

	Embodied Carbon (tCO2e)	Cost (£ 2021)	Embodied Air Pollution Cost (£ 2021)	
Concrete	0.00	0.00	0.00	
Asphalt	12.42	3038.02	3.34	
Gravel	6.49	1587.70	4.64	
TOTAL	18.91	4625.72	7.98	£

Ecosystem Services not included in final Valuation

Aesthetic Appreciation of Landscapes	682184.00	£/Year	Based on number of households; only relevant for woodland.

Financial Benefits by Ecosystem Service

Carbon Sequestration	818.35 £/year
Air Pollutant Removal	8350.42 £/year
Local Temperature Regulation	545.50 £/year
Water Regulation	1659.18 £/year
Biodiversity	1388.29 £/year
TOTAL	12761.74 £/year

Total cumulative benefits

Year:	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Discount rate	100%	97%	93%	90%	87%	84%	81%	79%	76%	73%	71%	68%	66%	64%	62%
Real value	£12,761.74	£25,523.48	£38,285.22	£51,046.96	£63,808.70	£76,570.44	£89,332.19	£102,093.93	£114,855.67	£127,617.41	£140,379.15	£153,140.89	£165,902.63	£178,664.37	£191,426.11
Discounted value	£12,761.74	£24,660.37	£35,739.66	£46,041.44	£55,605.60	£64,470.26	£72,671.79	£80,244.90	£87,222.72	£93,636.85	£99,517.42	£104,893.20	£109,791.59	£114,238.74	£118,259.57
Yearly discounted Values	£12,761.74	£12,330.18	£11,913.22	£11,510.36	£11,121.12	£10,745.04	£10,381.68	£10,030.61	£9,691.41	£9,363.68	£9,047.04	£8,741.10	£8,445.51	£8,159.91	£7,883.97

Benefits Registry

Carbon Sequestration Benefits

Natural habitats such as grasslands or forests remove carbon from the atmosphere and store it in soils and plant tissue. As carbon has the immediate potential to become CO2, carbon sequestration is a key benefit with regards to climate change and air quality.

Water retention & Carbon Benefits

Habitats such as grasslands, wetlands and forests contribute to flood risk management across the UK; specifically, they can reduce the volume and speed of runoff entering surface drainage systems and areas prone to flooding, thereby reducing the storage capacity requirement within this system and alleviating fluvial flood risk to downstream populations. Reducing the pressure on drainage systems has direct positive effects on the energy demands for water treatment. The alleviation of fluvial flood risk has mitigating effects on flood severity and damages due to flooding.

Air Pollutant Removal Benefits

Removed air pollutants due to air filtration through plants reflect a key health benefit as these air pollutants have serious negative health implications. The three air pollutants considered in the analysis are: nitrogen oxide (NOX) , sulfur dioxide (SO2) and particulate matter. Different air filtration rates per pollutant have been applied to reflect the difference in air pollutant removal between rural, semi-urban

Biodiversity Benefits

Nature's diversity, commonly referred to as 'biodiversity', is the variety of life on Earth. It includes all species (animals, plants, fungi etc) and the natural systems and habitats that support them. Biodiversity can be thought of as a core component of natural capital that supports the provision of environmental goods and services to people. It generates both use and non-use values, including insurance and resilience values. Biodiversity will underpin or be associated with many other ecosystem services and their benefits.

Local Temperature Regulation

Urban economic activity can be significantly impacted by hot summer temperatures. Woodland, grassland, gardens and open waters in urban areas reduce air temperature and so reduce these heat-related costs. Consequently, the creation or loss of urban vegetation will marginally affect this service. Temperature regulation will become more significant in future as climate change is expected to lead to hotter summers and more frequent heatwaves.

Aesthetic Appreciation of Landscapes

As a cultural ecosystem service, the aesthetic value of landscapes contributes to human well-being.

Pollination

Natural habitats such as shrubland, grassland or forests can support large numbers of pollinating insects. Particularly in rural or semi-rural areas, increased pollinator abundance can increase yields of agricultural crops.
While the model provides a quantification of pollinator support on site, it does not provide financial benefits, due to lack of data on surrounding farmland and crops that may benefit from pollination.

Noise Mitigation (Not quantified in model)

Noise pollution is associated with adverse health outcomes through lack of sleep and disturbance. According to the World Health Organisation it is the second largest environmental health risk in Western Europe. Vegetation can protect against noise pollution, by acting as a physical buffer between the source of the noise and those living nearby. This is particularly relevant in urban areas. Noise regulation by vegetation is highly spatially specific and is dependent upon sufficient height, depth, permeability and of vegetation to absorb noise.

Glossary of Terms

Biomethane	Renewable or low carbon gas that is a gas mixture predominantly comprising methane and is sourced from organic material (biomass). This gas has similar thermal characteristics to natural gas and may be cleaned and injected into the natural gas network.
Capital expenditure (capex)	Expenditure on investment in long-lived assets, for example gas pressure reduction infrastructure.
Carbon footprint	Total amount of greenhouse gas emissions caused directly and indirectly by a business or activity.
Diversion (gas)	Diverting part of the gas pipeline away from its current route in order to facilitate safe working, for example in association with an infrastructure scheme such as a new road construction.
Ecosystem services	The direct and indirect contributions of ecosystems to human wellbeing which have an impact on our survival and quality of life. There are four types of ecosystem services: provisioning (for example provision of food), regulating (for example noise mitigation), cultural (for example enabling recreation) and supporting services (for example biodiversity and maintenance of genetic diversity).
Gas distribution networks	Eight individually licenced gas network areas in Great Britain, known as East of England, North West, West Midlands, London, Northern, Scotland, Southern, and Wales & West.
Gas Transporter	The holder of a Gas Transporter's Licence in accordance with the provisions of the Gas Act 1986.
Gigawatt Hours (Gwh)	Equal to one million Kilowatt Hours.
The Health and Safety Executive (HSE)	A public body responsible for regulating health and safety in Great Britain with the primary function to secure the health, safety and welfare of people at work and to protect others from risks to health and safety from work activity.
Kilowatt Hours (Kwh)	A unit of energy equal to the work done by the power of 1000 watts operating for one hour.
Land remediation	Work activity which reduces the degree of soil and water contamination at a site to a point whereby the site no longer presents significant risks to human health, controlled waters and the wider environment.
Licence Condition (obligation)	An obligation placed on the network companies to meet certain standards of performance. The authority (see Ofgem) has the power to take appropriate enforcement action in the case of failure to meet these obligations.
Natural capital	The world's stocks of natural assets which include geology, soil, air, water and all living things. It is from this natural capital that humans derive a wide range of services, often called ecosystem services, which make human life possible.
Northern Gas Networks (NGN)	The gas transporter licence holder for the Northern gas distribution network.
Ofgem	The Office of Gas and Electric Markets, which supports the Gas and Electricity Markets Authority (GEMA), the body established by Section 1 of the Utilities Act 2000 to regulate the gas and electricity markets in Great Britain
Operating expenditure (opex)	The costs of the day to day operation of the network such as staff costs, repairs and maintenance expenditures, and overhead.
Price control	The control developed by the regulator (see Ofgem) to set targets and allowed revenues for network companies over a defined duration.
Price Control Deliverable	A specific investment for which funding has been provided to a network by Ofgem under a price control period (such as RIIO-2) and must be delivered or the funding returned to Ofgem. Examples could include purchase of a specified number of electric vehicles.
Reinforcement (gas)	The installation of new assets to accommodate changes in the level or pattern of gas supply and demand.
Replacement (gas)	The replacement or refurbishment of assets which are at the end of their useful life due to their age or condition, or need to be replaced on safety or environmental grounds. For gas distribution networks the primary component of replacement work is the HSE enforced iron gas mains replacement programme.
Replacement expenditure (Repex)	Expenditure related to the replacement or decommissioning of gas assets, in practice predominantly iron gas mains for gas distribution networks.
RIIO	Revenue = Incentives + Innovation + Outputs Ofgem's regulatory framework for gas and electricity networks.
Shrinkage	A term used to describe gas either consumed within or lost from a transporter's system. For gas distribution networks this comprises gas lost via leakage (c.95%), gas illegally taken by third parties (c.3-4%) and gas used in the operation of the network infrastructure, for example pre-heating prior to pressure reduction (c.1-2%).
Stakeholder	Those parties that are affected by, or represent those affected by, decisions made by network companies and Ofgem. As well as consumers, this would for example include Government and environmental groups.
Tank to wheel (TTW)	The greenhouse emissions arising from the use of a specified fuel from the point of purchase by the consumer.
Total expenditure (Totex)	All expenditure related to a licensee's regulated activities but with the exception of some specified expenditure items.
United Nations Sustainable Development Goals (UN SDGs)	17 goals which aim to end poverty and other deprivations, improve health and education, reduce inequality, and spur economic growth, all while tackling climate change and working to preserve our oceans and forests. https://sdgs.un.org/

Well to tank (WTT)	The greenhouse emissions arising from the extraction, production, refining and transportation (including any losses during transportation) of a specified fuel prior to the purchase and consumption by the consumer.
Well to wheel (WTW)	The sum total of well to tank and tank to wheel greenhouse gas emissions for a specified fuel thereby providing the whole life emissions for the use of this fuel.