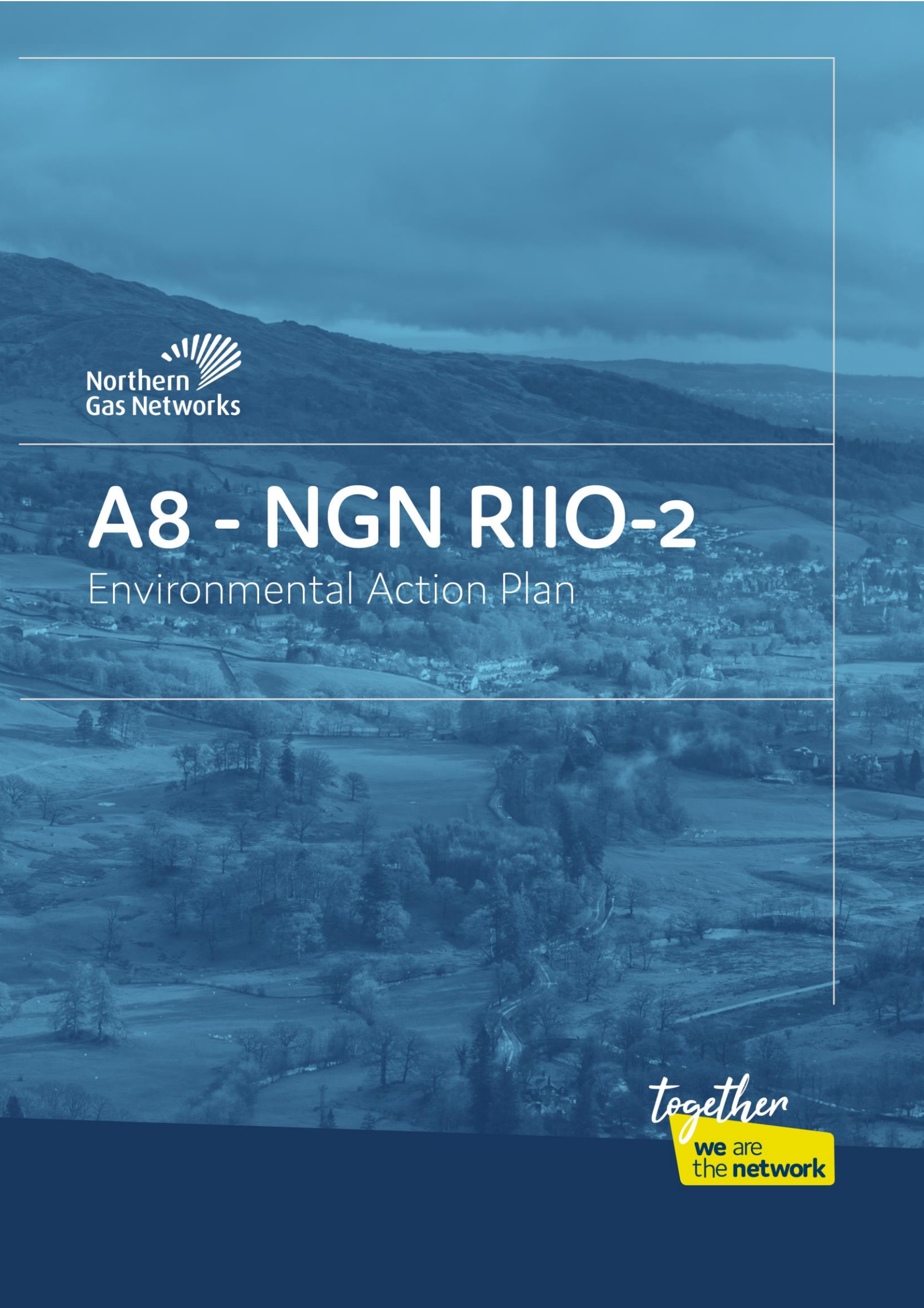


Northern Gas Networks

A8 - NGN RIIO-2

Environmental Action Plan

together we are the network

Environmental Action Plan

Foreword

This document outlines Northern Gas Networks' Environmental Action Plan (EAP) and addresses Ofgem's business plan guidance for us to develop a framework in which we focus on the following impact areas:

- decarbonising our energy network;
- reducing our other environmental impacts; and
- supporting the transition to an environmentally sustainable low-carbon energy system.

To this end, our EAP identifies initiatives that we can take now and in RIIO-2 to decarbonise our network to contribute to the achievement of our net zero greenhouse gas emissions target whilst also reducing the environmental impact of our operations.

We also note the interactions between this document, our Whole Systems Strategy, Innovation Strategy and Vulnerability Strategy:

- Whole Systems Strategy (Part 5.1 and Appendix A14 of our RIIO-2 business plan document) – this sets out our ambition to achieve the integration of whole systems thinking throughout the UK's energy sector and outlines key initiatives we'll look to deliver to support the energy transition through to achievement of our net zero emission targets by 2050.
- Innovation Strategy (Part 5.4 and Appendix A18 of our RIIO-2 business plan document) – this sets out our approach to delivering innovation in RIIO-2 (particularly in relation to enabling the achievement of our net zero emission targets and supporting customers in vulnerable situations), with a focus on the benefits provided to consumers.
- Vulnerability Strategy (Part 4.2 and Appendix A7 of our RIIO-2 business plan document) – this document sets out our approach to working with customers in vulnerable situations in RIIO-2 and includes consideration for ensuring a whole systems focus in our approach.

These four documents are complementary and together, set out our contribution to net zero.

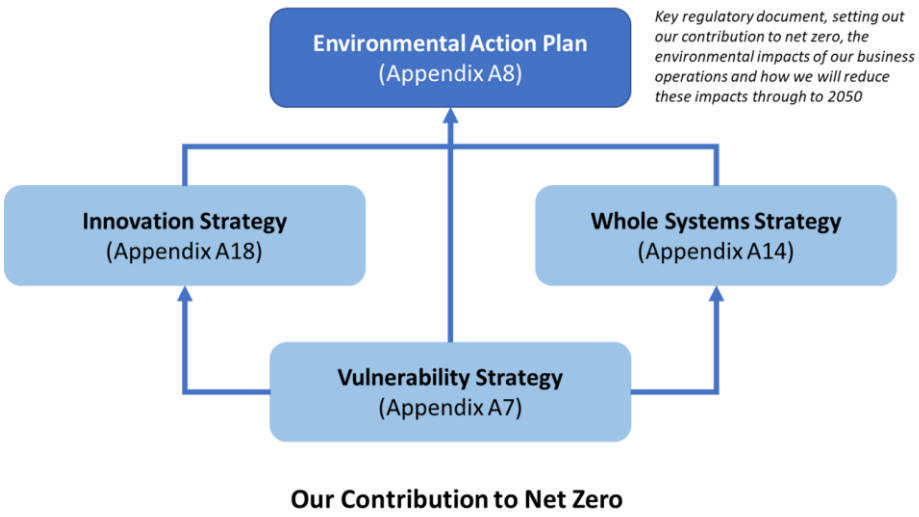


Figure 1 – Our contribution to net zero.

Document Structure

This document is structured as follows:

- **Chapter 1 "Executive Summary"**
- **Chapter 2 "Our contribution to a net zero future"**
- **Chapter 3 "Assessing our environmental impact"**
- **Chapter 4 "Progress during RIIO-1"**
- **Chapter 5 "Our Environment Strategy to 2050"**
- **Chapter 6 "Our Environmental Action Plan"** – this chapter sets out the key initiatives that we are looking to deliver in RIIO-2, on our pathway to reaching net zero by 2050.
    - Part 6.1 "Development of our Environmental Action Plan"
    - Part 6.2 "Protecting the environment"
    - Part 6.3 "Decarbonising our business"
    - Part 6.3 "Supporting a net zero carbon future"
- **Chapter 7 "Stakeholder views of our EAP"**
- **Chapter 8 "Summary"**
- **Annex A "RIIO-2 Business Carbon Footprint Targets"**

1 Executive Summary

We commit to decarbonising our network and supporting the transition to a sustainable low-carbon energy system to support the achievement of net zero greenhouse gas emissions in the UK as a whole by 2050 (or earlier in some of our specific network regions), in addition to significantly reducing the other environmental impacts of our business operations.

Our stakeholders have told us they expect us to be an environmental leader in society to drive the achievement of the UK's decarbonisation targets. They expect us to reduce all aspects of our carbon emissions in addition to our impacts on communities via our roadworks, landholding and our contribution to air pollution.

Our Environment Strategy, developed in conjunction with our stakeholders and launched in 2018, extends to 2050 and aims to reduce the environmental impact of our business activities across five key areas, in particular supporting the achievement of net zero emissions. During RIIO-2 we will work to deliver the objectives of our strategy via our Environmental Action Plan (EAP), with a key focus on initiatives to protect the environment, decarbonise our business and supporting a net zero carbon future. Our EAP is fully integrated with our Whole Systems, Innovation and Vulnerability Strategies to demonstrate the role we will play in the decarbonisation of the UK energy system to enable the achievement of net zero to the benefit of all customers and stakeholders. Our role in supporting the achievement of net zero is presented in this document and in Part 4.4.2 and Appendix A14 of our RIIO-2 business plan document.

As shown in Figure 2, our EAP contains a suite of initiatives to be accomplished during RIIO-2 to reduce the environmental impact of our business operations, including ambitious targets to reduce our non-shrinkage Scope 1 and 2 business carbon emissions to net zero by 2030/31.

Our EAP initiatives have received high levels of approval from our customers and stakeholders (>=70%) and as summarised in Figure 2 are estimated to deliver approximately 353,600 tonnes of carbon savings during RIIO-2 to support the journey to net zero from investment of approximately £610m. In addition, our EAP initiatives will also reduce the wider environmental impacts of our business operations during RIIO-2, including avoiding over 640,000 tonnes of natural resource use, diverting over 930,000 tonnes of waste from landfill, embedding sustainable procurement practices and self-funding the planting of 40,000 trees which will ultimately deliver £21m in societal benefits.

We will report our performance against each of our EAP commitments, in addition to our relevant whole systems and innovation activities, in our Annual Environmental Report (AER). The content and layout of the AER will be influenced by the needs and views of our stakeholders, including revising our EAP targets where necessary to drive continuous improvement.

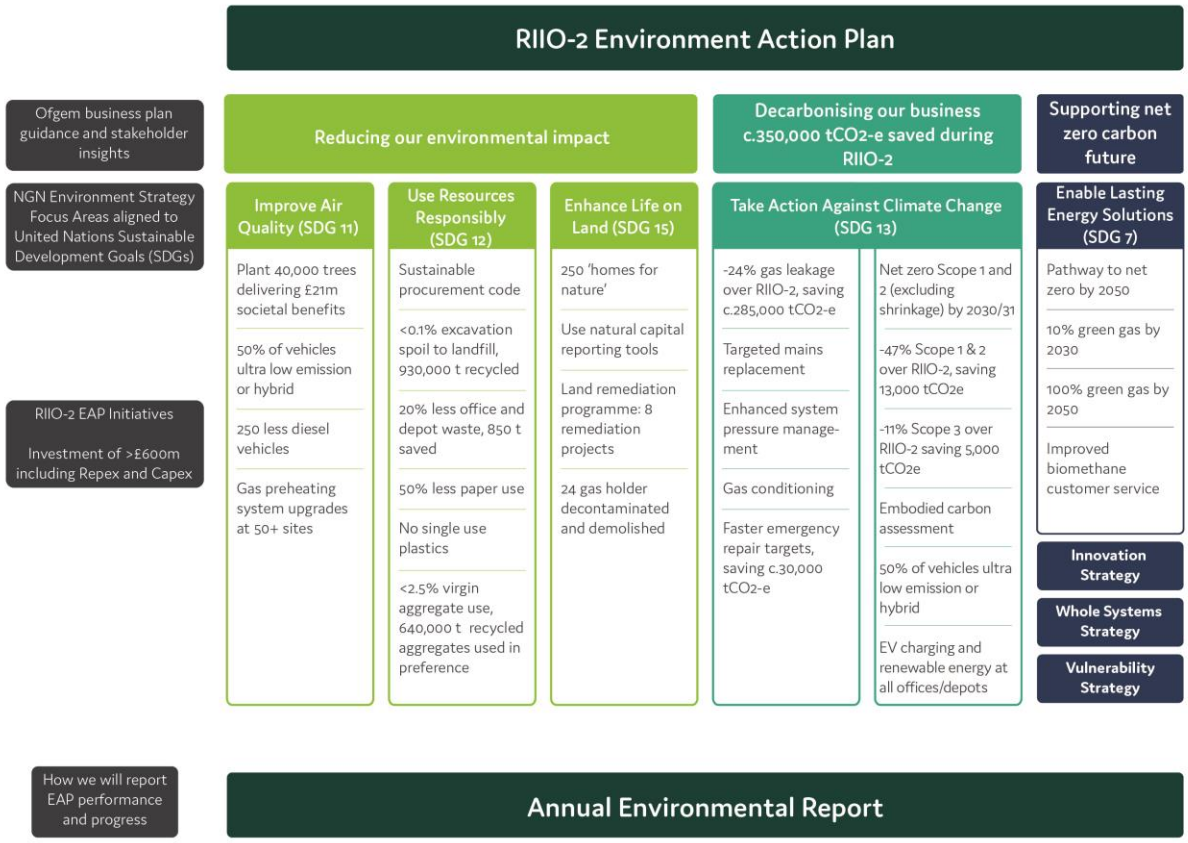


Figure 2 – Summary of our RIIO-2 Environmental Action Plan.

2 Our contribution to a net zero future

Based on recent work undertaken collaboratively with other gas distribution networks (GDNs)[1], we have developed our own pathway of how our network will be used in 2050.

This pathway has several key components, as follows:

- *Improved efficiency and reduced gas demand* – energy delivered through our network will reduce by 46% (although our network will still be relied upon to deliver peak heating demand in winter), largely driven by increasing energy efficiency of homes, the uptake of alternative technologies such as heat pumps and identification of areas of our network that are better suited to full electrification.
- *Biomethane* – biomethane will either solely supply segmented areas of our network (accounting for up to approximately 45% of total gas flows to customers) or be displaced by hydrogen and instead used for other applications such as transport.
- *Hydrogen* – most (if not all) of our network will be converted over to hydrogen and it will be predominantly supplied by blue hydrogen (coupled with carbon capture and storage (CCS)), with further transition to green hydrogen required beyond 2050.

[1] For further information, please see the "Pathways to Net Zero: Decarbonising the Gas Networks in Great Britain" report available online here: http://www.energynetworks.org/gas/futures/gas-decarbonisation-pathways/pathways-to-net-zero-report.html

- *Net zero emissions* – by 2050, our network supplies net zero emissions gas to customers, as CCS technologies have either improved to ensure 100% carbon capture or ongoing emissions will be offset by "negative emissions" derived from biomethane or biomass. Green hydrogen production will be supported by renewable electricity sources.

Importantly, this view of 2050 will only be achievable through strong collaboration with other sectors. A key example of this is in relation to close collaboration with the building sector to improve insulation levels of the building stock, resulting in lower utility bills and increased consumer comfort.

This view is depicted in Figure 3 below with full details provided in Section 4.4.2 and Appendix A14 of our RIIO-2 business plan document. Our EAP sets out a range of key initiatives that we will look to deliver in RIIO-2 (and beyond) in order to support achievement of this pathway, but also to ensure that NGN achieves net zero business carbon emissions by 2030/31 (Scope 1 and 2 excluding shrinkage, see Part 6.3 below for further details).

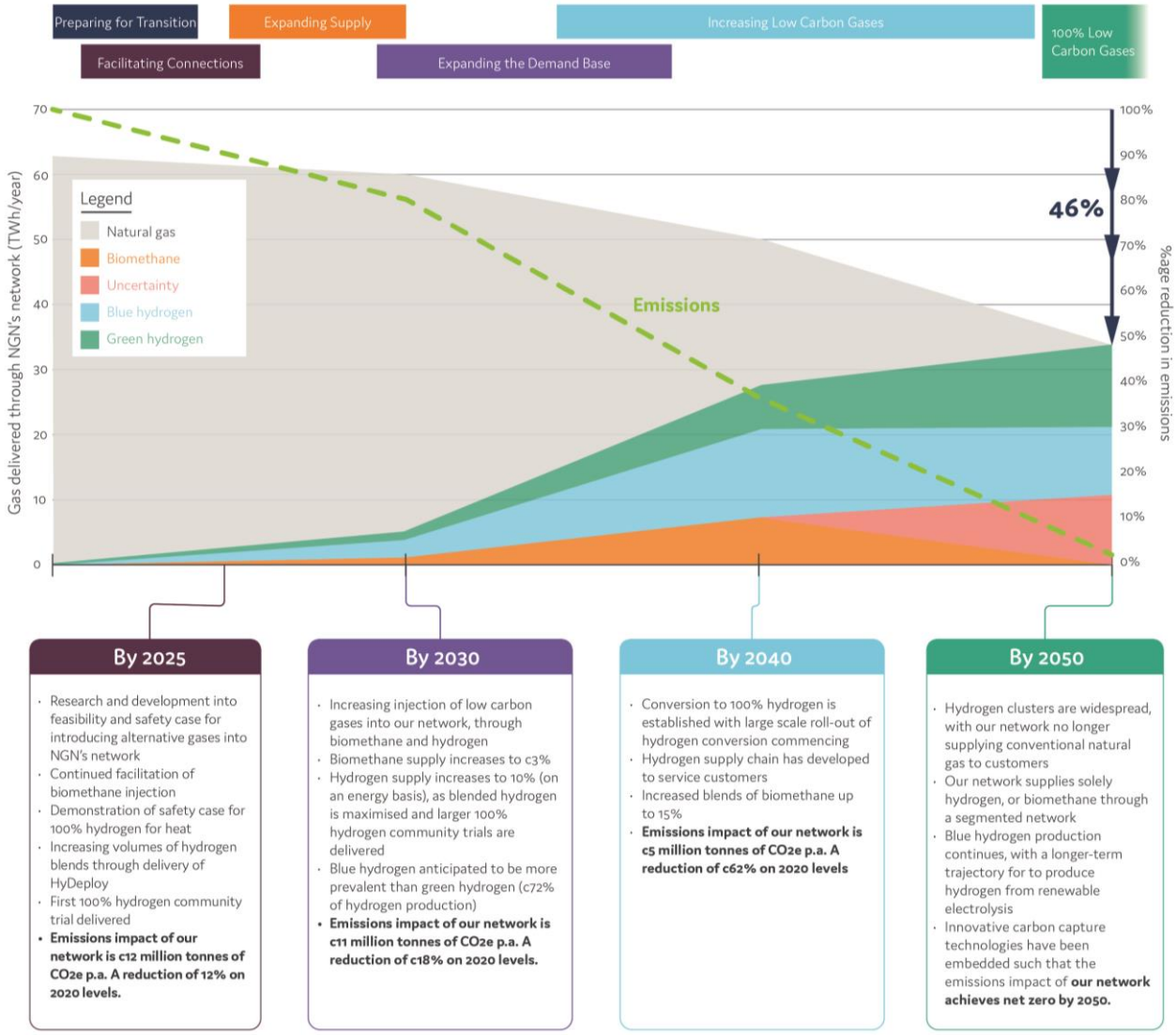


Figure 3 – Our pathway to net zero in 2050

3 Assessing Our Environmental Impact

Since achieving ISO14001 accreditation for our environmental management system (EMS) in 2000, we have continually analysed and monitored our business and our environmental performance to understand, mitigate and reduce the adverse impacts of our business. This process starts with understanding the context of our business as a regional gas distribution network 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	37,000 km of pipe	>99% of uncontrolled gas escapes attended within 1 hour	c.0.5% of gas throughout lost as shrinkage per year
Varied network area – cities, towns and National Parks.	700 company vehicles – 120 cars and 580 vans and HGVs	>500km of iron mains replaced by per year	10 biomethane connections enabled supplying green gas
1400 employees across 16 offices and depots	No gas holders connected to network, 19 demolished	£200m of goods and services purchased per year; £600,000 annual saving due to innovation	H21 - £10.3m of innovation funding awarded in 2017
c.13% of households in fuel poverty	148 asset sites built on known former gasworks sites	>12,000 fuel poor gas connections provided in GD-1	>200,000t of excavation spoil generated per year, >99% recycled
* Based on figures to end 2018/19.			

Table 1- Summary of key environmental features of NGN business.

3.1 Our significant environmental impacts

In accordance with our EMS, 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.

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.

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

As a gas distribution network, it is important to understand our greenhouse gas emissions. NGN's direct carbon emissions are approximately 420,000 tCO_2-e per annum, however our total carbon emissions, including upstream and downstream emissions, are many times greater (c.15m tCO2-e). The UK has committed to achieving net zero greenhouse gas emissions by 2050, with many of local authorities in our region targeting net zero emissions much earlier (for example Leeds City Region by 2038[2]), and we recognise that we have an important role to play in enabling these targets to be achieved. A summary of our estimated total carbon emissions for 2018/19 is provided in Table 3.

[2] https://www.westyorks-ca.gov.uk/all-news-and-blogs/politicians-businesses-and-young-people-join-forces-as-leeds-city-region-climate-coalition/ (accessed 31 October 2019).

Upstream Carbon Emissions	Direct NGN Carbon Emissions*	Downstream Carbon Emissions
• Natural gas production and transmission: 1.3m tCO2-e • Supply chain emissions: approximately 27,000 tCO2-e (estimate – typically 4 x direct operational NGN emissions[3])	• Gas leakage: 391,000 tCO2-e (94%) • Vehicle use by NGN and key contractors: 12,500 tCO-2e (3%) • PE pipe: 7,000 tCO2-e (1.5%) • Own gas use and theft: 3,950 tCO2-e (1%) • Energy use in depots/offices/sites: 1,900 tCO2-e (0.5%)	• NGN waste and asset disposal: approximately 250 tCO2-e** • Customer energy use: approximately 12.5m tCO2-e***
Total: c.1.4m tCO2-e	**Total: 417,000 tCO2-e**	**Total: c.12.5m tCO2-e**
* Based on 2018/19 NGN RIIO GD-1 Year 6 Report. ** Estimate excludes capital projects *** Gas shrinkage is approximately 0.5% of gas throughput. Estimate assumes 99.5% of gas throughout consumed by customers as per DEFRA conversion factor of kwh of natural gas consumed to CO2-e. Carbon emissions in tonnes of carbon dioxide equivalent (tCO2-e)		

Table 3 – Summary of NGN's annual direct and indirect carbon emissions based on 2018/19.

4 Our Progress During RIIO-1

During RIIO-1 we have reported a suite of outputs which focus on reducing key environmental impacts of our business operations, as guided by our environmental management system. We have consistently achieved or outperformed against our RIIO-1 targets, achieving all environmental targets during 2017/18 and 2018/19. As demonstrated in Table 4, we have significantly reduced our environmental impact over this period, achieving substantial reductions in gas shrinkage, excavation spoil disposed to landfill and virgin aggregate use in reinstatement. In addition, during this period our EMS was independently certified to the latest ISO14001:2015 standard and has undergone annual external certification throughout, without any major non-conformities being identified.

RIIO-GD1 Output	Environmental Objective	Yr1 Performance: 2013-14	Yr6 Performance: 2018-19	Improvement Over RIIO-GD1 Yr1 to Yr6
Gas Shrinkage (actual)*	Reduce greenhouse gas emissions RIIO-1 target: 94 Gwh (21%) leakage reduction over RIIO-1	417 GWh	341 GWh	18% reduction
Gas Leakage (actual)*		395 GWh	319 GWh	19% reduction >400,000 tCO2-e avoided during RIIO-1 vs 2012/13 baseline.
Business Carbon Footprint (Scope 1 and 2** excluding Shrinkage)	RIIO-1 target: 0.5% reduction year-on-year	8,919	6,737	24% reduction c.4,700 tCO2-e avoided during RIIO-1 vs 2013/14 baseline
Business Carbon Footprint (Scope 1, 2 and 3** excluding Shrinkage)		21,739	21,832	Negligible change
Excavation spoil disposal to landfill	Reduce waste to landfill RIIO-1 target: <13,000 tonnes to landfill per year	61,555t (36.0%)	744t (0.4%)	99% reduction for similar excavation volume >1m t of spoil diverted from landfill during RIIO-1
Virgin aggregate used in reinstatement	Reduce natural resource consumption RIIO-1 target: <17,000 tonnes to landfill per year	37,862t (28.9%)	8,160t (6.1%)	78% reduction for similar volume of aggregate purchased

[3] https://unfccc.int/news/leading-companies-cut-supply-chain-emissions-save-money (accessed 26 July 2019).

RIIO-GD1 Output	Environmental Objective	Yr1 Performance: 2013-14	Yr6 Performance: 2018-19	Improvement Over RIIO-GD1 Yr1 to Yr6
				>650,000 t of recycled aggregate preferentially used during RIIO-1
Land Remediation	Reduce pollution to land and water	0 sites remediated to statutory compliant condition	12 sites remediated to statutory compliant condition (cumulative)	Pro-active management of c.150 site portfolio. 12 sites (3,700 m^2 of land) returned to a compliant condition. National awards won for use of sustainable land remediation techniques.
ISO14001 Major Non-conformities	High quality environmental management	0	0	No major non-conformities during annual external ISO14001 certification audit throughout RIIO-1.
Gas holder demolition	Reduce greenhouse gas emissions Reduce pollution to land and water RIIO-1 target: demolish 23 gas holders	1 holder decontaminated and demolished	19 holders decontaminated and demolished (cumulative)	All gas holders disconnected from network. 19 gas holders decontaminated and demolished.
Biomethane	Enable low carbon energy supply	0 scmh capacity connected	10,050 scmh capacity connected (cumulative)	10,050 scmh total injection capacity connected

* Shrinkage comprises gas leakage (c.95%), gas theft (c.3%) and own gas use use (c.2%) and is estimated using the Shrinkage and Leakage Model that is common to all GDNs, customised using network specific characteristics.

** Scope 1: direct emissions caused by non-electricity energy consumption and transport, Scope 2: direct emissions caused by electricity consumption, Scope 3: specific indirect emissions caused by plastic gas pipe production and transport, key contractor vehicles, public transport usage including air travel, and transmission and distribution losses associated with electricity consumed.

Scmh = standard cubic metres of gas per hour.

Table 4 – Summary of NGN Environmental Output Performance over RIIO-1 to 2018/19.

4.1 Use of innovation

Our environmental performance improvements during RIIO-1 have been enabled by our deployment of a range of innovation techniques which help to reduce the direct environmental impacts of our network operations on customers and the wider environment. An example of this, as detailed in Part 5.4 of our Business Plan, is our utilisation of the total stub end abandonment technique which removes the requirement for large excavations in major highways, thereby reducing traffic congestion and the associated local air quality impacts to customers, reducing waste generation and minimising the carbon emissions associated with excavation and disposal of spoil. Furthermore, throughout RIIO-1 we have actively championed the facilitation of a low carbon energy supply through our pioneering HyDeploy and H21 projects, which evidence a pathway to decarbonise the provision of heat in the UK.

Our innovative and sustainable approach to delivering business as usual projects has been recognised as class leading in RIIO-1, demonstrating our commitment to seeking cleaner and greener approaches to delivering our objectives. A key example of this is the multi award winning Redheugh Gas Station land remediation project, undertaken as part of our Environmental Land Remediation Strategy, that

was the recipient of three separate awards for the innovative and sustainable approach that was taken. In addition, we have received multiple Considerate Constructors Scheme awards for the way in which we have delivered major projects with due regard to environmental protection, safety and stakeholders, in particular our gas holder demolition programme.

Case Study – Sustainable Land Remediation, Redheugh Gas Holder Station

We installed an innovative solar powered in-situ remediation system to recover historical hazardous coal tar from 9m below the ground surface at our former gas holder station. During 2017/18 and 2018/19 (in total) the remediation system recovered over 6,000 litres of toxic coal tar and over 17,000 litres of contaminated water for safe disposal, using only renewable solar energy. This approach saved approximately 66t of CO2-e and £28,000 compared to the use of traditional generators, whilst also having no significant environmental impact on site activities or neighbours. The project won the 'Best in situ treatment' category at the 2018 Brownfield Briefing Awards and the 'Sustainability Award' at the 2019 Ground Engineering Awards, with the judges commenting that it was "a good example of permanent, sustainable environmental betterment".

Custom solar powered land remediation equipment used at Redheugh Holder Station

Over 6,000 litres of historic hazardous coal tar removed from 9m deep using only 100% renewable energy

GROUND ENGINEERING AWARDS 2019 WINNER Sustainability Award

bb AWARDS 2018 WINNER

Sustainability Award of the Year Winner; CIWEM Tyne & Humber Branch Annual Awards 2018

4.2 Making the case for hydrogen

Displacement of natural gas for hydrogen offers the potential to significantly decarbonise the UK's energy system, thereby eliminating the carbon emissions associated with our network as shown in Figure 3 and Table 3. Backed by Ofgem's Network Innovation Competition funding, H21 set out to explore the potential of converting the existing gas networks to 100% hydrogen. The project began as a desktop exercise, and over the past three years has progressed to a number of follow-on projects, including real-world trials. The range of partners has expanded to include utilities across the UK, academia and private enterprise, and the programme has attracted international attention.

Over the next five years, in collaboration with our partners we will be carrying out hydrogen safety trials on the gas network; exploring how a mix of hydrogen and natural gas performs with existing cookers and boilers; researching customers' current perceptions of hydrogen, and carrying out detailed hydrogen modelling in other parts of the UK. All of this evidence will assist the government

in making a policy decision on hydrogen by 2025. Further details are provided in our Whole Systems Strategy, see Part 6.4.2 of this document and Appendix A14 of our RIIO-2 business plan document.

4.3 Developing integrated energy solutions

Along with our stakeholders, we consider that a low-carbon future does not rely on a binary choice between gas or electricity. Rather, it requires integrating different types of energy and technologies, to create the smart networks of the future. To support this integration, we launched the concept of InTEGReL which is an incubator for integrated energy system technology, allowing utilities and businesses to test their ideas in real-world conditions, and on a big scale. InTEGReL is based at a 15-acre site just outside Newcastle. The project is led by NGN, working alongside Northern Powergrid and Newcastle University and in partnership with the EPSRC National Centre for Energy Systems Integration (CESI). Further details are provided in our Whole Systems Strategy, see Part 6.4.2 of this document and Appendix A14 of our RIIO-2 business plan document.

4.4 Thought leadership

Our work in the field of hydrogen and other forms of sustainable energy has established NGN as an expert with an international reputation. We have used this knowledge to support regional businesses with their own green ambitions, and to lead the national conversation. Notable achievements include helping to set up a “hydrogen corridor” for the North of England; informing the North East’s “energy for growth” economic strategy; and leading the formation of a national Hydrogen Transformation Group, to allow the industry to speak with one voice. Further details are provided in our Whole Systems Strategy, see Part 6.4.2 of this document and Appendix A14 of our RIIO-2 business plan document.

5 Our Environment Strategy to 2050

During spring 2017 we commenced development of a long-term environment strategy to drive NGN to deliver a decarbonised energy network with reduced operational environmental impact that would enable the transition to a sustainable low-carbon energy system. We engaged with over 500 stakeholders to identify their environmental priorities, in addition to reviewing our environmental aspects and impacts to ensure that our most significant current, and potential future, impacts were understood.

By mapping our stakeholder’s environmental priorities against our understanding of our current and future significant environmental impacts, we identified five strategy focus areas on which to base our Environment Strategy, as show in Figure 4. For each focus area we developed a long term objective to be achieved by 2050, as detailed in Table 5, underpinned by short (to 2021) and medium (to 2026) term goals and action plans to help us deliver incremental improvement in the pursuit of our vision.

During May 2018 with the support of TBL Consultants we were the first UK GDN to map our entire business against the United Nations Sustainable Development Goals (UN SDGs) to identify the goals that we could most strongly influence the delivery of. Following this we aligned each of the five focus areas of our Environment Strategy to the relevant UN SDG, as shown in Table 5, as a conscious demonstration of our support for their achievement. In addition, in July 2018 we shared our understanding by introducing the other GDNs to the objectives of the UN SDGs via the ENA Gas Environment Group.

Our Environment Strategy was launched by our CEO on Clean Air Day on 18 June 2018 and since this time we have undertaken a process of communicating it to our colleagues and supply chain. A timeline detailing the development of our Environment Strategy is shown in Figure 5.

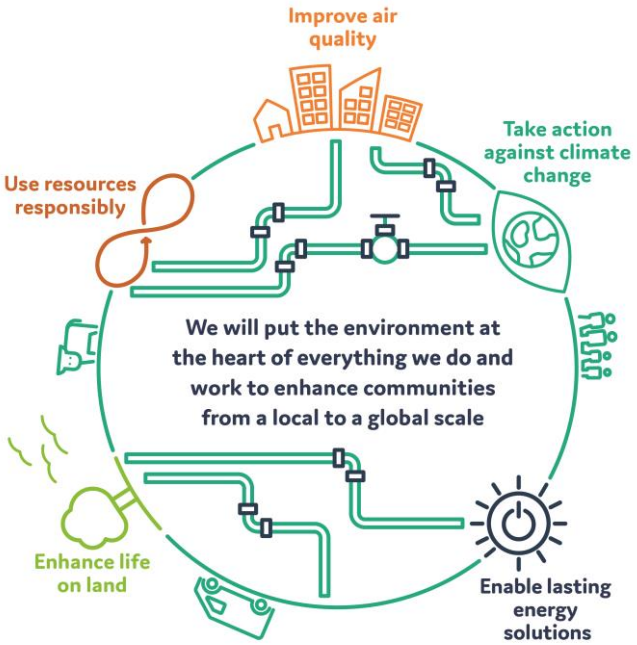


Figure 4 – Summary of our Environment Strategy

Environment Strategy Focus Area	Long Term Objective for 2050	Equivalent UN Sustainable Development Goal
Take Action Against Climate Change	Help the UK to achieve net zero greenhouse gas emissions by 2050 and ensure our assets are resilient to the environmental challenges of the future.	
Improve Air Quality	Reduce our impact on air quality in the communities where we live and work.	
Use Resources Responsibly	Develop a sustainable approach to procurement and resource consumption to reduce the environmental impact of what we buy, how we use it and how we dispose of it.	
Enhance Life on Land	We will have an enhancing impact on the landscapes and communities we work in.	
Enable Lasting Energy Solutions	Enable affordable, sustainable decarbonised heat, power and transport solutions with a whole systems approach to support the achievement of net zero greenhouse gas emissions by 2050.	

Table 5 – Our Environment Strategy focus areas, long term objectives and alignment to UN Sustainable Development Goals

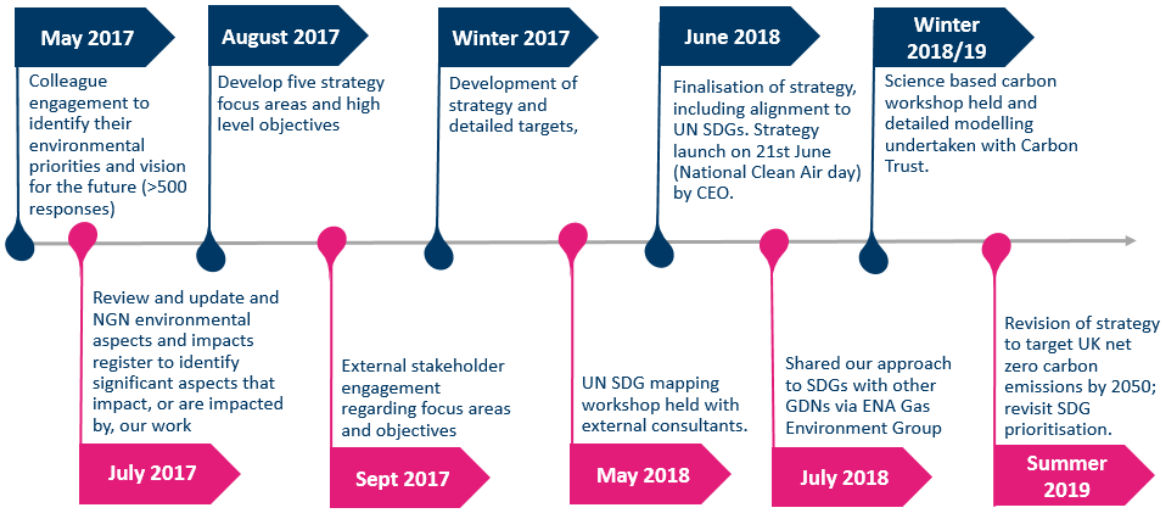


Figure 5 – Summary timeline of the development of our Environment Strategy

6 Our RIIO-2 Environmental Action Plan

Our Environment Strategy extends to 2050 and aims to reduce the environmental impact of our business activities across the five key focus areas identified in Figure 4 and Table 5, in particular supporting the achievement of net zero emissions in the UK by 2050. During RIIO-2 we will work to deliver the objectives of our strategy via our Environmental Action Plan (EAP), focussing on protecting the environment, decarbonising our business and supporting a move to net zero emissions. Our EAP includes specific initiatives to reduce our carbon impact, improve air quality, use resources responsibly and enhance life on land, in addition to how we can enable a net zero future via our Whole System and Innovation Strategies.

Protecting the environment

We commit to protecting the environment and minimising the significant impacts of our business activities. Our Environment Strategy aims to minimise the environmental impact our day-to-day activities have on communities and the natural environment that we live and work in and it formed the basis of our proposed activities for RIIO-2 and the development of our EAP.

Decarbonising our business

As shown in Table 3, our business operations directly generate carbon emissions from our vehicles and facilities and also indirectly from the waste that we generate and the goods and services that we procure. Building on the views of our stakeholders, as part of our long-term Environment Strategy we have set ambitious decarbonisation targets for RIIO-2 in our EAP. Our RIIO-2 carbon targets go beyond our existing science-based targets for our own Scope 1 and 2 carbon emissions to deliver emissions savings now to support a net zero future. In addition, we have set targets to measure and reduce key Scope 3 (value chain) carbon emissions, and measure and report the embodied carbon of our key projects.

Supporting a move to a net zero future

As a gas distributor our biggest direct environmental impact is the escape of gas from our network to the atmosphere. This is a significant contributor to human induced climate change and an area we are committed to minimising. In RIIO-2 we have set stretching targets for the reduction of gas leakage and shrinkage from our network. However, our ambition is to go beyond this and explore alternative

forms of gas such as hydrogen through our innovation programme to deliver a net zero future. Our work in RIIO-2 will extend beyond the gas network as we look to work in collaboration with wider utilities and partners in the delivery of our Whole Systems Strategy. This will identify new and ambitious solutions to change the current siloed approaches of utilities and deliver improved outcomes for our current and future customers.

6.1 Development of our Environmental Action Plan

Addressing our significant environmental impacts

We have developed our RIIO-2 EAP to target the significant environmental impacts of our business operations, as identified in Table 2. Specific initiatives are included in our EAP to tackle individual environment impacts as detailed in Parts 6.2, 6.3 and 6.4 of this document. Where solutions to impacts were not readily developed or available, these areas have been prioritised for inclusion in our RIIO-2 Innovation Strategy and/or Whole Systems Strategy. For example, operational venting of gas is identified as one of our significant environmental impacts however we do not currently fully understand the scale of the issue or have suitable solutions available. As such, and as detailed in our Innovation Strategy in Part 5.4 of our RIIO-2 business plan document, we have prioritised this environmental impact for inclusion in our RIIO-2 Network Innovation Allowance portfolio.

In addition to tackling our current environmental impacts, we must consider how our environmental impacts may change in the future and what we may need to do to mitigate this. In RIIO-2 it is anticipated that our core business activities, and their associated environmental impacts, will remain similar to current, however certain aspects of our business could change and bring with them a change to our environmental impacts. It is anticipated there will be increasing expectations from our stakeholders that we will pro-actively reduce the environmental impact of our business operations, in addition to potential for legislative or government policy decisions to bring about changes which will require us to make greater strides to do so. We considered these potential outcomes during the development of our RIIO-2 EAP, as detailed in Table 6 below, and we consider that our EAP positions us to be able tackle the challenges of the future in a flexible and response manner.

Known / Potential Changes During RIIO-2	Potential NGN Environmental Impact								NGN Mitigation - Environment Strategy Action Area
	Depletion of resources	Air pollution	Greenhouse gas emissions (NGN direct)	Greenhouse gas emissions (non-NGN direct)	Nuisance (eg odour, noise)	Land and Water Pollution	Waste generation	Ecosystem/habitat damage	
Known Changes									
No gas connections for new properties after 2025 (Spring Statement 2019).	✓	✓	✓	✓	✓		✓		Enable lasting energy solutions
Greater requirement for utility companies to work together to deliver whole system energy solutions to enable net carbon zero emissions by 2050	✓	✓	✓	✓	✓	✓	✓	✓	Enable lasting energy solutions / Whole Systems Strategy

Known / Potential Changes During RIIO-2	Potential NGN Environmental Impact								NGN Mitigation - Environment Strategy Action Area
	Depletion of resources	Air pollution	Greenhouse gas emissions (NGN direct)	Greenhouse gas emissions (non-NGN direct)	Nuisance (eg odour, noise)	Land and Water Pollution	Waste generation	Ecosystem/habitat damage	
Potential Changes									
Increasing demand for green gas connections; strongly influenced by government subsidies for producers	✓	✓	✓	✓	✓		✓	✓	Enable lasting energy solutions / Whole Systems and Innovation Strategies
Approval for long term decarbonisation of the UK gas system, for example via hydrogen, requiring preparatory work	✓	✓	✓	✓	✓		✓	✓	Enable lasting energy solutions / Whole Systems and Innovation Strategies
Decarbonisation of UK electricity grid			✓	✓					Take Action Against Climate Change
Tougher air quality legislation, eg more mandatory Clean Air Zones		✓							Improve Air Quality
Earlier than anticipated ban of new petrol and diesel engine vehicles		✓	✓						Take Action Against Climate Change / Improve Air Quality
Single use plastics ban	✓			✓			✓		Use Resources Responsibly
Ban on landfill disposal of recyclable or reusable waste				✓			✓		Use Resources Responsibly
Ban on planned venting of natural gas to atmosphere			✓		✓				Take Action Against Climate Change

Known / Potential Changes During RIIO-2	Potential NGN Environmental Impact								NGN Mitigation - Environment Strategy Action Area
	Depletion of resources	Air pollution	Greenhouse gas emissions (NGN direct)	Greenhouse gas emissions (non-NGN direct)	Nuisance (eg odour, noise)	Land and Water Pollution	Waste generation	Ecosystem/habitat damage	
Requirement to achieve biodiversity net gain on capital projects								✓	Enhance Life on Land
Climate change - greater risks to gas network assets, eg from flood risk, river and coastal erosion and landslip, and requirement for mitigation works such as diversions/relocations.	✓	✓	✓	✓	✓		✓	✓	Take Action Against Climate Change
Innovation to improve gas network operational processes	✓	✓	✓	✓	✓	✓	✓	✓	All / NGN Innovation Strategy
Greater digitalisation	✓	✓	✓	✓	✓	✓	✓	✓	All
Green tick signifies potential reduced environmental impact compared to current (RIIO-1). Red tick signifies potential increased environmental impact compared to current (RIIO-1).									

Table 6 – Analysis of potential future environmental impacts during RIIO-2

Identifying opportunities and challenges

We have considered the strategic opportunities and challenges that we face in addressing our significant environmental impacts during RIIO-2, a summary of which is provided in Table 7 below. This overarching assessment was used to guide the identification and analysis of potential initiatives for inclusion in our EAP, further supplemented by detailed consideration of specific opportunities and challenges to addressing each of our significant environmental impacts. This process also allowed identification of where innovation is required as there is no currently available solution to tackle a specific environmental impact. For example, operational venting of gas is identified as one of our significant environmental impacts however we do not currently fully understand the scale of the issue or have suitable solutions available. As such, and as detailed above, we have prioritised reducing operational gas venting for inclusion in our RIIO-2 Innovation Strategy (see Part 5.4 in our RIIO-2 business plan document).

Reducing the environmental impact of our roadworks is a key area where innovation can often be effectively and efficiently employed to develop new techniques and methods to significantly reduce the environmental impact of our works. Examples of this developed during RIIO-1 include innovative low or no dig technologies such as core and vac, which enable us to complete our works much quicker via less intrusive methods with a lower overall environmental impact. This area is constantly evolving and we see it as an important for developing new methods to reduce our environmental impact during

RIIO-2 via our Totex allowance and other funding sources (see Part 5.4.8 in our RIIO-2 business plan document for further details).

Opportunities	Challenges
• Stakeholders regard NGN as a responsible '*anchor*' business in the community which should reduce it's '*local and global*' scale environmental impacts. Significant interest in the decarbonisation of NGN's vehicle fleet. • Net zero emissions legislation provides a driver to decarbonise our own operations and contribute to wider decarbonisation of the UK energy system. • New technology and innovations are available which can be utilised to deliver improvements. • Innovation funding is available for appropriate initiatives. • Exemplar environmental performance can deliver reputational benefits. • Other gas networks and utility companies are often keen to work collaboratively on new initiatives and share examples of good practice.	• Initiatives must represent value for money to customers. • Initiatives must be robust and scalable to delivery material changes. • Initiatives must not risk achievement of our licence obligations or negatively impact on our customer performance. • Initiatives must consider whole life environmental costs. • Uncertainty regarding the future role of gas in the UK energy supply. NGN do not control the type of gas used in our network. • Significant environmental improvements have been delivered during RIIO-1 so further improvements may be more difficult in terms of cost and practicabilities.

Table 7 - Opportunities and challenges to achieving environmental strategy objectives

Initiatives options analysis methodology

Our EMS requires us to continually improve our environmental performance. This coupled with our RIIO-1 commitments has seen us introduce many initiatives since 2013 to reduce our most significant environmental impacts, for example inclusion of energy efficient lighting and heating in our office and depot refurbishments to reduce our carbon emissions. This experience and baseload of improvements already completed was referenced when considering potential RIIO-2 EAP initiatives.

Potential EAP initiatives were subjected to a rigorous cost-benefit analysis procedure to ensure value for money impact reduction initiatives were identified. During RIIO-1 we have embedded a sophisticated value framework within our investment cost benefit analysis process. Our value framework is a multi-criteria decision support tool that provides monetised unit rates for various outcomes, including customer, safety and significant environmental impacts. This enables the monetary costs of all of these potential outcomes to be taken into full consideration, alongside and with equal weighting to financial project costs, in investment decision making over a 45 year duration. Our value framework was developed in accordance with industry best practice and incorporates stakeholder priorities. It includes a comprehensive range of potential environmental impacts reflective of the significant impacts of business operations, including monetised values for emissions of carbon and air pollutants, and pollution incidents enabling them to be included in investment options analysis and decision making.

Our value framework process has been applied to robustly identify and assess potential RIIO-2 investment initiatives which reduce our significant environmental impacts whilst also being value for money in accordance with our investment procedures. Indeed, many of the investments proposed in our business plan have been identified as value for money based on the monetised carbon benefits of avoiding gas loss. Further details of our investment cost benefit analysis process are provided in Part 6 of our RIIO-2 business plan document.

As detailed in Parts 6.2, 6.3 and 6.4, many of the initiatives included in our EAP will be undertaken at no additional direct cost to the customer. These are typically well understood environmental impacts of low complexity, for example purchasing only renewable electricity. Such initiatives were not subject to a financial options analysis as detailed above as they required no direct investment of customer money but were subject to individual technical assessment options appraisal. The purpose of the

technical options appraisal was to identify ambitious yet practicable options to reduce an individual environmental impact which could be adopted without compromising our customer performance and safety standards, in addition to identifying potential constraints. Further details of individual initiative option and constraint analyses are provided in Parts 6.2, 6.3 and 6.4 below.

Consideration of environmental impacts in RIIO-2 planning and decision making

Our Environment Strategy was developed during 2017-18 enabling its objectives and targets to be fully embedded and integrated throughout our RIIO-2 business planning process. This enabled the opportunities and challenges to delivering our strategy to be recognised (as detailed in Table 7), synergies with other key NGN strategies to be identified (such as Innovation and Whole Systems Strategies), and potential initiatives considered and placed in our business plan where they will be most effective. Our approach allowed identification and robust assessment of initiatives which directly target our Environment Strategy action areas for inclusion in our EAP. In addition, our approach also enables the identification of business initiatives where environmental improvement is not the primary objective but which deliver additional benefits that support the achievement of our Environment Strategy action areas. As detailed above, our RIIO-2 investment decision making is guided by our value framework which enables environmental outcomes to be taken into full consideration, alongside and with equal weighting to financial project costs.

Of particular note, our EAP is fully integrated with our Whole Systems and Innovation Strategies, as detailed in Part 5 of our RIIO 2 business plan, to ensure that we are utilising new technology, methods and thinking to drive continuous improvement in our aim to reduce our environmental impact and support a net zero future.

Meeting the needs of our stakeholders

We have built on the engagement undertaken to support the development of our Environment Strategy, to ensure that our EAP meets the needs and expectations of our stakeholders. As detailed in Part 3 of our RIIO-2 business plan document, we have engaged with stakeholders extensively in the development of our environment commitments for RIIO-2 and gained clear insight into what their priorities are. Key insights gained from our engagement that have shaped our EAP commitment are summarised in Table 8.

Environmental Stakeholder Engagement Findings	NGN Response
Stakeholders want us to be an environmental leader by driving behavioural change, adopting stretch targets over a longer period into the future (Customer Insight 43).	Long term objectives (to 2050) established in Environment Strategy and reflected in EAP, supporting achievement of net zero emissions in UK by 2050. Industry leading science-based carbon reduction targets set and then further refined to deliver net zero Scope 1 and 2 emissions (excluding shrinkage) by 2030/31. EAP coordinated with NGN Whole Systems and Innovation Strategies.
It is imperative that we act against climate change, by reducing both shrinkage and non-shrinkage emissions to reduce carbon emissions (Customer Insight 43)	Taking action against climate change is a focus area in our Environment Strategy. EAP includes initiatives to reduce shrinkage and non-shrinkage carbon emissions. Industry leading carbon reduction targets set.
Customers want us to use our resources responsibly, and work considerately by leaving the local environment clean and tidy (Customer Insight 44).	Using resources responsibly is a focus area in our Environment Strategy. EAP includes initiatives to reduce resource use and waste, promote sustainable supply chains and create positive impacts on biodiversity.
Air pollution is a key issue. Stakeholders expect us to be proactive in this area for both moral and reputational reasons as an anchor institution (Customer Insight 45).	Improving air quality is a focus area in our Environment Strategy. EAP includes initiatives to reduce our air quality impact.
There is significant appetite for us to reduce our vehicle carbon footprint, and go above and beyond by phasing out diesel vehicles sooner (Customer Insight 46).	EAP includes initiatives to reduce the environmental impact of our vehicle fleet. RIIO-2 vehicle replacement plans enhanced following stakeholder feedback (see case study below).
Customers and stakeholders want us to plan works to minimise the impact on traffic and reduce congestion caused by approximately	EAP includes initiatives to reduce our air quality impact. Innovation Strategy targets improvements in our operational

Environmental Stakeholder Engagement Findings	NGN Response
180,000 excavations we undertake each year (Customer Insight 48).	procedures to reduce their impacts on customers and the environment. Whole Systems Strategy targets working closer with anchor institutions and local councils to improve planning and the impact of road works.
We have a responsibility to remediate our land where it is impacted by gas industry pollution. When gas land is remediated, customers and stakeholders expect us to actively improve habitats for wildlife at NGN's permanent sites (Customer Insight 49).	EAP includes continuation of land remediation management programme commenced in RIIO-1. We have also committed to improving biodiversity and introducing valuation techniques, so we can measure the value delivered.
Future customers welcome the Environmental Action Plan as a starting point that demonstrates what can and should be done with other organisations in the region (Customer Insight 50).	Our EAP is a key element of our Whole Systems Strategy. Through the EAP we commit to reporting against this framework and disseminating the improvement and benefits that we realise to other organisations.
Biomethane production is still an emerging sector and discussions on how NGN can best collaborate with stakeholders should be ongoing as it develops (Customer Insight 59).	EAP commits to ongoing engagement with Biomethane stakeholders including targeted annual workshops.

Table 8 – RIIO-2 stakeholder environmental priorities and our response.

Our engagement has confirmed the importance of the existing five focus areas of our Environment Strategy to our stakeholders and enabled us to develop our EAP and its suite of initiatives with confidence that we are meeting their expectations. We considered this feedback when developing our EAP initiatives detailed below.

The feedback has also reaffirmed our own view that we should deliver reductions to both our shrinkage (c.95% of total) and non-shrinkage (c.5% of total) carbon emissions, in addition to other air pollutants. It also strongly identified that our initial proposals for decarbonising our vehicle fleet did not go far enough to meet the expectations of our stakeholders. As a result, and as detailed below, we have substantially revised our RIIO-2 vehicle fleet decarbonisation commitments within our EAP. Further details of our RIIO-2 vehicle decarbonisation proposals are provided in Part 6.2.1 below.

Case Study - Responding to stakeholder feedback on vehicle investments

"I would like to see a clear plan to deliver a proportion of the fleet which have zero emissions"

Customer Insight 46: There is significant appetite for us to reduce our vehicle carbon footprint, and go above and beyond by phasing out diesel vehicles sooner.

Stakeholders clearly told us that our original EAP commitment to ensure 100% of our diesel commercial vehicle fleet are Euro VI engine (the cleanest currently available and Clean Air Zone compliant) by end RIIO-2 did not go far enough to deliver decarbonisation or air quality improvements. They also told us that we shouldn't just focus on our commercial vehicle fleet, as we can also deliver improvements by changing our company car fleet to cleaner alternatives. Building on this commitment, we now commit to approximately 50% of our total vehicle fleet being ultra low emission or hybrid by the end of RIIO-2, thereby removing approximately 250 diesel vehicles from our fleet. In addition, we propose to extend these commitments to colleagues undertaking business mileage in privately owned cars. Full details of our vehicle fleet improvements are provided in Part 6.2.1 below.

Our revised fleet strategy represents a significant step forward and is in direct response to customer feedback. We have set challenging targets in RIIO-2 to improve carbon emissions from our vehicle fleet without compromising our safety or customer service objectives.

Monitoring and Reporting Progress - Annual Environmental Report

We will report our progress in delivering against our EAP through the publication of an Annual Environment Report (AER) throughout RIIO-2 which will outline our performance against each of the

initiatives, metrics and targets that we propose in the EAP, including revising our EAP targets where necessary to drive continuous improvement. Our AER will present historic and current performance analysis, including year to year and over the RIIO-2 period, and present information in absolute terms (such as tonnes of CO2-e) and via relevant intensity metrics (such as tonnes of CO2-e per full time employee).

We will work with our stakeholders to determine the contents and layout of our AER to ensure it meets their needs and any regulatory standards determined by Ofgem. Our engagement during RIIO-1 to date has identified that our stakeholders would value our AER containing historic and current performance data in addition to real life case studies of what has worked well and what has not. They value smaller amounts of well presented data over large amounts of difficult to access information, potentially displayed in an interactive format that would allow them to interrogate our environmental impact in their region. They are also interested to see where green gas is injected into our network and how much, the benefits we have delivered via innovation, and the engagement we have undertaken.

6.2 Protecting the environment

Our EAP commitments which aim to reduce the environmental impacts of our business operations, as guided by our Environment Strategy, is provided below, with a summary of the key costs and benefits delivered provided in Table 9. Our initiatives reduce several significant environmental impacts of our business operations, ensure our legal compliance, and also deliver approximately 9,200 tCO2-e of cumulative carbon savings over RIIO-2 from investment of approximately £52m.

EAP Initiative	Environment Strategy Focus Area	Environmental Benefit Delivered During RIIO-2	Estimated Cumulative Carbon Saving (tCO2-e) over RIIO-2 Compared to RIIO-1 Performance	Cost to Customer (£)*
Vehicle fleet improvements (25% of commercial vehicles ultra low emission or hybrid)	Improve Air Quality	Reduced air pollutant and carbon emissions 250 diesel vehicles removed from NGN fleet Electric vehicles charging infrastructure at all NGN offices/depots	2,440**	£19.5m
Vehicle fleet improvements (100% of car fleet ultra low emission or hybrid)			1,800**	No additional cost to customer
Tree planting in our region (40,000 trees)		>£21m of cumulative benefits over 50 years including reduced air pollution, carbon sequestration, biodiversity gain, flood alleviation and amenity gain	2,450^	No additional cost to customer *£0.4m cost funded by NGN shareholders*
Gas preheating system improvements (c.50 sites)		Reduced air pollution and carbon emissions	1,890	£16.5m
Virgin Aggregate Reduction	Use Resources Responsibly	c.640,000 t of recycled aggregate preferentially used <=2.5% virgin aggregate use by 2025/26	80	No additional cost to customer
Excavation spoil to landfill reduction		c.930,000 t of excavation spoil recycled <0.1% excavation spoil to landfill by 2025/26	10	No additional cost to customer
Office and depot waste reduction		850t waste reduction 4,800t waste diverted from landfill, 0% to landfill by 2025/26 Reduced plastic gas pipe waste	480	No additional cost to customer

EAP Initiative	Environment Strategy Focus Area	Environmental Benefit Delivered During RIIO-2	Estimated Cumulative Carbon Saving (tCO2-e) over RIIO-2 Compared to RIIO-1 Performance	Cost to Customer (£)*
Half paper use		30t of paper use avoided	30	No additional cost to customer
Eliminate single use plastics		Reduced carbon emissions, resource use and waste	Unknown	No additional cost to customer
Sustainable procurement procedures and supplier code		Sustainable procurement practices to reduce carbon and air pollutant emissions, waste, resource use and pollution	Unknown	No additional cost to customer
Homes for nature	Enhance Life on Land	250 positive interventions to enhance biodiversity	n/a	No additional cost to customer
Land remediation programme		Management programme including 8 remediation projects – reduced risk of pollution	n/a	£3.4m
Gas holder demolition programme		Decontaminate and demolish 24 gas holders – reduced risk of pollution	n/a	£16m
Total		**£21m cumulative benefits from tree planting scheme** **640,000t natural resource use avoided** **>930,000t waste diverted from landfill** **850t office/depot waste avoided** **250 positive biodiversity actions** **8 land remediation projects** **24 gas holder demolitions**	**9,170**	**£55.4m**

Notes:
Estimated carbon savings presented to nearest 10tCO2-e.
*** As per costs presented in RIIO-2 business plan data tables, excluding secondary asset costs.**
**** Includes tank to wheel carbon emissions for non-electric vehicles and well to wheel emissions for electric vehicles.**
^ Benefits over 50 years based on 10ha planted mixed broad leaf and coniferous woodland, with ultimate 10% aerial loss, and 272 tonnes CO2 per hectare of British woodland: Morison, J. et al (2012) "Understanding the Carbon and GHG balance of UK Forests", Forest Research (www.forestresearch.gov.uk/research/understanding-the-carbon-and-greenhouse-gas-balance-of-forests-in-britain/).

Table 9 – Summary of key benefits and costs of EAP initiatives to protect the environment

6.2.1 Initiatives to Improve Air Quality

Initiatives to *Improve Air Quality*	**50% of vehicle fleet ultra low emission or hybrid** **250 diesel vehicles removed from fleet** **30% reduction in vehicle carbon emissions**
Benefits Delivered in RIIO-2	**40,000 trees planted in urban areas in our network; £21m benefits** **Cleaner gas preheating systems at 50+ sites**

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[4]. Air pollution is important to our stakeholders, in particular in Leeds which is one of five cities in the UK with a mandatory requirement to significantly air improve air quality.

Vehicle Fleet Improvements

Our vehicle fleet is intrinsic to our ability to operate a safe and reliable network with excellent customer service. As of September 2019, we own and operate a commercial fleet of approximately 580 vehicles comprising:

- 325 x 3.5t diesel vans used by our engineering teams. These vehicles must be able to carry the tools and equipment that we require to complete our works in a safe, timely and professional manner. Many of these vehicles require on-board power generation capabilities to enable them to self-sufficiently operate power tools and equipment wherever they go without the requirement for additional generators.
- 230 x small diesel vans and car derived vans used predominantly by our emergency response engineers and operational support colleagues. These vehicles must be robust to enable us to respond to our gas emergency response time standards.
- 22 x petrol hybrid all wheel drive vehicles. These are provided to our maintenance teams to provide the resilience that they can access our gas infrastructure sites regardless of weather and ground conditions.
- 8 x diesel heavy goods vehicles. These are typically grab wagons and syphon water tanker vehicles.

In addition to our commercial vehicle fleet, our colleagues also undertake business related driving as follows:

- NGN operate a fleet of approximately 120 'company cars', 90% of which are currently diesel with average emissions of 111gCO2-e/km. These cars are leased by NGN on behalf of individuals who use the vehicles for business and private travel. Company cars are made available to individuals with high business mileage and senior staff and are typically leased for three years.
- Approximately 200 colleagues undertake business mileage in privately owned vehicles. This comprises approximately 150 colleagues who accept a financial contribution from NGN to provide their own vehicle as an alternative to taking a company provided car, and approximately 50 colleagues who undertake casual business travel in their own vehicle and are reimbursed on a mileage rate. These vehicles have average emissions of 127gCO2-e/km and approximately 60% of them are diesel.

As detailed above, our stakeholders clearly told us during our RIIO-2 engagement that our original vehicle replacement plans, which focussed on improving our existing fleet of commercial diesel vehicles and reviewing other alternatives available on the market, did not go far enough to deliver decarbonisation or air quality improvements. They also told us that we should look at improvements that we could make by changing our company car fleet to cleaner alternatives.

Any changes to our vehicle fleet, in particular our commercial fleet, need to be carefully considered to ensure that we maintain a robust, flexible and resilient fleet of vehicles which enable us to operate our network safely and effectively for our customers. In response to this feedback we have undertaken a detailed review of our vehicle fleet requirements, in depth analysis of distances travelled, and assessment of alternatives currently available on the market and those anticipated in the future. As a

[4] https://www.gov.uk/government/publications/health-matters-air-pollution/health-matters-air-pollution (accessed 26 July 2019).

consequence, we have substantially reviewed our RIIO-2 vehicle investment plans to deliver a significantly decarbonised vehicle fleet with lower air quality impact.

We commit to achieving the following by the end of RIIO-2:

- 100% of our company cars (currently c.120 cars) being ultra low emission, plug-in hybrid or hybrid. All company cars will typically have carbon emissions of no greater than 95 gCO2e/km (an improvement of at least 15% compared to the current fleet average), with no diesel vehicles in the car fleet. Equal vehicle requirements will apply to colleagues accepting a financial payment as an alternative to a company provided car, with similar restrictions on car types to be used for casual business mileage (delivering at least a 25% reduction in emission rates compared to the current average emission rate of these vehicles).
- At least 25% of our commercial vehicle fleet (c.145 vehicles) being ultra low emission, plug-in hybrid or hybrid by the end of RIIO-2. These vehicles are predominantly anticipated as replacements for our fleet of small diesel vans as there are no currently widely available or reasonably foreseeable viable alternatives for our larger engineering vans which can robustly meet the operational requirements (see below for further details). To enable this, we are undertaking comprehensive road trials of ultra low emissions vans during RIIO-1 to ensure we identify robust and practicable solutions.
- All remaining diesel vans to be at least Euro VI engine (cleanest currently available and Clean Air Zone compliant) by end of RIIO-2.

The vehicle fleet improvements identified above mean that approximately 50% of our total fleet will be ultra low emission, plug-in hybrid or hybrid by the end of RIIO-2 compared to 3% currently. In addition, all business car mileage will be undertaken in ultra low emission or hybrid vehicles by the end of RIIO-2, and we are targeting a 20% reduction in non-operational business mileage (vs 2017/18 baseline) via use of technology, such as video-conferencing.

As detailed in Part 6.3.1 below, we are targeting a minimum 30% reduction in our vehicle carbon emissions by the end of RIIO-2 compared to our 2017/18 baseline, saving approximately 4,230 tCO2-e of tank to well emissions cumulatively over RIIO-2. Our RIIO-2 vehicle investment proposals will also deliver reduced air quality impact associated with our vehicle fleet as we will be removing approximately 250 diesel vehicles from our fleet, with the health benefits of changing our fleet of 120 company cars alone valued at approximately £0.47m[5].

We have incorporated our significantly improved commercial vehicle fleet targets into our £19.5m RIIO-2 operational vehicle investment plans as detailed in Part 6 and Appendix A23.K of our RIIO-2 business plan document. To enable this we commit to providing electric vehicle charging infrastructure at all of our offices and depots (currently 14 sites) by the end of RIIO-2 at a cost of approximately £0.85m (included in the £19.5m identified above). Our company car fleet improvements are being delivered at no additional costs to the customer.

As identified above, we currently operate a fleet of approximately 325 3.5t diesel vans used by our engineering teams. There are currently no widely available viable low emission alternatives to these vehicles which can robustly meet the operational requirements, and no alternatives can be reasonably foreseen at the moment during RIIO-2. During RIIO-2 we commit to ensuring all of our diesel vans will be at least Euro VI engine (the cleanest currently available and Clean Air Zone compliant) by the end of RIIO-2. We will also explore potential opportunities to reduce our emissions associated with diesel

[5] See NGN RIIO-2 Customer Value Proposition (Appendix A13 of our RIIO-2 business plan document) for full details.

use in vehicles, plant and equipment by assessing the potential to use lower carbon alternatives such as biodiesel.

During RIIO-2 we will continuously review the low emission alternatives available on the market when investing in any new commercial vehicles via our value framework assessment approach to ensure that we are flexible to technological advancements and challenging ourselves to decarbonise our fleet. We also commit to seeking and exploring opportunities for innovation to decarbonise our fleet, notably via working with other utilities and anchor institutions to identify synergies to improve our environmental performance, for example shared alternative fuel infrastructure. We have already commenced discussions with other utilities and public sector bodies during RIIO-1 (including Yorkshire Water, Cadent and Bradford Council) about potential alternative fuel vehicle projects they are looking to invest in, including compressed natural gas and hydrogen fuelled vehicles.

During RIIO-2 we will communicate and cascade our vehicle fleet decarbonisation targets with our supply chain, encourage and support them in decarbonising their vehicle fleets, and measure their performance. Of note we will explore opportunities to enable our critical supply chain small and medium sized enterprises, such as our Direct Service Providers, to benefit from our commercial arrangements and alternative fuelling infrastructure, to assist them to decarbonise their fleet where they may not otherwise have been able to do so.

Tree Planting in Our Region

Within our network and neighbouring areas the Northern Forest aims to plant 50 million trees over the next 25 years to deliver a range of social benefits valued at over £1 billion including improved health and wellbeing, flood risk management, carbon sequestration and green collar jobs[6]. The Woodland Trust identify that trees can cut indoor and outdoor air pollution by 50% in urban areas.

In recognition of the benefits that tree planting can deliver to air quality within communities, in addition to the improved flood risk management that they can deliver to our assets, NGN's shareholders commit to funding (at no cost to the customer) the planting of 40,000 trees (covering c.10 hectares) in the designated Northern Forest areas in our network area during RIIO-2. Working in partnership with the White Rose Forest we commit to funding the tree planting in our communities in West Yorkshire, with a specific focus on urban areas close to transport corridors to directly combat the air pollution that we contribute to. A summary of the benefits delivered by our tree planting scheme is provided in Table 10 below which NGN value at a total benefit to customers of approximately £21m over 50 years as detailed in our RIIO-2 Customer Value Proposition (Appendix A13 of our RIIO-2 business plan document), including sequestration of approximately 2,450 tCO2-e.

Benefit of NGN Tree Planting Scheme	How Will Benefits be Realised
Air Quality	Planting site selection – 40 x 0.25ha urban schemes close to transport corridors will be prioritised within the scoping process. Tree species selection- all schemes will include tree species that are known to remove air pollutant particulates, such as birch and scots pine, to maximise air quality benefits.
Social	Planting site selection – schemes will be prioritised in areas that have public access and are in areas where there is a current lack of publicly accessible woodland. Community involvement - communities will be involved in site design and planting, and possibly long term stewardship of the site. Creation of one full time job for five years.
Biodiversity	Site design - each scheme will include a significant proportion of native and pollinator friendly species.

[6] https://www.woodlandtrust.org.uk/about-us/woodland-creation/the-northern-forest-our-vision/ (accessed 26 July 2019).

Benefit of NGN Tree Planting Scheme	How Will Benefits be Realised
Carbon Sequestration	All the sites have the potential to contribute to the offsetting of carbon emission by replacement of existing regular grass mowing regimes and by growth of trees and absorption of carbon dioxide. Total estimated carbon sequestration of 2,450 tonnes CO_2[7] assuming 10ha planted with 10% lifetime loss.

Table 10 – Summary of benefits of NGN RIIO-2 tree planting scheme

The project will fund the appointment of a full time urban forester by the White Rose Forest for a duration of five years to manage the design and implementation of the planting programme, and target the achievement of match funding from other sources to enable the planting of more trees.

The White Rose Forest reflected that our proposed partnership during RIIO-2:

"can be used as a model of how future government and other funding could be shaped to best effect. We have a real opportunity to plan and implement a resource efficient programme with multiple benefits, match funding and best practice."

We aim to directly deliver some of planting of the forest ourselves via use of our corporate volunteering policy.

Gas Preheating System Improvements

Our gas preheating systems provide a source of air pollutants, in particular NOx, through their combustion of gas, in addition to carbon emissions. As detailed in Part 6 of our RIIO-2 business plan document (and Appendix A23.A and A23.B), during RIIO-2 we will invest approximately £16.5m in upgrading our gas preheating systems at over 50 sites with more efficient, less polluting technology which will deliver local air quality benefits. This workload is part of a refurbishment and replacement programme to ensure our portfolio of gas pre-heating systems are more energy efficient, less polluting, and by 2030, compliant with the air quality requirements of the Medium Combustion Plant Directive. In addition to reducing air pollutant emissions from our sites, this investment is estimated to avoid approximately 1,890 tCO2-e during RIIO-2.

6.2.2 Initiatives to Use Resources Responsibly

Initiatives to *Use Resources Responsibly*	**Sustainable procurement embedded by supplier code**
Benefits Delivered in RIIO2	**930,000t waste diverted from landfill** **850t less office/depot waste** **640,000t natural resource use avoided** **No single use plastics** **50% less paper use**

Our Environment Strategy recognises the need for us to develop a sustainable approach to procurement and resource consumption to reduce the environmental impact of our business operations and c.£200m of goods and services that we buy each year from our 700 strong supply chain. Building on our improvements on excavation spoil to landfill and virgin aggregate consumption

[7] Based on 272 tonnes CO2 per hectare of British woodland: Morison, J. et al (2012) "Understanding the Carbon and GHG balance of UK Forests", Forest Research (www.forestresearch.gov.uk/research/understanding-the-carbon-and-greenhouse-gas-balance-of-forests-in-britain/).

during RIIO-1, we have developed a range of targets to be achieved during RIIO-2 to achieve this objective as summarised in Table 11 below. We will report our performance against each of these initiatives within our AER.

Procurement	Resource Use	Waste Generation and Disposal
Embed our Sustainable Procurement Policy via a Supplier Code; at least 80% of suppliers (by value) to comply with Supplier Code.	Use no more than 2.5% virgin aggregate use*. Eliminate single use plastic items from offices and depots. Reduce paper use by 50% (vs 2017/18).	Reduce office and depot waste by 20% (vs 2017/18). 0% disposal of recyclable or recoverable waste to landfill. Less than 0.1% of excavation spoil to landfill**.
All targets to be achieved by end RIIO-2. * Definition as per RIIO-1. ** Definition as per RIIO-1, excluding excavation spoil classified as hazardous waste.		

Table 11 – Environment Action Plan initiatives to use resources responsibly

Sustainable Procurement

The United Nations estimates that carbon emissions from supply chains are typically four times those of a company's direct emissions[8]. These carbon emissions are one element of the environmental impact of supply chains. Currently we preferentially engage suppliers who have been approved via the Achilles Utilities Vendor Database, an independent supply chain assurance assessment. In addition, all potential suppliers (including those not on Achilles and sole source appointments) complete a pre-qualification questionnaire and are asked questions regarding their past environmental performance, their corporate environmental objectives, and how they meet our Environment Strategy objectives, and are awarded scores accordingly.

We recognise that our current procurement processes enable us to identify suppliers with good environmental track records, but there is room for improvement in terms of ensuring that the objectives of our Environment Strategy are embedded with our supply chain and that we are able to monitor and measure our suppliers' environmental performance.

We are in the process of finalising our Sustainable Procurement Policy which will be embedded within our supply chain by a Supplier Code. Our Supplier Code will require our contracted suppliers to adhere to the high standards of environmental management and sustainable practices required in our Environment Strategy, including embedding the principles of the Circular Economy. As a minimum, our Supplier Code will require suppliers to:

- have an environmental policy and environmental management system,
- measure and report their Scope 1 and 2 carbon emissions to NGN,
- measure and report their waste generation to NGN,
- measure and report their material consumption to NGN,
- establish action plans to reduce their carbon emissions, waste generation and resource consumption and report their performance against these plans to NGN annually.

The provision of the above information will assist us in measuring and reducing our embodied carbon emissions, in addition to our overall environmental impact.

We commit to at least 80% of our suppliers (by value, currently approximately 50 companies based on 2018 data) meeting the Supplier Code by the end of RIIO-2. We will report on the percentage of suppliers (by value) meeting the code within our AER, in addition to other selected relevant metrics important to our stakeholders. In addition, we will work with our supply chain throughout RIIO-2 to

[8] https://unfccc.int/news/leading-companies-cut-supply-chain-emissions-save-money (accessed 26 July 2019).

enable us to estimate the carbon footprint of key elements of our supply chain and target initiatives to reduce it.

Resource Use – Virgin Aggregate

We typically use 135,000 tonnes of aggregate per year to reinstate our streetworks excavations, making aggregates one of our most significant materials used by mass. The aggregate used for backfilling can either be virgin, i.e. newly quarried from the ground, or be made from recycled materials such as brick, concrete and asphalt. The use of recycled aggregate has several environmental benefits over using virgin material, including driving the circular economy, so we continually strive to increase the amount of recycled aggregate we use.

During RIIO-1 we have reduced the amount of virgin aggregate we use for re-instatement works by over 75%[9], achieving 6.1% usage in 2018/19. Improvements have been achieved by driving innovations to utilise no dig technology such as our core and vac vehicles, favouring insertion over open cut for mains replacement works, and helping our contractors access high quality recycled aggregate. Engineering situations still exist necessitating the use of virgin aggregates in certain situations, for example when reinstating roads constructed of concrete.

Building on our advances during RIIO-1 and improvements we anticipate to make via our Innovation Strategy, we are committed to reducing our virgin aggregate use for mains replacement, connections and emergency works to no greater than 2.5% per year by the end of RIIO-2 (by weight, based on the same definition as in RIIO-1). This improvement will be achieved at no direct extra cost to the customer and is estimated to result in the use of over 640,000 tonnes of recycled aggregate in preference to virgin aggregate over the duration of RIIO-2. Compared to our latest RIIO-1 virgin aggregate usage, our improved RIIO-2 performance is estimated to avoid the use of an additional approximately 17,000 tonnes of virgin aggregate, providing carbon savings of approximately 80 tCO2-e.

We will share our learning and examples of good practice with our fellow gas distribution networks and utilities within our region.

Resource Use – Single Use Plastics

During summer 2019 we have commenced a sustainability working group with our regional utility partners (Yorkshire Water and Northern Powergrid) with the objective of identifying opportunities where we can work collaboratively to collectively reduce our environmental impacts. This has identified that we could be doing more to reduce plastic consumption, in particular single use plastic. We have subsequently commenced a project to analyse our consumption of plastic items and are committing to eliminate our use of single use plastic items in our offices and depots by the end of RIIO-2. This improvement will be achieved at no direct extra cost to the customer.

We have already commenced this work during RIIO-1 as we have identified the opportunity to avoid the purchase of approximately 45,000 single use plastic bottles annually by providing our operational colleagues with a reusable drinking water bottles. This is an example of how such small changes can deliver large environmental benefits when applied at scale.

[9] 2013/14 performance vs 2018/19 performance.

Resource Use – Paper

During RIIO-1 we have typically purchased the equivalent of approximately 3m sheets of A4 paper each year, nearly all of which was made from virgin materials. We commit to reducing the amount of paper that we use in our offices and depots by 50% by the end of RIIO-2 (compared to 2017 baseline). We plan to achieve this target by engaging with our colleagues via an awareness programme and by utilising our RIIO-1 systems investments (such as SAP4 Hana) to reduce the amount of paper-based work that we conduct. In addition, during RIIO-2 we will purchase only recycled paper (where available). This improvement will be achieved at no direct extra cost to the customer and is estimated to save approximately 30 tCO2-e over RIIO-2 associated with reducing our paper usage by approximately 30 tonnes of virgin paper.

Waste Generation and Disposal

A summary of NGN's typical annual waste generation is provided in Table 12 below. This identifies that NGN generate over 200,000 tonnes of waste annually, with over 99% of our total waste and approximately 95% of our non-excavation spoil waste being diverted from landfill.

Waste Stream	Total Annual Tonnage (t)	Tonnage to landfill (t)	Tonnage Diverted from Landfill (t)	% Diversion from Landfill
Excavation Spoil	202,932	744	202,188	99.6%
Confidential paper waste from offices and depots	12	0	12	100%
Office, depot and operational waste (excluding confidential paper waste)	958	47	911	94.7%
Plastic (PE) gas pipe	176	0	176	100%
Total	**204,077**	**791**	**203,285**	**99.6%**
Total excluding excavation spoil	**1,145**	**47**	**1,096**	**95.7%**

Table 12 – Summary of NGN waste generation during 2018

Building on our current waste management performance and in accordance with our existing targets within our Environment Strategy we commit to achieving the following by the end of RIIO-2:

- dispose of less than 0.1% of excavation spoil to landfill[10];
- reduce our non-excavation spoil waste by 20% (2018 baseline vs 2025/26); and
- dispose of 0% of office and depot waste[11] to landfill.

During RIIO-1 we have reduced the amount of excavation spoil we send to landfill by 99%[12], achieving 0.4% disposal to landfill in 2018/19. Improvements have been achieved by driving innovations to utilise no dig technology such as our core and vac vehicles, favouring insertion over open cut for mains replacement works, and helping our contractors to access recycling facilities. During RIIO-2 we will continue to reduce the amount of excavation spoil that we send to landfill by continuing the management techniques we introduced during RIIO-1 and via improvements we anticipate to make via our Innovation Strategy. These improvements will be achieved at no direct extra cost to the customer and are estimated to result in the recycling of approximately 930,000 tonnes of excavation spoil in preference to landfill disposal during RIIO-2. Compared to our latest RIIO-1 performance, our RIIO-2 proposals are estimated to divert an additional approximately 1,900 tonnes of excavation spoil away from landfill during RIIO-2, saving approximately 10 tCO2-e.

[10] By weight, assuming same definition as during RIIO-1 and excluding excavation spoil classified as hazardous waste.
[11] Recyclable or recoverable waste, excluding excavation spoil.
[12] 2013/14 performance vs 2018/19 performance.

We will achieve our proposed reductions in non-excavation waste generation by harnessing the benefits of our RIIO-1 system investments which are anticipated to reduce the amount of paper based work that we conduct and improve our material stock management to reduce overordering and material wastage. For example, we are targeting reductions in the amount of plastic gas pipe that we waste that are estimated to save approximately 450 tCO2-e during RIIO-2. In addition, we will be engaging with our supply chain to eliminate unnecessary waste, for example excessive packaging. Our waste reduction and waste disposal to landfill targets have been established as key performance indicators within our new facilities management contract to ensure our waste is managed in the manner that we require. Our RIIO-2 proposals are estimated to reduce our office and waste generation by approximately 850 tonnes over RIIO-2, reducing our waste disposal to landfill by 180 tonnes and saving approximately 30 tCO2-e.

These improvements will be achieved at no direct extra cost to the customer. We report the amount of waste that we generate and the proportions disposed to landfill, recycled and reused in our AER.

6.2.3 Initiatives to Enhance Life on Land

Initiatives to *Enhance Life on Land*	**250 'homes for nature'** **Ecosystem services assessments at 50 sites** **8 land remediation projects**
Benefits Delivered in RIIO2	**24 gas holders decontaminated and demolished** **Asset site appearance improvements**

Our Environment Strategy aims to enhance the landscapes and communities in which we work by pro-actively improving our landholding. This is supported by our research which identified that stakeholders were actively interested in the extent to which we can proactively manage our above-ground asset sites to deliver environmental betterment and considered this to be of medium importance.

Biodiversity

In accordance with our 'Homes for Nature' commitment in our Environment Strategy which we commenced during RIIO-1, by the end of RIIO-2 we commit to have made positive changes at 250 of our fixed asset sites to encourage biodiversity. This could include installing habitats or changing vegetation management techniques to promote conditions in which biodiversity can increase. We will report our progress with this commitment in our AER.

To create greater awareness of our biodiversity impacts and drive positive actions, during RIIO-2 we will adopt an appropriate methodology/tool and reporting metrics, developed in accordance with ecological guidance, to enable measurement of:

- net changes in ecosystem services from our asset sites which cover more than 0.5 hectares (maximum of 50 sites), with reporting in our AER in RIIO-2 years 1 (baseline), 3 and 5; and

- natural capital changes (across relevant ecosystem services) from different options for key projects as they arise during RIIO-2, with reporting in our AER (key projects over £0.25m in value with identified significant potential natural capital impacts).

These improvements will be achieved at no direct extra cost to the customer.

Land Remediation

Our stakeholders were strongly of the view that NGN should be doing more in relation to land remediation. During RIIO-2 we propose to continue 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. Continuing our work from RIIO-1, as demonstrated in Part 4.1 of this document, we will continue to utilise sustainable techniques wherever possible.

In summary our land remediation workload for RIIO-2 includes investment of £3.4m over the RIIO-2 period on:

- 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-1 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. These works will provide a permanent reduction in environmental pollution potential associated with these sites.

Further details of our proposed expenditure on environmental land remediation is provided in Part 6 of RIIO-2 business plan document. We will report our progress against these targets, in addition to expenditure, in our AER.

Gas Holder Demolition

During RIIO-2 we commit to decontaminating and demolishing the remaining 24 water sealed gas holder that are features of our network. These structures bring with them a legacy of contamination from the town gas era, including many thousands of cubic metres of contaminated water and hundreds of tonnes of hazardous sludges, which pose a potential pollution threat to the environment. For example, the demolition of a typically sized gas holder at Ayres Quay in Sunderland during 2016 resulted in the removal and treatment of approximately 9,400 m3 of contaminated water from the below holder ground tank, in addition to removal and disposal 133 tonnes of oil/oily water and 212 tonnes of hazardous sludge containing toxic chemicals including lead, benzene, cyanide and polycyclic aromatic hydrocarbons.

Our comprehensive gas holder decontamination and demolition process permanently removes the pollution risk associated with these structures, in addition to reducing the visual landscape impact of

our network infrastructure, thereby often enabling the land to be regenerated by third parties to benefit local communities.

Asset Enhancements

Our RIIO-2 business plan includes approximately £1m of expenditure per year for maintenance and minor civil engineering works at our asset sites. These works are necessary to ensure asset performance and security but will also improve the aesthetic appearance of our assets and reduce their visual impact on the landscape.

Measuring and Reporting Our Performance

We will measure and report our progress in implementing each of our RIIO-2 EAP initiatives to protect the environment in our AER. This information will be presented in a format based on feedback from engagement with our stakeholders and in compliance with Ofgem requirements.

6.3 Decarbonising our business

The second aspect of our EAP is to identify initiatives to decarbonise our business operations to contribute to a net zero greenhouse gas emission future. NGN's direct carbon emissions are approximately 420,000 tCO2-e per annum (approximately 0.1% of the UK's total annual emissions[13]), however as per Table 3 our total carbon emissions, including indirect upstream and downstream emissions, are many times greater (c.15m tCO2-e) due to our critical role in the UK's energy system. As detailed in Sections 2 and 6.4, we have an essential role in actively participating in efforts to find low cost, low carbon heat source energy solutions for our customers via the coordinated objectives and efforts of our Whole System and Innovation Strategies. Our plans for enabling the decarbonisation of the UK energy system during RIIO-2 are identified in Part 2 of this document and Parts 4.4 and 5.1 of our RIIO-2 business plan document, but whilst this work is underway, we will maximise our efforts to reduce the carbon emissions from our network now.

Setting Science Based Targets and Achieving Net Zero by 2030/31

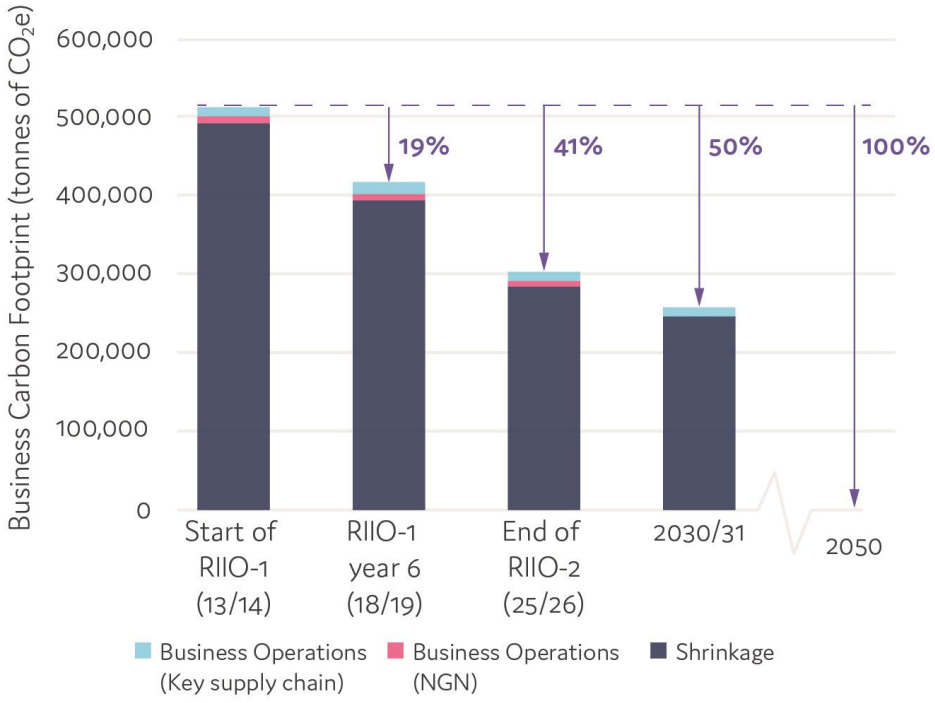
Our stakeholders have told us that they expect us to reduce all elements of our carbon emissions, not just gas shrinkage (Customer Insight 43). Working with the Carbon Trust in 2018/19 as part of our long-term Environment Strategy we were the first UK gas network to establish and adopt science-based carbon reduction targets. These targets plot a responsible reduction trajectory to 2050 for our non-shrinkage Scope 1 and 2 emissions for a well below 2 degree warming scenario in 2050[14]. We have taken a leading role in the gas industry with this work, introducing the approach to the other GDNs via the Energy Networks Association Gas Environment Group. In addition, we also utilised this work to set targets for the key Scope 3 emissions that we measured during RIIO-1. Our science-based targets are presented in Section 6.3.1 below.

Since developing and adopting our science-based targets we have refined them in light of the UK's commitment to achieving net zero greenhouse gas emissions by 2050. In response we have set ambitious short and long term decarbonisation targets which go beyond our existing science-based targets. These targets, underpinned by our EAP initiatives (as detailed in Section 6.3.1 and Table 13 below) and coupled with anticipated developments in technology, mean we are targeting the

[13] 2018 UK Greenhouse Gas Emissions Provisional Figures; Department for Business, Enterprise & Industrial Strategy; 28 March 2019.
[14] 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. Such a trajectory is more challenging that a 2 degree trajectory. Our 2017/18 non-shrinkage carbon emissions form the baseline of this modelling.

achievement of net zero non-shrinkage Scope 1 and 2 business carbon emissions by the end of the 2030/31. These targets directly support the achievement of net zero emissions in our network regions and the UK. Full details of our carbon reduction targets are provided in Section 6.3.1 and Table 14 below, with a summary of our forecast pathway to net zero carbon emissions provided in Figure 6 below.

We will report our performance against our business decarbonisation EAP initiatives in our AER, including revising our targets where necessary during RIIO-2 to drive continuous improvement.



We are forecasting to achieve net zero in our Business Operations by 2030

Figure 6 – Summary of NGN carbon emissions on the pathway to net zero

Our EAP includes specific initiatives and commitments to deliver real-world, measurable reductions in our business carbon emissions, as guided by our Environment Strategy. As summarised in Table 13, our business decarbonisation EAP initiatives will deliver estimated carbon savings of approximately 353,600 tCO2-e during RIIO-2. These carbon savings will be delivered by a range of initiatives, small and large, at a cost of approximately £610m to customers with approximately 21% of the carbon savings being achieved by bespoke asset investments and initiatives and the remainder achieved by mandatory gas mains replacement works.

EAP Initiative	Environment Strategy Focus Area	Environmental Benefit Delivered	Estimated Cumulative Carbon Saving (tCO2-e) over RIIO-2	Carbon Emission Scope	Carbon Saving Reflected in NGN Business Carbon Footprint?	Cost to Customer (£)
Gas shrinkage reduction strategy – including mandatory and non-mandatory mains replacement	Take Action Against Climate Change to Support Net Zero Future	Reduced carbon emissions	283,050*	Scope 1	Yes	£538.7m^
Gas shrinkage reduction strategy – excluding mains replacement (included in above)			12,600* (included in above)	Scope 1	Yes	£8.5m
Emergency repair time improvements			30,000	Scope 1	No**	No additional cost to customer
Network capital investments across 10 asset types			22,480	Scope 1	No**	£51.1m
Vehicle fleet improvements (50% of total fleet ultra low emission or hybrid)			4,230	Scope 1	Yes	£19.5m
Purchase of 100% renewable gas for metered use			530	Scope 1	Yes	No additional cost to customer
Purchase of 100% renewable electricity			7,100	Scope 2	Yes	No additional cost to customer
Renewable energy generation installation			280	Scope 2	Yes	£0.6m
Reduced business air travel			30	Scope 3	Yes	No additional cost to customer
Contractor vehicle carbon emission reduction targets			2,800	Scope 3	Yes	No additional cost to customer
Reduced plastic gas pipe wastage			450	Scope 3	Yes	No additional cost to customer
Tree planting in our region (40,000 trees)			2,450	Scope 1	No	No additional cost to customer *£0.4m cost funded by NGN shareholders*
EAP Initiatives to Protect the Environment delivering carbon benefits***			150	Scope 3	No	No additional cost to customer
Total (including mandatory and non-mandatory mains replacement)			**353,600**			**£610m**
Total (excluding mandatory and non-mandatory mains replacement)			**70,590**			**£79.7m**

Estimated carbon savings presented to nearest 10tCO2-e.
* From Shrinkage and Leakage Model estimates based on proposed RIIO-2 mains replacement, pressure management and gas conditioning investments. See Part 6.4.1 and Table 16 for full details of RIIO-2 shrinkage and leakage forecasts.
** Shrinkage and Leakage Model insufficiently detailed to capture the carbon emission savings delivered by these investments.
*** From Table 9, excluding preheating, company cars, commercial vehicles, plastic gas pipe wastage and tree planting as already included above.
^ Costs include mains replacement, gas conditioning and system pressure management investments.

Table 13 – Summary of key benefits and costs of RIIO-2 EAP initiatives to reduce our business carbon emissions

6.3.1 Initiatives to Take Action Against Climate Change to Support Net Zero

Initiatives to *Take Action Against Climate Change to Support Net Zero*	**Net zero Scope 1 and 2 business emissions by 2030/31**
	52% reduction in Scope 1 and 2 business emissions vs 2017/18
	28% reduction in Scope 1, 2 and 3 business emissions vs 2017/18
	353,600 tCO2-e saved
Benefits Delivered in RIIO2	**50% of vehicle fleet ultra low emission or hybrid**
	40,000 trees planted
	Embodied carbon assessment and reporting
	Asset protection against environmental hazards

Reducing our business carbon footprint to achieve net zero business emissions by 2030/31

Since developing and adopting our science-based targets in 2018/19 we have reviewed and refined our targets in light of the UK's commitment to achieving net zero greenhouse gas emissions by 2050. In the absence of a common science-based definition of "net-zero" we have enhanced our targets based on our planned EAP initiatives and reasonably foreseeable technological advancements to ensure that we are contributing to achieving net zero. As demonstrated in Table 14 below, our ambition is now to achieve net zero Scope 1 and 2 business carbon emissions (excluding shrinking) by the end of 2030/31, subject to foreseeable advances in low emissions vehicles, most notably commercial vehicles.

Based on our revised science-based targets, during RIIO-2 we are committing to reduce our Scope 1 and 2 non-shrinkage carbon emissions by 52% from our 2017/18 baseline level by the end RIIO-2, significantly greater than our original science-based target of 25%. Going further we commit to achieving a 16% reduction in key Scope 3 emissions[15] over the same period. This equates to a 47% reduction in Scope 1 and 2 emissions, and a 11% reduction in Scope 3 emissions, over the duration of RIIO-2. Our original science based carbon footprint targets and our more ambitious RIIO-2 business carbon footprint targets are shown in Table 14 below. A full itemised breakdown of our RIIO-2 business carbon footprint targets is provided in Annex A of this document.

We commit to measuring and reporting our Scope 3 emissions during RIIO-2 as per those measured during RIIO-1 to allow continuity in performance measurement. In addition, we will also undertake a scoping assessment to determine other Scope 3 carbon emissions that we could measure to add value to our stakeholders, such as emissions associated with water use, waste disposal and customer gas use, and will report Scope 3 emissions that are important to our stakeholders.

[15] Emissions associated with PE pipe production and transport, mains replacement contractor vehicles, NGN business travel by rail and air, and transmission and distribution losses associated with electricity consumed by NGN.

Non-shrinkage Carbon Emissions	17/18 (actual - baseline)	20/21	25/26	30/31	2040	2050	% reduction 17/18 vs 25/26	% reduction over RIIO-2
Scope 1 &2 Emissions – Science-based Targets for well below 2 degree scenario based on 2017 UK energy grid characteristics								
Scope 1: Gas use (metered)	285	235	162	95	52	25		
Scope 1: NGN vehicles^^	5,119	4,776	4,062	3,351	2,422	1,808		
Scope 2: Electricity use	2,019	1,730	1,323	905	310	0		
Total Scope 1 & 2	7,423	6,740	5,547	4,351	2,785	1,793	25%	18%
Scope 1 &2 Emissions – Science-based Targets revised to meet net zero based on NGN EAP initiatives (RIIO-2 targets)								
Scope 1: Gas use (metered)	285	235	0*	0*	0*	0*		
Scope 1: NGN vehicles^^	5,119	4,776	3,267	0**	0**	0**		
Scope 2: Electricity use^^^	2,019	1,730	313^	0	0	0		
Total Scope 1&2	**7,423**	**6,740**	**3,580**	**0**	**0**	**0**	**52%**	**47%**
Scope 3 Emissions								
Scope 3	**14,387**	**13,562**	**11,892**	**10,783**	**5,000*** **	**0**	**16%**	**11%**
Scope 1, 2 and 3 Emissions (inc EAP initiatives)	**21,810**	**18,746**	**15,472**	**10,783**	**5,000**	**0**	**28%**	**23%**

Figures quoted in tCO2-e.
Scope 1, 2 and 3 emissions source definitions and calculations as per RIIO-1. Scope 1: direct emissions caused by non-electricity energy consumption and transport, Scope 2: direct emissions caused by electricity consumption, Scope 3: specific indirect emissions caused by PE pipe production and transport, key contractor vehicles, business travel by rail and air, and transmission and distribution losses associated with electricity consumed.
* Assumes green gas (currently 1kwh biogas = 0.00021 kgCO2-e, DEFRA 2019) tariff widely commercially available. Emissions forecasts based on market approach.
** Subject to technological advancement of appropriate zero carbon emission vehicles meeting cost-benefit analysis
*** Scope 3 emissions are estimates only beyond 2030/31 due to uncertainty regarding the future of gas.
^ Carbon emissions for building and infrastructure electricity consumption forecasts based on market approach for office and depot usage. Forecast carbon emissions for electric vehicle charging including based on location approach using 2019 DEFRA conversion factors for UK grid electricity.
^^ Tank to wheel emissions.
^^^ Includes electricity consumption to charge electric vehicles used for NGN operational and business travel which is assumed to be as per 2019 DEFRA conversion factor for UK grid average electricity in 2025/26 as this will often be done at employees' homes or via public charging facilities.

Table 14 – RIIO-2 business carbon footprint emissions forecasts

A summary of our key RIIO-2 decarbonisation initiatives to contribute to net zero is provided below:

Our Vehicles (see Part 6.2.1 for full details)

- 100% of our company cars (currently c.120 cars) being ultra low emission, plug-in hybrid or hybrid by the end of RIIO-2. All cars to typicallu have carbon emissions of no greater than 95gCO2e/km, with no diesel vehicles in the fleet. Equal vehicle requirements for colleagues accepting a financial payment as an alternative to a company provided car (currently c.150 colleagues), and similar restrictions on car types to be used for casual business mileage.

- At least 25% of our commercial vehicle fleet (c.145 vehicles) being ultra low emission, plug-in hybrid or hybrid by the end of RIIO-2, in addition to the existing hybrid vehicles in our commercial fleet. These vehicles are predominantly anticipated as replacements for our fleet of small diesel vans as there are no currently widely available or reasonably foreseeable viable alternatives for our larger engineering vans.
- All remaining diesel vans to be at least Euro VI engine (cleanest currently available) by end of RIIO-2.
- Installation of electric vehicle charging infrastructure all of our offices and depots (currently 14 sites) by the end of RIIO-2.
- 20% reduction of non-operational business mileage (vs 2017/18 baseline) via use of technology, such as video-conferencing.

The above initiatives will require the investment of approximately £19.5m (part included in our Vehicle and Wheeled Plant Strategy) and will mean that approximately 50% of our total vehicle fleet will be ultra low emission, plug-in hybrid or hybrid by the end of RIIO-2 and all business car mileage will be undertaken in low emission vehicles. The changes to our company car fleet will be delivered at no additional cost to the customer. Our proposed vehicle fleet enhancements are anticipated to deliver cumulative (tank to wheel) carbon savings of approximately 4,230 tCO2-e over RIIO-2, equivalent to a 30% saving in annual vehicle carbon emissions in 2025/26 compared to 2017/18, in addition to significantly reduced air quality impact as we will be removing approximately 250 diesel vehicles from our fleet.

Contractor Vehicles

We already measure and report vehicle carbon emissions from our gas mains replacement and reinstatement contractors within our Scope 3 emissions. We have established vehicle carbon emission reduction targets for our mains replacement contractors (Direct Service Providers) and reinstatement contractors based on our existing science based targets. We are targeting a 19% reduction in vehicle carbon emissions for these contractors between 2025/26 and our 2017/18 baseline. This target will be communicated with our contractors and their carbon emission performance measured and reported to track progress. We will explore opportunities to enable these contractors, who are typically small and medium sized enterprises, to benefit from our commercial arrangements and alternative fuelling infrastructure, to assist them to decarbonise their fleet where they may not otherwise have been able to do so.

Business Travel by Rail and Air

We already measure and report our business travel via rail and air within our Scope 3 emissions.

Our business air travel has varied widely from year to year throughout RIIO-1, from 49 tCO2-e in 2014/15 to 422 tCO2-e in 2017/18. We have established a baseline for RIIO-1 Years 1 to 6 of 211 tCO2-e based on our average annual air travel carbon emissions and are targeting achieving a 10% reduction in annual air travel carbon emissions against this baseline in 2025/26. This would represent a 55% reduction in business air travel emissions in 2025/26 compared to 2017/18, providing cumulative savings of approximately 30 tCO2-e over RIIO-2.

Business rail travel carbon emissions for our 2017/18 baseline year were 22 tCO2-e and similar throughout RIIO-1. We have assumed annual business rail travel carbon emissions will remain the

same as our baseline throughout RIIO-2 as we will continue to encourage the use of public transport as a more sustainable option to private vehicle travel.

Energy Use in Buildings and Gas Sites

- We will purchase 100% renewable electricity for our offices, depots and gas infrastructure sites (where available) at no direct additional cost to customers. This is forecast to save approximately 7,100 tCO2-e over RIIO-2. We will continue to utilise some UK grid average electricity to charge electric vehicles at public charging facilities and employee's home (assumed to be 100% UK grid average electricity for this purpose).
- We will purchase 100% renewable gas for our metered consumption at offices, depots and gas infrastructure sites at no direct additional cost to customers (assuming this is widely commercially available). Achievement of this from 2023/24 onwards (to allow for market development) is forecast to save approximately 530 tCO2-e over RIIO-2.
- We will invest over £2m in our offices and depots to provide a smaller number of modern, more energy efficient facilities with reduced energy consumption. The first phase of refurbishment of our Leeds headquarters during RIIO-1 was calculated to have improved the energy efficiency of the building by 28%.
- Building on the approximately 310KW peak (KWp) of renewable energy generation that we plan to install at our sites during RIIO-1 to reduce our grid electricity consumption, during RIIO-2 we will invest approximately £0.6m in installing on-site renewable energy generation across all of our offices and depots[16] (investment details are provided in Part 6 of our RIIO-2 business plan document). This will provide a further 370 KWp of generation potential avoiding approximately 280 tCO2-e of emissions related to electricity consumption during RIIO-2.

  We commissioned an alternative energy source assessment during RIIO-1 which identified that our gas infrastructure sites may be potentially suitable for installation of solar photovoltaic (PV) or wind generation energy technology. Following a detailed assessment, at this stage we are not proposing to install either of these technologies at our gas sites. Our gas sites are often relatively small and congested and as such wind turbines offer the potential for integrity damage to our infrastructure in the event of failure of the turbine (such as impact damage). In addition, solar PV is not ideally suited to our gas infrastructure sites as the energy generation profile does not match our pattern of usage at these sites (usage is usually early in the morning and evening). Also, these sites are typically in isolated locations without permanent on-site staff and as such the solar PV equipment could attract trespassers thereby providing an unacceptable security and integrity risk. We have also considered installing such technology on the small number of totally redundant areas of land that we own, however in the absence of an energy demand on these sites and the removal of the feed-in-tariff, such investments currently do not show as good value for money in our cost-benefit analysis. Throughout RIIO-2 we will continue to explore how we can utilise our landholding to generate low carbon energy to the benefit of customers in the journey to net zero.

- We will invest approximately £16.5m in in upgrading our gas preheating systems at over 50 sites with more efficient technology which consumes less gas. This will deliver real world

[16] Properties solely occupied by NGN which have suitable structural conditions to enable safe installation of renewable energy technology such as solar panels.

reduction in gas consumption and associated carbon savings of approximately 1,890 tCO2-e over RIIO-2. Investment details are provided in Part 6 of our RIIO-2 business plan document.

Resource use minimisation

We will utilise our RIIO-1 investments in new systems and innovations to reduce our wastage of plastic gas pipe via improved material stock management to reduce over-ordering and material wastage.

We already measure and report the carbon emissions associated with the production and transport of the plastic gas pipe and fittings that we purchase in our Scope 3 emissions. We are targeting reductions in the amount of plastic gas pipe that we waste that are estimated to save approximately 450 tCO2-e during RIIO-2.

Embodied carbon assessment

We will develop and adopt tools to monitor, report and reduce embodied carbon on our key new RIIO-2 projects. Following identification of an appropriate measurement method and a period of baseline monitoring (during 2020/21 and 2021/22) we will establish an embodied carbon baseline and reduction target to be achieved by end RIIO-2. We will communicate this target with our supply chain, in conjunction with our Supplier Code development, and report our progress and performance in our AER.

Tree Planting and carbon sequestration (see Part 6.2.1 for full details)

As detailed above, NGN shareholders will fund the planting of 40,000 trees in our network area during RIIO-2 as part of the Northern Forest to deliver air quality improvements. In addition, it is estimated that this tree planting with deliver approximately 2,450tCO2-e of carbon sequestration as a secondary benefit.

Stopping leaks faster

Whilst not included in the Shrinkage and Leakage Model, it is recognised that gas escapes associated with (but not limited to) third party damage, joint failure and pipe corrosion result in emissions of natural gas (a potent greenhouse gas) to atmosphere. As detailed in Part 4.2.2 of our RIIO-2 business plan document, we have committed to repairing emergency gas escapes quicker during RIIO-2, with continuous improvement in repair times throughout the period, which will deliver savings in the volume of gas lost to atmosphere. These commitments will deliver real-world carbon emission savings that whilst difficult to estimate, could amount to 30,000 tCO2-e over RIIO-2. This improvement will be achieved at no direct extra cost to the customer.

Network asset investments

In addition to our Shrinkage Management Strategy investments, during RIIO-2 we are proposing a suite of investments across a further 10 network asset types which will deliver safety and customer benefits in addition to saving approximately 22,480 tCO2-e during RIIO-2 associated with avoided natural gas loss. These investments, totalling £51.1m have been optimised via our utilisation of value framework cost benefit analysis procedure as identified above. A summary of the carbon emissions avoided during RIIO-2 by our network investments per asset type is provided in Table 15 below.

Asset Type Subject to RIIO-2 Investment by NGN	Carbon Emissions Avoided During RIIO-2 (tCO2-e)	Total RIIO-2 Investment (£)*
Governors (district, service, and industrial and commercial)	1,000	£11.9m
Preheating (Offtake and PRS)	1,890	£16.5m
Pressure Control Systems (Offtake and PRS)	12,020	£8m
Filters (Offtake and PRS)	7,550	£2.6m
Local Transmission System Pipelines	20	£12.1m
Total	**22,480**	**£51.1m**

The carbon savings identified above are not directly included in the shrinkage model forecasts derived from the Shrinkage and Leakage Model as identified in Table 16 below.
* As per costs presented in RIIO-2 business plan data tables, excluding secondary asset costs.

Table 15 – Carbon emission benefits from non-mandatory NGN network asset capital investments during RIIO-2

Network Resilience to Climate Change

The latest UK climate change predictions[17] identify that in the future there is an increased chance of warmer, wetter winters and hotter, drier summers along with an increase in the frequency and intensity of extremes. During RIIO-1 we have reviewed the risks posed to our most critical assets by a range of environmental hazards including flooding, coastal erosion, river bank erosion and landslip. We undertook this review to assess the resilience of our assets to current and potential future environmental risks brought about by climate change to ensure that we can be confident that they can continue to serve our customers into the future.

Our assessments identified that environmental hazards posed a general low risk of asset integrity damage or asset non-performance, however as detailed in Part 6 we have included capital investments to improve the resilience of critical aspects of our network to environmental hazards. This includes £6.1m on the diversion of two sections of high pressure pipeline which have been identified to be potentially at risk of integrity damage from river bank erosion, and £1.9m on remediating sections of pipeline which are forecast to require protection from river bed/bank erosion during RIIO-2.

In addition, we have identified approximately 19km of high pressure pipeline which have a potential medium risk of landslide integrity damage. In response to this risk assessment and as an appropriate alternative to high cost pipeline diversion works, we have identified a non-intrusive surveillance programme to be undertaken during RIIO-2 to ensure that the landslide risk posed to the pipelines is monitored and reviewed.

Measuring and Reporting Our Performance

We will measure and report our progress in implementing each of our RIIO-2 EAP business decarbonisation initiatives, our Scope 1, 2 and 3 carbon emissions, and our performance against our targets in our AER. We will report our annual fuel and energy usage in litres / kwh and carbon emissions (based on grid average conversion factors and our own contractual conversion factors), including analysing performance trends. We will also represent our energy/fuel use and carbon emissions by relevant intensity metrics, such as per full time employee, per £m of turnover and per Gwh of gas transported for uniformity. This information will be presented in a format based on feedback from engagement with our stakeholders and in compliance with Ofgem requirements.

[17] UK Climate Projections 2018 (Met Office).

6.4 Supporting a net zero carbon future

Initiatives ***Supporting a Net Zero Carbon Future***	**24% reduction in gas leakage during RIIO-2** **283,000 tCO2-e gas shrinkage saved** **Better, faster, cheaper green gas customer service** **Whole systems thinking**
Benefits Delivered in RIIO2	

6.4.1 Initiatives to Reduce Our Gas Shrinkage and Leakage

Shrinkage includes natural gas leaking from the network (c.95%), gas stolen from the network (c.3%), and gas used during distribution (c.2%), e.g. to preheat gas at our infrastructure sites. Methane, the primary constituent of natural gas, is a powerful greenhouse gas and as such gas leakage is our single greatest carbon emission and environmental impact. Reducing our gas shrinkage is a key contribution that we make now to the UK's journey to net zero greenhouse gas emissions by 2050.

Between Years 1 and 6 of RIIO-1 we have reduced gas shrinkage and leakage by 18% and 19% respectively, saving approximately 405,000 tCO2-e. Our achievements during RIIO-1 were delivered via 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. Figures from all gas networks for the first five years of RIIO-1 identify baseline mains replacement work typically contributes approximately 85% of leakage reductions, with non-baseline mains replacement a further 5% and other activities such as system pressure management and gas conditioning an additional 10%.

During RIIO-2 we will continue and enhance our Shrinkage Reduction Strategy. As identified in Table 16, we have set ambitious shrinkage and leakage reduction targets for RIIO-2 which are forecast to deliver approximately 23% and 24% reductions, respectively, over the period. Our shrinkage reduction target equates to cumulative savings of 221 Gwh of gas over RIIO-2, equivalent to approximately 283,050 tCO2-e. Achievement of these targets will mean that by the end of RIIO-2 we will have reduced in-year shrinkage and leakage by 43% and 45%, respectively, since the end of RIIO-1 Year 1 (2013/14). We will deliver these targets by continuing our targeted mains replacement programme and further optimising our successful strategies from RIIO-1, including:

- Proactively managing system pressure through maintenance of our current system and further investment in remote pressure management and control equipment. As detailed in Part 6 and Appendix A23.I of our RIIO-2 business plan document, during RIIO-2 the equipment installed during RIIO-1 will be maintained and refreshed with additional equipment installed on a further 10 networks at a total cost of approximately £7.9m. In addition, our Innovation Strategy includes £1.25m for Network Innovation Allowance projects to create data driven networks to manage risk, enable transition and modernise delivery with improvements to network pressure management identified as a key area for innovation. Our pressure management strategy is estimated to save approximately 12,600 tCO2-e associated with avoided gas leakage during RIIO-2 (4.5% of total forecast RIIO-2 shrinkage carbon saving); and

- Effectively managing our gas conditioning via injection of MEG within our network. As detailed in Part 6 of our RIIO-2 business plan document we propose to invest approximately £0.6m (Opex and Capex) on gas conditioning over the period.

Year	RIIO-1	RIIO-2					% Reduction over RIIO-2
	20/21	21/22	22/23	23/24	24/25	25/26	
Shrinkage (GWh)	312	295	281	268	255	242	23%
Leakage (GWh)	290	272	259	246	233	220	24%

Table 16 – RIIO-2 shrinkage and leakage forecasts based on Shrinkage and Leakage Model and proposed investments in mains replacement, system pressure management and gas conditioning

Measuring and Reporting our performance

We will measure and report our progress in implementing our RIIO-2 Shrinkage Reduction Strategy and our annual and long-term gas shrinkage and leakage performance in our AER. We also commit to sharing our data and contributing to the evidence base regarding where gas shrinkage occurs and the proportion that gas networks can control, for example via participation in Energy Networks Association working groups. This information will be presented in a format based on feedback from engagement with our stakeholders and in compliance with Ofgem requirements.

6.4.2 Initiatives to Enable Lasting Energy Solutions

Enabling Green Gas

We are committed to enabling the connection of green gas to our network to support the transition to a flexible, low carbon energy system and enable net zero emissions by 2050. Building on our work done in RIIO-1 to date, we forecast to have 17 biomethane production plants connected to our network by early 2020 with a maximum capacity of 16,140 scm/hour, enough to heat over 60,000 homes per year. During RIIO-1 we have also engaged with our biomethane stakeholders to identify areas where we can improve our customer service to assist the connection and operation of green gas production sites.

In response to stakeholder feedback we have recently dedicated a resource to increase green gas market development, drive improvement initiatives and lead our green gas stakeholder engagement. We will expand our focus to include both commercial and social considerations to ensure that we are actively involved in overcoming commercial barriers associated with green gas and ensuring the social value of green gas is realised.

Based on the findings of our engagement with biomethane industry stakeholders, including mapping the biomethane customer journey, during RIIO-2 we commit to the following initiatives to improve our facilitation of green gas injection (as detailed in Table 17), focussing on being better, faster and cheaper:

Better – We need to deliver a better service to biomethane producers. We will do this through better understanding their needs by liaising with our green gas stakeholders at least annually throughout RIIO-2 to gather feedback and identify areas to improve our customer performance, and working to minimise barriers to injecting into our network.

Faster – We need to be more responsive to the needs of biomethane producers and commit to providing relevant information quicker and responding to technical challenges sooner.

Cheaper – We will look to standardise biomethane connections across the industry as much as possible, to ensure consistency and a least cost approach for biomethane producers.

Our RIIO-2 Innovation Strategy (as detailed in Part 5.4.8 of our RIIO-2 business plan document) includes approximately £5.5m of funding for Network Innovation Allowance projects to enable decarbonisation through intelligent network solutions. We are targeting specific RIIO-2 innovation project opportunities to identify increased opportunities for the connection of green gas supplies to our network, and develop simplified connection processes to help the flow of green gas into our network.

RIIO-2 Green Gas Initiative	RIIO-1 Target	RIIO-2 Target	Cost (£)
Green gas connection - initial capacity study	<=15 working days	<=5 working days	Nil
Green gas connection - detailed capacity study	<=30 working days	<=20 working days	Nil
System fault response time	Response next working day	Response within 4 hours of receipt of report	Nil
Stakeholder liaison	N/A	Minimum annual engagement	Nil
Reporting	Tables 7.6 and 7.7 of Regulatory Reporting Pack	To be included in AER with detail influenced by stakeholder views	Nil

Table 17 – RIIO-2 biomethane connection customer service commitments

Measuring and Reporting our performance

We commit to measuring and reporting our biomethane connection and customer service performance in our AER via a set of reporting outputs influenced by what information our stakeholders find useful. This information will be presented in a format based on feedback from engagement with our stakeholders and in compliance with Ofgem requirements.

Innovative Whole Systems Thinking

To further support this component of our EAP, we are committed to facilitating the development of an efficient, coordinated and cost-effective approach to meeting our net zero emission targets by 2050 through our Whole Systems and Innovation Strategies. The role of gas that we envisage in a net zero future, and the pathway to net zero, is identified in Part 2 above, and in detail in Part 4.4.2 and Appendix A14 of our RIIO-2 business plan document.

As identified in the Foreword to this document, we have integrated our Environment, Whole Systems, Innovation and Vulnerability Strategies to commit to whole systems thinking across our business in RIIO-2.

Our Whole Systems Strategic Framework is set out in Figure 7 below.

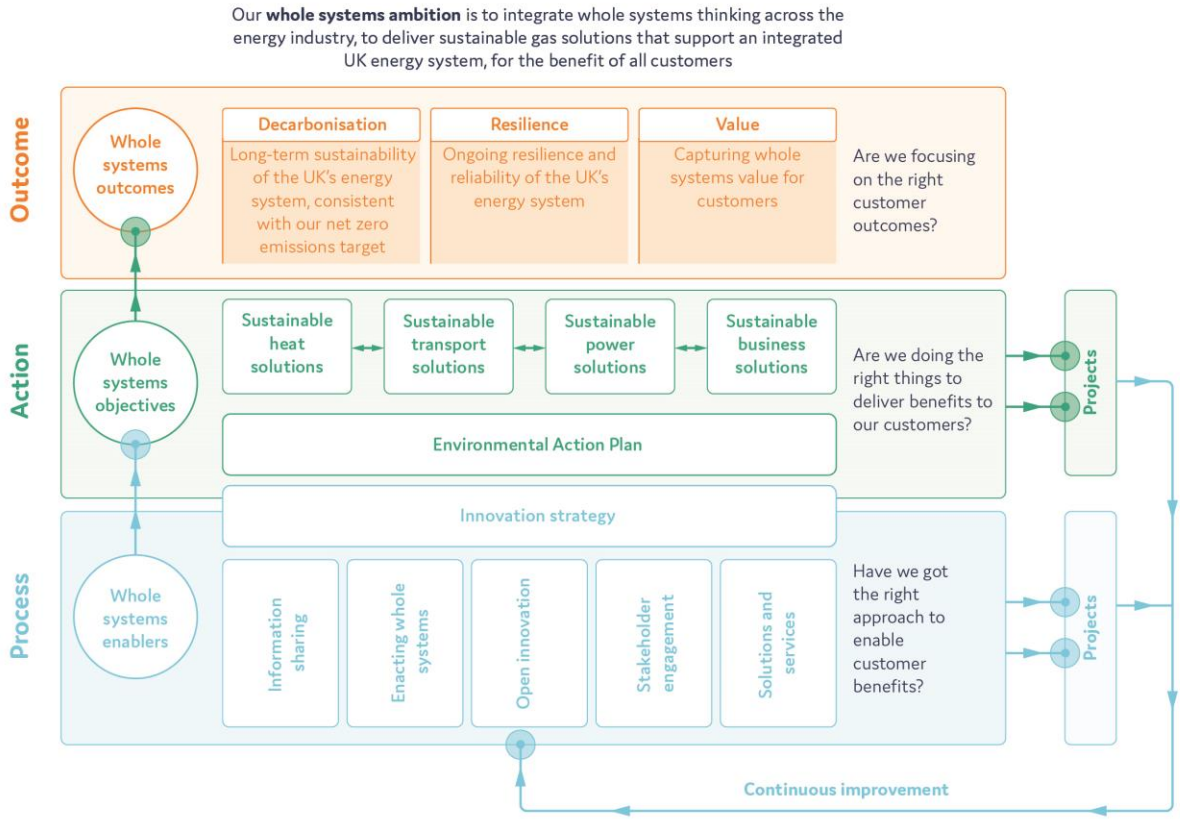


Figure 7 – Our Whole Systems Strategic Framework

Of particular relevance to our EAP are our Whole Systems Objectives which are focused on enabling and delivering in the following four areas:

- *Sustainable heat solutions* – we will investigate the potential and test the role of gas in delivering sustainable sources of heat through the facilitation of biomethane injection into the network and demonstration of the capabilities of hydrogen.
- *Sustainable transport solutions* – we will work with stakeholders to facilitate sustainable transport solutions, with a focus on how we can support the roll-out of required infrastructure to enable CNG, hydrogen and electric vehicles.
- *Sustainable power solutions* – we will continue to investigate optimised energy solutions for customers and support the ongoing integration of electricity and gas networks through innovation at InTEGReL.
- *Sustainable business solutions* – we will ensure the sustainability of our business by continuing to adopt best practice, not just in relation to environmental management, but also workforce resilience and ensuring we understand and are adapting to the needs of future stakeholders.

To support these objectives and our wider Whole Systems Strategy, in RIIO-2, we are specifically looking to deliver the following:

- *Increase our collaboration capabilities* – Whole systems thinking requires strong links between organisations to ensure effective knowledge-sharing. We will improve our capabilities around

data sharing through our focus on digitalisation and innovation in RIIO-2. We will explore technology and data capabilities to enable sensing, control and information transfer through cross connected network systems.

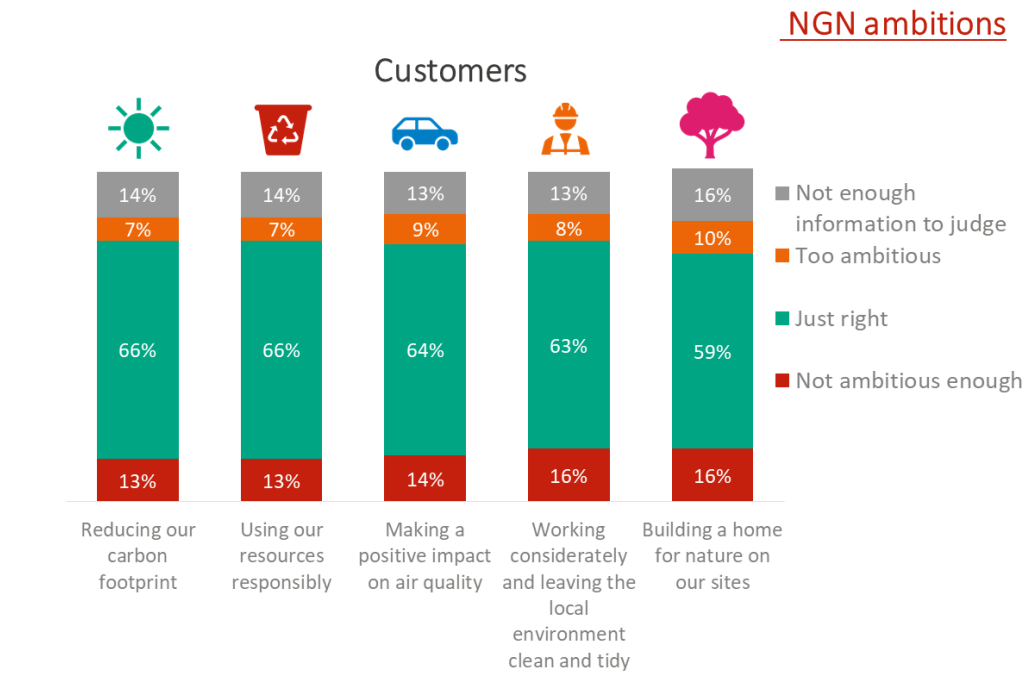
- *Embed a whole systems approach* – We are broadening our focus in RIIO-2 to include dedicated focus on Sustainable Transport Solutions, Sustainable Power Solutions and Sustainable Business Solutions, to ensure that we are embedding a truly whole systems approach across our business. We will continue to leverage third party funding to support development of our InTEGReL facility, in collaboration with our stakeholders.
- *Continue R&D investment* – We will continue to invest in delivering the safety case for hydrogen through our H21 work program. This is NGN's key contribution to demonstrating the technical feasibility of converting gas networks in the UK over to hydrogen and we note that it is a critical work program that needs to be delivered to support a government policy decision on heat.
- *Deliver a small 100% hydrogen conversion community trial* – We will deliver a small (around 300 consumer) occupied community trial on our network, subject to funding. This trial will provide significant insights into both the technical challenges and customer impacts of converting our network to hydrogen, which will help to inform future, larger-scale roll-outs across the UK.
- *Improved service levels* – We are committed to improving the level of service we provide to biomethane producers and will be implementing a range of initiatives to support a better, faster and cheaper service offering in RIIO-2 (i.e. we will make it simpler for people to connect to our grid).

Further details of our Whole Systems Enablers and identified key focus areas for RIIO-2 are provided in Part 5.1 of our RIIO-2 business plan document, with our complete Whole Systems Strategy included as Appendix A14, as summarised in Figure 7 above. Part 5.4 of our RIIO-2 business plan document also outlines our Innovation Strategy which includes environment and low carbon as a specific innovation theme.

We will report our progress against the low carbon elements of our Whole System and Innovation Strategies during RIIO-2 in our AER.

7 Stakeholder Views of Our EAP

As summarised in Figure 8, our stakeholder engagement has identified that customers and stakeholders showed a high level of approval of our EAP, with at least 70% of our customers responding that each element of our EAP proposals was 'just right' or 'too ambitious'. It was notable that feedback from stakeholders showed more caution that our proposals were 'too ambitious'.



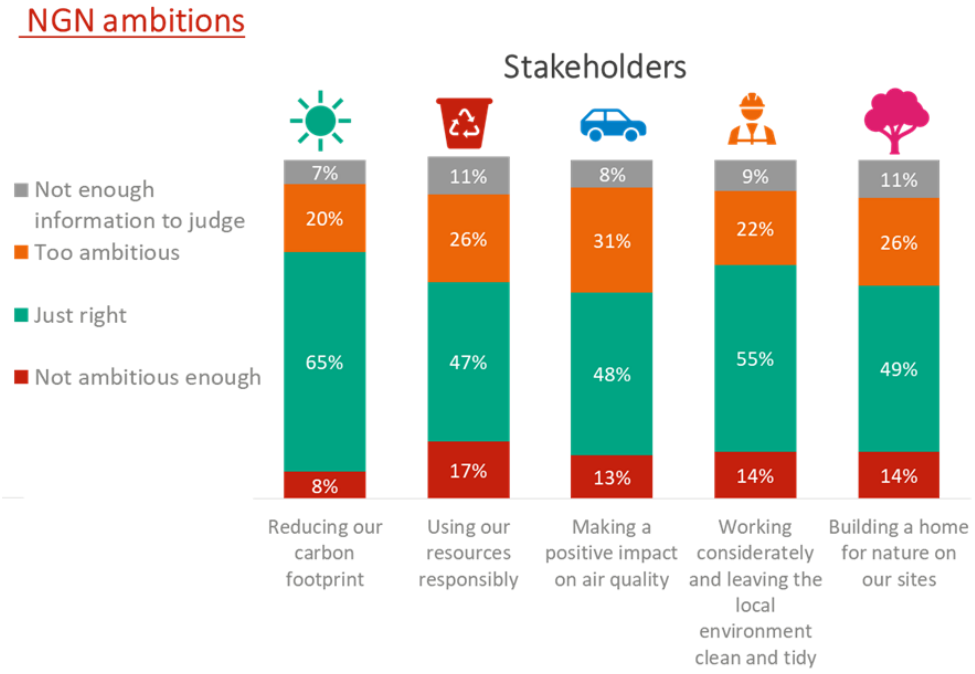


Figure 8 - Percentages of customers and stakeholders rating our RIIO-2 Environmental Action Plans initiatives as too ambitious, not ambitious enough or just right

8 Conclusion

Our Environment Strategy, launched in 2018, extends to 2050 and aims to reduce the environmental impact of our business activities across five key areas, in particular decarbonising our business to support the achievement of net zero emissions in the UK by 2050 (and earlier in some of our specific network regions). To contribute to the achievement of the long term objectives of our Environmental Strategy, we have developed an EAP which is fully integrated with our Whole Systems, Innovation and Vulnerability Strategies to demonstrate the role we will play in decarbonisation of the UK energy system to enable the achievement of net zero to the benefit of all customers and stakeholders.

Our EAP contains a suite of initiatives to be accomplished during RIIO-2 to reduce the environmental impact of our business operations, including ambitious targets to reduce our non-shrinkage Scope 1 and 2 business carbon emissions to net zero by 2030/31. Our EAP has received high levels of approval from our customers and stakeholders and our initiatives are estimated to deliver approximately 353,600 tonnes of carbon savings during RIIO-2, from £610m of investment, to support the journey to net zero. In addition, our EAP initiatives will also reduce the wider environmental impacts of our business operations during RIIO-2, including avoiding over 640,000 tonnes of natural resource use, diverting over 930,000 tonnes of waste from landfill, embedding sustainable procurement practices and self-funding the planting of 40,000 trees which will ultimately deliver £21m in societal benefits.

We will report our performance against each of our EAP commitments, in addition to our relevant whole systems and innovation activities, in our AER. The content and layout of the AER will be influenced by the needs and views of our stakeholders, including revising our EAP targets where necessary to drive continuous improvement.

Annex A – RIIO-2 Business Carbon Footprint Targets

Scope	Item	RIIO-1		RIIO-2					RIIO-3				
		2017/18 (actual - baseline)	20/21 (forecast)	21/22	22/23	23/24	24/25	25/26	26/27	27/28	28/29	29/30	30/31
1	Metered gas use	285	235	220	205	191	0	0	0	0	0	0	0
1	Operational vehicles	3,935	3,689	3,441	3,156	2,917	2,795	2,729	2,183	1,638	1,092	546	0
1	Business mileage	1,184	1,086	955	752	555	546	538	0	0	0	0	0
2	Electricity use - offices, depots and gas sites	2,019	1,730	165	158	0	0	0	0	0	0	0	0
2	Electricity use - electric vehicle charging (operational vehicles)	0	0	80	162	242	242	242	194	145	97	48	0
2	Electricity use - electric vehicle charging (business mileage)	0	0	24	49	73	72	71	355	355	355	355	0
3	Contractor vehicles - road vehicles	7,744	7,264	6,868	6,682	6,495	6,309	6,122	5,940	5,758	5,576	5,394	5,212
3	Contractor vehicles - helicopter	64	64	64	64	64	64	64	58	51	45	38	32
3	PE Pipe	5,939	5,642	5,612	5,583	5,553	5,523	5,494	5,464	5,434	5,404	5,375	5,345
3	Rail	22	22	22	22	22	22	22	22	22	22	22	22
3	Air	422	200	198	196	194	192	190	186	182	179	175	171
3	Transmission and distribution losses	182	156	14	13	0	0	0	0	0	0	0	0
Total Scope 1		**5,404**	**5,010**	**4,616**	**4,113**	**3,663**	**3,341**	**3,267**	**2,183**	**1,638**	**1,092**	**546**	**0**
Total Scope 2		**2,019**	**1,730**	**269**	**369**	**315**	**314**	**313**	**549**	**500**	**452**	**403**	**0**
Total Scope 1 & 2		**7,423**	**6,740**	**4,885**	**4,482**	**3,978**	**3,655**	**3,580**	**2,732**	**2,138**	**1,544**	**949**	**0**
Total Scope 3		**14,162**	**13,349**	**12,779**	**12,561**	**12,329**	**12,111**	**11,892**	**11,670**	**11,448**	**11,226**	**11,004**	**10,782**
Total Scope 1, 2 & 3		**21,585**	**20,089**	**17,664**	**17,043**	**16,306**	**15,766**	**15,472**	**14,402**	**13,586**	**12,770**	**11,953**	**10,783**