GAS GOES GREEN

DELIVERING THE PATHWAY TO NET ZERO

TOMORROW'S HEAT, TODAY'S OPPORTUNITY

ena energynetworks association

CONTENTS

"We all need to reduce our carbon emissions from our homes to play our part in halting climate change. But tomorrow's heat is today's opportunity. Here's our plan for how Britain's homes could reduce those emissions through the work we are delivering."

– *Chris Train OBE, ENA's Green Gas Champion*

THE CHALLENGE WE ALL FACE

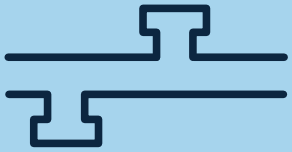
2/3s of our **national household energy demand** is met by natural gas.

85% of Britain's homes currently rely on natural gas for their energy.

55% The increase in GB energy demand during the unexpected **'Beast From The East'** cold snap of March 2018, met by gas networks, when the temperature dropped as low as **-14 Celsius**.

Britain's gas network has **284,000 km** of gas pipelines and infrastructure **worth £24BN**

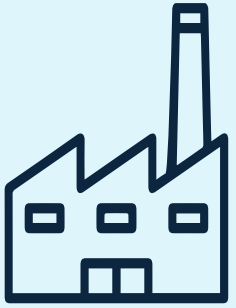
Britain's gas networks have a reliability rate of **99.9%** On average, there is an unplanned interruption to supply once every **140 YEARS**



Household carbon emissions from **heating, cooking & hot water** need to drop by **95%** in the next 30 years.

39% of Britain's final energy demand is currently met through natural gas.

6x **more energy** is delivered to Britain's homes and businesses by gas than electricity at times of peak demand.



70% of gas demand comes from households and gas-fired power stations.

WHAT IS GAS GOES GREEN?

For Britain to meet the challenge of climate change, we need to replace the carbon-emitting natural gas that 85% of our homes rely upon for heating, hot water and cooking.

We believe that the best way to do that is to replace that gas with a combination of hydrogen and biomethane, working in partnership with an increased use of electricity.

Bringing together all five of Britain's gas network companies, Energy Networks Association's Gas Goes Green programme is our response to that challenge. The changes that we will introduce through this programme will:

- Reduce carbon emissions from Britain's homes in a way that means that people can use their heating, hot water and cooking exactly as they are used to, using existing central heating systems to help keep bills down.

- Use our world-leading expertise to deliver hydrogen and biomethane to homes, offices and industry safely and securely - whilst supporting people's ability to choose the right appliances for their needs.

- Mean that Britain's gas network companies will deliver long-term, sustainable investment in communities and industries around the country, creating new demand for clean technologies and green gas, stimulating new green industries, supply chains & jobs.

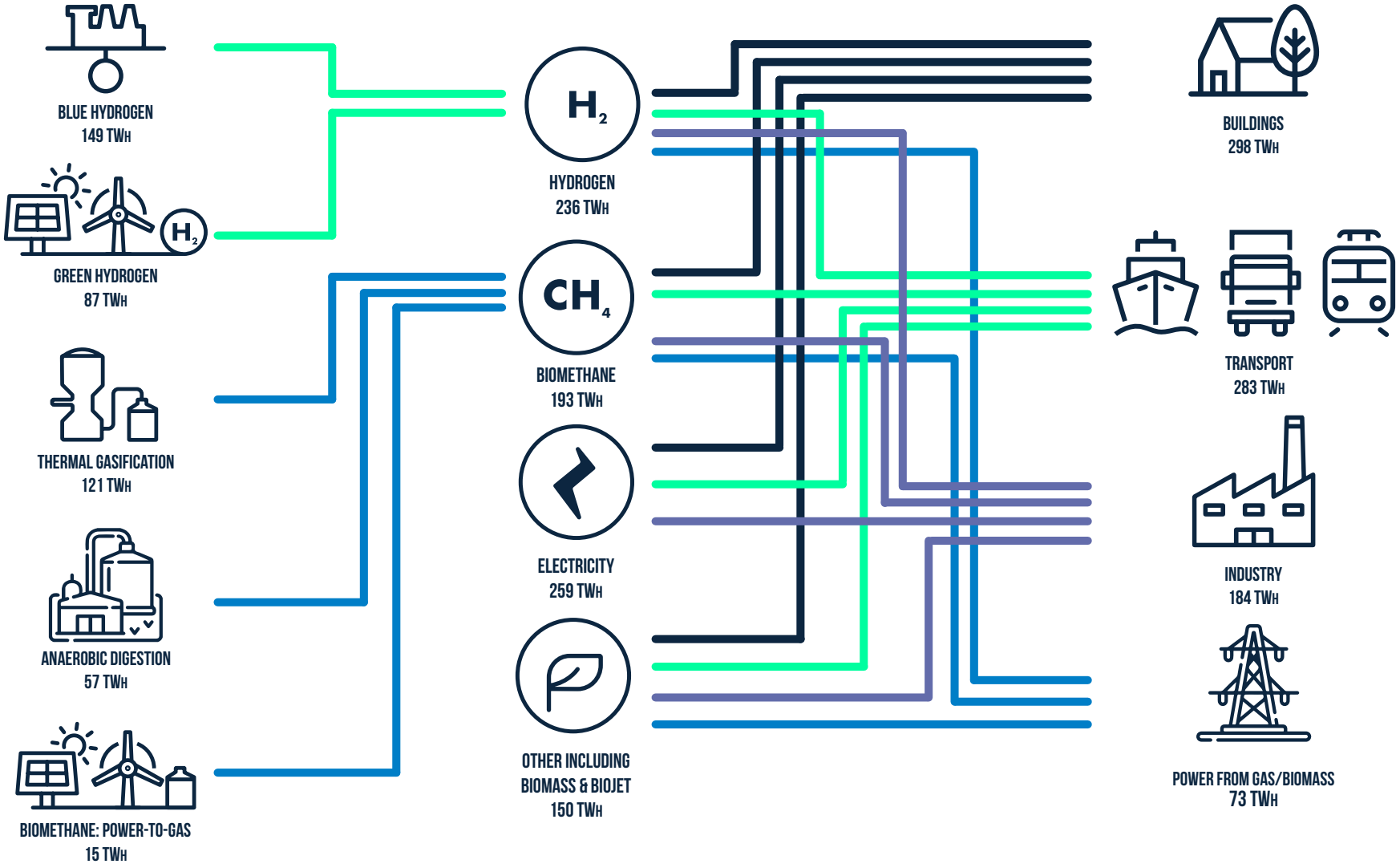
The programme will research, co-ordinate and implement the changes needed to convert Britain's world-leading 284,000km of gas network infrastructure to run on hydrogen and biomethane.

To do this, we are following the Gas Goes Green Pathway to Net Zero, which sets out the actions that need to be taken to deliver the world's first zero carbon gas grid by 2050.

If you have any questions please email GasGoesGreen@energynetworks.org. If you would like to sign up to receive updates, please click here.

HOW OUR PATHWAY TO NET ZERO WILL MEET BRITAIN'S 2050 ENERGY DEMAND

Meeting Britain's 2050 energy demand through the Gas Goes Green Pathway to Net Zero.

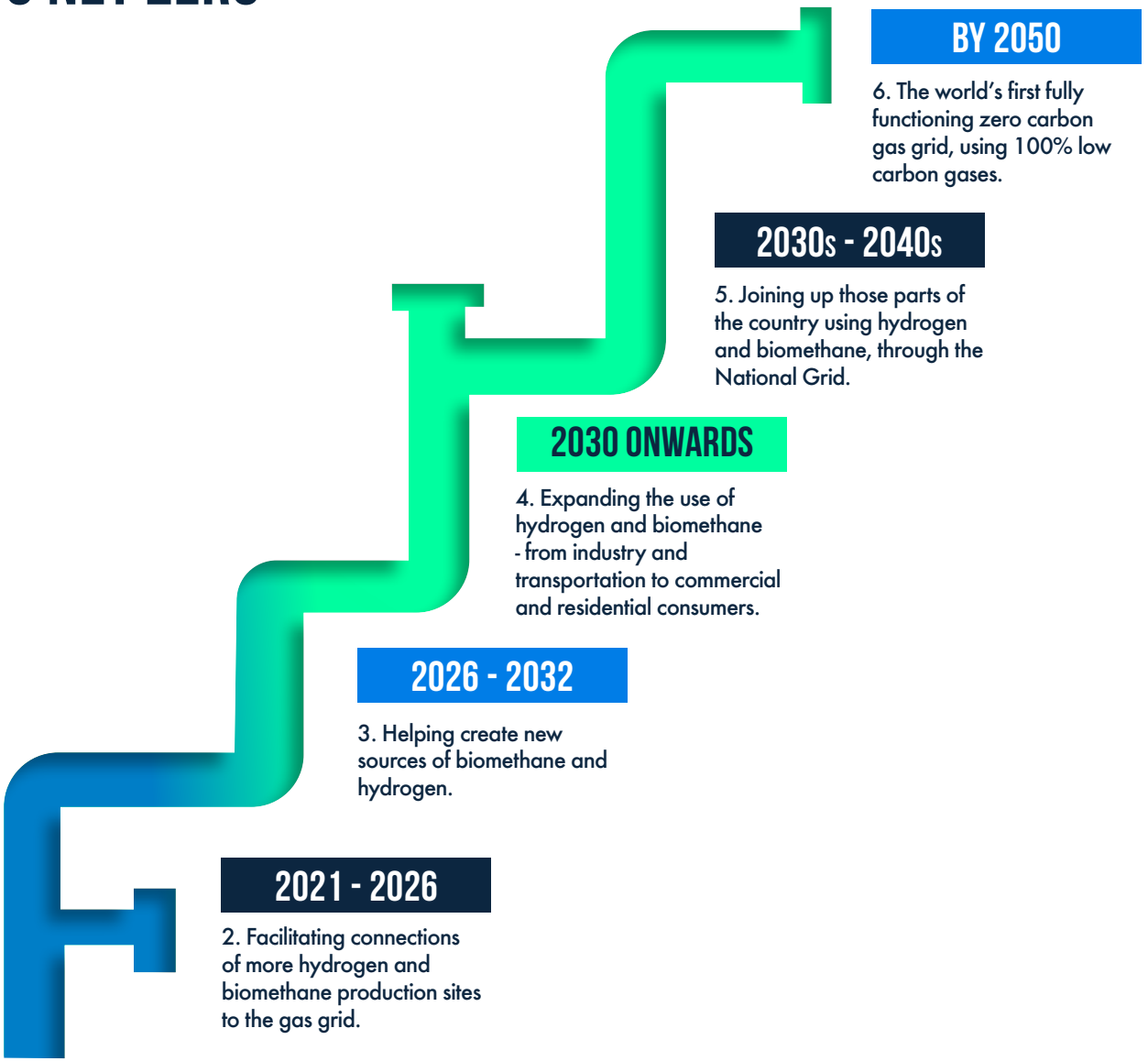


OUR PATHWAY'S SIX STEPS TO NET ZERO

The Gas Goes Green Pathway to Net Zero, commissioned by Energy Networks Association (ENA), developed in consultation with industry partners and academics and independently peer-reviewed by Imperial College, sets out a clear pathway to 2050 for how Great Britain can replace methane natural gas with a combination of hydrogen and biomethane. It also sets out how a zero-carbon gas grid can work with other parts of the energy industry to reduce our carbon emissions.

Our Pathway is a holistic one, based on the principle that if the challenges of decarbonisation are interconnected and interdependent, then so must their solutions. It sets out a vision of how hydrogen and biomethane, working in close partnership with increased electrification of our energy system, could save around £13bn a year compared to an alternative pathway that relies on electricity alone.

Our Pathway is based on Britain's gas networks working together to deliver six key stages:

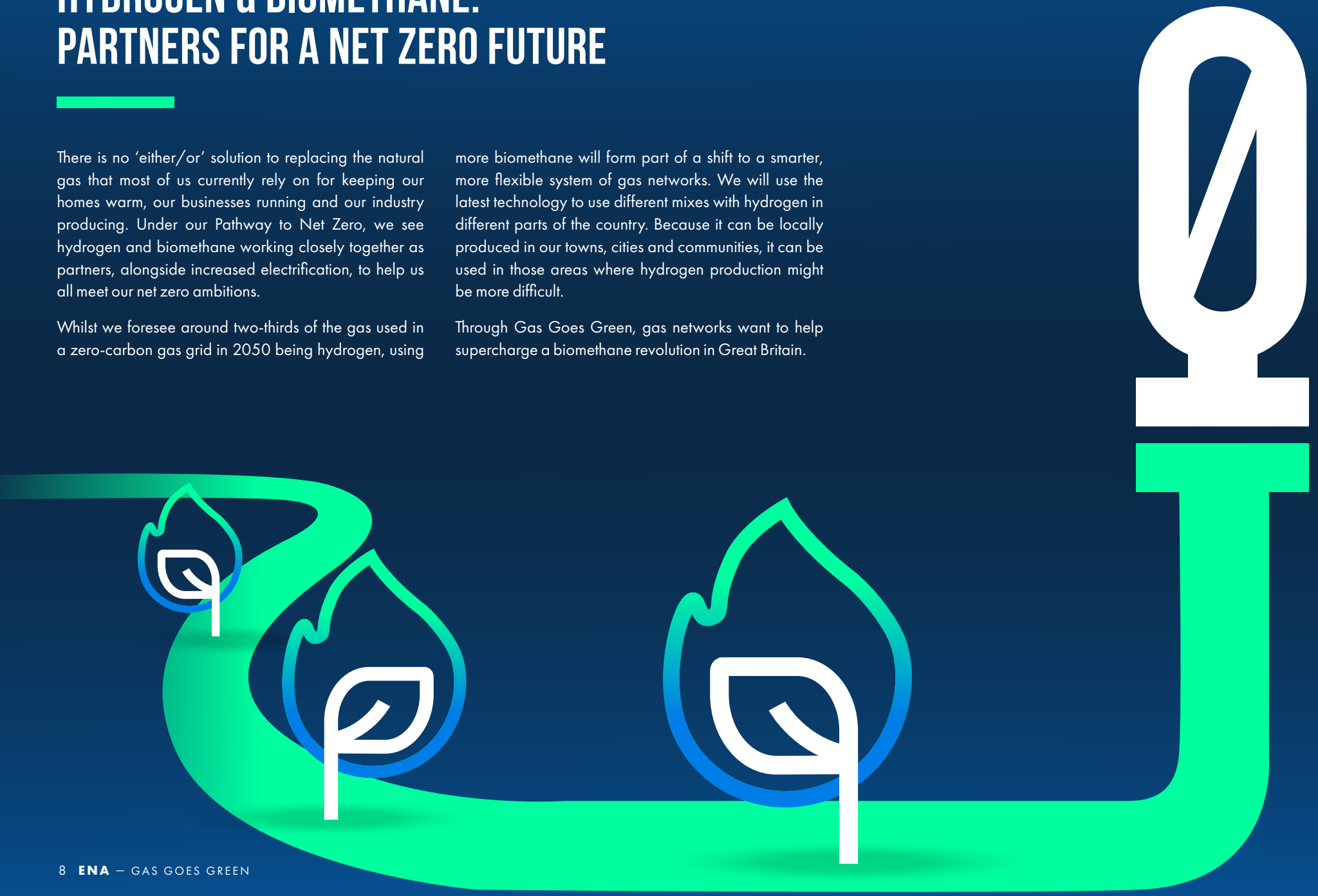


HYDROGEN & BIOMETHANE: PARTNERS FOR A NET ZERO FUTURE

There is no 'either/or' solution to replacing the natural gas that most of us currently rely on for keeping our homes warm, our businesses running and our industry producing. Under our Pathway to Net Zero, we see hydrogen and biomethane working closely together as partners, alongside increased electrification, to help us all meet our net zero ambitions.

Whilst we foresee around two-thirds of the gas used in a zero-carbon gas grid in 2050 being hydrogen, using more biomethane will form part of a shift to a smarter, more flexible system of gas networks. We will use the latest technology to use different mixes with hydrogen in different parts of the country. Because it can be locally produced in our towns, cities and communities, it can be used in those areas where hydrogen production might be more difficult.

Through Gas Goes Green, gas networks want to help supercharge a biomethane revolution in Great Britain.



WHAT ARE THE PROGRAMME OBJECTIVES?

Gas Goes Green co-ordinates the activity of Britain's £24bn of gas network infrastructure, to meet the challenges of climate change, whilst supporting policy decisions to deliver the decarbonised gas we need.

By following the Gas Goes Green Pathway to Net Zero, we will:

1. Demonstrate the role of gas in meeting net zero emissions and our carbon budgets and the importance of innovation and investment to deliver against decarbonisation pathways.
2. Work across the networks to provide a comprehensive view of key infrastructure changes required, taking a whole-systems approach which recognises the interdependence of Britain's energy and utility infrastructure.
3. Launch new projects in specific areas to address new challenges and opportunities for net zero emissions.
4. Articulate what the Gas Goes Green vision will deliver for the Britain's nations and regions.
5. Identify policy, regulatory, skills and research and innovation gaps, setting out policy options and short term 'low regrets' measures.
6. Engage strategically with the Government and across the energy industry to ensure the gas networks are delivering their objectives.

The Gas Goes Green Advisory Group, made up of representatives from across industry, academia and policymaking circles, allows stakeholder input to programme developments and will report back the progress of the programme to the wider industry. It provides input to the Gas Goes Green Steering Group, on the overall project scope, progress, risks & issues, as well as on workstreams, with comments and feedback on deliverables, as outlined in the Terms of reference.

The Advisory Group is essential to our programme, to:

- Give our stakeholders the opportunity to provide early input and improve the quality of our deliverables.
- Help stakeholders increase their awareness of Gas Goes Green and upcoming activities.
- Increase awareness about programme opportunities and risks, and support collaboration wherever possible.

Many of our stakeholders are also a part of ENA's joint gas and electricity network Whole Energy Systems Group. This Group explores the value of integrating the way our energy networks more closely together. It reports to both Gas Goes Green and Open Networks Steering Groups.

2020: OUR FIRST YEAR IN REVIEW

Our Gas Goes Green programme launched in April 2020. In its first year it has firmly established itself as a leading source of industry learning, knowledge and expertise, at the vanguard of Britain's nascent hydrogen revolution. In this first year, we have focussed on Step 1 of our six-step Gas Goes Green Pathway to Net Zero, the Planning & Research phase that is necessary to fully understand and address the challenges and opportunities before us.

Our Zero Carbon Commitment set out the investment that Britain's gas network companies propose to deliver between 2021 and 2026 in world-leading network innovation projects that will allow the country to meet the challenges we face and maximise the opportunities before us. Set out across four areas, these projects will enable Britain's gas network companies to complete Steps 1 and 2 of the Gas Goes Green Pathway, to prepare for the net zero transition and facilitate more green gas connections.

For the first time, we provided an industry-wide view of progress in installing new, hydrogen-ready gas pipelines in local gas distribution grids, helping inform future decisions in this area. Through the Iron Mains Risk Replacement Programme, 60,000km of pipelines have been installed, enough pipeline to go around the world's equator one and a half times. Emissions from methane-natural gas, whose climate-impact is thirty times greater than that of carbon, have fallen by a fifth.

2020: OUR FIRST YEAR IN REVIEW

Stakeholder engagement is at the core of our Planning & Research phase, and in autumn of last year we formed the Entry Customer Forum to bring together the gas network companies, green gas producers, energy suppliers and equipment manufacturers to provide a new forum for raising and resolving issues preventing gas producers from connecting to the gas grid – ultimately giving GB more green gas. The Forum has received several proposals from its membership of gas networks, green gas producers, equipment suppliers and representative trade associations, and is addressing these collectively as an industry.

We also published Britain's Hydrogen Network Plan, bringing together the detail of the work being undertaken and planned by Britain's five gas network companies in relation to hydrogen into one, go-to place, matching it with four key principles to guide that work going forward. Our Plan will turn the government's Ten Point Plan for a Green Industrial Revolution into a reality, building on the experience the gas network companies have built up so far.

2021 will also see the completion of the Decarbonisation Pathways for Scotland and Green Gas Transport Pathways.

As we continue to progress through the first step of our Pathway, and look towards the next steps, this activity has been supported by a number of other announcements from GGG and our member companies, including:

- Two, in-depth studies as part of our 'Hydrogen: Cost to the Consumer' series, setting out the detail of hydrogen production needed for the UK to reach its net zero carbon emissions target and the associated costs and benefits of investment to energy billpayers.
- Two of our members' innovation projects, SGN's H100 & National Grid's FutureGrid, received a £27m funding boost from the energy regulator, Ofgem – enabling gas network companies to investigate the delivery of renewable hydrogen and how to prepare the national gas transmission grid for hydrogen.
- With Cadent Gas Ltd, Gas Goes Green published an in-depth pathway to introduce the blending of up to 20% of hydrogen into Britain's gas grid, setting out the associated actions for government, industry and gas networks.
- The H21 Project published its ground-breaking social science research with Leeds Beckett University, into the public's attitudes towards hydrogen. The research found that cleaner hydrogen energy systems to heat homes would be supported by the public - but that steps need to be taken to ensure customers aren't left behind in green energy discussions.

Cadent
Your Gas Network

nationalgrid

Northern Gas Networks

SGN
Your gas. Our network.

WALES&WEST UTILITIES

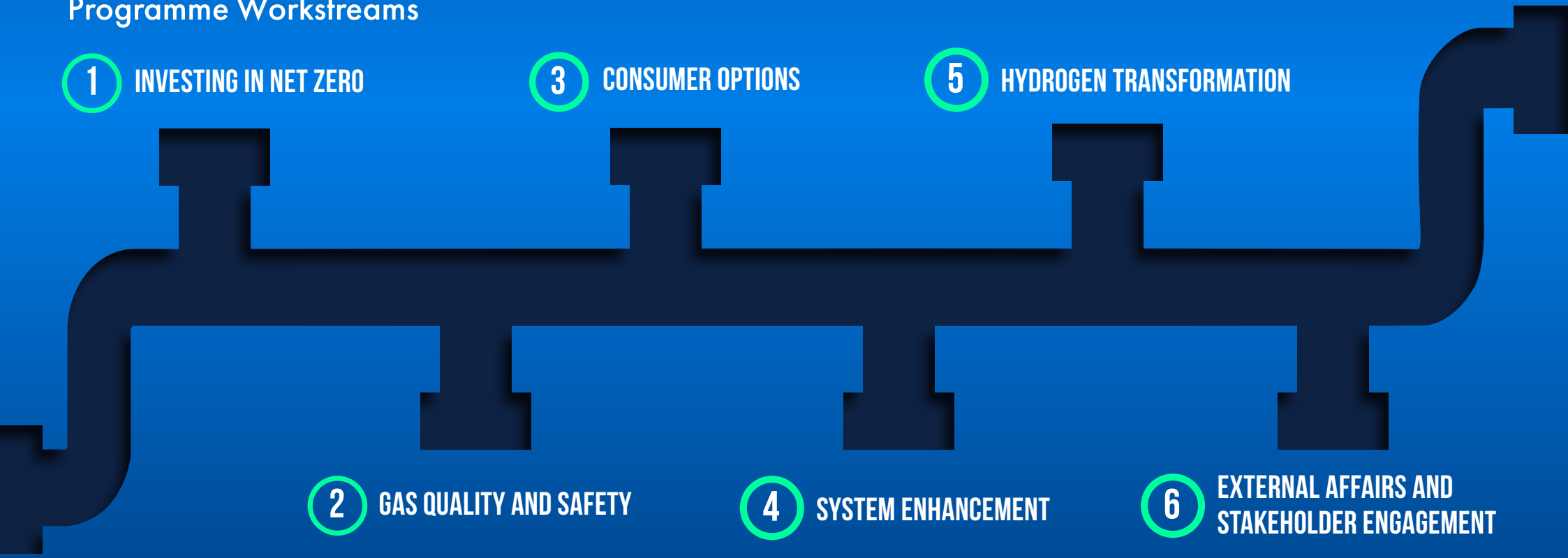
GAS GOES GREEN PROGRAMME SCOPE

In 2021, we will continue to make progress in the Planning and Research phase of our Pathway to Net Zero, whilst taking the first steps in the second phase, Connecting More Green Gas Plants.

The scope of work for Gas Goes Green is allocated across six workstreams, each of which supports the programme's objective to creating the world's first zero carbon gas grid.

This document sets out the details on the work being taken forward under each workstream in 2021, in line with the first two steps of our Pathway to Net Zero.

Programme Workstreams



HOW THE PROGRAMME WORKS

Britain's gas network infrastructure is a major national infrastructure asset, operated by network companies on behalf of the country. As we set out in Britain's Hydrogen Network Plan, our work to deliver the Gas Goes Green Pathway to Net Zero is guided by four key principles, which are to:

- Ensure the safe delivery of hydrogen and biomethane to our homes, businesses and communities.
- Maintain the security of energy system, to ensure gas networks have enough capacity to meet Britain's energy demands using hydrogen and biomethane.
- Work with people's needs, to ensure that people and businesses have a choice of different low carbon technologies – in our homes, our offices and factories, as well as on our roads.
- Deliver green jobs and investment, through the extensive reach of our world-leading network of gas infrastructure.

Ensuring we have the right governance in place is therefore key for the programme. We will provide this principally through two groups:

1. The Gas Goes Green Steering Group - The gas networks meet quarterly to monitor progress and review programme deliverables.
2. The Gas Goes Green Advisory Group - The programme's Advisory Group provides opportunity for regular stakeholder input and feedback on progress to date. The Group will meet quarterly. If you would like to register your interest in joining the Advisory Group please email GasGoesGreen@energynetworks.org

WORKSTREAM 1: INVESTING IN NET ZERO

This workstream considers the decarbonisation commitments made by the networks for RIIO2, for the period 2021-26, as well as future investment work that may be required to deliver net zero. Deliverables in this workstream will examine the role the gas networks have in delivering the cost optimal route to a net zero future in a balanced energy system.

1.1 – Energy Networks Association's Strategy for Net Zero

Working across ENA's membership and engaging with stakeholders throughout the energy industry, we want to develop a whole systems net zero strategy for electricity and gas networks. We will investigate the policy and regulation required to get us there and the investment required.

1.2 – Zero Carbon Commitment: 2021

Since our original Zero Carbon Commitment was published in spring 2020, gas network companies have received the final determinations of how much funding is available to them under the RIIO-2 price control. We will examine our Commitment in light of this, examine achievements to date and reaffirm our ambition. The 2021 update to our Commitment will set out the shared vision the gas networks have for achieving net zero and the funding it will require under the price control system.

1.3 – Local, regional and national pathway and planning studies

At the centre of Gas Goes Green is the shared pathway to transition the GB energy system to net zero. This establishes high level pathways for achieving net zero emissions for buildings, transport, industry and power. Local, regional and national studies provide opportunity to build on this learning, providing greater detail on particular sectors or geographies.

WORKSTREAM 2: GAS QUALITY & SAFETY

Deliverables in Workstream 2 will prepare for the transition of the gas network to enable low carbon gases of biomethane and hydrogen to be transported and distributed safely and to a maintained quality. This is a first step that needs to be taken in this area of the pathway to net zero.

2.1 - Blending delivery timeline

Following the HyDeploy trial and the Government's commitment to blending in the Ten Point Plan for a Green Industrial Revolution, this deliverable will set out the gas network vision for introducing hydrogen blends. As well as timelines this work will set out impact and opportunities on green gas producers and customers.

WORKSTREAM 3: CONSUMER OPTIONS

Deliverables here will evaluate the implications on consumers of net zero compliant gases and whole systems interfaces.

3.1 - Cost to Consumer

We will update our Cost to Consumer analysis following updates to a number of key assumptions such as cost of conversion to distribute hydrogen and energy storage, as well as new scenarios from the Climate Change Committee's Sixth Carbon Budget advice to government.

3.2 - A proposed licensing regime for industrial cluster hydrogen infrastructure

While the operation of a large-scale hydrogen pipeline system is a licensed activity, the likely business model to support hydrogen as a fuel, and the initial unconnected nature of the various Industrial Clusters SuperPlaces, means that the current gas system arrangements may not be applied. This deliverable will evaluate whether existing licences are adequate and, if new Licenses are required, review the roles, responsibilities, powers, duties and obligations required for the network companies involved.

3.3 - Decarbonising off grid communities

To demonstrate the long-term role of gas in the net zero energy system we will undertake an assessment of whole systems decarbonisation options for off gas grid communities. As well as gaining a better understanding of the emissions reductions that could be delivered this work will provide analysis of any impact of fuel poverty.

3.4 - Impacts of reducing gas demand

This deliverable will develop a bespoke modelling tool to provide a robust view on network decommissioning costs, taking into consideration the full range of network assets as well as wider social and economic impacts implications.

WORKSTREAM 4: SYSTEM ENHANCEMENT

This workstream is focused on enhancing the energy system to facilitate low carbon and renewable gas, to make it easier for new connections to connect, to reduce costs and to improve system operation to accommodate different gases.

4.1 Supporting green gas producers

ENA launched the Entry Customer Forum in October 2020 to support gas connection processes, development of standards, and associated commercial arrangements to promote standardisation across the networks. The scope of the Forum includes the application and assessment process, the construction and initial connection to the gas grid, ongoing operation of entry gas connections, and changes through the lifetime of a facility. It will continue to meet monthly in 2021, and we will publish the outcomes of the changes delivered through the Forum and milestones achieved as a result of its input.

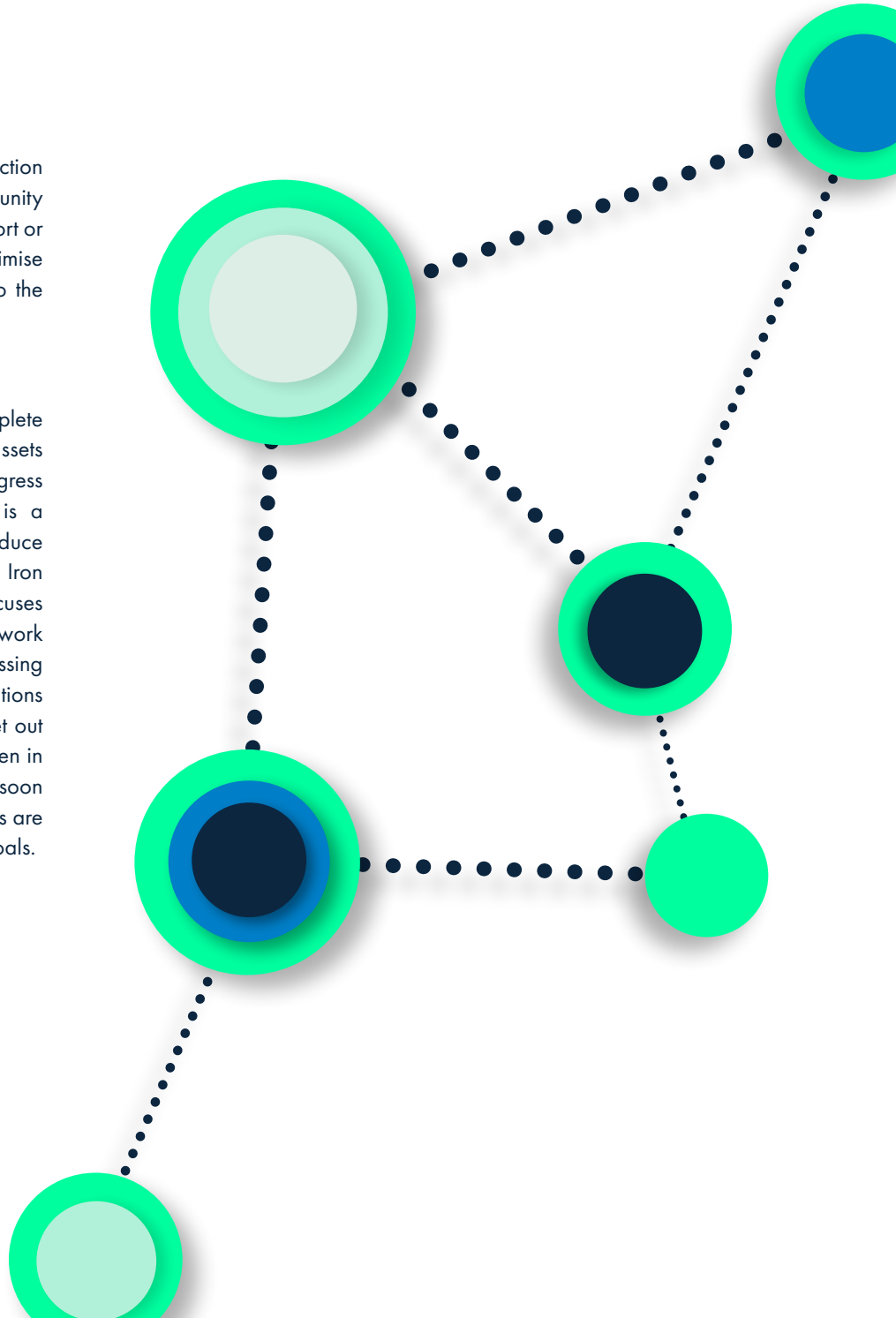
If you would like to register your interest in joining the Entry Customer Forum please email EnCF@energynetworks.org

4.2 Assess opportunity for CHP engine plant on electricity tariffs

This deliverable will assess the opportunity for biogas plants to be converted into biomethane facilities. We will investigate the number of biogas CHP plants on ROC in each gas network and across GB and the remaining length of their tariff support, the remaining asset life of biogas consumption assets, and typical conversion costs for gas grid entry – looking at both on-site gas grid entry and shared biomethane upgrade and injection hub approaches. As well as the size of the opportunity this work will consider what appropriate tariff support or other funding mechanisms may be required to maximise the biomethane resource that can be injected into the gas networks.

4.3 Reducing network fugitive emissions

Fugitive emissions are an important issue with incomplete combustion and venting from gas network assets contributing to climate change. To support progress towards net zero carbon gas networks, there is a requirement to identify, model, quantify, control, reduce and report fugitive emissions. In addition to the Iron Mains Risk Replacement Programme, which focuses on low pressure mains and services, the gas network companies have innovation projects addressing medium pressure mains and above ground installations leakage. When these projects conclude we will set out our view on what further work should be undertaken in this space through a Gap Analysis. We will also soon be publishing a report on how the UK gas networks are contributing to the UN Sustainable Development Goals.



WORKSTREAM 5: HYDROGEN TRANSFORMATION

The gas networks have been working together to provide the necessary technical, safety, quality and financial evidence to demonstrate the viability of using the gas networks to transport and distribute 100% hydrogen through existing and new networks.

5.1 Delivering joint government/industry hydrogen programme activity

In Britain's Hydrogen Network Plan, we set out our vision for a hydrogen network and how we would deliver it. We will continue to make progress against our Plan throughout 2021 including through our support for a range of joint government/industry hydrogen activity relating to both hydrogen blends and 100% hydrogen networks, coordinated through Gas Goes Green.

5.2 Hydrogen connection agreement

A Network Entry Agreement will need to be developed for hydrogen blending and 100% hydrogen connections to address network configuration, the gas quality specification, the physical location of the injection/delivery point and the standards to be used for both gas quality and the measurement of flow. This deliverable will establish the principles that need to underpin these Agreements to ensure they are standardised across gas networks from the outset.

WORKSTREAM 6: EXTERNAL AFFAIRS & STAKEHOLDER ENGAGEMENT

This workstream will receive feedback on the programme and will engage stakeholders on the environmental, economic and social benefits of a decarbonised gas grid.

6.1 Green gas and power generation data

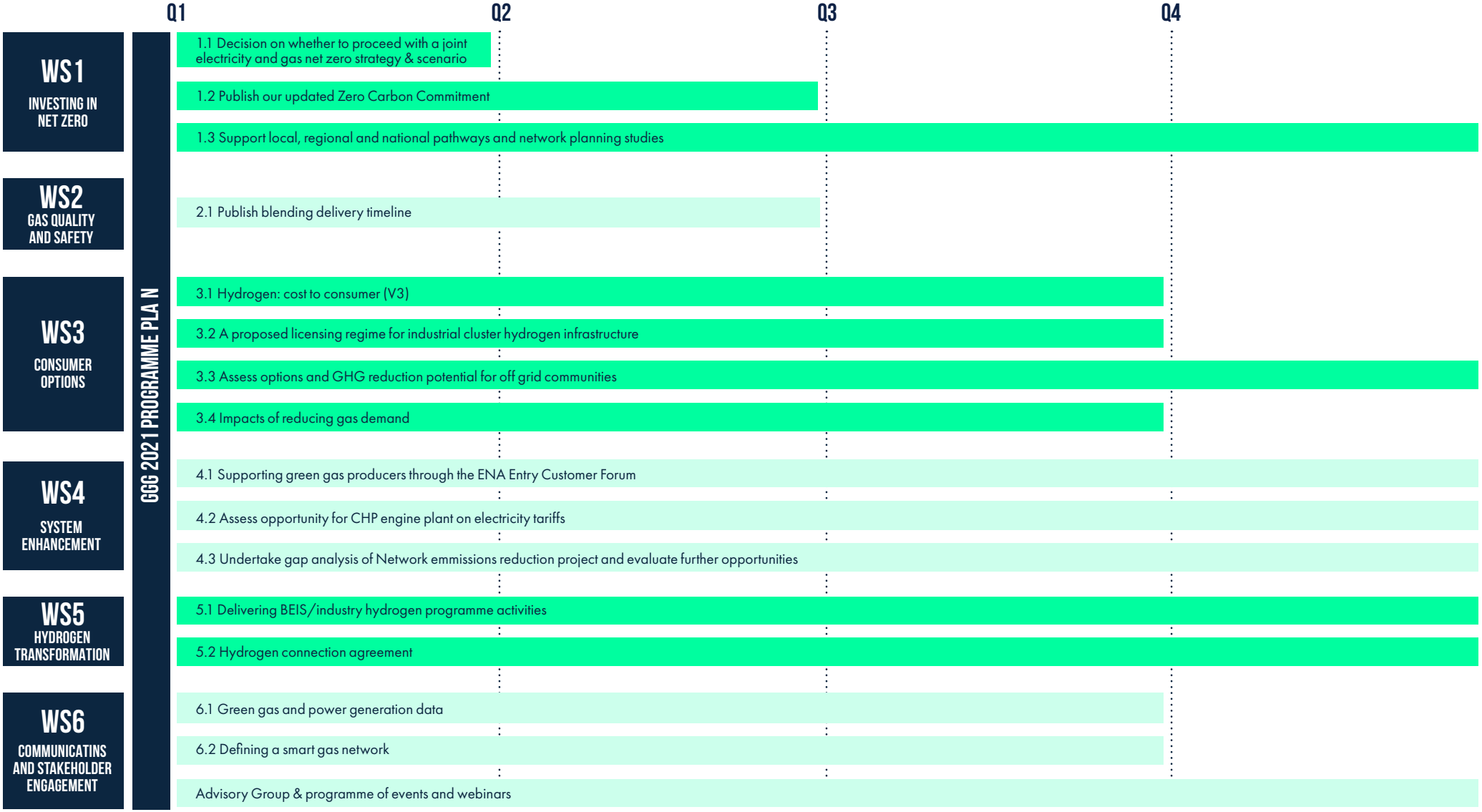
We want to reflect the progress being made to deliver net zero and will be developing a central data source for all green gas network data. We will develop and launch a new public reporting mechanism using data on details such as percentage of polyethylene hydrogen-ready network, green gas flow and power generation connections.

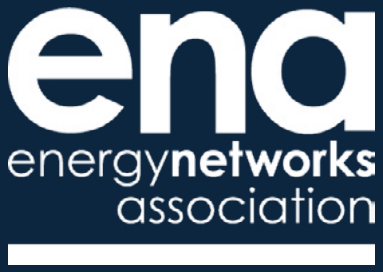
6.2 Defining a smart gas network

This deliverable will evaluate how the gas network is run today to manage supply and demand and how, as the networks continue to become smarter, this may change going forward, including pressure management and real time modelling of gas flows.

TIMELINE

The following table shows the Gas Goes Green work programme for 2021.





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