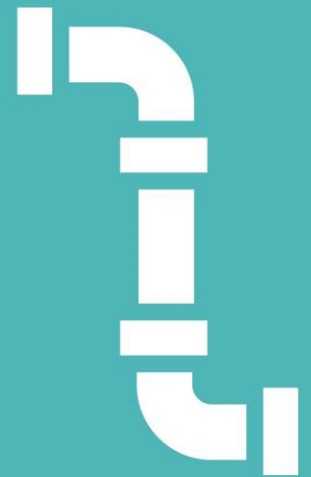




# Appendix 13F: Whole system work



### Legal Notice

This paper forms part of Wales & West Utilities Limited Regulatory Business Plan. Your attention is specifically drawn to the legal notice relating to the whole of the Business Plan, set out on the inside cover of The WWU Business Plan. This is applicable in full to this paper, as though set out in full here.

## 1 Introduction

This appendix supports Chapter 13 of our business plan, which sets out our net zero ready vision for 2035.

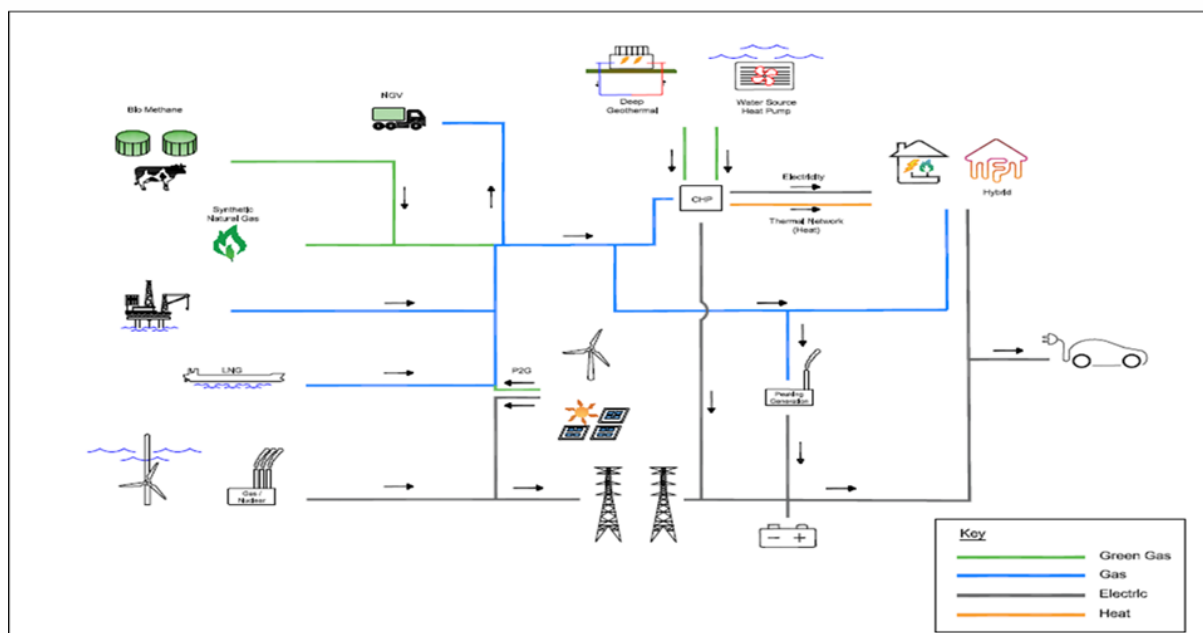
As Appendix 13A outlined, since 2015 we have been undertaking a programme of engagement, research and analysis to drive forward our understanding of the future of energy debate and to identify low-cost, sustainable and reliable decarbonisation solutions.

This appendix explains the way in which we have worked with others to understand whole system operation, and outlines how we will further demonstrate our commitment in this area.

## 2 WWU whole system definition

A whole systems approach considers all energy demands, all energy supplies and the networks that join them together. So, a whole energy system will include appliances such as heating systems and transport, as well as sources of generation such as wind, tidal and green gases. The network will include provision of storage, flexibility and the means to connect everything together in a reliable way. Networks in a whole system take responsibility for operation of the system and balancing. In addition, the market that controls these interactions is an essential part of the whole system.

from a network's perspective, this process can be represented as shown below:



Simple examples of whole system thinking will include:

- How vehicles can provide storage and can recharge when electricity is cheap and green.
- How multi vector heating systems switch between say wind and green gas depending on the carbon content of the grids and the balance of renewable energy generation.
- How we can the best use of technologies, using one to mitigate the shortfalls of another at different times – for example using the gas grid for its huge biogas storage potential, and using the electricity grid to utilise renewable electricity.
- Understanding how the market can provide flexibility and minimise investment.

Whole system thinking will enable the lowest cost pathway to be identified, making best use of each resource or technology. It is more challenging than traditional approaches as it requires more complex thinking and involves multiple parties; however, the improvements in cost and reliability pay back the investment.

In addition to the above, some selected areas outside the above definition can be helpful, such as waste streams that can be turned into low, zero or negative carbon energy or carbon capture use and storage technology.

In the context of housing, taking a whole system approach will optimise the costs to consumers of energy, considering not only the investment required in the home, but the costs of energy production and network charges, both of which are passed on to the consumer by their energy supplier. Studies published by the UK Committee on Climate Change (June 2018) identify significant savings by adopting such a whole systems approach, noting that a hybrid heat decarbonisation pathway is the lowest cost.

Past research and analysis by gas networks that will be utilised in GD2 include:

- Regional FES – Regen – 2019  
This work researched the symbiotic relationship between the electricity and gas networks. In GD2, the analysis will be developed by WWU in association with Western Power Distribution to inform both GD2 and ED2 investments.
- Pathfinder Simulator – A whole system simulation model – 2018  
The Pathfinder simulator has been upgraded to Pathfinder Plus, which will be licenced at no cost to local organisations to develop agreed whole system solutions.
- Cornwall Energy Island – 2016  
The first attempt to model a whole system, this project demonstrated how storage could enable a decarbonised county, but also how this could be unaffordable. The project pointed the way to a balance of generation and demand, enabled by flexibility, which would include storage. In GD2, it enables the value of each element of a whole system, rather than cost.

Research and analysis – Joint with DNOs

- Project Freedom – The development of smart hybrid heating systems – 2018  
This ground-breaking project provided information that can now be used by a wide range of organisations to understand how the widespread roll out of hybrid heating systems could facilitate low carbon heating at the lowest cost.
- Green City Vision – the whole systems design of an existing small city – 2019  
The template developed to design Swindon and its surroundings can be replicated in GD2 and ED2 to identify the best local and regional solution.



### 3 Whole system principles

The overarching principles utilised within WWU that we will take through RIIO GD2, ED2 and beyond are summarised below:

- The goal is to provide national and local decision-makers and stakeholders with robust information to allow them to make the right investment decisions on energy to achieve net zero securely and at lowest whole system cost.
- Provide open access to our research and key people to provide expertise that others may not have.
- Collaboration. We recognise that our people, our network and our services are one component of a large set of factors that stakeholders take into account when making energy decisions.
- Listening and learning culture. We are continually learning and improving our understanding of the challenges and opportunities facing our stakeholders and decision makers. Our engagement on the 'Pilot Bridgend Study' (2014 to 2018) with Energy Systems Catapult, the Welsh Government, Local Council, Cardiff University, National Grid Transmission and WPD has been crucial in shaping our principles.
- Outcomes focused – we aim to publish and encourage all others to publish outcomes of learning impacts (bills, carbon and reliability) to grow the knowledge base for all to use.

#### 3.1 Joint planning with other network companies and/or the system operator

Our principles and learning to date have driven us to engage with; and well beyond other network companies and the national Grid System operator. In summary our RIIO GD2 plans include:

- Continued leadership and engagement through the Energy Networks Association Future of Energy groups – we already lead a workstream for the electricity focused 'Open Networks' project. Through the ENA, we engage and will continue to engage with all gas and electricity networks (transmission and distribution).
  - We are committed to developing iterations of the 'single scenario work'
  - We are committed to work on the annual and national 'Future Energy Scenario' publications for each year of RIIO GD2 and beyond
  - We are committed to working with DNOS to help inform RIIO ED2
  - We are committed to delivering and funding joint network publications such as 'Pathways' which provide national insights into future whole system solutions
  - We are committed to innovating and researching on cross sector solutions utilising the ENA gas and electricity innovation forums already in place
  - We are committed to working collaboratively on data and digitalisation strategies to deliver valuable and effective data outcomes for all stakeholders – building on the EDTF publications.

#### 3.2 Joint planning with others

We see our role in joint planning continuing to be much wider than just other networks in GD2 and we commit to extending this as follows:

- Academia

We recognise the ability of academic establishments to look over the horizon and to provide the impetus for early stage innovation. In GD1 we started this engagement with extensive contact with our local universities, in addition to some of the wider academic community, for example:



## Whole systems work

- Supergen Hub Advisory Group membership
- University of South Wales CAPSE Board member
- Nottingham University – storage and flexibility work
- Cardiff University liaison on whole systems modelling
- Bath University SWOP project
- South Wales Universities Flexis steering group member

We will continue to develop our relationships with this sector and seek to maximise the mutual benefits.

- Key national energy groups

We will continue to provide support to key national energy groups:

- We commit to being an active member of Parliamentary groups on energy in order to:
  - Gain insight from the group
  - Provide expertise and support
- We will take a proactive role in other national and local groups, such as the Energy Research Partnership, the Academic Supergen Hub, Local Enterprise Partnerships and Combined Local Authority groupings.

- Climate Change Committees (national and regional)

We have an established relationship with the Climate Change Committee and will continue to work with them to:

- Support with insight and reports during GD2
- Provide support to our stakeholders by interpreting CCC recommendations for them – for example, the Welsh Government and TATA

- Regionally based energy system planning groups.

We will continue to develop our own regionally based forecasts and are developing our Gas 'long term outlook' into a Regional Energy Outlook with WPD, NTS (gas and electricity) and Scottish Power Electricity Network In addition:

- We are committed to supporting the Welsh Government and South West forums as they develop their responses to the net zero challenges. We already support cross sector working groups and will continue this through GD2
- Building on the pilot Bridgend Study we will develop resources to support Local Area Energy Plans.
- We will support Hydrogen Cymru, a new cross vector group that will explore the opportunities and challenges for hydrogen across Wales.

- Our key customers

We are already working with our major customers such as TATA steel and Severn Power Station with National Grid, WPD and their stakeholders to support their needs for getting to net zero. We plan to continue this into and beyond GD2. We are already on the Flexis advisory board and are helping this group to develop the outcomes required from its own funded research.



- Green gas and electricity generators

We will support organisations such as the Anaerobic Digestion and Biomethane Association, the Institute of Welsh Affairs and Regen that are not for profit organisations devoted to the decarbonisation of the UK economy.

### 3.3 Identification and adoption of whole system solutions and approaches

We have engaged widely over GD1 in whole system solutions, working closely with the partners described above. The investment we have identified for GD2 in Chapter 13 of our business plan (our net zero ready vision) has been derived from the needs of others to decarbonise power, heat and transport using the following principles:

- Only proposing investment where a gas solution represents the best solution in customers' interests, for example providing backup for renewable generation via distributed generation.
- Identifying the least risk option. For example, examining both market solutions and investment solutions (such as holding flexibility auctions in 2019).
- Identifying the impact on consumer bills.
- Setting out the wider system business case using the Customer Value Proposition (CVP) process. This cost benefit analysis also identifies the value of the investment in both cost and carbon terms.

### 3.4 Value of consumers and wider society, uncertainty and mitigation

The GD2 business plan has for the first time placed a value on our proposed investment in terms of cost benefit (for consumers) and the carbon benefit (for wider society). The methodology is set out in the CVP section and appendices, but in simple terms it:

- Identifies the investment needed for a gas distribution solution as requested by the relevant stakeholder (for example power generators or biomethane plants).
- Assesses the cost to the consumer per annum.
- Completes a cost and societal benefit analysis of the whole system benefits and compares this with other solutions.
- Allocates the contribution of the parties involved in the solution in addition to the GDN, for example, biomethane producers, innovators, electricity distribution networks.
- For the GDN allocation, provides the investment leverage, i.e. for every pound invested, how many pounds are saved or offset, including those across the whole system, say in avoided additional costs to consumers.

Uncertainties are inherent in this area as current policies, regulation or charging methodologies are still developing to achieve the net zero ambition. The following principles have been used to mitigate this uncertainty:

- No base funding has been proposed in GD2.
- An uncertainty mechanism has been proposed to ensure that consumers are protected.
- Short term market-based solutions will be sought to avoid long term investment stranding risk.



### 3.5 Societal and broader economic benefits

We have sought in GD1 to quantify the costs and benefits of solutions using the Pathfinder simulator. This has recently been upgraded to include more detailed costs and carbon benefits of scenarios analysed. This will be utilised in GD2 to evidence and quantify the impacts of proposed solutions. In addition, the CVP calculations include the value of carbon as well as costs. As an example, the benefits of connecting heavy transport to the gas grid to utilise compressed methane vehicles has included the carbon dioxide benefits and in future will include the clean air benefits by valuing NOx emission reductions.

We are committed to developing appropriate funding mechanisms to allow Ofgem, BEIS, the Welsh Government and local authorities to make effective investment decisions. We are proposing a net zero funding mechanism which is new and would be applied to all sectors as part of GD2. This is covered within the uncertainty mechanisms chapter of our business plan.

We are also committed to being a support partner for bids into BEIS/Welsh Government funding where there is potential energy benefit to our involvement. For example, the Milford Haven Energy Kingdom. We will also support bids outside of our geographical areas where our expertise is valued. For example, BankEnergy in London.

### 3.6 Justification and costing of net zero proposals

The investment proposals incorporated in the business plan have been designed with the following principles:

- Cost benefit analysis (CBA)
  - CBA has been conducted on a bespoke whole system basis, valuing each investment category against alternative whole system approaches.
  - As more detailed Local Area Energy Plans are developed, these CBAs will be rerun to account for emerging technology or cost changes to alternative scenarios.
  - Prior to investment approval the usual mechanisms for approval will be applied, such as costs and engineering justification.
- Consumer benefits
  - Future bills have been assessed to ensure actions taken today do not result in major increases to future bills.
  - Environmental impacts have been assessed, such as carbon and clean air benefits.
  - Whole system reliability is maintained, for example we have ensured that power generation is reliable in a suggested scenario (Pathfinder Plus assesses the future number of blackouts in any scenario).
  - Benefits have been calculated in three timescales – the immediate benefit in GD2, the benefits to 2050 and the benefits over the life of the asset.
- The contribution of other sectors
  - It is recognised that WWU is just one part of the decarbonisation equation and other parties will contribute. For example, in heating we have identified six other parties that should take an equal share in the credit accrued.
- The value to other sectors
  - We recognise the value to other sectors, such as reliable power generation and decarbonised transport.



### 3.7 Coordination and agreement with others

- In GD2 we have worked with others to formulate options to decarbonise the economy, initially with two sample areas, Cornwall and Swansea. These two pilots paved the way for the more detailed analysis conducted with SSEN to assess the best future for Swindon and surrounding areas as part of our Green City Vision project. This project made significant progress on both identifying an optimised solution and creating a proposal that can form the basis of both GD2 and ED2 investment.
- In GD2 we will continue this work on the back of the Regional FES project, which facilitates the opportunity to replicate this work across our entire network.

### 3.8 Market based solutions

- Market based alternatives for investment in GD2 have already been investigated and will be utilised where they present a realistic alternative that meets the objective.
- In GD2, more market-based alternatives will be explored, for example how a flexibility market could emerge, facilitated by smart meters.

### 3.9 Net zero and business as usual

- Investment to create a net zero ready network has been considered separately from our business as usual activities
- Business as usual activity, such as creating a low cost, low carbon network (for example the repex programme) has been incorporated into base allowances.
- Investment beyond this, to facilitate renewable power generation, decarbonised heat and transport has been identified clearly in the net zero chapter.

## 4 Whole Systems Charter

To further demonstrate our commitment, we propose a whole systems charter to underpin our approach to whole systems planning. The charter will commit us to work with all stakeholders to create customer focused, least cost and joined up solutions to deliver net zero:

1. Stakeholder engagement  
Identifying stakeholders and partners in developing local and regional approaches. Understanding their needs and contribution. Acting as a bridge between local and national requirements, therefore engaging with National Grid as part of this process.
2. Data and information sharing and innovative solution proposals  
We commit to sharing available data with our partners to assist in designing whole system solutions. In GD1 we piloted this for the Swansea City Area project led by the Institute of Wales. Very positive feedback was provided by the project lead, and we plan to develop this approach in GD2 across all parts of our network. Of particular value was the derivation of heat demand, from street corner level to large regions.
3. Whole system local area energy plans development  
We have trialled licensing Pathfinder free of charge for non-commercial use in GD1 and will provide licences to use it to develop Local Area Energy Plans. In GD1 we found significant support was needed to develop such plans and we propose offering this in GD2.





4. Understand the customer value or 'business case'  
We have evaluated the business case for its proposals using the CVP methodology described in the CVP chapter and appendices. The methodology developed compares different proposals that can provide the same whole system outcome. Proposed solutions can be evaluated on cost, carbon value or both. We will continue to develop this methodology and will offer to work with the electricity networks in our region to explore a common methodology to ensure investments proposed in GD2 cannot be achieved in a better way in ED2, or visa-versa. Work has begun with WPD on scoping such an approach to develop Local Area Energy Plans.
5. Open the proposals to competition, including market solutions.  
For the GD2 business plan we have looked for market solutions to the predicted shortfall in storage and capacity by running an interruptions auction in the areas where decarbonisation investment was needed. We will continue to use this option to derive the best value solutions for consumers, noting that a market solution may be better in the short term while decarbonisation solutions are developed. We have noted that electricity DNOs have started similar market options such as flexibility tenders. We will explore how these independent activities could dovetail to ensure a coordinated strategy.

It is also noted that suppliers could have a valuable role in this market by incentivising consumers and energy suppliers to take a wider role in keeping network costs and investment down. We will engage with suppliers in GD2 in the same way as we have maintained close links with projects that have started in GD1, such as Centrica's Local Market Initiative.

We propose to ask the Customer Engagement Group to review our proposals and monitor progress against the charter on an annual basis.

