

Future energy scenarios for heat and gas in Wales

Briefing document for attendees

Project summary

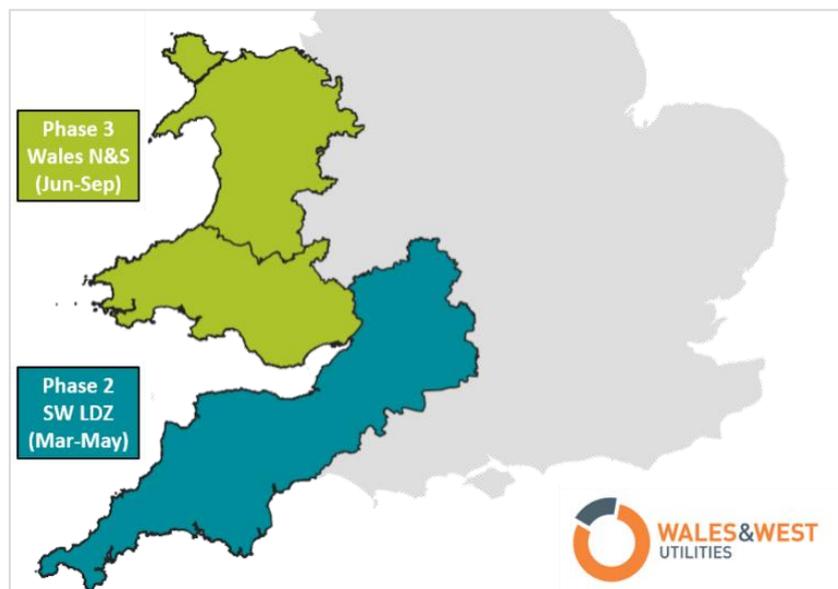
To support Wales & West Utilities' future gas demand forecasting, network analysis and investment planning, Regen has been commissioned to undertake a Network Innovation Allowance funded project. The scope of the project is to develop and trial a new methodology to create a set of regional and sub-regional growth scenarios for gas and heat from a 2018 baseline out to 2035. The intention is that these growth scenarios, backed by extensive analysis and stakeholder engagement, will create a dataset and evidence case to help Wales & West Utilities, and other stakeholders, to understand the future requirements and usage of the gas network.

As well as the need to evidence and justify future network planning and investment decisions, there is also an increasing need for gas and electricity network operators to demonstrate to customers and stakeholders that they are delivering a network to meet a variety of economic and societal objectives. The need for investment to support decarbonisation to reduce the impact of climate change has grown in urgency, alongside a number of other priority areas on network operators such as supporting a clean growth industrial strategy, the delivery of local and regional economic strategies, providing energy security and addressing wider societal issues such as fuel poverty and supporting vulnerable customers.

Geographic scope

The remit of the project that Regen is delivering for Wales & West Utilities and will be summarising at the event, surrounds the creation of a set of regional future energy scenarios for the gas distribution network in the South West of England and in Wales.

The project is being delivered in three phases. The first phase of the project, completed in Feb 2019, developed the project scope, methodology and approach. Phase 2, which



completed at the end of May, created a set of regional future energy scenarios for gas and heat for the South West of England. Phase 3, which Regen began in June, will be to develop a similar set of scenario projections for the gas distribution network in Wales. On 25 June, Regen and Wales & West Utilities hosted a joint workshop in Cardiff discussing the baseline position for Wales and approach being taken to produce scenario forecasts for heat and gas in the region.

Use and development of future energy scenarios

The project has used and adapted the four **National Grid FES 2018** energy scenarios¹ with the addition of a fifth, **Hybrid Accelerator**, scenario which has been developed in conjunction with Wales & West Utilities and regional stakeholders. Use of these national scenarios has provided a common framework and an overarching set of assumptions, while the regional scenarios have themselves been developed through a bottom up process of data gathering, energy system analysis and stakeholder engagement for the specific regions (South West and Wales).

¹ See National Grid FES website and 2018 FES document here: <http://fes.nationalgrid.com/fes-document/>

Of the five scenarios used, three are intended to be consistent with the UK's existing commitment to reduce carbon emissions by 80% by 2050, while two would not deliver the required carbon reduction. In the context of recent policy announcements, these three scenarios would not necessarily meet a more ambitious net-zero or 95% emissions reduction target and would not meet more accelerated net zero carbon targets. However, the trajectories of the resultant scenarios developed for this project (out to 2035), could be considered in the context of a 2050 outcome. With the 2019 edition of the FES also being published part way through this project, some of the future projections and assumptions in the 2019 scenarios have been reviewed, but have not significantly affected the outcomes of this project.



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Scenario forecasting for individual elements

The project considers the energy system holistically, resulting in the creation of forecast projections for over 60 individual gas and heat system elements, which are related to key sources of energy demand and alternative sources of supply. These elements have been grouped into the following areas:

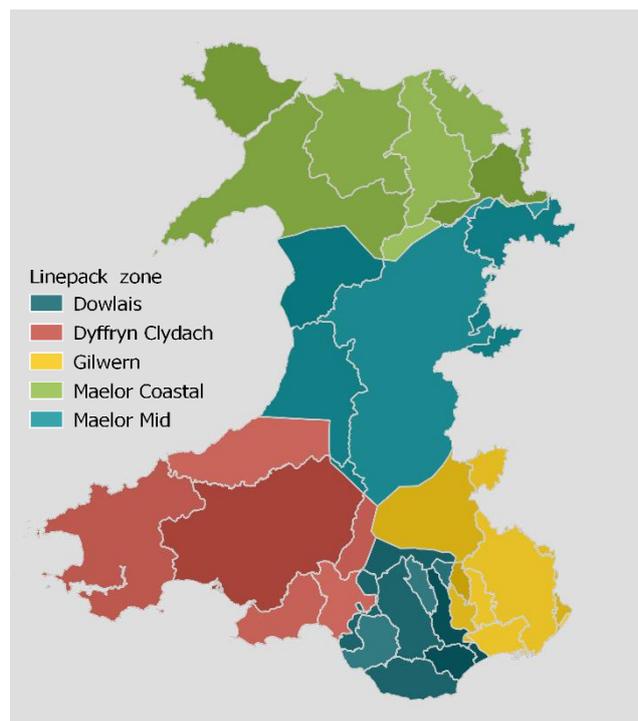
- **Domestic heat demand (including existing dwellings and new housing)**
- **Non-domestic/commercial heat (including existing and new developments)**
- **Large gas fired industrial processes**
- **Gas fired electricity generation**
- **Gas fuelled transport**
- **Alternative supplies of gas energy such as biomethane and hydrogen, and unconventional gas**

In-region geographical distribution

The requirement to create regional scenarios that can be used for strategic gas network planning, has led to the creation of smaller geographic zones or 'Gas Supply Areas' (GSAs) within both the South West and Wales regions. There are 37 GSAs in Wales, shown in the image to the right.

These geographic zones disaggregate the gas distribution network by both local authority boundaries and Wales & West Utilities' linepack zones - gas network pressure management areas.

The scenario projections developed by Regen can then be distributed geographically across these 37 GSAs. This enables Wales & West Utilities to view the scenario projections for each energy system element (out to 2035), down to a finer resolution and can help to identify gas demand 'hot spots' or potential future constraints around e.g. green gas injection in low demand areas.



Stakeholder engagement

A key part of the project methodology has been to engage with regional and local stakeholders. Regen and Wales & West Utilities hosted two workshops in Exeter and Bristol as an opportunity to gather insight and input to develop the regional scenarios for the South West area. The workshop in Cardiff held towards the end of June engaged 52 stakeholders, representing a number of sectors, about the Wales phase of the project. The event was able to clarify some of the impacts of key market, policy and technology drivers, provide insight into the changing commercial landscape for the use of gas in domestic, commercial and industrial sectors as well as understanding the future growth/shrinkage of some of the key elements of the scenario analysis, specifically in Wales.

The workshop in Llandudno is intended to similarly engage stakeholders on:

- The approach, data, evidence base and assumptions we are using to drive the scenarios
- Gauge opinions on the evolving landscape for the use of gas and future of heat supply in Wales
- 'Road test' the draft results of the scenario projections out to 2035 we have produced to date, for each of the specific sources of demand and alternative sources of supply.

Workshop focus areas

Whilst there are a number of energy system elements that feature as part of the scenario analysis, the workshop will focus on the following four key areas, through a series of focused roundtable discussions:

1. Domestic heating

For the purposes of this assessment, domestic heat is being considered as the demand for energy to provide space heating and domestic hot water within domestic dwellings. The demand for domestic heat is strongly influenced by a range of factors, such as the type of dwelling, availability of the gas grid, the type of heating appliance and fuel conversion efficiency. The future energy scenario projections for domestic heat have been determined through analysing the following elements:

- a) Number of dwellings (now and in the future)
- b) Annual heat demand (considering energy efficiency deployment)
- c) Diversity of heat delivery technologies (and their conversion efficiency)

These elements are modelled to evolve over time to a lesser or greater degree across the five future scenarios described on the previous page. Some of the aspects of the modelling that flex, depending on the scenario, include:

- The domestic heat energy demand (related to scale of energy efficiency uptake)
- Percentage of dwellings with different technologies as their prime (or sole) source of heat
- Number of dwellings served by heat networks and the fuel that they run on

Some of the assumptions and considerations we would like to gain feedback on for domestic heat, are:

> **Average domestic heat demand now and moving forward, specifically relating to energy efficiency deployment scenarios 'deep retrofit' vs 'continuing baseline trend'**

> **Efficiency and losses relating to district heat networks and the fuels that they may operate on now (i.e. natural gas) and in the future (i.e. biomass or biomethane)**

> **Uptake of low carbon heating technologies, driven by the RHI or other means (i.e. heat pumps).**

2. Commercial and industrial users

Commercial and industrial heat is considered as the demand for energy to provide space heating and hot water in occupied commercial premises, and the demand for gas for large industrial processes. The factors influencing demand for commercial and industrial space heating are similar to those outlined in domestic heating, with considerations around scale. For industrial processes, demand for gas is influenced primarily by the efficiency of the process and ability to reduce heat losses.

The future energy scenario projections for commercial and industrial heat have therefore been determined through analysing the following:

- a) Number of premises and processes (now and in the future)
- b) Annual heat and gas demand (considering energy efficiency deployment/process efficiency)
- c) Diversity of heat delivery technologies

These elements are similarly modelled to evolve over time to a lesser or greater degree across the five scenarios described. Some aspects of the modelling that flex, depending on the scenario, include:

- The commercial heat energy demand (related to scale of energy efficiency uptake)
- The energy demand from industrial processes (related to process efficiency improvements)
- Percentage of commercial and industrial premises with different technologies as their prime (or sole) source of heat, including future considerations around hydrogen fuelled industrial clusters
- Number of commercial premises served by heat networks and the fuel that they run on

Some of the assumptions and considerations we would like to gain feedback on and discuss in regard to commercial and industrial heat are:

- > **The potential to see a slower shift to low carbon heating technologies for commercial and industrial space heating, compared to domestic space heating, due to a lack of incentives on landlords**
- > **Anticipated changes to energy demand from the gas network for industrial processes**
- > **Potential for switching the primary fuel for large-scale industrial processes in Wales, specifically around the potential for hydrogen fuelled industrial clusters in both south and north Wales.**

3. Distributed gas fired electricity generation

In the context of this assessment, gas fired power generation scenario analysis has focused on gas distribution network connected sites, whose primary purpose is electricity generation for grid export. The development of distributed gas fired power capacity and operation is driven by a number of factors, such as the type of electricity generating technology, the needs of the electricity system and wider energy system decarbonisation objectives. The future energy scenario projections for gas fired power generation has been determined through analysing the following key stages:

- a) Assess existing/baseline installed generation capacity (MW_e) and the mixture of the type of gas generating technology (CCGT, OCGT or reciprocating engines) for each connected site
- b) Assess pipeline of known future developments, including their gas generating technology and any relevant planning and Capacity Market activity
- c) Capacity factors, annual generation output, gas conversion efficiency and demand for gas

Aspects of the modelling of future distributed gas generation that flex by scenario, include:

- The potential for CCGT/OCGT sites that may be decommissioned out to 2035
- The pipeline projects that are or are not brought online (and in which year)
- The average capacity factor for each generating technology type and therefore the resultant annual energy generation output and demand for gas

Some of the assumptions and considerations we would like to gain feedback on for gas fired power are:

- > **The market potential for gas generation technology types (CCGT, OCGT and reciprocating engines)**
- > **Business models and sources of revenue for distributed gas generation now and in the future (Capacity Market, Balancing Mechanism, Project TERRE, gas/electricity market price arbitrage etc.)**
- > **Evolving capacity factors for distributed gas generation over time**
- > **The potential for the replacement of behind-the-meter diesel backup generators with gas engines**
- > **The impact of hydrogen blending on gas generation technologies.**

4. Green gas usage and injection

Whilst the gas blend in networks is currently predominantly natural gas (methane), fed from the National Transmission System, there has been a slowly increasing proportion of biomethane that is being injected into the distribution networks in certain areas, from commercial operators and injection sites. In the Wales & West Utilities South West gas network area, for example, there are currently some 18 biomethane injection sites connected to the network with a combined injection capacity of 13,550 scm/h. However, in Wales there are a very limited number of injection sites currently operating or seeking to connect and inject green gas into the network.

The future energy scenario projections for green gas injection analyses the following key areas:

- a) Assessment of existing/baseline operational green gas injection sites, their primary feedstock (if known), injection capacity (scm/h) and annual injection rate (%).
- b) Assessment of known future developments or applications to connect and inject in the future.
- c) Future potential for additional injection sites, capacity, feedstocks and annual injection rates.
- d) Analysis of resultant total annual green gas volume, as both a percentage of total gas supplied in the Wales gas distribution network and the indicative proportion of national biomethane availability (based on future biomethane feedstock availability information).

Aspects of the modelling of future green gas injection potential that flex by scenario, include:

- The number of injection projects and in which year they commence injecting
- The resultant annual green gas volume injected into the network

The assumptions and considerations we would like to gain feedback on for green gas injection are:

> **The reasons behind a comparatively low uptake of green gas injection projects in Wales to date**

> **The potential for an upsurge in new/additional green gas injection capacity coming online within the timeframe of this assessment (2018 – 2035)**

> **The business model for new green gas sites (RHI, Welsh government targets, feedstock availability)**

> **The potential annual injection rates now and in the future for green gas injection sites**

> **The potential for hydrogen blending in the gas network in Wales within the timeframe of the assessment or beyond.**

Project Team and contact

Regen and Wales & West Utilities welcome your input at this stakeholder workshop.

If you have any questions relating to this overview document or about the format of the day, please contact **Ray Arrell**, Senior Project Manager at Regen on rarrell@regen.co.uk.

If you have any questions relating to the event venue, logistics or details about the arrangements on the day, please contact **Emma Pavans de Ceccatty**, Membership and Events Administrator at Regen on epavans@regen.co.uk.