A carbon-free future

Our research and proposals indicate that we could fully decarbonise heat by 2050.

Our vision is built on our five milestone projects:

1 FUTURE OF ENERGY
Understanding the challenges

2 2050 ENERGY PATHFINDER
Discovering the opportunities

3 FUELLING THE FUTURE
Testing three energy scenarios

4 SMART HYBRID SYSTEMS
Finding an innovative way forward

5 PREPARING THE NETWORK
Taking practical steps

Find out more and let us know what you think

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WALES&WEST UTILITIES

At Wales & West Utilities we're preparing for a greener future, now.

Read about our research and proposals.

WALES&WEST UTILITIES

We Are Wales & West Utilities.

We don't sell gas, instead we look after the pipes that transport gas to heat homes and power businesses across Wales and the south west of England.

We invest £2m a week across our network, connecting new homes, responding to gas emergencies and upgrading old metal pipes to new plastic ones so the communities we serve receive a safe and reliable gas supply for generations to come.

It's a vital service, and one we are extremely proud to deliver.

Leading the way

How our world produces, stores and uses energy is rapidly changing – the world is driven by the urgent need to reduce carbon emissions.

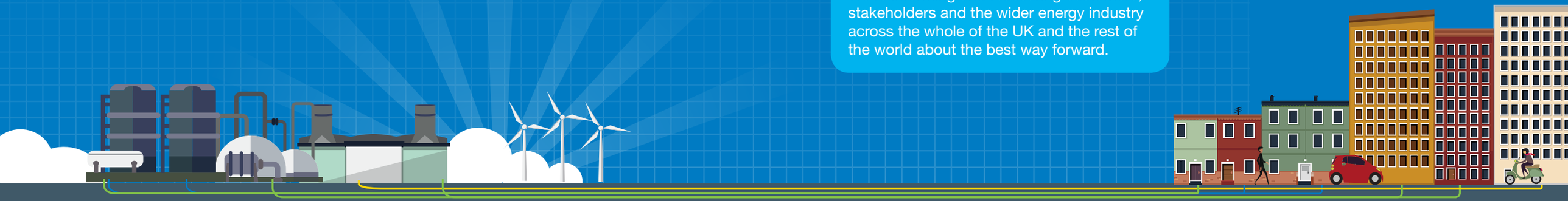
As a key part of the energy system today, we're not watching from the sidelines; **we're leading the way.** Through ground-breaking projects, our experts are researching the future of the energy system in the UK – and we've got a clear vision for the way forward.

With our customers' needs at the heart of everything we do, our work goes beyond Wales and South West England. We're informing and reassuring customers, stakeholders and the wider energy industry across the whole of the UK and the rest of the world about the best way forward.

UK CO_2 targets
compared to 1990 levels

34% by 2024

80% by 2050



A cleaner, greener future for customers

We are committed to delivering reliable, affordable and green energy now and in the future. Currently, in Wales and the south west, over 80% of heat and power demand at peak times is met by the gas network.

We have a duty to continue to deliver reliable, affordable, green energy into the future.

Looking into all the options

Continuing to invest in and use our safe, secure and resilient gas network.

Investigate alternative sources of gas such as biomethane, BioSNG and hydrogen blends to supply energy for heat, power and light.

Focusing on carbon neutral to deliver safe, green energy for all customers and help the UK meet CO_2 targets in the future.

7.5 million people rely on us

Safe, reliable gas supply

2.5m homes and businesses

37 power stations

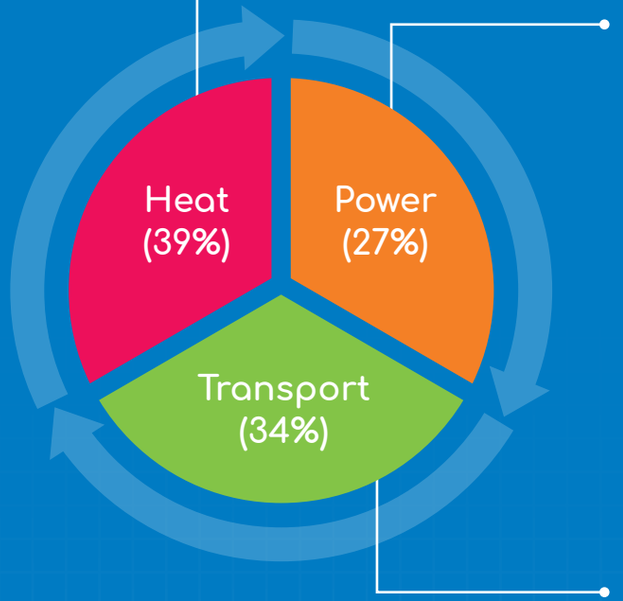
24/7 service, 365 days a year

What do people rely on us for?

Heating and cooking

Powering businesses

Keeping the lights on



Our vision sets out how gas and gas networks are integral to not only decarbonising heat, but also how a true whole systems approach means they have a part to play in supporting the decarbonisation of power and transport too.

Heat

Decarbonising heat is where reducing emissions are most challenging – and where the least amount of progress has been made

Power

We've made good progress on decarbonising power supply, with increasing amounts of renewable energy connected to the electricity grid. Wind energy, solar parks, nuclear power stations and hydro power, alongside gas replacing coal, have all helped make Britain's electricity supply one of the greenest in Europe.

Transport

With increasing electrification of the railways and a record breaking increase in the number of EVs on the road, we're making good progress on transport too. But there's still more to do, particularly on heavy goods vehicles and public transport, with a focus on not only reducing carbon but also improving air quality.

On track for the future

Our five milestones have helped us develop a vision of affordable, reliable and sustainable energy long into the future.

Understanding the challenges

Discovering the opportunities

Testing three energy scenarios

Finding an innovative way forward

Taking practical steps

Our carbon-free vision for the future is emerging

1

Understanding the challenges

FUTURE OF ENERGY

We need to continue to deliver reliable energy at affordable costs for customers, and to help the UK meet strict decarbonisation targets. It's a tough challenge: reducing carbon emissions while continuing to deliver what customers want and need.

We need to find a balance

When weighing up the pros and cons of different energy solutions, it's important to consider three things: how reliable it is; the environmental impact it has; and how much it costs. Some solutions might be very sustainable, but cost a lot and are unreliable. Others might be cheaper and reliable, but less sustainable.

The energy balance is how we refer to the challenge of finding a balance between all three:

Secure
Reliable supply and infrastructure that meet demand

Sustainable
Decarbonised and carbon neutral

Affordable
Cost-effective across the whole UK population

Can customers pay?

Future energy policy will be paid for by customers' bills. So before we started exploring the future of energy, we spoke to real energy consumers in a typical town in South Wales to ask them what they want and need.

Our research shows the initial setup cost is a key deciding factor for consumers considering switching to an alternative heating source.

Where an up-front cost was required, more than 80% of consumers would not – or could not – afford to change.

This means that any solution to the decarbonisaton of heat must consider access to low cost loans and grants or subsidies to make sure everyone can benefit.

Supporting clean growth

The UK is at the forefront of encouraging global clean growth, and by one estimate, the UK's clean economy could grow at four times the rate of GDP. The future energy system must support this as we move towards a greener economy.

Keeping it simple

However we meet future energy needs, it's important to keep disruption to a minimum, in homes, businesses and local communities. And it will be much easier for everyone to adapt to the changes if we don't ask them to do too many things differently.

2

Discovering the opportunities

2050 ENERGY PATHFINDER

To help us address these challenges, we created a simulation model called the 2050 Energy Pathfinder.

It's our unique tool that models future energy supply and demand. It works out opportunities, risks and trade-offs when designing the energy system of the future at local, regional and national levels.

And that's not all

It works out what future energy solutions could mean for energy bills. For the first time it allows policy makers and asset managers to take a whole systems approach to future investment and planning, making sure that our gas and electricity networks and suppliers work together rather than in isolation.

How the simulator works

The data we put in

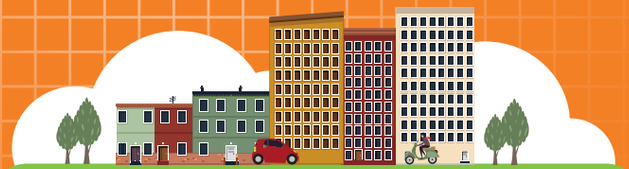
Supply (coal, gas, nuclear, geothermal, wind, solar, tidal, natural gas, green gas, hydrogen) | Demand (heat, power, transport) | Costs | CO_2 emissions | Population

What Pathfinder simulates

Supply profiles | Demand profiles | Supply scaling | Energy efficiency | Appliance efficiency | Levelised costs | Hybrid heating | Storage and generation merit order

The data we get out

Customer cost | Emissions | Storage needs | Generation capacity | Interconnector capacity | Supply shortfall



Learning and sharing our knowledge

Today our 2050 Energy Pathfinder is helping partners, including local government, to model different ways to achieve decarbonisation and plan their own energy strategies.

But we know we don't have all the answers. In developing our simulator and our energy vision we've worked with others – both inside and outside the energy industry – to develop and test our ideas.

3

Testing assumptions

FUELLING THE FUTURE

For a while now, electrifying home heating systems has been the most popular strategy to decarbonise heat.

However, with up to 80% of todays' heat demand being met by the gas network, that would be a significant challenge. Using our 2050 Pathfinder simulator, and through collaboration with others, we set to work on testing the feasibility of fully electrified heating.

Can it meet the challenges?

We put a range of electrification scenarios into our 2050 Pathfinder, testing against the three big energy challenges:

While it's a sustainable solution, the results show that it's very difficult to strike a balance with electrification alone.

An affordable electric heating system still comes at a price: decreased reliability, with lengthy periods of power cuts.

And for electrification to be reliable, a sizeable investment in low carbon generation and battery storage would be needed – which would significantly increase energy bills.

They took into account existing assumptions of how we would decarbonise heat – through electrification.

Here's how they compare:

Scenario 1 (today): **Reliance on natural gas and solid fuel**	
Secure	✓
Affordable	✓
Sustainable	✗

Scenario 2 (future): **Reliable electrification**	
Secure	✓
Affordable	✗
Sustainable	✓

Scenario 3 (future): **Affordable electrification**	
Secure	✗
Affordable	✓
Sustainable	✓

A practical change?

Strategic decisions aside, there are also practical issues to consider, for the networks, supplier and customers.

In homes and businesses

Wholesale switching to electrification will require the conversion of existing home heating systems, plus an intensive programme of insulation measures. And who will pay for this? With the cost being fed through energy bills, there's a big impact on customers.

The network

Upgrading the electricity network to be able to meet the electrical demand for heating would be disruptive, with extensive work required across the UK. The noise, inconvenience and environmental impact on communities would be significant.

So what can we do?

It's clear that full electrification cannot decarbonise heat in a way that balances reliability and affordability. That's why we've been working collaboratively to fill in the gaps.

Hydrogen cities

As a partner in the H21 project, we've been exploring the feasibility of the conversion of the existing gas network in 17 cities across the UK to hydrogen. With hydrogen produced by steam methane reformers in the short term before global low carbon hydrogen markets take off, this could be done with minimal impact on customers' bills.

A missing link?

With the majority of homes outside cities, our research made it clear another option was needed. It's time to look at Smart Hybrid.

4

Finding an innovative, integrated way forward

SMART HYBRID SYSTEMS

Smart hybrid systems allow us to make the most of both our electricity and our gas networks in an innovative and integrated way, with minimal disruption to communities and very little cost for customers.

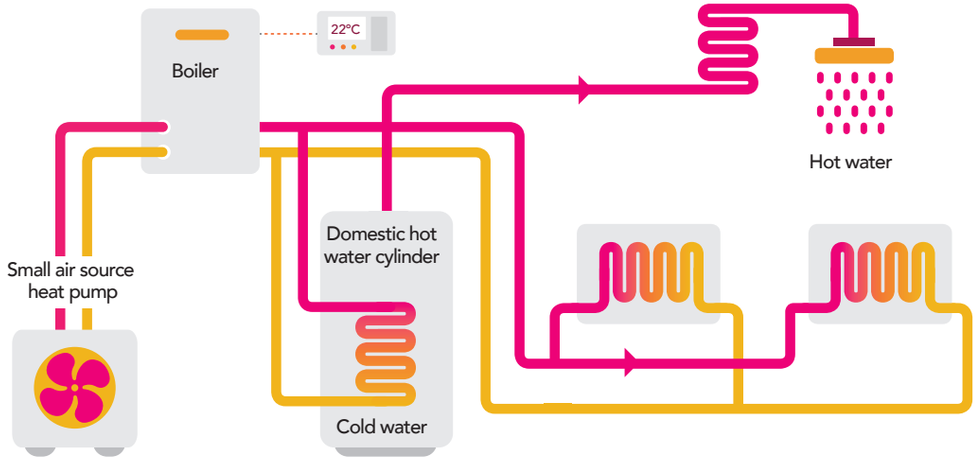
What is a smart hybrid system?

With smart control technology at it's heart, it manages the delivery of heat from both a conventional gas boiler and an air source heat pump.

Controlled by an intuitive app and with switching based on either cost or carbon, smart hybrids allow us to make the best use of the existing gas and electricity grids.

Smart switching to gas boilers when heat demand is at peak, and when electricity has a high cost or carbon intensity, brings into play the huge energy storage capacity of the gas network.

Smart hybrid systems could reduce whole energy system costs by as much as £15 billion per year compared to full electrification.



Freedom Project

The Freedom Project

An industry first cross-sector collaboration between Wales & West Utilities and Western Power Distribution, supported by Imperial College, Delta-ee and City University, delivered by PassivSystems.

Hybrid Home Heating

Our Freedom Project, based in the ‘living heat laboratory’ in Bridgend, tested the control technologies in 75 different homes, and helped prove the concept of smart hybrid systems.

Heating future businesses

Hybrid heating is not just for homes. It could also help decarbonise heating in non-domestic buildings like offices, schools and care homes. We’re working to explore these opportunities further.

Off Grid Hybrids

Hybrid heating isn’t just for those on the gas grid. It brings the benefits of reducing costs and carbon to homes on oil or LPG too.

As part of the Freedom Project, hybrid heating was installed in 3 homes off the gas grid.

One resident said: “I was reluctant to use our heating before the hybrid heating system was installed because of the cost. Now, we’re saving £700 a year, I’m more control of our heating system – and our home is always warm.”

The breakthrough we've been looking for

Smart hybrid heating is a new, innovative solution which helps gas and gas networks deliver a greener future, keep disruption to customers to a minimum and keep energy bills low. Smart hybrid heating can help fully decarbonise heat by 2050.

Pathfinder

Taking into account what we learned from the Freedom Project, we used the 2050 Energy Pathfinder to simulate a future energy system that included smart hybrid heating:

Secure

Gas and electricity networks are just as reliable as today

Affordable

Dual fuel bill similar to 2019 prices

Sustainable

Meets carbon reduction targets

The impact of smart hybrid systems

What changes are needed?

Hybrids can be easily retrofitted to existing homes and businesses – with only the addition of an air source heat pump and the smart control technology.

There is little to no behaviour change required – appliances continue to function normally. And there's no changes to the existing heating system and building insulation required.

How disruptive will it be?

As they take advantage of the existing gas and electricity networks, smart hybrid systems avoid the need for disruptive, unsightly and costly reinforcement to the electricity network.

Who pays for it?

We know initial hardware and installation costs are often a barrier to switching to low carbon heating systems.

In the short term, customers could be encouraged to switch by Government subsidies or low interest loans.

In the longer term, the development of 'heat as a service' offers an alternative way of paying, similar to existing mobile devices and vehicle personal contract purchase arrangements.

But what does that mean for the UK energy system?
Read on to see our vision.

Our carbon-free vision for 2050

The way forward is clear. Smart hybrids can deliver an affordable, reliable and sustainable future for energy.

Hydrogen Cities

- 17 of the UK's largest cities will be converted to run on hydrogen.
- Durable plastic pipes installed in the pipe upgrade programme allow gas networks to run on hydrogen in place of natural gas through the existing system, with minimal disruption to cities and customers.

Other cities, towns and suburbs

- 70% of homes across the UK will have hybrid heating systems like Freedom, helping them to make the best use of the green gas and renewable energy.
- By 2050, we expect that gas boilers will use only green gases – like biomethane and synthetic natural gas – making carbon-heavy natural gas obsolete for home heating.

Transport

- Many heavy goods vehicles, buses and trains will be fuelled by hydrogen or green gas, significantly improving air quality.
- The vast majority of private cars are electric vehicles, with more than 36m on the road.
- Gas and electric vehicles are cleaner than diesel and will significantly improve air quality.

Power

- The primary sources of electricity will be renewable.
- Wind, solar, tidal, marine and a small fleet of nuclear power stations supported by back up gas generation plants will keep the lights on.
- A small amount of electricity storage across the UK will help balance the grid, while smart hybrid systems installed in homes and businesses will enable flexibility.

5

Taking practical steps

PREPARING THE NETWORK

Right now, we're working on a range of projects and schemes that will help deliver our vision of a reliable, affordable and green whole energy system.

Ahead of a strategic decision on heat from the UK Government, these are all 'no-regrets' initiatives that can start delivering the decarbonisation of heat today.

Pipe upgrades

In 2002 we started a national programme to upgrade old metal gas pipes. **By 2032** all pipes within 30 meters of buildings will be plastic. This is part of our commitment to keep gas flowing safely to homes and businesses long into the future. This programme reduces gas leaks and therefore carbon emissions from the operation of the gas network, while also making the network cost effective. Our pipes will be safer, more durable, and future-proof.

Renewable gas

We have **19** renewable sources of gas connected to our network, including a tomato farm and a sewage works. They supply the equivalent of **113,000** homes with low-carbon green gas. And this is just the start. We're working with third parties to help connect more sources of green gas to our network.

Renewable gas production is a growing part of our safe and reliable gas supply

Our new plastic pipes have a lifespan of more than 80 years

New builds

With the results of our vision clear, and endorsement of hybrid heating as a key part of low carbon heat from the UK Committee on Climate Change, we're supporting local and devolved government make decisions on the heating of new build housing stock.

Smart gas grid

With the dramatic increase in injection of low-carbon green gas, we need to make sure our network is as flexible as possible. We're working on a project with other gas networks that will help us to make the most of the sources of green gas we have in the UK.

A fully reversible gas grid – where low carbon gas can be moved up the pressure tiers and transmitted long distances – will help us maximise the carbon reductions green gas can deliver.

Keeping Britain moving

With more CNG vehicles on the roads than ever before, our network is already supplying the gas for buses in Plymouth and Bristol, with capacity for many more. Nationwide, large supermarket chains are adopting CNG fuelled trucks.

Keeping the lights on

We've already got more than 30 power stations connected to our network, generating enough energy for 3 million homes. Most of them are flexible 'peakers', taking advantage of the massive storage capacity of the gas network.

These flexible power stations support renewable energy, generating electricity when the wind drops or the sun doesn't shine, as well as providing frequency response services, helping to keep the electricity network stable.

Energy centres and heat networks

Combined heat and power stations connected to our network are not only generating low carbon electricity and heat for factories and other industrial applications, they're also playing a key role in developing heat networks, including in Bristol.